LINEEYE

LE590-SG
User's Manual

< 3rd >

Table of Contents

1. LE590-SG Overview

LE590-SG provides a powerful and sophisticated virtual front control panel to manage the LE-590TX. Two test ports can be independently configured with parameters to define multiple streams, filters, and capture capabilities. Traffic for various network protocols can be customized, transmitted, and received on each port. Comprehensive statistics provide users an in-depth analysis of the performance of the DUT (Device Under Test).

1.1. Starting LE590-SG

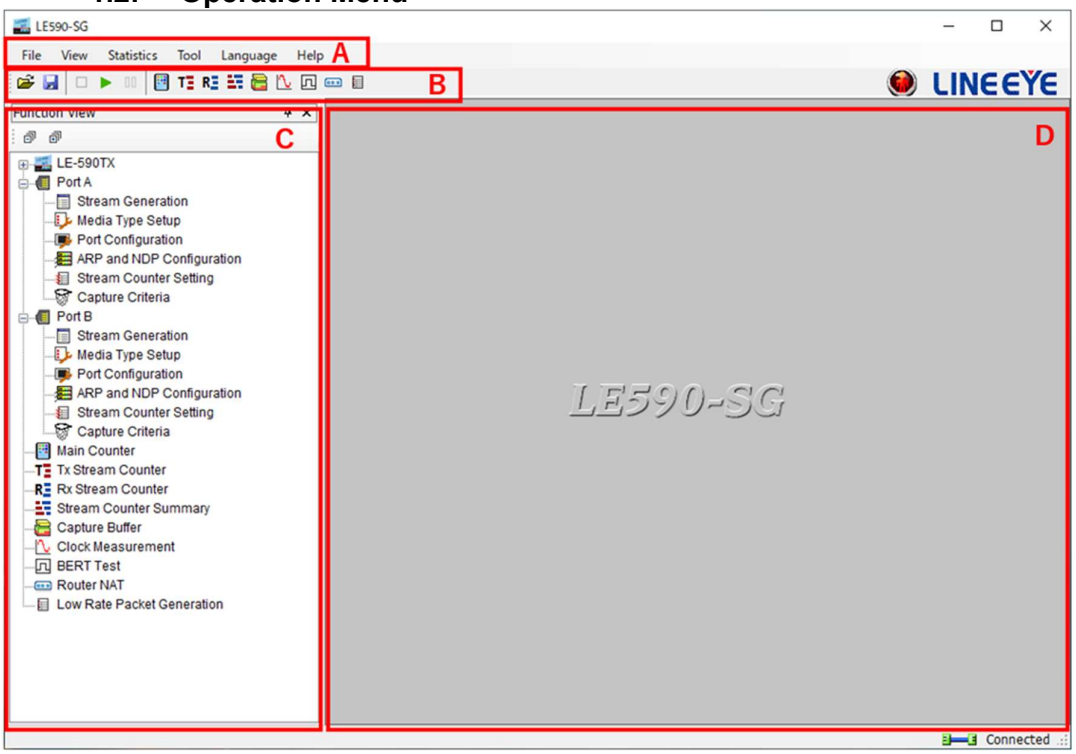
Connect the LE-590TX to the PC with the included USB cable.
Start the program by clicking Start -> Programs -> LINEEYE -> LE-590TX -> LE590-SG Vxxxxx -> LE590-SG Vxxxxx or

LE590-SG.exe at desktop, then main windows is shown.

Please refer to the user guide for LE590-SG installation.

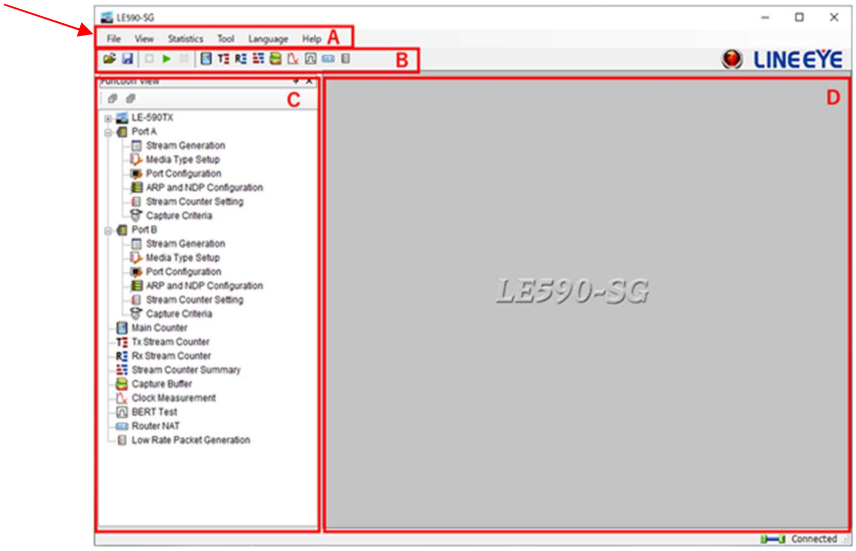
This manual is for LE590-SG v2.0b003 or later.
Please use the FPGA version of v2.3b038 or later for the LE-590TX main unit.
FPGA upgrade is performed from the LE590-NIC software.

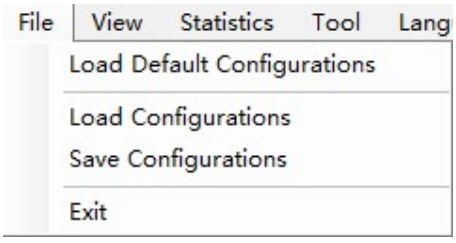
1.2. Operation Menu



1.2.1. File Sub-menu

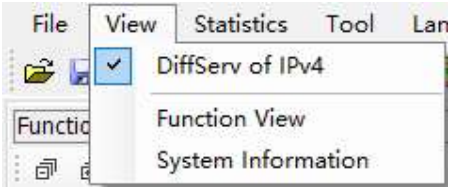
Block in main window: A





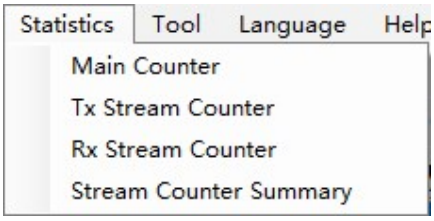
Menu	Function
Load Defualt Configurations	Reset all settings to default value.
Load Configurations	Load config from a saved file.
Save Configurations	Save the current settings to file.
Exit	Exit and close this utility.

1.2.2. View Sub-menu



Menu	Function
DiffServ of IPv4	Check **Diffserv of IPv4** here, the QoS priority settings in the **Frame Data Edit** window will be DSCP, shown as the upper picture on the left. Uncheck **Diffserv of IPv4** here, the QoS priority settings will be ToS, shown as the lower picture on the left.。
Function View	Display or hide the “Function View”.
System Information	System Information

1.2.3. Statistics Sub-menu

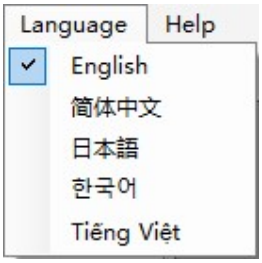


Menu	Function
Main Counter	You can view counter reports, start/stop packet counts.
Tx Stream Counter	Display of Tx data.
Rx Stream Counter	Display of Rx data.
Stream Counter Summary	Display of test data.

1.2.4. Tool Sub-menu

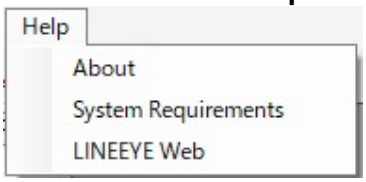
Menu	Function
IFG Converter	IFG Converter allows the user to converter the frame gap among different units.
Frame Gap for USB Transferring	You can set the gap of packets that will be transmitted back via USB cable per time.

1.2.5. Language Sub-menu



LE-590 provides **English**, **Simplified Chinese**, **Korean**, **Japanese**, and **Vietnamese**.

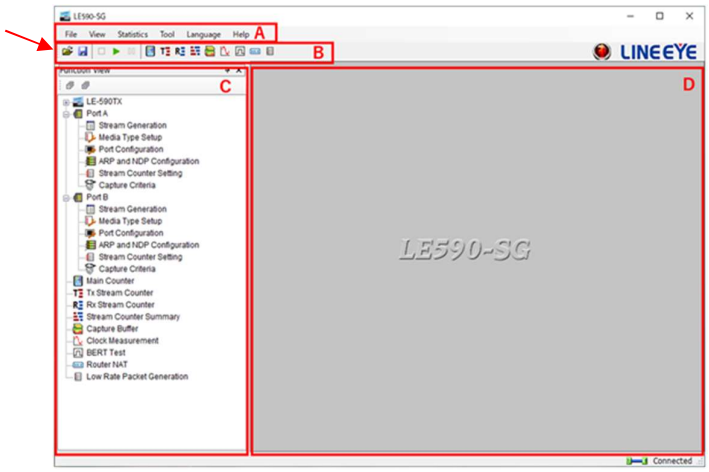
1.2.6. Help Sub-menu



Menu	Function
About	System information, such as Utility version and Hardware version of this device
System Requirements	A “**System Requirements**” window will pop up and show the requirements for your PC and the FPGA/Firmware of the device.
LINEEYE Web	Access LINEEYE website.

1.3. Tool Bar

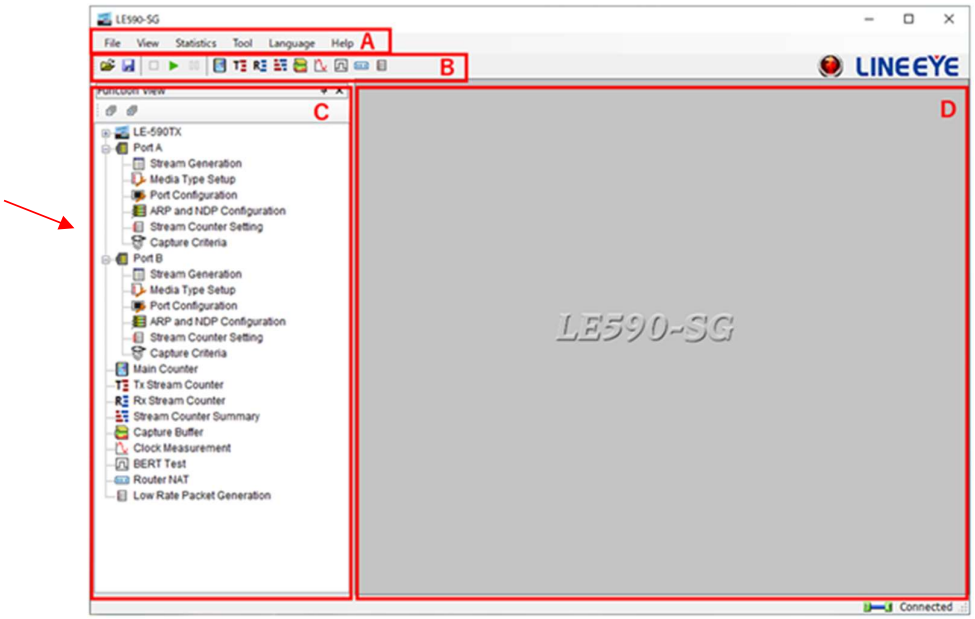
The Toolbar is located below operation menu of this utility
Block in main window: **B**



Keys	Function
Load Configurations	Select the ".dsc" file you saved before, the system will load the configurations.
Save Configurations	Save the current configuration as the".dsc" file.
Stop All Ports Transmit	Click this button, the 2 ports will stop transmitting.
Start All Ports Transmit	Click this button, the 2 ports will start transmitting.
Pause or Resume All Ports Transmit	Click this button, the 2 ports will pause or resume transmitting.
Main Counter	You can view counter reports, start/stop transmitting on the **Main Counter** window.
Tx Stream Counter	**Tx Stream Counter** allows the user to view the Tx test data of his interest.
Rx Stream Counter	**Rx Stream Counter** allows the user to view the Rx test data of his interest.
Stream Counter Summary	**Stream Counter Summary** allows the user to view the test data of his interest.
Capture Buffer	User can set capture buffer criteria or start/stop capturing packets here.
Clock Measurement	You can test the Crystal Oscillator's frequency of the DUT and see if it's either faster or slower than standard speed in ppm scale.
BERT Test	BERT stands for Bit Error Rate Test.
Router NAT	Test the NAT function of the DUT.
Low Rate Packet Generation	A special packet transmit mode for low rate.

1.4. Configuration and Information Zone

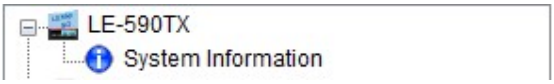
Block in main window: **C**



For different selections, there are System Information, Configuration and Status of Port A, Port B, Report and Function Configuration in this block.

1.4.1. System Information

Click the item below to show the system information



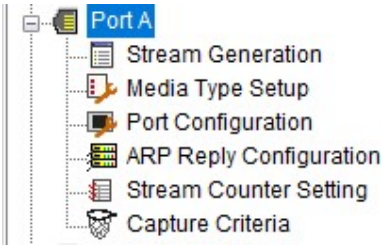
On the right side of the main window, it shows

System Information

Model	LE-590TX
S/N	[redacted]
MAC Address	[redacted]
PCB Version	MP03
FPGA Version	v2.3b038
Firmware Version	v0.9b030
API Version	v1.0b062

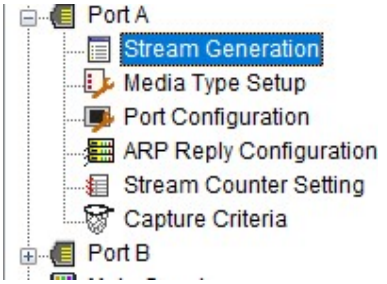
1.4.2. Port Status and Configuration

Click the item of ports to show the status or configuration

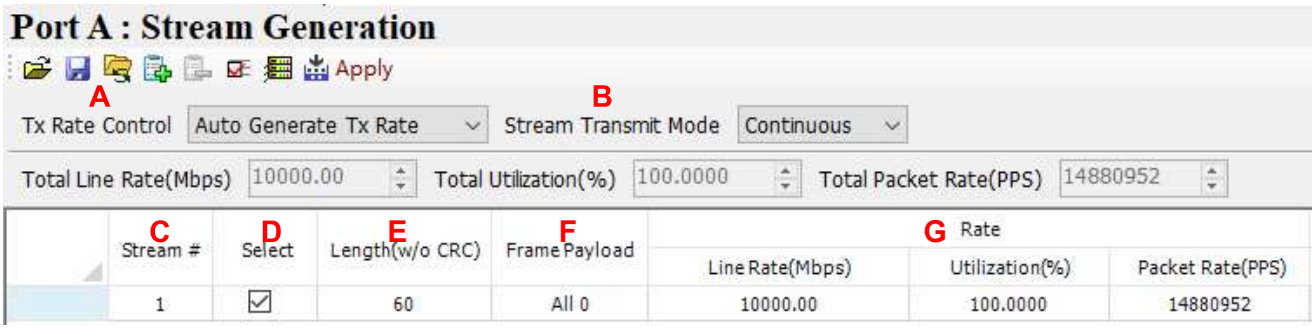


1.4.2.1. Stream Generation

Click item below to view the Multi Streams Generation configuration window.



System shows the configuration window. User can configure the streams patterns for streams generation.



Icon	Item	Function
	Load	Load a saved config file from PC
	Save	Save current configuration to a local file
	Set to Default	Set all configuration to default value
	Add Stream	The Add Stream window will popup
	Delete Stream	Delete the selected stream
	Column View Setting	Set the columns shown or hidden in the list by select the item
	Transit SA and SIP to ARP Configuration	Apply the SA and SIP value here to ARP Reply Configuration
Apply	Apply	Apply the current settings

A: Tx Rate Control:
B: Stream Transmit Mode: There are 3 transmit mode.

- **Continuous**: The stream will be transmitted continuously until user click Stop Transmit button.
- **Packets Limit**: User can set a number that packets will be sent
- **Time Mode**: User can set duration that transmission will be last.

C: Number of Streams: Volume of streams that will be generated
D: Select Stream : User can tick the checkbox to active the stream generation of this stream
E: Length (w/o CRC): Frame length in bytes without CRC
F: Frame Payload: Select the pattern of the frame
G: Rate: Select the unit and input the value of the parameter that the packets will be generated.

- **Line Rate(Mbps)**: Mbytes per second in transmission
- **Packet Rate(PPS)**: Packet per second. Volume of packets that will be generated per second.
- **Utilization(%)**:Percentage of Wirespeed transmission

H Tx Frame/Gap Control			I X-TAG		J Append CRC	K Error Generation	L Frame Data	M Protocol Type
IFG (bit time)	IBG (bit time)	Frames	Enable	X-ID				
96	96	14880952	☐	0	☑	No Error	Edit	None

H: Tx Frame/Gap Control

- **IFG(bit time)**: Interframe Gap. Ethernet devices must allow a minimum idle period between transmissions of Ethernet frames. It is called interframe gap (IFG) as the illustration below

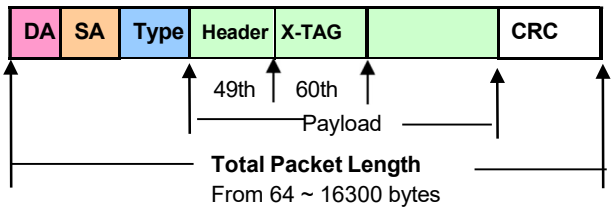
Frame	IFG	Next Frame

The minimum interframe gap is 96 bits time or 12 byte time. It is the time taken for transmission of 96 bits raw data on the media.

- **IBG(bit time)**: Inter Burst Gap. Gap between each burst streams.
- **Frames**: Total frames that will be sent

I: X-TAG Enable: User can tick the checkbox to active tag generation of X-TAG. When it is ticked, user can select X-ID. Each X-TAG has an unique ID. If there are more than one product of LE-590TX is generating the data stream on the same network, their X-ID should be different

X-TAG that is used as stream tags for providing fundamental information for collecting statistics of multi-stream traffic. Advanced tests like latency, packet loss, and packet sequence miss can be realized by X-TAG.
X-TAG is an proprietary 12 bytes embedded tag that is located at 49th~60th bytes of each testing frames that are generated by Rapid-Matrix for multi-stream tests.

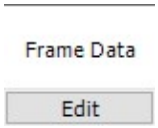


J: Append CRC: Add CRC checksum to the end of each frame. CRC checksum is the way to verify the

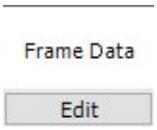
correctness after data transmission. 4 bytes will be added at the end of the frame when CRC checksum is added.

K: Error Generation: User can insert frame errors to the stream.

- **No Error:** No error frames will be generated.
- **CRC Error:** Streams with CRC Error will be generated.
- **IPCS Error:** Streams with IPCS Error will be generated.



L: Frame Data Edit: Configure the payload contents in frame. Click the **Edit** to edit the detailed contents in frame. For the detail of how to use Frame Editor, please refer to **1.11 Frame Date Edit**



M: Protocol Type: System shows the Protocol Type when frame content is configured in

N MAC		O VLAN L1		P IPv4		
DA	SA	Enable	VID	Enable	DIP	SIP
00-22-A2-00-02-01	00-22-A2-00-02-00	☐	0	☐	192.168.2.1	192.168.2.0

N: MAC: This field displays the **DA (Destination MAC Address)** and **SA (Source MAC Address)** of the stream. Double-click the **DA** and **SA** of each stream, user can edit the destination/source MAC addresses

O: VLAN L1: This field allows you to enable/disable the VLAN that will be added into the frames. Click and check the "**Enable**" check box to enable the VLAN function, or uncheck the "**Enable**" check box to disable this function. Also, to set the **VID** (VLAN ID), please input the VID manually in the **VID** field.

P: IPv4: This field displays the **DIP (Destination IP Address)** and **SIP (Source IP Address)** of IPv4 protocol. If user would like to add IPv4 header to the frames, click and check the "**Enable**" check box, then edit the value.

Q IPv6			R TCP			S UDP		
Enable	DIP	SIP	Enable	DPort	SPort	Enable	DPort	SPort
☐	0000:0000:0000:0000:0000:0000:C0A8:0201	0000:0000:0000:0000:0000:0000:C0A8:0200	☐	9	8	☐	9	8

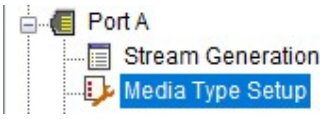
Q: IPv6: This field displays the **DIP (Destination IP Address)** and **SIP (Source IP Address)** of IPv6 protocol. If user would like to add IPv6 header to the frames, click and check the "**Enable**" check box, then edit the value.

R: TCP: This field displays the **DPort (Destination Port)** and **SPort (Source Port)** of TCP protocol. If user would like to add TCP header to the packets, click and check the "**Enable**" check box, then edit the value.

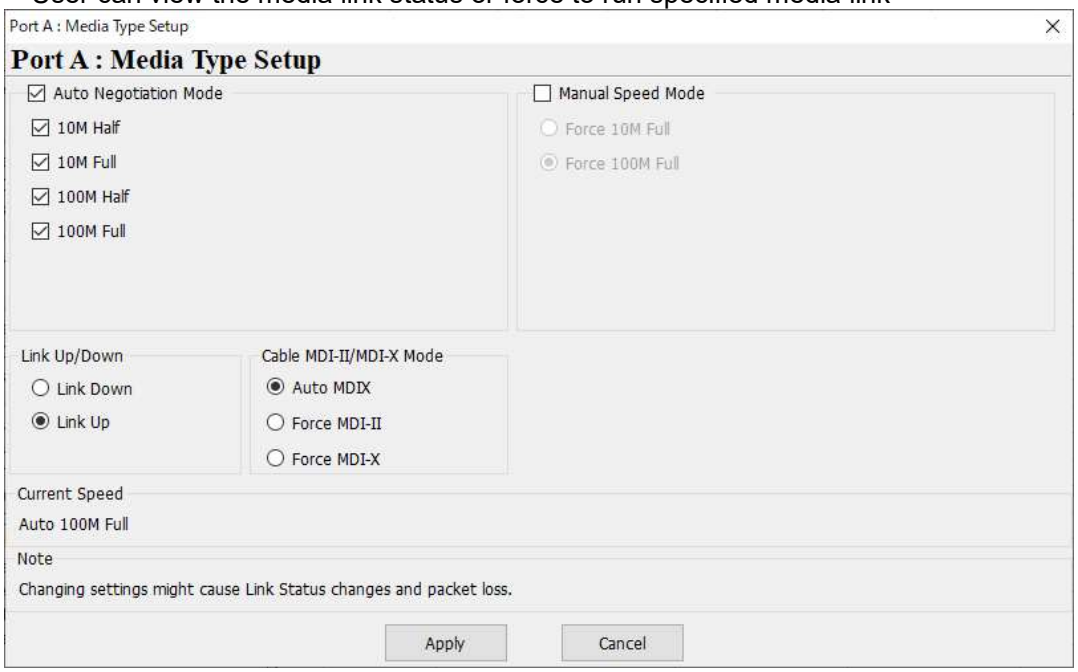
S: UDP: This field displays the **DPort (Destination Port)** and **SPort (Source Port)** of UDP protocol. If user would like to add UDP header to the packets, click and check the "**Enable**" check box, then edit the value.

1.4.2.2. Media Type Setup

Click item below to configure the link mode. Port A and port B has the same configuration items



User can view the media link status or force to run specified media link



1.4.2.3. Port Configuration

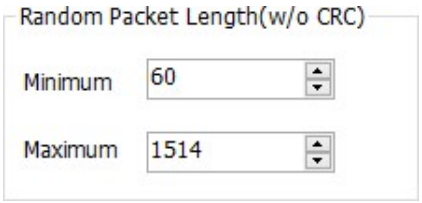
Click item below to view the Multi Streams Generation configuration window.

The **Port Configuration** window contains 7 menu tabs.

A. Flow Control

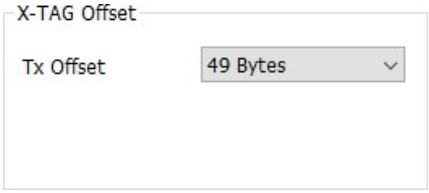
- **Flow Control：** This function is used to release the network congestion situations. Including **Tx Flow Control** and **Rx Flow Control.**
- **Rx Rate Control**: Enable this function to control the rate of receiving data. You can input the maximum receiving speed of the port in **Rate Limited**.

B. Random Packet Length



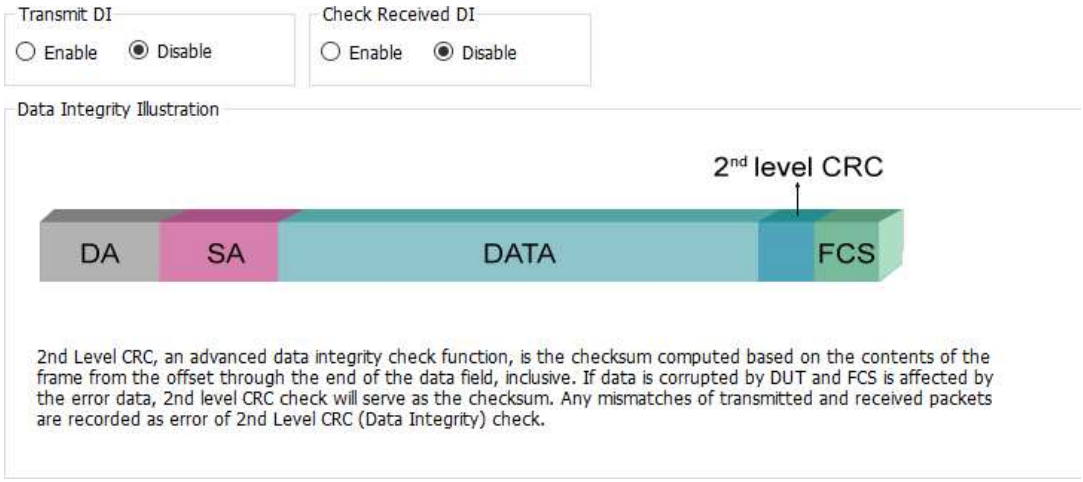
- **Random Packet Length (w/o CRC)**: Set the range of the random packet length.

C. X-TAG Offset



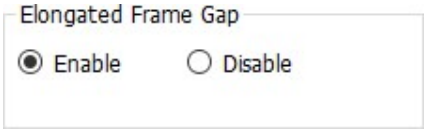
- **Tx Offset:** Set the starting position of the X-TAG in the transmitted packet from the scroll down menu.

D. Data Integrity (DI)



- **Transmit DI:** When enabled, NuWIN-RM will check data integrity of transmitted packets.
- **Check Received DI:** When enabled, NuWIN-RM will check data integrity of received packets.

E. Elongated Frame Gap

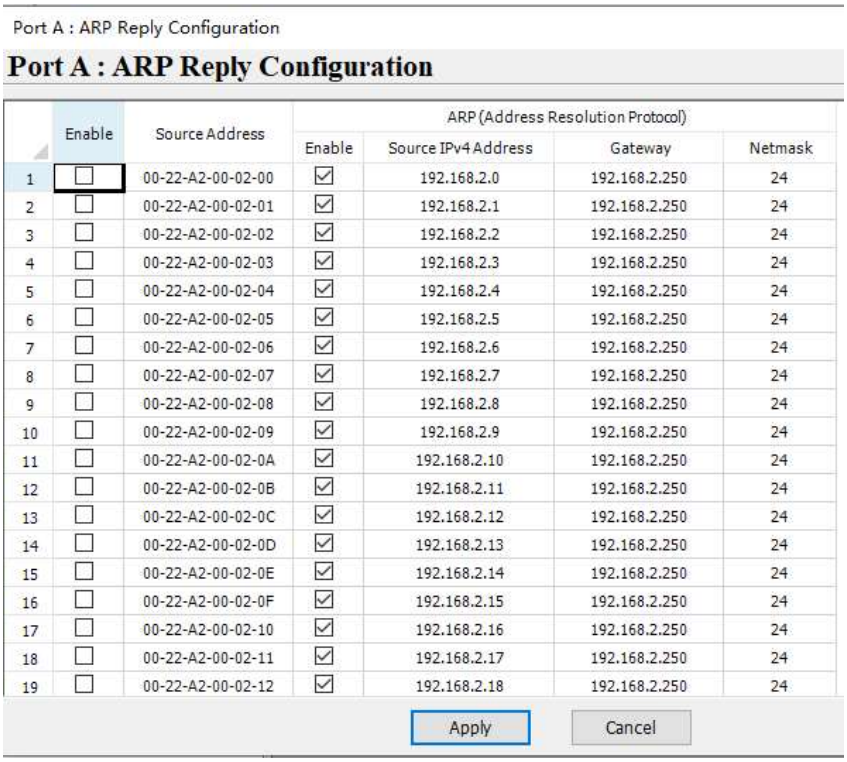


When this function is enabled and the transmitting packet flow reaches wirespeed, a 1 byte-time of frame gap will be inserted after a certain amount of packets are transmitted. This can reduce packet loss caused by crystal frequency differentials between DUT and test instrument. Enabling Elongated Frame Gap can compensate crystal frequency differentials by around 30 ppm as simulation.

F. Packet of USB Burst Transfer

- You can set the amount of packets that will be stored in the capture buffer and transmitted back via USB cable per time.

1.4.2.4. ARP Reply Configuration



ARP, namely address resolution protocol, is a TCP/IP protocol to obtain the MAC address based on the IP address.

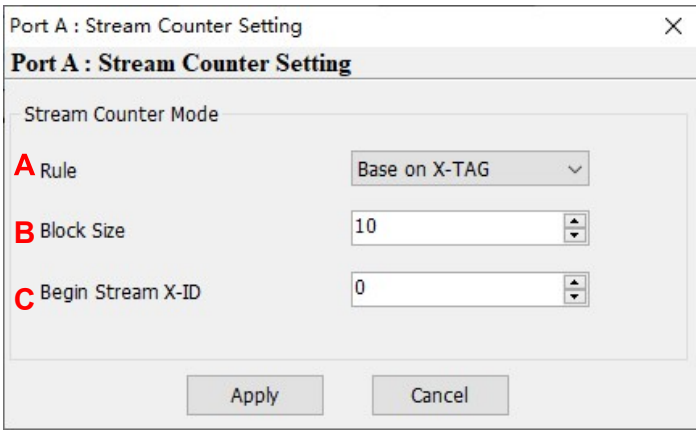
You can assign multiple MAC address and IP address pairs to one port. As long as the IP address in the ARP request fits one of the assigned pairs, the port will response the ARP request.

To assign a specific MAC address and IP address pair to the port, check the corresponding line in the most left **Enable** column.

Meanwhile, you must enable the ARP according the type of the IP address by check the corresponding line in the ARP **Enable** column.

Each port can simulate 24 MAC/IP pairs.

1.4.2.5. Stream Counter Setting



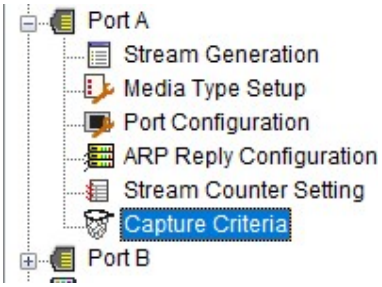
A: Rule: The stream counter will be counted base on the selection.

B: Block Size: The count of stream counter will be counted.

C: This area will display different content according to different rule.

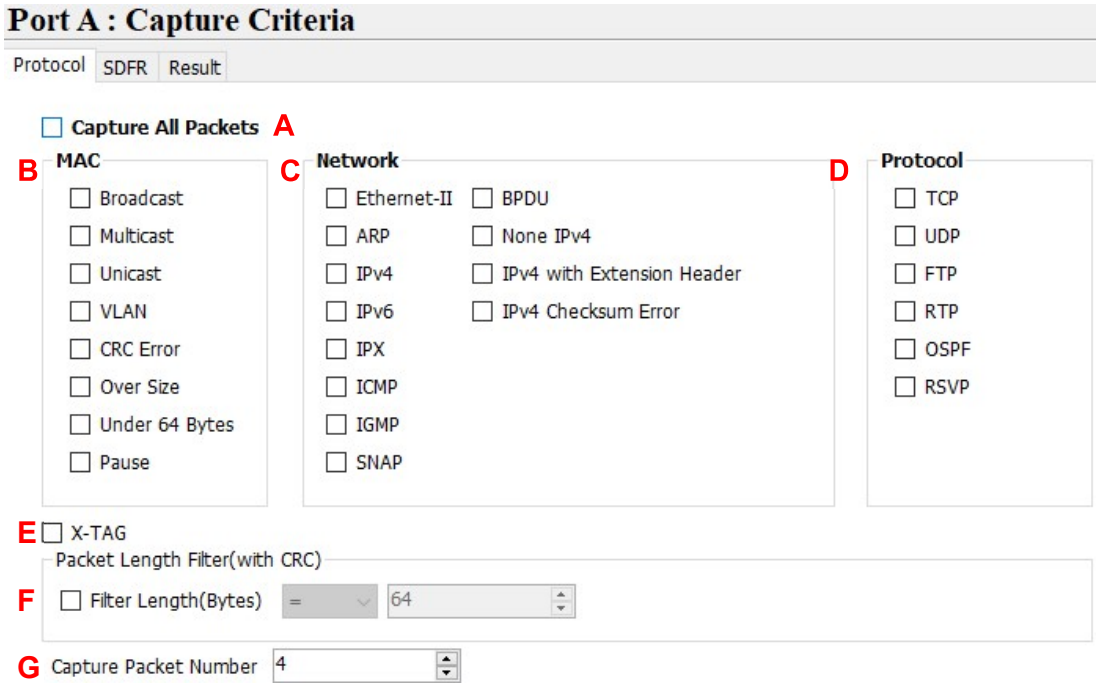
1.4.2.6. Capture Criteria

Click item below to view the Capture Criteria configuration window.



System shows the configuration window. Users can configure the criteria that they want to capture, from protocol or SDFR aspects

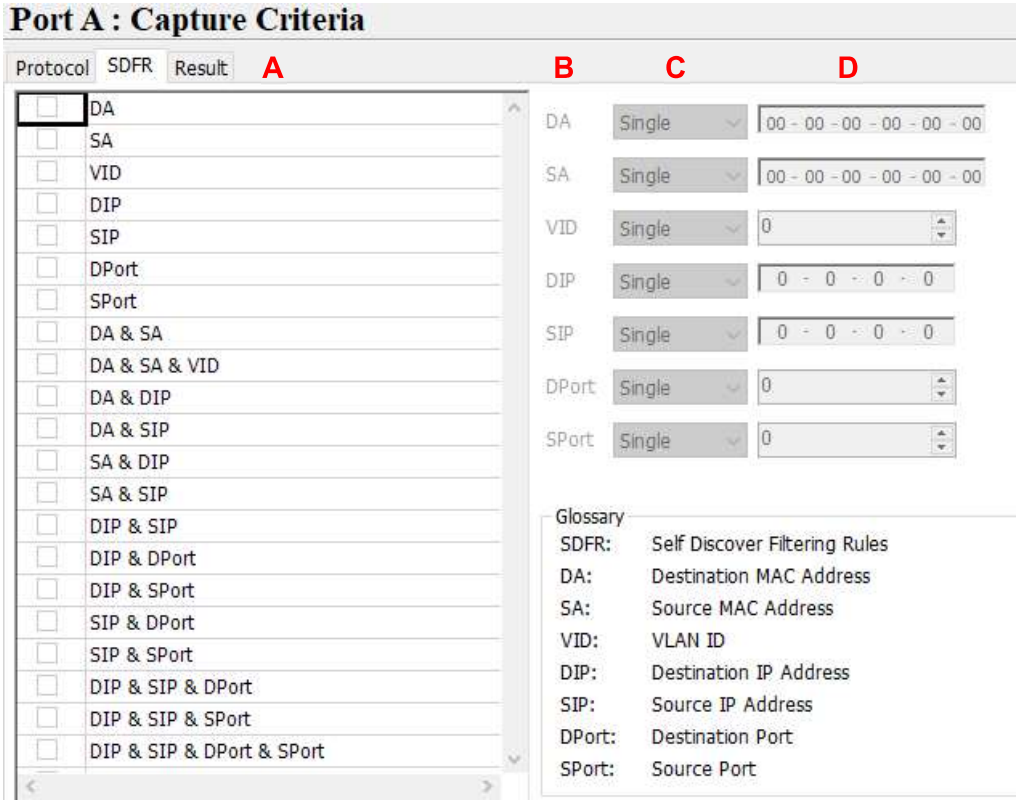
- **Protocol**
- Different protocols can be combined as unique criteria



A: Capture all packets: All packets are captured and sent to PC by USB port. Be attention that packet loss is possible if the captured traffic is higher than traffic allowed for USB port.
B: MAC: MAC based criteria. Packets with MAC events in the list is captured and sent to PC by USB port.
C: Network: Network events criteria. Packets with network events in the list is captured and sent to PC by USB port.
D: Protocol: Protocol Type criteria. Packets with protocol type in the list is captured and sent to PC by USB port.
E: X-TAG: X-TAG is an proprietary 12 bytes embedded tag that is located at 49th~60th bytes of each testing frames that are generated by Rapid-Matrix for multi-stream tests.
F: Packet length filter: Capture packet (frame) length in specified range of length
G: Set the count of capture packets.

◆ **SDFR:**

- SDFR (Self-Discover Filtering Rules) is a technique that make capture of Ethernet easy and convenient.
- User-friendly interface that the value such as source IP, destination IP and other criteria for capture and filter can be input directly without calculating mask.
- SDFR value for capture or filter includes several network event (such as DA, SA, DIP…), varied length of frame (oversized, undersized) and varied of frame/packet type (CRC error, IP checksum error…).
- Value of SDFR can be a unique value or a range of values between specified values. All packets that fit the value are captured
- Multiple filter condition can be activated easily by just clicking different options.
- Displays captured packet in real-time while network is still running.
- Value of SDFR and filter criteria can be changed dynamically during capture procedure.



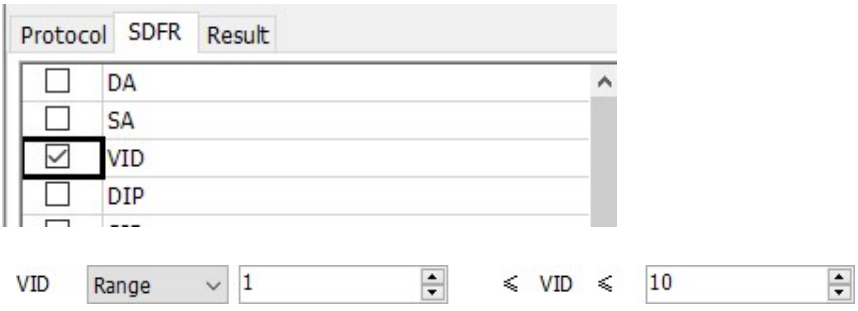
A: SDFR items: User can tick the items that act as criteria. When user ticks one option, some other options will be gray. It means the option what user tick has covered the range of those options in gray.

B: Pattern

- DA: Destination MAC address
- SA: Source MAC address
- VID: VLAN ID that follows 802.11Q standard
- DIP: Destination IP address
- SIP: Source IP address
- DPort: Destination port of IP address
- SPort: Source port of IP address

C: Pattern Mode: Select a pattern (Single, Pair, Range) to cover the value of criteria items.

D: Patterns: The unique value or range of values specified as the capture criteria of criteria items. For example, user wants to capture packets with VLAN ID 1 to 10.

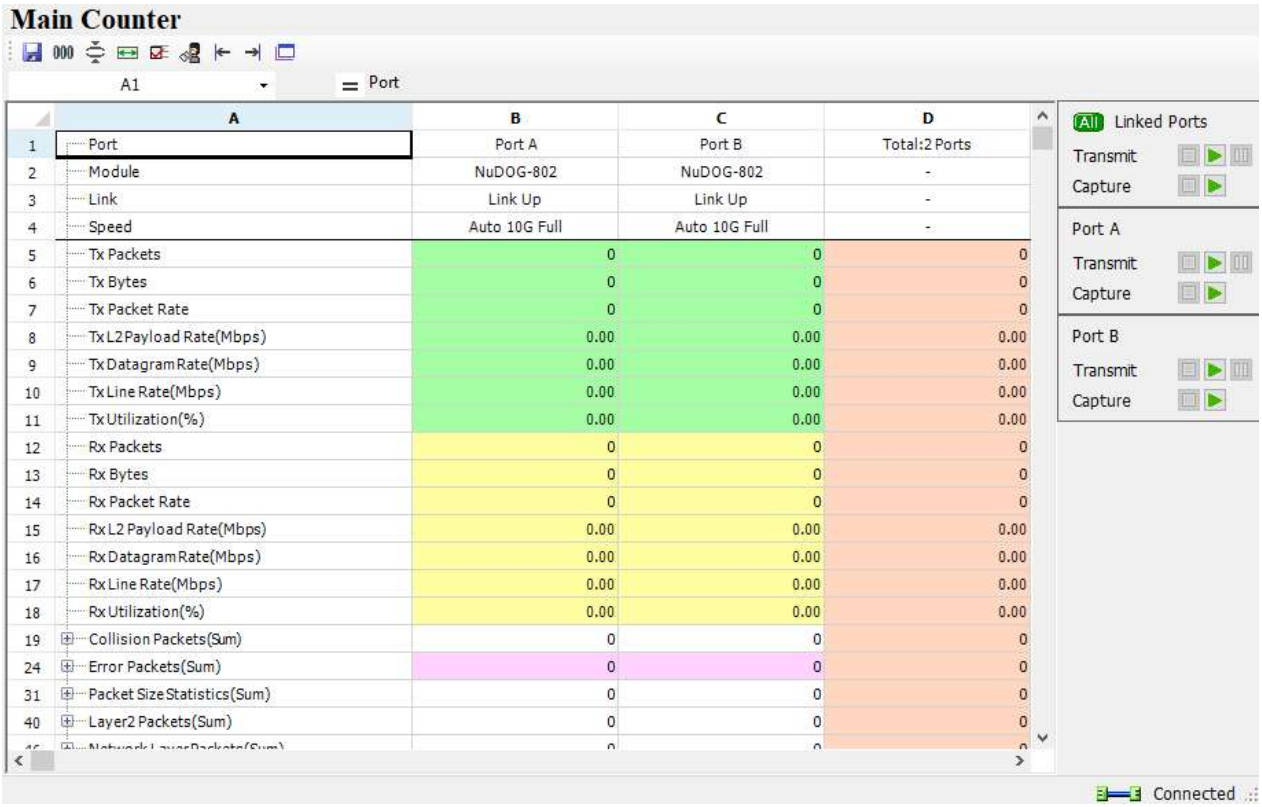


1.4.3. Main Counter

Click item below to view the Main Counter window.

or

Control button of this window can control packet generation and receiving, and also view the result counter.

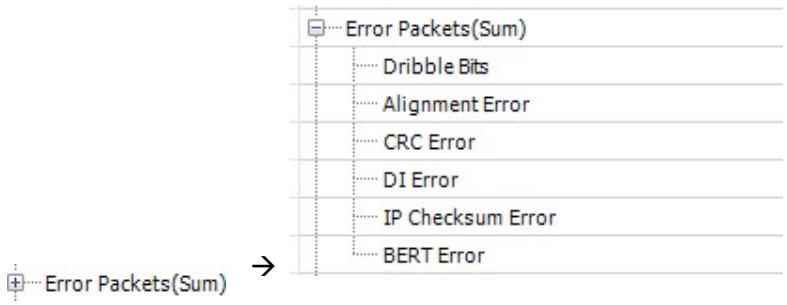


	A	B	C	D
1	Port	Port A	Port B	Total:2 Ports
2	Module	NuDOG-802	NuDOG-802	-
3	Link	Link Up	Link Up	-
4	Speed	Auto 10G Full	Auto 10G Full	-
5	Tx Packets	0	0	0
6	Tx Bytes	0	0	0
7	Tx Packet Rate	0	0	0
8	Tx L2 Payload Rate(Mbps)	0.00	0.00	0.00
9	Tx Datagram Rate(Mbps)	0.00	0.00	0.00
10	Tx Line Rate(Mbps)	0.00	0.00	0.00
11	Tx Utilization(%)	0.00	0.00	0.00
12	Rx Packets	0	0	0
13	Rx Bytes	0	0	0
14	Rx Packet Rate	0	0	0
15	Rx L2 Payload Rate(Mbps)	0.00	0.00	0.00
16	Rx Datagram Rate(Mbps)	0.00	0.00	0.00
17	Rx Line Rate(Mbps)	0.00	0.00	0.00
18	Rx Utilization(%)	0.00	0.00	0.00
19	Collision Packets(Sum)	0	0	0
24	Error Packets(Sum)	0	0	0
31	Packet Size Statistics(Sum)	0	0	0
40	Layer2 Packets(Sum)	0	0	0

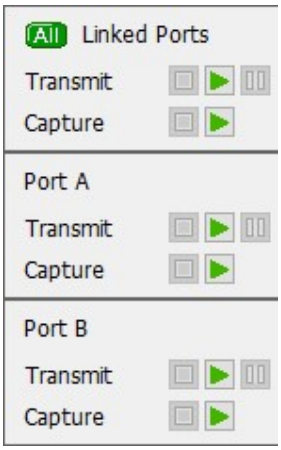
- **Tool Bar**

Icon	Item	Function
	Save Main Counter Data	Save current data of counters to Excel file
000	Clear All	Clear all counters to 0
	Hide Zero Counters	If all the counters of this row are 0, this row will be hidden until the value changed
	Column Width Setting	Set column's width by input the value
	Row View Setting	Set the rows shown or hidden in Main Counter window by select the item
	Send Learning Packets	The linked port will transmit some learning packets
	Float Counters Window	The Main Counter window will popup

Counter with ⊞ mark is expansible. Please click the ⊞ mark



- **Operation**

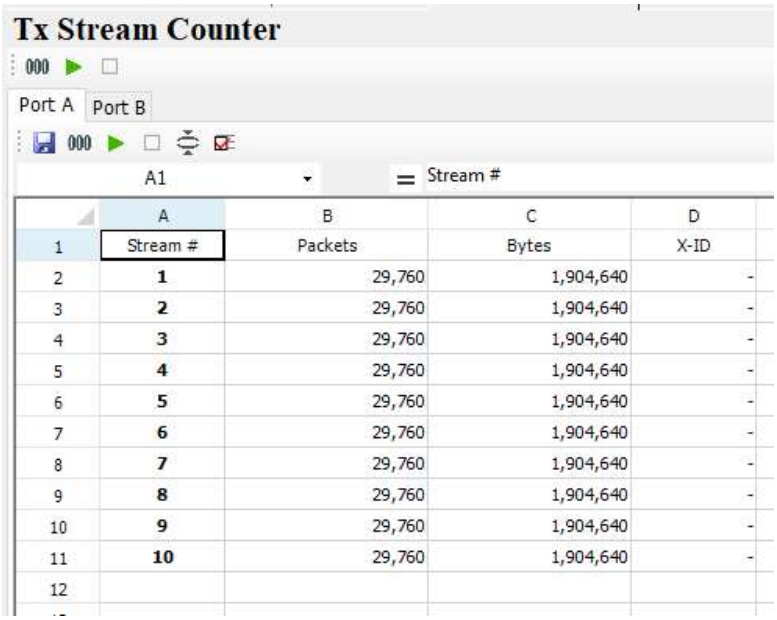


This option can activate Transmit or Capture of port A, port B or port A + B individually.

Button	Function
	Stop complete procedure of transmitting or capturing
	Start to transmit or capture procedure
	Pause transmitting or capturing procedure. System still measure the statistics counter, however, the counter value is static for user to watch the status when user click the  button. When user click  again, the counter status resume to real status instantly. Click this button does not affect the real counters values.

1.4.4. Tx Stream Counter

Click item below to view the Tx Stream Counter window.

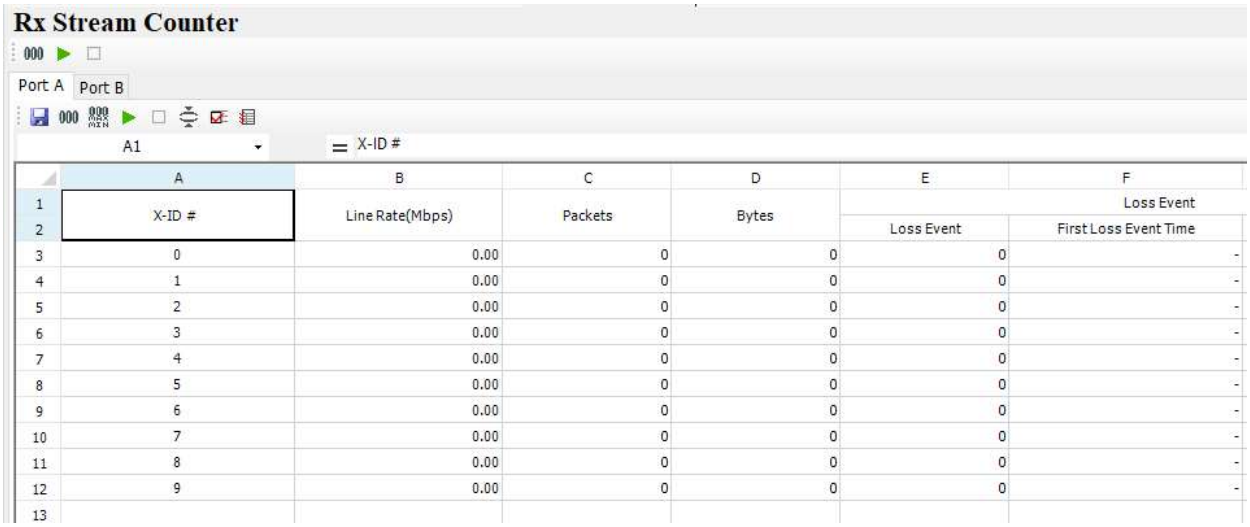


Stream #	Packets	Bytes	X-ID
1	29,760	1,904,640	-
2	29,760	1,904,640	-
3	29,760	1,904,640	-
4	29,760	1,904,640	-
5	29,760	1,904,640	-
6	29,760	1,904,640	-
7	29,760	1,904,640	-
8	29,760	1,904,640	-
9	29,760	1,904,640	-
10	29,760	1,904,640	-

Icon	Item	Function
	Save Tx Stream Counter Data	Save current data of counters to Excel file
	Clear (All)	Clear stream counters to 0 for 2 ports or single port.
	Start (All Ports) Transmit	Start Tx Stream Counter of 2 ports or single port.
	Stop (All Ports) Transmit	Stop Tx Stream Counter of 2 ports or single port.
	Hide Zero Counters	If all the counters of this row are 0, this row will be hidden until the value changed.
	Column View Setting	Set the column shown or hidden in the window by select the item

1.4.5. Rx Stream Counter

Click item below to view the Rx Stream Counter window.

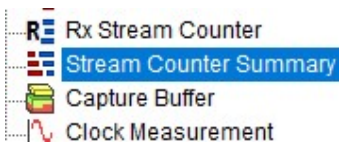


X-ID #	Line Rate(Mbps)	Packets	Bytes	Loss Event	First Loss Event Time
0	0.00	0	0	0	-
1	0.00	0	0	0	-
2	0.00	0	0	0	-
3	0.00	0	0	0	-
4	0.00	0	0	0	-
5	0.00	0	0	0	-
6	0.00	0	0	0	-
7	0.00	0	0	0	-
8	0.00	0	0	0	-
9	0.00	0	0	0	-

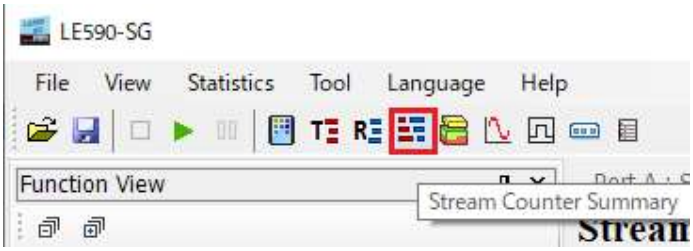
Icon	Item	Function
	Save Rx Stream Counter Data	Save current data of counters to Excel file
	Clear (All)	Clear stream counters to 0 for 2 ports or single port
	Clear All Maximum/Minimum Latency	Clear maximum and minimum latency.
	Start (All Ports) Transmit	Start Tx Stream Counter of 2 ports or single port.
	Stop (All Ports) Transmit	Stop Tx Stream Counter of 2 ports or single port.
	Hide Zero Counters	If all the counters of this row are 0, this row will be hidden until the value changed
	Column View Setting	Set the column shown or hidden in the window by select the item
	Stream Counter Setting	The **Stream Counter Setting** window will pop up if you press this button.

1.4.6. Stream Counter Summary

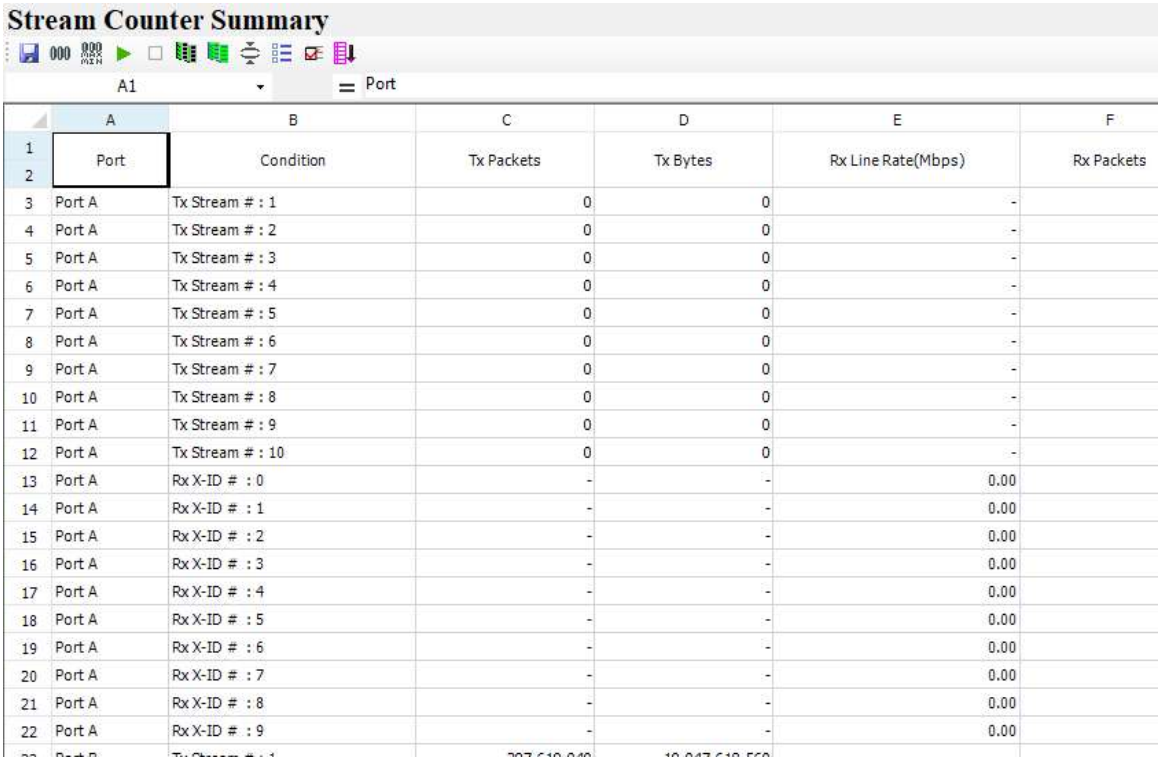
Click item below to view the Stream Counter Summary window.



or



User can make stream counter settings here to view the data receiving items of their interest. The dynamic statistics will be displayed here in a table form.



Stream Counter Summary

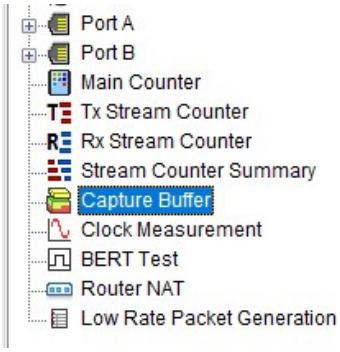
A1 = Port

	A	B	C	D	E	F
1	Port	Condition	Tx Packets	Tx Bytes	Rx Line Rate(Mbps)	Rx Packets
2						
3	Port A	Tx Stream # : 1	0	0	-	
4	Port A	Tx Stream # : 2	0	0	-	
5	Port A	Tx Stream # : 3	0	0	-	
6	Port A	Tx Stream # : 4	0	0	-	
7	Port A	Tx Stream # : 5	0	0	-	
8	Port A	Tx Stream # : 6	0	0	-	
9	Port A	Tx Stream # : 7	0	0	-	
10	Port A	Tx Stream # : 8	0	0	-	
11	Port A	Tx Stream # : 9	0	0	-	
12	Port A	Tx Stream # : 10	0	0	-	
13	Port A	Rx X-ID # : 0	-	-	0.00	
14	Port A	Rx X-ID # : 1	-	-	0.00	
15	Port A	Rx X-ID # : 2	-	-	0.00	
16	Port A	Rx X-ID # : 3	-	-	0.00	
17	Port A	Rx X-ID # : 4	-	-	0.00	
18	Port A	Rx X-ID # : 5	-	-	0.00	
19	Port A	Rx X-ID # : 6	-	-	0.00	
20	Port A	Rx X-ID # : 7	-	-	0.00	
21	Port A	Rx X-ID # : 8	-	-	0.00	
22	Port A	Rx X-ID # : 9	-	-	0.00	

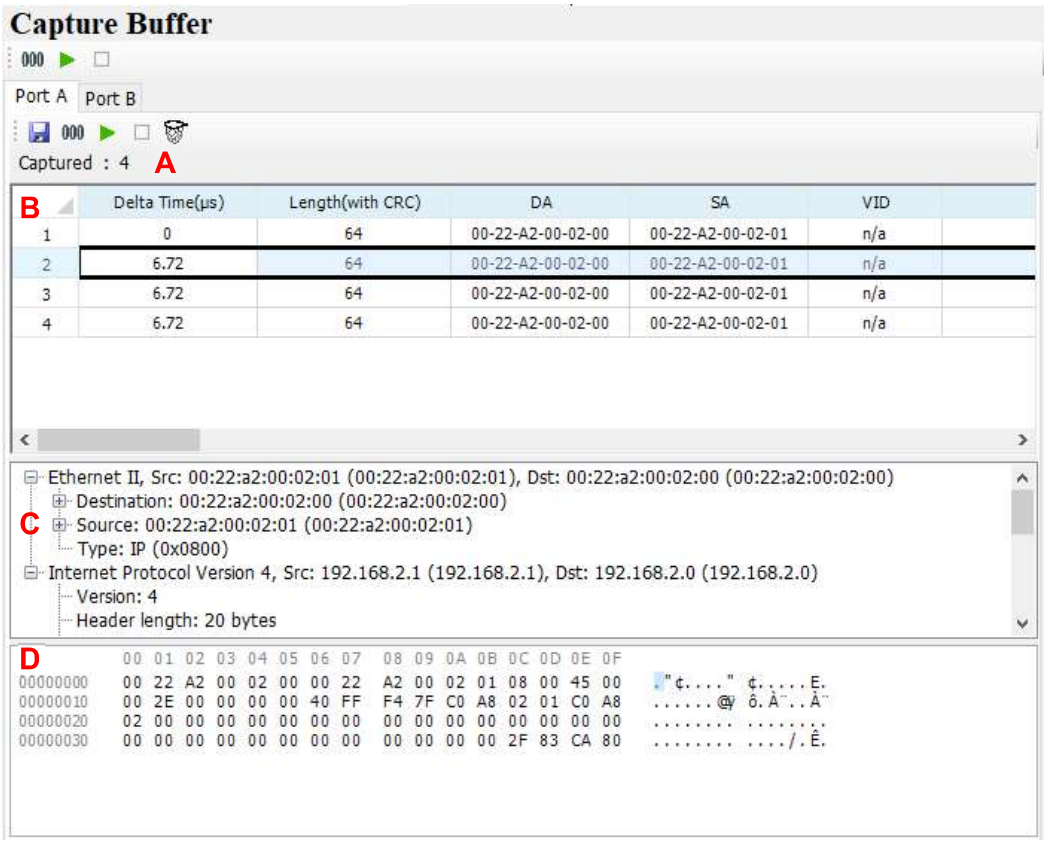
Icon	Item	Function
	Save Stream Counter Data	Save current data of counters to Excel file
	Clear (All)	Clear stream counters to 0 for 2 ports or single port
	Clear All Maximum/Minimum Latency	Clear maximum and minimum latency.
	Start All Ports Transmit	Start Tx Stream Counter of 2 ports.
	Stop All Ports Transmit	Stop Tx Stream Counter of 2 ports.
	Assign Port Map	This button allows user set the ports which they want to view. Only the statistics of the selected ports will be displayed.
	Stream Map Setting	This button allows user set the streams which they want to view. Only the statistics of the selected streams will be displayed.
	Hide Zero Counters	If all the counters of this row are 0, this row will be hidden until the value changed
	Row View Setting	A **Row View Setting** window will pop up if you press this button. Check the items you want to view here, then the checked item will be listed as a row
	Column View Setting	A **Column View Setting** window will pop up if you press this button. Check the items you want to view here, then the checked item will be listed as a column.
	Sort Rows	Sort the ports in a ascend trend according to the port ID and Stream ID. This helps the user quickly set the ports in order when the port sequence is messed manually.

1.4.7. Capture Buffer

Click item below to view the Capture Buffer configuration window.



To view the contents of captured packets, user can select the captured packets from Capture Buffer window



Icon	Item	Function
	Save as Pcap	Save the captured packets to pcap file
	Clear	Clear current captured packets
	Start Capture	Start to capture procedure
	Stop Capture	Stop complete procedure of capturing
	Capture Criteria	Set column's width by input the value

A: The count of captured packets

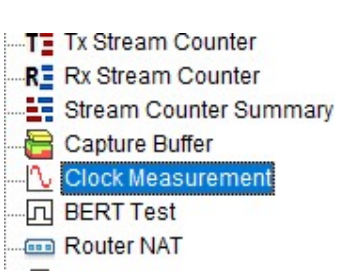
B: The list of all captured packets, and summary of network items

C: Frame view of selected packet

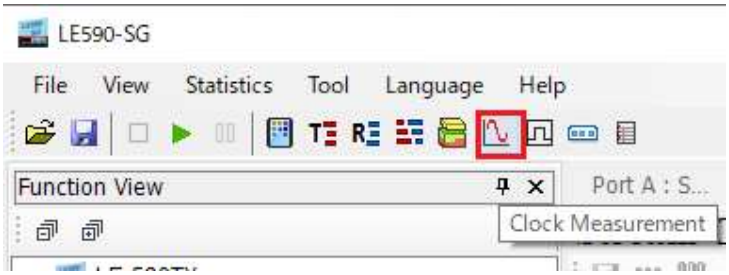
D: The contents of selected packet

1.4.8. Clock Measurement

Click item below to view the Clock Measurement window.

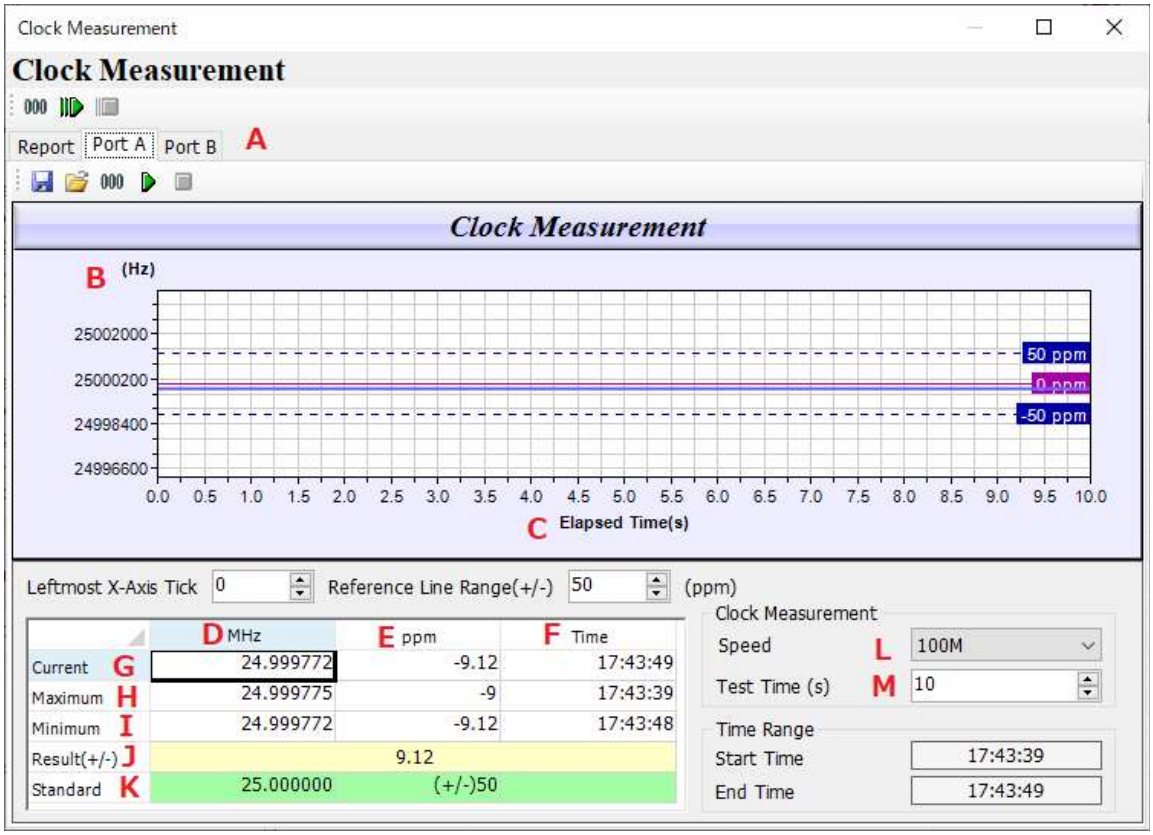


or



This device is equipped with high precision 1 ppm temperature-compensated oscillator that can generate precise speed network streams to DUT, or measures the speed rate of DUT's oscillator for speed control of network streams.

By using this application software, operator is able to measure oscillator's speed of DUT that is either faster or slower than standard speed in ppm scale, or use it as criteria to judge the result of test.



Icon	Item	Function
	Save	Save the data in the chart to csv file
	Load	Load the data from a csv file
	Clear Chart Values	Clear current test value
	Start Testing	Start current port to test
	Stop Testing	Stop current port's procedure of testing
	Start Testing All	Start all ports to test
	Stop Testing All	Stop all port's procedure of testing

A: Select Port: Select port that connect to DUT for test.

B: Hz: Hz scale in this curve graph.

C: Elapsed Time(s): Time (second) scale in this curve graph.

D: MHz: The frequency of Quartz Oscillator.

E: ppm: faster (+) or slower (-) then standard speed. For example, +20 means 20ppm faster then standard speed

F: Time: The time of the value detected.

G: Current: Current detected value.

H: Maximum: Maximum value of MHz or ppm during the test.

I: Minimum: Minimum value of MHz or ppm during the test.

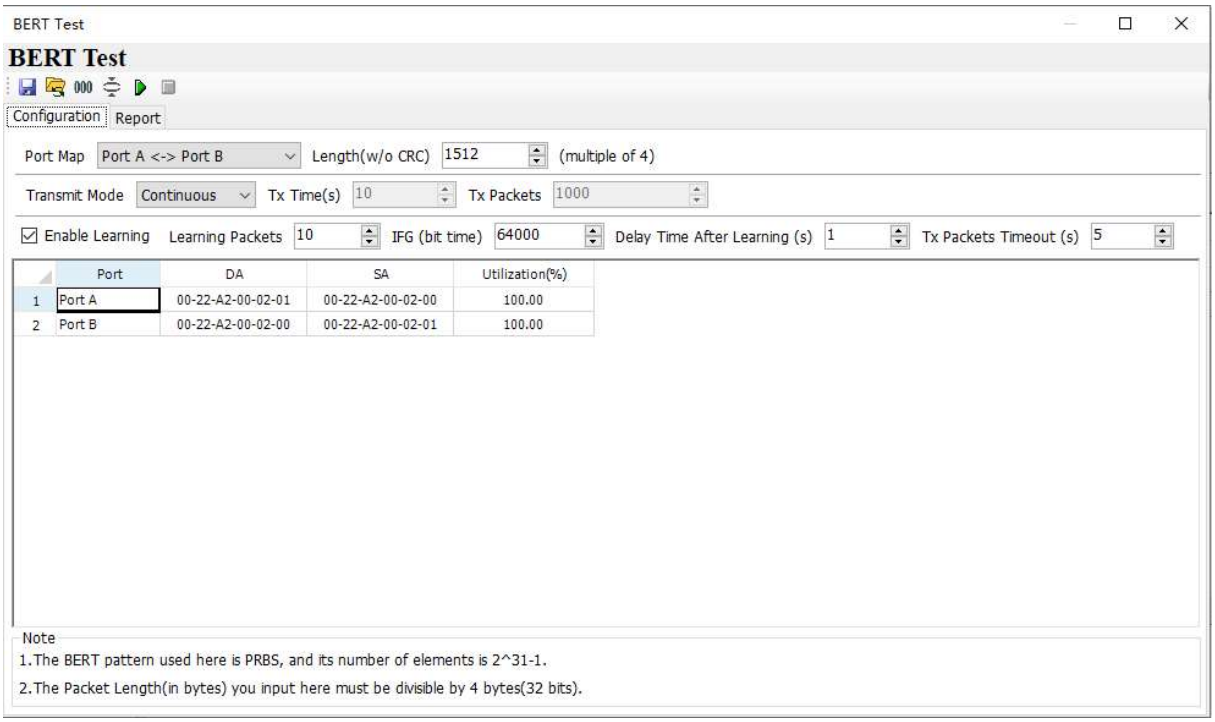
J: Result: The test result in ppm.

K: Standard: Standard value for reference.

L: Mode (Speed): Select network speed that user wants to test the DUT.

M: Test Time(s): Configure the duration of the test.

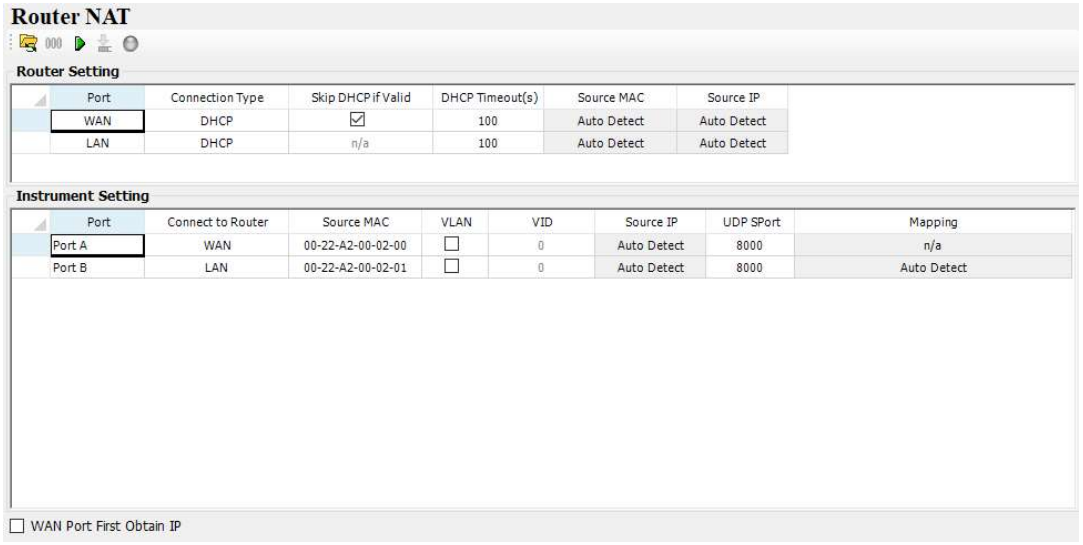
1.4.9. BERT Test



BERT stands for **Bit Error Rate Test** LE590-SG uses 2^31-1 number of elements to generate BERT pattern, LE590-SG will check if BERT patterns are in received packets.

1.4.10. Router NAT

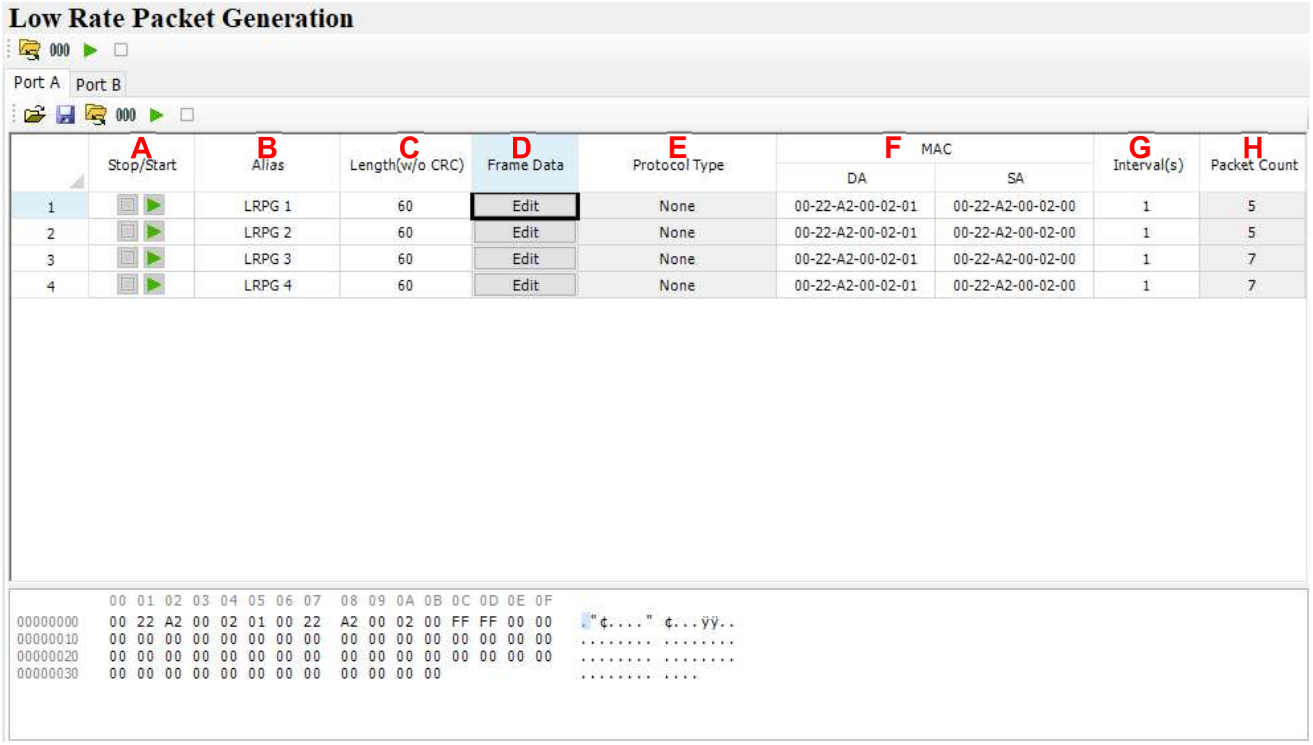
Router NAT is specially used when the DUT is a router. This function provides complete configuration information for testing the routers, which greatly facilitate the configuration work. The settings areas are divided into two types, the white areas and the gray areas. The content in the white area can be configured as the user's expectations while the content of the gray area is automatically obtained after running this function.



Icon	Item	Function
	Set to Default	Set all the values to the default
	Clear	Clear the test result
	Start	Start running the Router NAT function
	Set to Stream	The settings here will be applied to the packet settings of the stream by clicking this button. User can check the result by view **Stream Generation**.
	Keep Alive	With Keep Alive button activated, the system will transmit low flow data by correct configuration to ensure the smoothness of the link. If the correct configuration is not yet obtained, no actions should be taken.

1.4.11. Low Rate Packet Generation

A special packet transmit mode for low rate. There are 4 entries, every entry can send 1 packet per second at most.



A: Stop/Start: Stop or Start transmission.

B: Alias: Alias of this entry.

C: Length (w/o CRC): Frame length in bytes without CRC

D: Frame Data Edit: Configure the payload contents in frame. Click the **Edit** to edit the detailed contents in frame.

E: Protocol Type: System shows the Protocol Type when frame content is configured in Frame Data.

F: MAC: MAC: This field displays the **DA (Destination MAC Address)** and **SA (Source MAC Address)** of the stream. Double-click the **DA** and **SA** of each stream, user can edit the destination/source MAC addresses.

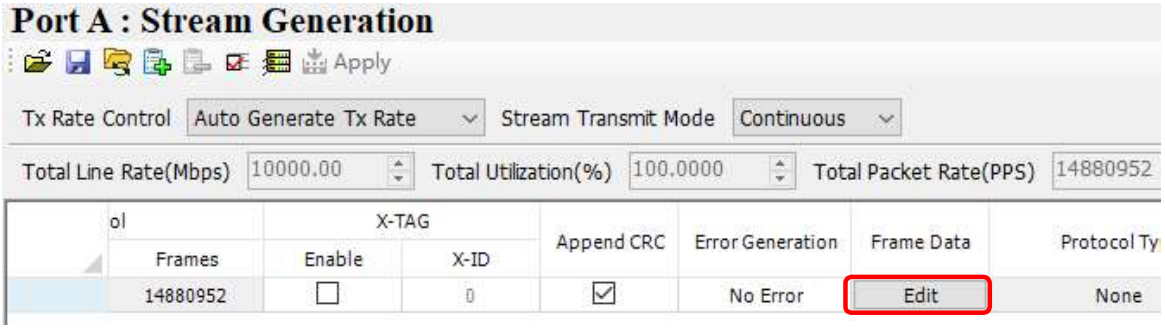
G: Interval(s): The interval the packets will be sent.

H: Packet Count: The count of the packets has been sent.

1.5. Frame Date Edit

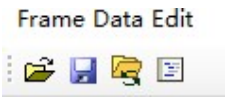
To create the pattern and contents of the streams what user want to generate, the utility has Frame Data Edit function to create what user want.

Click Stream Generation system shows



Configure related parameters, then user can click Edit to edit the detailed contents in frame.

1.5.1. Menu

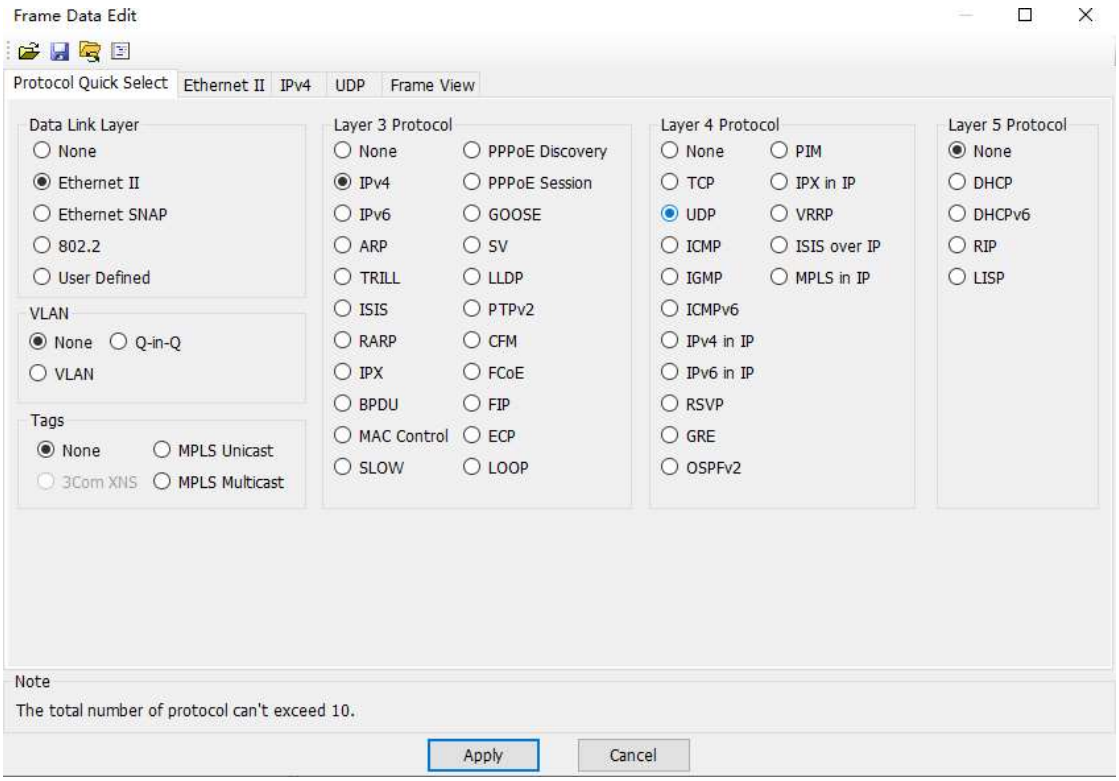


Icon	Item	Function
	Load	Load a pcap file from PC to generate the same stream.
	Save	Save the configuration to a pcap file.
	Set to Default	Set frame data to default value.
	Transfer Protocol to User Defined	Base on the protocol which user selected, user can edit the data by themselves.

This window shows all frame type that is configurable. User can also import user-defined file (*.pcap of Ethereal or Wireshark) for test directly.

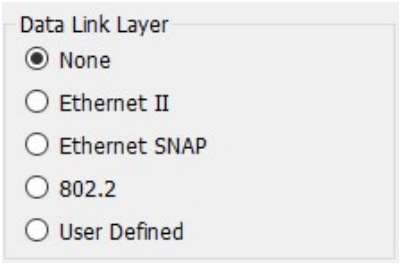
1.5.2. Protocol Quick Select

This Frame View window shows the frame structure of the frame that user want to edit.



1.5.3. Data Link layer

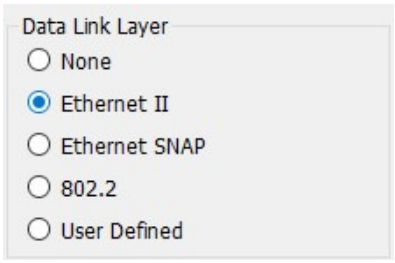
Data Link Layer type of streams generation

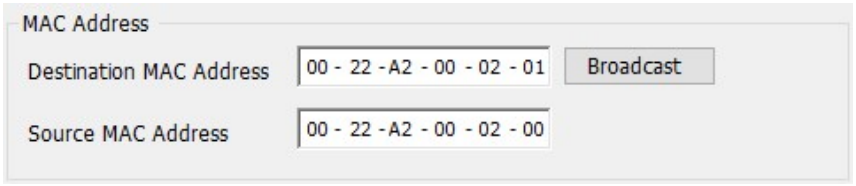


Data Link layer: The Data Link Layer is Layer 2 of the seven-layer OSI model of computer networking. The Data Link Layer protocols respond to service requests from the Network Layer and they perform their function by issuing service requests to the Physical Layer. Several protocols options can be chosen for the test.

1.5.3.1. Ethernet II

Ethernet II: The most common Ethernet protocol currently used on LAN



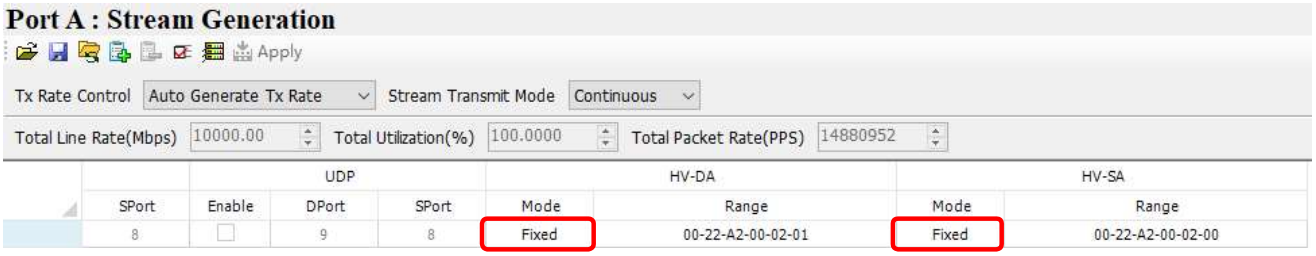


User can configure the MAC address of DUT.
Destination Address (DA): Default: FF:FF:FF:FF:FF:FF, means broadcast frame. To use variation of DA function, this MAC address is the start MAC address

Source Address (SA): Default: 00:00:00:00:00:00, means the MAC address of this device itself. To use variation of SA function, this MAC address is the start MAC address

1.5.3.2. Variation of DA, SA and VID

The DA and SA is variable if increase or decrease selection is selected
DA, SA of Default Multi Streams generation is fixed



User can click the selection and change it to increase or decrease and also specify a range of variation as the example below

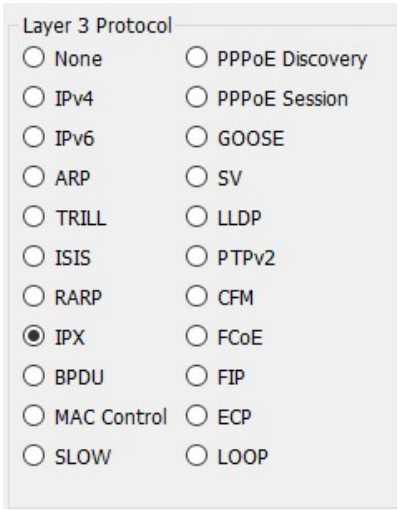
HV-DA		HV-SA	
Mode	Range	Mode	Range
Increase	00-22-A2-00-02-00 ~ 00-22-A2-00-02-FF	Increase	00-22-A2-00-02-00 ~ 00-22-A2-00-02-FF

Assume that the DA is 00-00-21-5C-0A-22

- When increase mode is selected, the last 2 hexdecimal digits will be 22, 23, 24…till the counts of the range.
- When decrease mode is selected, the last 2 hexdecimal digits will be 22, 21, 20…till the counts of the range.

1.5.3.3. IPX

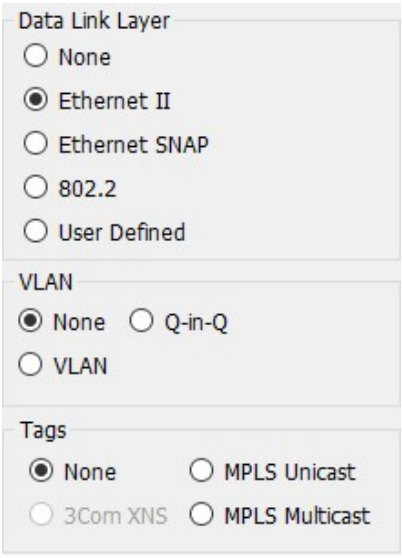
IPX: Internetwork Packet Exchange (IPX) is the OSI-model Network layer protocol in the IPX/SPX protocol stack. The IPX/SPX protocol stack is supported by Novell's NetWare network operating system.



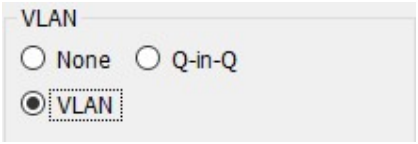
This editor of IPX will added if required.

1.5.4. Tags

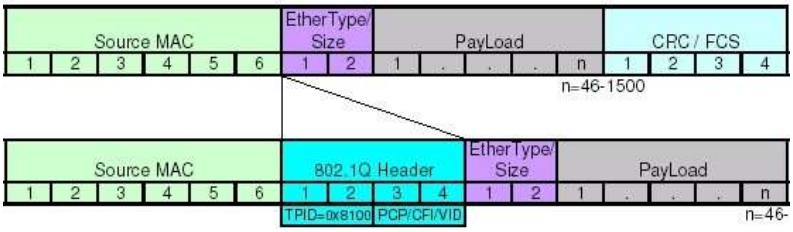
When Ethernet II of Data Link Layer is selected, extra tag options is available.
When Ethernet II is selected, Tags option is enabled.



1.5.4.1. VLAN

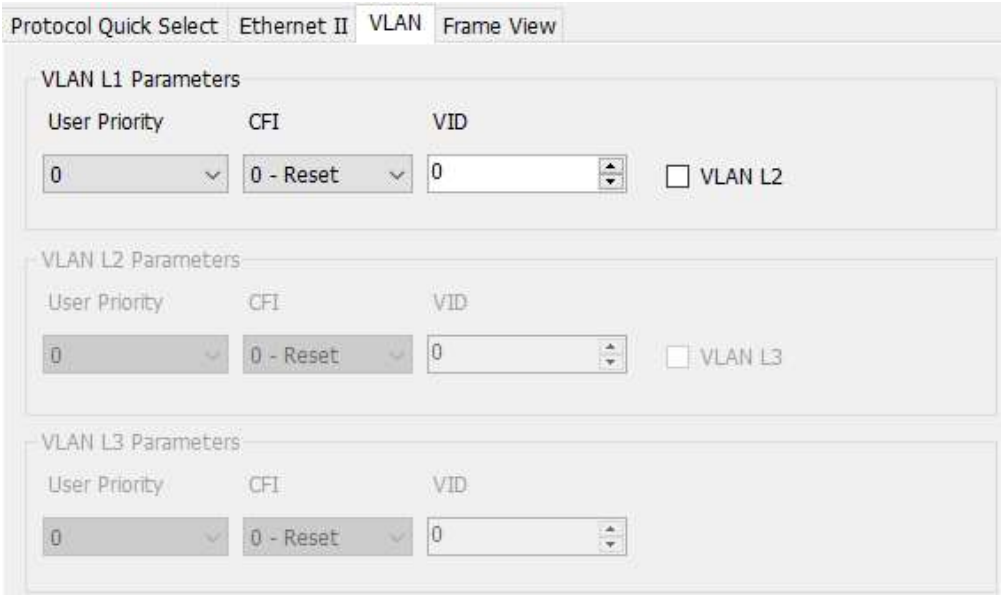


A virtual LAN, commonly known as a VLAN, is a group of hosts with a common set of requirements that communicate as if they were attached to the Broadcast domain, regardless of their physical location. The protocol most commonly used today in configuring virtual LANs is IEEE 802.1Q.
IEEE 802.1Q adds a 32-bit field between the source MAC address and the EtherType/Length fields of the original frame. The VLAN tag field has the following format:



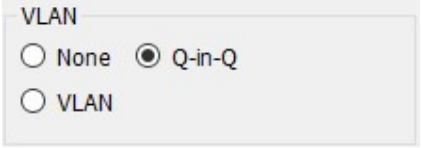
VLAN Tag in Ethernet Frame

To configure the VLAN for streams generation, click the VLAN Tab

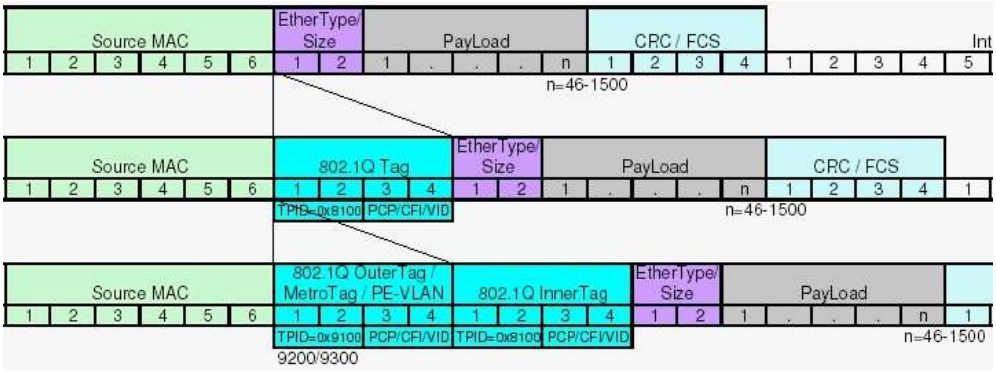


User priority (also called COS, class of service) and VID are most common parameter for the test

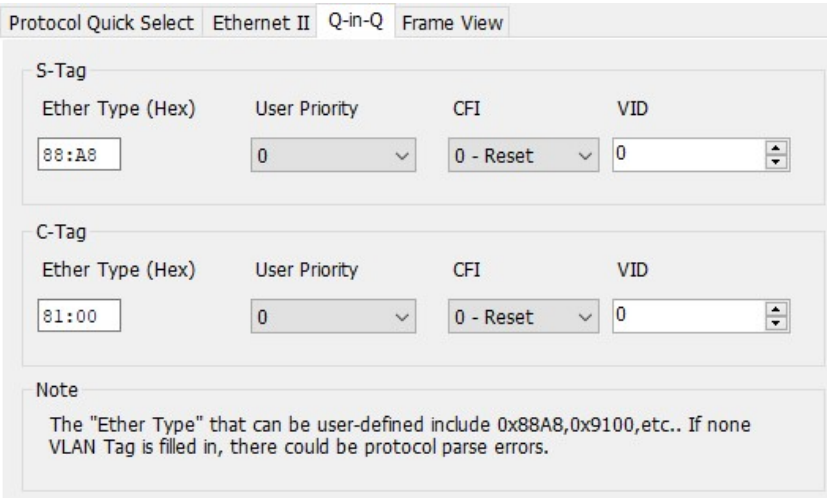
1.5.4.2. Q-in-Q



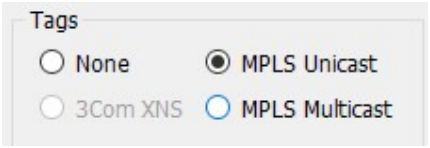
IEEE 802.1ad (Provider Bridges) is an amendment to IEEE standard IEEE 802.1Q-1998 and it is called Q-in-Q or Stacked VLANs



To configure the Q-in-Q for streams generation, click the Q-in-Q Tab



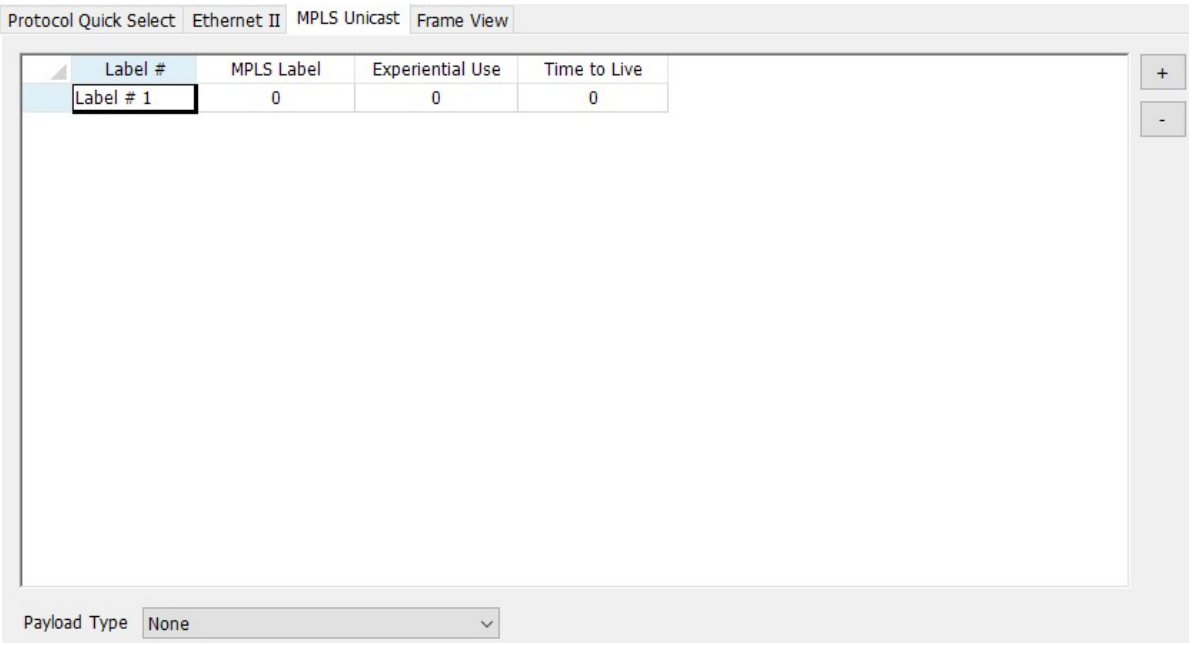
1.5.4.3. MPLS



In computer networking and telecommunications, Multiprotocol Label Switching (MPLS) refers to a mechanism that directs and transfers data between Wide Area Networks (WANs) nodes with high performance, regardless of the content of the data. MPLS makes it easy to create "virtual links" between nodes on the network, regardless of the protocol of their encapsulated data.

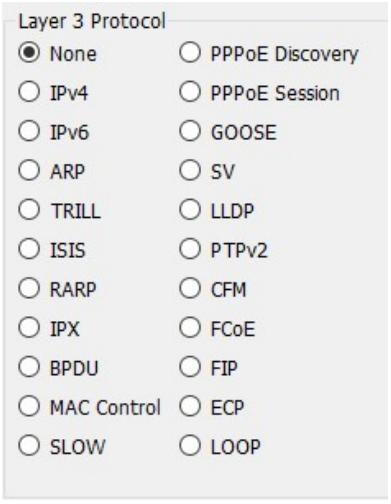
MPLS works by prefixing packets with an MPLS header, containing one or more 'labels'. This is called a label stack. Each label stack entry contains four fields:

- A 20-bit label value.
- A 3-bit Traffic Class field for QoS (Quality of Service) priority (experimental) and ECN (Explicit Congestion Notification).
- A 1-bit bottom of stack flag. If this is set, it signifies that the current label is the last in the stack.
- An 8-bit TTL (time to live) field.

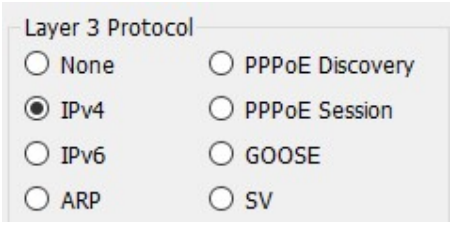


1.5.5. Layer 3 Header

In the payload of frame, layer 3 header as the items below is configurable



1.5.5.1. IPv4

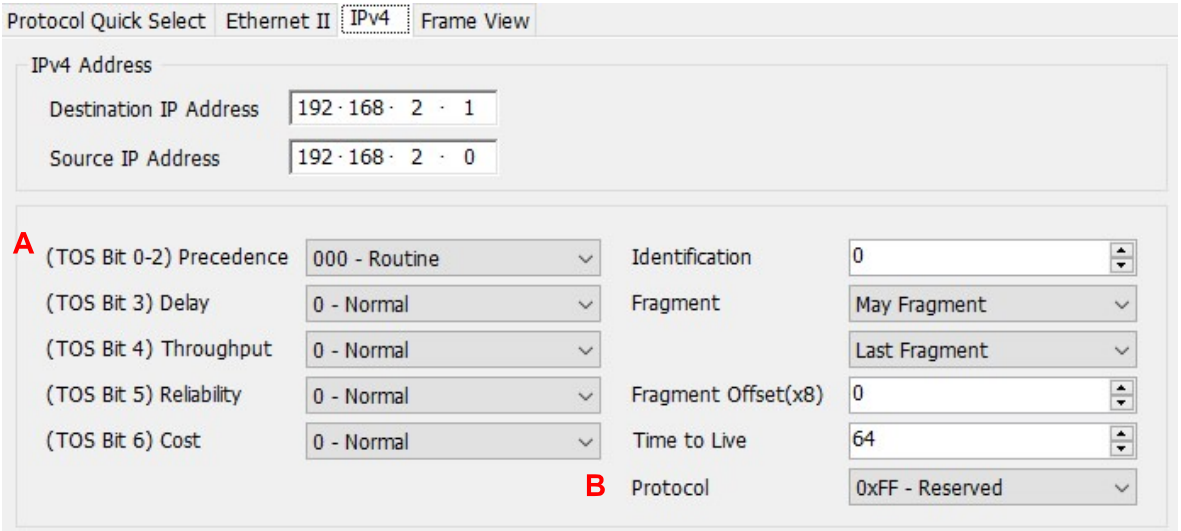


IPv4: Internet Protocol version 4 (IPv4) is the fourth revision in the development of the Internet Protocol (IP) and it is the first version of the protocol to be widely deployed.

The structure of IP header is illustrated below

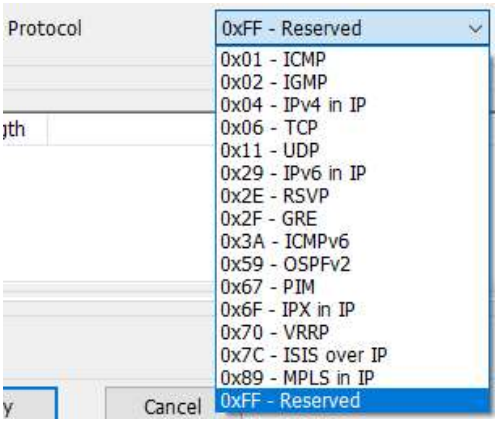
bit offset	0–3	4–7	8–15	16–18	19–31
0	Version	Header length	Differentiated Services	Total Length	
32	Identification			Flags	Fragment Offset
64	Time to Live		Protocol	Header Checksum	
96	Source Address				
128	Destination Address				
160	Options				
160 or 192+	Data				

The utility has user configurable interface to match the structure of IPv4 header

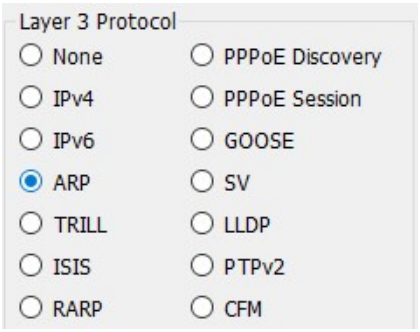


A: Differentiated Services (DS) was originally defined as the TOS (**Type of Services**) field; this field is now defined by RFC 2474 for Differentiated services (DiffServ) and by RFC 3168 for Explicit Congestion Notification (ECN), matching IPv6.

B: Most common protocols numbers are listed below and the utility has detail configuration of these protocol.



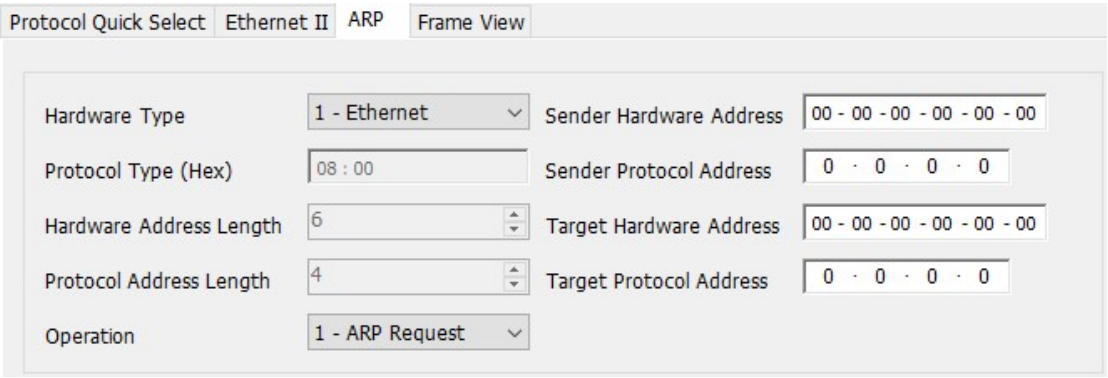
1.5.5.2. ARP



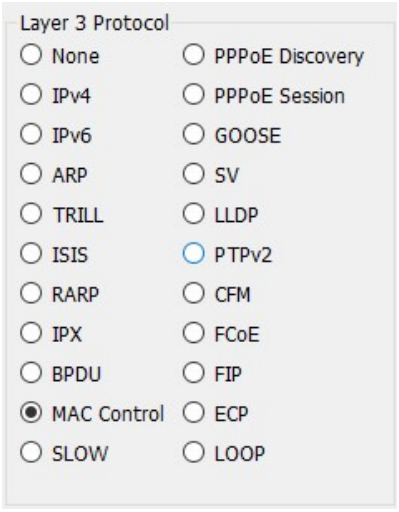
ARP: Address Resolution Protocol (ARP) is the method for finding a host's link layer (hardware) address when only its Internet Layer (IP) or some other Network Layer address is known. ARP is primarily used to translate IP addresses to Ethernet MAC addresses.

bit offset	0 - 7	8 - 15	16 - 31
0	Hardware type (HTYPE)		Protocol type (PTYPE)
32	Hardware length (HLEN)	Protocol length (PLEN)	Operation (OPER)
64	Sender hardware address (SHA) (first 32 bits)		
96	Sender hardware address (SHA) (last 16 bits)		Sender protocol address (SPA) (first 16 bits)
128	Sender protocol address (SPA) (last 16 bits)		Target hardware address (THA) (first 16 bits)
160	Target hardware address (THA) (last 32 bits)		
192	Target protocol address (TPA)		

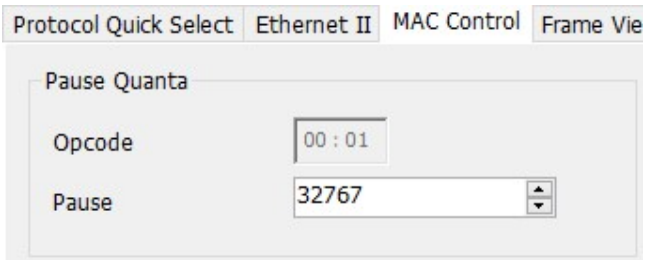
The utility has user configurable interface to match the structure of ARP header.



1.5.5.3. Pause



Pause: PAUSE is a flow control mechanism on full duplex Ethernet link segments defined by IEEE 802.3x and uses MAC Control frames to carry the PAUSE commands.

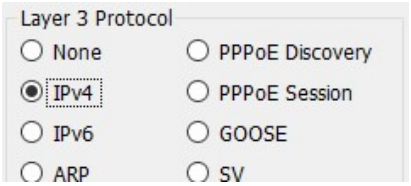


The Destination Address of Pause frame is 01:80:C2:00:00:01. This particular address has been reserved for PAUSE frames.
The MAC Control opcode for PAUSE is 00:01 (0X0001 in hexadecimal)

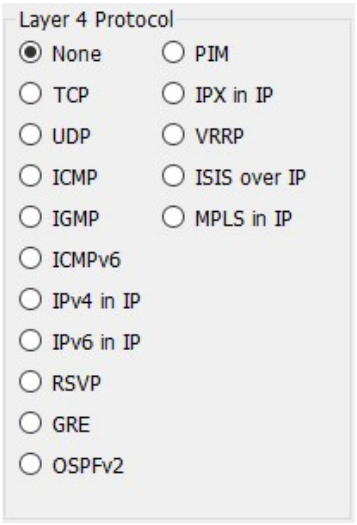
A PAUSE frame includes the period of pause time being requested, in the form of two byte unsigned integer (0 through 65535). This number is the requested duration of the pause.

1.5.6. Layer 4 Header

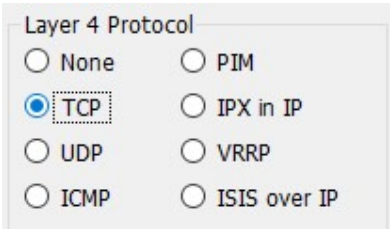
In the payload of frame, if IPv4 is selected



Then Layer 4 header as below is configurable



1.5.6.1. TCP/IP



The Transmission Control Protocol (TCP) is one of the core protocols of the Internet Protocol Suite.
The structure of TCP segment is illustrated below. The TCP header starts after bit 160 of the IP header.

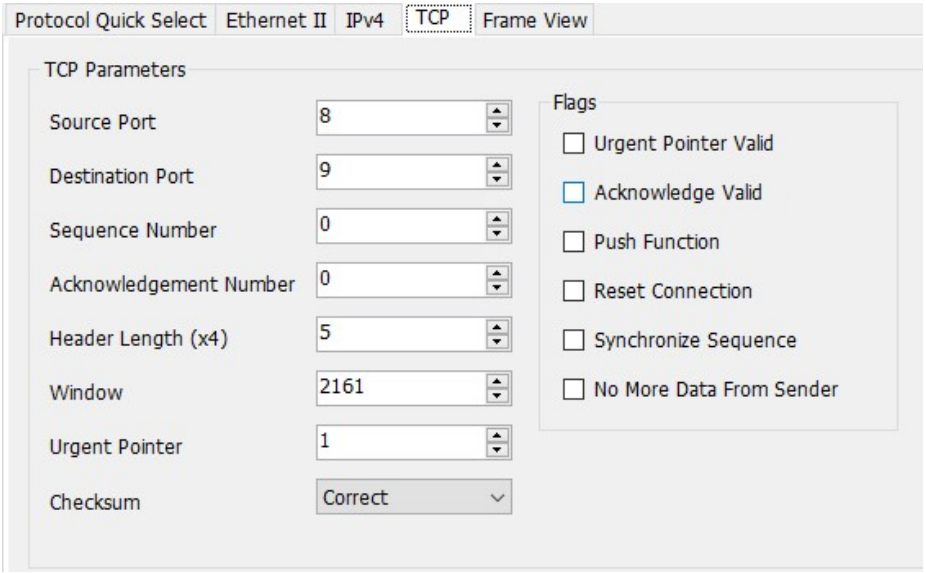
TCP Header

Bit offset	0–3	4–7	8–15	16–31
0	Source port			Destination port
32	Sequence number			
64	Acknowledgment number			
96	Data offset	Reserved	CWR ECE URG ACK PSH RST SYN FIN	Window Size
128	Checksum			Urgent pointer
160	Options (optional)			
160/192+	Data			

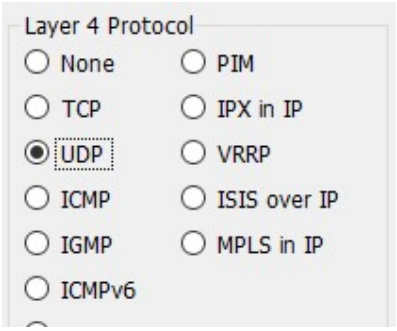
Flags (8 bits) (called Control bits) – contains 8 1-bit flags

- CWR (1 bit) – Congestion Window Reduced (CWR) flag is set by the sending host to indicate that it received a TCP segment with the ECE flag set (added to header by RFC 3168).
- ECE (ECN-Echo) (1 bit) – indicate that the TCP peer is ECN capable during 3-way handshake (added to header by RFC 3168).
- URG (1 bit) – indicates that the URGent pointer field is significant
- ACK (1 bit) – indicates that the ACKnowledgment field is significant
- PSH (1 bit) – Push function
- RST (1 bit) – Reset the connection
- SYN (1 bit) – Synchronize sequence numbers
- FIN (1 bit) – No more data from sender

The utility has user configurable interface to match the structure of TCP segment



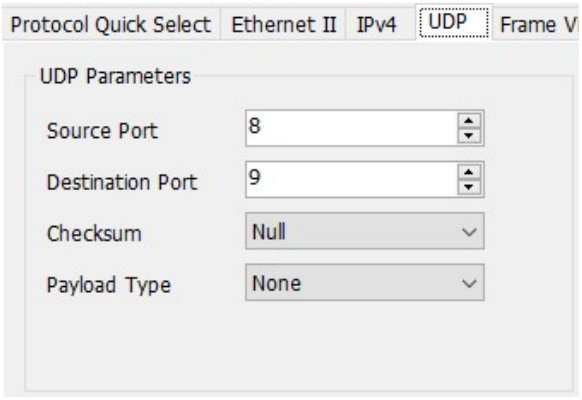
1.5.6.2. UDP/IP



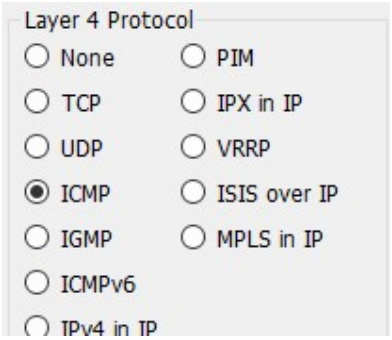
The User Datagram Protocol (UDP) is one of the core members of the Internet Protocol Suite, the set of network protocols used for the Internet.
The structure of UDP segment is illustrated below. The UDP segment starts after bit 160 of the IP header

bits	0 - 15	16 - 31
0	Source Port	Destination Port
32	Length	Checksum
64	Data	

The utility has user configurable interface to match the structure of UDP segment



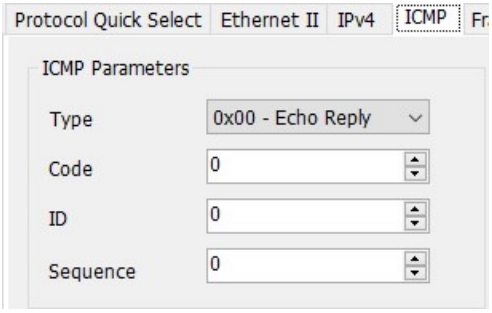
1.5.6.3. ICMP/IP



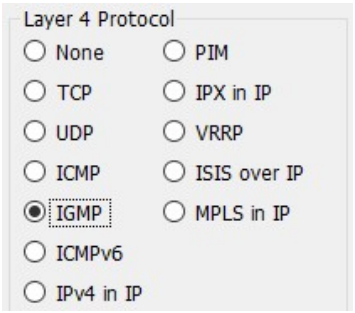
The Internet Control Message Protocol (ICMP) is one of the core protocols of the Internet Protocol Suite.
The structure of ICMP segment is illustrated below
The ICMP header starts after bit 160 of the IP header

Bits	160-167	168-175	176-183	184-191
160	Type	Code	Checksum	
192	ID		Sequence	

The utility has user configurable interface to match the structure of ICMP segment



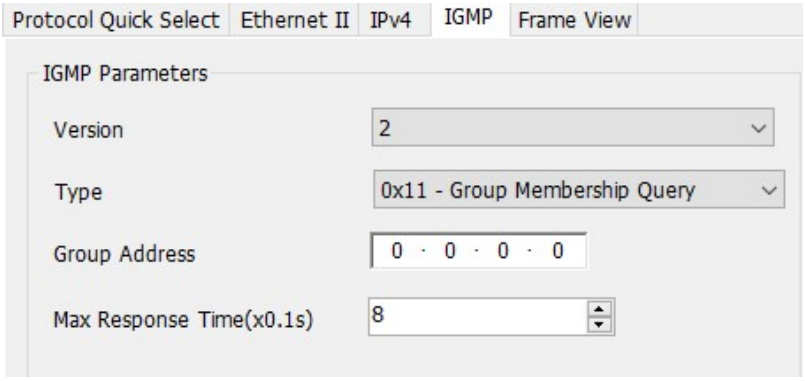
1.5.6.4. IGMP/IP



The Internet Group Management Protocol (IGMP) is a communications protocol used to manage the membership of Internet Protocol multicast groups.
The structure of IGMP segment is illustrated below. The IGMP header starts after bit 160 of the IP header

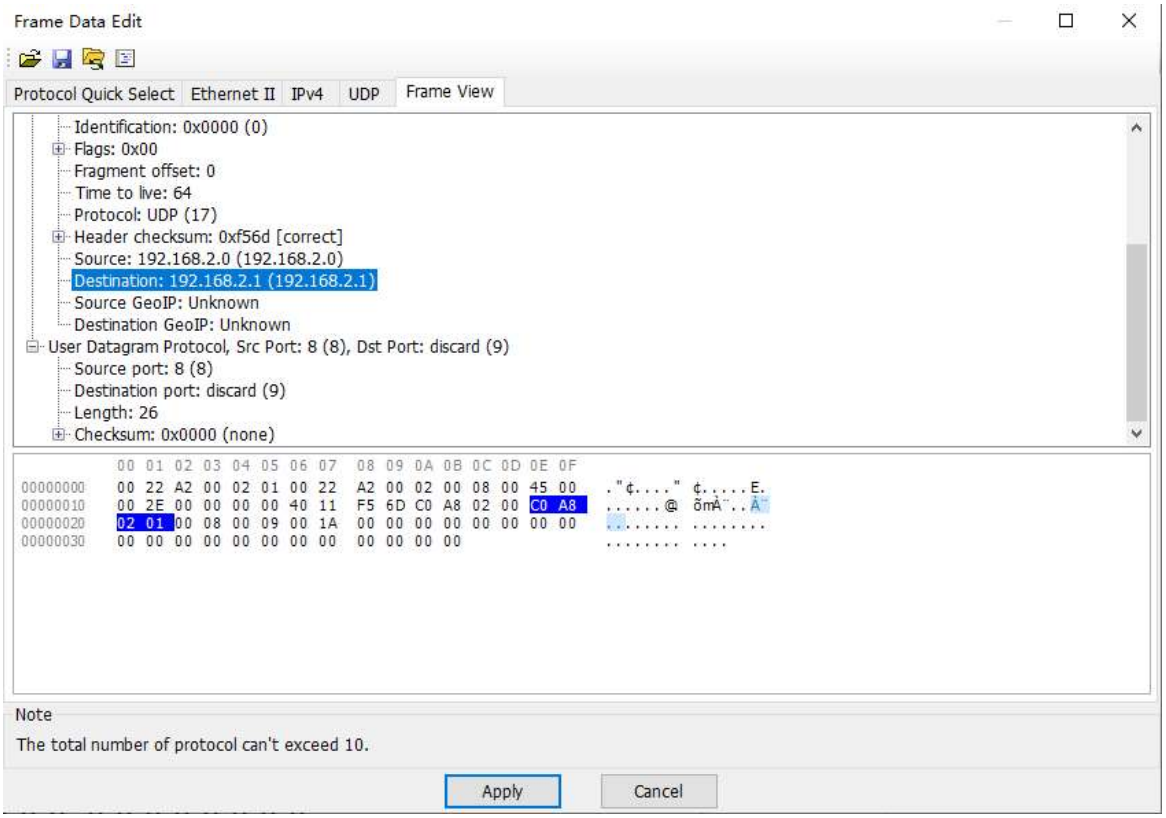
+	Bits 0 - 7	8 - 15	16 - 23	24 - 31
0	Type	Max Resp Time	Checksum	
32	Group Address			

The utility has user configurable interface to match the structure of IGMP segment there are three versions of IGMP



1.5.7. Frame View

The figure shows the structure of packet/frame that will be generated. The figure is changeable, depending on the configuration of the packet/frame.

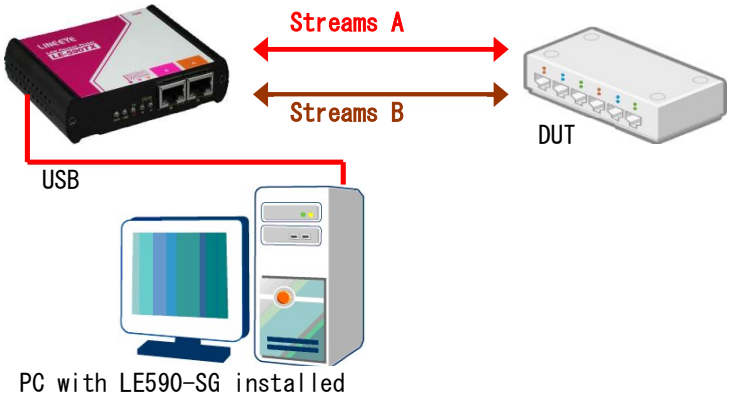


2. Operation of LE-590TX with LE590-SG

This chapter tells you how to use this device to test the DUT

2.1. Hardware connection

To use this device, user can connect it to DUT as the illustration below.



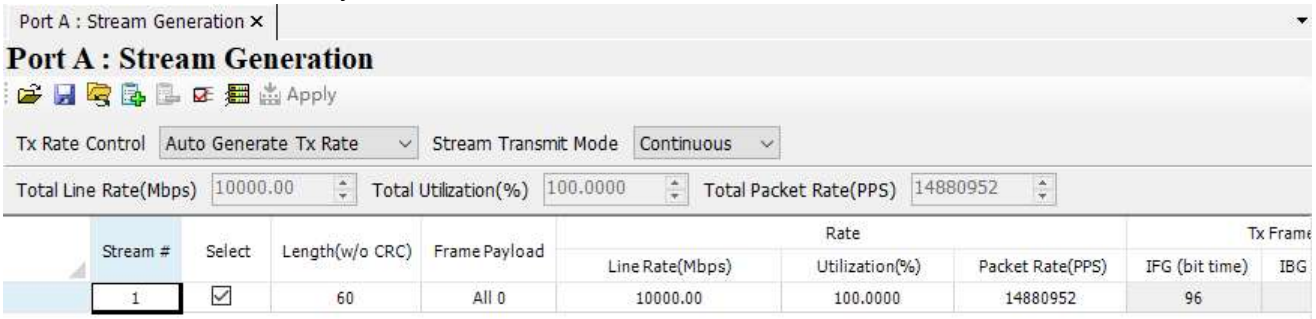
Then LE-590TX can generate test stream to DUT and also receive data stream from DUT for analysis.

2.2. Operation of LE590-SG

2.2.1. Generate Test Streams to DUT

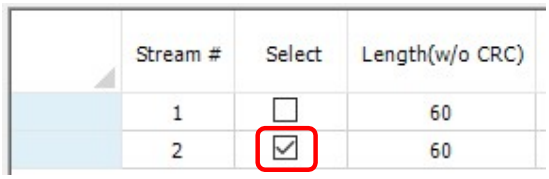
To generate the test streams, user should configure the pattern and contents of the test streams

Click Stream Generation ,System shows

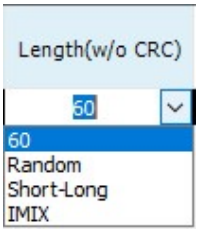


Select the streams volume user want to generate.

User can create many streams; however, only tick streams that user want to send



Double click value in the grid of length, then user can change the value. Select Random, Short-Long, IMIX or input the length directly.



Select the unit and input the value of the parameter that the packets will be generated.

Rate		
Line Rate(Mbps)	Utilization(%)	Packet Rate(PPS)
10000.00	100.0000	14880952
10000.00	100.0000	14880952

Line Rate: Mbytes per second in transmission

Utilization: Percentage of Wirespeed transmission

PPS: Packet per Second. Volume of packets that will be generated per second.

Tick to activate X-TAG if user needs

X-TAG	
Enable	X-ID
☑	0
☑	0

Click Frame Editor to edit the pattern and contents of stream packets. Please refer to 5.5 Frame Date **Edit** about how to use frame editor

When all procedures are done, the read-only basic information at last few items if shown automatically

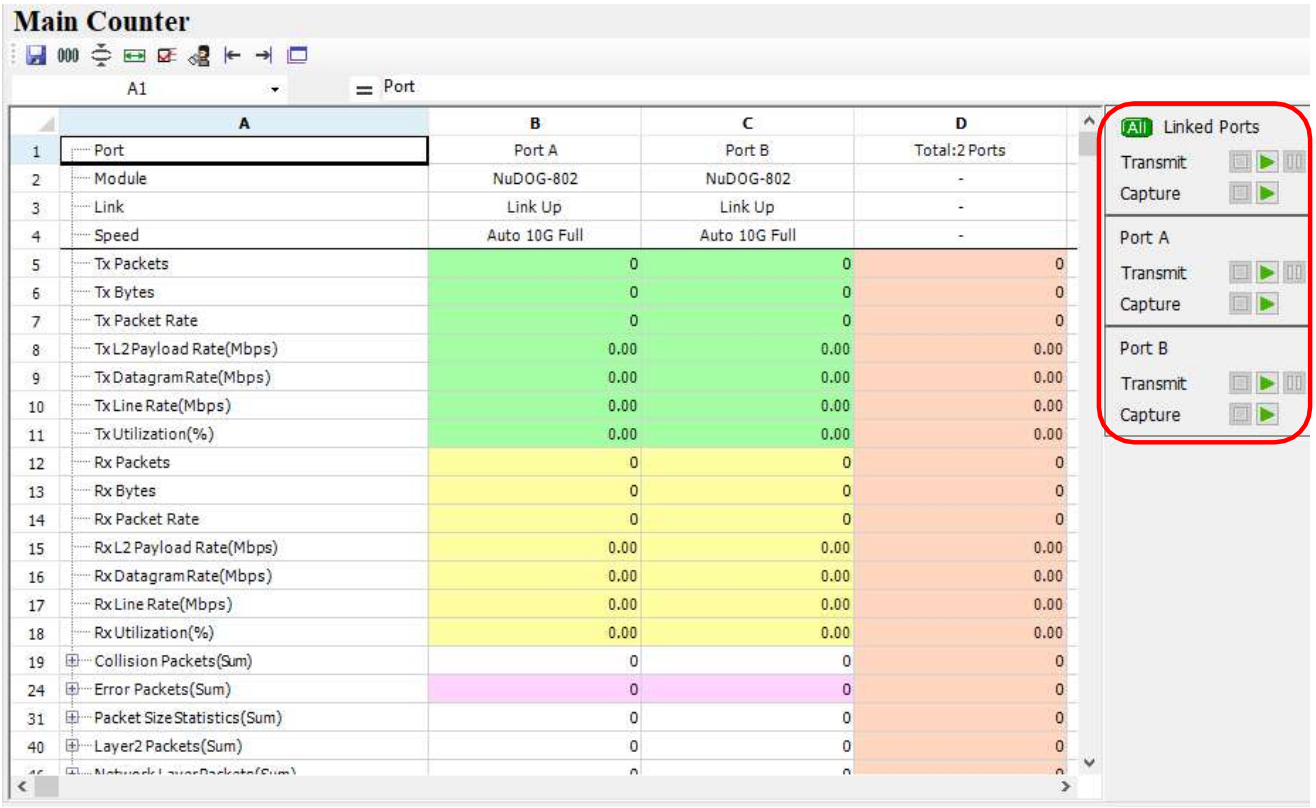
Tx Frame/Gap Control		
IFG (bit time)	IBG (bit time)	Frames
96	96	14880952
96	96	14880952

Then click 

to take effect.

2.2.1.1. Start to generate test streams

When all configurations is done, click Main Counter Panel on Toolbar



	A	B	C	D
1	Port	Port A	Port B	Total:2 Ports
2	Module	NuDOG-802	NuDOG-802	-
3	Link	Link Up	Link Up	-
4	Speed	Auto 10G Full	Auto 10G Full	-
5	Tx Packets	0	0	0
6	Tx Bytes	0	0	0
7	Tx Packet Rate	0	0	0
8	Tx L2 Payload Rate(Mbps)	0.00	0.00	0.00
9	Tx Datagram Rate(Mbps)	0.00	0.00	0.00
10	Tx Line Rate(Mbps)	0.00	0.00	0.00
11	Tx Utilization(%)	0.00	0.00	0.00
12	Rx Packets	0	0	0
13	Rx Bytes	0	0	0
14	Rx Packet Rate	0	0	0
15	Rx L2 Payload Rate(Mbps)	0.00	0.00	0.00
16	Rx Datagram Rate(Mbps)	0.00	0.00	0.00
17	Rx Line Rate(Mbps)	0.00	0.00	0.00
18	Rx Utilization(%)	0.00	0.00	0.00
19	Collision Packets(Sum)	0	0	0
24	Error Packets(Sum)	0	0	0
31	Packet Size Statistics(Sum)	0	0	0
40	Layer2 Packets(Sum)	0	0	0

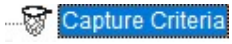
Click control button on operation button to control the packet generation

Expend

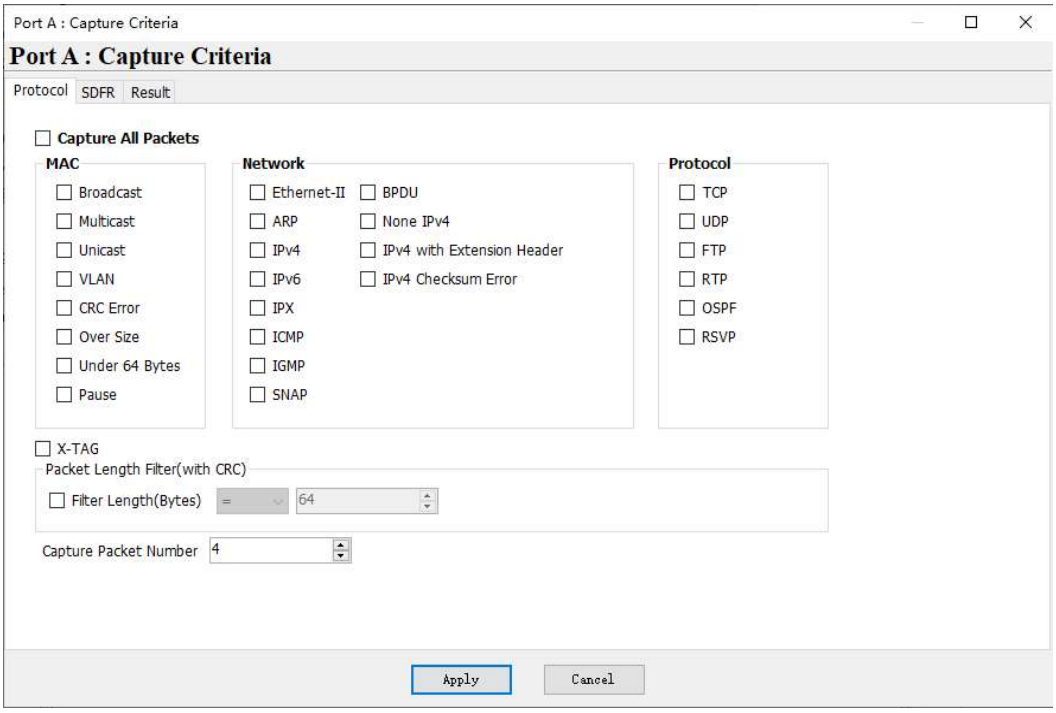
sub-item counter to see more details of counters.

2.2.2. Capture Specified Packets

To capture packets/frames of incoming streams to PC via USB port, configure capture criteria is required.

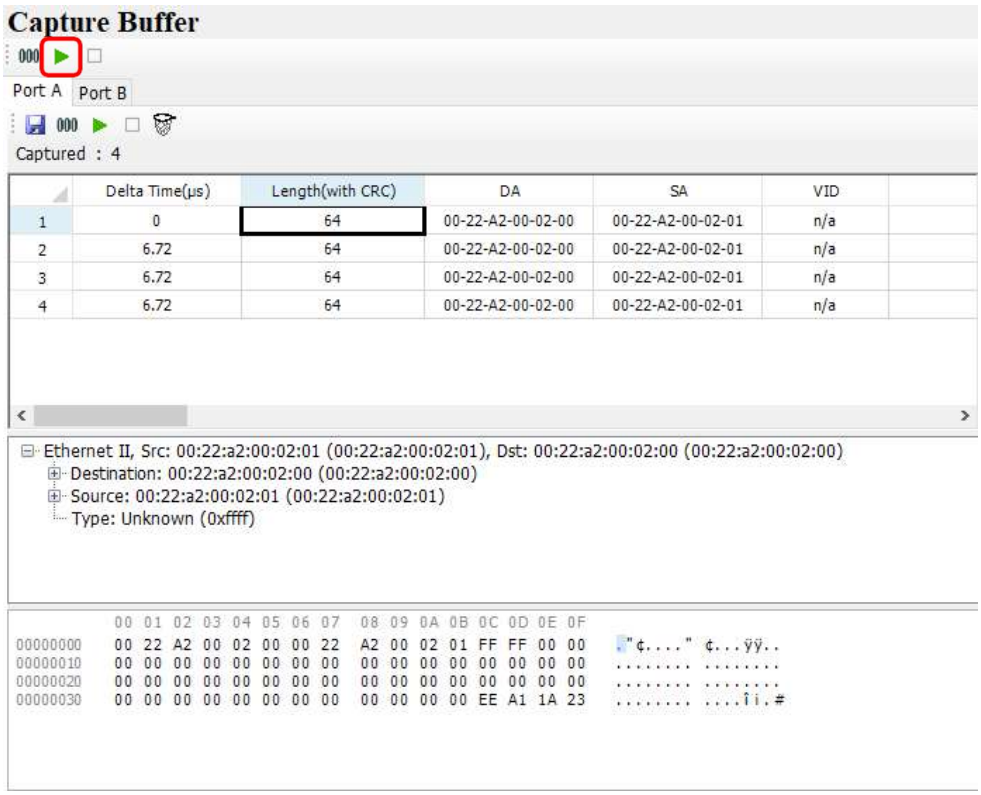
Click 

button. The system shows the capture criteria settings



User can configure criteria of Protocol, SDFR according to section **1.3.2.6 Capture Criteria**

Then Click Capture Buffer , Start capture from the Capture Buffer window



The result of captured frame is shown on Capture Buffer window.

2.2.3. View counter of captured packet and others

User can view the counters of captured packet by SDFR criteria

Click Main Counter Panel on Toolbar

Expand SDFR sub , counter item by clicking "+" of 

, user can see the packet counts that is captured by SDFR criteria User also can see counters of other events.

SDFR (Self Discover Filtering Rules)(Sum)	0	3,073,103	3,073,103
DA Rule Hit	0	3,073,103	3,073,103
SA Rule Hit	0	0	0
VID Rule Hit	0	0	0
SIP Address Rule Hit	0	0	0
DIP Address Rule Hit	0	0	0
DPort Rule Hit	0	0	0
SPort Rule Hit	0	0	0

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