

MU120131A/32A

PON Quick Start Guide

MD1230B

Data Quality Analyzer

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1. Introduction

The MD1230/MP1590 family (hereafter MD1230B) is a measuring instruments designed for next-generation networks. This documents explains its applications for PON used in increasingly common FTTH networks (B-PON, E-PON (GE-PON), G-PON).

First, it explains the methods for performing simultaneous one-way and two-way End-to-End measurement of all the ONU and OLT equipment in a 32-branch PON system with a single measuring instrument.

Additionally, it explains the method for verifying E-PON frames by capturing and decoding system frames, especially E-PON related.

1.1. Structure of Guide

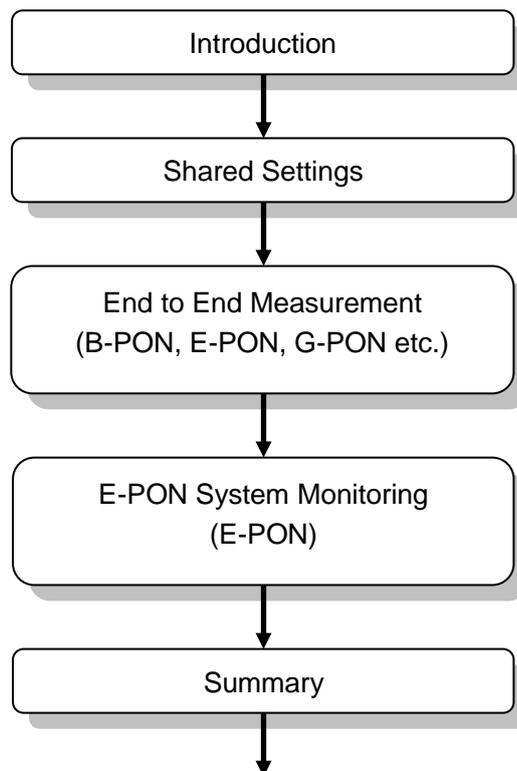


Fig. 1 Structure of Guide

*This document presumes use of the MU120131A/32A module (Ver. 7.0 and later). For the procedure for installing or upgrading Ver. 7.0 of the MD1230 software, see the version upgrade procedure.

*Upgrade the firmware according to the version upgrade procedure, check the installation and then connect to the unit.

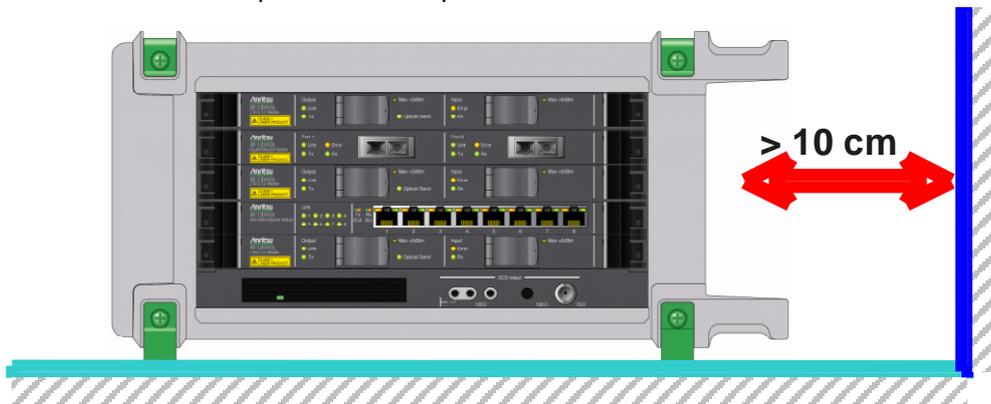
Note: When the Ver. 7.0 installer is executed. All setting conditions are cleared. When wanting to save the settings of the older version, use the Save settings function before upgrading.

2. Starting

This section explains installation of the MD1230B and the power-on and start-up procedures.

2.1. Installing MD1230B

- Install the MD1230B on a flat and stable surface.
- The MD1230B has a cooling fan in the back panel. Position the MD1230B so that it is at least 10 cm from walls and obstructions to allow sufficient cooling air flows.
- Supply power in the voltage ranges of 100~120 Vac or 200~240 Vac at a frequency of 50~60 Hz. The power consumption is 600 Vac.



2.2. Installing Modules

- Install three MU120131A units in Slots 2 to 4 and one MU120132A in Slot 5.

2.3. Power-on/off



(1) At power-on

- Plug the power cord into the power socket.
- Set the power switch to ON.

(2) At power-off

- Shutdown the MD1230B in the same way as a normal PC and set the power switch to OFF.

2.4. Starting



✧ Main start-up

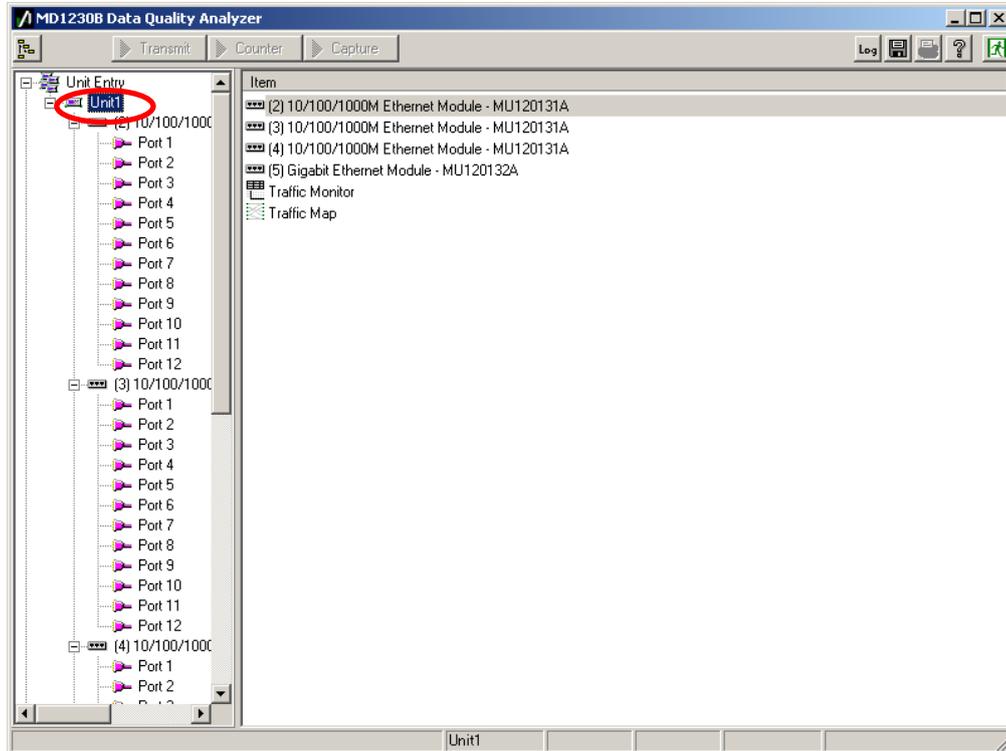
- At power-on, the Selector screen shown above is displayed. Click "Main application". The screen changes to the Measurement screen automatically after about 15 seconds.

3. Shared Settings

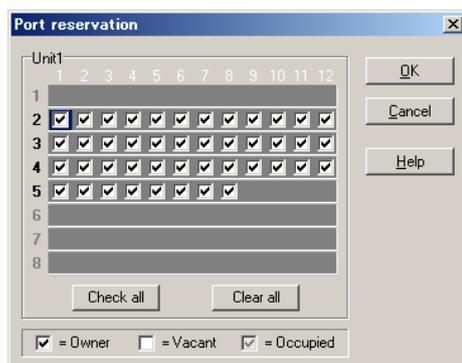
This section explains the procedures for reserving and setting ports.

3.1. Obtaining Ownership

- ✧ Before starting measurement, the ports to be measured must be reserved.

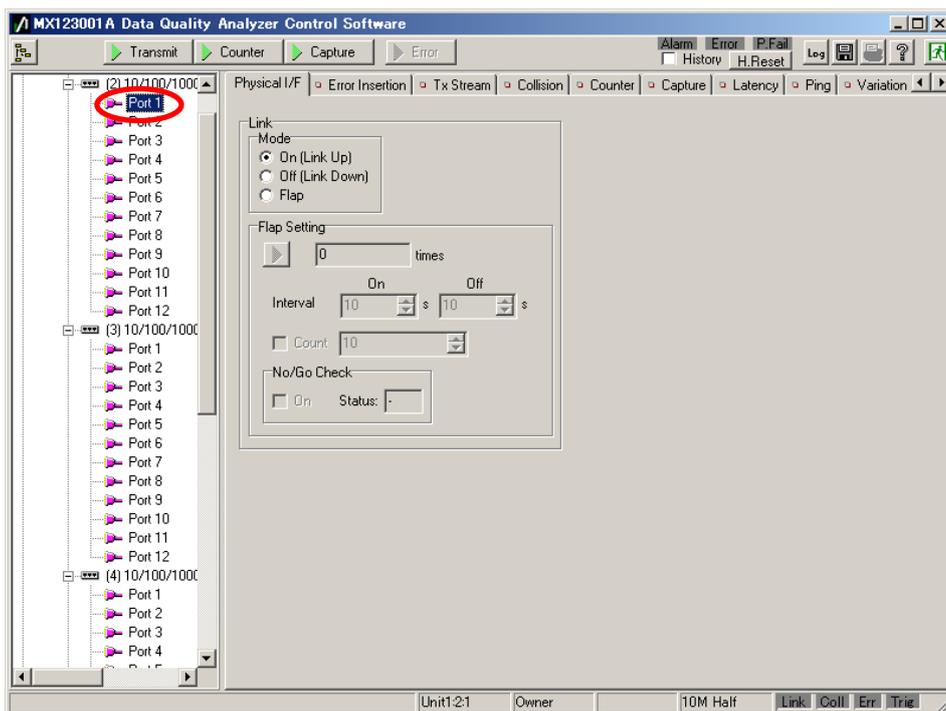


- Right-click Unit1 and select “Reservation...” . The ports of usable modules that can be used are listed as shown below; place checkmarks in the required ports and press the “Check all” button.

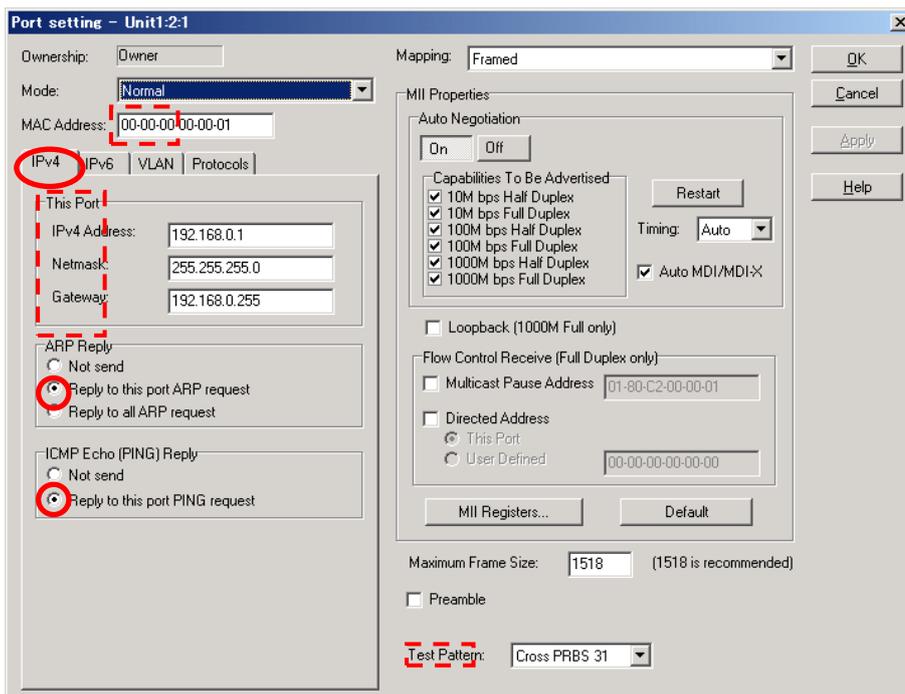


3.2. Setting Ports

- ✧ After reserving the ports to be measured, set the ports.



- Right-click Port1(Unit1:2:1) and select “Port Setting...”.



- Open the “IPv4” selector screen and set “IPv4 Address:”, “Netmask:”, and “Gateway:”. (Any values can be set but here “192.168.0.1”, “255.255.255.0”, and “192.168.0.255:” are used as examples.)
- Put checkmarks in “Reply to this port ARP request”, and in “Reply to this port PING request” (when performing ARP and PING).
- Set “MAC Address:”. (Any value can be set but here “00-00-00-00-00-01” is used as an example.)
- Set “Test Pattern:” to “Cross PRBS 31”
- ✧ Set Port1~Port12 for Unit2, Unit3, and Unit4 in the same way. Set “IPv4 Address:” sequentially in the range of “192.168.0.1 to 36”, and “MAC Address:” in the sequential range of “00-00-00-00-00-01~24” (hexadecimal).

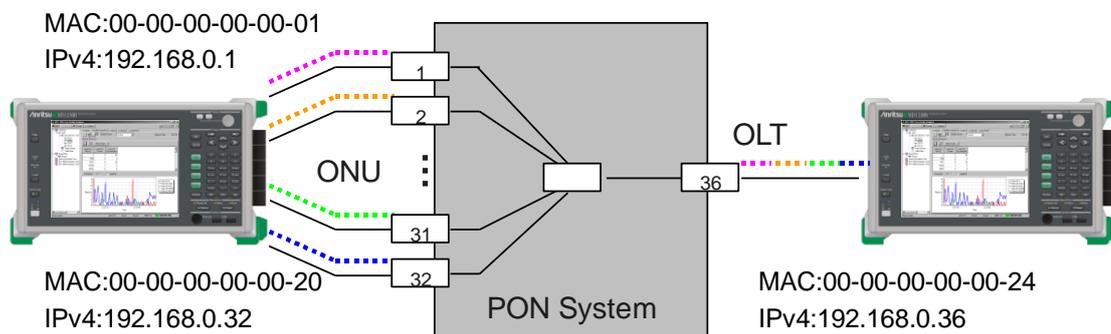
4. End-to-End Measurement

This section explains the end-to-end measurement procedure by connecting the measuring instrument to the OLT and the outside of each ONU.

In concrete terms, this measurement checks that data is flowing normally to each ONU by measuring Throughput and Latency by counting Bit Rate and number of Frames. In addition sequence errors are detected by imposing a load by varying the number of Frame and gaps and using the packet BER measurement function to confirm that packet loss does not occur.

4.1. Connecting DUT

- ✧ Connect ONI1~32 to Unit1 Port1~Port12 of the MU120131A, Unit2 Port1~Port12, and Unit3 Port1~Port8. Connect the OLT to Unit3 Port12.



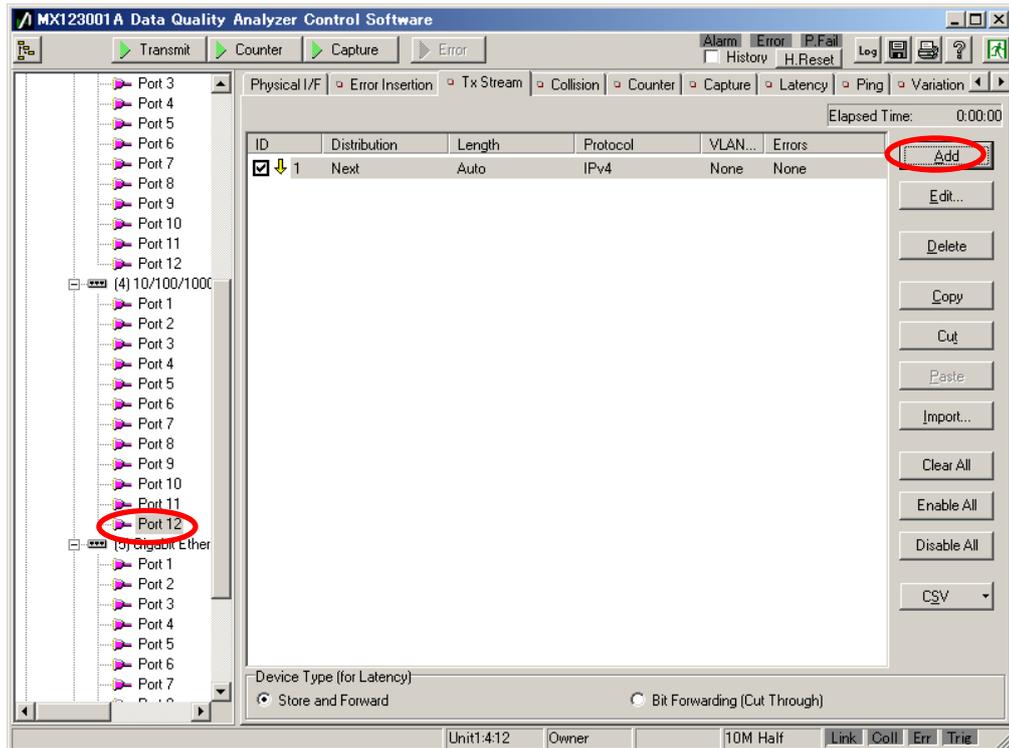
4.2. Creating OLT-side Tx Frames (and Setting OLT->ONU Stream (Down Signal)) (Objective) Using 32-branch PON, create test signal emulating real network with different payloads in each Frame

(Procedure) Increment the MAC address for each ONU address and create a multiple-address stream.

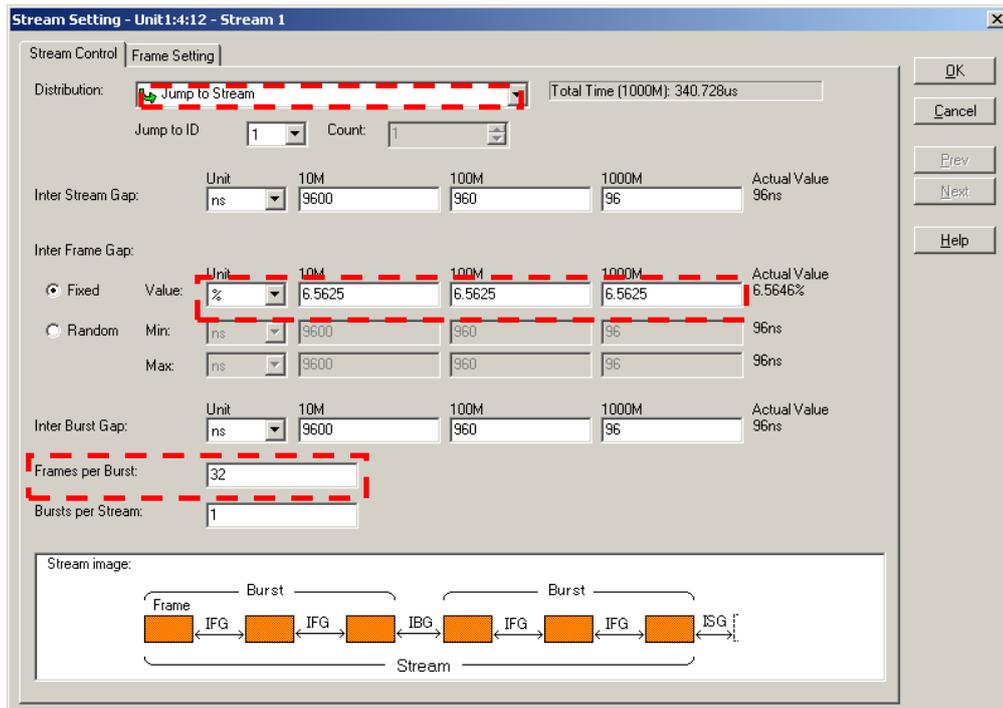
Input a PRBS pattern and perform BER measurement.

(Results, Goal) Create OLT-side Tx Frames~Create OLT→ONU Stream (Down signal)

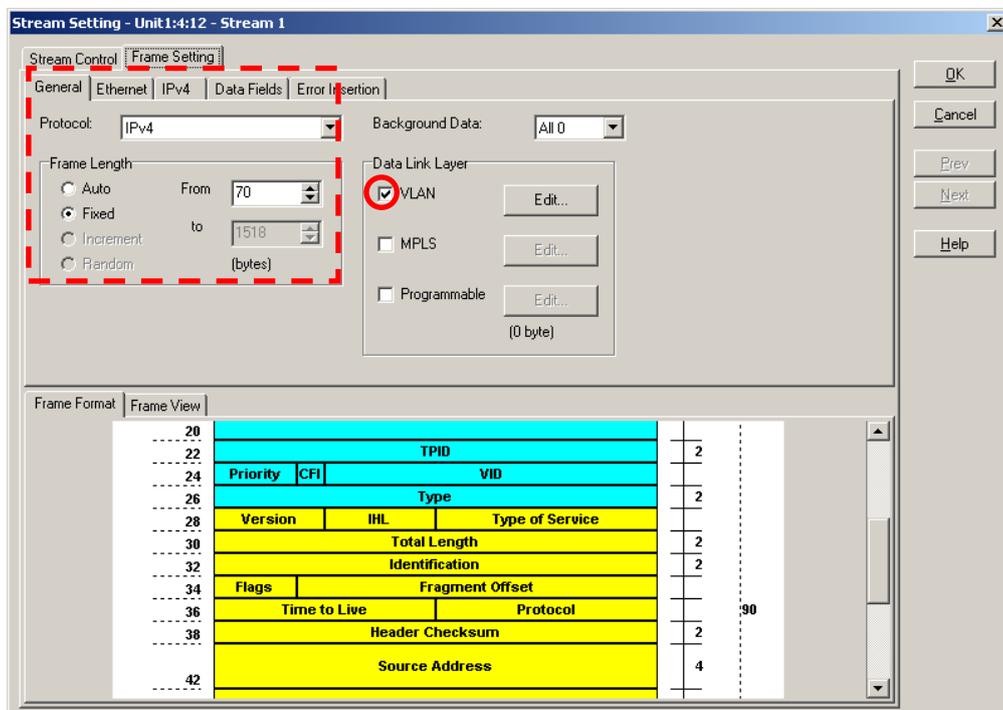
✧ Creating OLT-side Tx Frames (Tx Stream)



- Select Port12 of Unit4.
- Press “Add” at the Tx Stream screen and create the stream.
- Press “Edit...” to edit the created stream.

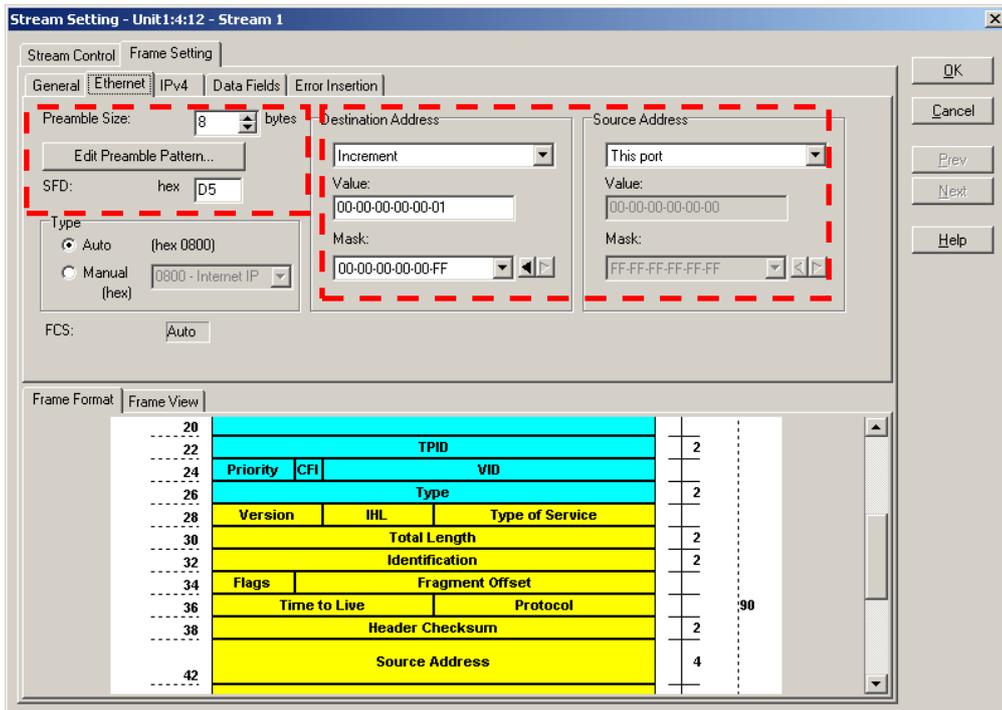


- Select “Jump to Stream” at “Distribution:” of **Stream Control** and “Frame per Burst:” to 32. (This returns to the default stream after sending 32 streams.)
- Setting “Inter Frame Gap:” changes the Tx rate. Here, select “Fixed” at “Inter Frame Gap:” and set “Unit” of “Value:” to “%” and “6.5625%”. (The setting is 6.5625% (5 Mbps) here, because the data is the same as video traffic of several Mbps flowing on an actual network.)

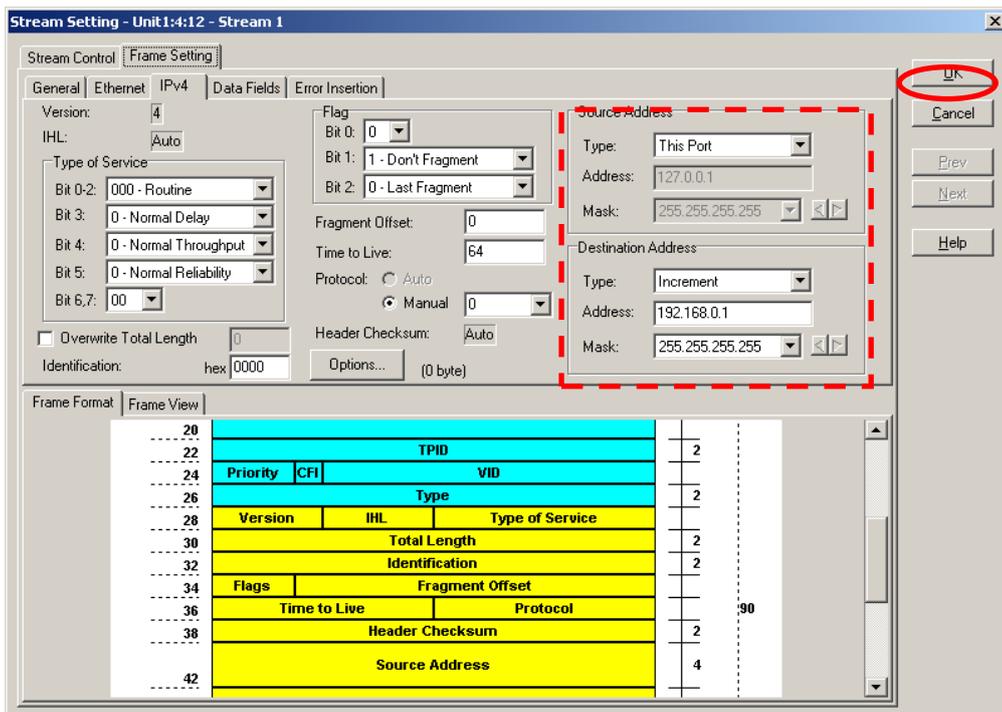


- Set “Frame Length” at [General] of **Frame Setting**. (When “Auto” is selected, 64 byte is set automatically. With E-PON Frames, 64 bytes is common, but set 70 bytes because we want a PRBS test frame of more than 28 bytes in the Data Field.)
- Leave “Protocol:” unchanged as “IPv4”. (This is the common protocol setting.)
- Put a checkmark in VLAN (because group division is commonly by LAN for each

service).

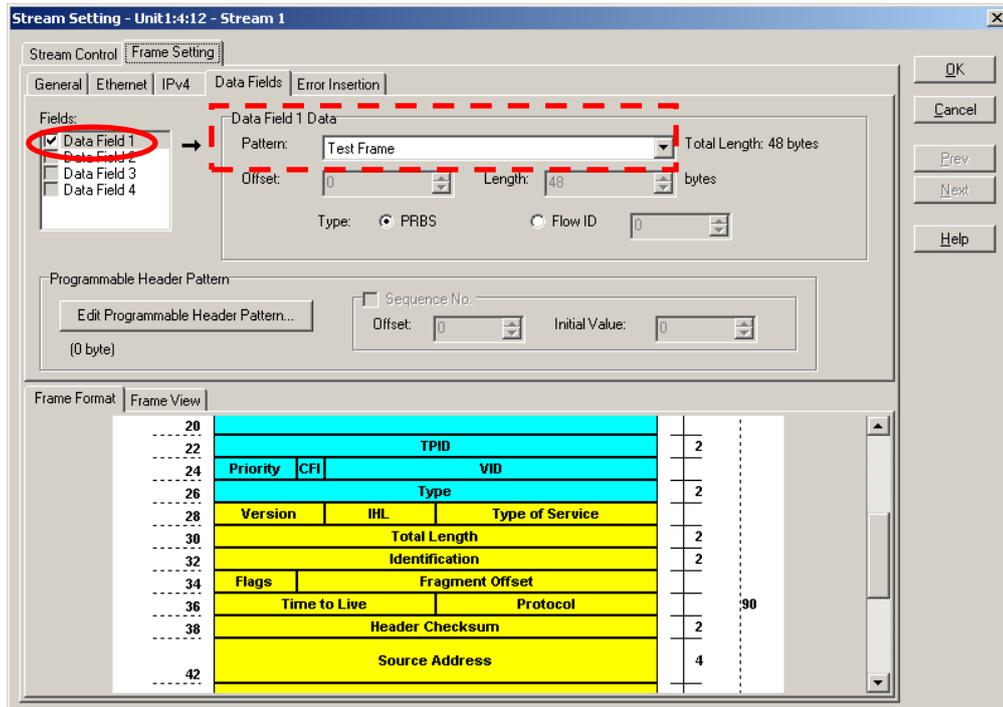


- Set Preamble and DA, SA at [Ethernet] of **Frame Setting**.
- ✓ Here Preamble is left unchanged as the default.
- ✓ Set "Destination Address" to "Increment", "Value:" to "00-00-00-00-00-01" and "Mask:" to "FF-FF-FF-FF-FF-FF". (Jump to Stream is performed for 32 streams; data can be set for 32 ONU addresses (00-00-00-00-00-01~00-00-00-00-00-20).)
- ✓ Set "Source Address" to "This port" (to set the port setting value).



- Set DA, SA at [IPv4] of **Frame Setting**.
- ✓ Set Type at "Source Address" to "This port" (to set the port setting value).
- ✓ At "Destination Address", set "Type:" to "Increment", "Address:" to "192.168.0.1", and

“Mask:” to “255.255.255.255”. (IP addresses are incremented according to each MAC address increment.)



- Insert the PRBS pattern at [Data Fields] of **Frame Setting**.
- ✓ Put a checkmark in “Data Field1” at “Fields:”, and select “Test Frame” at “Pattern” of “Data Field1 Data”. (This supports BER tests.)
- Press “OK” to close the Setting screen.

4.3. Creating ONU-side Tx Frames (and Setting ONU->OLT Stream (Up Signal))

(Objective) Using 32-branch PON, create test signal for when each ONU has 1/32 equal share of network bandwidth. (As in section 4.2. create a test signal emulating an actual network in which the payload of each frame is different.)

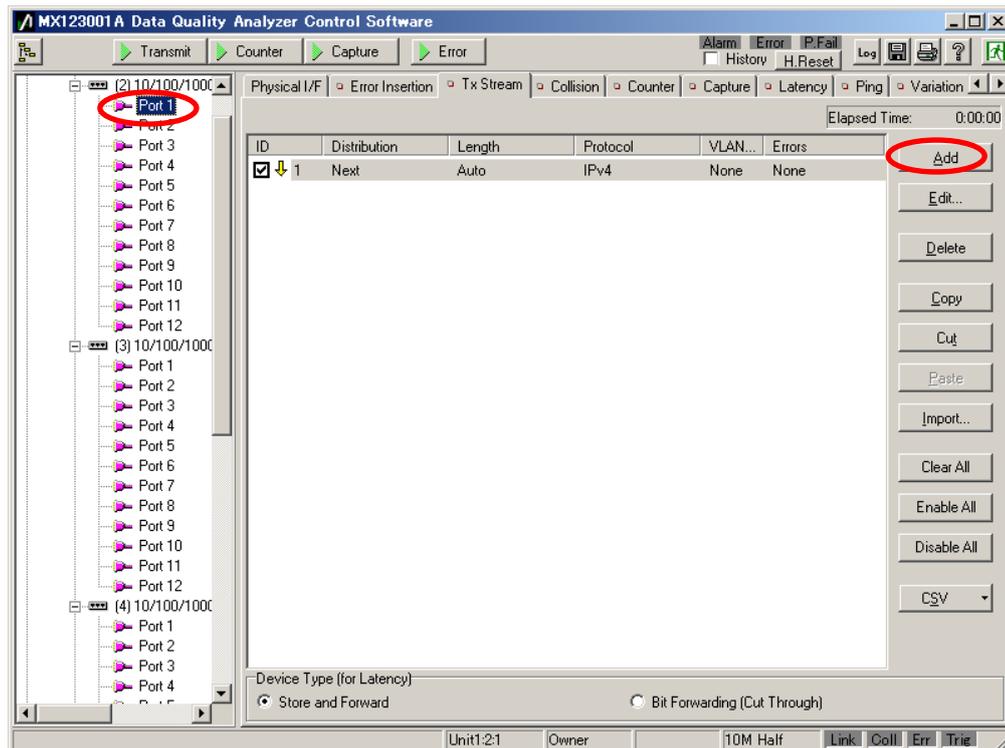
(Procedure) Create an OLT address stream from each ONU

Input PRBS pattern and perform BER measurement.

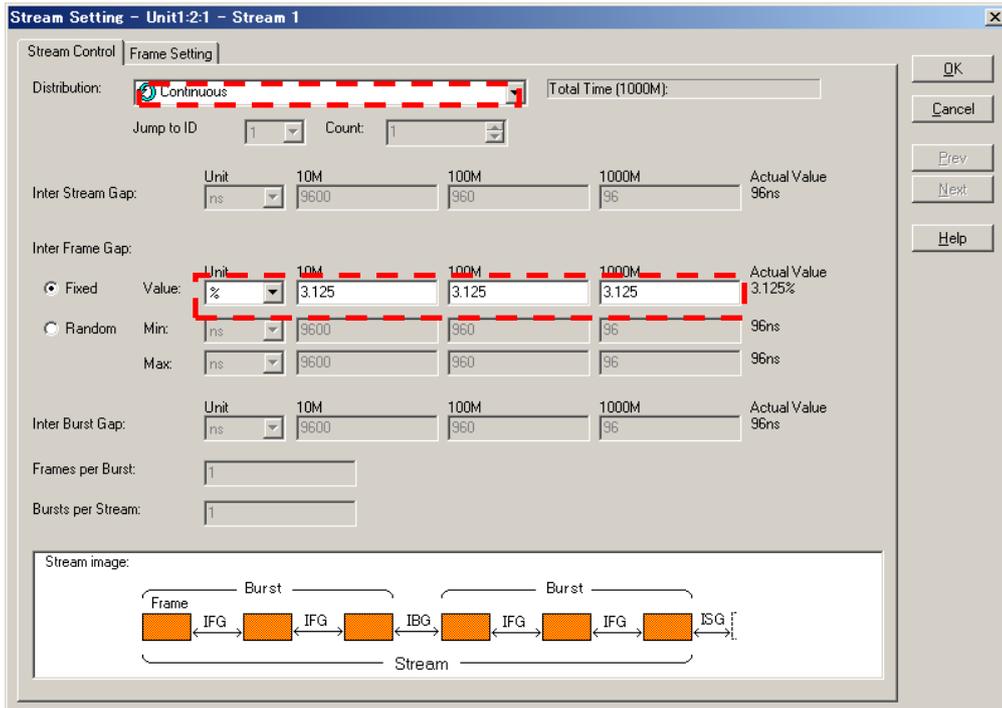
(Results, Goal) Create ONU-side TX stream~Create ONU→OLT Stream (Up Signal)

✧ Creating ONU-side Tx Frames (Tx Stream)

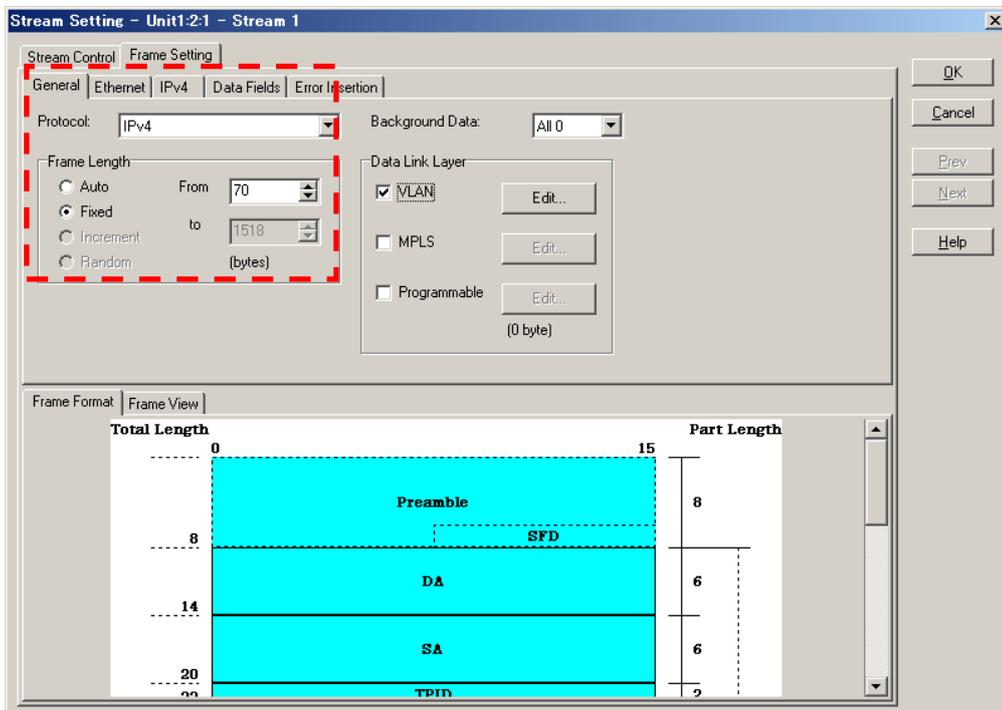
(1) Settings for ONU1



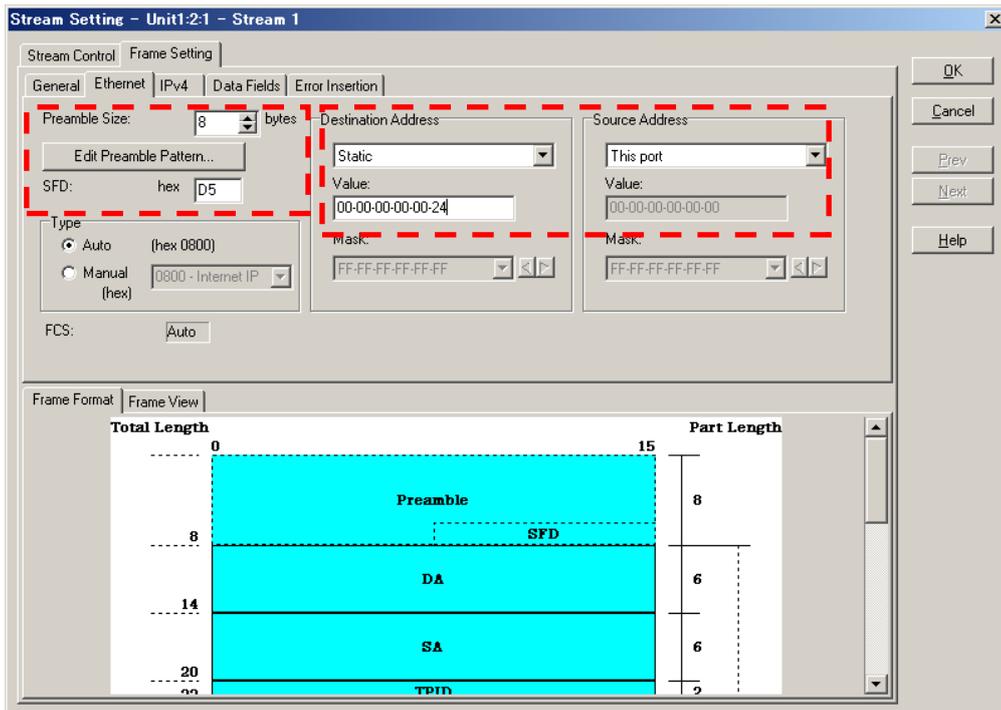
- Select Unit2 Port1.
- Press “Add” at Tx Stream and create the stream.
- Press “Edit...” to edit the created stream.



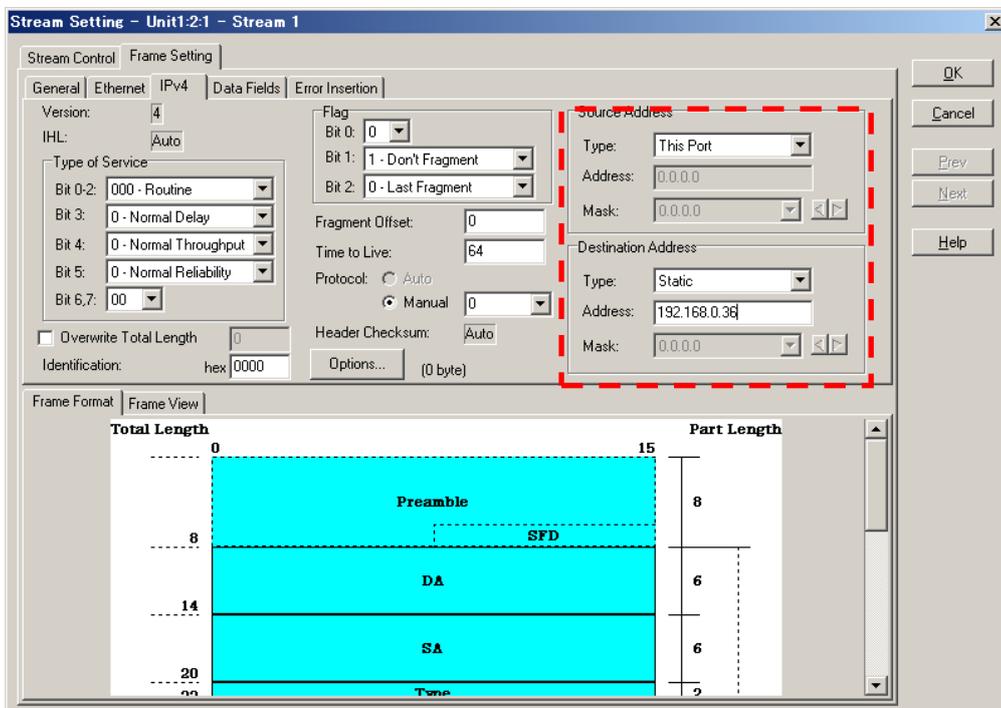
- Select “Continuous” at “Distribution:” of **Stream Control**. (For testing, the signal must be flowing.)
- Setting “Inter Frame Gap:” changes the send rate. Here, select “Fixed” at “Inter Frame Gap:”, and set “Unit” of “Value:” to “%” and set “3.125%”. (This setting divides the full wire rate bandwidth into 32 equal parts for the 32 ONU units.)



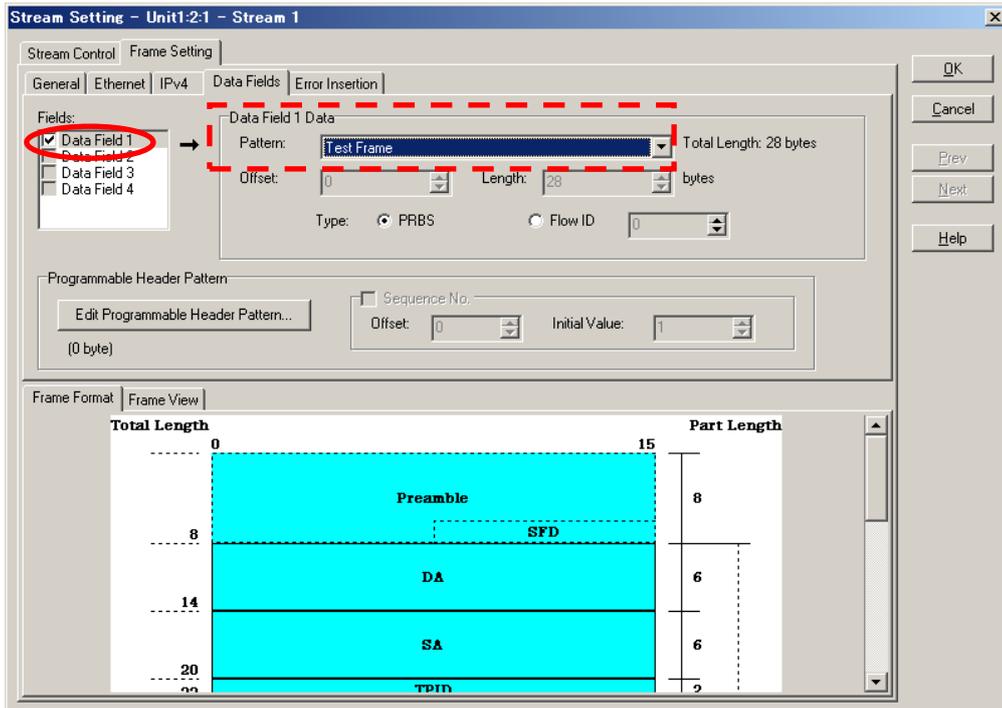
- Set “Frame Length” at [General] of **Frame Setting**. (When “Auto” is selected, 64 byte is set automatically.)
- Leave “Protocol:” unchanged as “IPv4”.



- Set Preamble and DA, SA at [Ethernet] of Frame Setting.
- ✓ Here Preamble is left unchanged as the default.
- ✓ Set "Destination Address" to "Static", and "Value:" to "00-00-00-00-24".
- ✓ Set "Source Address" to "This port" (sets ONU port setting addresses at OLT address).



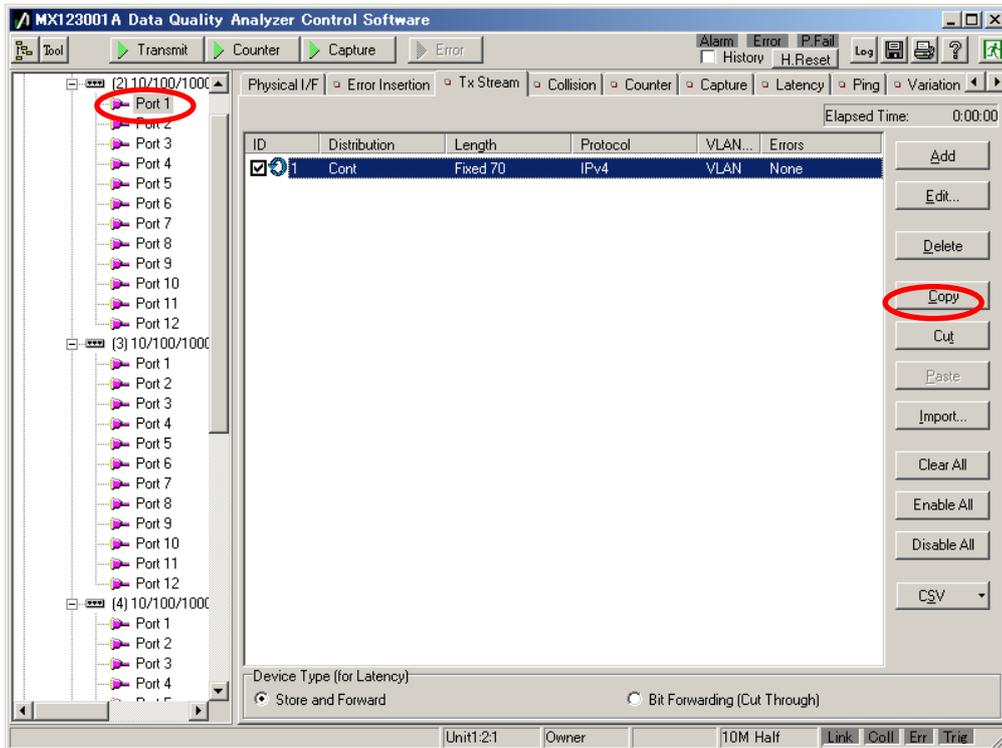
- Set DA, SA at [IPv4] of Frame Setting
- ✓ Set "Type:" at "Source Address" to "This port".
- ✓ At "Destination Address", set "Type:" to "Static", and "Address:" to "192.168.0.36" (sets to OLT address).



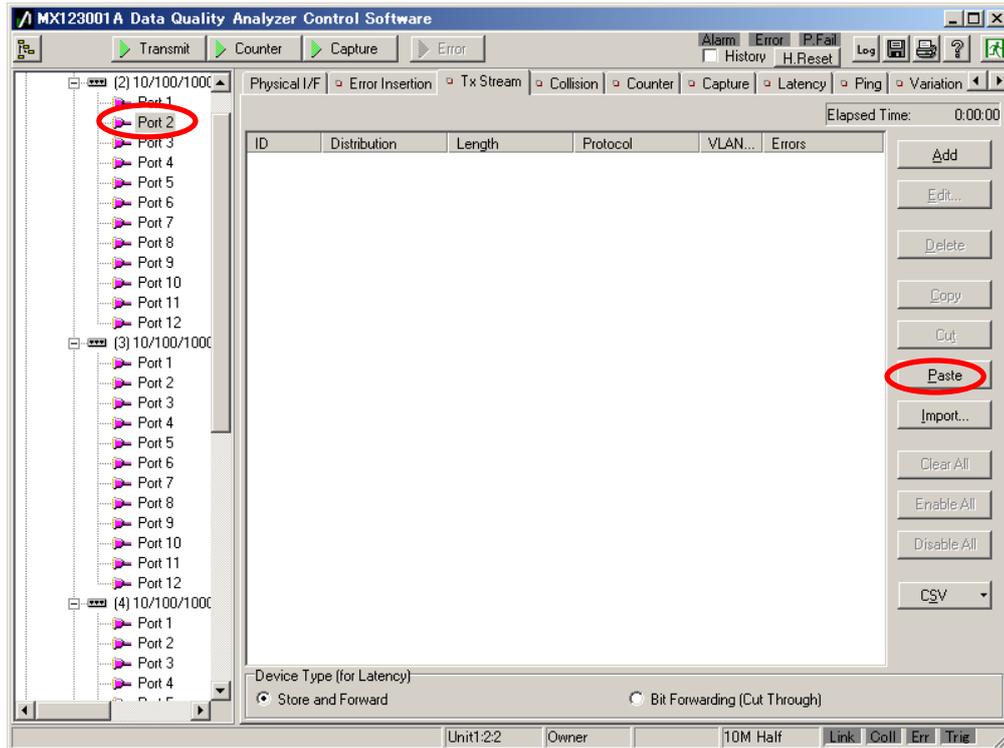
- Insert the PRBS pattern at [Data Fields] of **Frame Setting**.
- ✓ Put a checkmark in “Data Field1” at “Fields:” and select “Test Frame” at “Pattern” of “Data Field1 Data”.
- Press “OK” to close the Setting screen.

(2) Settings for ONU2~32

- ✧ Copy the Tx Frames (Tx Stream) for Unit2 Port1 to Unit2 Port2~12, Unit3 Port1~12, and Unit4 Port1~8.



- Select the created stream at Unit2 Port1 **Tx Stream** screen and press “Copy”.



- Press “Paste” at the Unit2 Port2 Tx Stream screen.
- Similarly, paste (the created stream) to Unit2 Port3~12, Unit3 Port1~12, and Unit4 Port1~8. (Copy & Paste is possible because MAC SA and IPv4 SA both reference shared port settings.)

4.4. Checking Flow from Each ONU (Setting OLT↔ONU Tx/Rx Counter)

(Objective) Checking that throughput of signal from each ONU is at set value (flowing normally)

(Procedure) Use the multiflow counter to count the Bit Rate and number of Frames of each stream at the OLT side.

(Results, Goal) Count of multiple flows at one port and clarify throughput (ONU→OLT stream (Up signal))

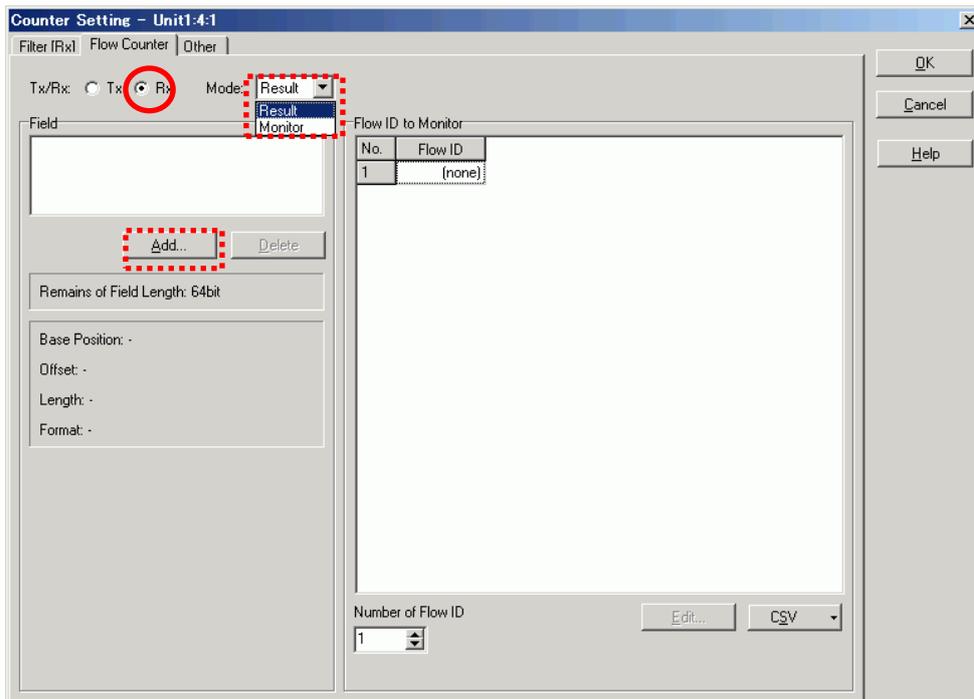
✧ Setting Multi Flow Counter for OLT Side

(1) Opening Counter Setting Screen

Name	Unit1:4:1 Current	Unit1:4:1 Accumulated
Transmitted Bit Rate (bit/s)	18,786bit/s	47,095bit/s
Transmitted Bit Rate (%)	80.00%	29,837.00%
Transmitted Rate (%)	10,040.00%	48,977.00%
Transmitted Byte	875	43,218
Transmitted Frame	10,040	3,907
Transmitted Frame (fps)	26,428fps	26fps
Transmitted IPv4 Packet	8,759	56,485
Transmitted IPv4 Packet (pps)	15,498pps	47,035pps
Transmitted ARP Reply	25,990	27,652
Transmitted ARP Request	15,145	32,852
Transmitted Ping Reply	19,353	13,090
Transmitted Ping Request	19,314	21,280
Transmitted IPv6 Packet	3,829	19,710
Transmitted IPv6 Packet (pps)	13,648pps	37,094pps
Transmitted ICMPv6 (NA)	8,683	51,414
Transmitted ICMPv6 (NS)	23,992	16,688
Transmitted ICMPv6 (Echo Reply)	5,601	0
Transmitted ICMPv6 (Echo Request)	15,759	19,123
Transmitted Test Frame	28,503	13,126
Received Bit Rate (bit/s)	503bit/s	37,080bit/s
Received Rate (%)	62.00%	14,196.00%

- Select Unit4 Port12 (Unit1:4:12) for the measured port.
- Open the Counter screen and press the counter icon (hammer symbol) to open the Setting screen.

(2) Opening Field Setting Screen



- Open the **Flow Counter** screen and select either Tx Frame or Rx Frame. Here, we are performing settings for Rx Frames, so set "Tx/Rx:" to "Rx".
- Open the "Mode:" tab and select either "Result" (displays Accumulate results when counter stops) or "Monitor" (displays results at every 1 s while counting). Here, "Monitor" is set for measuring Latency (Ave) and displaying graphical results.
- Press the "Add" button to open the Field Setting screen.

(3) Selecting Field Conditions

The screenshots illustrate the following steps:

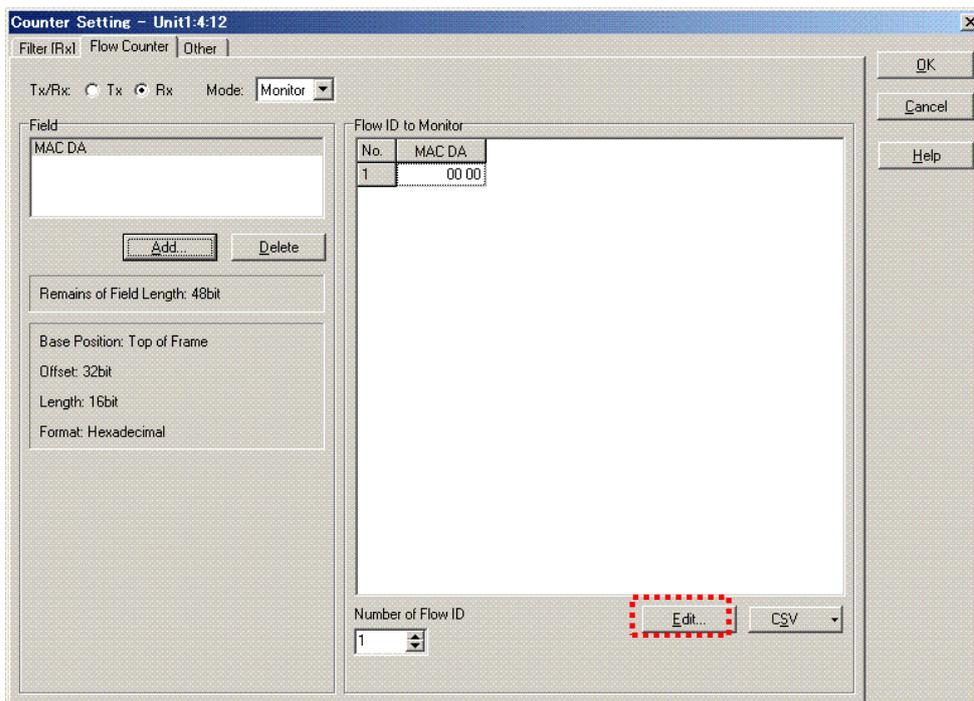
- Field Setting:** Select "MAC DA (48bit)" from the list. The "Remains of Field Length" is 64bit. The "Format" is set to "Decimal".
- Field Edit:** The field name is "MAC DA". The "Base Position" is "Top of Frame", "Offset" is "0", and "Length" is "48". The "Format" is "Hexadecimal".
- Field Edit:** The "Offset" is changed to "32" and the "Length" is changed to "16". These fields are highlighted with a red dashed box.
- Field Setting:** The "MAC DA (16bit)" option is now checked. The "Remains of Field Length" is 48bit. The "Base Position" is "Top of Frame", "Offset" is "32bit", and "Length" is "16bit". The "Format" is "Hexadecimal". The "OK" button is highlighted with a red dashed box.

- ① At the [Field Setting] screen, select the allocation conditions. Here, first, allocation is performed using the destination address so select "MAC DA (32bit)" and press "Edit...".
- ② When "MAC DA" is "00-00-00-00-00-24", looking at the last 16 bits of "-00-24", when "Format:" is "Hexadecimal", "Offset:" becomes "32" and "Length:" becomes "16". Press "OK".
- ③ Put a checkmark in "MAC DA (16bit)" and press "OK" to confirm.

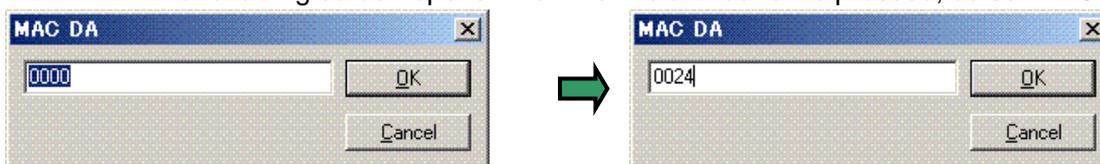
* The Field setting supports up to 16 bitx4 Block. When Offset is divided by 8 and the sum of the remainder and Length exceeds 16 bits, it becomes 1 Block. The above setting is 2 Blocks.

$$[(\text{Offset}(32) \div 8 = \text{remainder } 0) + \{\text{Length}(16)\}] \div 16 = 12 \text{ Blocks}$$

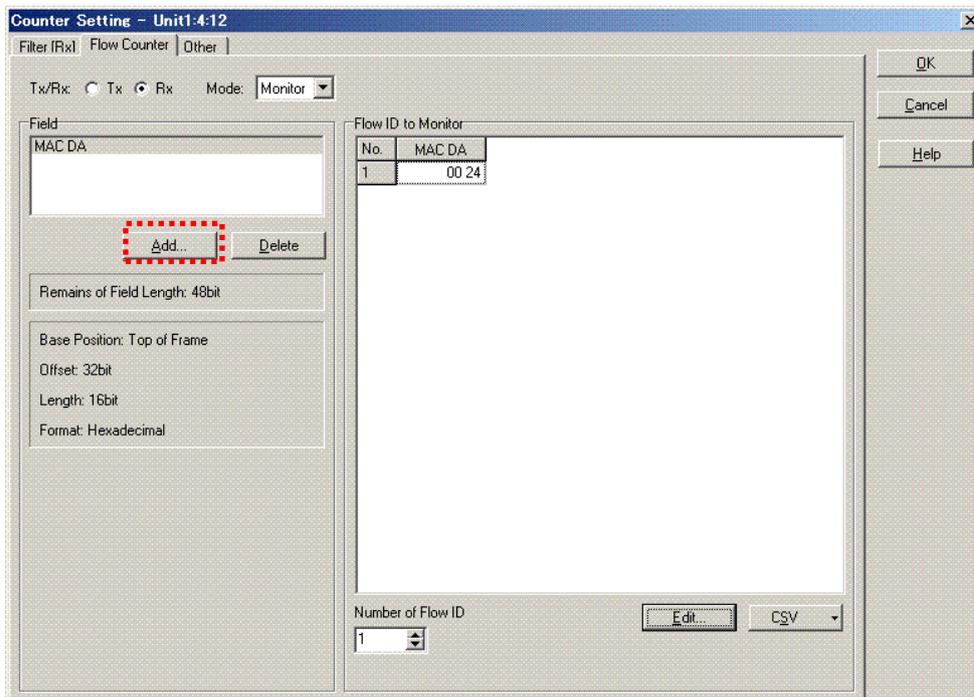
(4) Editing Field Conditions



- The following screen opens when the “Edit...” button is pressed, so set MAC DA.

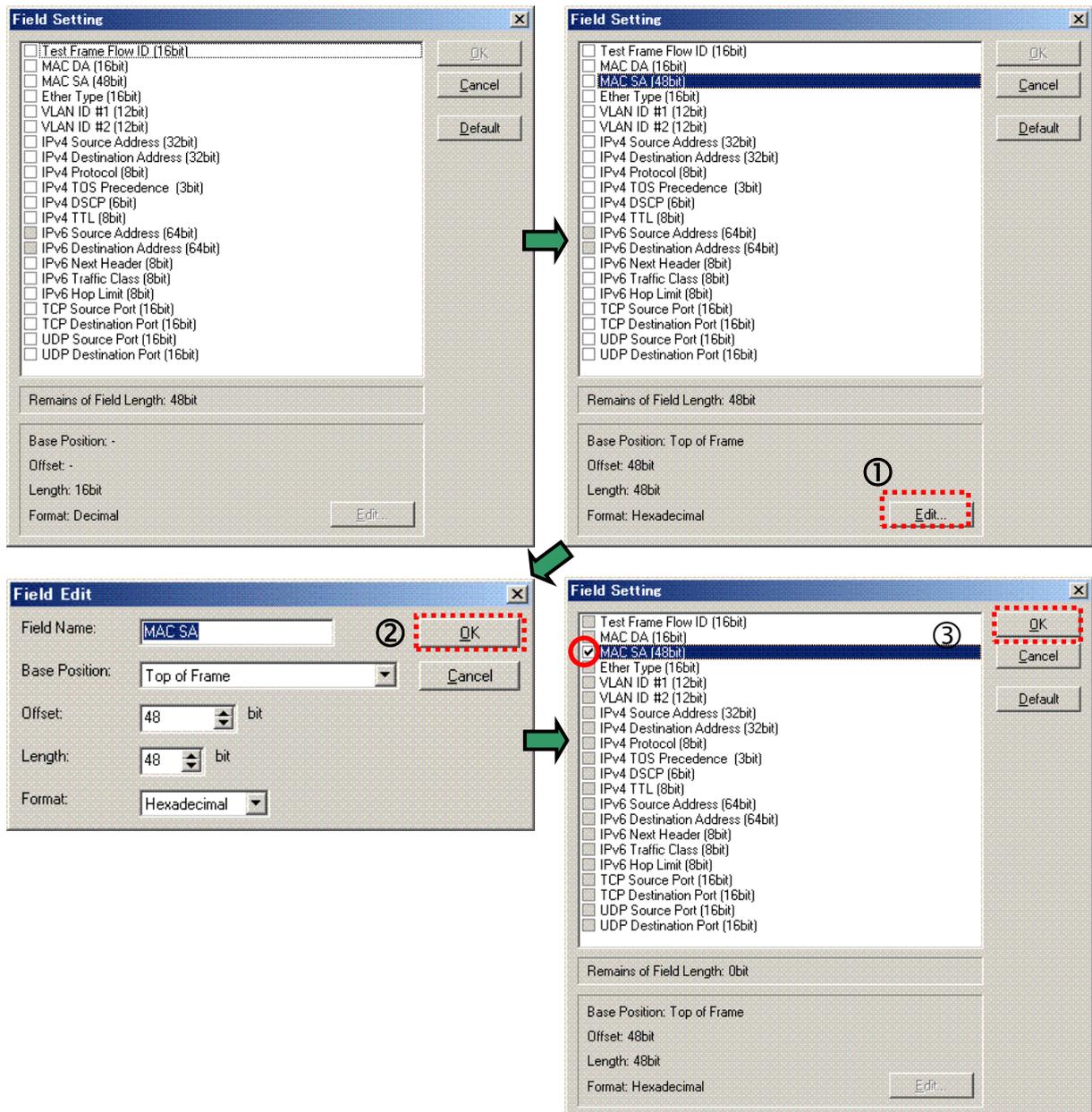


(5) Adding Field Conditions



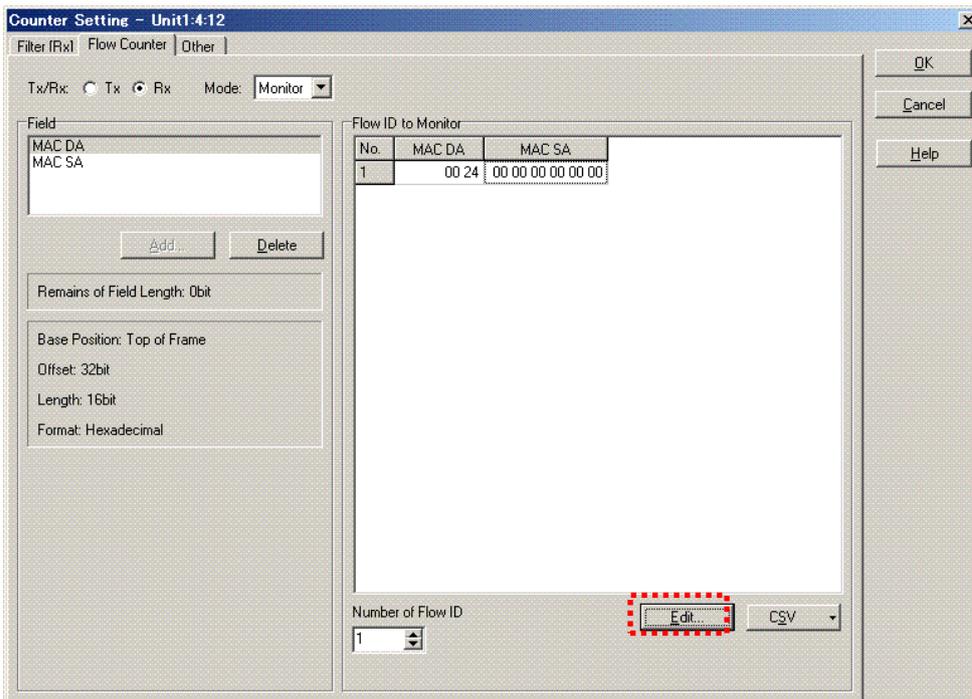
- Press the “Add” button and add the Field conditions.

(6) Selecting Added Field Conditions

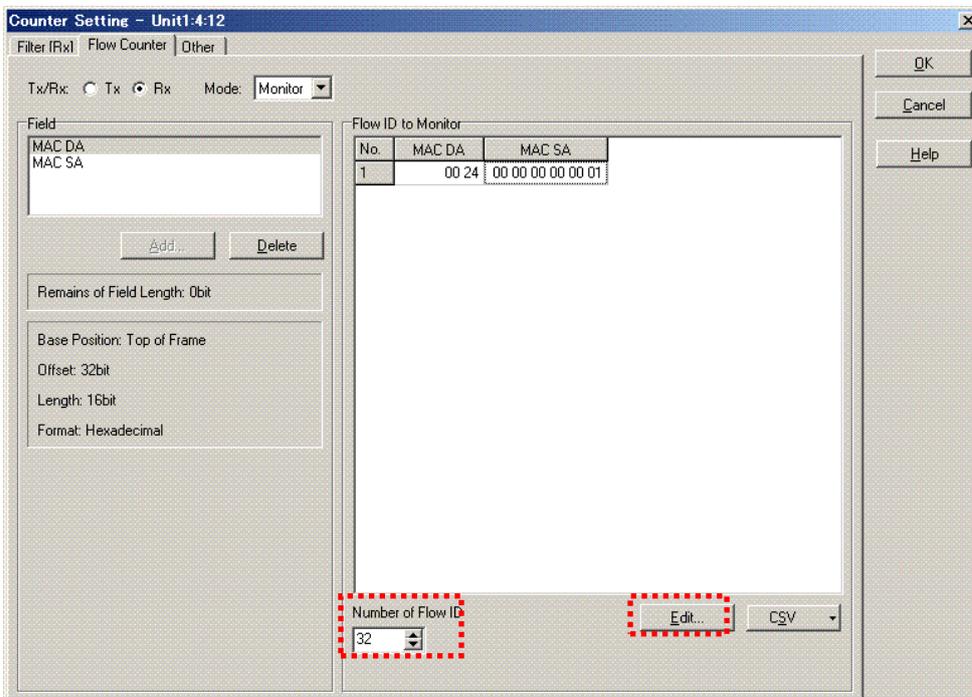
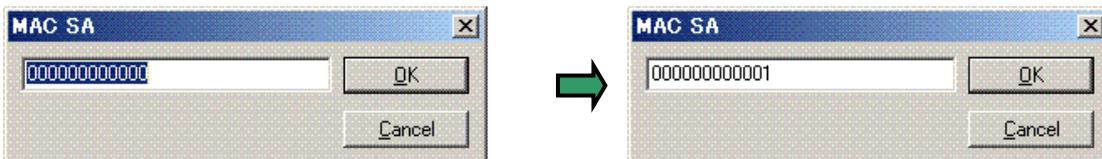


- ① Select additional allocation conditions at the [Field Setting] screen. Here, allocation is performed using MAC SA, so select “MAC SA (48bit)” and press the “Edit...” button.
- ② Leave the defaults for “Base Position:”, “Offset”, “Length”, and “Format:” unchanged and press “OK”.
- ③ Set a checkmark at “MAC SA (48bit)” and press “OK” to confirm.

(7) Editing Added Field Conditions

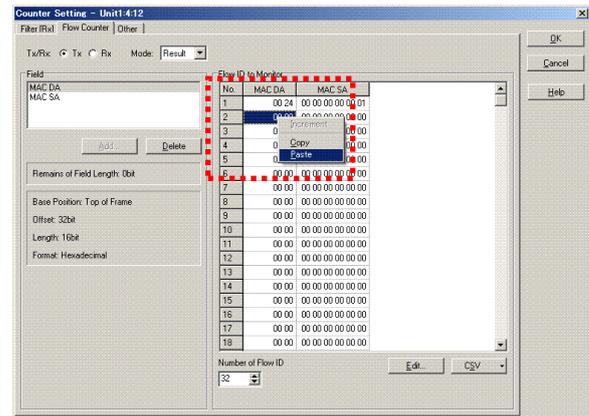
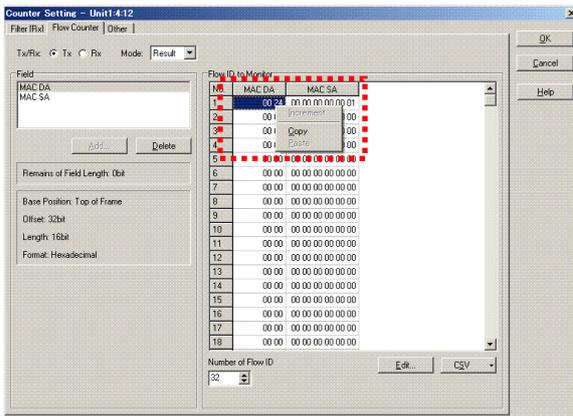


- Press the “Edit...” button and set MAC SA at the following screen. Here, set the MAC address of ONU1.

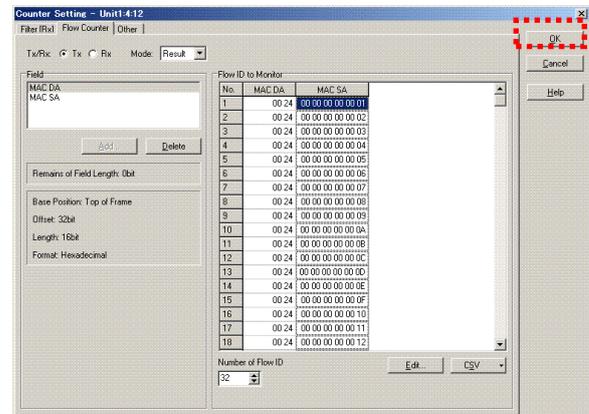
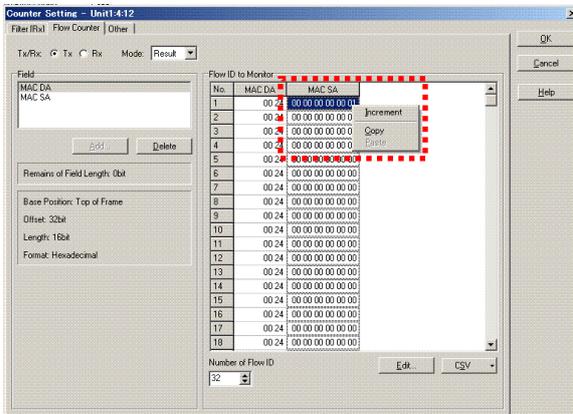


- When counting several flows, set the number of flows to be counted at “Number of Flow ID”. Here 32 there are flows from 32 ONUs so set “Number of Flow ID” to 32 and press “Edit..”.

*With one MD1230B unit, the Flow number can be set to 256 minus the number of ports selected at “Mode: Monitor” For example, when the monitored port number is 1, up to 255 flows can be set.

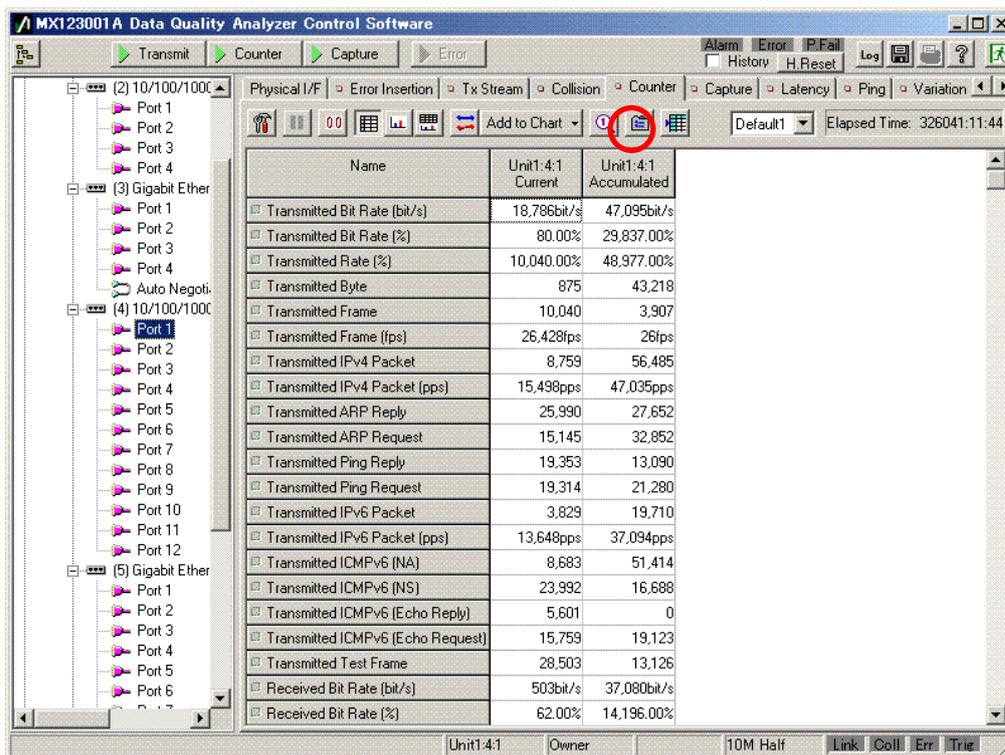


- Select “MAC DA” for “No.1” and copy the value by right-clicking.
- Select “MAC DA” for “No.2”~“No.32” and paste the copied value to set by right-clicking.

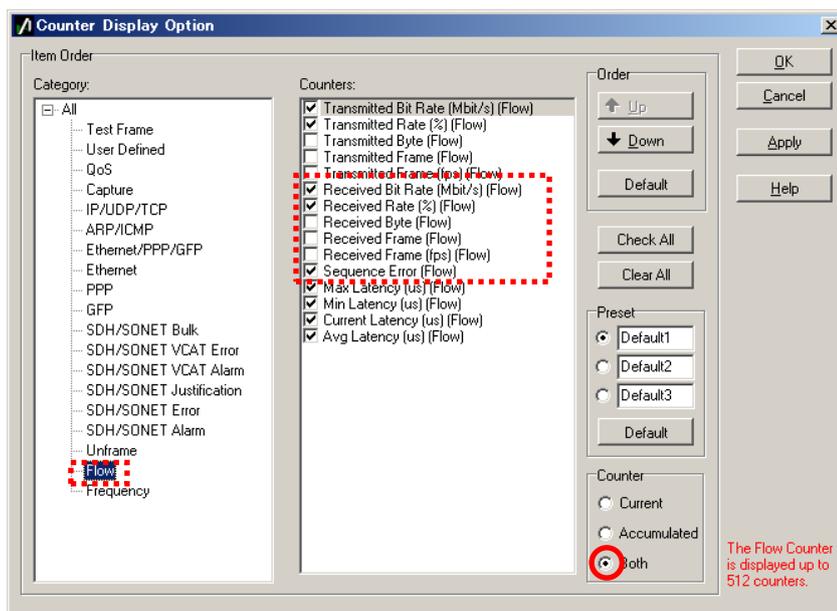


- Select “MAC SA” for “No.1”~“No.32” and the value incremented from 1 is input when “Increment” is chosen by right-clicking at “No.1”. (This divides the signal using each address of ONU1 to 32.)
- Record all the items as shown above and press the “OK” to complete the settings.

◆ Setting Counter Display



- Press the “Display Option” icon at the **Counter** screen to open the setting screen.



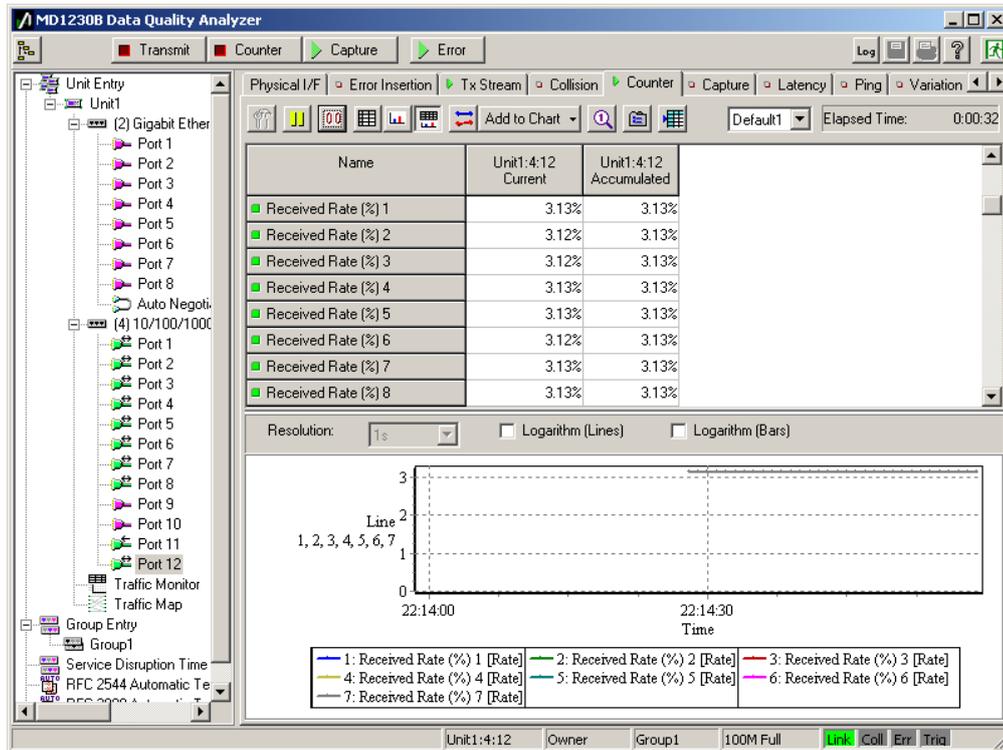
- Set which measurement items are to be displayed by placing checkmarks. Here, select “Flow” at “Category:” and place checkmarks at “Received Bit Rate [Mbit/s] (Flow)”, “Received Rate [%] (Flow)” and “Sequence Error” at “Counters:”. Select “Both” at “Counter”. (This permits monitoring of each flow in 1 second intervals using the multiflow counter.)

*When a checkmark is placed in the Latency item, it is possible to confirm each Latency measured value at the same time.

- Press “OK” to close the screen.

✧ Displaying Measurement Results

- The Counter Log starts.
- At the Counter screen, start Counter. Start Transmit at ONU1~32.
- Check that the Current value [%] for each Rx Frame of each flow is 3.125% and the same as the set value. As a result, clarify that the Throughput is 100%.
- If a Sequence Error is counted, Frame loss has occurred and if Frame loss occurs, the Throughput cannot be 100%.



*If the PLT Tx count and Rx count for each ONU are the same value, the Throughput is 100%.

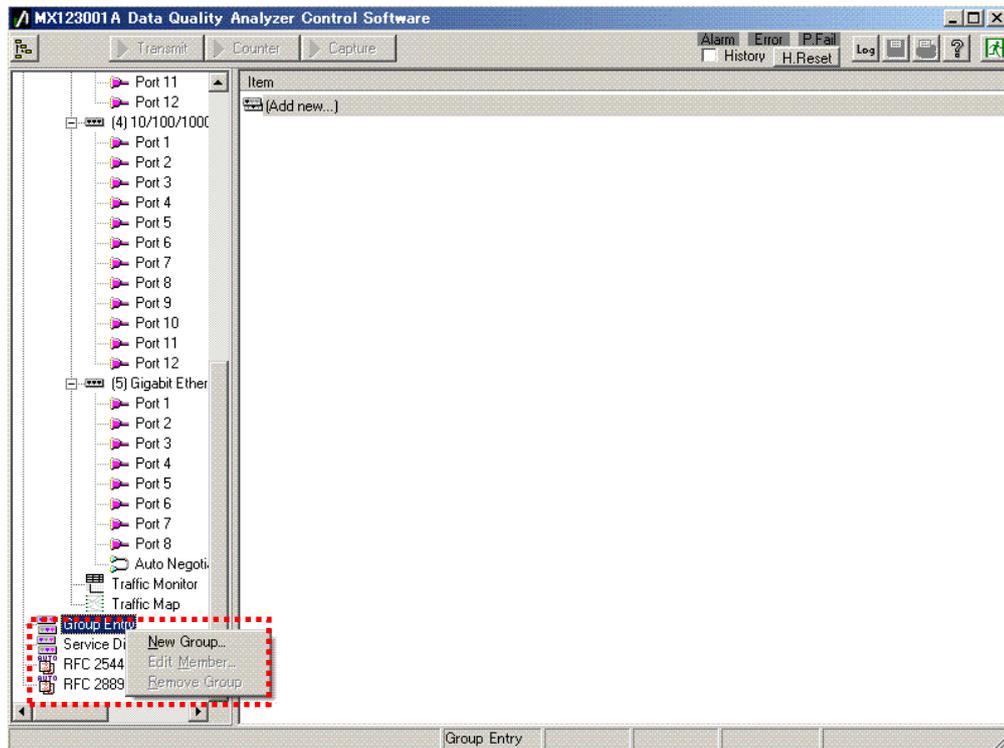
4.5. Checking OLT→ONU (Down Signal) Flow~Setting Custom Counter

(Objective) Check whether or not there is any Frame loss in the signal from OLT to ONU (the flow is normal).

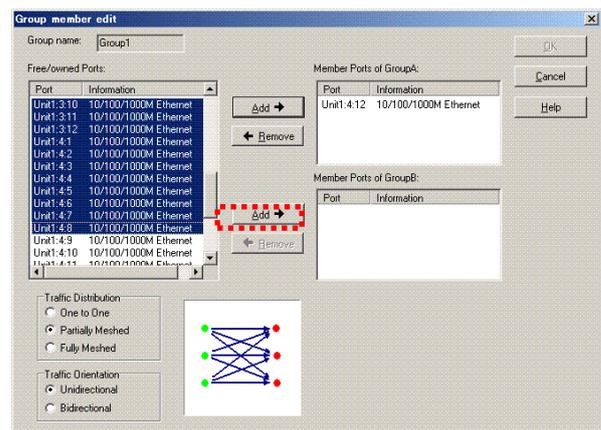
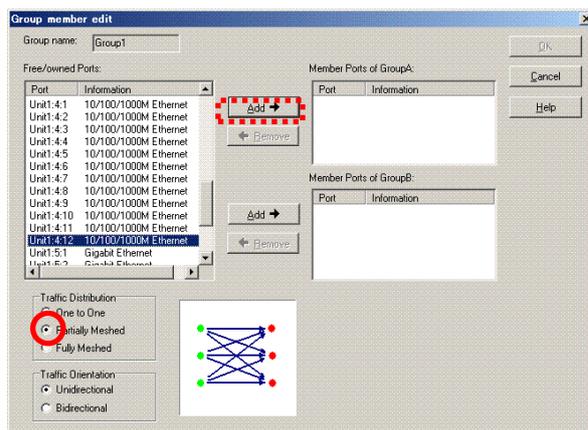
(Procedure) Group the ports and measure the Frame Loss using Custom counter.

(Results, Goal) Count of total flow at multiple ports (OLT→ONU (Down signal))

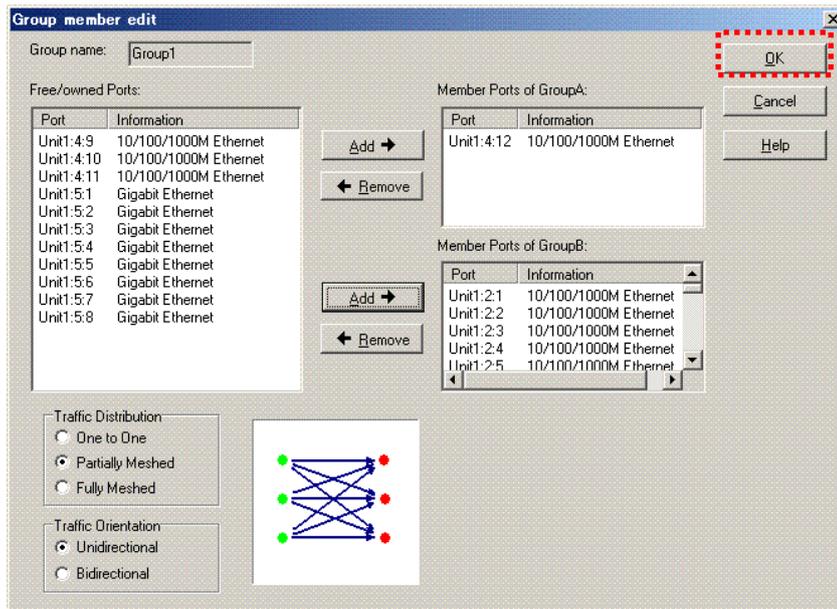
✧ Setting Group Entry



➤ Right-click “Group Entry” and select “New Group...”.

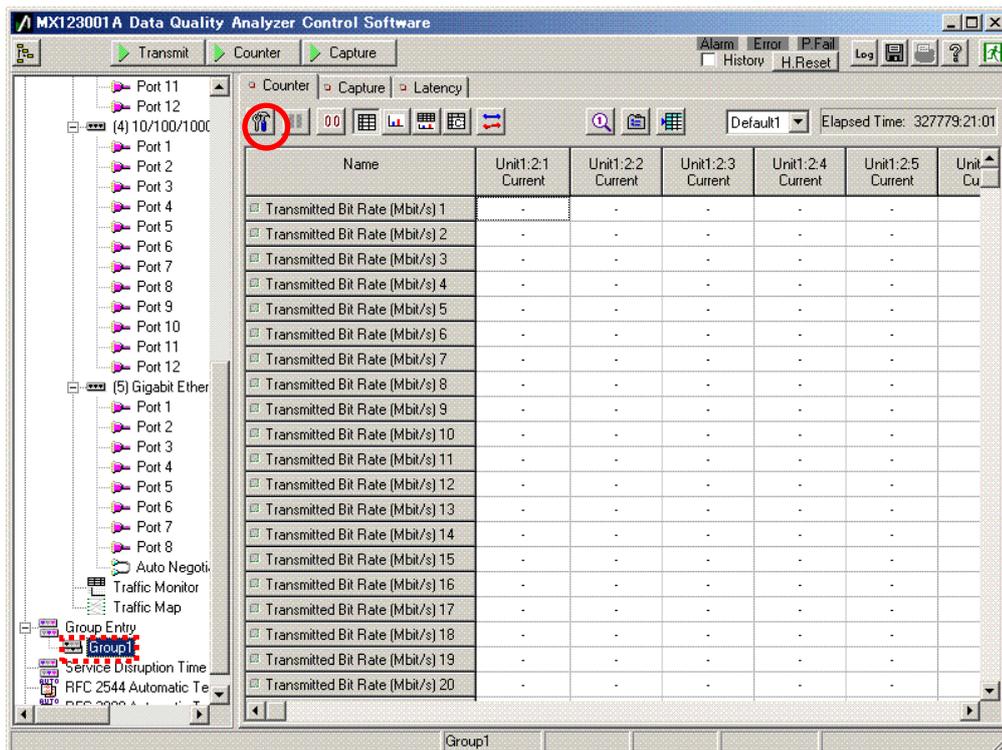


- Place a checkmark in “Partially Meshed” at “Traffic Distribution” and select the OLT-side port (Unit4 Port12); press “Add” at Group A (Top).
- Select all ports (Unit2, 3 Port1~12, Unit4 Port1~8) at the ONU-side and press “Add” at Group B (Bottom). (This performs a total count at OLT (Group A)↔Each ONU(Group B).

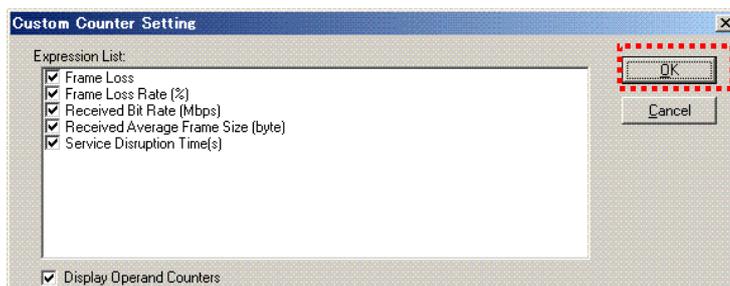


➤ Press “OK” to close the screen.

✧ Setting Custom Counter



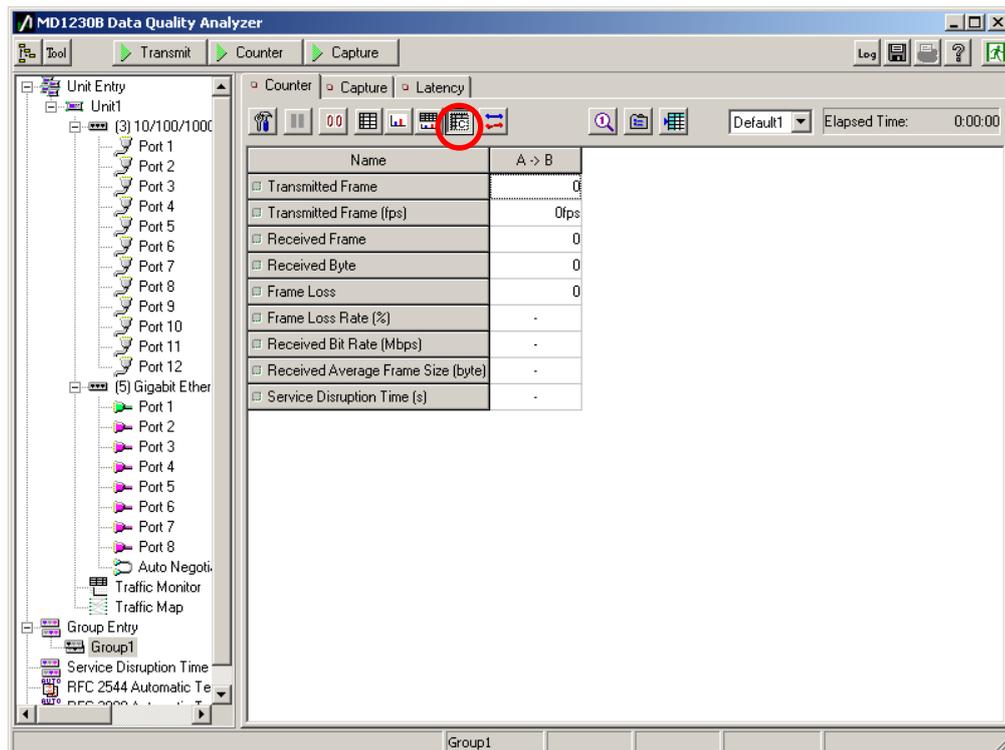
➤ Select Group1 and press the Custom counter display setting button (blue hammer icon) at the Counter screen to open the screen.



➤ At the “Custom Counter Setting” screen, place checkmarks in all items and press

“OK”.

- When the Custom counter display is selected, the screen appears as follows.



❖ Displaying Measurement Results

- The Counter Log starts.
- At the Counter screen, start Counter and Transmit.
- If there is a difference between the counts of the OLT Tx Frames and total of Rx Frame counts for each of the ONUs, Frame loss has occurred and “Frame Loss” and “Frame Loss Rate [%]” are counted.

Name	A -> B
Transmitted Frame	229,827
Transmitted Frame (fps)	10,330fps
Received Frame	229,827
Received Byte	15,168,582
Frame Loss	0
Frame Loss Rate (%)	0.00%
Received Bit Rate (Mbps)	4.04Mbps
Received Average Frame Size (byte)	66.00byte
Service Disruption Time (s)	0.00s

*It is also possible to simultaneously confirm the service stoppage time.

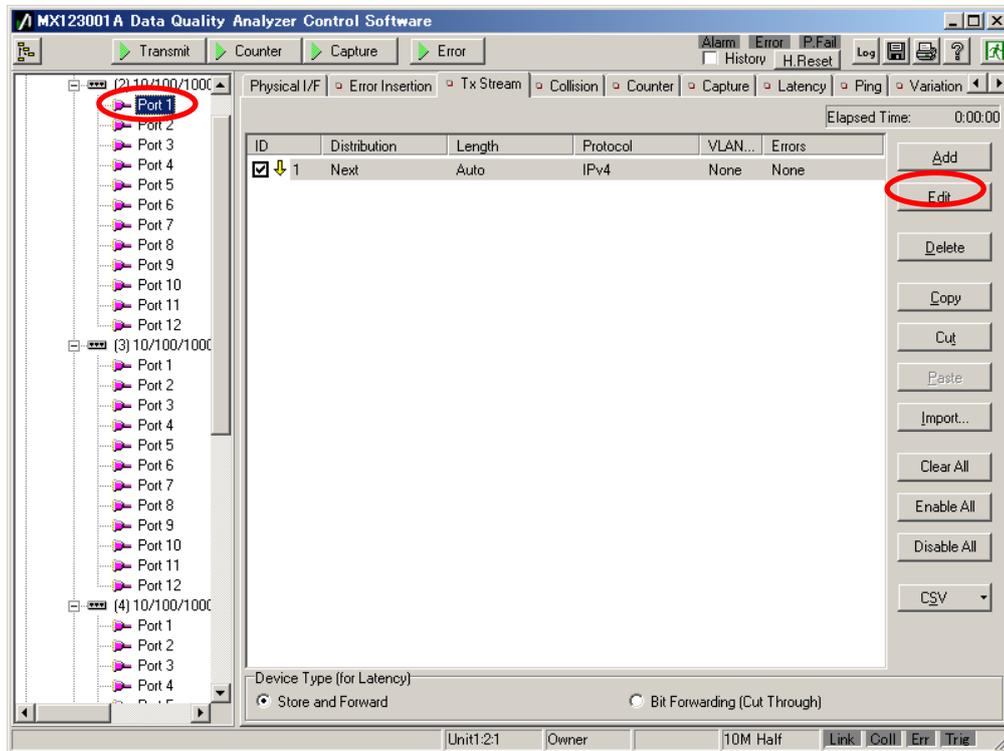
4.6. Testing Load

(Objective) To perform network load testing to evaluate the PON system performance

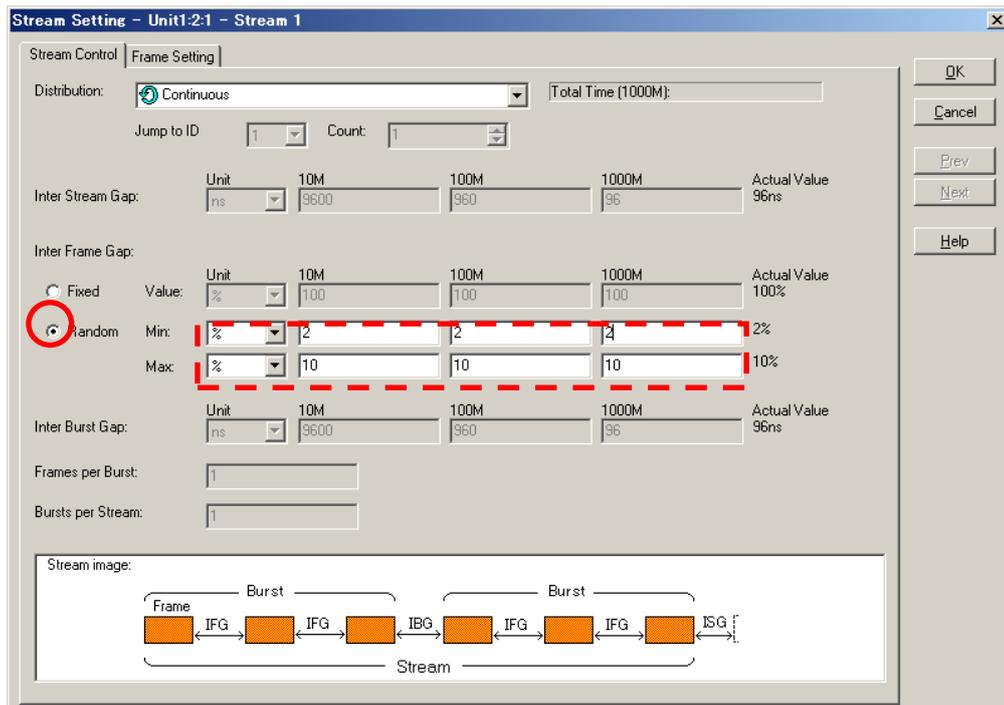
(Procedure) Vary the ONU1 Tx rate.

(Results, Goal) Generate network load and measure BER

✧ Increasing load of OLT-side Tx Frames

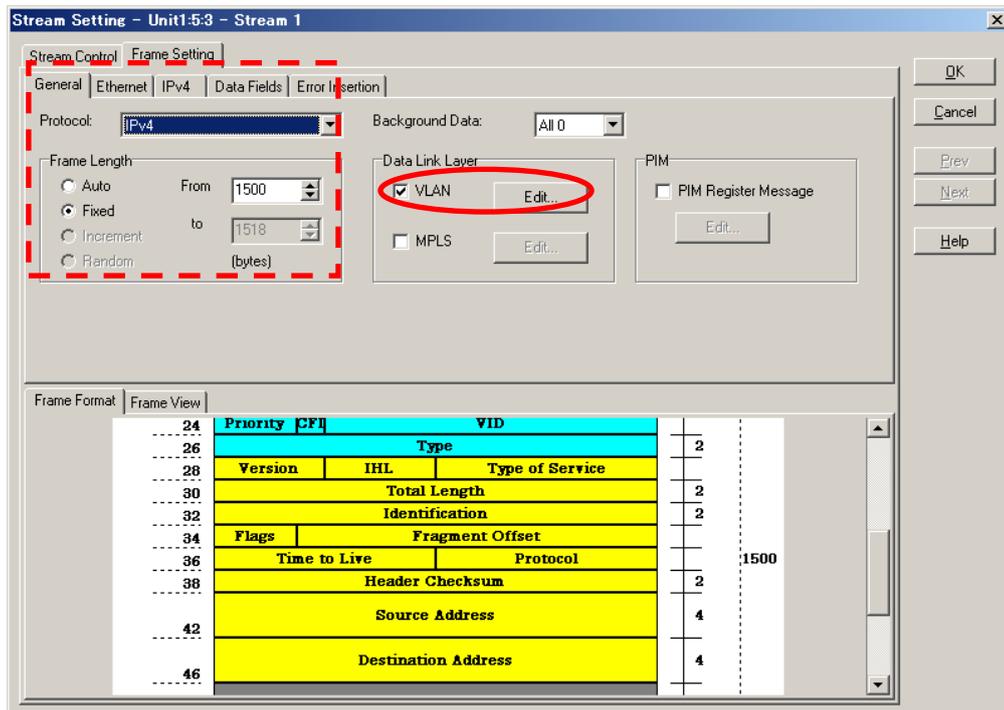


- Select Unit3 Port1.
- Stop Transmit.
- Select the stream and press “Edit...” to edit the stream.

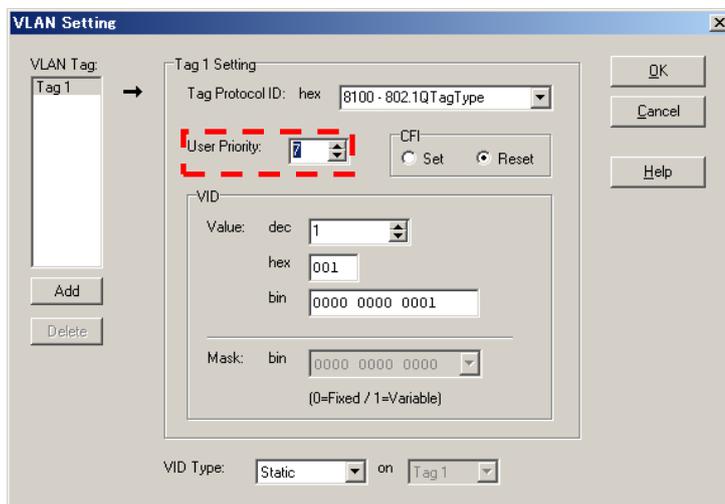


- Select “Random” at “Inter Frame Gap:” and set 1% at “Unit:” of “Min:” and 10% at

“Unit” of “Max:”. (This varies the band dynamically.)



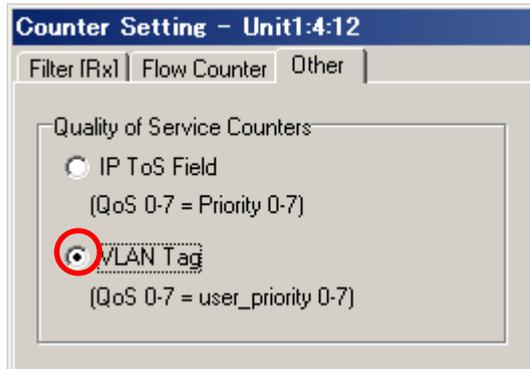
- Put a checkmark in VLAN and press “Edit...”. The data transmission priority can be increased by increasing “User Priority:”. Here set the priority to 7 so as to secure the band maximum priority. (Doing this guarantees the band required by ONU1 and divides the remaining band into 31 equal parts for ONU2 to 32.)



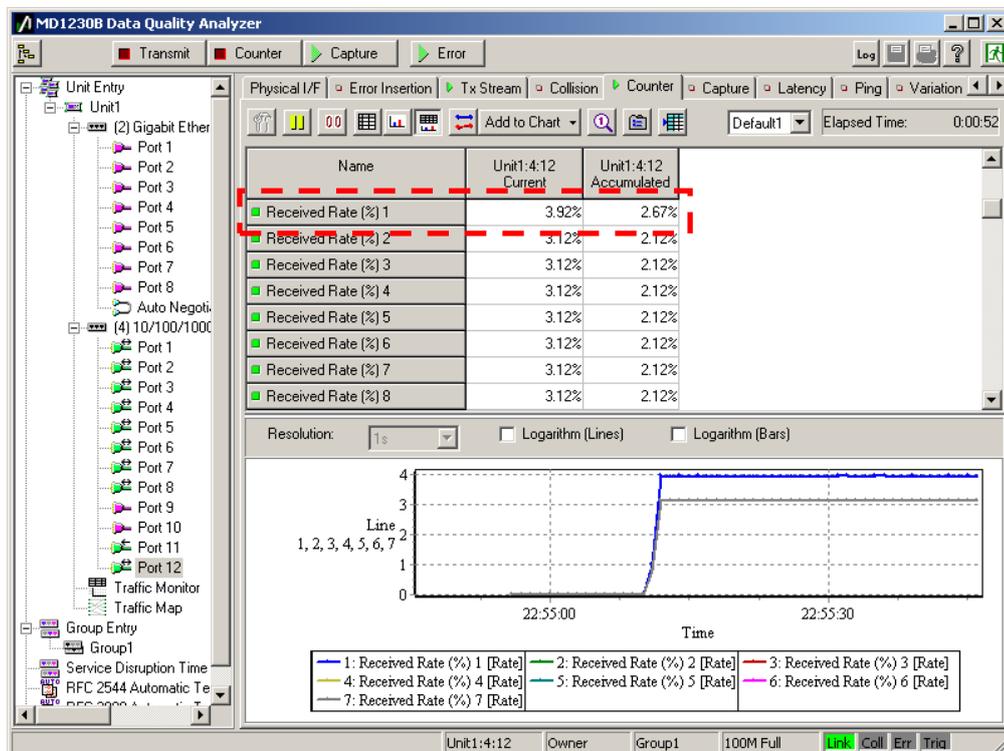
- Transmit is started.
- Counting is performed at the Count screen.

❖ Displaying Measurement Results~BER Measurement

- As in section 4.4, perform counting at the OLT-side Counter screen. This time, set “Counter Setting” of “Other” to “VLAN Tag” at Unit4 Port12.



- The rates of ONU2~32 decreasing due to the increased load of ONU1 will be seen.



*If there is any difference between the OLT and total counts for the ONU Tx/Rx, errors have occurred. Monitor the “Sequence Error” counts and measure the BER at these times.

Name	Unit1:4:12 Current	Unit1:4:12 Accumulated
QoS 0	30,382	1,184,897
QoS 7	5,443	213,434
Received Test Frame	35,825	1,398,331
Sequence Error 1	0	0
Sequence Error 2	0	0
Sequence Error 3	0	0
Sequence Error 4	0	0
Sequence Error 5	0	0

❖ Finishing Measurement

- Stop Transmit and counting.
- The logs are stored in the path C:\Program Files\Anritsu\MX123001A\Main\LOG.

5. Monitoring E-PON Systems

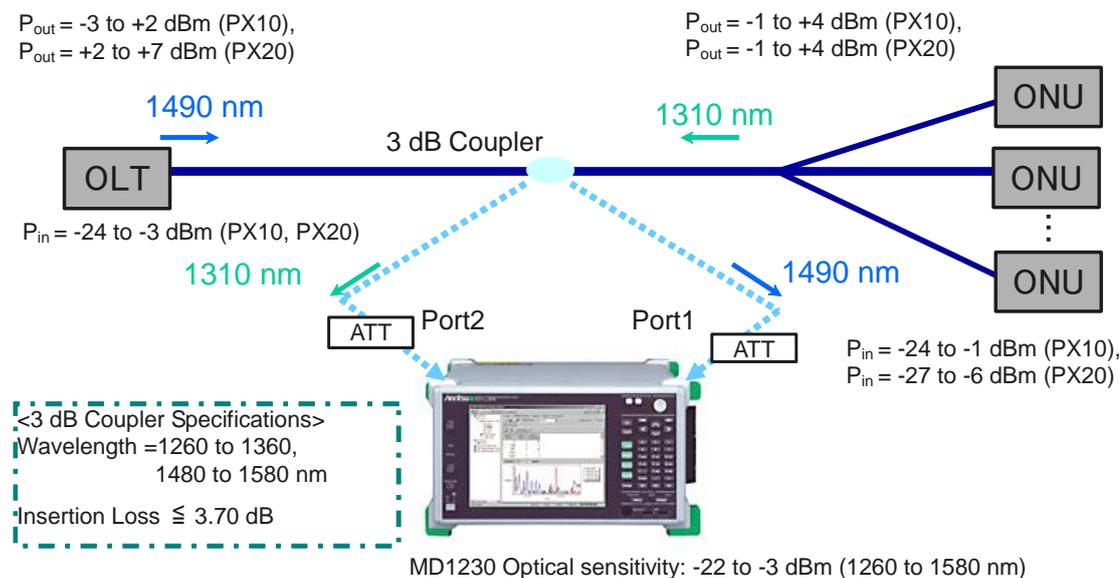
This part explains the procedure for monitoring E-PON systems.

In concrete terms, we shall capture PON system Frames and check that MPCP (Multi-Point Control Protocol) control and the OAM (Operations, Administration, and Maintenance) function are operating correctly. Additionally, how to check the OLT DBA (Dynamic Bandwidth Allocation) function and how to change priority are explained as well.

In other words, the procedures for testing service provider services are explained.

5.1. Connecting DUT

✧ Connecting with Coupler



- Insert a 2 x 2 coupler between the OLT in the PON system and splitter. Here the coupler is connected directly after the OLT.

Note: When the distance between the OLT and ONU is short, sometimes the equipment permissible optical power range may be exceeded. In this case, insert an optical attenuator (ATT) directly after the OLT.

Since light has directivity, connect the coupler end of the side monitoring the Down signal (1490 nm) to Port 1 of the MU120132A (Unit5) as shown in the above diagram. Connect the Up signal (1310 nm) to Port 2. Since high power light is input to the receiver, use a 6 dB optical ATT inserted at the input section of the measuring instrument when the OLT and each ONU use 1000Base-PX10, and a 12 dB optical ATT when they use 1000Base-PX20. (This is not necessary when the power is -3 dBm or less.)

*The coupler characteristics are as described above. Use a coupler with a normal extinction ratio (50:50) from any maker.

Note: Normally, since the reflected/leakage light is 40 to 50 dB less, the impact on the optical signal is small, but reflection from an open connector can have an

impact on the optical signal. Ensure that all ONUs and couplers after the splitter are always connected to the equipment or are terminated.

5.2. Checking MPCP Control and OAM Function

(Objective) Checking MPCP control (P2MP discovery when new ONU added to PON system) and OAM function indicating problems when fault occurs

(Procedure) Monitor the MPCP signal in the E-PON system and monitor the OAM signal while generating load at End-to-End measurement and inserting errors.

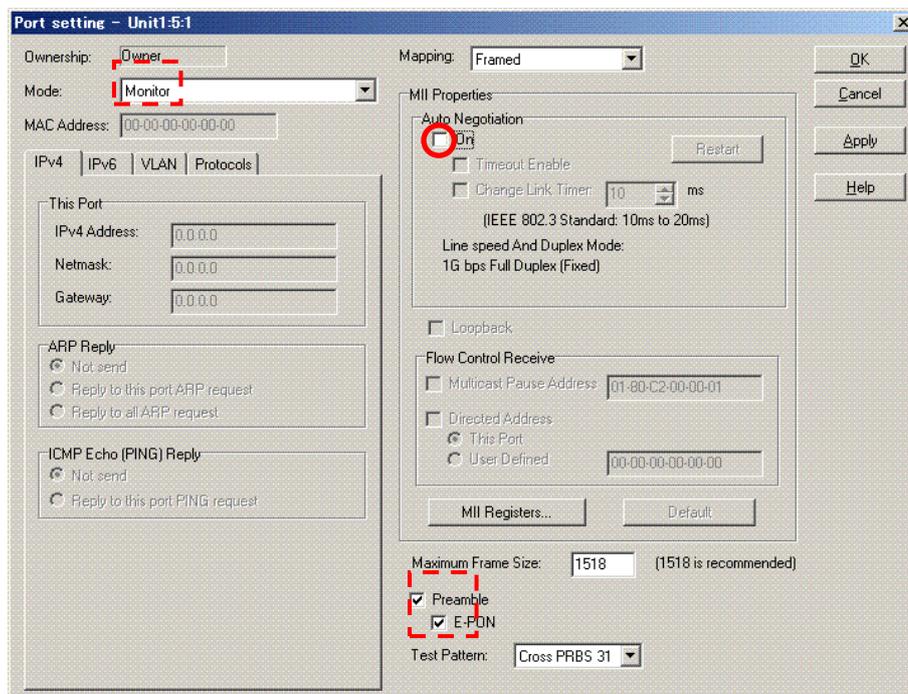
(Results, Goal) Monitoring E-PON Frames and understanding capture data

*For verification, PON system encoding is monitored in the off condition.

✧ Perform port setting for ports monitoring E-PON signals with the ONU not connected.

(1) Setting Port (Unit5 Port1) using EPON Signal from OLT

- Right-click Port1(Unit1:5:1) and select “Port Setting...”.



① Set “Mode:” to “Monitor”.

② Place a checkmark in “Preamble” so that capture can be performed from preamble.

Moreover, placing a checkmark in “E-PON” supports capture of E-PON Frame capture.

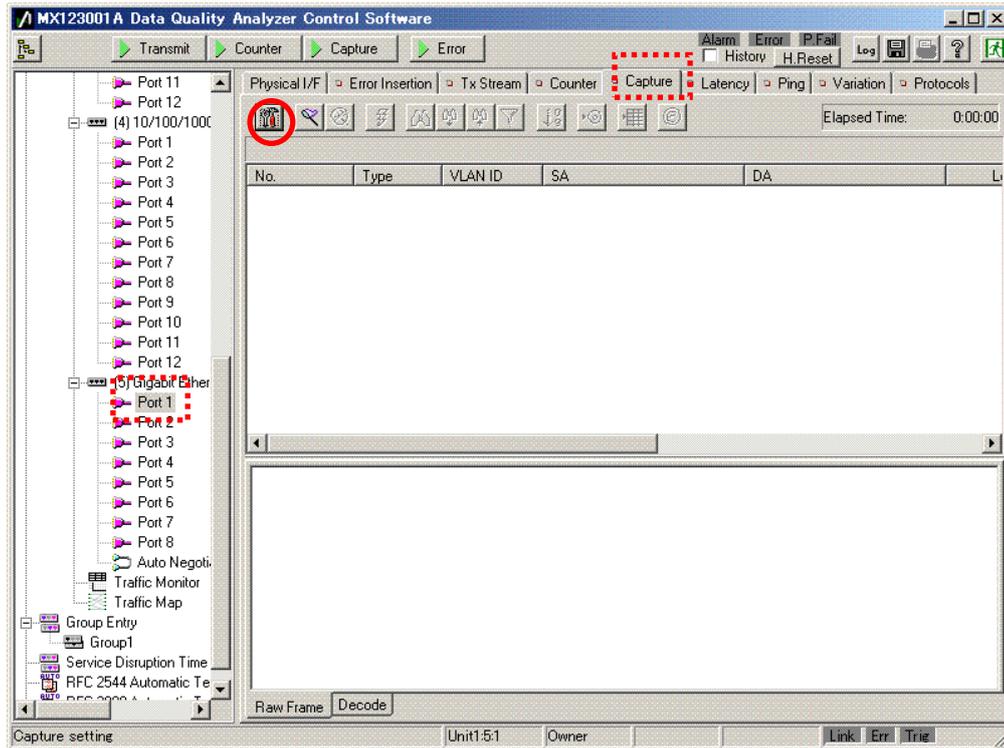
③ Remove the checkmark from “Auto Negotiation” to set “Off”. (This enables monitoring of PON systems with burst signals.)

*When a checkmark is placed in “E-PON” with firmware Ver. 7.1 or later, since Auto Negotiation in the MD1230 is set to Off, it is not necessary to perform step 3 above. However, it must be performed for earlier firmware versions.

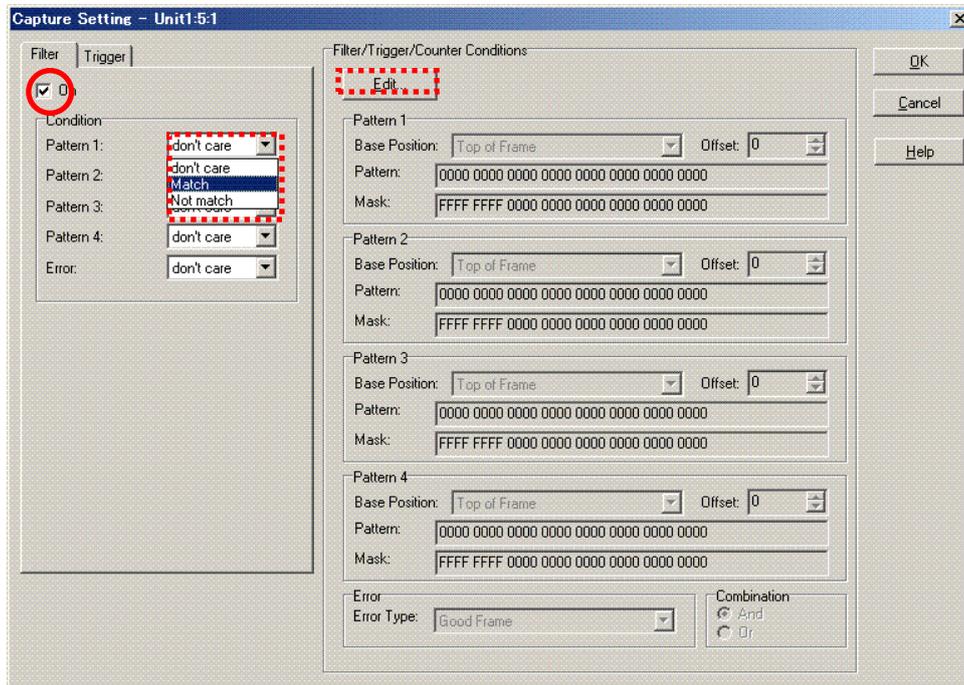
(2) Setting Port (Unit5 Port2) using EPON Signal from ONU

- Perform the Unit5 Port2 port setting in the same manner as above.

✧ Checking MPCP Control (P2MP Discovery)



- Select the port to be monitored (Unit5 Port1 (Unit1:5:1) here).
- Open the Capture screen and press the capture setting icon (hammer mark) to open the setting screen.



- Place a checkmark in “On” at the Filter screen and change “Pattern 1:” of “Condition” to “Match”.
- Press “Edit...” at “Filter/Trigger/Counter Conditions” to perform setting.

No.	Type	VLAN ID	SA	DA
	MAC Control Frame	-	00-00-00-00-01	00-00-00-00-02
	MAC Control Frame	-	00-00-00-00-02	00-00-00-00-01
	MAC Control Frame	-	00-00-00-00-01	00-00-00-00-02
	MAC Control Frame	-	00-00-00-00-01	00-00-00-00-02
	MAC Control Frame	-	00-00-00-00-02	00-00-00-00-01

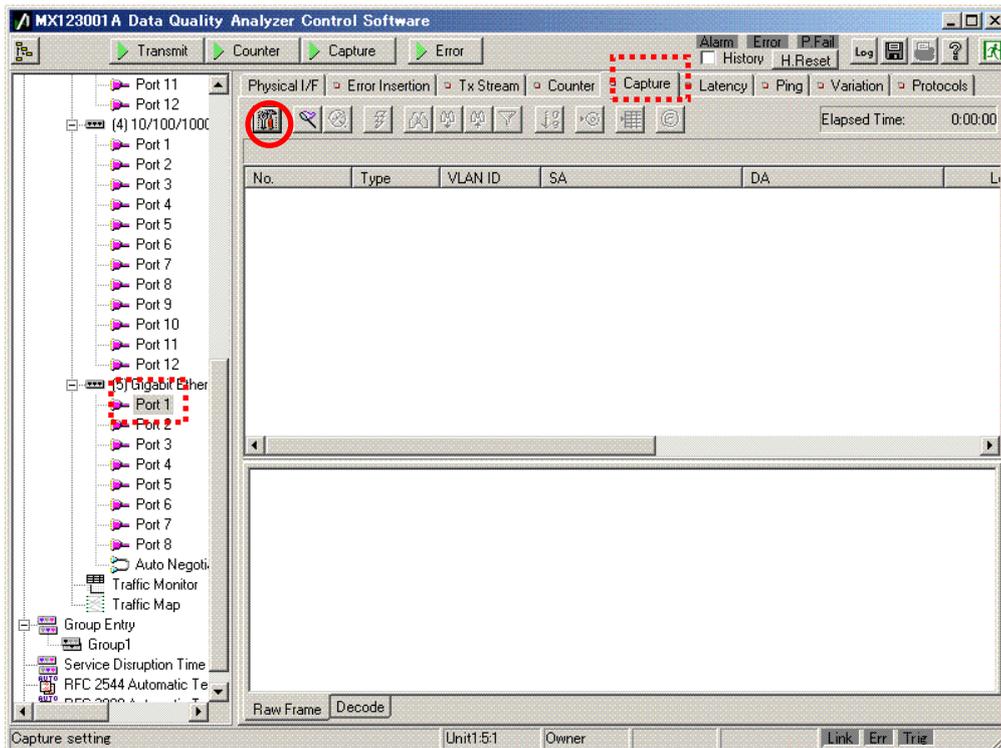
```

Ethernet : --- Ethernet Header ---
Ethernet : Destination Address = 00 00 00 00 02
Ethernet : Source Address   = 00 00 00 00 01
Ethernet : Type             = 88 08 (802.3 MAC Control Type)
MAC Ctrl : --- MAC Control Frame ---
MAC Ctrl : MAC CONTROL OPCODE = 00 05 (MPCP REGISTER)
MAC Ctrl : Timestamp         = 00 00 00 00 (0 Quanta)
MAC Ctrl : Assigned Port     = 00 00 (0)
MAC Ctrl : Flags             = 00 (0: Reserved)
MAC Ctrl : Sync Time        = 00 00 (0)
MAC Ctrl : Echoed Pending Grants = 00 (0)
MAC Ctrl : RESERVED         = 00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
MAC Ctrl : RESERVED         = 00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
MAC Ctrl : RESERVED         = 00 00 (transmitted as zeroes)
Ethernet : --- Ethernet Trailer ---
Ethernet : FCS = 1D 72 C0 9D (correct)

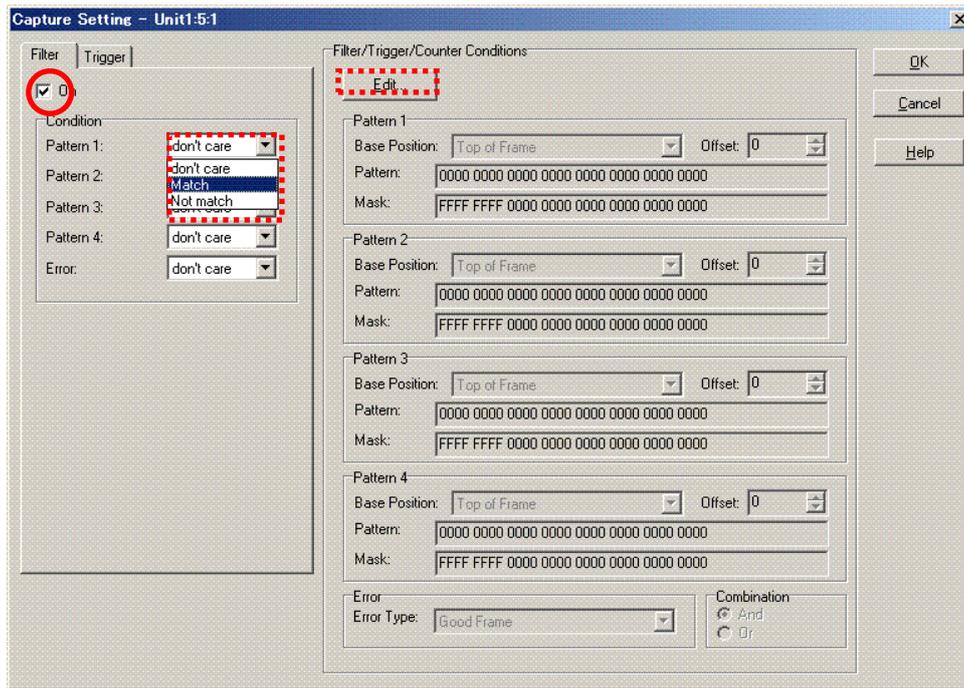
```

- Group Unit5 Port1 and 2. The results appear as below.

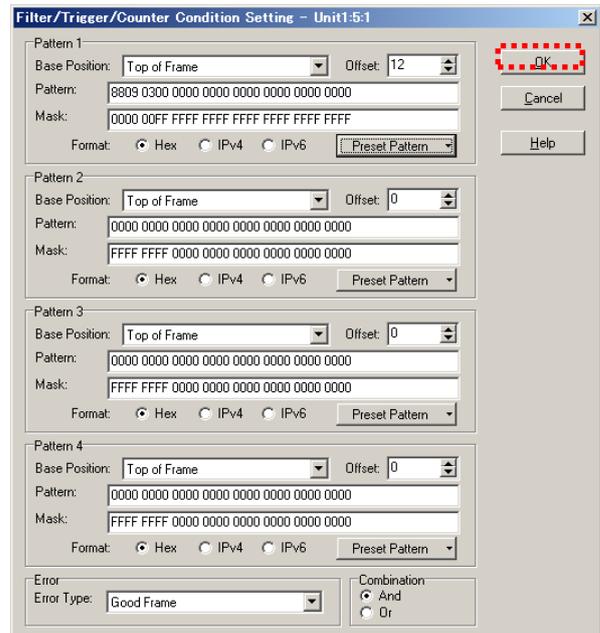
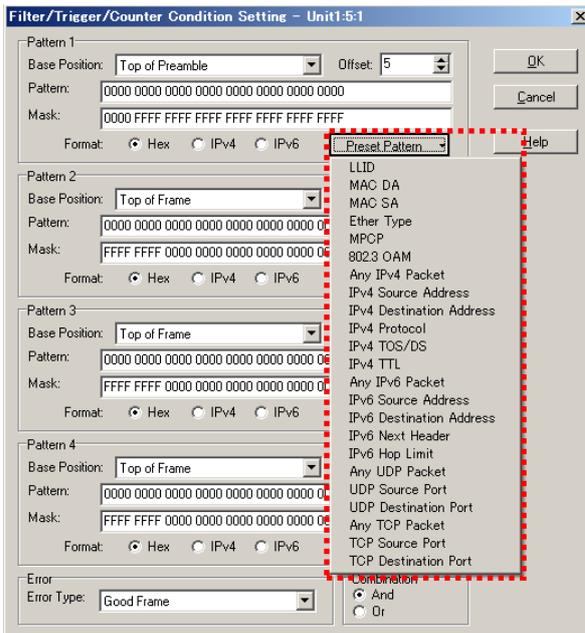
✧ Checking OAM Function



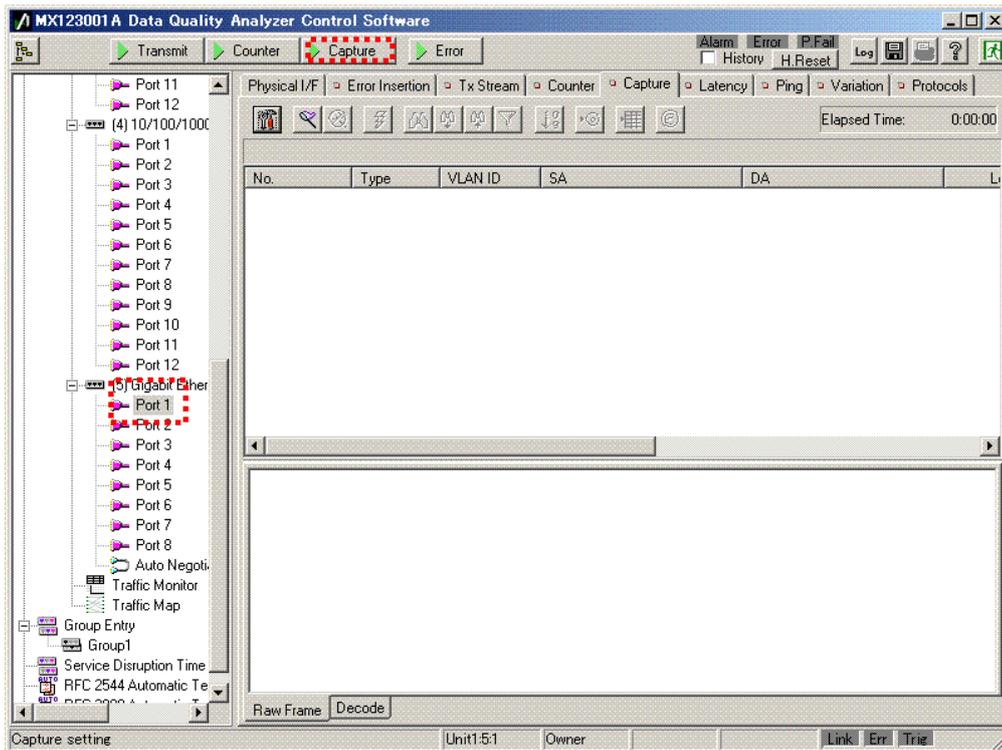
- Select the port to be monitored (Unit5 Port1 (Unit1:5:1) here).
- Open the Capture screen and press the capture setting icon (hammer mark) to open the setting screen.



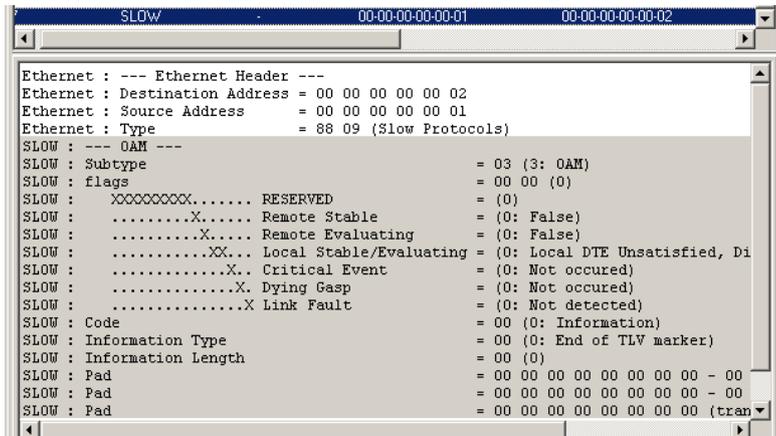
- Place a checkmark in “On” at the **Filter** screen and change “Pattern 1:” of “Condition” to “Match”.
- Press “Edit” at “Filter/Trigger/Counter Conditions” to perform setting.



- Open “Preset Pattern” of “Pattern 1” and select “802.3 OAM”.
- Press “OK” to close the screen.
- Perform setting for Unit5 Port2 in the same manner.



- Start capture of the port to be monitored (Unit5 Port1, 2).
- Perform the End-to-End load test described in section 4.6 and capture the fault notification signal at a fault.



- The results appear as below.

5.3. Application Example 1: Verifying DBA Function

(Objective) Verifying OLT DBA function (checking band priority operating normally)

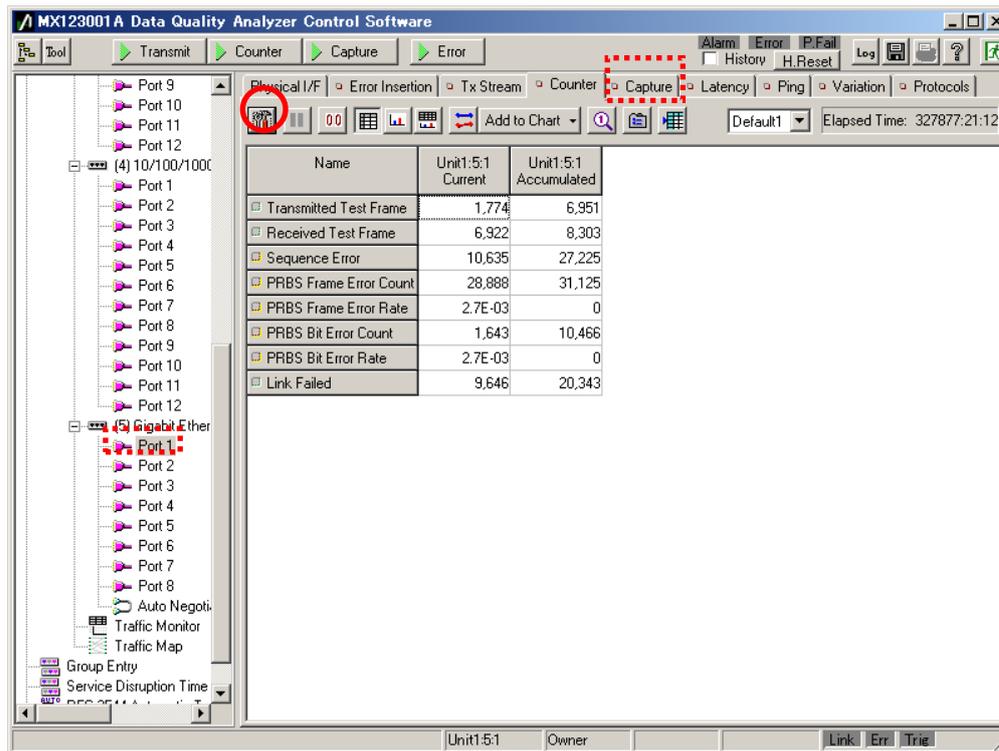
(Procedure) Count and monitor OAM signals while changing the priority of the VLAN tag for End-to-End measurement and performing QoS measurement.

(Results, Goal) Counting E-PON Frames

*For verification, perform monitoring with the PON system encoding set to off.

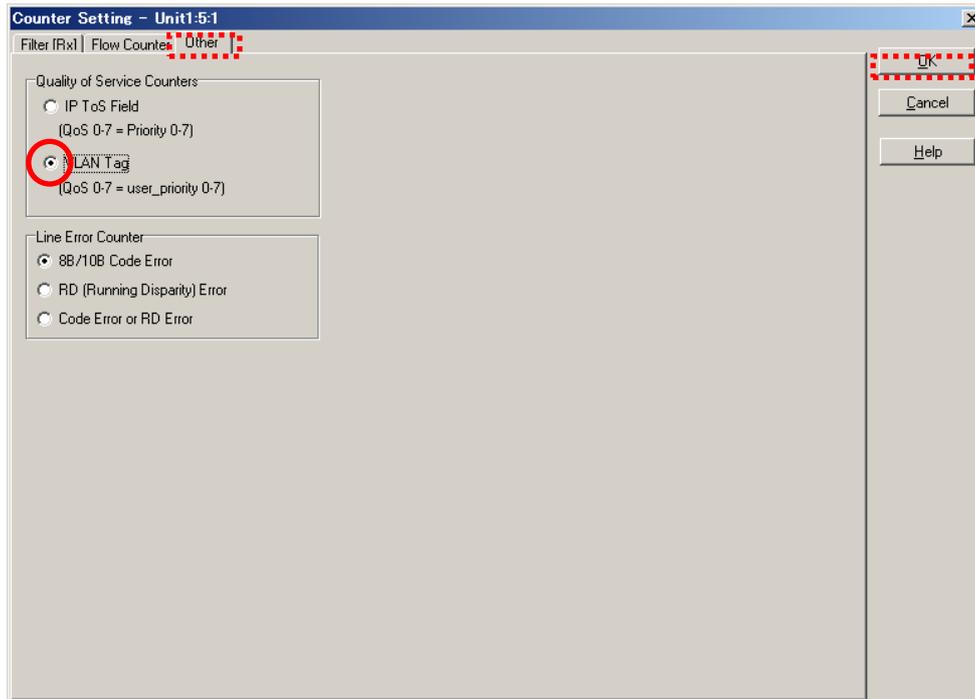
✧ Setting Counter

(1) Opening Counter Setting Screen



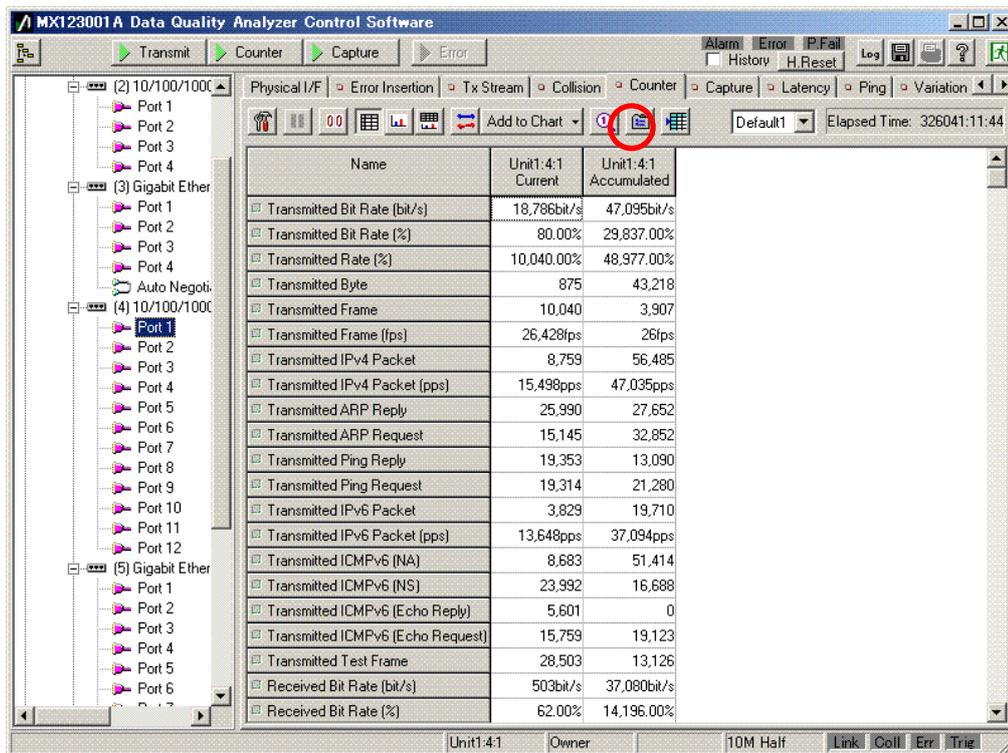
- Select the port to be measured (Unit5 Port2 (Unit1:5:2) here).
- Open the Counter screen and press the counter setting icon (hammer mark) to open the setting screen.

(2) Opening Field Setting Screen

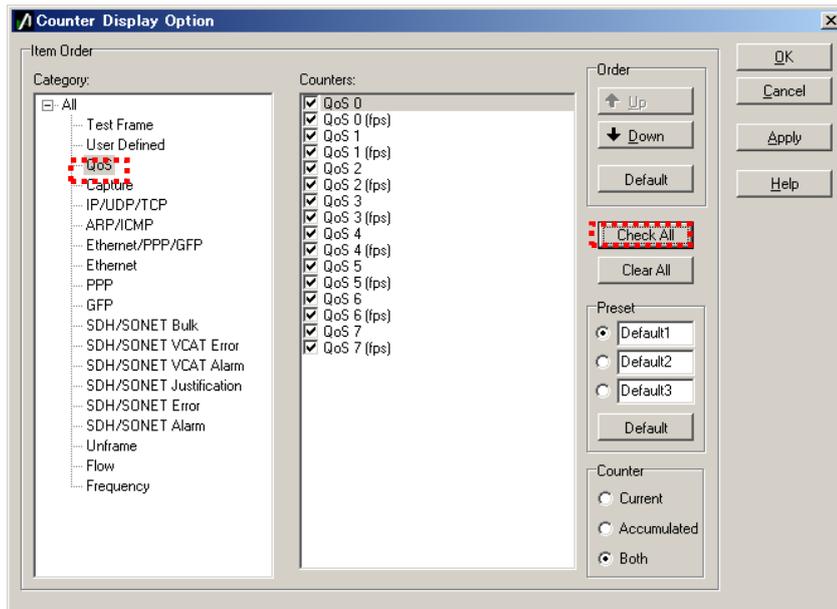


- Open the **Other** screen and choose “VLAN Tag” at “Quality of Service Counter”.
- Press “OK” to close the screen.

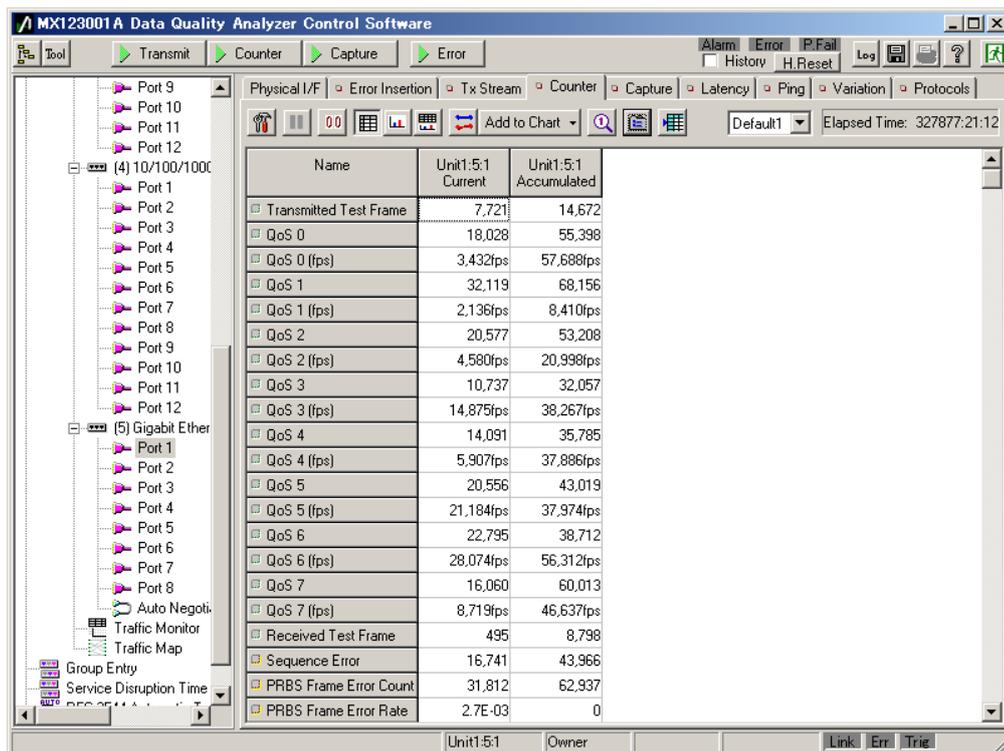
✧ Setting Counter Display



- Press the “Display Option” icon at the **Counter** screen to open the setting screen.



- Place checkmarks to set which measurement items to display. In this example, select “QoS” at “Category:” and either put checkmarks in all items at “Counters:” or press “Check All”.
- Press “OK” to close the screen.



- Counter and capture start.
- Perform End-to-End QoS measurement as described in section 4.6 and check the network DNA function when varying priority at the VLAN tag.

5.4. Application Example 2: Verifying QoS

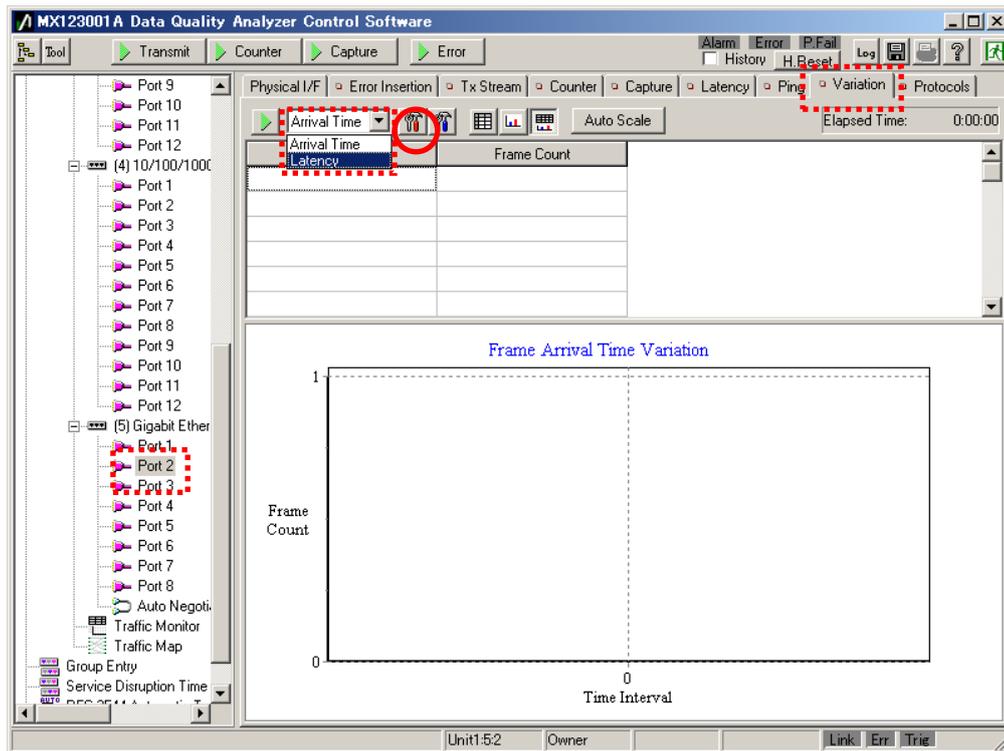
(Objective) Confirming whether service provider’s guaranteed delay (≤ 10 ms) is problematic with PON system

(Procedure) Measure the Latency of each signal.

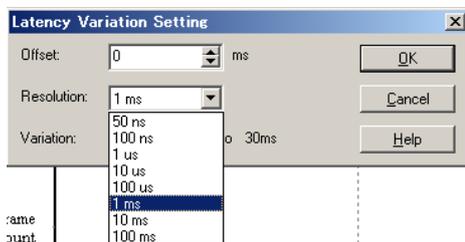
(Results, Goal) Measuring Latency

*For verification, perform monitoring with the PON system encoding set to off.

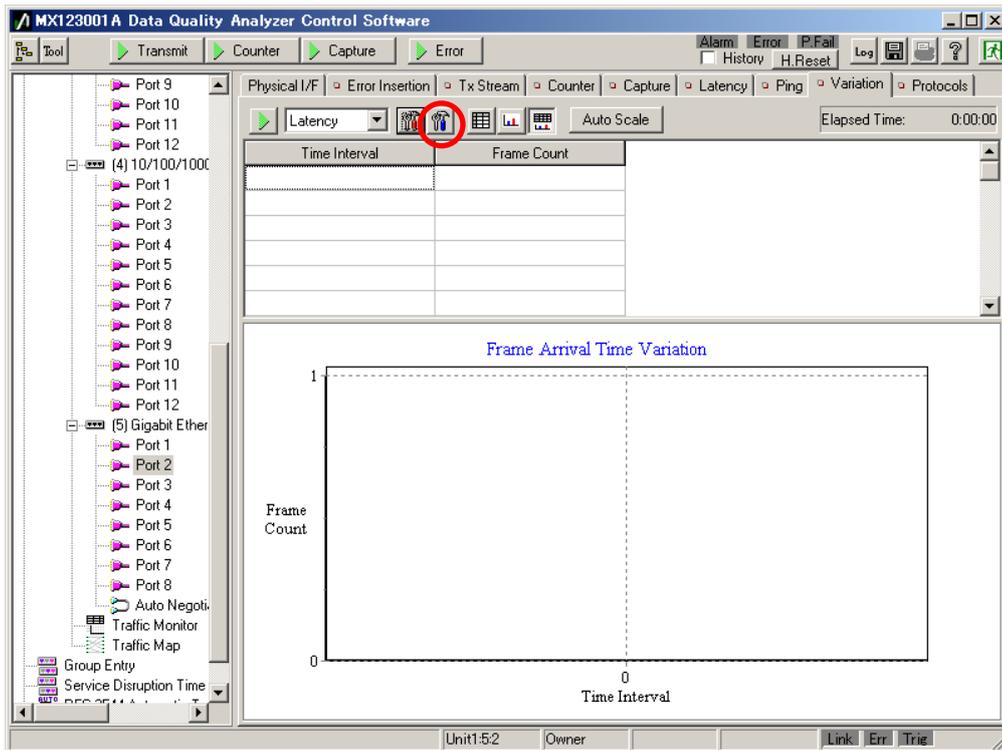
✧ Measuring Latency



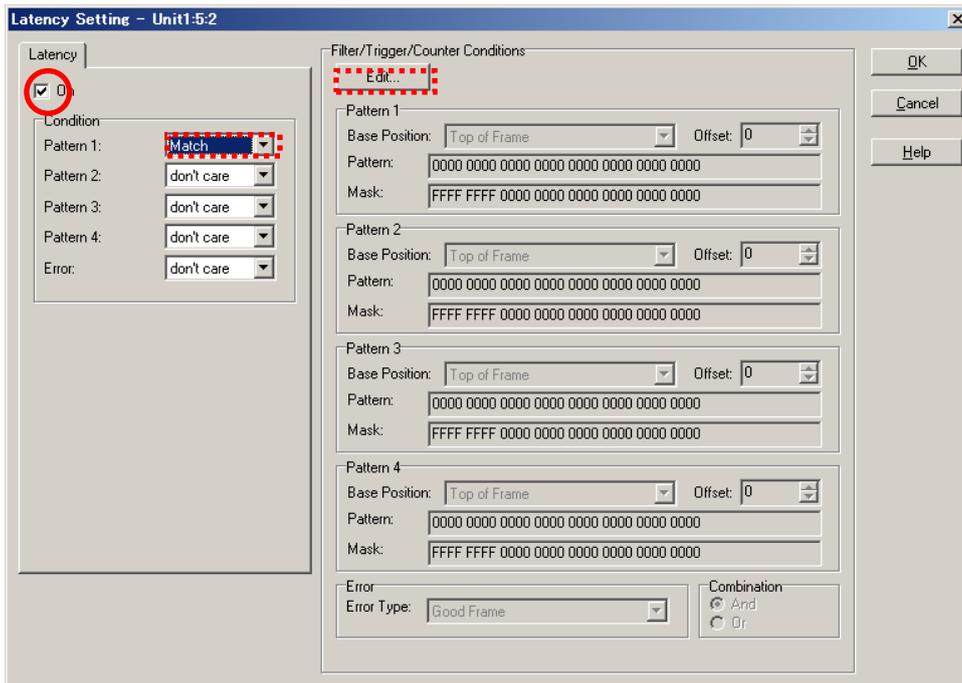
- Select the port to be monitored (Unit5 Port2 (Unit1:5:2) here).
- Open the **Variation** screen and select Latency.
- Press the Latency Variation setting icon (red hammer mark) to open the setting screen.



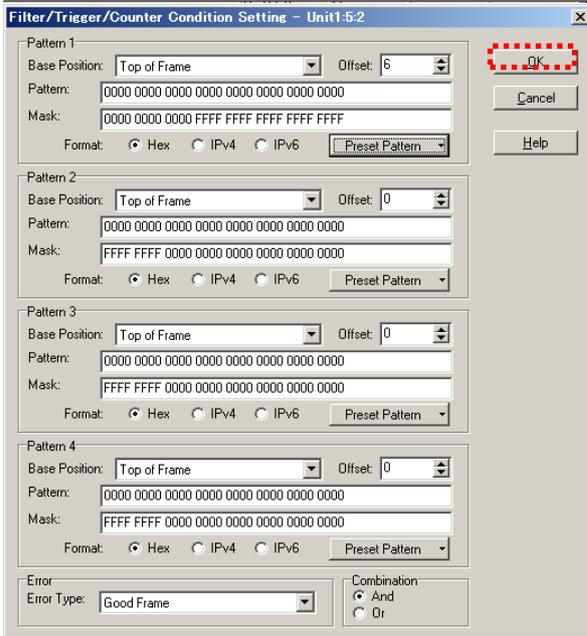
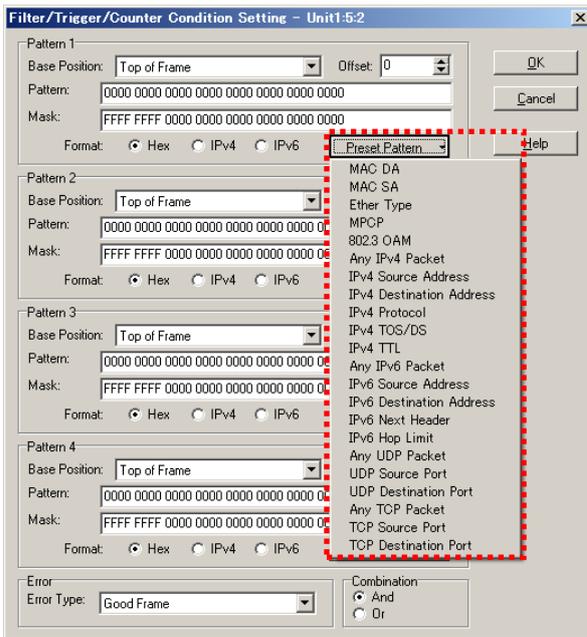
- Select “1 ms” at “Resolution:” and press “OK” to close the screen. (This enables measurement of the Latency distribution up to 30 ms with 1 ms resolution.)



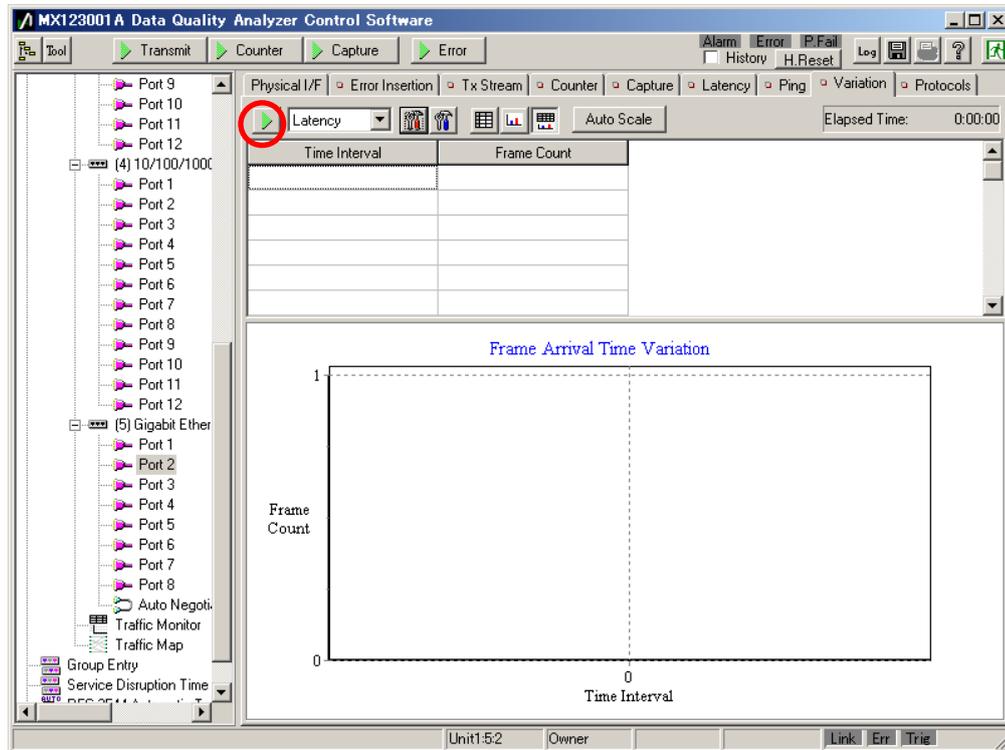
- Press the setting icon (blue hammer symbol) to open the setting screen.



- Place a checkmark in “On” at the **Filter** screen and change “Pattern 1:” for “Condition” to “Match”.
- Press “Edit...” at “Filter/Trigger/Counter Conditions” and perform setting.



- Open “Preset Pattern” of “Pattern 1” and select “MAC SA”.
- Press “OK” to close the screen.



- Measurement starts.
- The service providers guaranteed delay time (10 ms or less) is verified.

6. Summary

The MD1230/MP1590 family with installed MU120131A/MU120132A options is designed for verifying and evaluating multicast PON systems. The all-in-one design supports End-to-End load tests and QoS measurements for verifying PON systems, making it ideal for improving QoS. Furthermore, since E-PON system frames can be monitored simultaneously using the MU120132A, quality evaluations are even more efficient.

By offering a total measurement solution for PON systems, the MD1230/MP1590 family is perfect for building an application test environment.

Product Features

- The MD1230B provides all-in-one support for evaluating the functions of all ONUs and the OLT in a 32-branch PON system.
- It supports capture and decoding of IEEE802.3-compliant OAM and MPCP frames, including preamble in E-PON systems.
- Statistics using Frame Count function and custom counter

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