MU120131A/32A

IP Multicast Measurement

MD1230B/MP1590B

Data Quality Analyzer / Network Performance Tester

Contents

1. Introduction

The rapid spread of broadband networks is leading to a new era of IP-network based services. One of the most important services is IPTV, using IP multicast technology. Anritsu's MD1230B and MP1590B are general-purpose IP testers that also support QoS evaluation of multicast networks.

This guide explains some examples of IP multicast network QoS evaluations using the MD1230B and MP1590B.

1.1. Structure of Guide

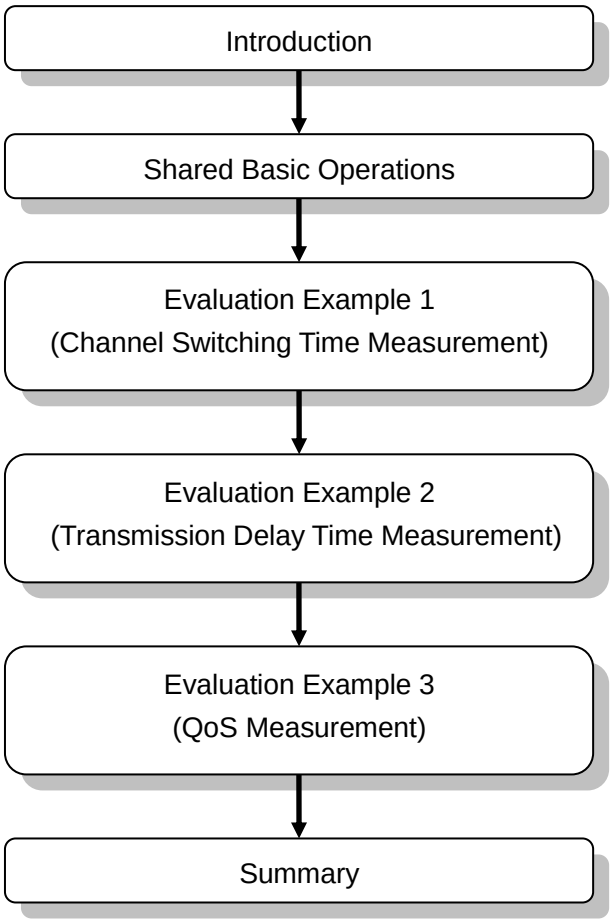


Fig. 1 Structure of Guide

* This guide assumes that the MU120131A/132A module (Ver. 7.0 or later) is installed in the MD1230B. When installing MD1230 family software Ver. 7.0, refer to the Version Upgrade procedure on the software CD-ROM.

* 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.

1.2. About Multicast Distribution

With the rapid growth of broadband network environments, subscribers and providers are increasingly demanding and providing rich-content services including graphics, voice, and video. However, because provision of rich content requires transmission of very large data amounts, there is concern about the loads on servers supplying the content and on the distribution networks. In video streaming services typified by IPTV, the increasing numbers of subscribers and rising server loads mean that the old unicasting technology (one stream to one subscriber) is no longer adequate. As a result, more providers are using multicasting technology (one stream to many subscribers) as a way of reducing loads on networks and servers.

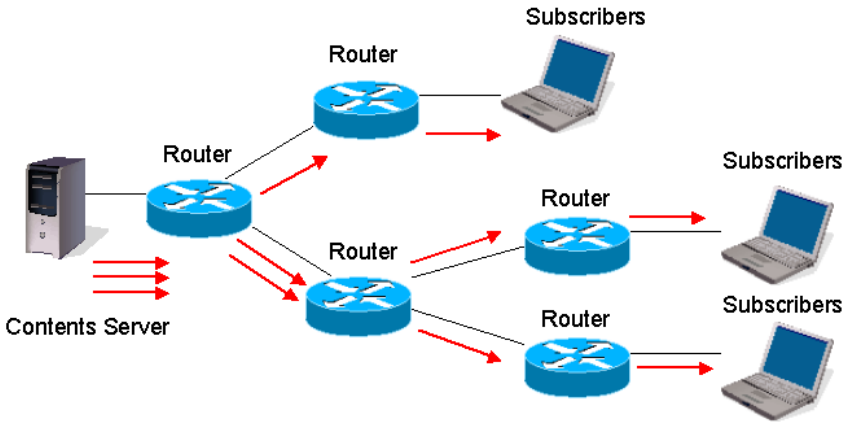


Fig. 2 Unicast Distribution

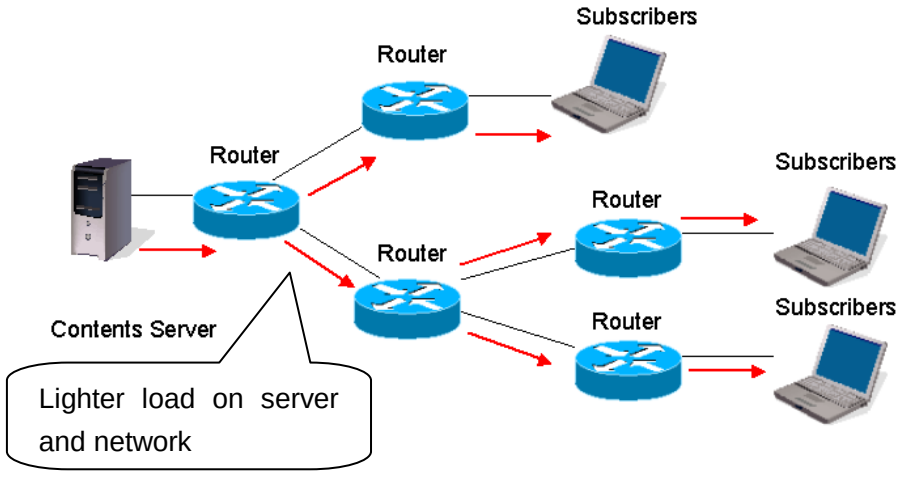


Fig. 3 Multicast Distribution

In multicast content distribution, the routers must support the multicast routing protocol. Routers are identified as a group including multiple subscribers using a multicast address to perform routing and distribution. In video services, this multicast address is the equivalent of a broadcast channel.

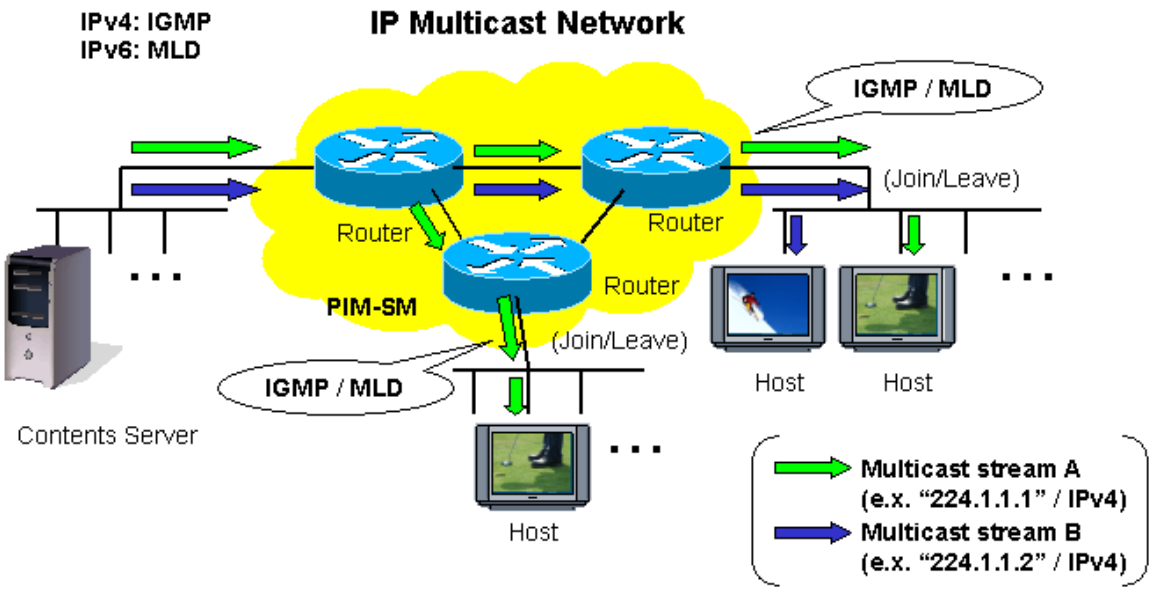


Fig. 4 IP Multicast Network

Frequent channel switching (Zapping) on IPTV causes extremely high loads on routers and the network. Zapping verification is a very important item in assuring and evaluating the quality of multicast services.

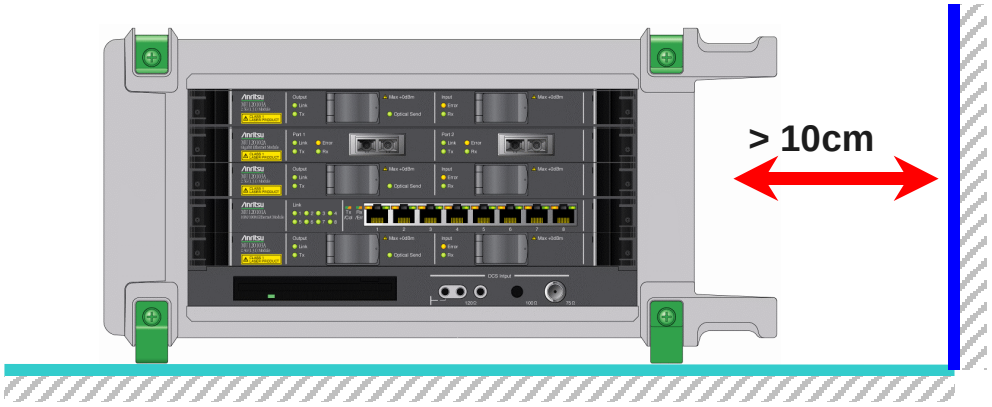
This guide explains channel switching time measurement, transmission delay time measurement and QoS measurement based on the assumptions that Zapping is performed frequently.

2. Shared Basic Operations

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

2.1. Installing MD1230B

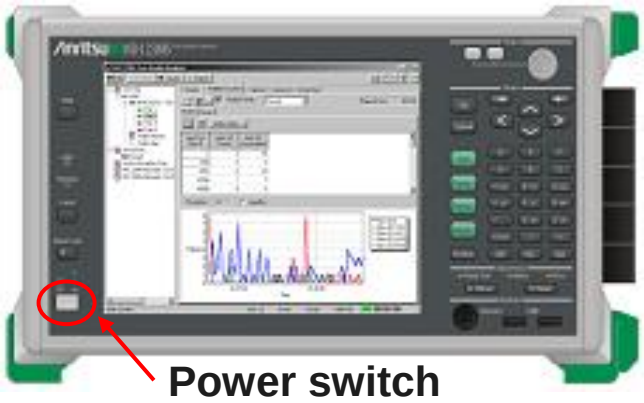
- Install the MD1230B on a flat and stable surface.
- The MD1230B has a cooling fan in the back panel. Position the MD1230B so that it is at least 10 cm from walls and obstructions to allow sufficient cooling air flows.
- Supply power in the voltage ranges of 100~120 Vac or 200 ~ 240 Vac at a frequency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



2.2. Installing Modules

- Install one MU120131A unit in Slot 3.

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

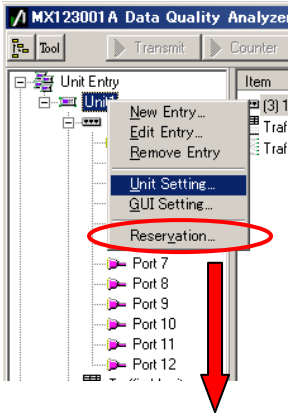
- Shutdown the MD1230B in the same way as a normal PC and set the power switch to OFF.

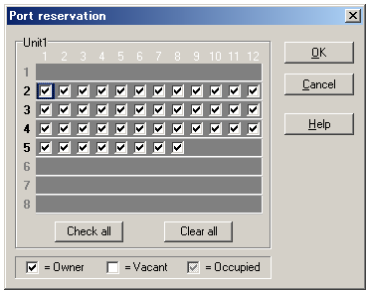
2.4. Starting

- 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.

2.5. 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. Evaluation Example 1…Measuring Channel Switching Time

This section explains measurement of channel switching time of a multicast distribution network.

Channel switching time measurement measures the time from when the IGMP/MLD Join message is sent until the traffic flow starts and can be used to monitor a multicast network.

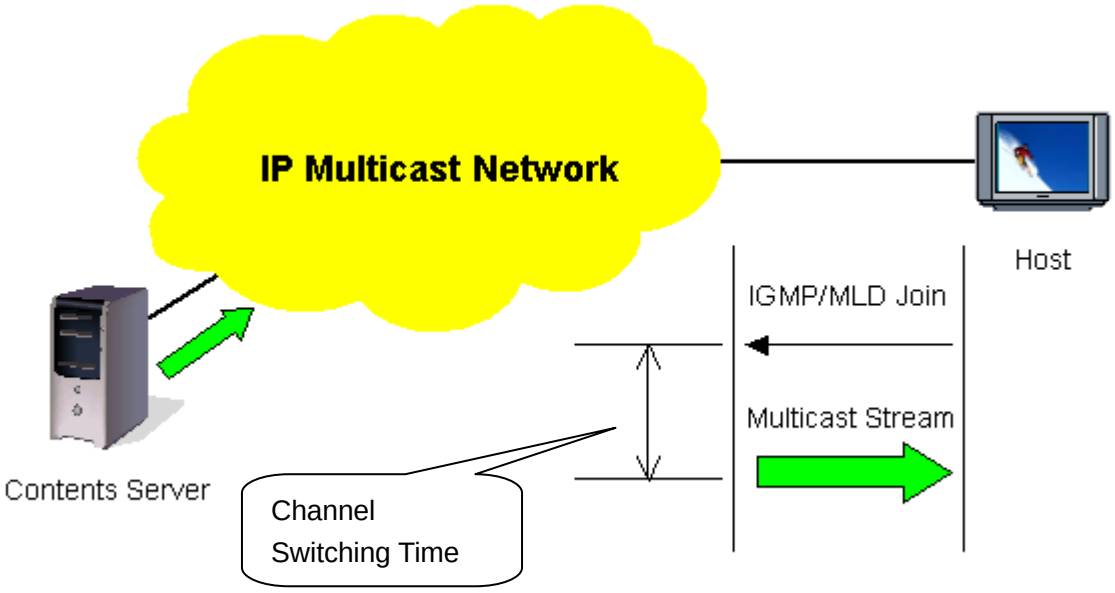


Fig. 5 Channel Switching Time

Channel switching time can be monitored using general protocol analysis software, but in this case, it is necessary to provide a contents server broadcasting the multicast stream as well as a host outputting the channel switching request (Join message). Using the MD1230B, both the contents server and host can be emulated, so channel switching time can be measured with no need for this extra equipment.
The channel switching time is measured using the MD1230B Capture function.

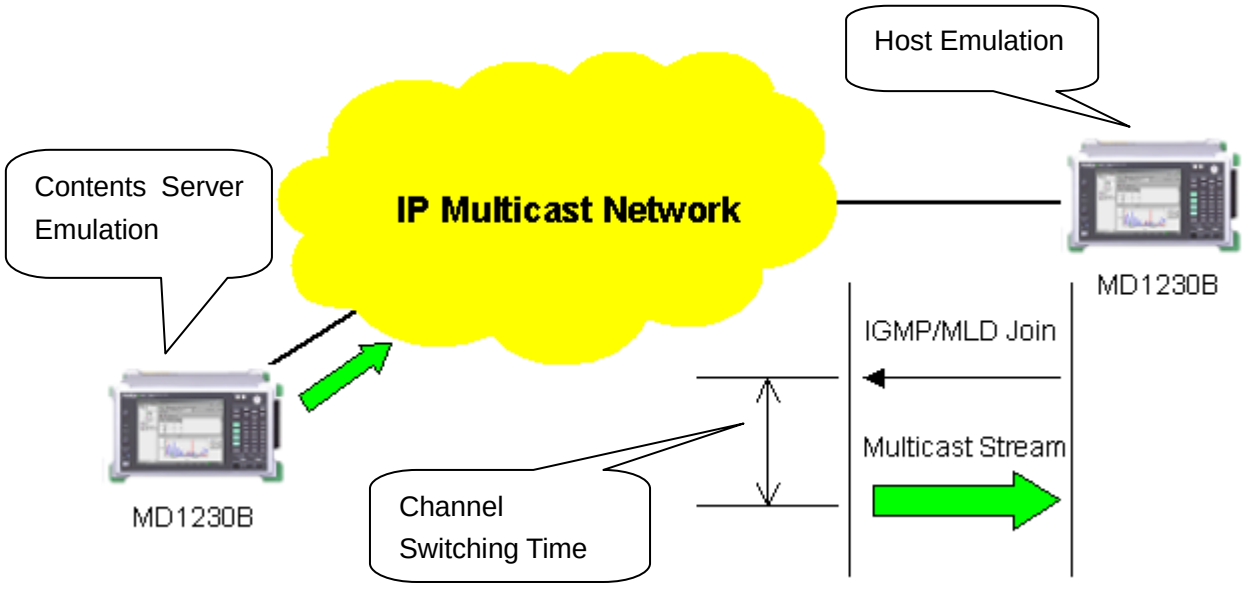


Fig. 6 Measuring Channel Switching Time with MD1230B

3.1. Connecting DUT

(Outline)
Connect an IP multicast network to the MD1230B.
(Contents)
First, provide an IP multicast network environment using a router. (This guide describes an IPv4 network using the IGMP protocol (at host side) and PIM-SM protocol (at network side).
When connected to the MU120131A, Port 1 emulates a server and Port 2 emulates a host.
The Port 3–Port 4 Through function is used to issue the channel switch request at the emulated host side (Join message) and to capture the broadcast multicast stream when the request is received.
(Results)
You will learn about connecting the DUT with measuring equipment.

- Connecting Multicast Routers
  - Connect Port1 of the MU120131A to the server-side router. (In this guide, the server-side network is “192.168.4.0/24”.)
  - Connect Port2 of the MU120131A via Port3-Port4 (Through Mode) to the host-side router. (In this guide, the host-side network is “192.168.1.0/24”.)
    - Connect Port2 of the MU120131A to Port3.
    - Connect Port4 of the MU120131A to the host-side router.

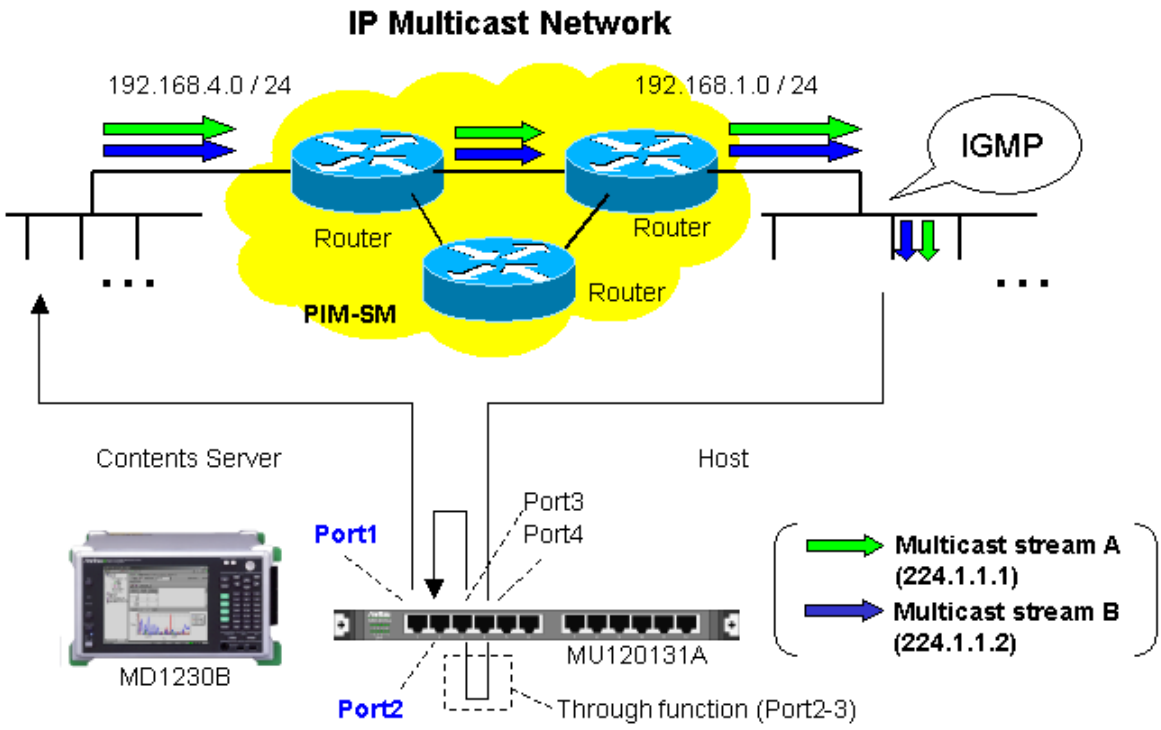


Fig. 7 Connecting DUT

3.2. Setting Measurement Ports

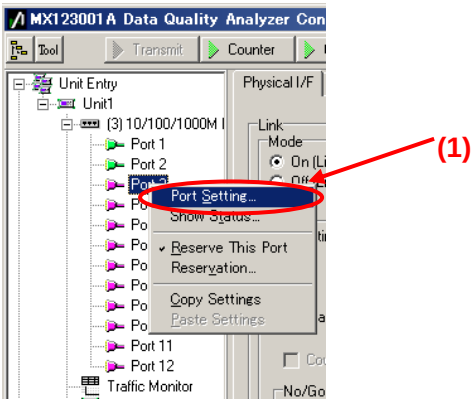
(Outline)
Perform the basic settings for the ports operating as the emulated server and emulated host.
(Contents)
Set the following port numbers and addresses for the emulated server and host.
In addition, perform settings for ARP and Ping.

[Emulated Server]
Port number: Port1
MAC Address: 00-00-91-01-01-01
IPv4 Address: 192.168.4.10
Netmask: 255.255.255.0
Gateway: 192.168.4.254

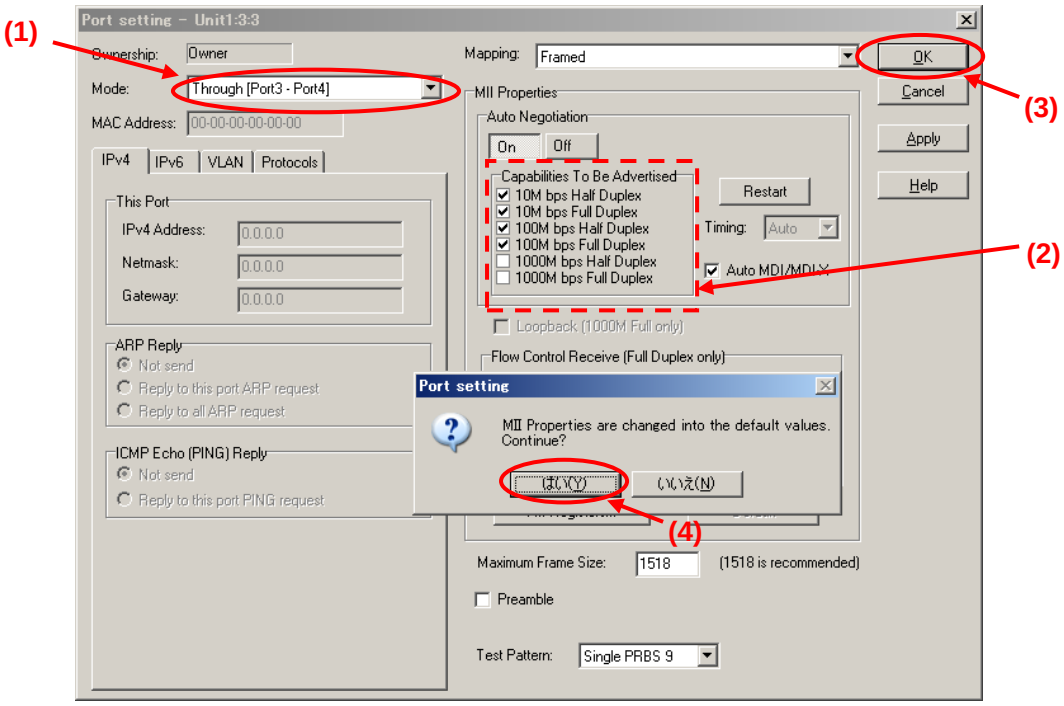
[Emulated Host]
Port number: Port2
MAC Address: 00-00-91-01-01-02
IPv4 Address: 192.168.1.10
Netmask: 255.255.255.0
Gateway: 192.168.1.254

Change Port3-Port4 to the Through Mode to capture the broadcast stream when the emulated host issues the channel switching request (Join message).
(Results)
You will learn basic settings for using ports for measurement.

- Changing Port3-Port4 to Through Mode.
  - Select Port3 and right-click to select “Port Setting” (opens “Port Setting” window).

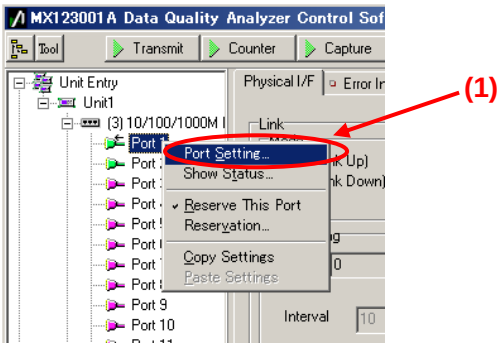


  - Set “Mode:” to “Through [Port3–Port4]”.
  - Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).
  - Press the “OK” button.
  - When the dialog “MII Properties are changed into the default values. Continue?” is displayed, select “Yes”.



✧ Setting Port Operating as Emulated Server

➢ Select Port1 and right-click to select “Port Setting” (opens “Port Setting” window).



➢ Set “MAC Address:” to “00-00-91-01-01-01”.

➢ Set “IPv4 Address:” to “192.168.4.10”.

➢ Set “Netmask:” to “255.255.255.0”.

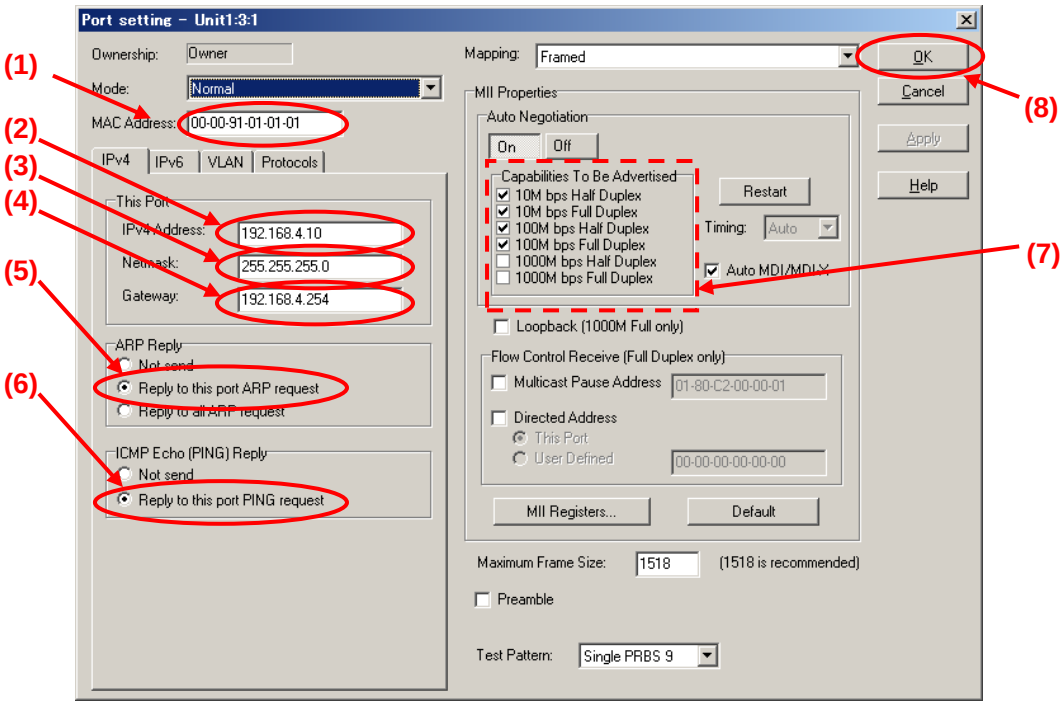
➢ Set “Gateway:” to “192.168.4.254”.

➢ Select “Reply to this port ARP request”.

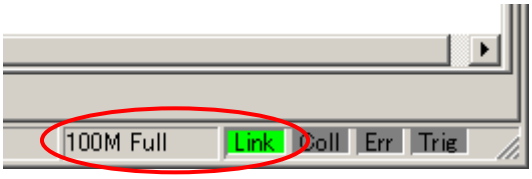
➢ Select “Reply to this port PING request”.

➢ Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).

➢ Press the “OK” button.

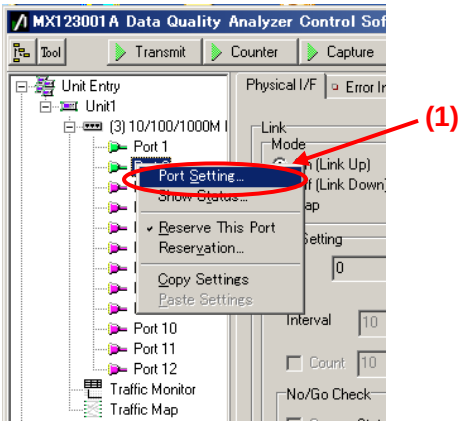


- Check that 100M Full is displayed at the screen bottom right and that the Link LED is green. (Confirm that the connection between the router and instruments is Link Up at “100Mbps Full Duplex”.)



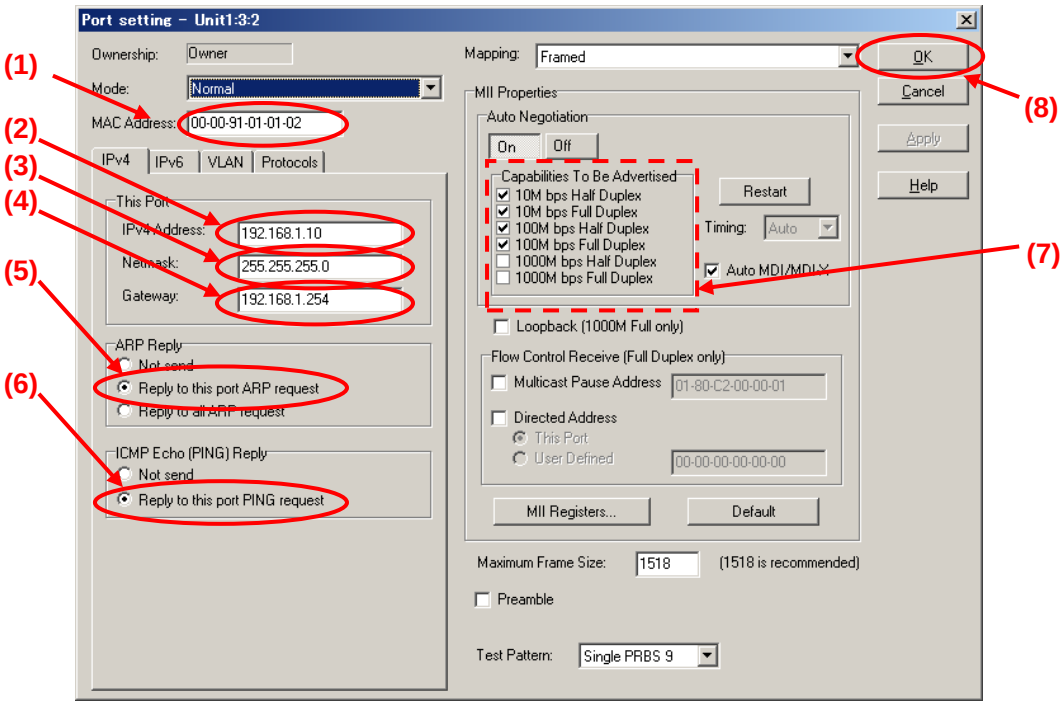
✧ Setting Port Operating as Emulated Host

- Select Port2 and right-click “Port Setting” (opens “Port Setting” window).

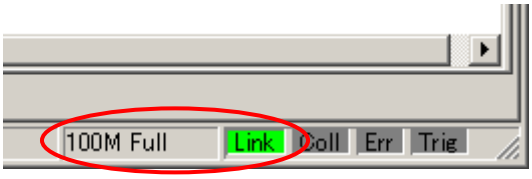


- Set “MAC Address:” to “00-00-91-01-01-02”.
- Set “IPv4 Address:” to “192.168.1.10”.
- Set “Netmask:” to “255.255.255.0”.
- Set “Gateway:” to “192.168.1.254”.
- Select “Reply to this port ARP request”.
- Select “Reply to this port PING request”.

- Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).
- Press the “OK” button.

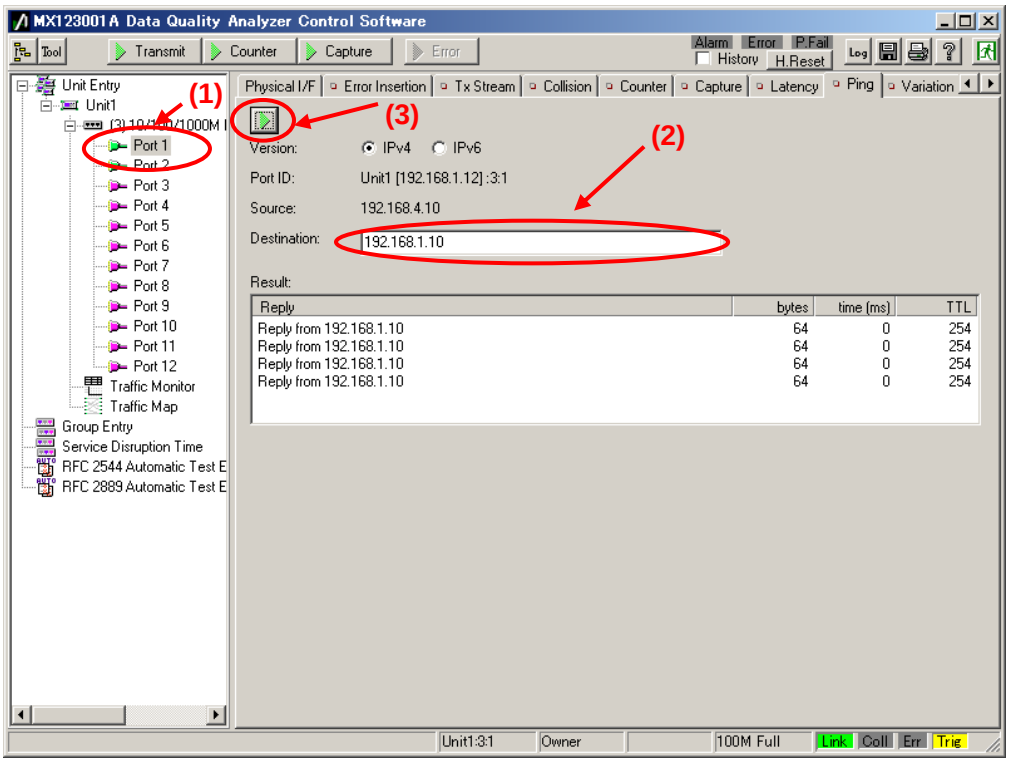


- Check that 100M Full is displayed at the screen bottom right and that the Link LED is green. (Confirm that the connection between the router and instruments is Link Up at “100Mbps Full Duplex”.)



✧ Checking Connection

- Display the Ping screen for Port1, set the value of “Destination:” to “192.168.1.10” and press the “Ping” button.

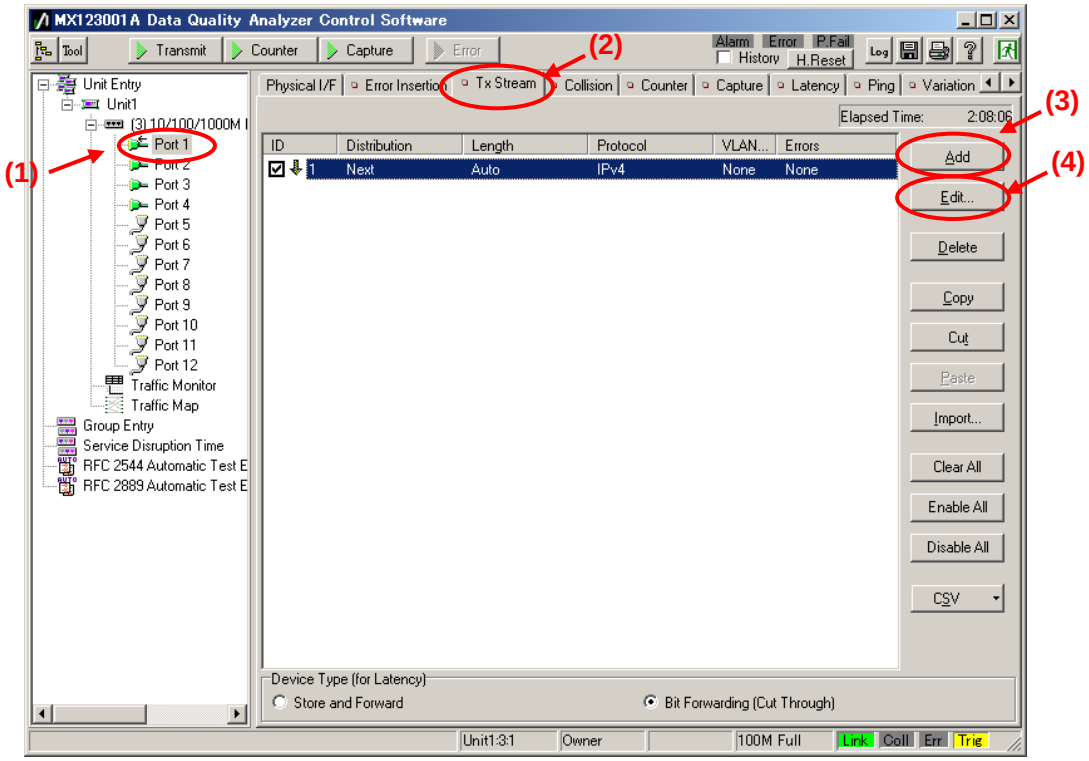


- Check that “Reply from 192.168.1.10” is displayed in “Result:”. (This checks the connection over the router.)

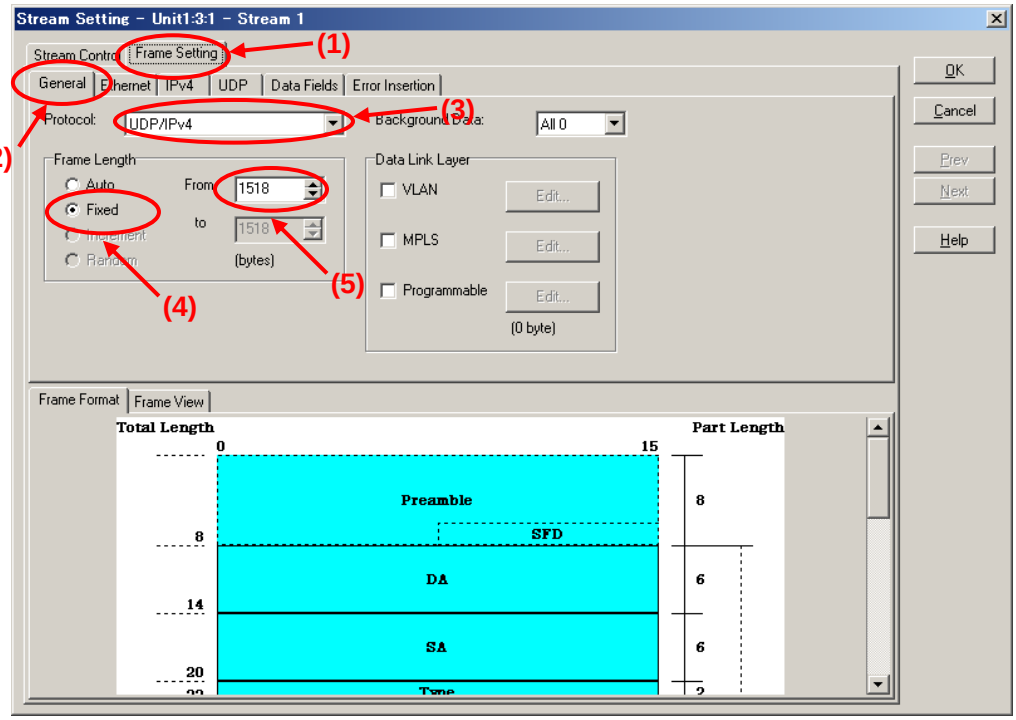
3.3. Setting Tx Stream

(Outline)
Create multicast stream data for operating as emulated server.
(Contents)
Broadcast a multicast stream using the MD1230B Tx Stream generation function.
In this example, two multicast streams are prepared (multicast addresses: “224.1.1.1” / “224.1.1.2”). The traffic for each stream is 5 Mbps.
(Results)
You will learn how to set up an emulated server broadcasting video on two channels each with a bandwidth of 5 Mbps.

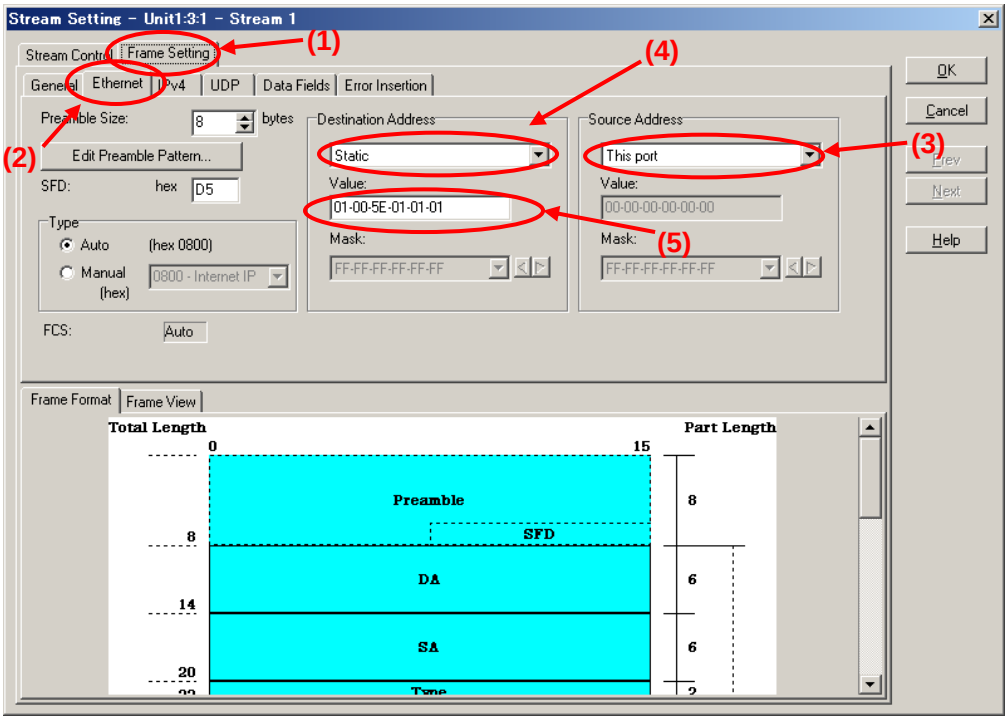
- Creating Multicast Stream Data 1 Generated from Port1 at Server Side (Multicast Address: 224.1.1.1)
  - Select Port1 and press “Add” at the Tx Stream screen to add one stream.
  - With the added stream selected, press “Edit...” to edit the stream.



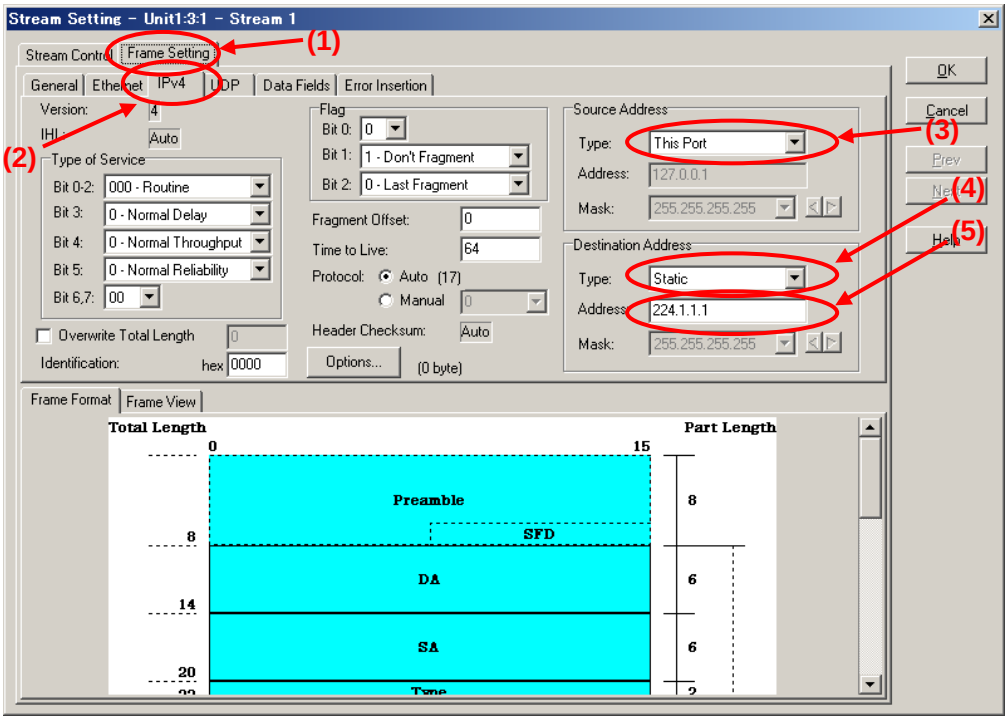
  - Set “Protocol” at [General] of the Frame Setting screen to “UDP/IPv4”. (Multicast broadcasts generally use the UDP protocol.)
  - Set “Frame Length:” to “Fixed” and a value of “1518”. (The maximum length of Ethernet frames is 1518 bytes.)



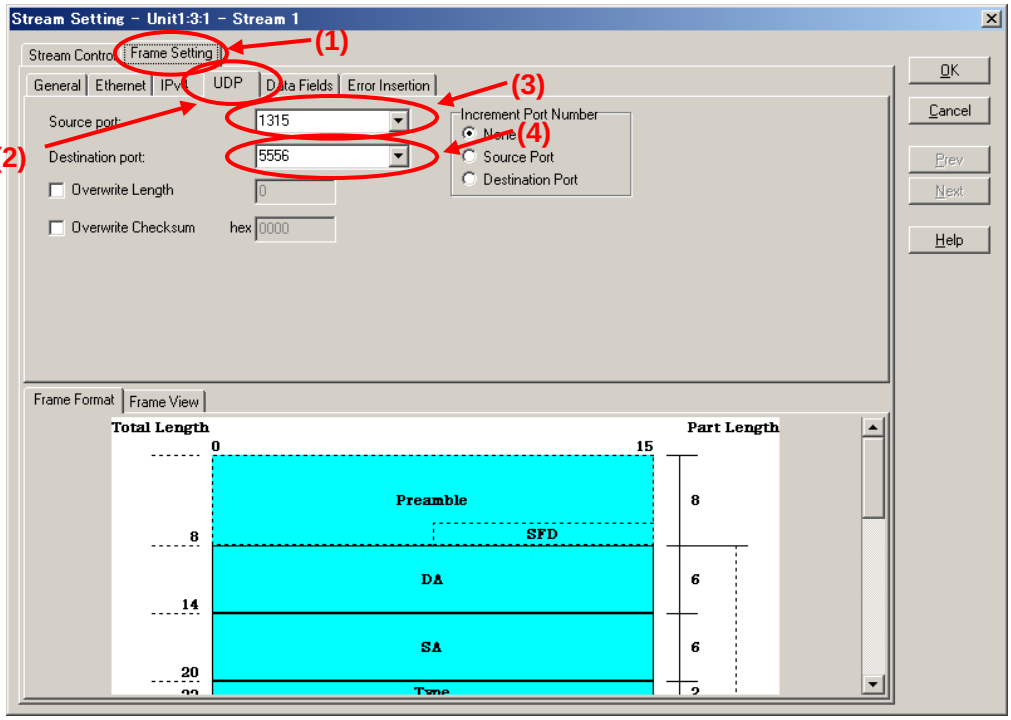
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified by “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-01”. (“01-00-5E-01-01-01” is the MAC address used by multicast address “224.1.1.1”.)



- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.1”.



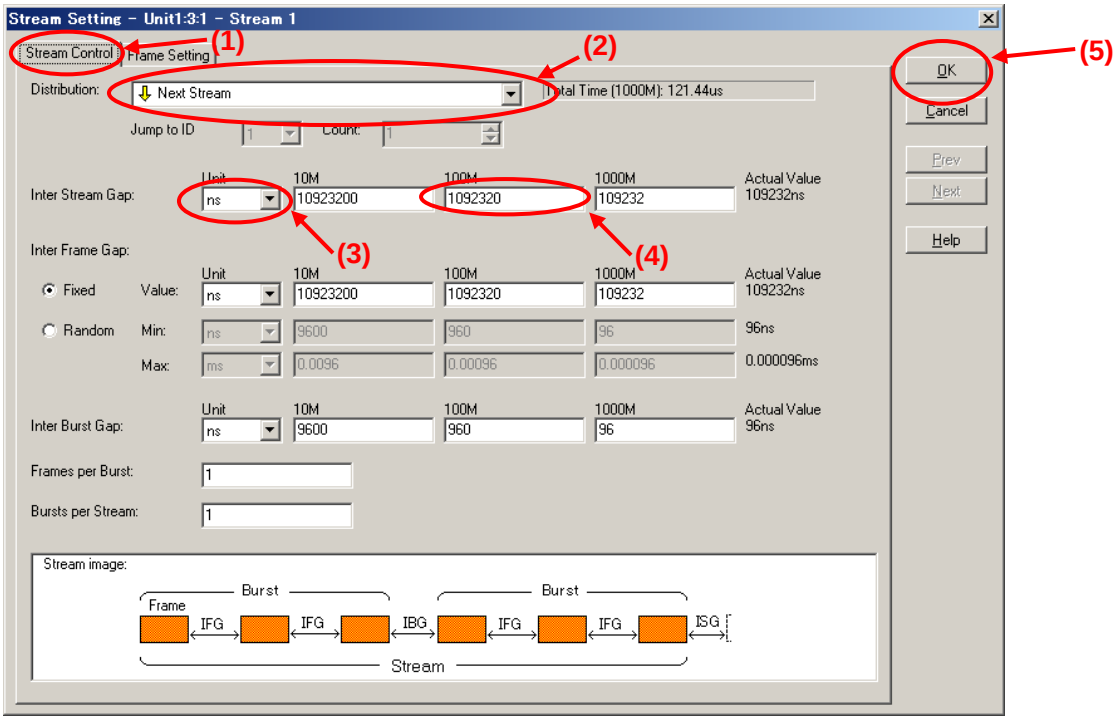
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1315”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5556”. (This specifies the undefined UDP port address.)



- Select “Next Stream” at “Distribution:” on the Stream Control screen.
- Set “Unit” of “Inter Stream Gap:” to “ns” and set the value of “100M” to “1,092,320”. (Setting the inter-frame gap to 1,092,320 ns means sending the stream over the 10 Mbps band at a 100M Link speed.) Since two streams are created in this example and are broadcast alternately, the actual output for this setting is 5 Mbps.

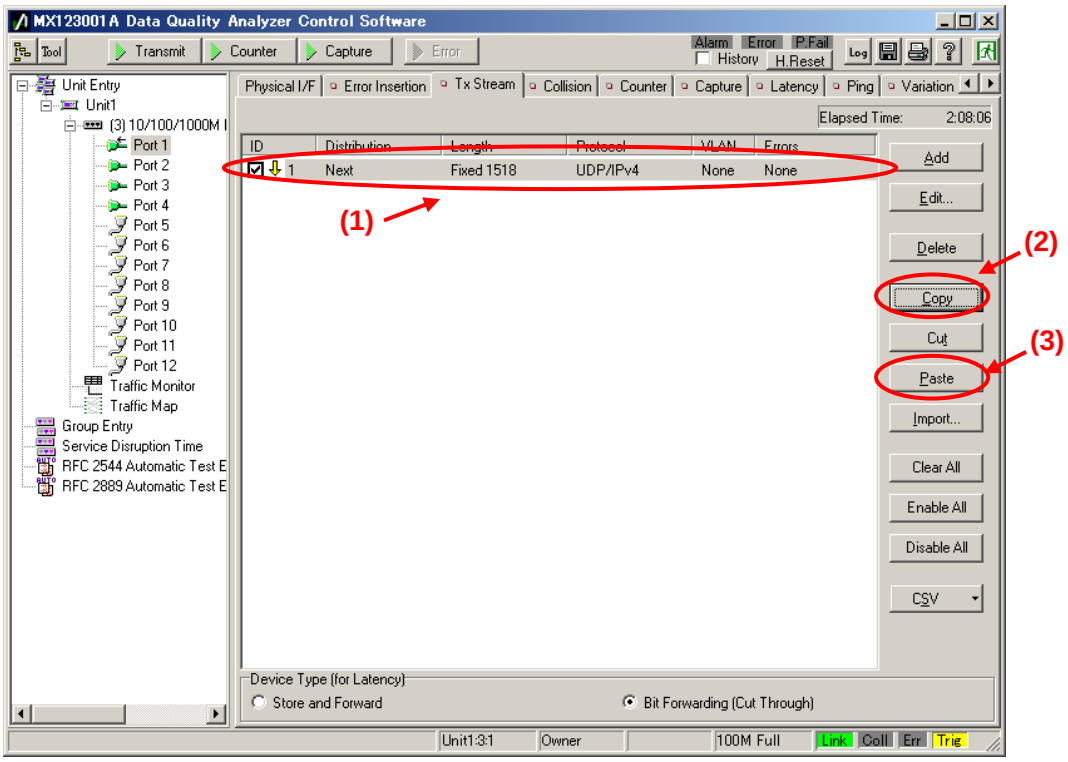
After setting “Unit” of “Inter Frame Gap:” to “bit/s” and inputting “10,000,000”, return “Unit” to “ns” and confirm that the 10-Mbps equivalent gap time is 1,092,320 ns.

- Press the “OK” button to close the setting screen.

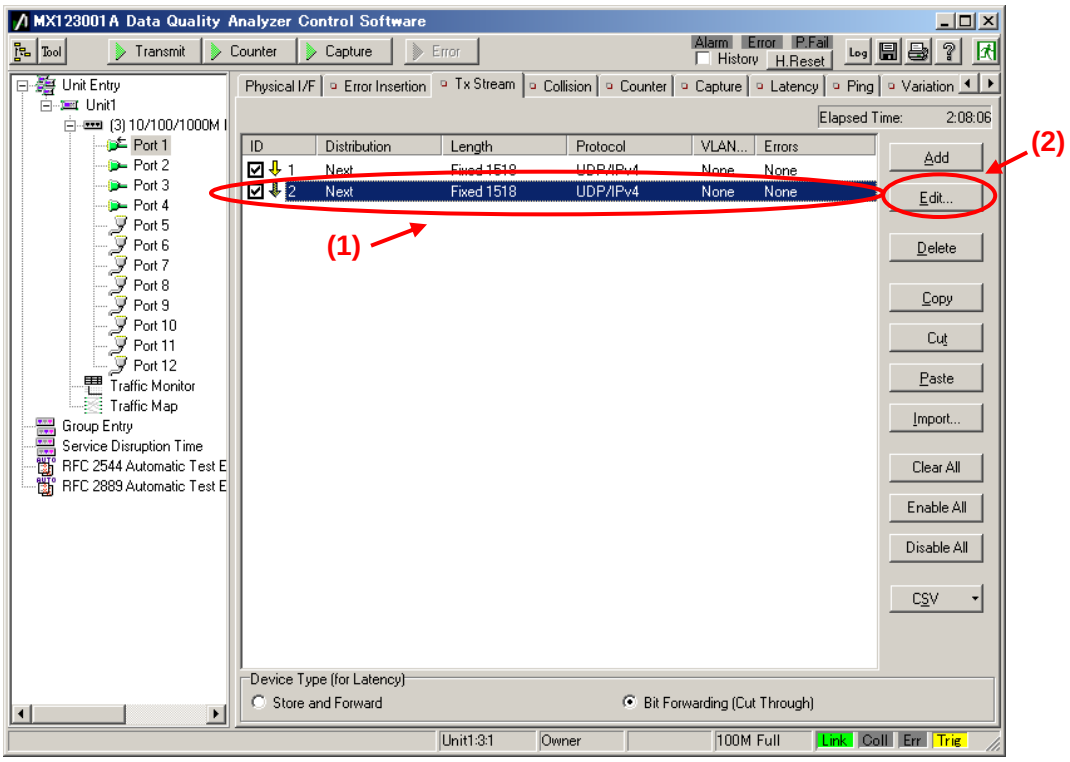


✧ Creating Multicast Data Stream 2 Generated from Server Side Port1 (Multicast Address: “224.1.1.2”)

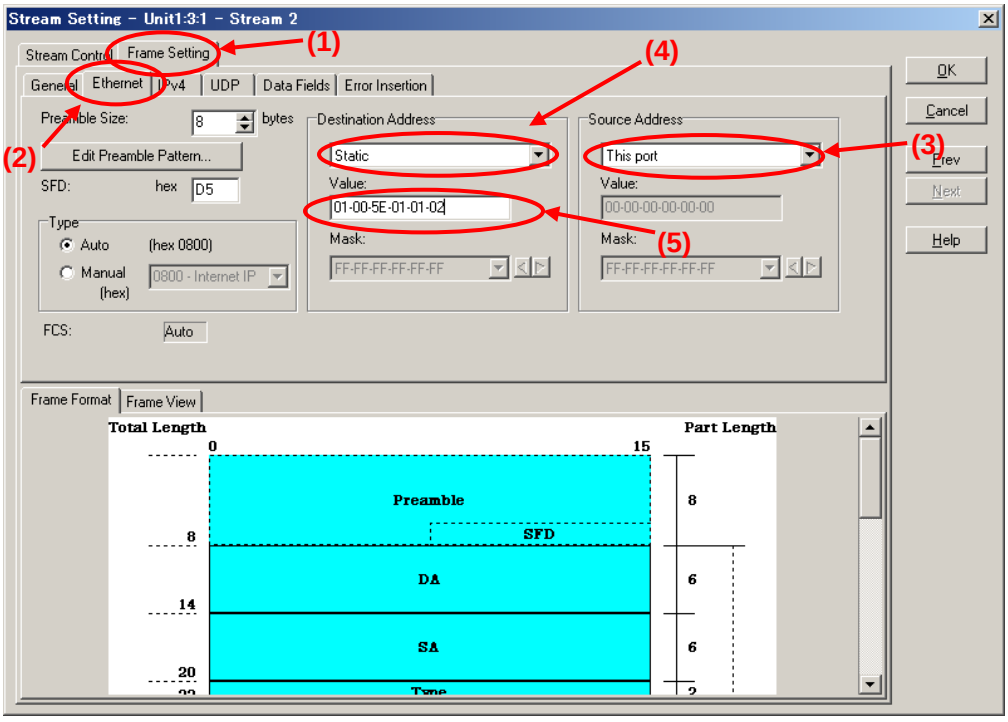
- With the stream selected at the Tx Stream screen, press “Copy” and then press “Paste” (to copy one stream).



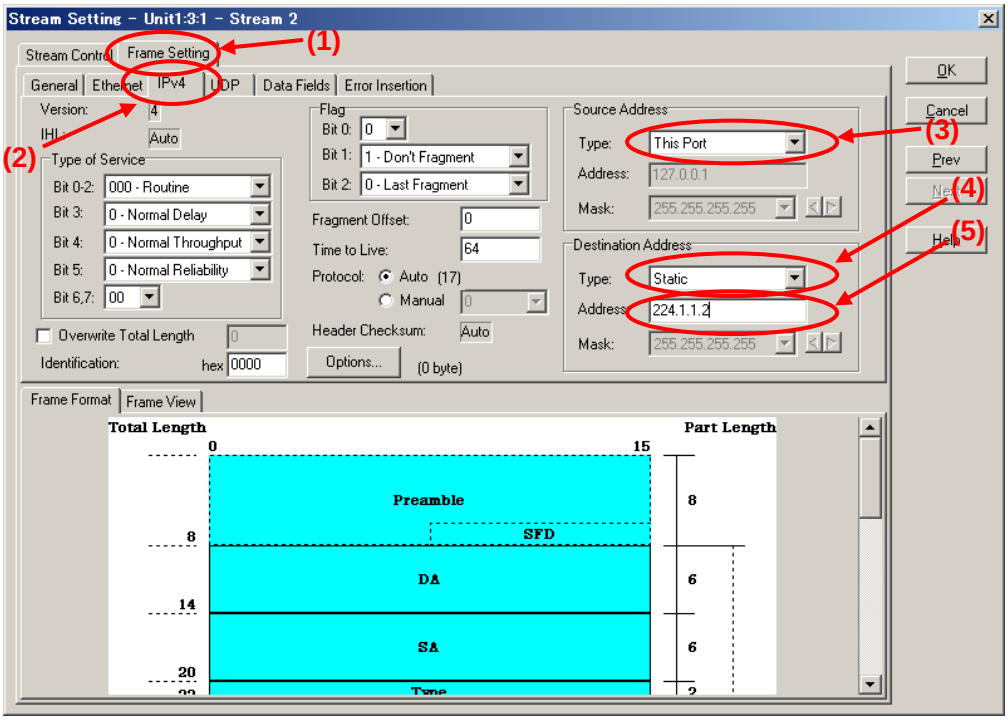
- With the second stream selected, press “Edit...” to edit the stream.



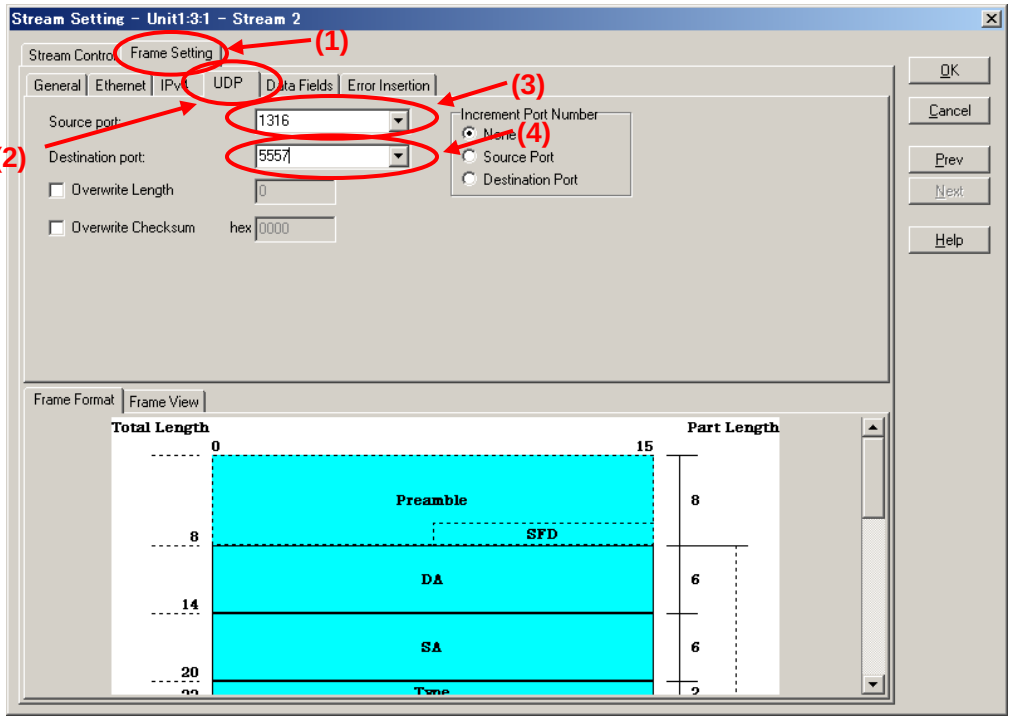
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This Port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-02”. (“01-00-5E-01-01-02” is the MAC address used by multicast address “224.1.1.2”.)



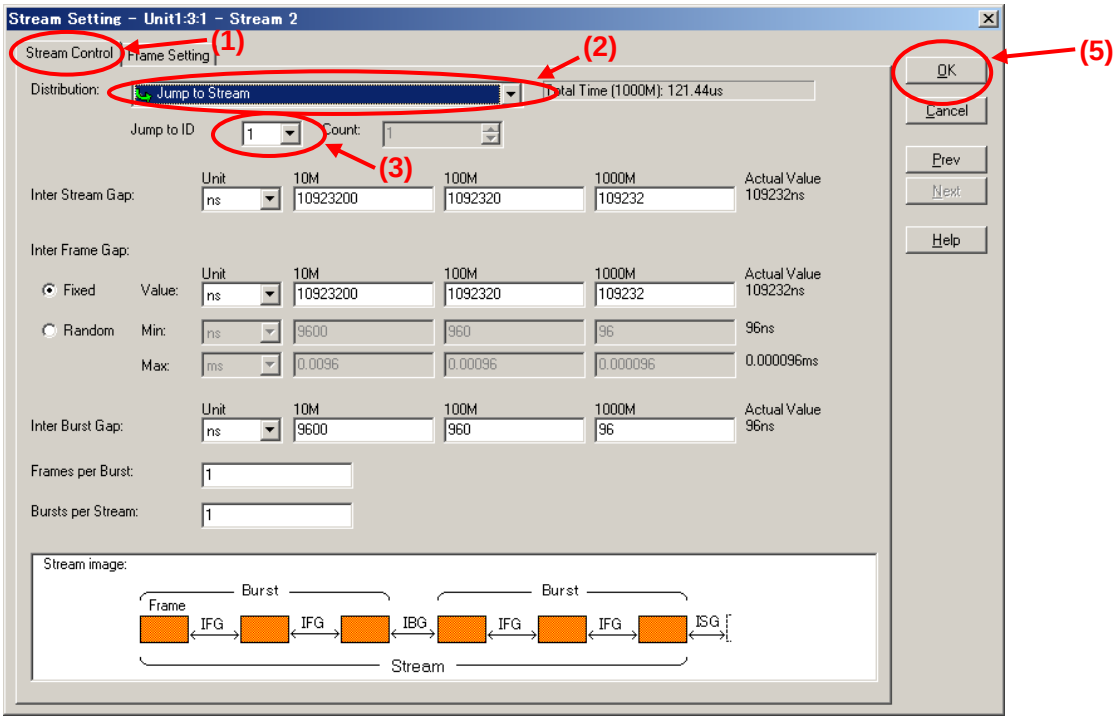
- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.2”.



- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1316”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5557”. (This specifies the undefined UDP port address.)



- Select “Jump to Stream” at “Distribution:” of the Stream Control screen.
- Set the value “Jump to ID” to “1” (sets jump stream destination to stream 1).
- Press “OK” to close the setting screen.

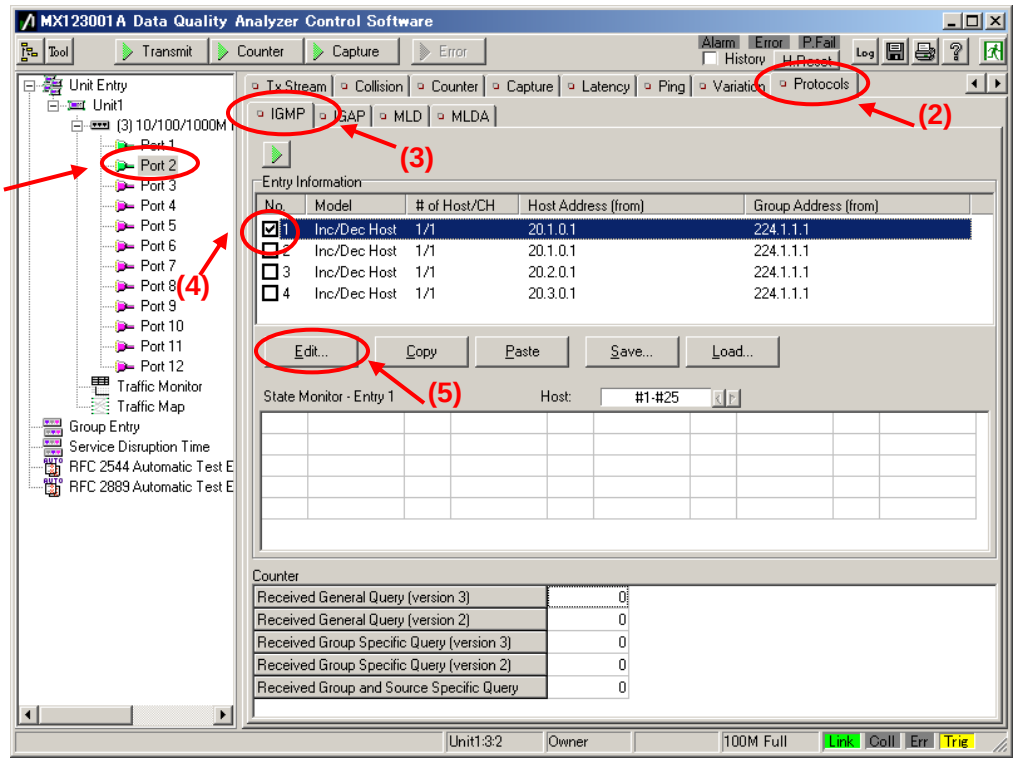

Stream Setting – Unit1:3:1 – Stream 2
Stream Control
Frame Setting
(1)
(2)
(3)
(5)
Distribution:
Jump to Stream
Total Time (1000M): 121.44us
Jump to ID
1
Count:
1
OK
Cancel
Prev
Next
Help
Inter Stream Gap:
Unit
10M
100M
1000M
Actual Value
ns
10923200
1092320
109232
109232ns
Inter Frame Gap:
Fixed
Value:
Random
Min:
Max:
9600
960
96
96ns
ms
0.0096
0.00096
0.000096
0.000096ms
Inter Burst Gap:
Frames per Burst:
Bursts per Stream:
Stream image:
Burst
Frame
IFG
IBG
ISG
Stream

3.4. Setting Host Emulation

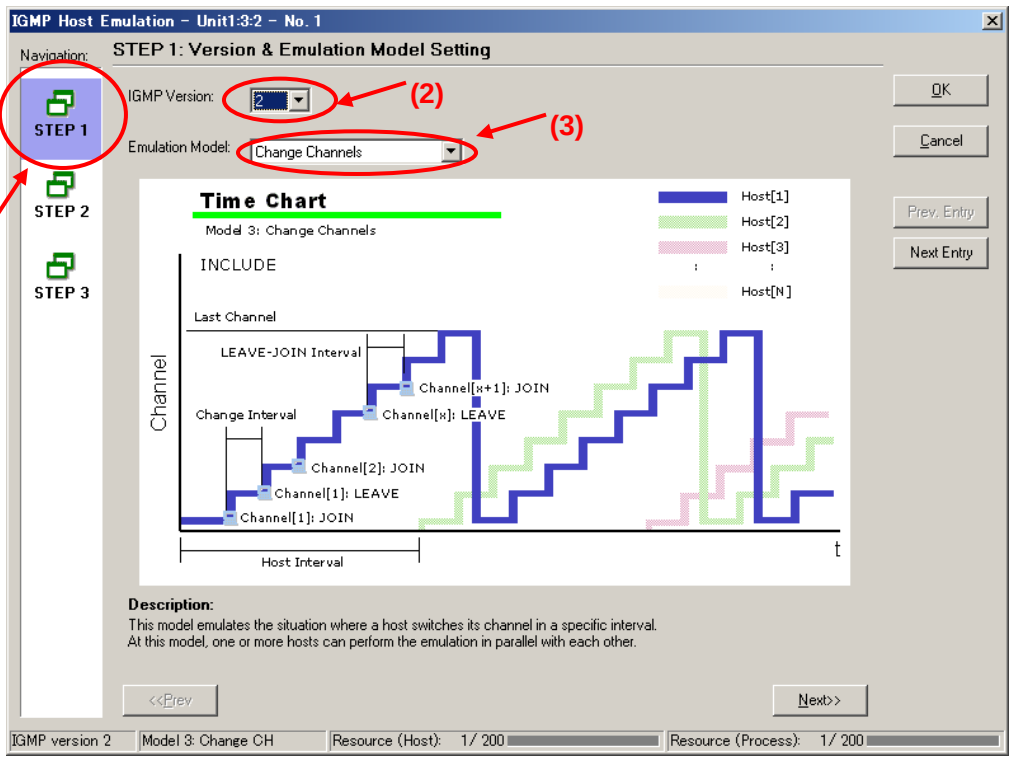
(Outline)
Create an IGMP protocol sequence for operation as an emulated host.
(Contents)
Use the MD1230B protocol emulation function to assemble a Join/Leave sequence for the multicast group.
In this example, two multicast groups (multicast address: “224.1.1.1” / “224.1.1.2”) are created using the IGMP-v2 switching sequence.
(Results)
You will learn how to switch 2-channel video data and how to construct an emulated host sequence.

✧ Setting Port2 as Emulated Host Supporting IGMP

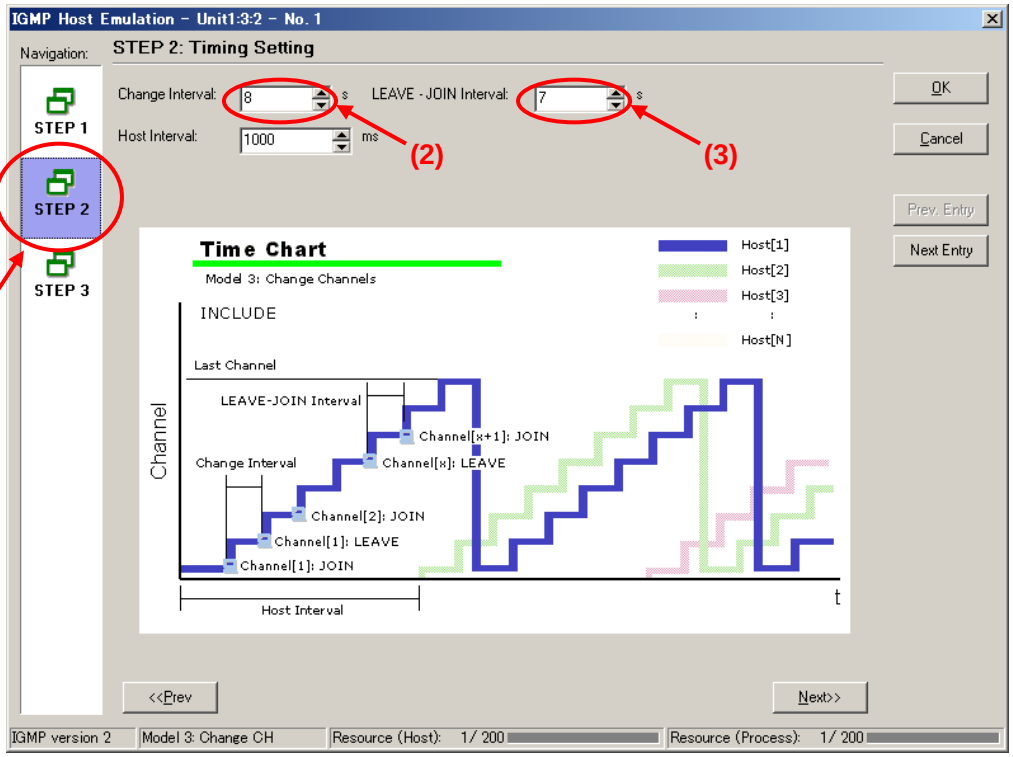
➢ Select Port2 and place a checkmark in the first “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.



➢ At [Step1] on the IGMP Host Emulation screen, set “IGMP Version:” to “2” and “Emulation Model:” to “Change Channels” (supports IGMP-v2 channel switching).



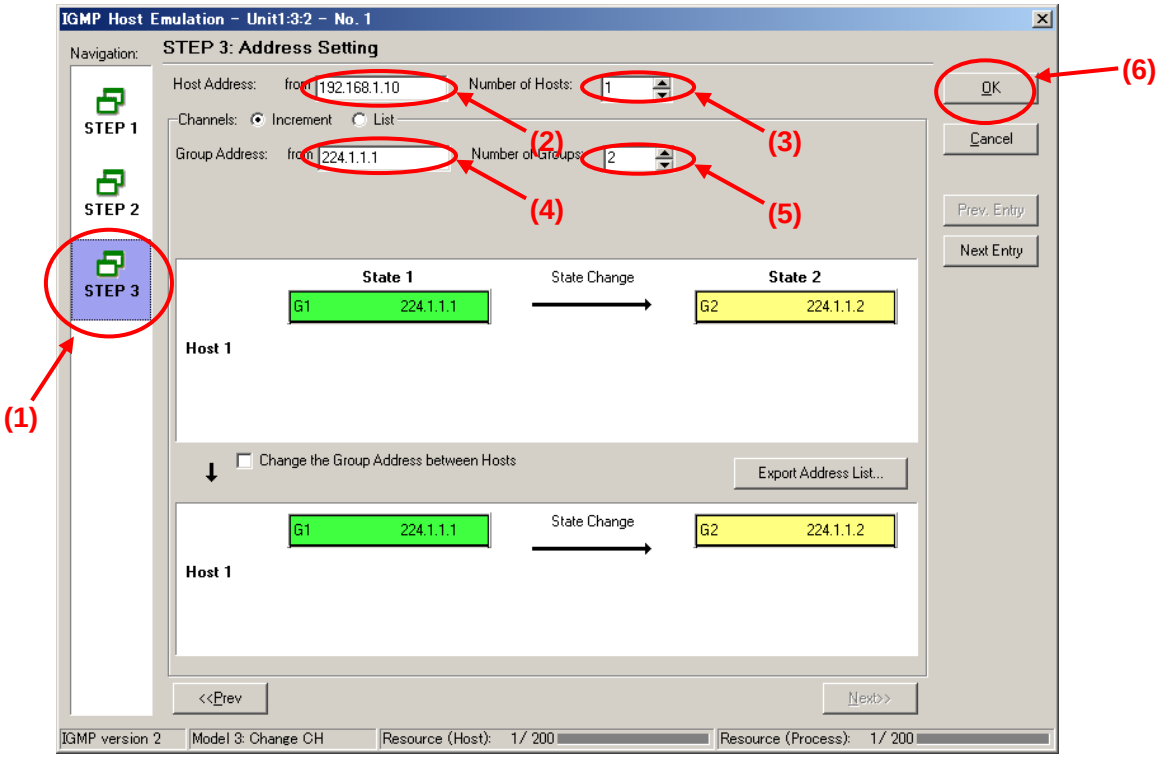
- At [Step2] of the IGMP Host Emulation screen, set “Change Interval:” to “8s” and set “LEAVE–JOIN Interval:” to “7s”. (This holds an 8-s interval after the channel is switched, and a 7-s interval after cutoff, and then repeats the operation.)



- Set the value of “Host Address:” at [Step3] of the IGMP Host Emulation screen to “192.168.1.10”.
- Set the value of “Number of Host:” to “1”.
- Set the value of “Group Address:” to “224.1.1.1”.

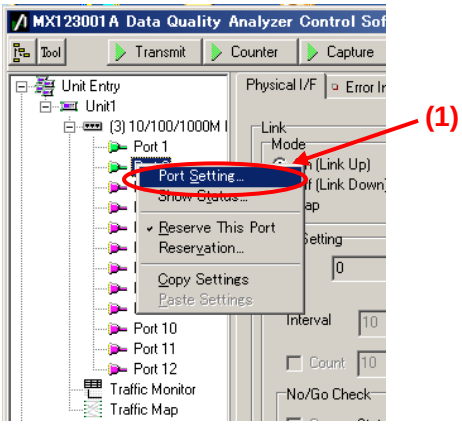
- Set the value of “Number of Group:” to “2”.
- Press “OK” to close the setting screen.

This setting performs switching alternately between “224.1.1.1” and “224.1.1.2”. There is one emulated host (on “192.168.1.10”).

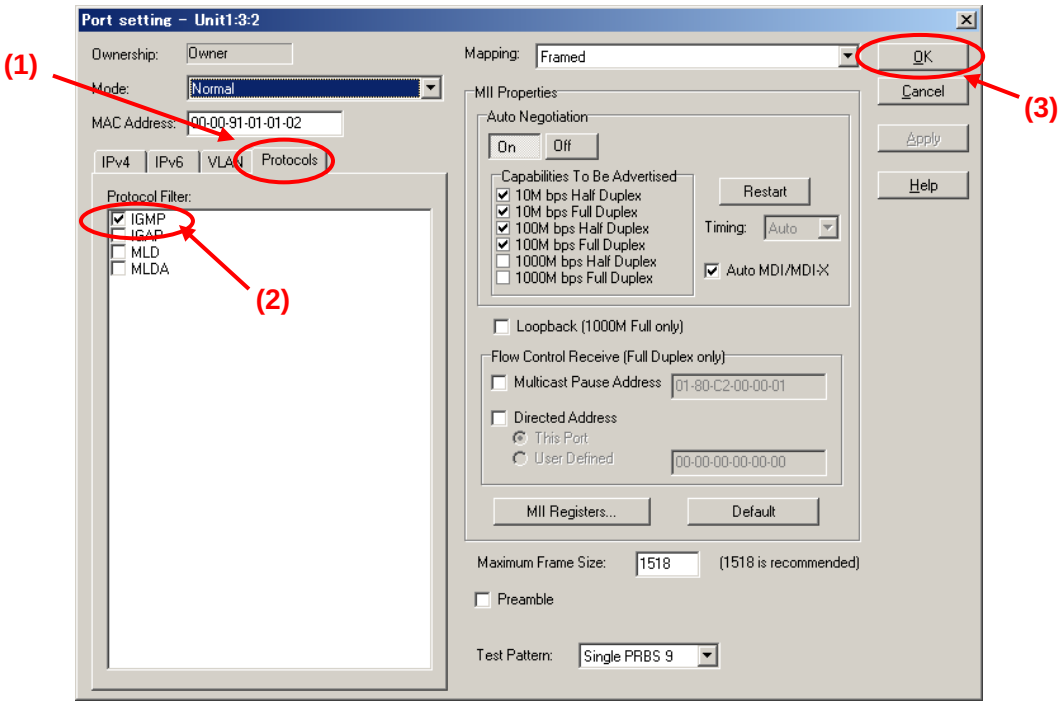


✧ Enabling IGMP Protocol at Port2

- Select Port2 and right-click to select “Port Setting” (opens “Port Setting” window).



- Place a checkmark in “IGMP” of “Protocol Filter:” at [Protocol] of the Port Setting screen.
- Press the “OK” button.


Port setting – Unit1:3:2
Ownership:
Owner
Mode:
Normal
MAC Address:
00-00-91-01-01-02
IPv4
IPv6
VLAN
Protocols
Protocol Filter:
IGMP
IGAP
MLD
MLDA
Mapping:
Framed
MII Properties
Auto Negotiation
On
Off
Capabilities To Be Advertised
10M bps Half Duplex
10M bps Full Duplex
100M bps Half Duplex
100M bps Full Duplex
1000M bps Half Duplex
1000M bps Full Duplex
Restart
Timing:
Auto
Auto MDI/MDI-X
Loopback (1000M Full only)
Flow Control Receive (Full Duplex only)
Multicast Pause Address
01-80-C2-00-00-01
Directed Address
This Port
User Defined
00-00-00-00-00-00
MII Registers...
Default
Maximum Frame Size:
1518
(1518 is recommended)
Preamble
Test Pattern:
Single PRBS 9
OK
Cancel
Apply
Help
(1)
(2)
(3)

3.5. Setting Capture Filter

(Outline)
Perform capture settings for measuring channel switching time.
(Contents)
The MD1230B has functions for capturing and analyzing received packets. This part shows how to set filters for capturing the Join message (Port3) and the resultant received multicast stream (Port4) to measure the channel switching time.
(Results)
You will learn how to set triggers for performing synchronized capture at two ports.

- Connecting and Synchronizing Port3 and Port4 Capture
  - Use a BNC cable to connect “Output Trigger” and “Input Trigger” on the back panel of the main frame.

  By using this external trigger, capture of Port4 can be started automatically using the timing of the Join message detected at Port3.

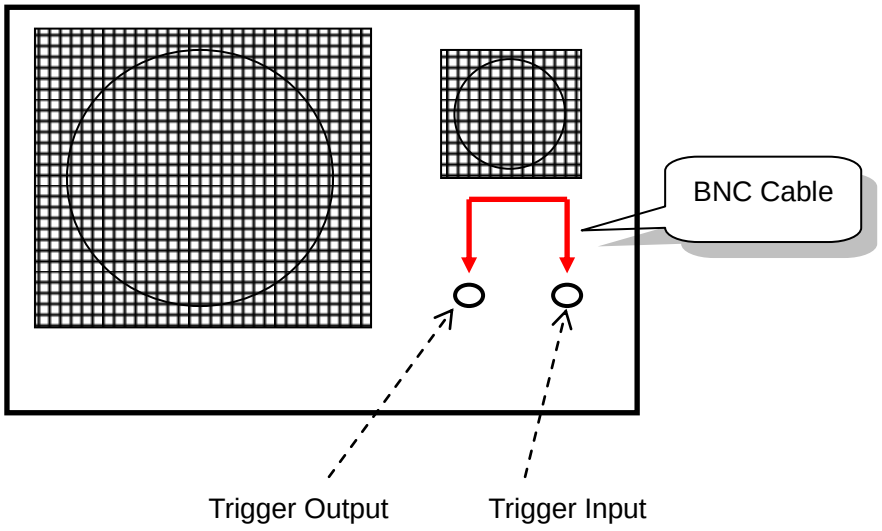
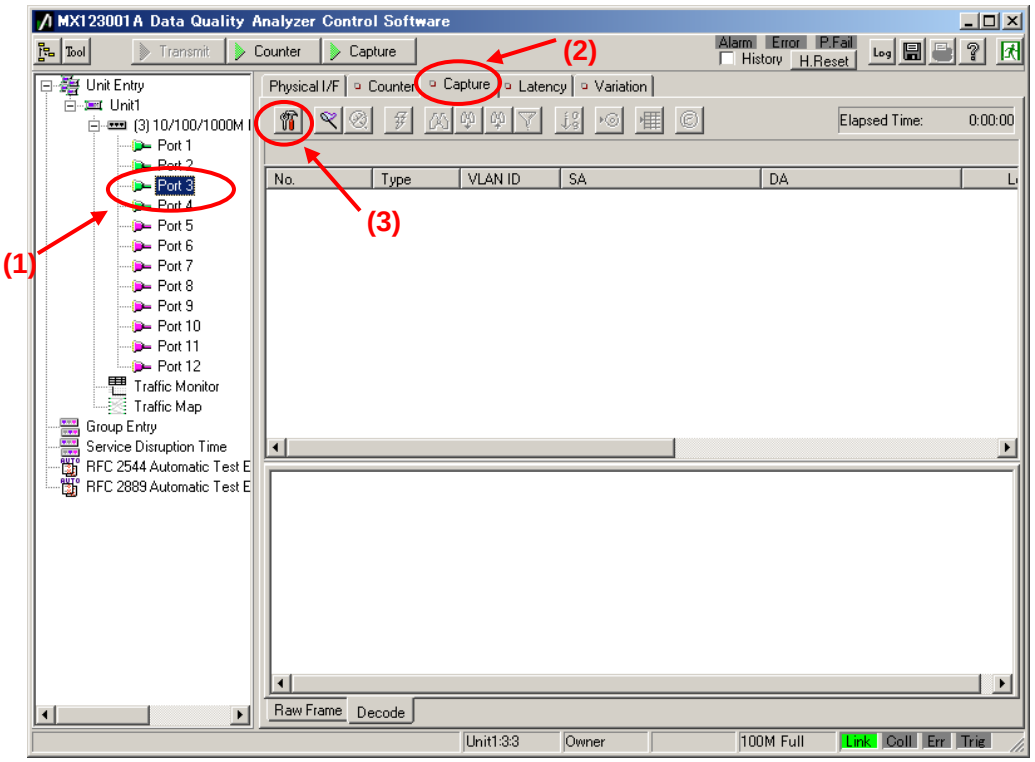
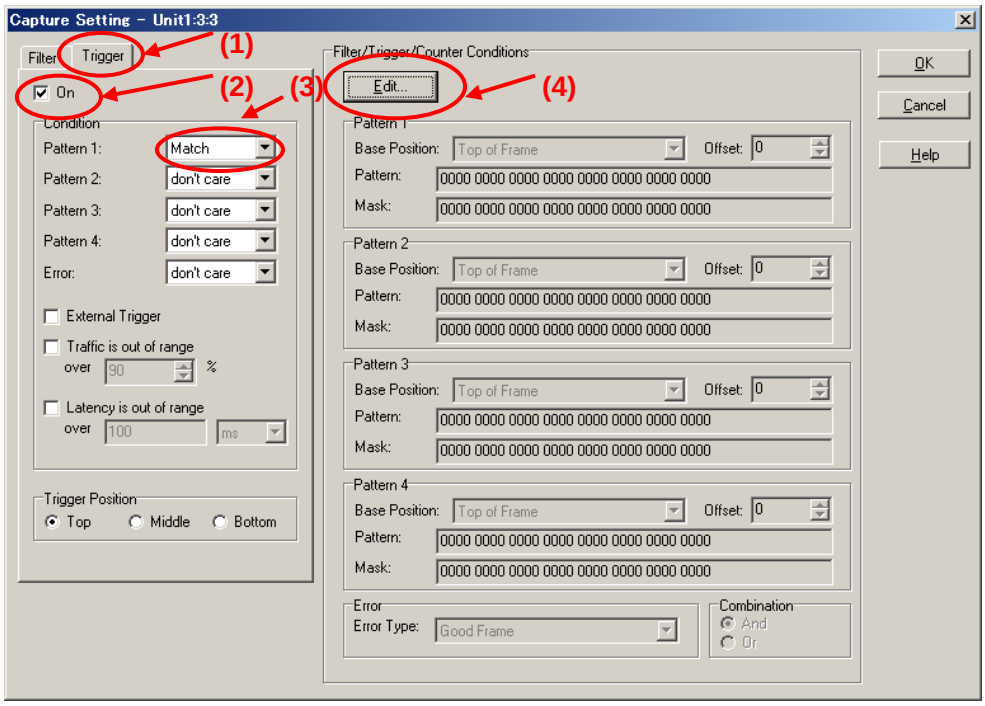


Fig. 8 MD1230B Back Panel

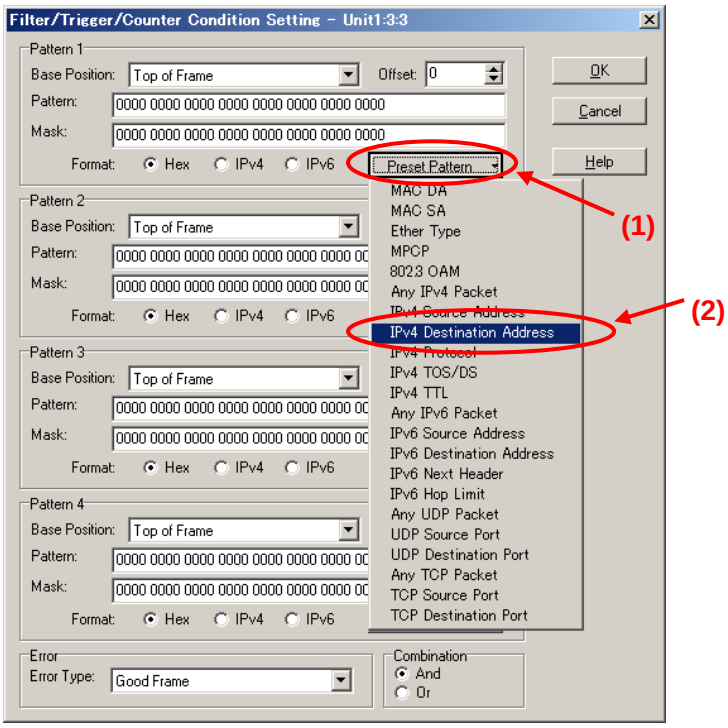
- Setting Filter for Detecting Join Message at Port3
  - Select Port3 and press the “Filter” button at the Capture screen to open the Capture Setting” screen.



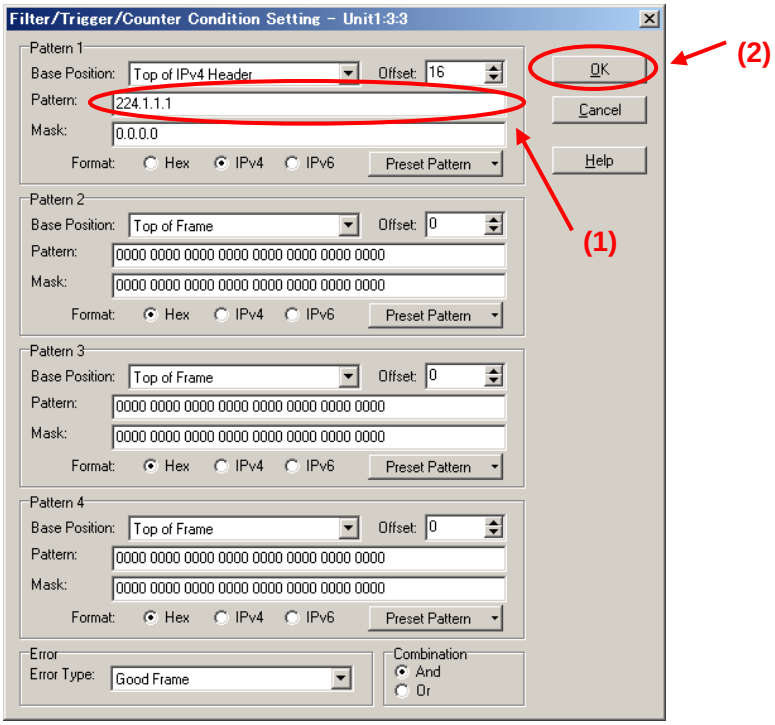
- Place a checkmark in “On” at [Trigger] of the Capture Setting screen and set “Pattern1” of “Condition” to “Match”.
- Press “Edit…” to open the “Filter/Trigger/Counter Condition” screen.



- Select “IPv4 Destination Address” from ”Preset Pattern” at Pattern1 of the Filter/Trigger/Counter Condition Setting screen.

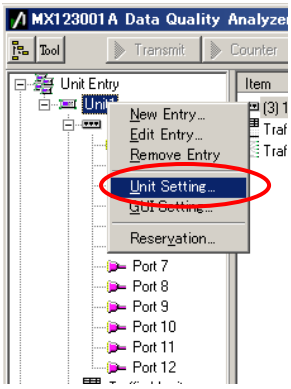


- Set the value of “Pattern:” at Pattern1 on the Filter/Trigger/Counter Condition Setting screen to “224.1.1.1”.
- Press the “OK” button to close the screen.

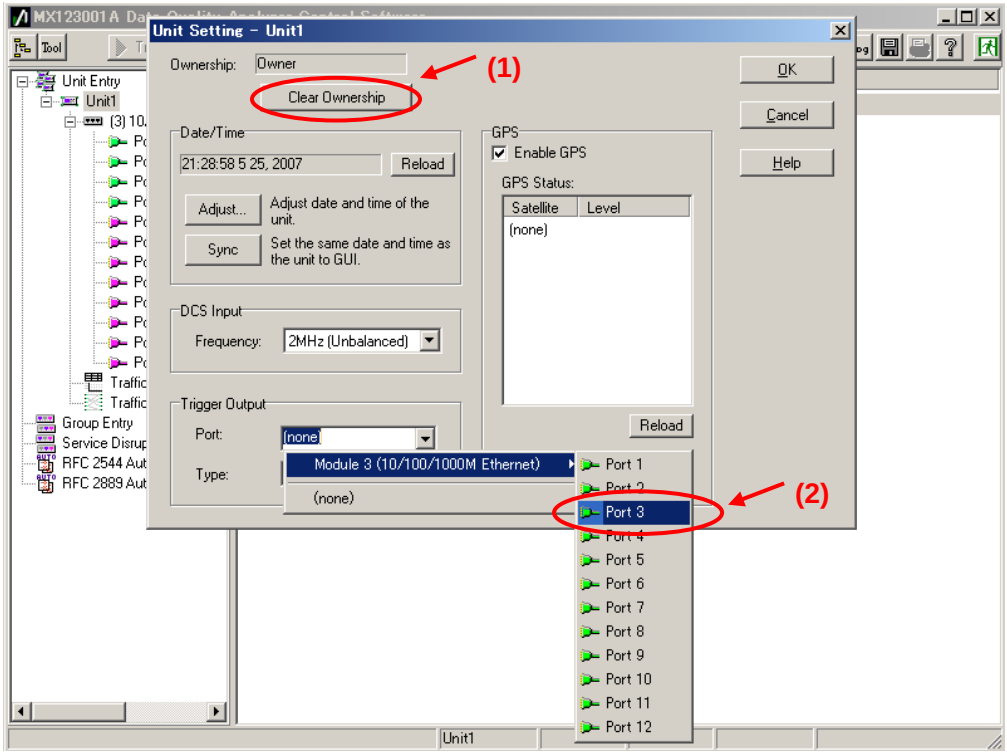


✧ Setting External Trigger at Port3

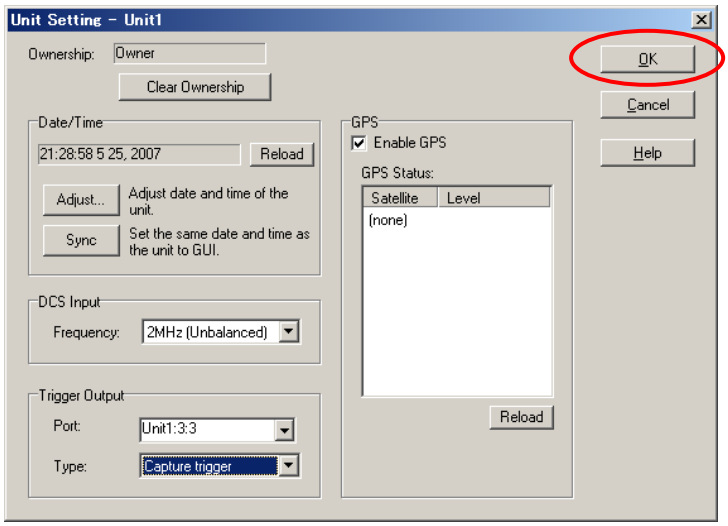
- Select Unit and right-click to select “Unit Setting” (opens “Unit Setting” screen).



- Press the “Ownership” button at the Unit Setting screen to obtain setting rights.
- Set “Port” of “Trigger Output” to “Port3” of “Module3 (10/100/1000M Ethernet)”.

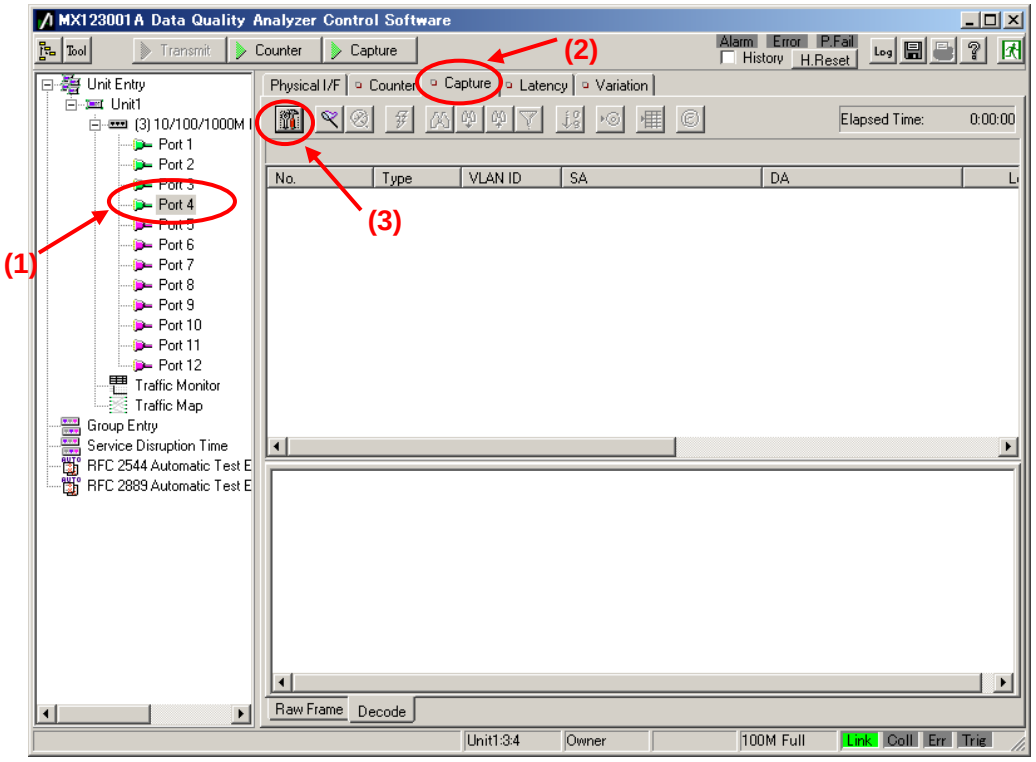


- Press the “OK” button to close the screen.



✧ Setting External Trigger at Port4

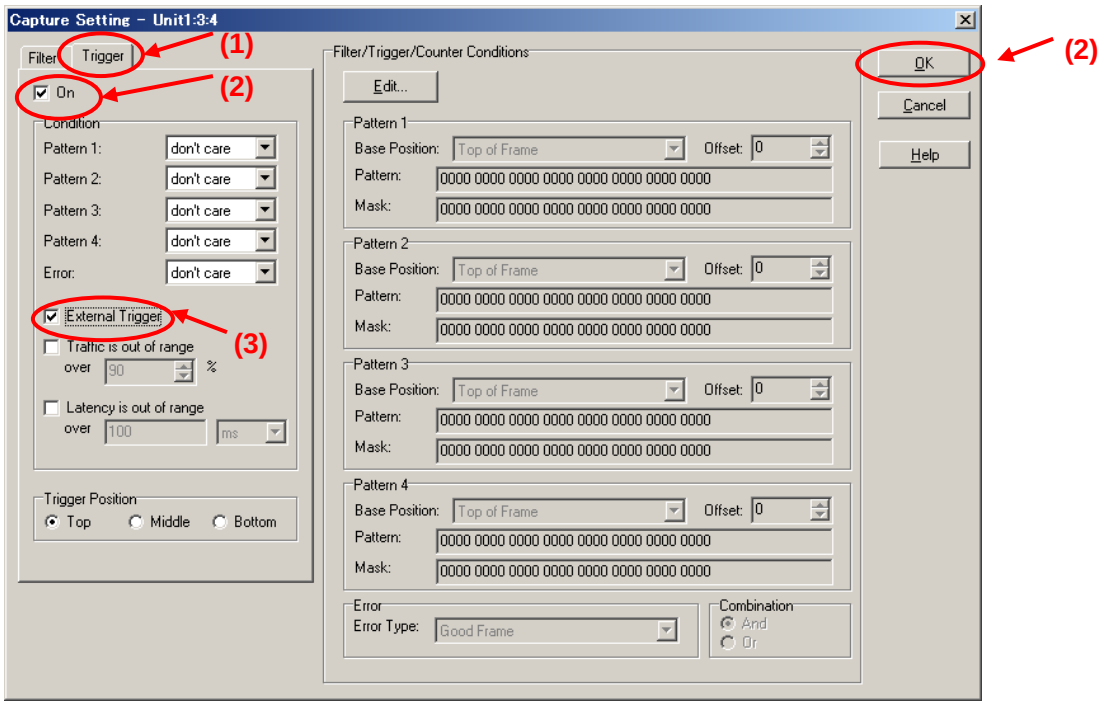
➢ Select Port4 and press “Filter” button at the Capture screen to open the “Capture Setting” screen.



➢ Place a checkmark in “On” at [Trigger] of the Capture Setting screen.

➢ Place a checkmark in “External Trigger”.

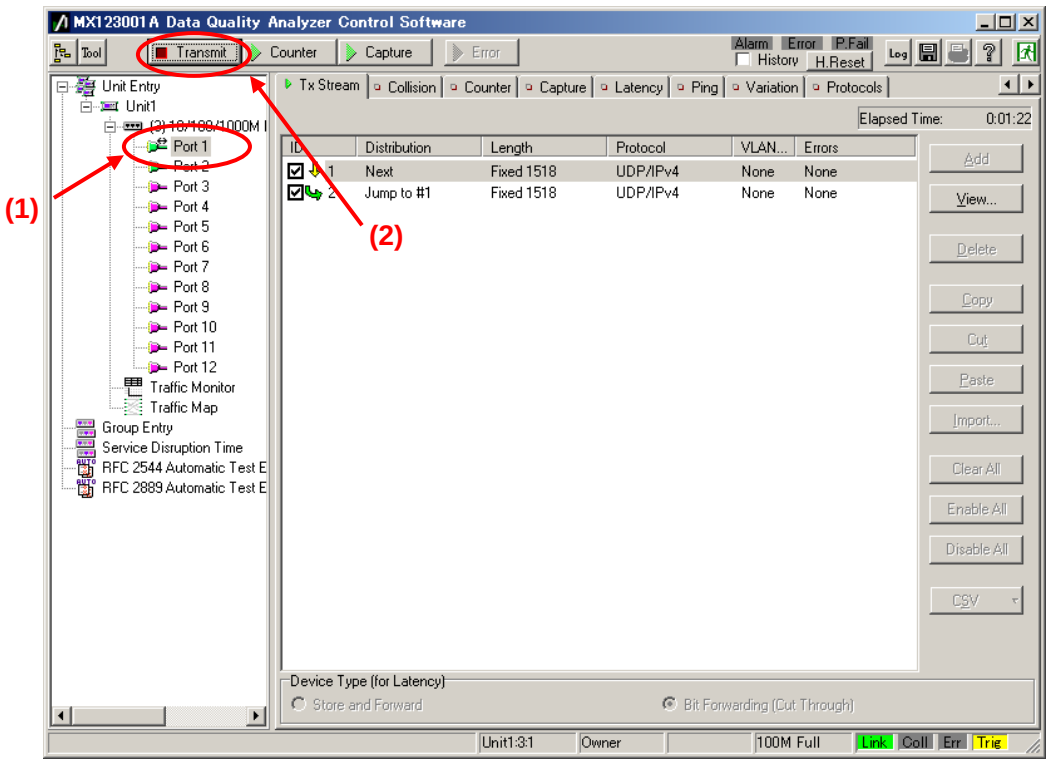
➢ Press the “OK” button to close the screen.



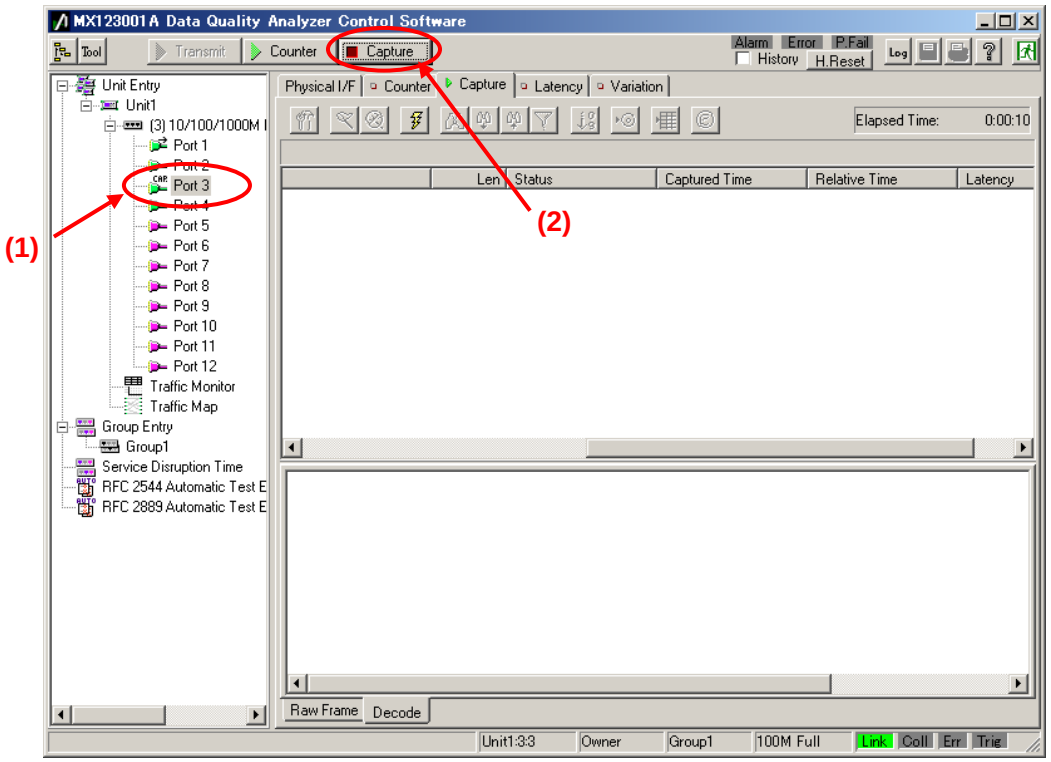
3.6. Measuring Channel Switching Time

(Outline)
Run the emulated server and host and measure the channel switching time using the capture function.
(Contents)
Send multicast streams from Port1 and perform Join/Leave operation at Port2. In this status, capture packets in both directions at Port2 side (emulated host side) using Port3 or Port4.
(Results)
You will learn how to perform measurement operations to measure channel switching times at multicast distribution.

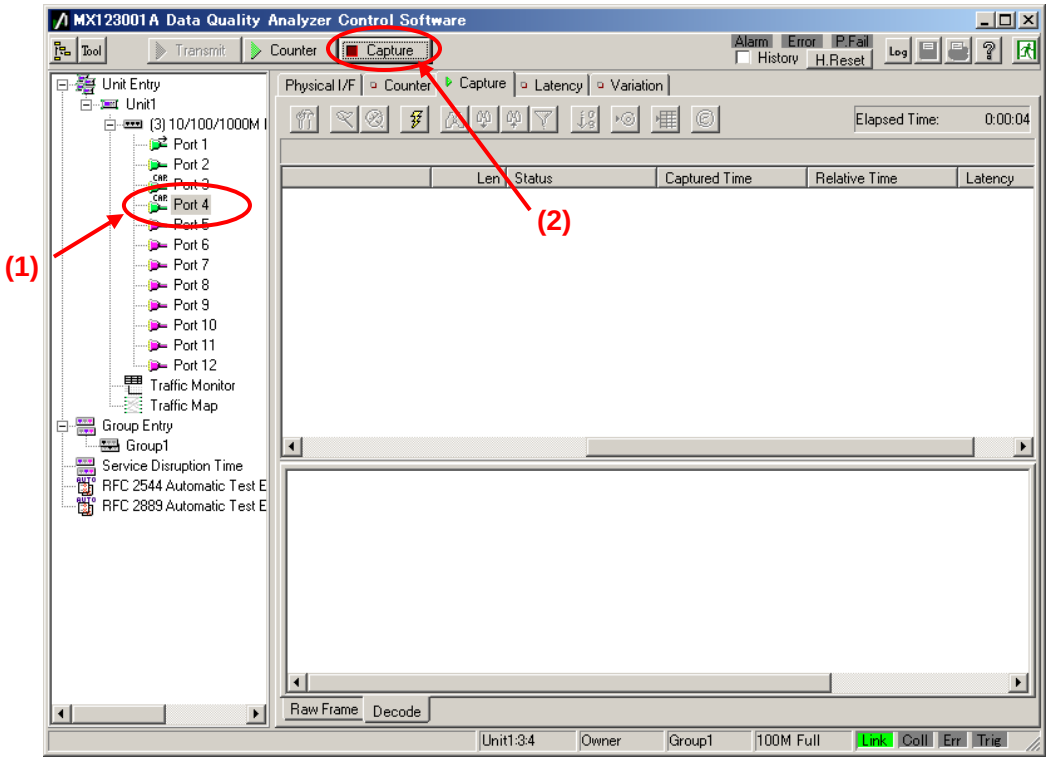
- Sending Multicast Streams from Port1 (Starting Output from Emulated Server)
  - Select Port1 and press the “Transmit” button at the screen top.



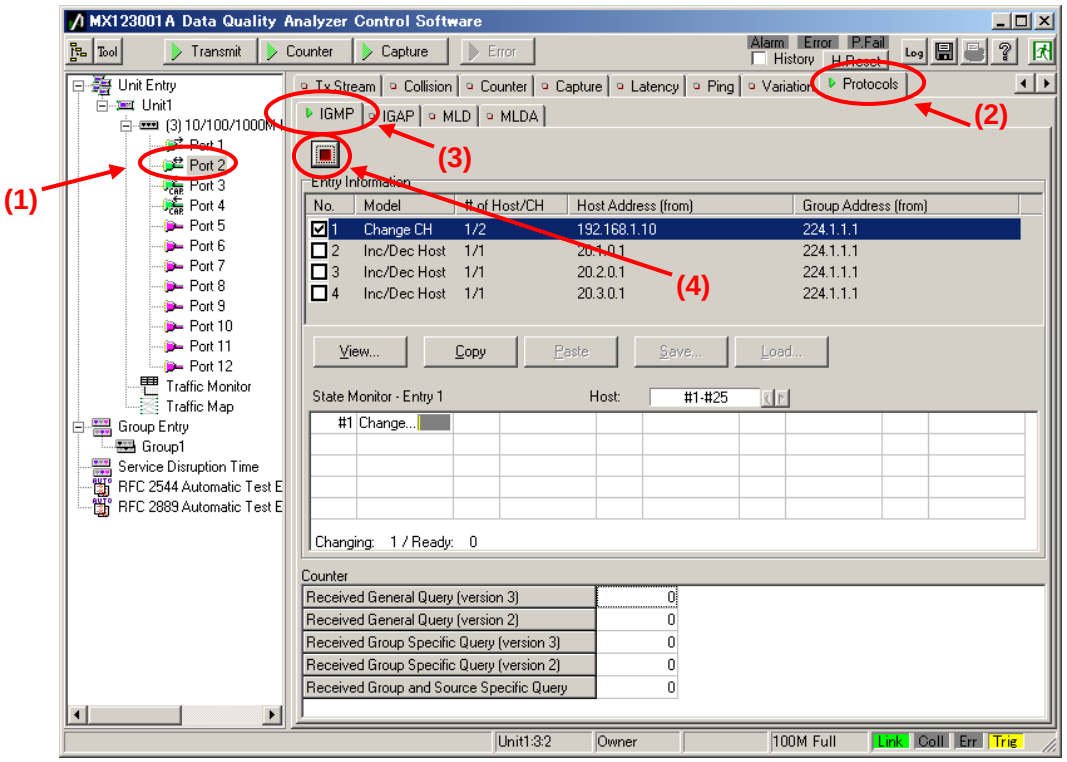
- Starting Capture Operation for Port3 and Port4
  - Select Port3 and press the “Capture” button at the screen top. (This condition is waiting for trigger input. Data is actually captured after the Join message is detected.)



- Select Port4 and press the “Capture” button at the screen top. (This condition is waiting for trigger input. Data is actually captured after the Join message is detected.)

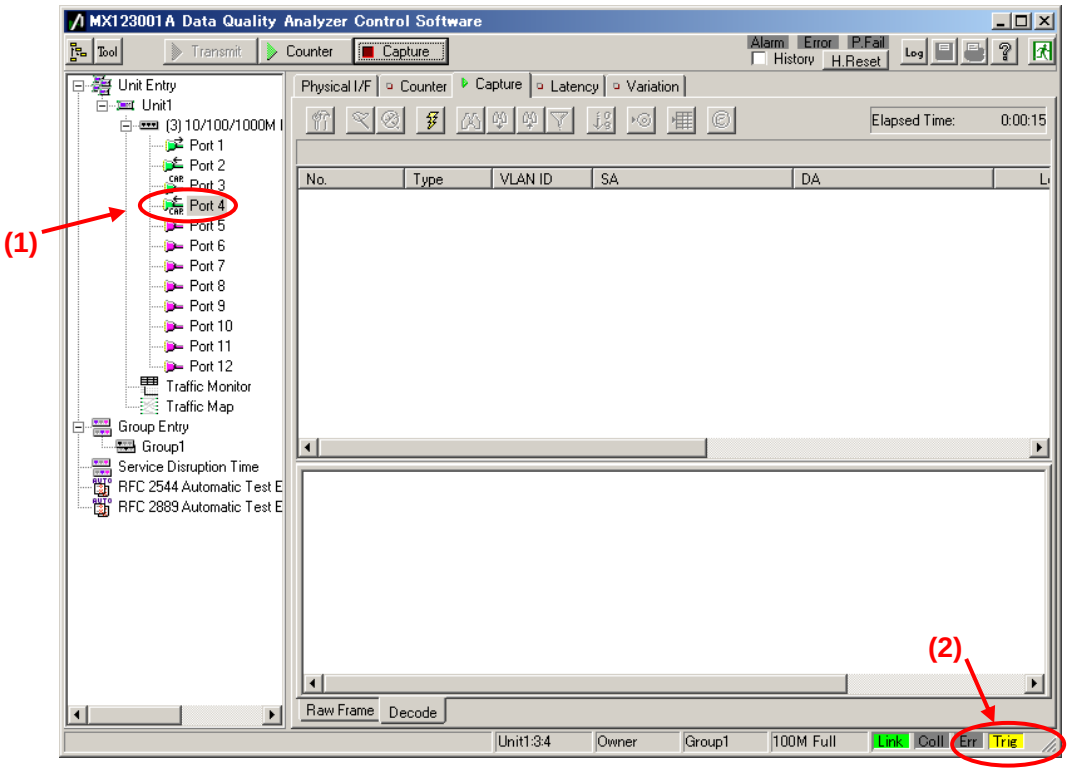


- Starting Join/Leave Operation at Port2 (Starting Emulated Host Operation)
  - Select Port2 and press the IGMP Start button at [IGMP] at the Protocol screen. (This starts repeated Join/Leave operation.)



✧ Checking Capture Triggering

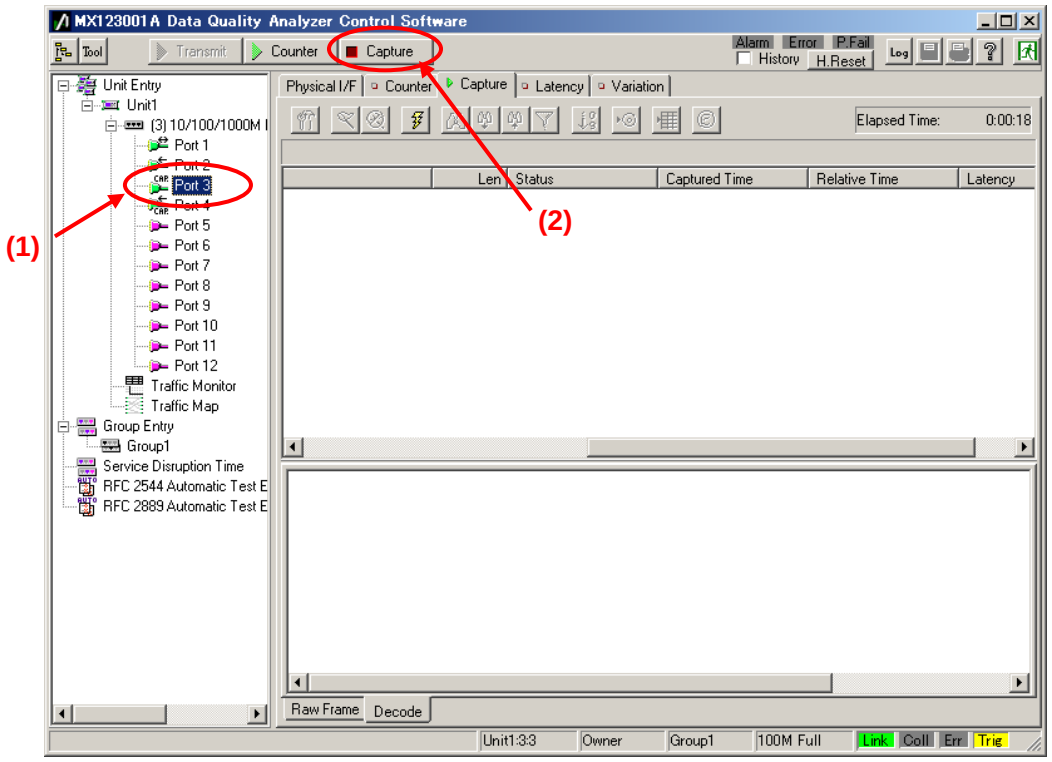
➢ Select Port4 and confirm that the “Trig” LED at the screen bottom right is yellow. (This means that when a trigger is detected at Port4, Port3 also outputs a trigger.)



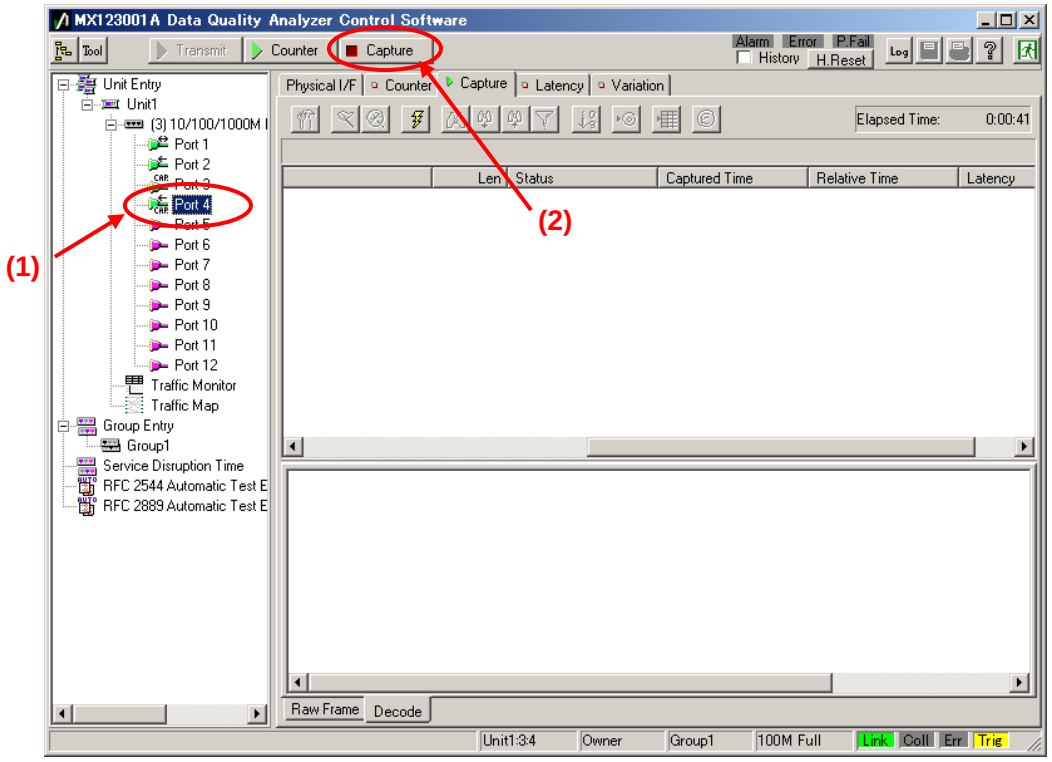
✧ Stopping Port3 and Port4 Capture Operation

➢ Select Port3 and press the “Capture” button at the screen top to stop the Capture operation. (When the button icon is green, capture is stopped automatically, so do not press the “Capture” button. When a trigger is set, capture stops automatically when

the capture memory become full.)



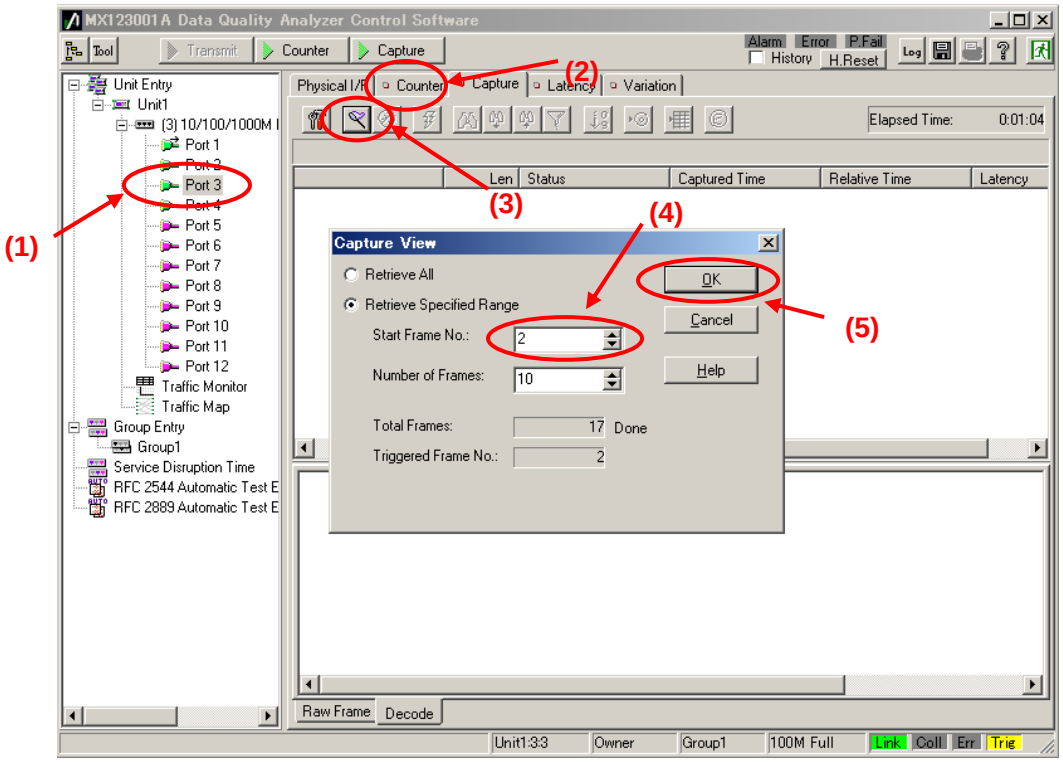
- Select Port4 and press the “Capture” button at the screen top to stop the Capture operation. (When the button icon is green, capture is stopped automatically, so do not press the “Capture” button. When a trigger is set, capture stops automatically when the capture memory become full.)



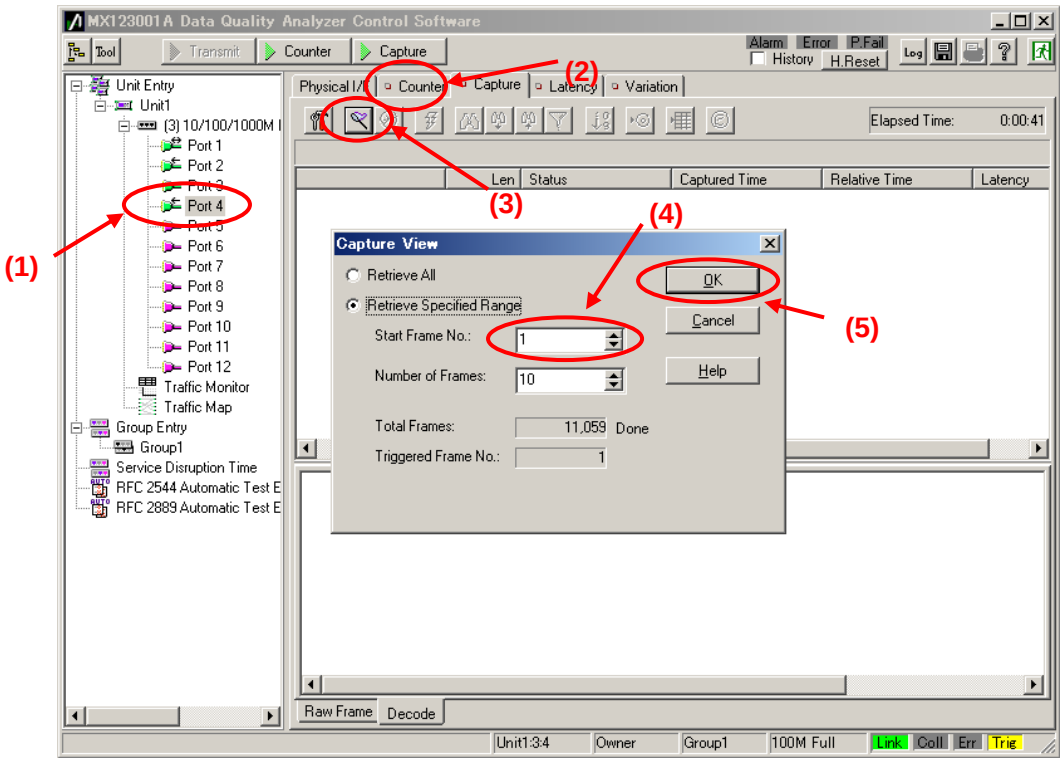
✧ Obtaining Data Captured at Port3 and Port4

- Select Port3 and press the “Capture View” button at the Capture screen.

- Set the value of “Start Frame No.:” to the same value as “Triggered Frame No.:” to obtain the header of the triggered frame and after it. (Screen example: “Start Frame No.:” = “2”)
- Press the “OK” button to close the screen.



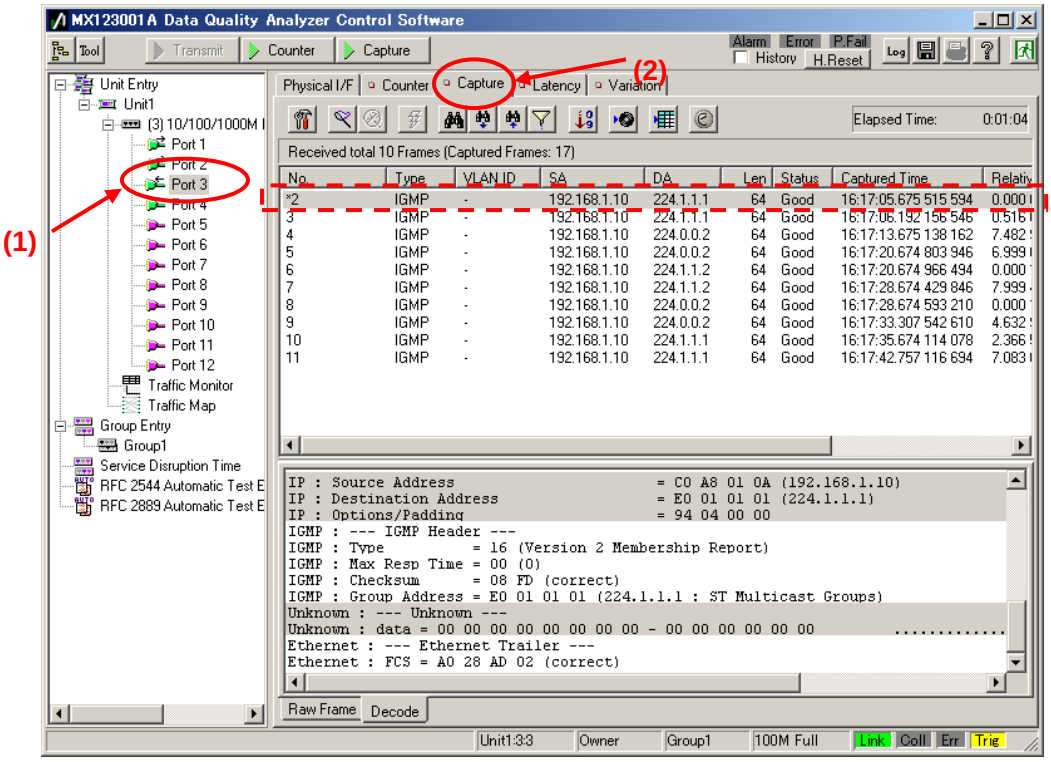
- Select Port4 and press “Capture View” button at the Capture screen.
- Set the value of “Start Frame No.:” to the same value as “Triggered Frame No.:” to obtain the header of the triggered frame and after it. (Screen example: “Start Frame No.:” = “1”)
- Press the “OK” button to close the screen.



✧ Checking Data Captured at Port3 and Port 4

➢ Select Port3 to display the Capture screen.

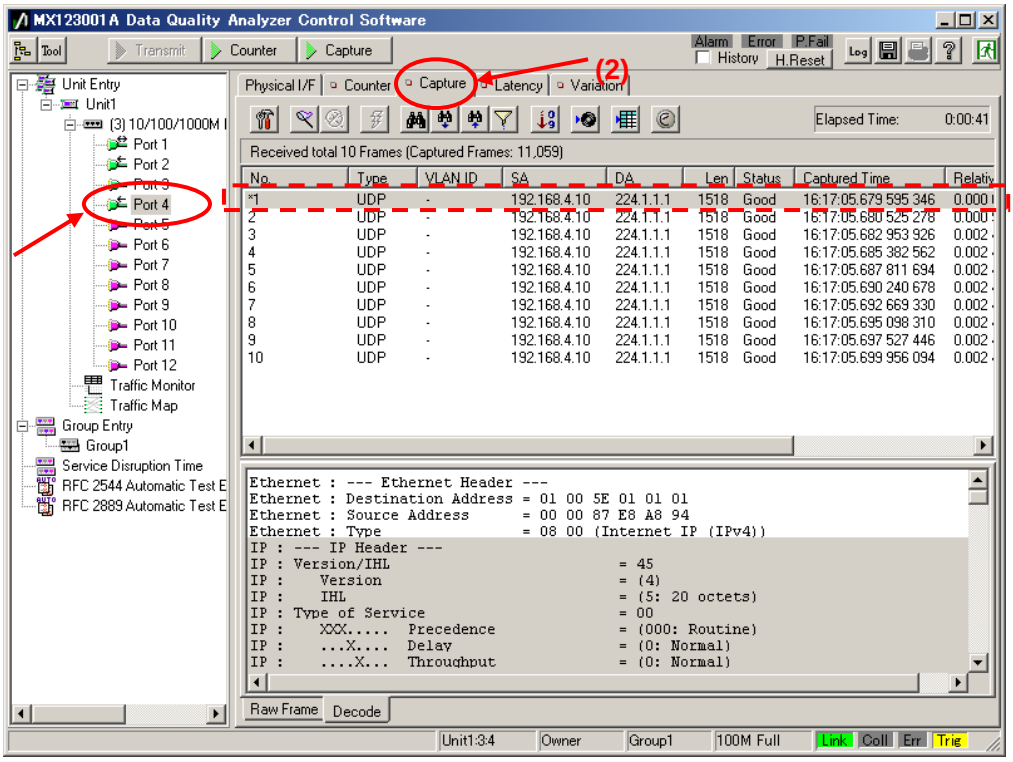
➢ Search for the Frame triggered at Port3 (trigger point indicated by *). This frame is displayed when Type is IGMP and is the Frame including the Join message (Membership Report).



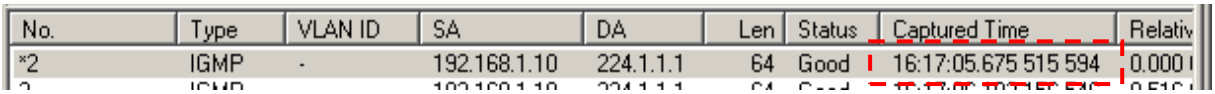
➢ Select Port4 to display the Capture screen.

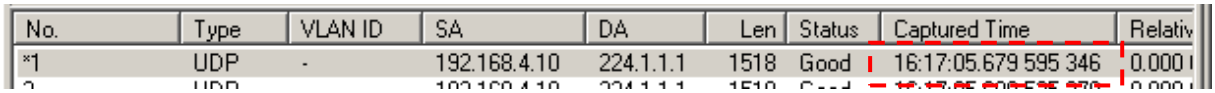
➢ Search for the Frame triggered at Port4 (indicated by *). This Frame is displayed

when Type is UDP and is the Header Frame of the multicast stream transferred when the Join message (Membership Report) is received.



- The time difference between the above two triggered Frames is the channel switching time of the IP multicast network.
  (Screen example: “16:17:05.679595346” - “16:17:05.675515594” = “0.004079752” (seconds))





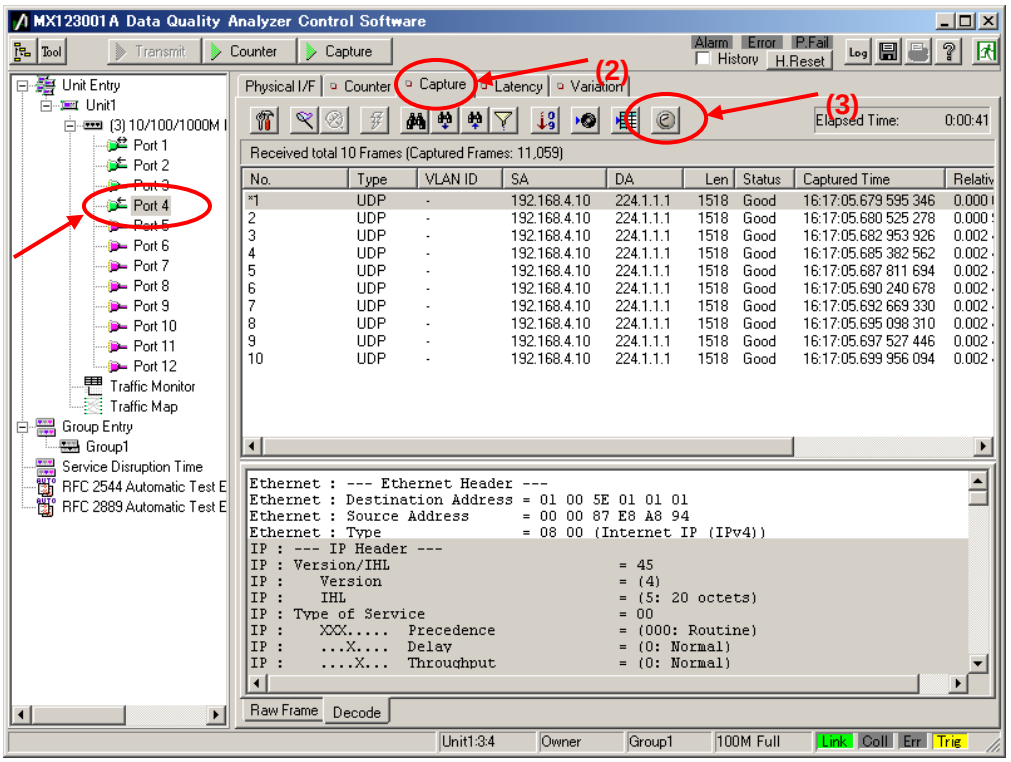
✧ Using Ethereal to Check Channel Switching Time

By using the MD1230B Ethereal Function, the time difference between two Frames can be calculated automatically.

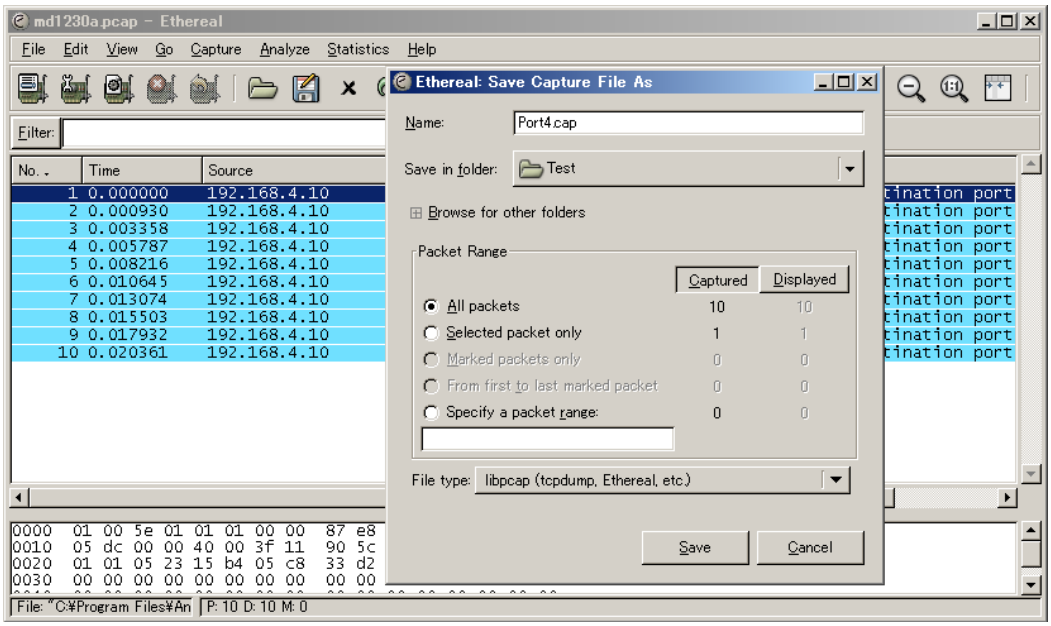
However, in this case, the time resolution is lower.

To use the Ethereal function, the customer must install Ethereal in the MD1230B. For details, see the MX123001A Operation Manual.

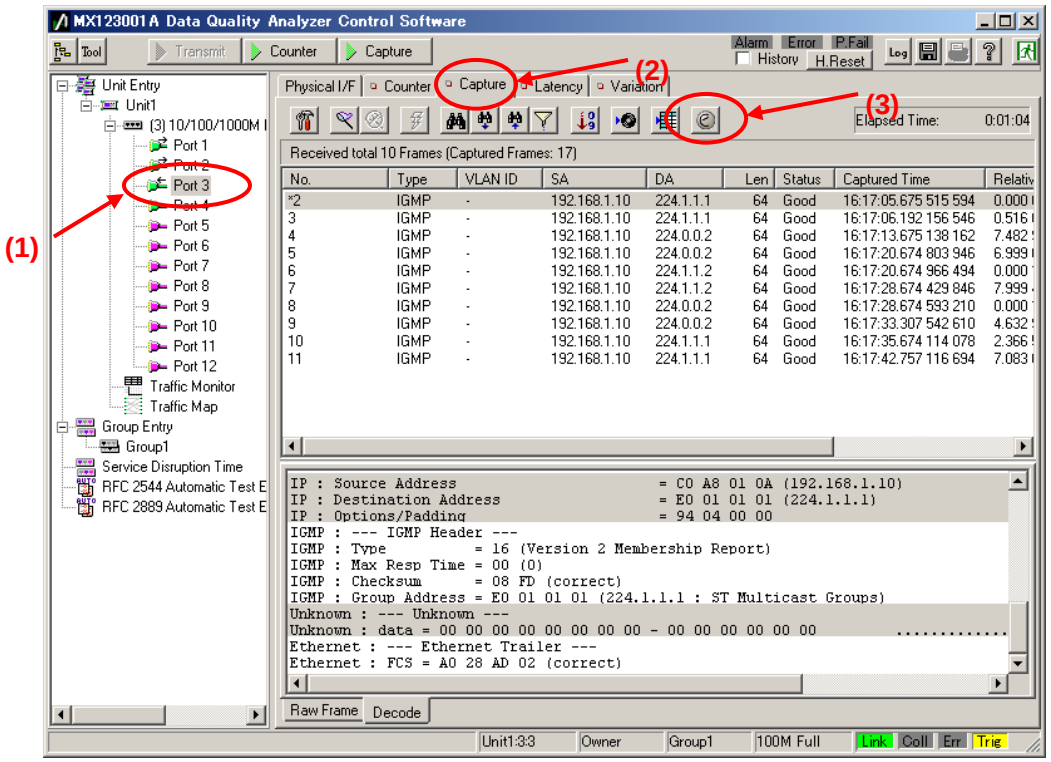
- Select Port4 to display the Capture screen.
- Press the Ethereal button to start Ethereal.



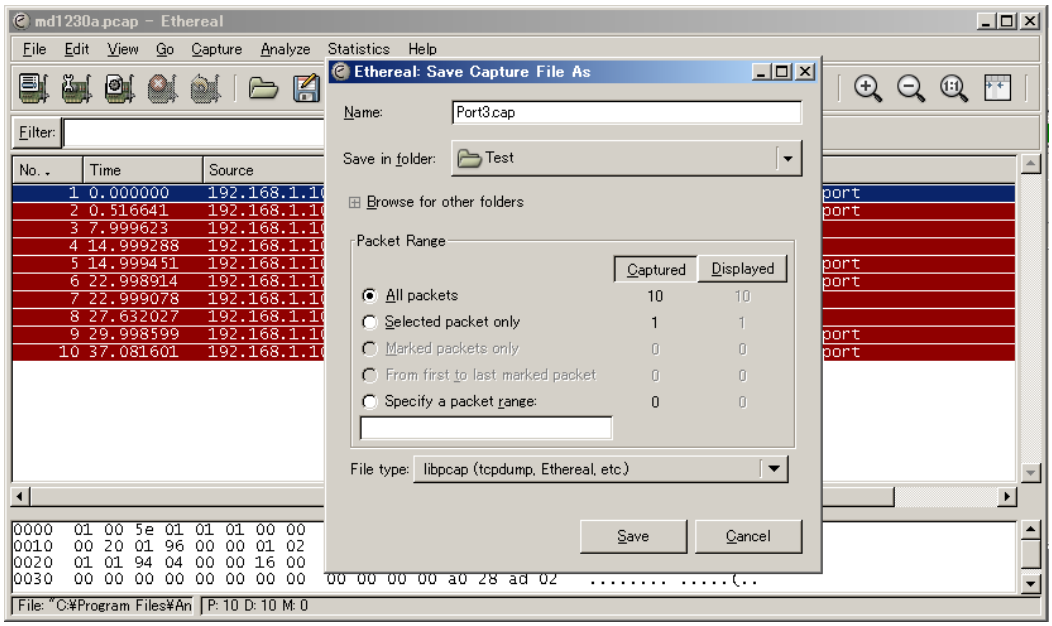
- The captured data is saved by Ethereal (file name: Port4.cap).



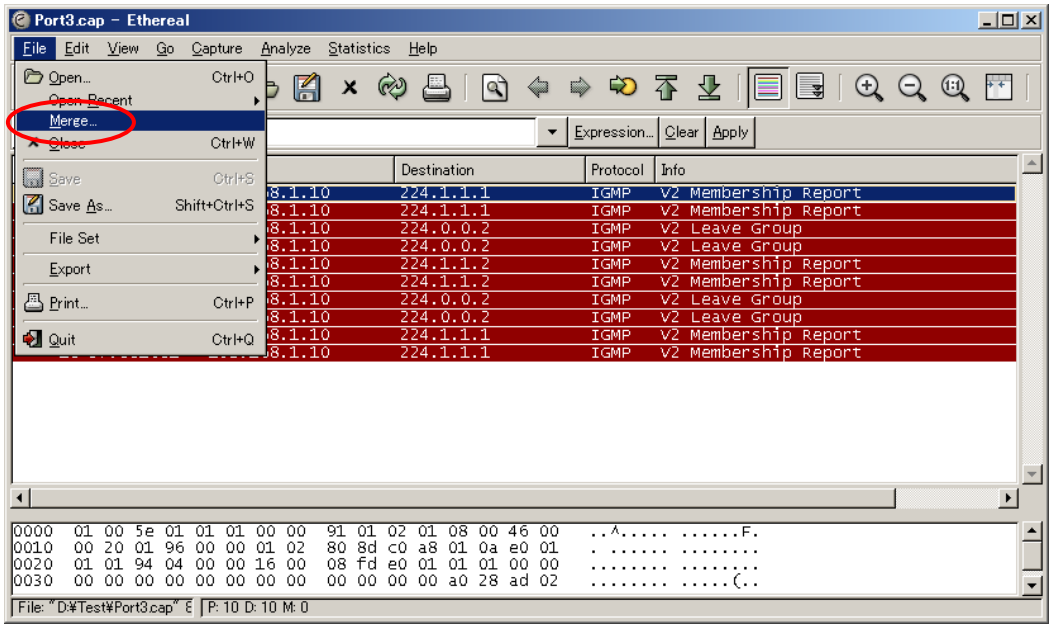
- Select Port3 to display the Capture screen.
- Press the Ethereal button to start Ethereal.



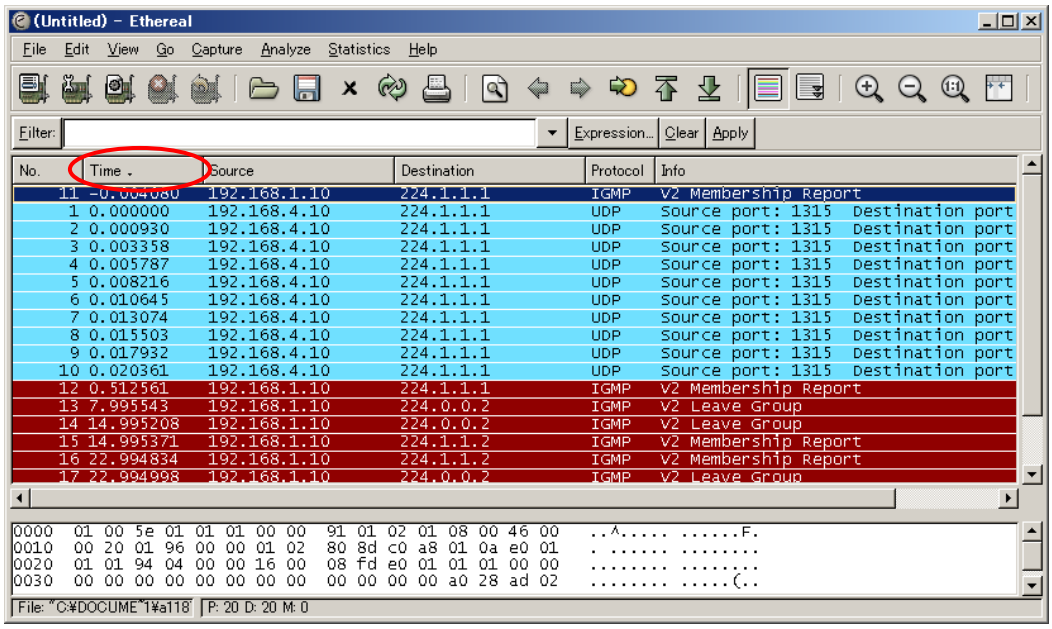
- The capture data is saved by Ethereal (File name: Port3.cap)



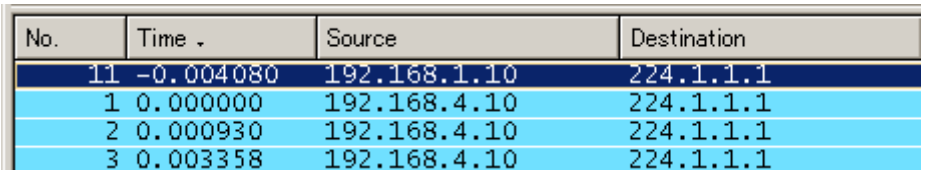
- Merge the file saved previously by Ethereal (Port4.cap).



- Press the Time button to sort the data. (Sorting displays the two data by capture time.)



- The first Time column is the IP multicast network channel switching time (0.004080 (sec) in this example).



3.7. Analysing Measurement Results

(Outline)
Analyze channel switching time measurement results for multicast distribution.
(Contents)
Refer to the measurement results in the screen example.
(Results)
You will learn how to measure and perform basic evaluation of channel switching results for multicast distribution.

The channel switching time result in the screen example is about 4 ms (0.004079752 s).
This shows the time required for the host (subscriber) to switch channels on a video streaming network typically used by IPTV. However, the actually perceived speed can sometimes feel longer. In a simple network environment (with one router), the cause does not include the low performance of the STB (set top box) and terminal used to view the content. In an actual more complex network with a number of multicast routers of varying performance and varying numbers of subscribers and contents, the switching time can vary too. When monitoring the overall service, it is very important to remember that all users impact the network performance.
The purpose of this measurement is evaluation of network performance. Evaluating network performance in advance can help prevent problems before they occur and plan future network development.

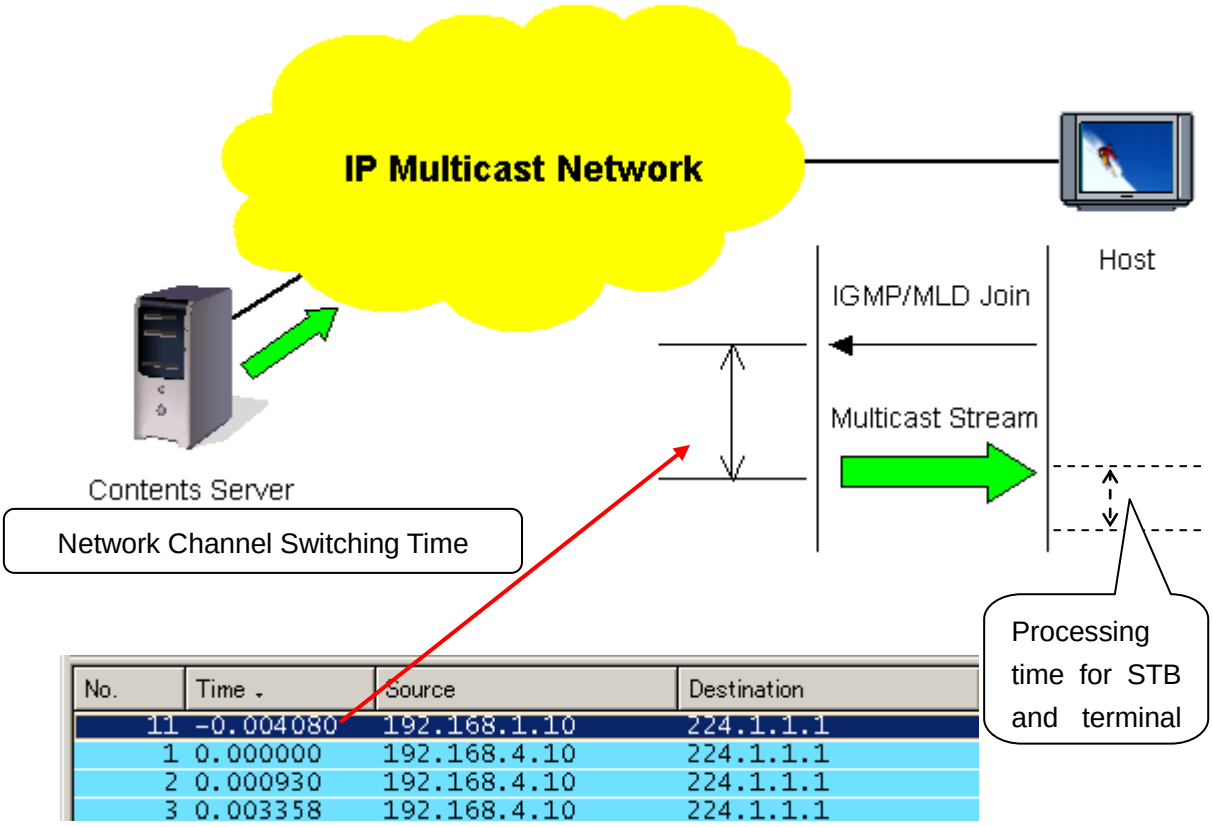


Fig. 9 Network Channel Switching Time

4. Evaluation Example 2…Measuring Transmission Delay Time

4.1. Connecting DUT

(Outline)
Connect an IP multicast network to the MD1230B.
(Contents)
First, provide an IP multicast network environment using a router. (This guide describes an IPv4 network using the IGMP protocol (at host side) and PIM-SM protocol (at network side).
When connected to the MU120131A, Port 1 emulates a server and Port 2 emulates a host.
(Results)
You will learn about connecting the DUT with measuring equipment.

- Connecting Multicast Routers
  - Connect Port1 of the MU120131A to the server-side router. (In this guide, the server-side network is “192.168.4.0/24”.)
  - Connect Port2 of the MU120131A to the host-side router. (In this guide, the host-side network is “192.168.1.0/24”.)

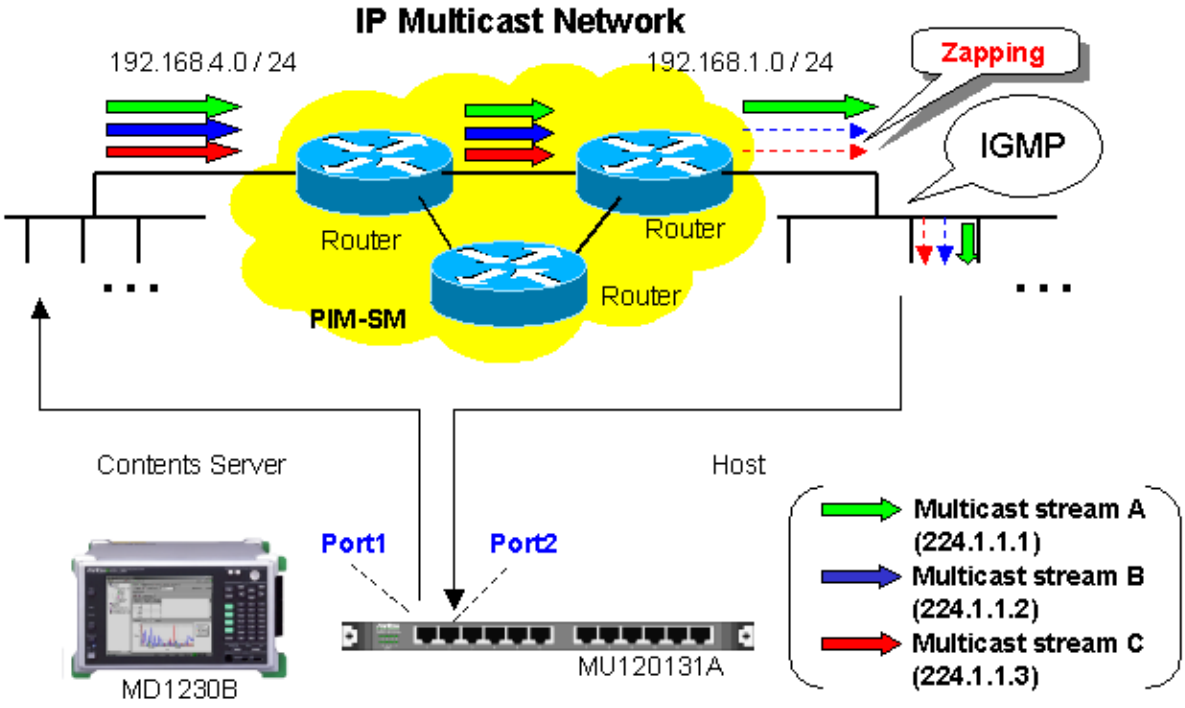


Fig. 10 Connecting DUT

4.2. Setting Measurement Ports

(Outline)
Perform the basic settings for the ports operating as the emulated server and emulated host.
(Contents)
Set the following port numbers and addresses for the emulated server and host.
In addition, perform settings for ARP and Ping.

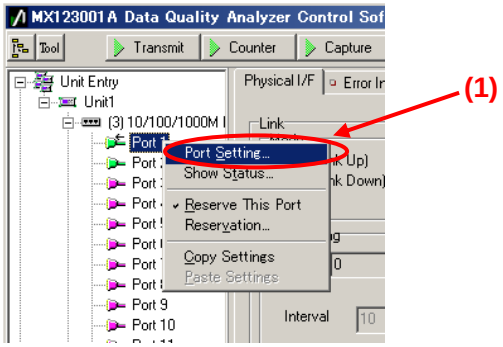
[Emulated Server]
Port number: Port1
MAC Address: 00-00-91-01-01-01
IPv4 Address: 192.168.4.10
Netmask: 255.255.255.0
Gateway: 192.168.4.254

[Emulated Host]
Port number: Port2
MAC Address: 00-00-91-01-01-02
IPv4 Address: 192.168.1.10
Netmask: 255.255.255.0
Gateway: 192.168.1.254

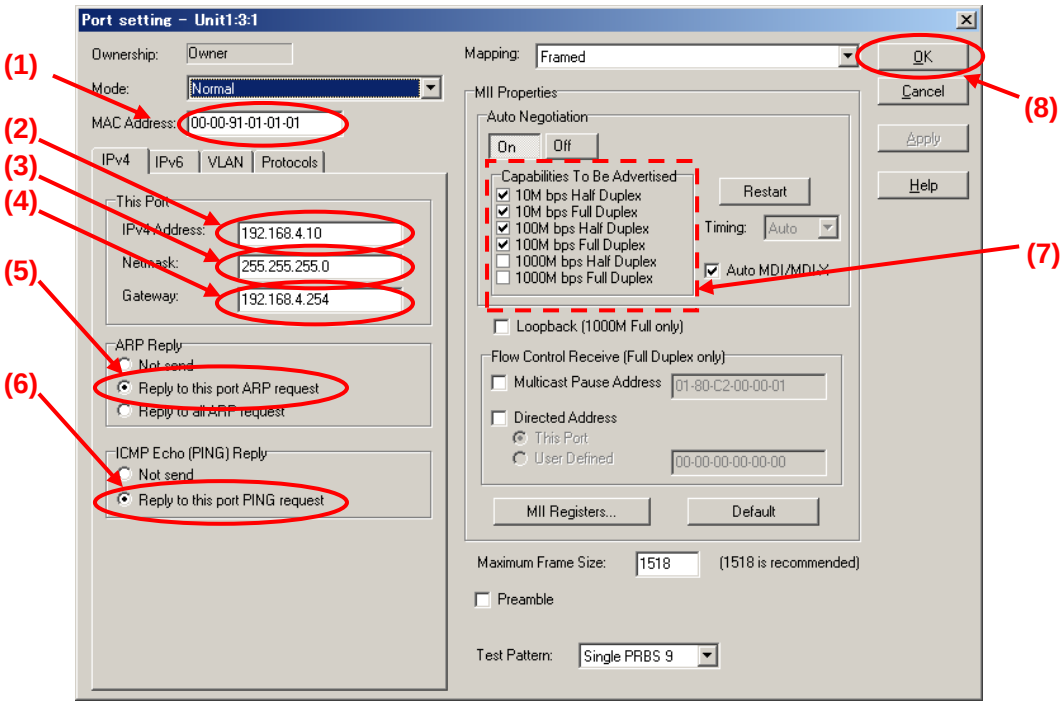
(Results)
You will learn basic settings for using ports for measurement.

✧ Setting Port Operating as Emulated Server

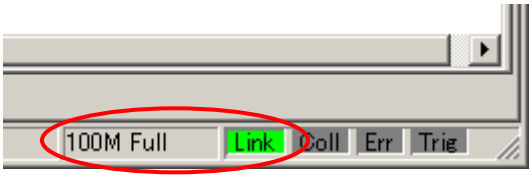
➢ Select Port1 and right-click to select “Port Setting” (opens “Port Setting” window).



➢ Set “MAC Address:” to “00-00-91-01-01-01”.
➢ Set “IPv4 Address:” to “192.168.4.10”.
➢ Set “Netmask:” to “255.255.255.0”.
➢ Set “Gateway:” to “192.168.4.254”.
➢ Select “Reply to this port ARP request”.
➢ Select “Reply to this port PING request”.
➢ Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).
➢ Press the “OK” button.

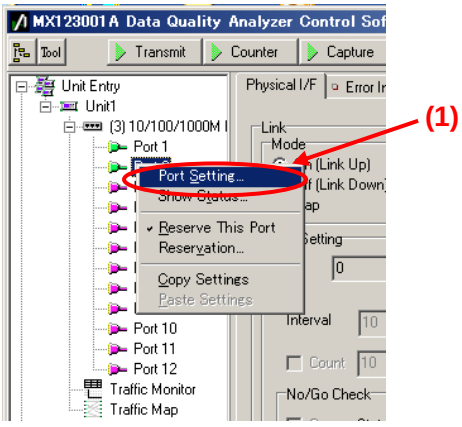


- Check that 100M Full is displayed at the screen bottom right and that the Link LED is green. (Confirm that the connection between the router and instruments is Link Up at “100Mbps Full Duplex”.)



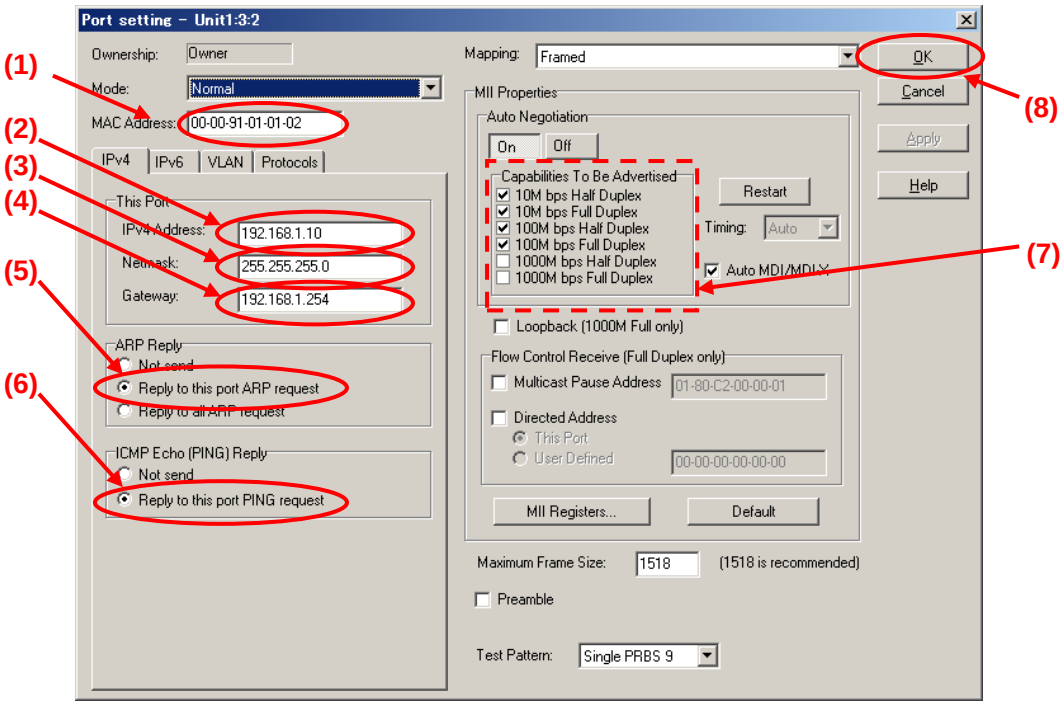
✧ Setting Port Operating as Emulated Host

- Select Port2 and right-click “Port Setting” (opens “Port Setting” window).

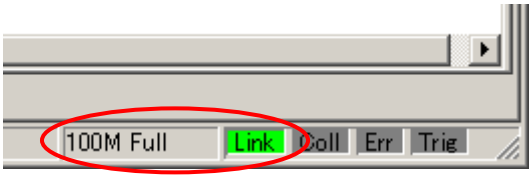


- Set “MAC Address:” to “00-00-91-01-01-02”.
- Set “IPv4 Address:” to “192.168.1.10”.
- Set “Netmask:” to “255.255.255.0”.
- Set “Gateway:” to “192.168.1.254”.
- Select “Reply to this port ARP request”.
- Select “Reply to this port PING request”.

- Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).
- Press the “OK” button.

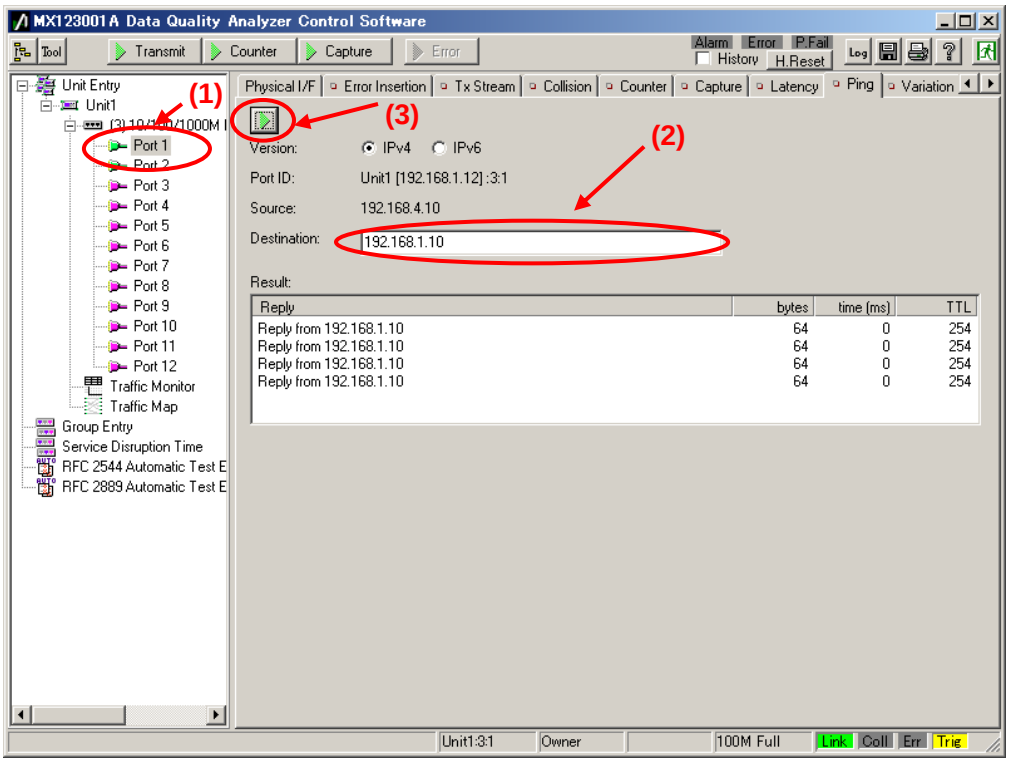


- Check that 100M Full is displayed at the screen bottom right and that the Link LED is green. (Confirm that the connection between the router and instruments is Link Up at “100Mbps Full Duplex”.)



✧ Checking Connection

- Display the Ping screen for Port1, set the value of “Destination:” to “192.168.1.10” and press the “Ping” button.

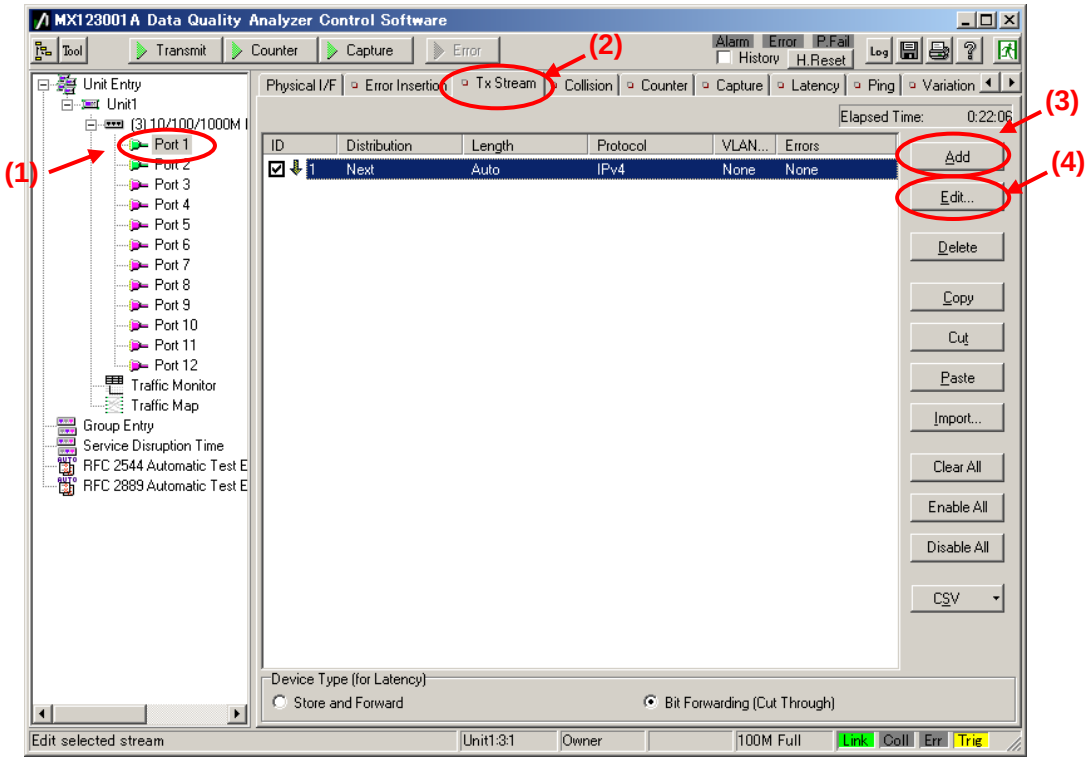


- Check that “Reply from 192.168.1.10” is displayed in “Result:”. (This checks the connection over the router.)

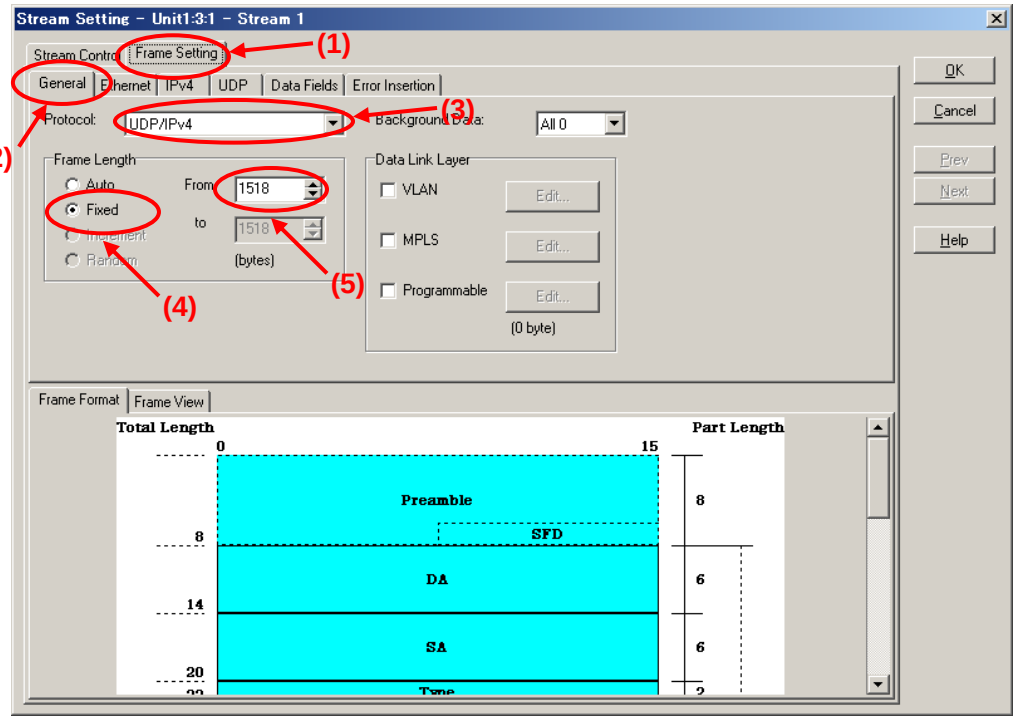
4.3. Setting Tx Stream

(Outline)
Create multicast stream data for operating as emulated server.
(Contents)
Broadcast a multicast stream using the MD1230B Tx Stream generation function.
In this example, three multicast streams are prepared (multicast addresses: “224.1.1.1” / “224.1.1.2” / “224.1.1.3”). The traffic for each stream is 5 Mbps. To measure the delay time, a timestamp is buried in the stream with multicast address “224.1.1.1”.
(Results)
You will learn how to set up an emulated server broadcasting video on three channels each with a bandwidth of 5 Mbps. (One channel will have a timestamp.)

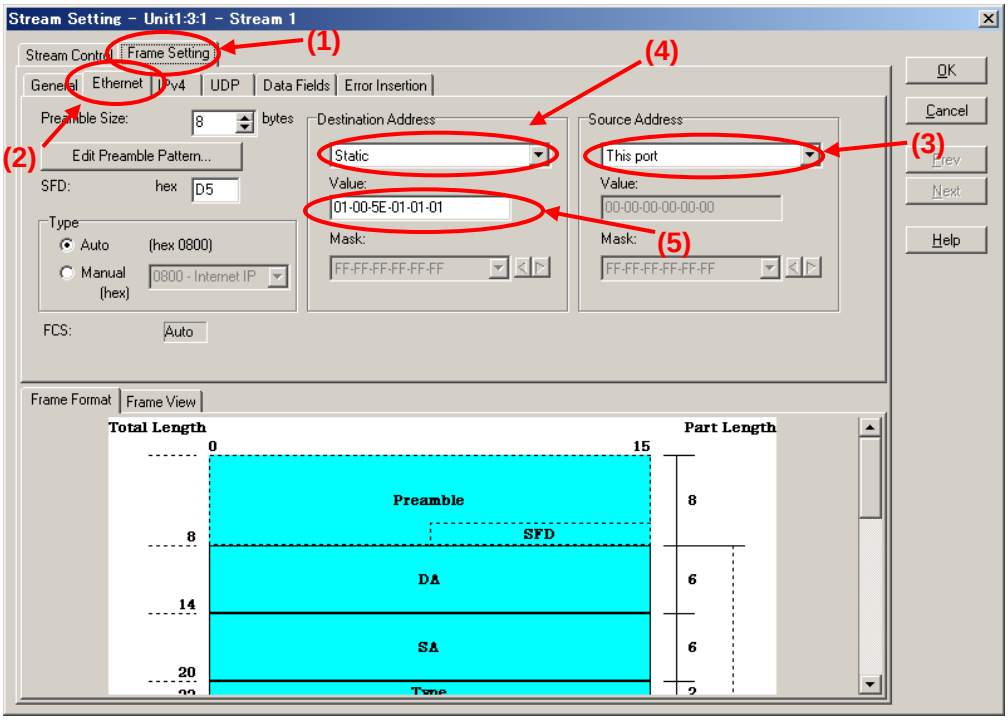
- Creating Multicast Stream Data 1 Generated from Port1 at Server Side (Multicast Address: 224.1.1.1)
  - Select Port1 and press “Add” at the Tx Stream screen to add one stream.
  - With the added stream selected, press “Edit...” to edit the stream.



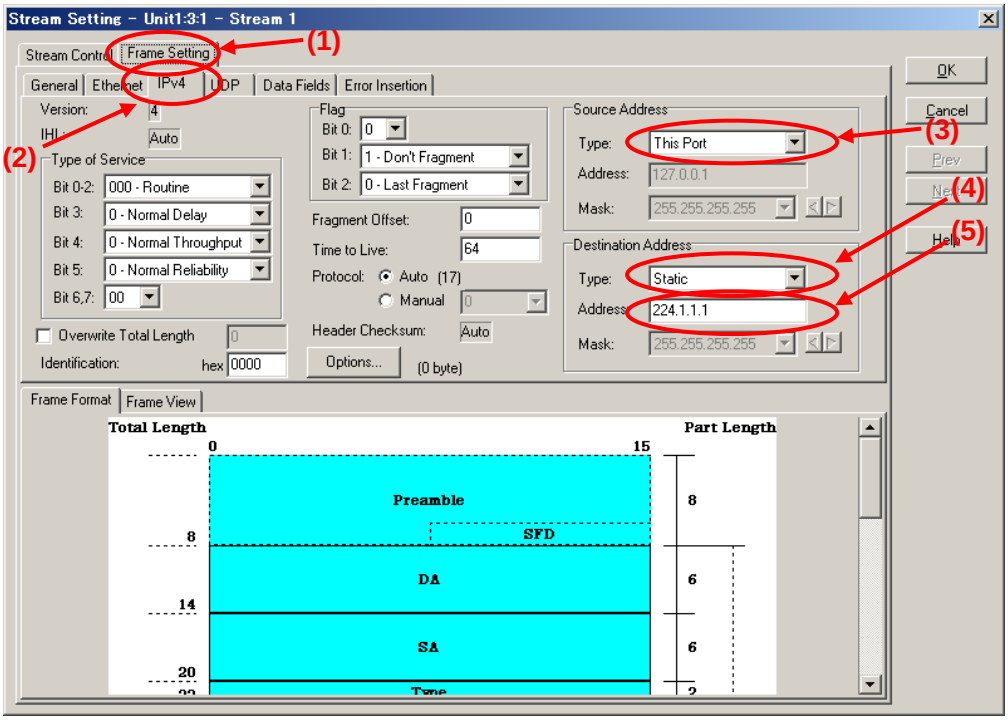
  - Set “Protocol” at [General] of the Frame Setting screen to “UDP/IPv4”. (Multicast broadcasts generally use the UDP protocol.)
  - Set “Frame Length:” to “Fixed” and a value of “1518”. (The maximum length of Ethernet frames is 1518 bytes.)



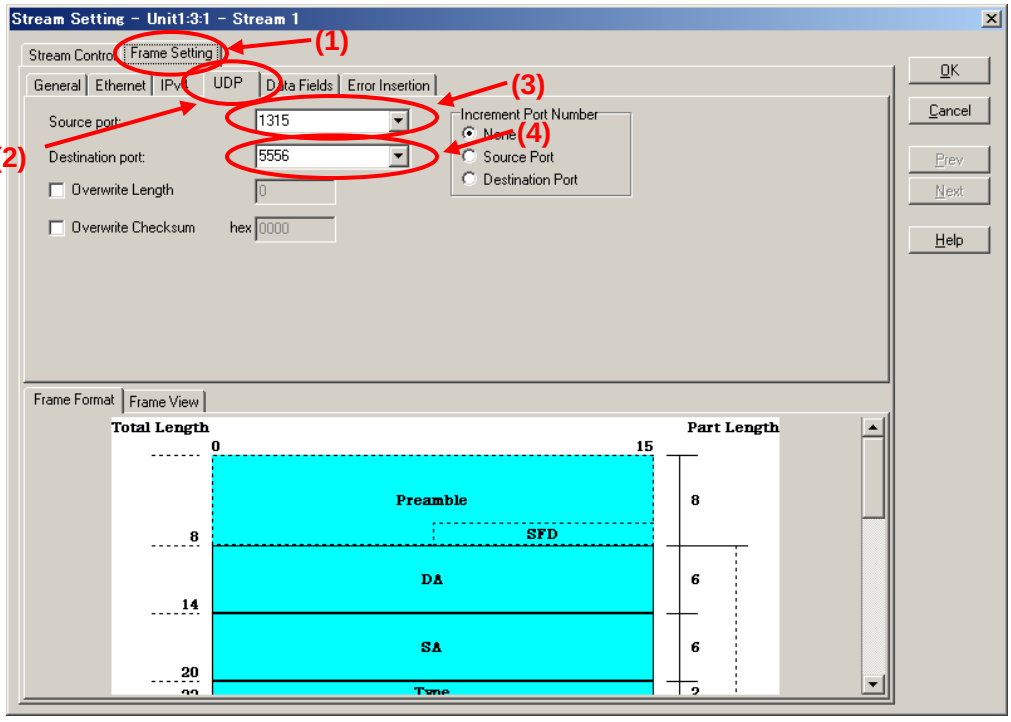
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified by “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-01”. (“01-00-5E-01-01-01” is the MAC address used by multicast address “224.1.1.1”.)



- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.1”.



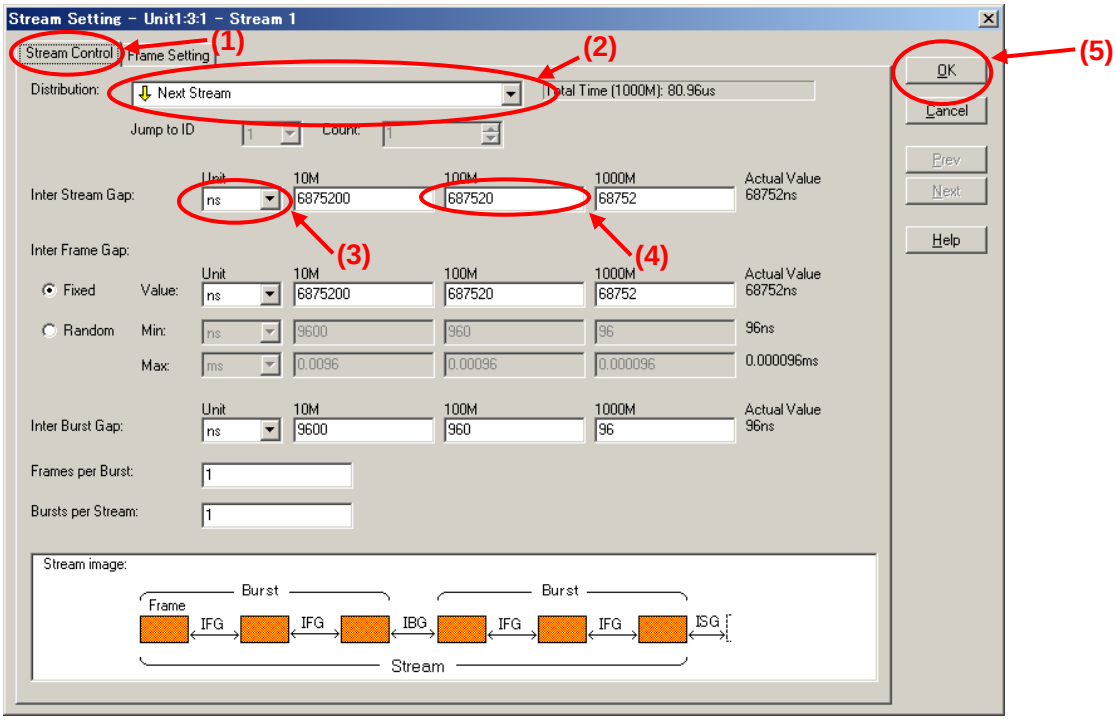
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1315”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5556”. (This specifies the undefined UDP port address.)



- Select “Next Stream” at “Distribution:” on the Stream Control screen.
- Set “Unit” of “Inter Stream Gap:” to “ns” and set the value of “100M” to “687,520”. (Setting the inter-frame gap to 687,520 ns means sending the stream over the 15 Mbps band at a 100M Link speed.) Since three streams are created in this example and are broadcast sequentially, the actual output for this setting is 5 Mbps.

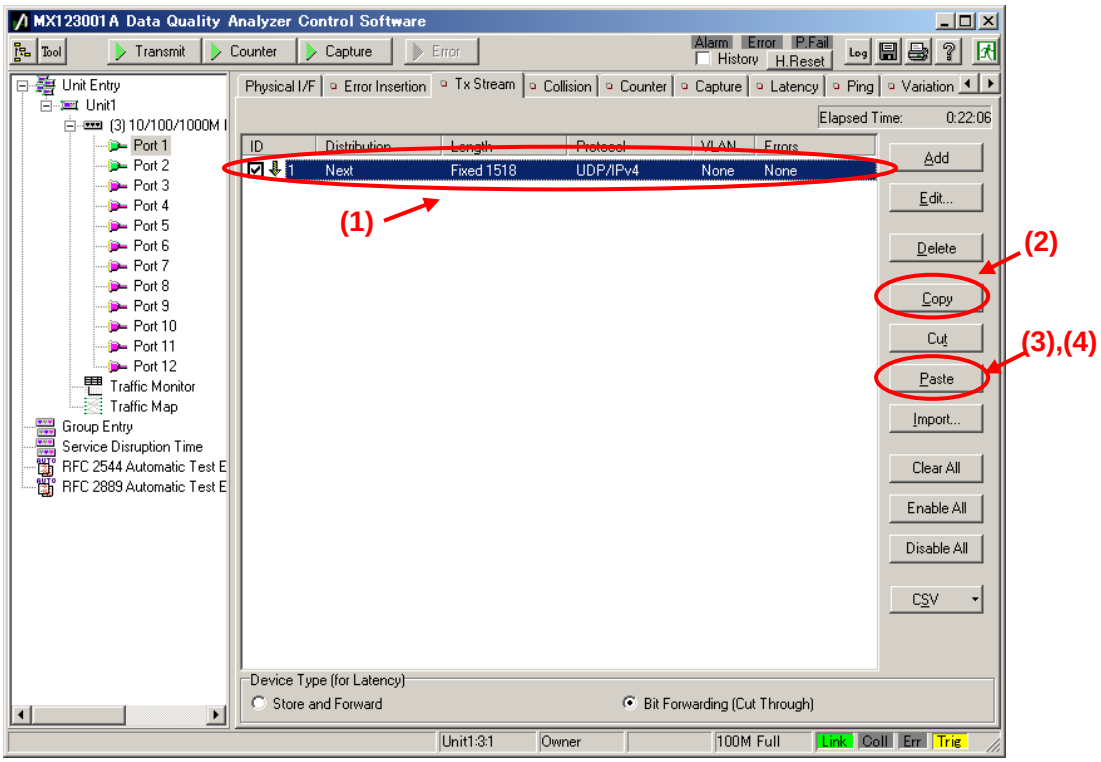
After setting “Unit” of “Inter Frame Gap:” to “bit/s” and inputting “15,000,000”, return “Unit” to “ns” and confirm that the 15-Mbps equivalent gap time is 687,520 ns.

- Press the “OK” button to close the setting screen.

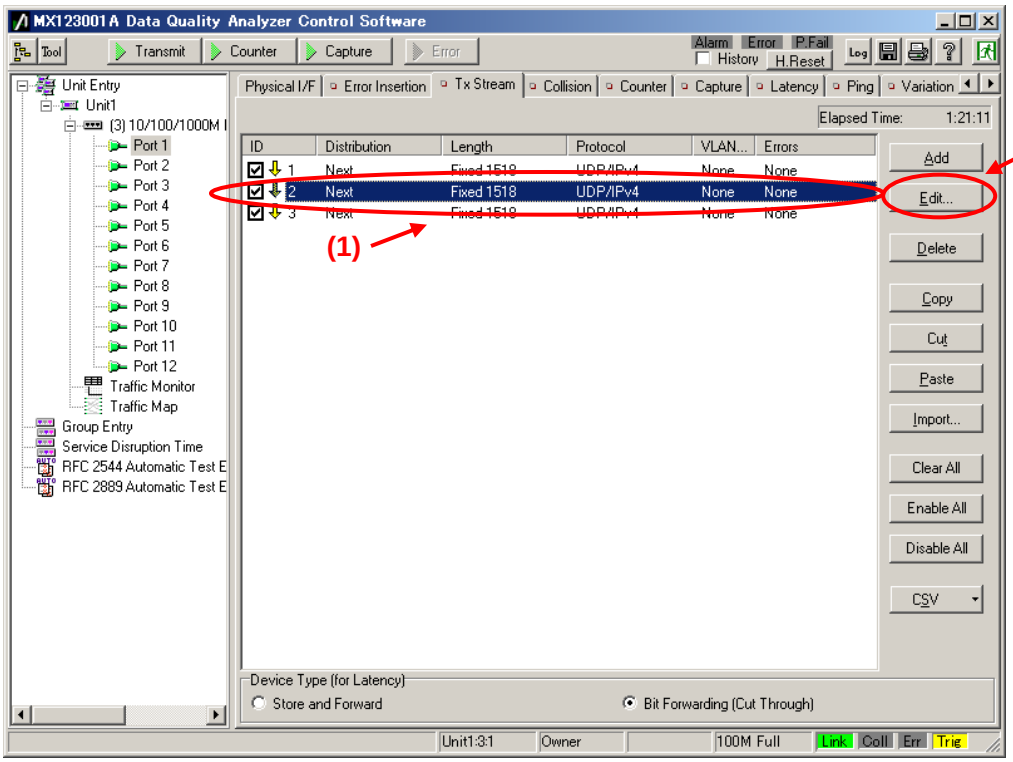


✧ Creating Multicast Stream Data 2 and Multicast Stream Data 3 from Server-side Port1 (Multicast address: “224.1.1.2”/“224.1.1.3”)

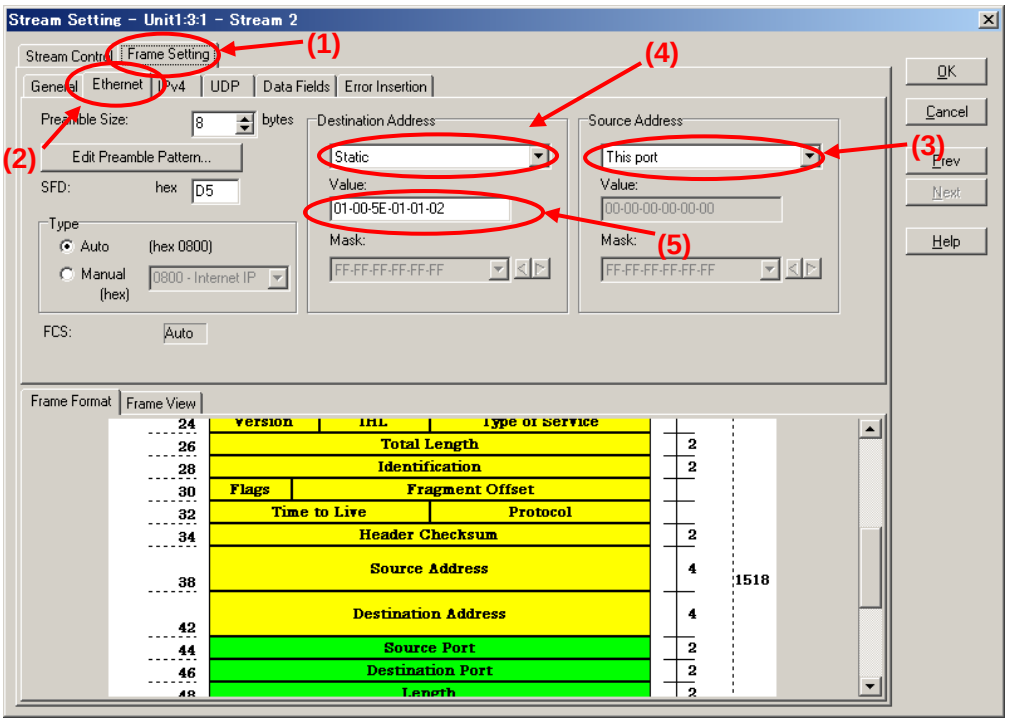
- With the stream select at the Tx Stream screen, press “Copy” and then press “Paste” two times (makes two copies of stream).



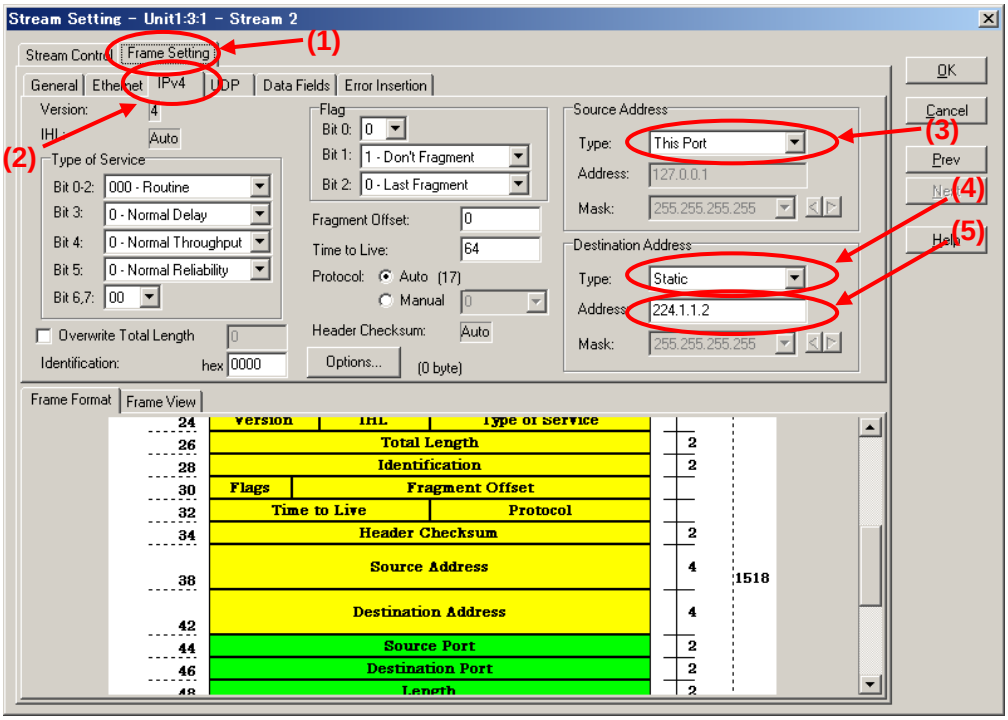
- With the second stream selected, press “Edit...” to edit the stream.



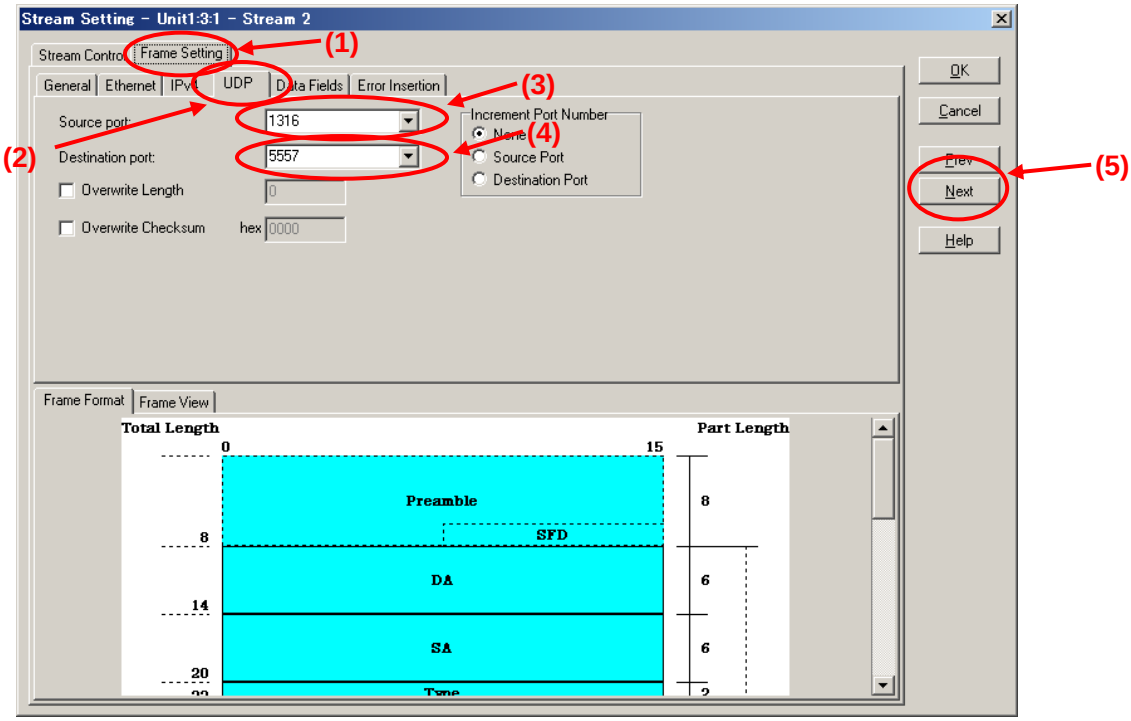
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This Port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-02”. (“01-00-5E-01-01-02” is the MAC address used by multicast address “224.1.1.2”.)



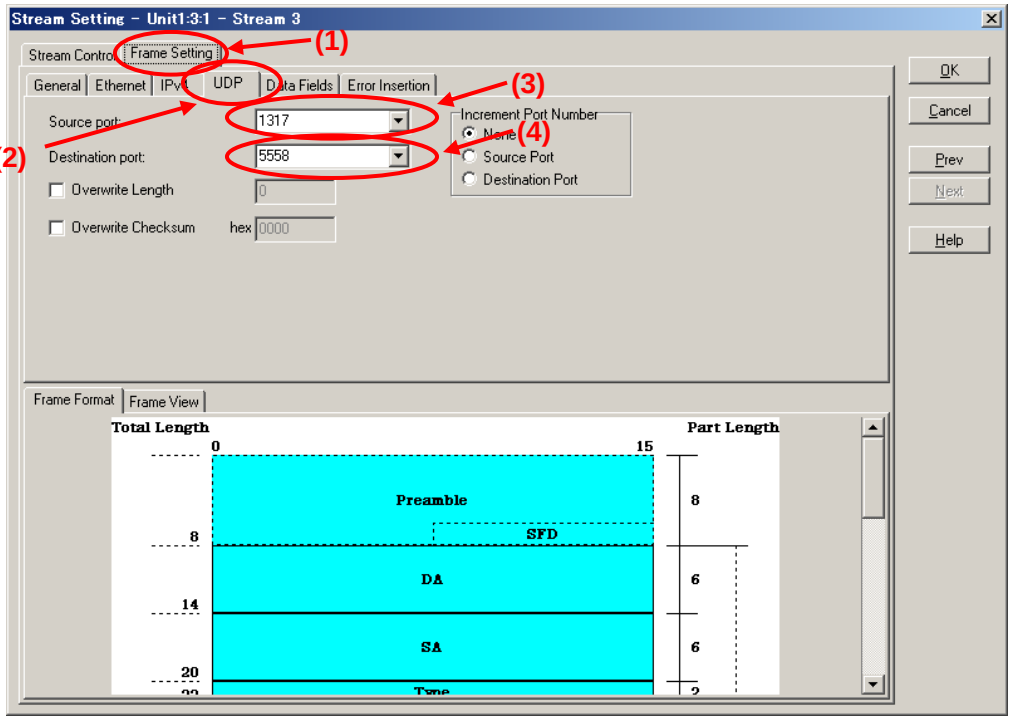
- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.2”.



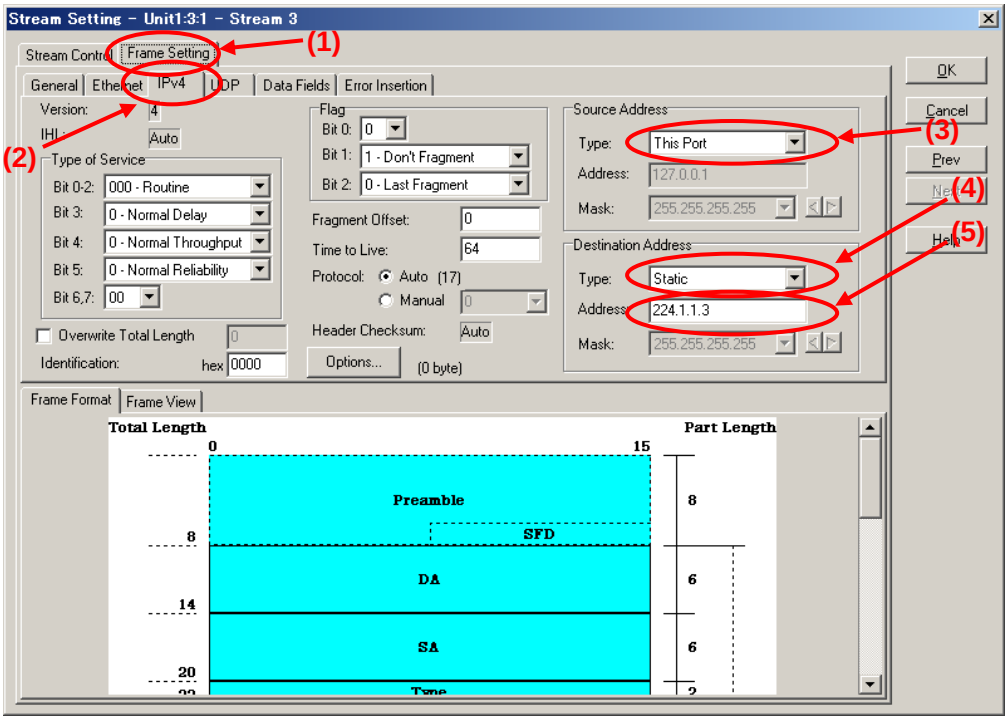
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1316”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5557”. (This specifies the undefined UDP port address.)
- Press “Next” to open Stream3 setting screen.



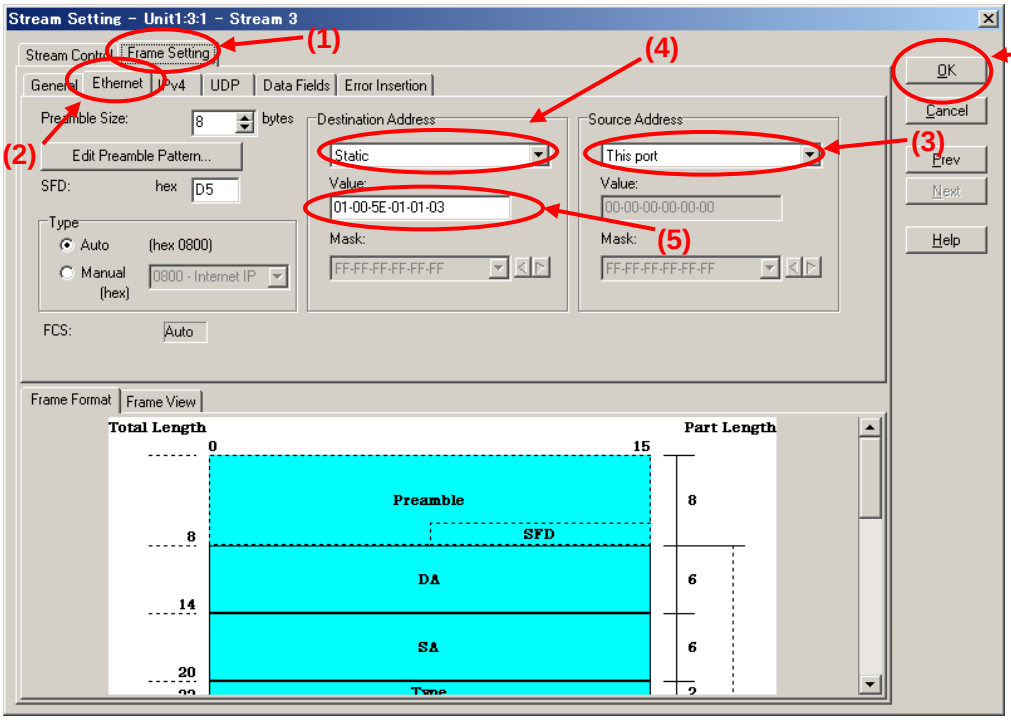
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1317”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5558”. (This specifies the undefined UDP port address.)



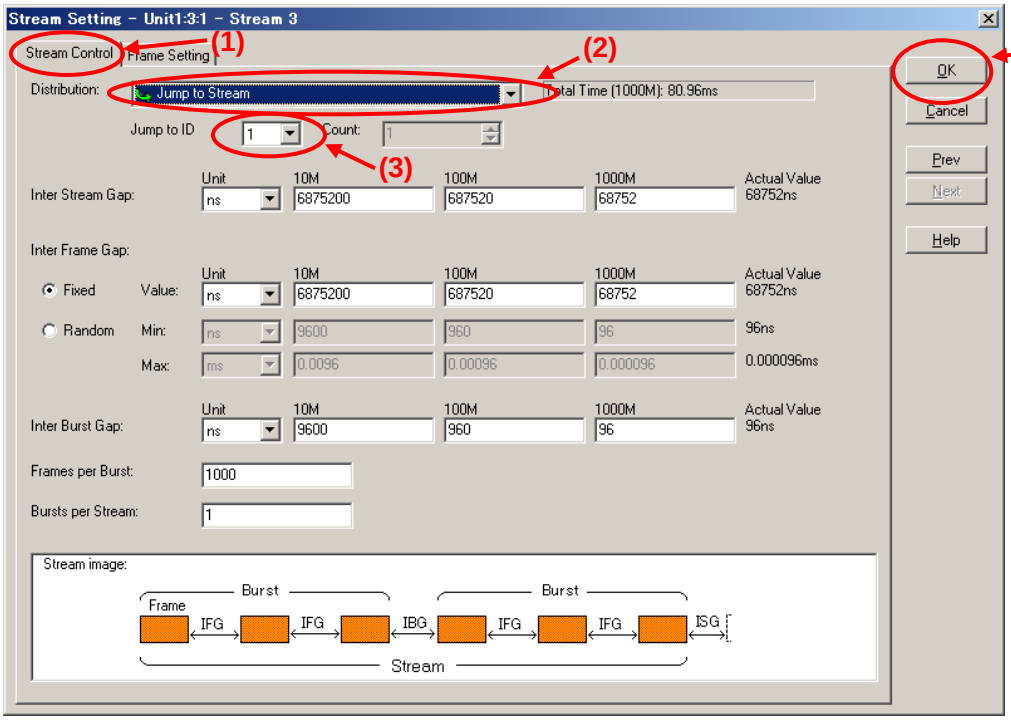
- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.3”.



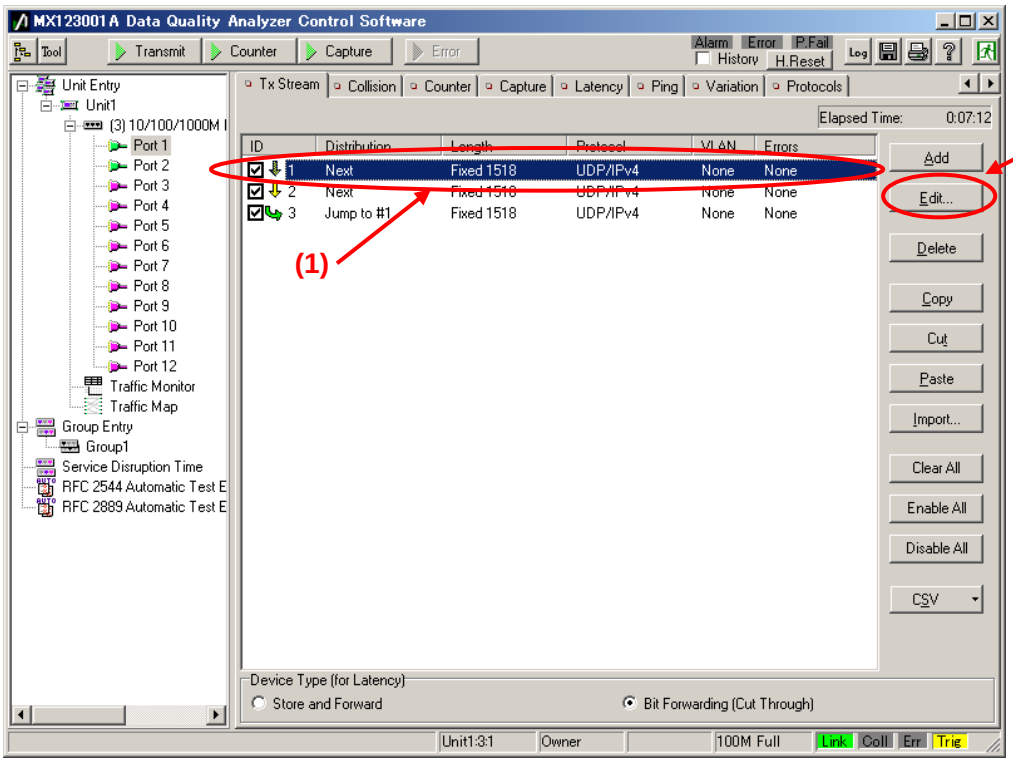
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This Port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-03”. (“01-00-5E-01-01-03” is the MAC address used by multicast address “224.1.1.3”.)



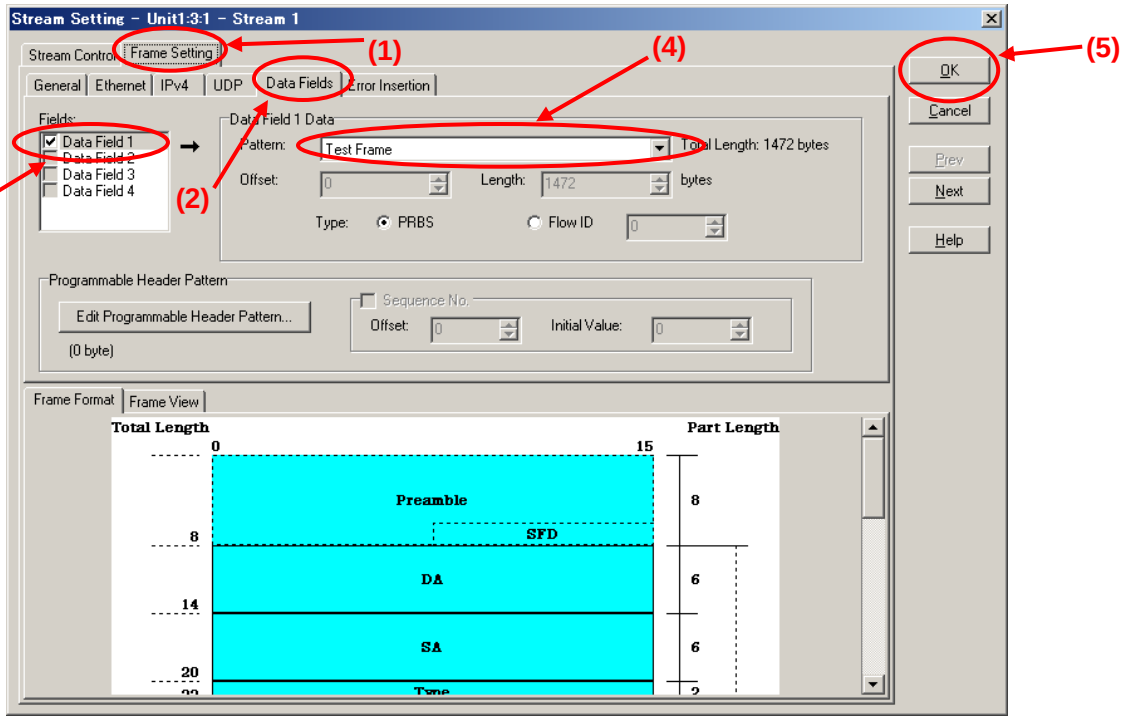
- Select “Jump to Stream” at “Distribution:” of the Stream Control screen.
- Set the value “Jump to ID” to “1” (sets jump stream destination to stream 1).
- Press “OK” to close the setting screen.



- ✧ Burying Timestamp in Multicast Stream Data Generated at Server-side Port1 (Multicast address: “224.1.1.1”)
  - With the first stream selected, press the “Edit...” button to edit the stream.



- Place a checkmark in “Data Field 1” of [Data Fields] at the Frame Setting screen and set “Pattern:” to “Test Frame”.
- Press “OK” to close the setting screen.



4.4. Setting Host Emulation

(Outline)
Create an IGMP protocol sequence for operation as an emulated host.
(Contents)
Use the MD1230B protocol emulation function to assemble a Join/Leave sequence for the multicast group.
In this example, the following three multicast groups are created.

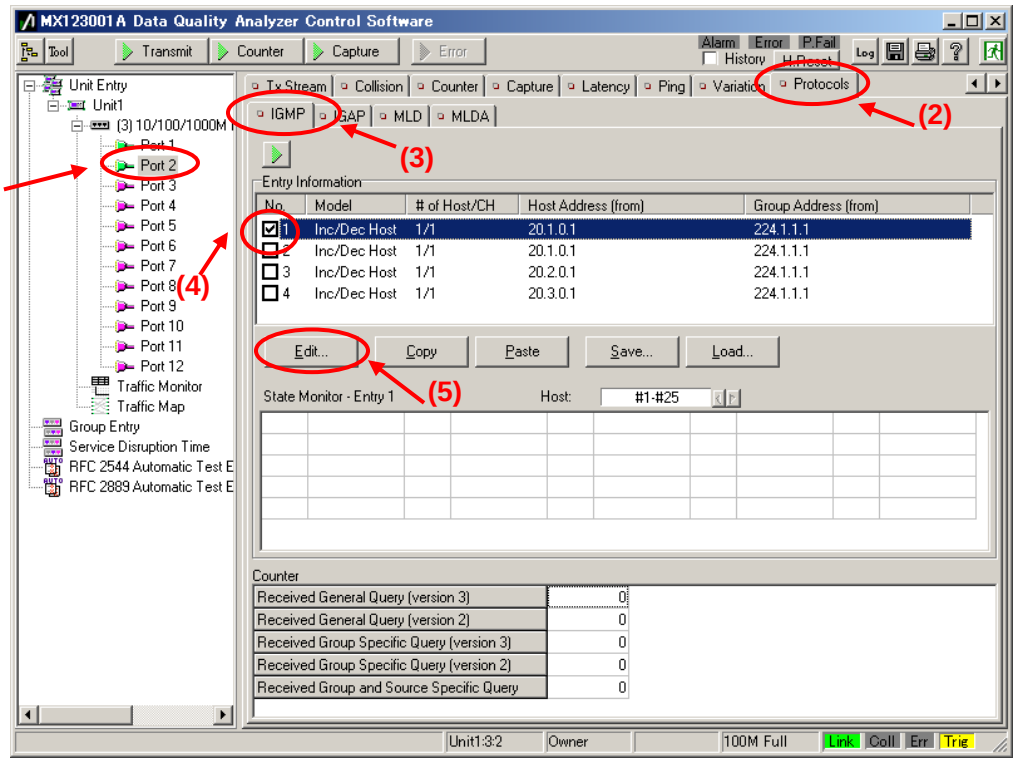
- ✓ Sequence 1: Join multicast address “224.1.1.1” and hold this status for “100,000” seconds. (This is the multicast stream for measuring transmission delay time.)
- ✓ Sequence 2: Join multicast address “224.1.1.2” and perform repeated “connect for 8 seconds/Disconnect for 7 seconds” operations.
- ✓ Sequence 3: Join multicast address “224.1.1.3” and perform repeated “connect for 8 seconds/Disconnect for 7 seconds” operations.

Sequences 2 and 3 are for emulating Channel Zapping by performing repeated channel switching operations.

(Results)
You will learn how to continuously receive video data for one channel in the Channel Zapping condition and how to configure the emulated host sequence.

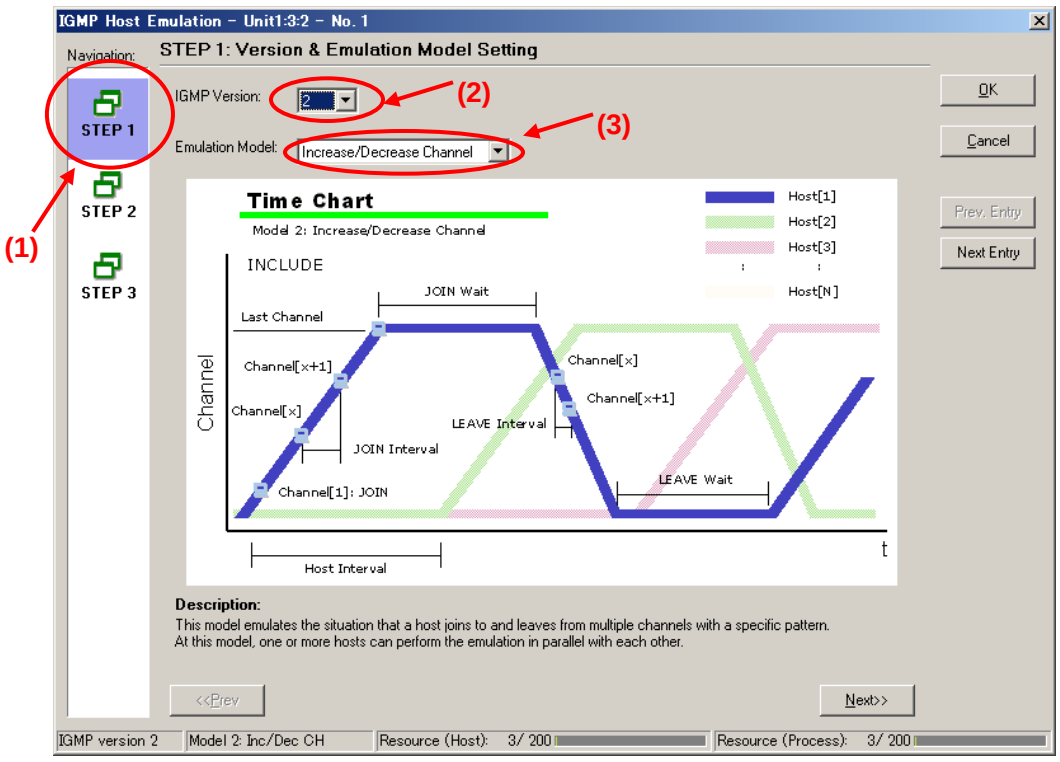
✧ Setting Port2 as Emulated Host Supporting IGMP (Sequence 1)

➢ Select Port2 and place a checkmark in the first “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.

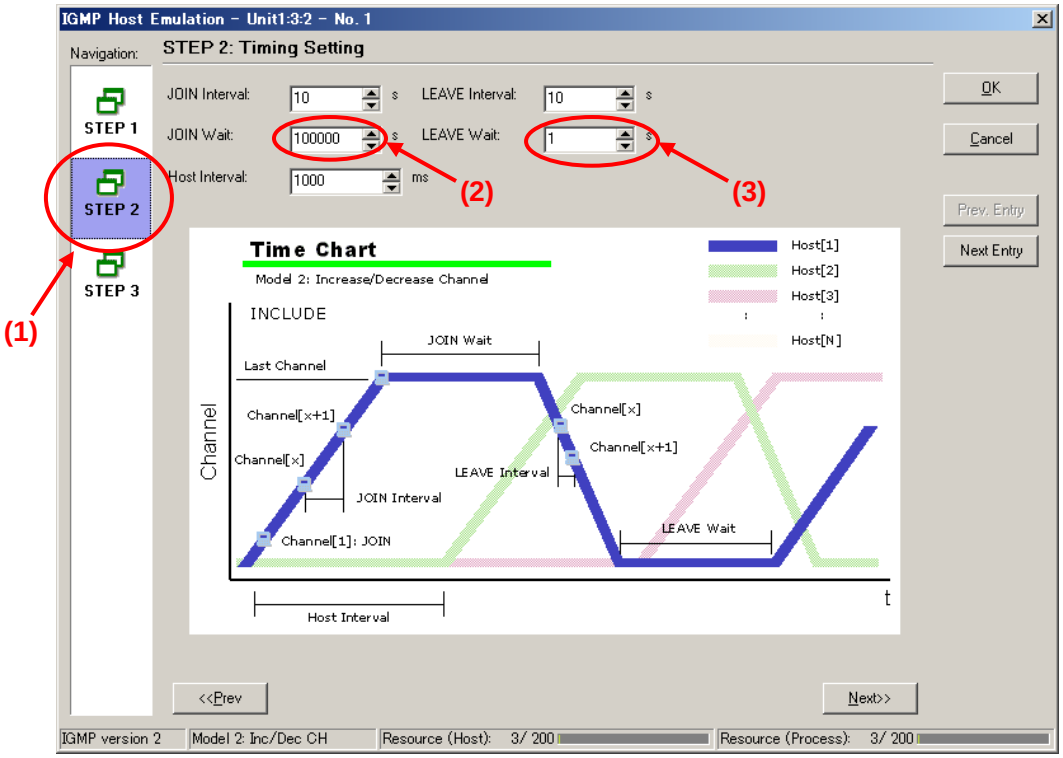


➢ At [Step1] on the IGMP Host Emulation screen, set “IGMP Version:” to “2” and “Emulation Model:” to “Increase/Decrease Channel” (supports IGMP-v2 channel

joining).



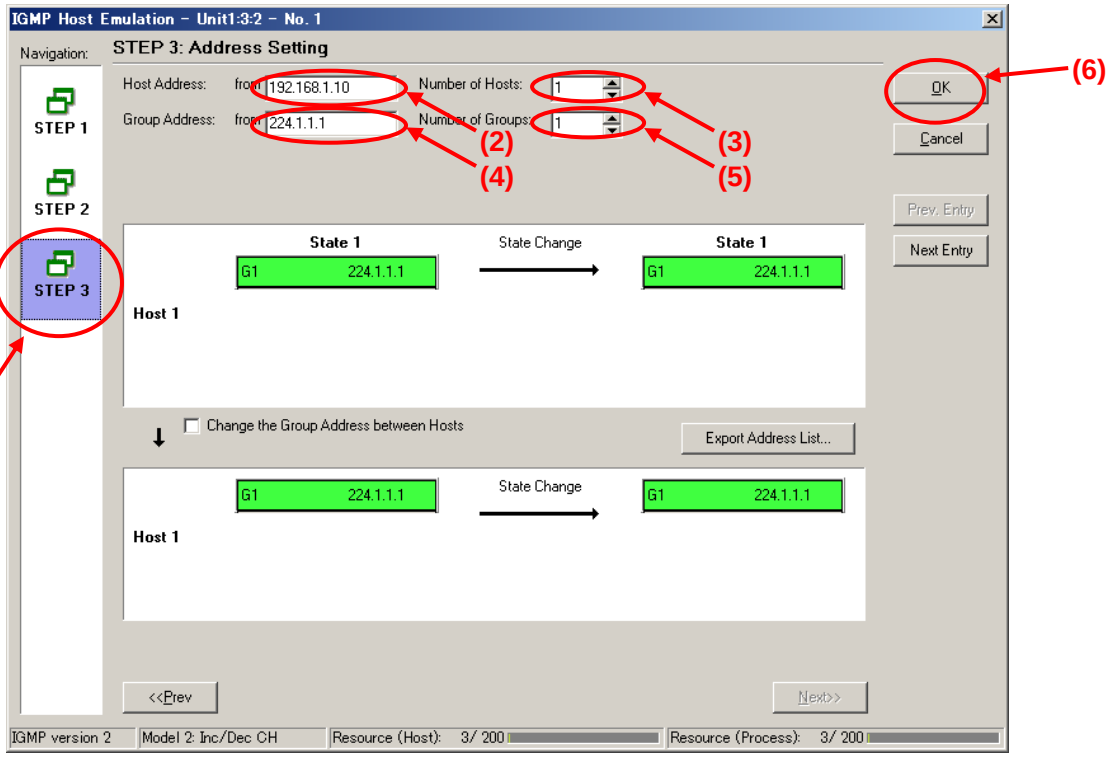
- At [Step2] of the IGMP Host Emulation screen, set “Join Wait:” to “100000s” and “LEAVE Wait:” to “1s”. (This holds the connection for 100,000 s after joining the channel.)



- Set the value of “Host Address:” at [Step3] of the IGMP Host Emulation screen to “192.168.1.10”.
- Set the value of “Number of Host:” to “1”.

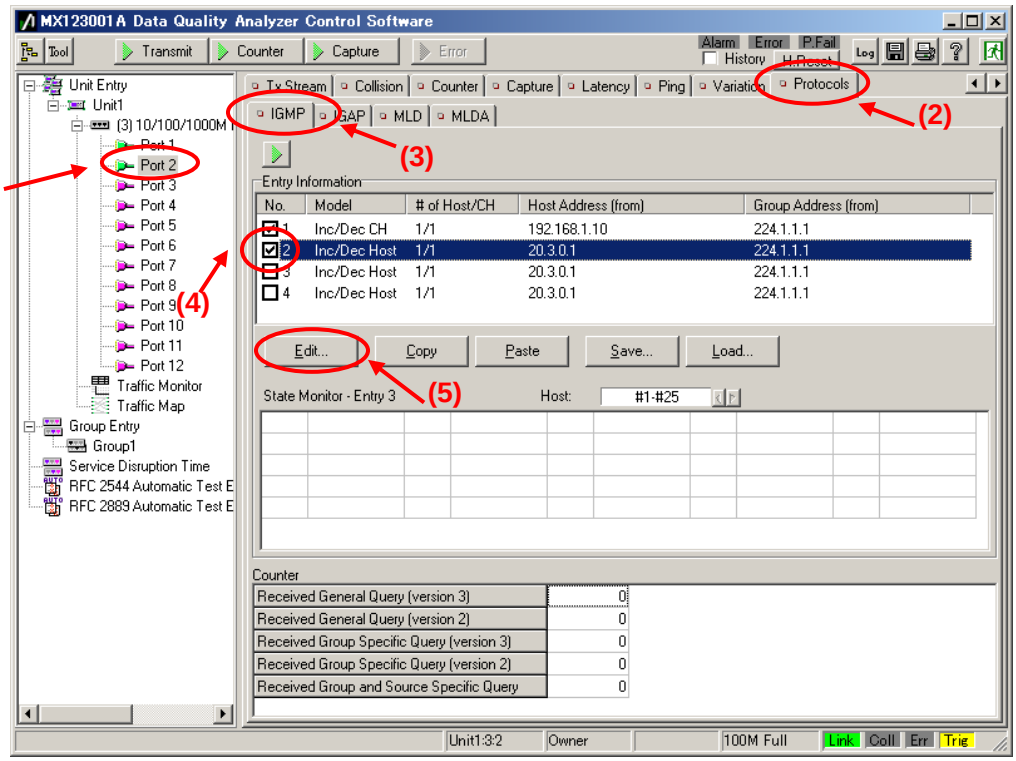
- Set the value of “Group Address:” to “224.1.1.1”.
- Set the value of “Number of Group:” to “1”.
- Press “OK” to close the setting screen.

This setting performs the Join/Leave to multicast address “224.1.1.1” with one emulated host (“192.168.1.10”).

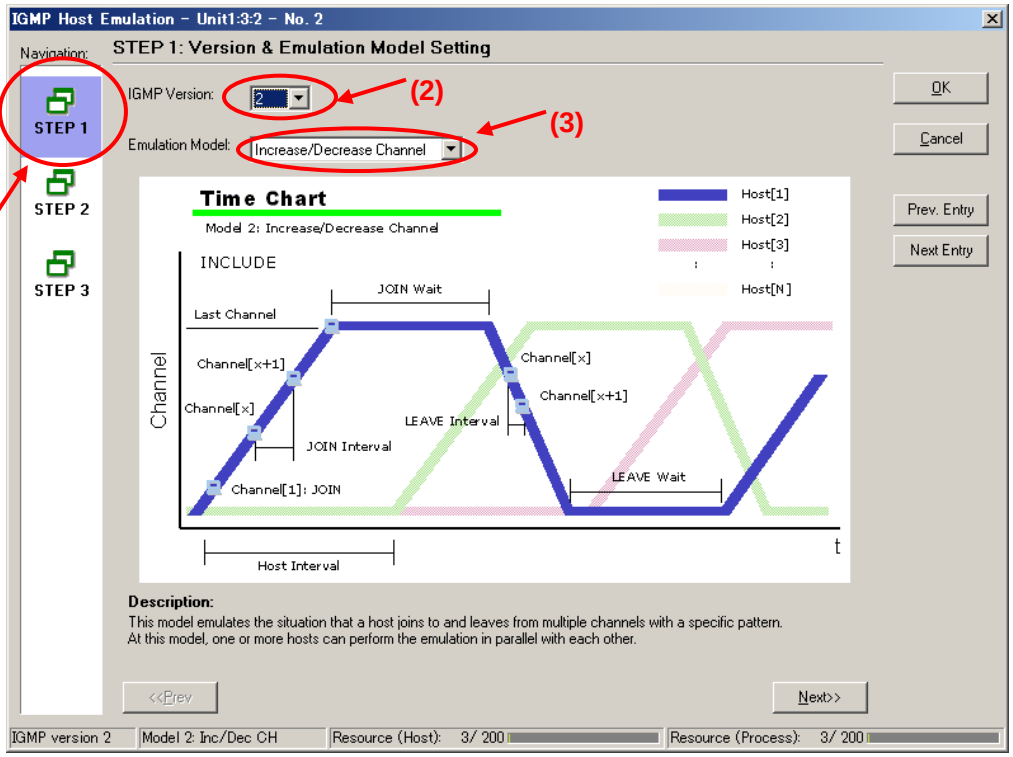


✧ Setting Port2 as Emulated Host Supporting IGMP (Sequence 2)

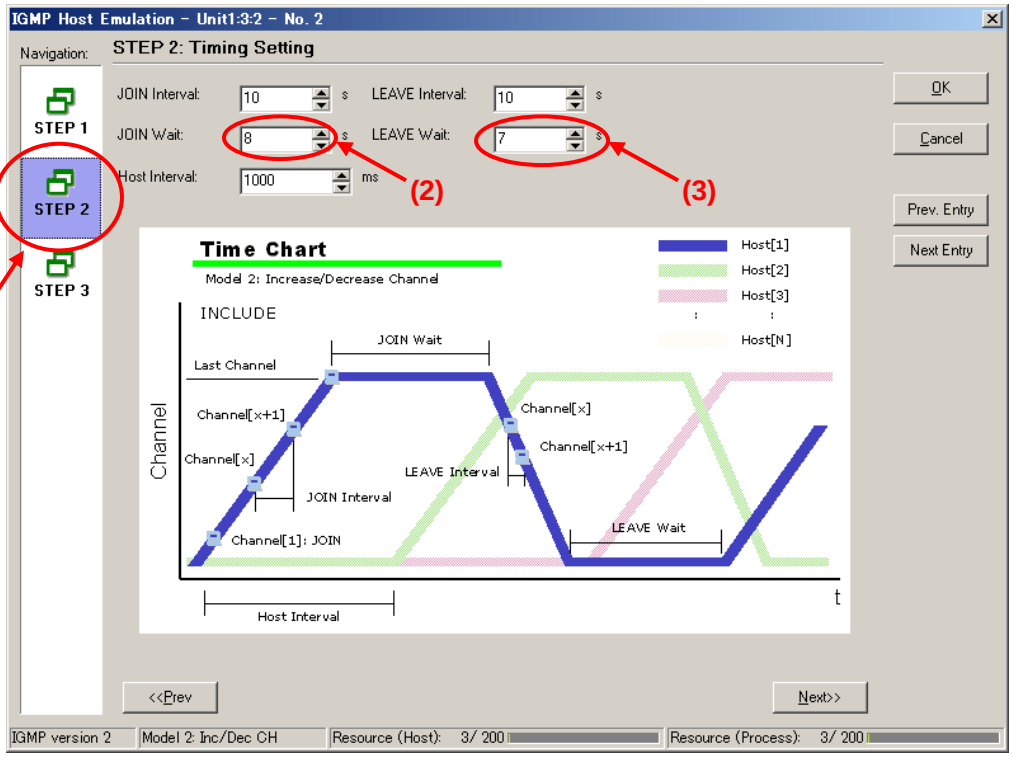
- Select Port2 and place a checkmark in the second “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.



- At [Step1] on the IGMP Host Emulation screen, set "IGMP Version:" to "2" and "Emulation Model:" to "Increase/Decrease Channel" (supports IGMP-v2 channel joining).



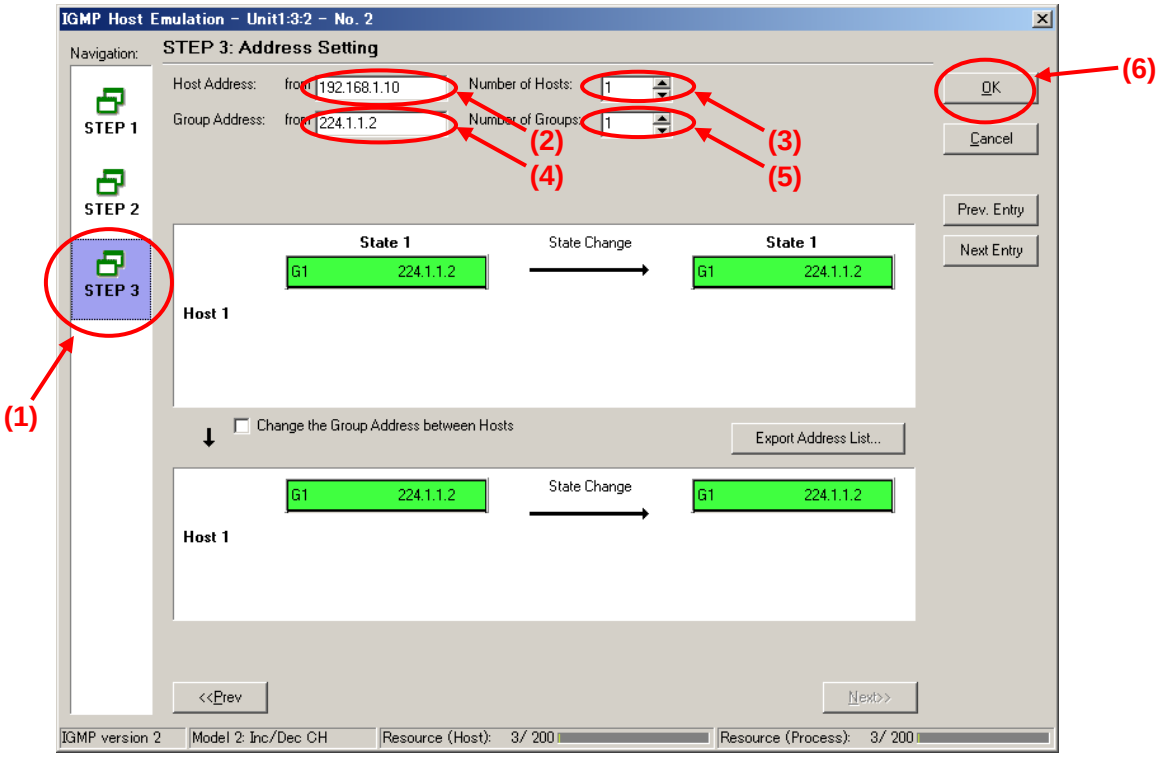
- At [Step2] of the IGMP Host Emulation screen, set "Join Wait:" to "8s", and "LEAVE Wait:" to "7s". (After joining the channel, this performs repeated "Connect for 8 seconds/Disconnect for 7 seconds" operations.)



- Set the value of "Host Address:" at [Step3] of the IGMP Host Emulation screen to "192.168.1.10".

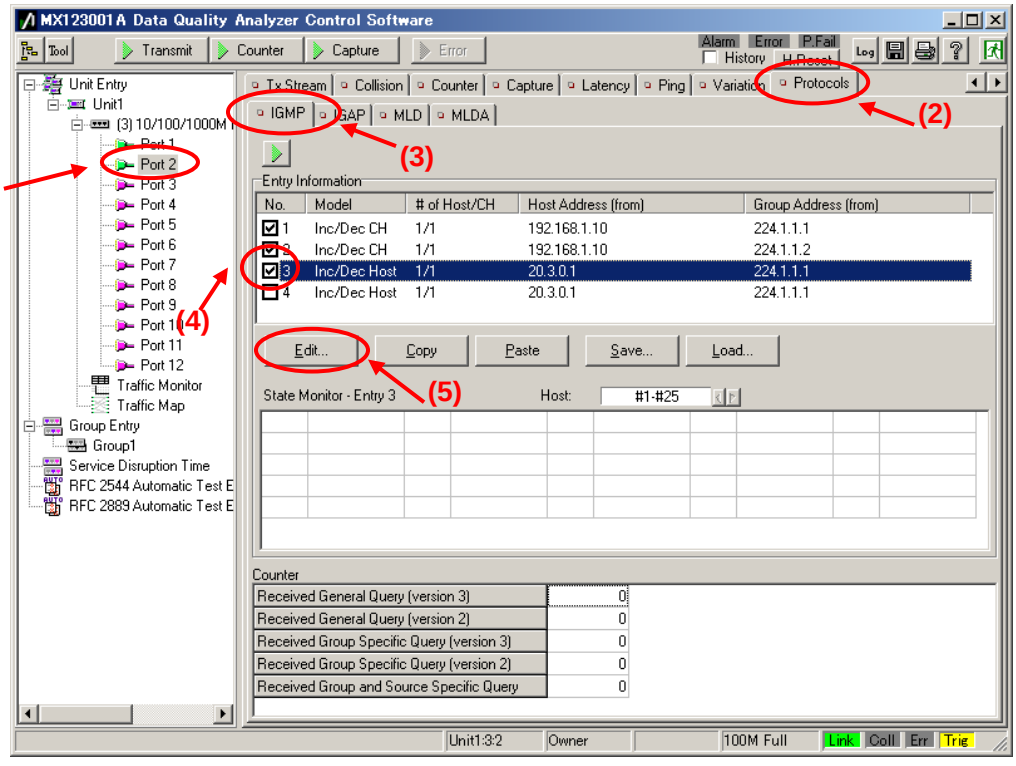
- Set the value of “Number of Host:” to “1”.
- Set the value of “Group Address:” to “224.1.1.2”.
- Set the value of “Number of Group:” to “1”.
- Press “OK” to close the setting screen.

This setting performs repeated Join/Leave operations to multicast address “224.1.1.2” with one emulated host at “192.168.1.10”.

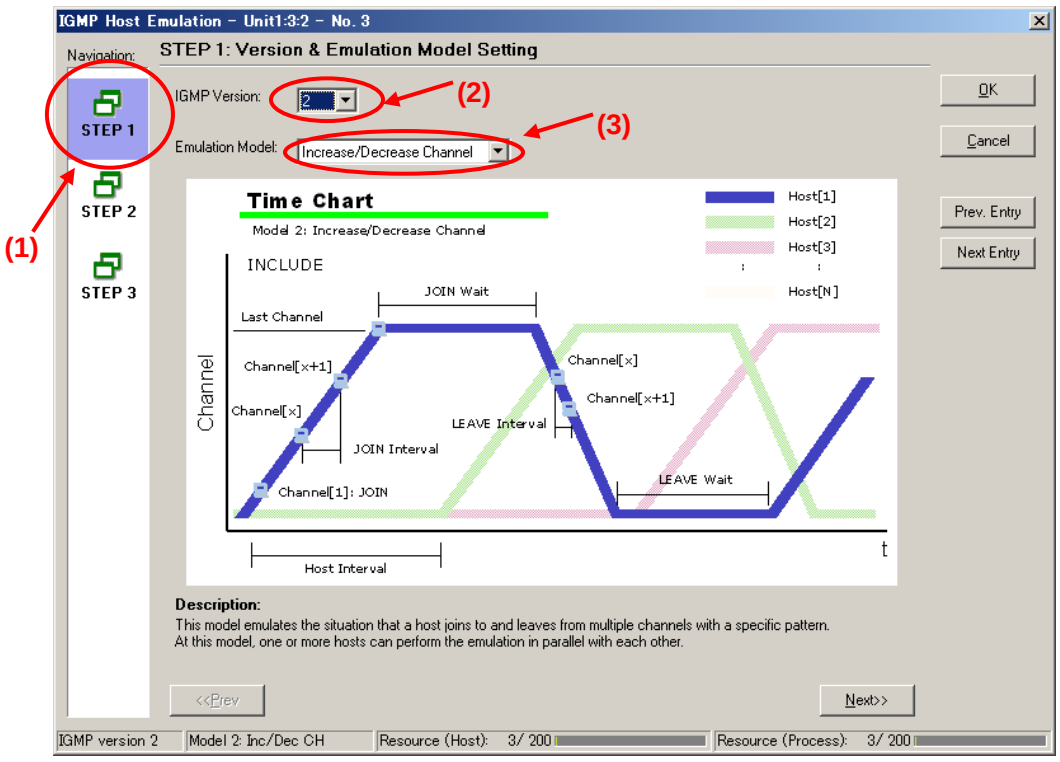


✧ Setting Port2 as Emulated Host Supporting IGMP (Sequence 3)

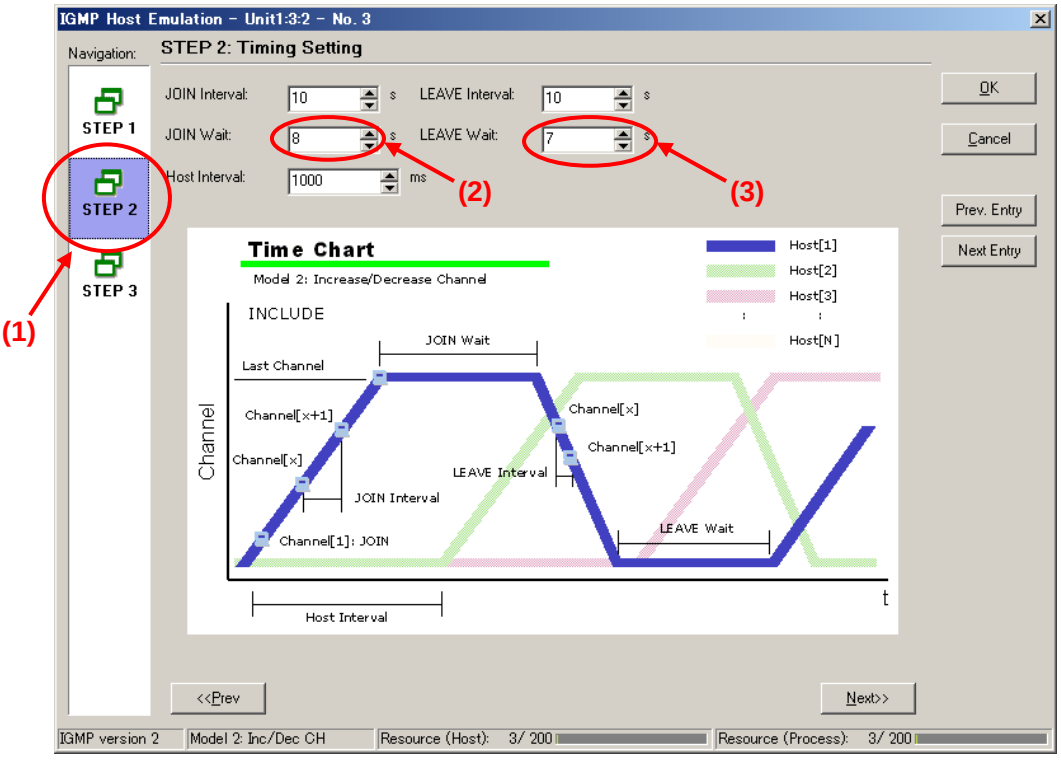
- Select Port2 and place a checkmark in the third “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.



- At [Step1] on the IGMP Host Emulation screen, set “IGMP Version:” to “2” and “Emulation Model:” to “Increase/Decrease Channel” (supports IGMP-v2 channel joining).

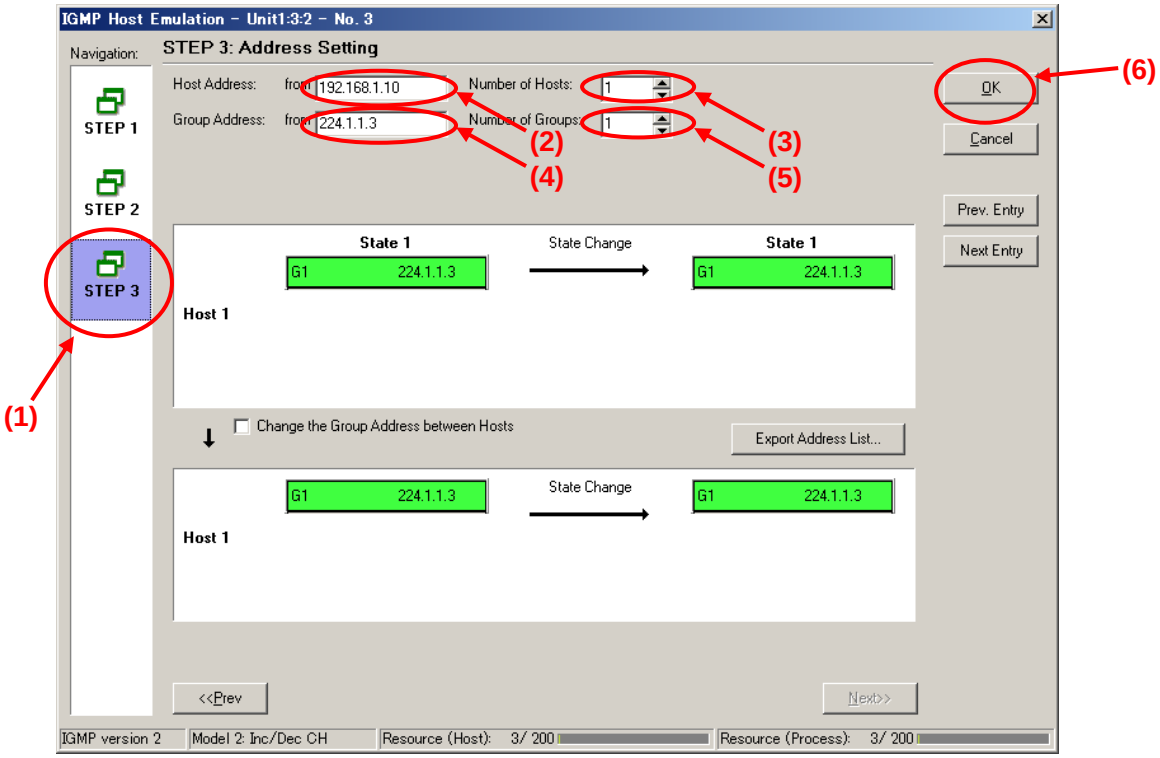


- At [Step2] of the IGMP Host Emulation screen, set “Join Wait:” to “8s”, and “LEAVE Wait:” to “7s”. (After joining the channel, this performs repeated “Connect for 8 seconds/Disconnect for 7 seconds” operations.)



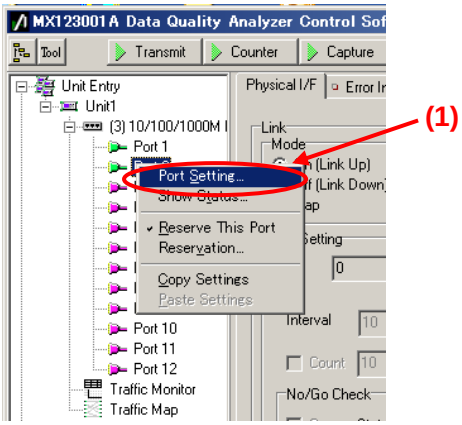
- Set the value of “Host Address:” at [Step3] of the IGMP Host Emulation screen to “192.168.1.10”.
- Set the value of “Number of Host:” to “1”.
- Set the value of “Group Address:” to “224.1.1.3”.
- Set the value of “Number of Group:” to “1”.
- Press “OK” to close the setting screen.

This setting performs repeated Join/Leave operations to multicast address “224.1.1.3” with one emulated host at “192.168.1.10”.

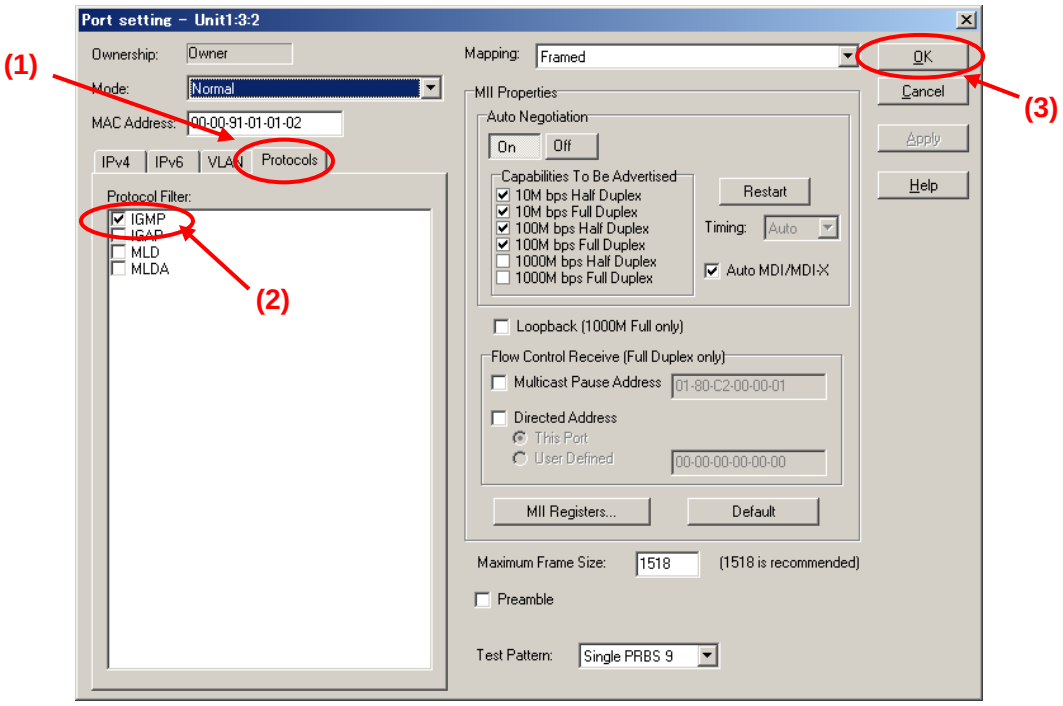


✧ Enabling IGMP Protocol at Port2

- Select Port2 and right-click to select “Port Setting” (opens “Port Setting” window).



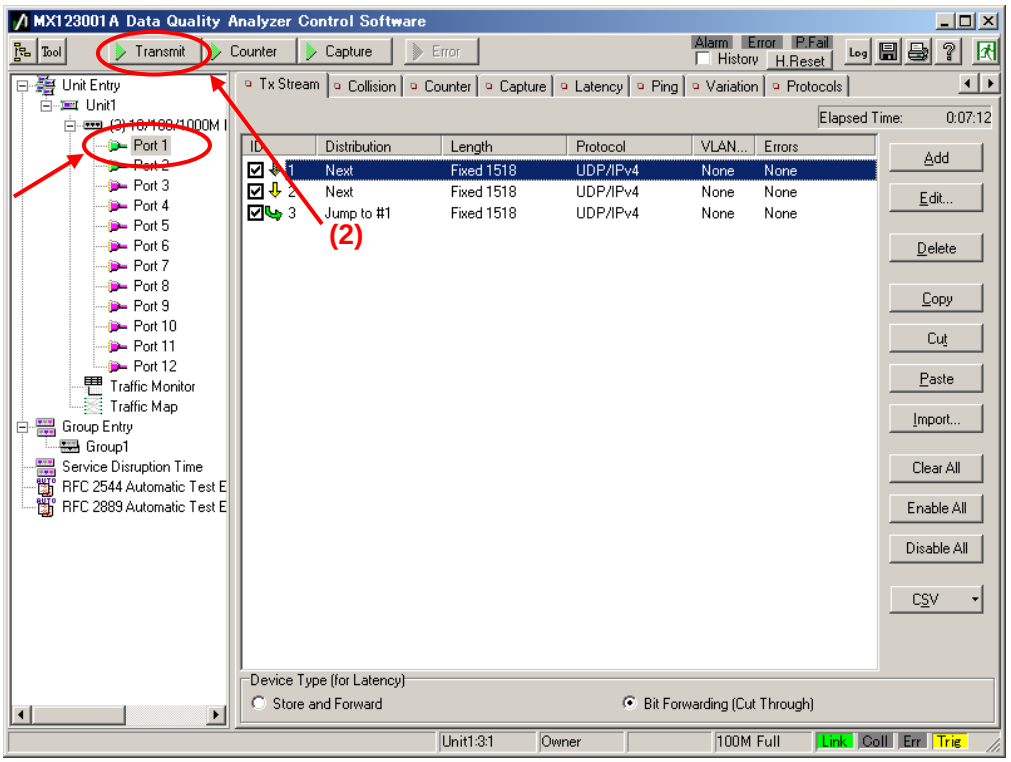
- Place a checkmark in “IGMP” of “Protocol Filter:” at [Protocol] of the Port Setting screen.
- Press the “OK” button.


Port setting – Unit1:3:2
Ownership:
Owner
Mode:
Normal
MAC Address:
00-00-91-01-01-02
IPv4
IPv6
VLAN
Protocols
Protocol Filter:
IGMP
IGAP
MLD
MLDA
Mapping:
Framed
MII Properties
Auto Negotiation
On
Off
Capabilities To Be Advertised
10M bps Half Duplex
10M bps Full Duplex
100M bps Half Duplex
100M bps Full Duplex
1000M bps Half Duplex
1000M bps Full Duplex
Restart
Timing:
Auto
Auto MDI/MDI-X
Loopback (1000M Full only)
Flow Control Receive (Full Duplex only)
Multicast Pause Address
01-80-C2-00-00-01
Directed Address
This Port
User Defined
00-00-00-00-00-00
MII Registers...
Default
Maximum Frame Size:
1518
(1518 is recommended)
Preamble
Test Pattern:
Single PRBS 9
OK
Cancel
Apply
Help
(1)
(2)
(3)

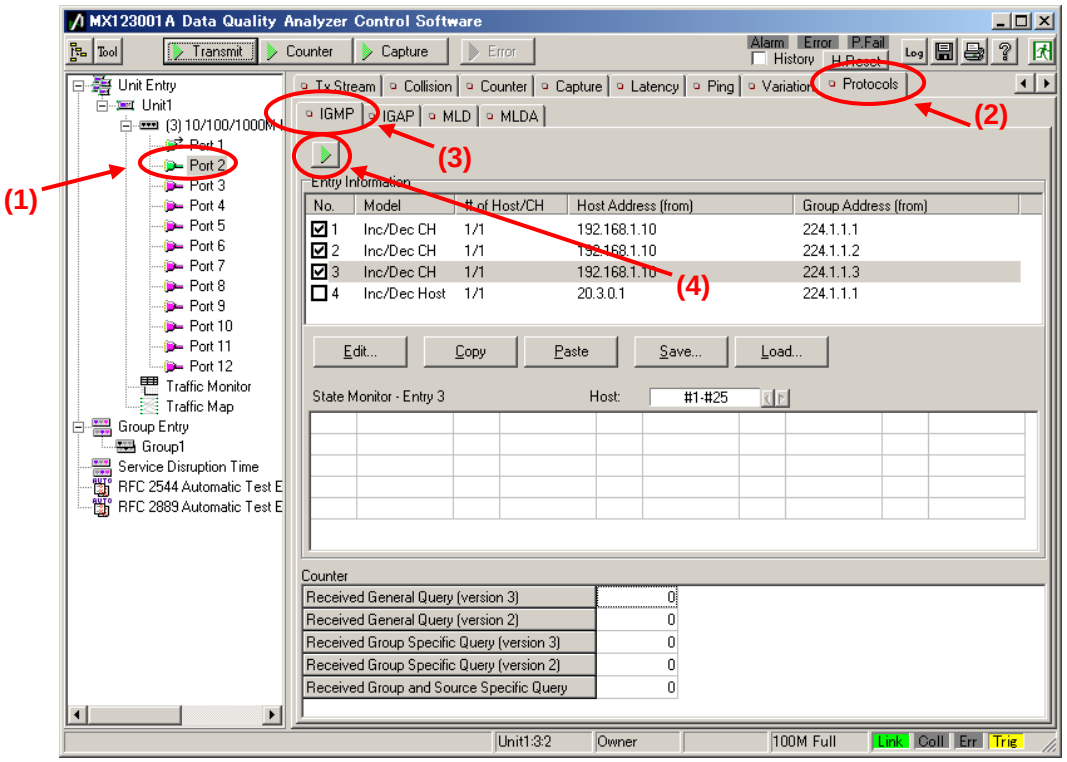
4.5. Monitoring Transmission Delay Time 1

(Outline)
Operate the emulated server and hosts and use the Multi Flow Counter function to monitor chronological changes in the transmission delay time.
(Contents)
Send the multicast stream from Port1 and perform Join/Leave operations (Channel Zapping) at Port2. In this condition, monitor the transmission delay time for multicast address “224.1.1.1”.
(Results)
You will learn how to monitor the transmission delay time of a multicast stream in the Channel Zapping condition and display the results as a chronological graph.

- ✧ Sending Multicast Stream from Port1 (Starting Output of Emulated Host)
  - ➢ Select Port1 and press the “Transmit” button at the top of the screen.

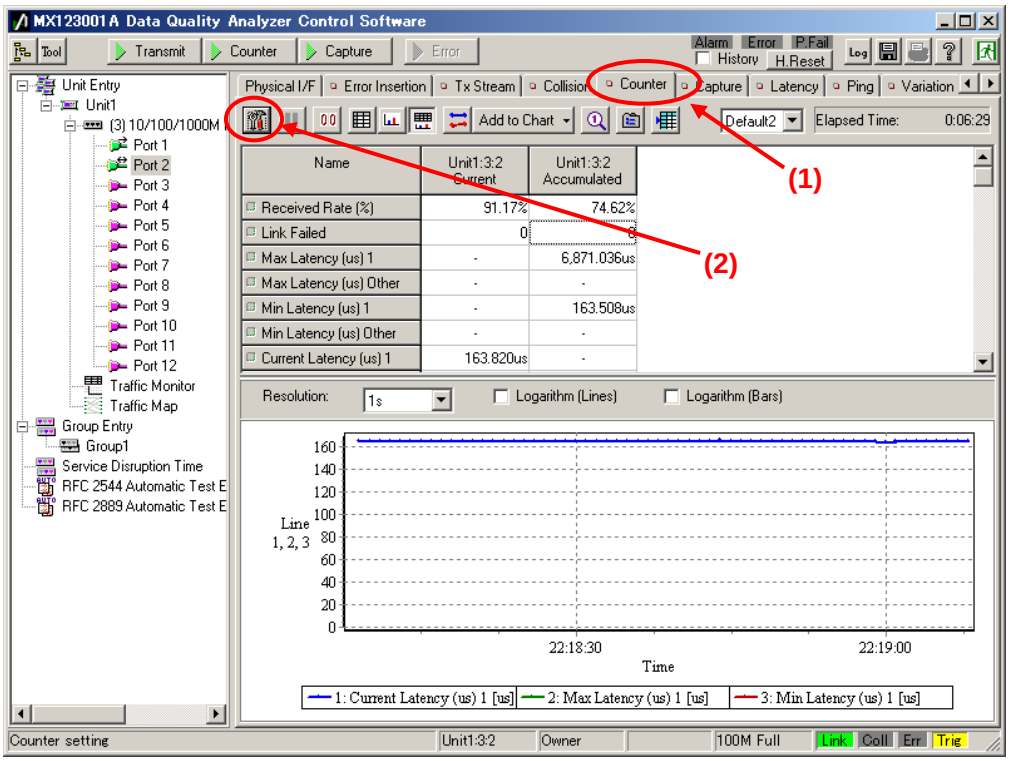


- ✧ Starting Join/Leave Operation at Port2 (Starting Emulated Host Operation)
  - ➢ Select Port2 and press the “IGMP” button at [IGMP] of the Protocol screen (starts repeated Join/Leave operation).



✧ Setting Filters for Multi Flow Counter at Port2 (Enables Latency Count for Flow at Multicast Address “224.1.1.1”)

➢ Select Port2 and press the “Counter Setting” button at the Counter screen to open the “Setting” screen.

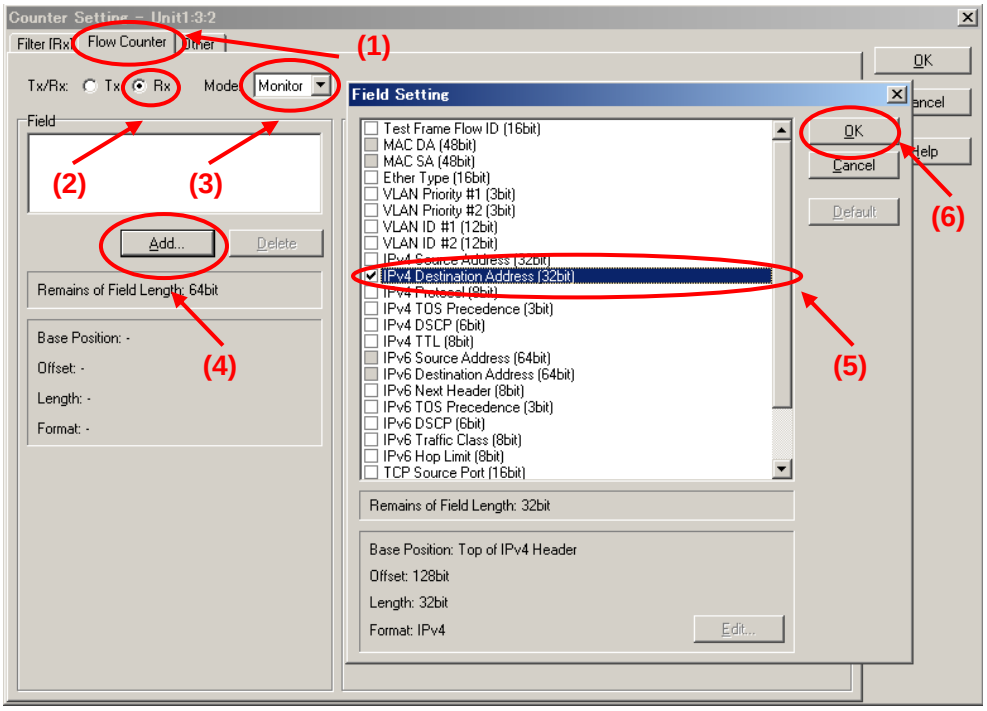


➢ Set “Tx/Rx” at “Flow Counter” of the Counter Setting screen to “Rx”.

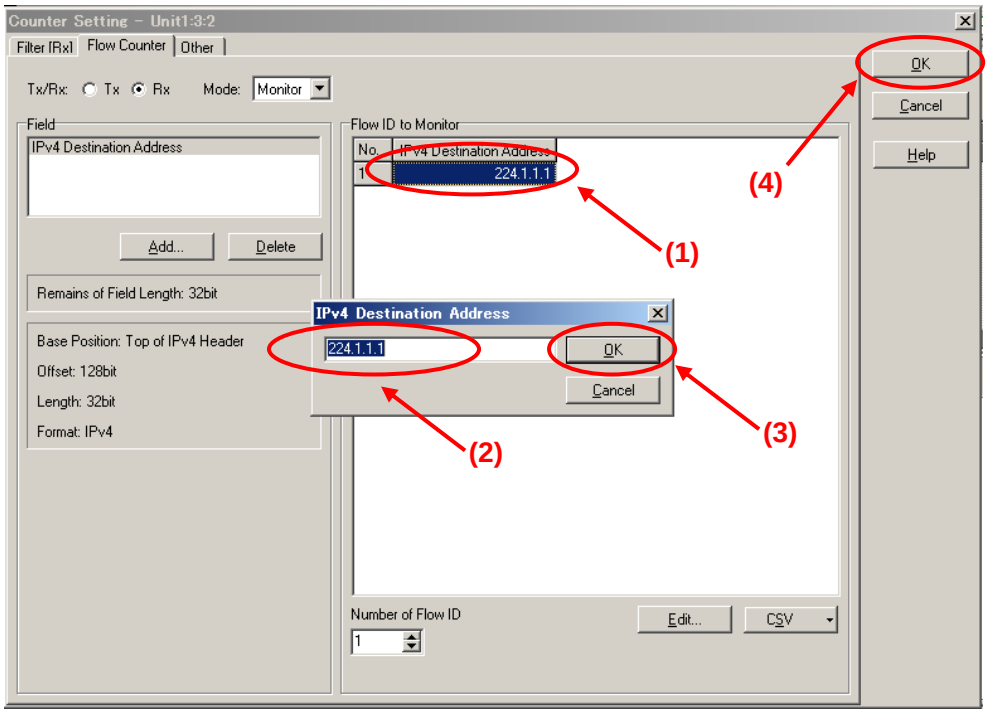
➢ Set “Mode:” to “Monitor”.

➢ Press the “Add…” button to open the “Field Setting” screen.

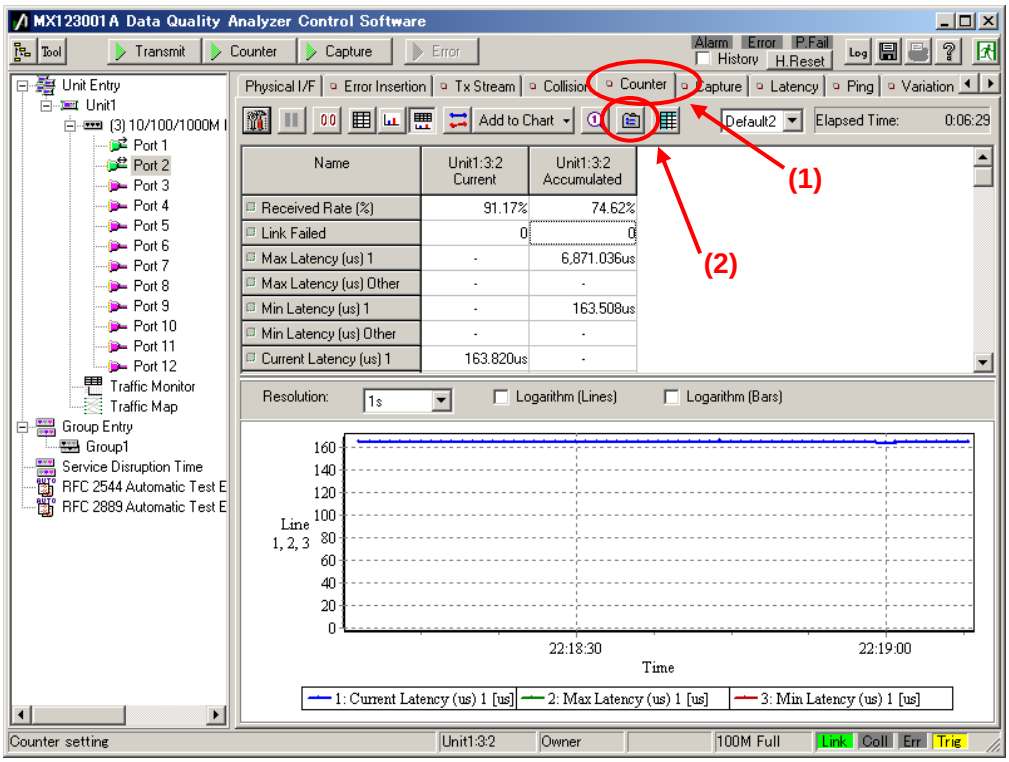
- Place a checkmark in “IPv4 Destination Address [32bit]” at the Field Setting screen and press the “OK” to close the window.



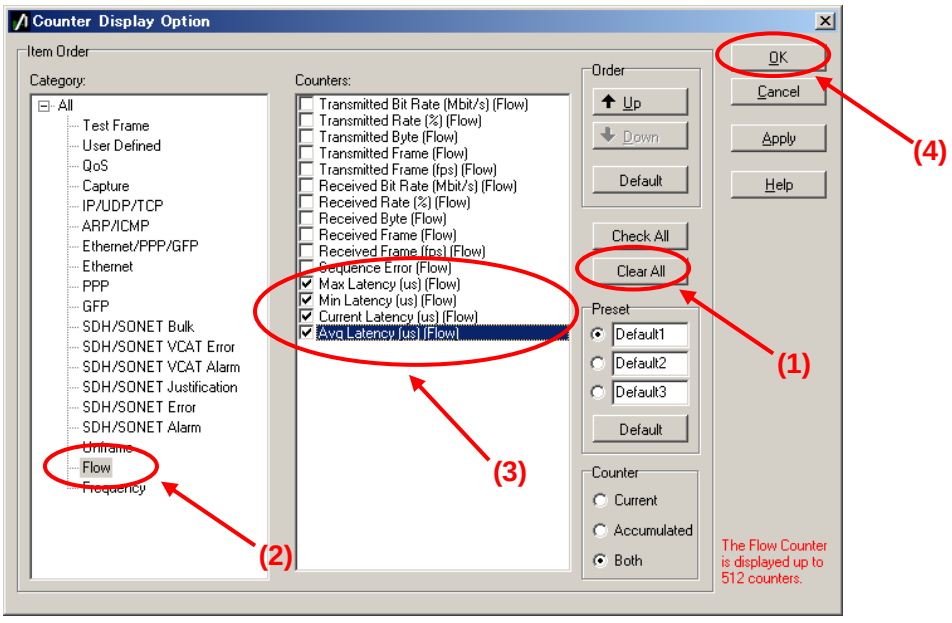
- Select “IPv4 Destination Address” at Flow Counter of the Counter Setting screen and press the “Edit…” button to open the ”IPv4 Destination Address” input window.
- Input “224.1.1.1” at the “IPv4 Destination Address” input window and press the “OK” button.
- Press the “OK” button to close the Counter Setting screen.



- Select Port2 and press the “Counter Display Option” button at the Counter screen to open the “Counter Display Option” screen.

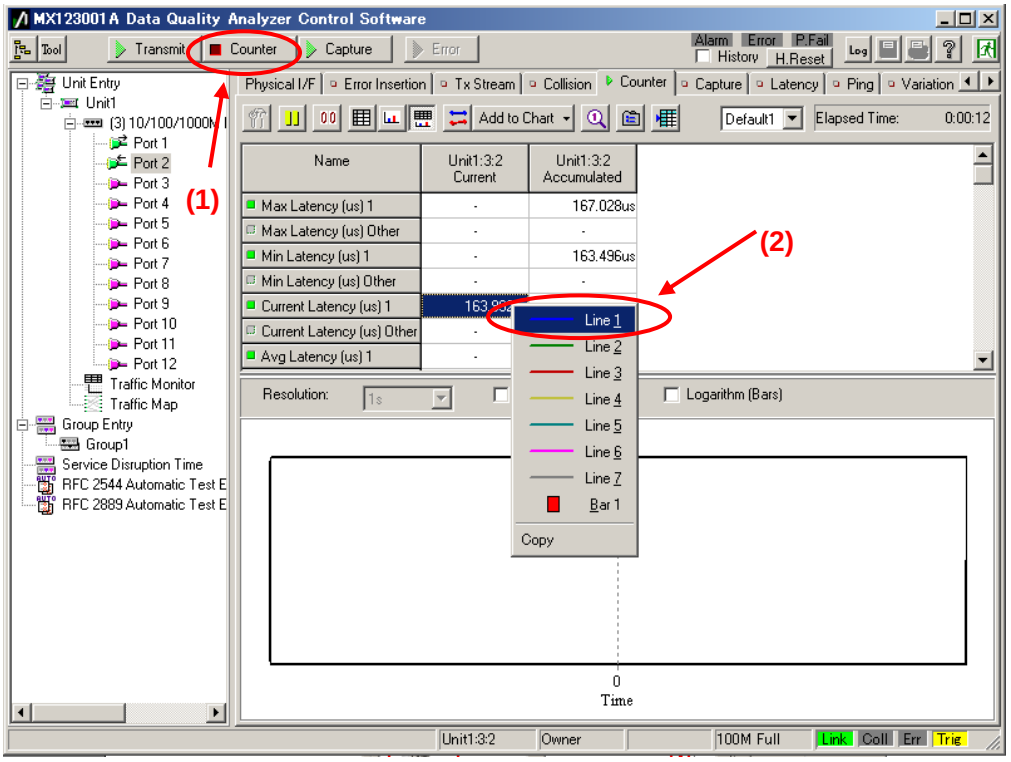


- Press the “Clear All” at the Counter Display Option screen to clear all the displayed counts at once.
- Select “Flow” of “Category” and place checkmarks in the following items.
  - ✓ “Max Latency (us) [Flow]”
  - ✓ “Min Latency (us) [Flow]”
  - ✓ “Current Latency (us) [Flow]”
  - ✓ “Ave. Latency (us) [Flow]”
- Press the “OK” button to close the screen.

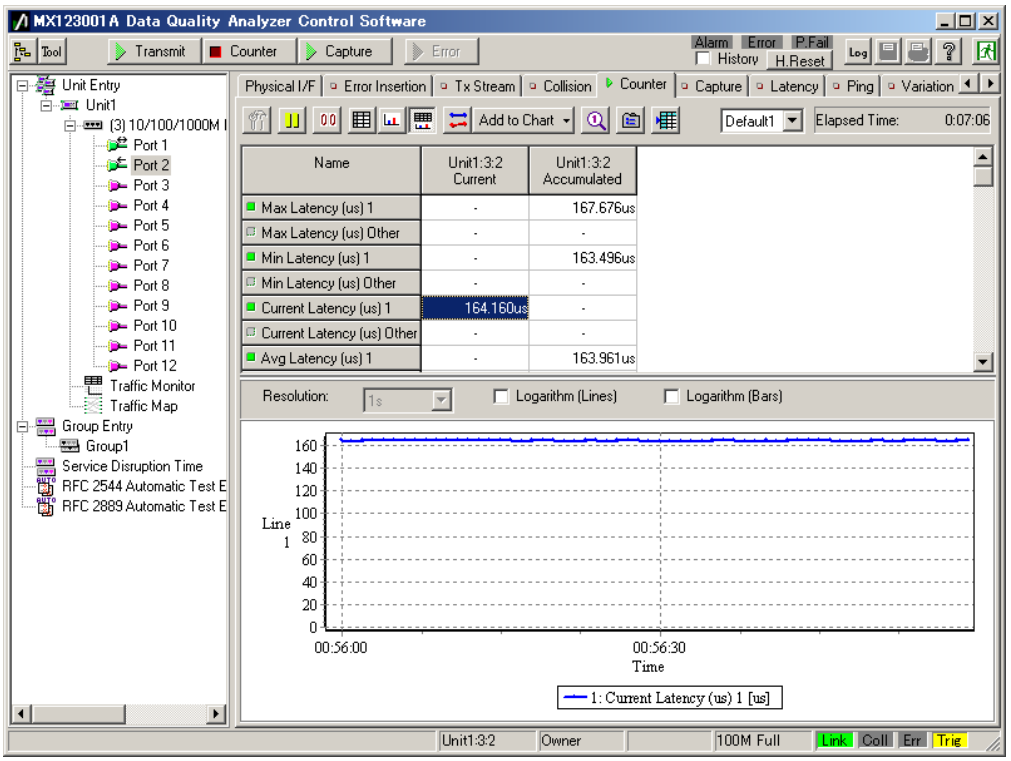


- Select Port2 and press the “Counter” button at the top of the screen to start measurement.

- Select “Current Latency (us) 1” of the counter items and right-click “Line 1” from the menu.



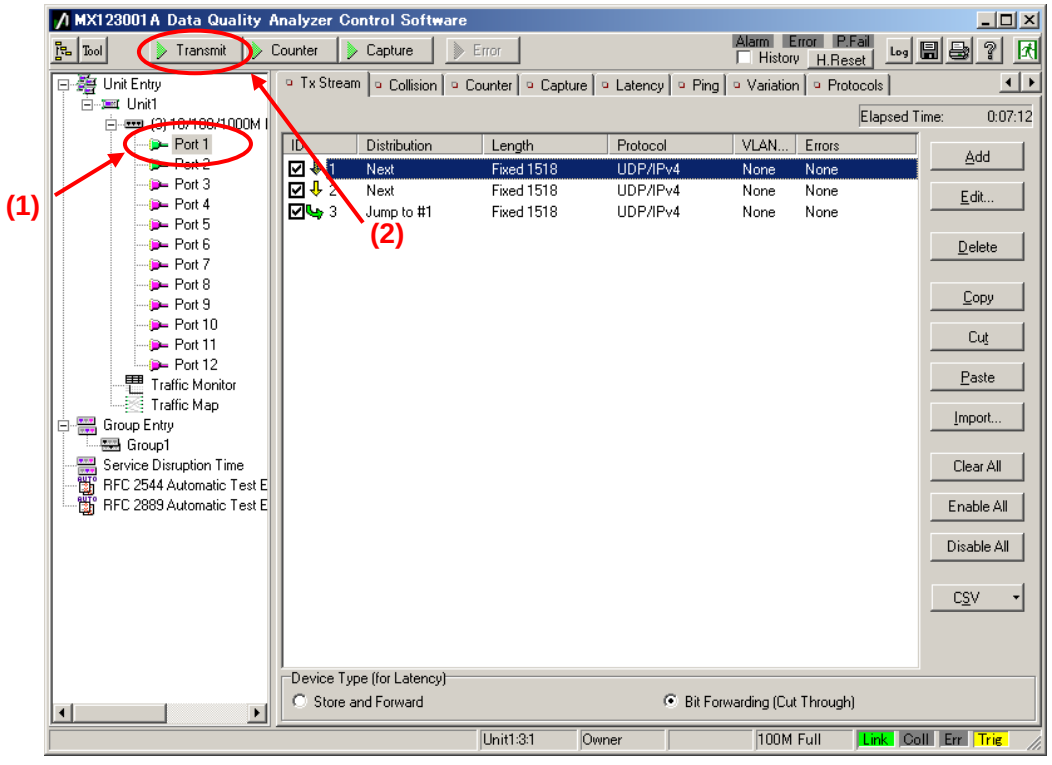
- The transmission delay time changes over time as shown below, and can be monitored on the graph.



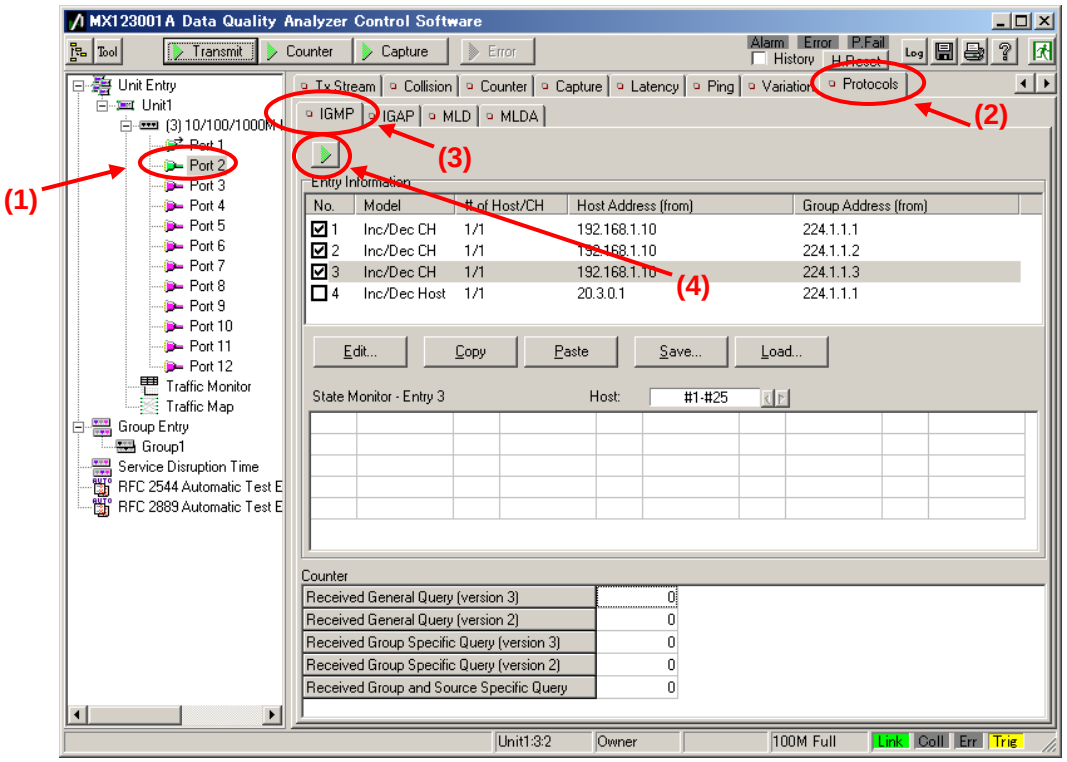
4.6. Monitoring Transmission Delay Time 2

(Outline)
Operate the emulated server and host and monitor the dispersion (Packet Jitter) of the transmission delay time using the Variation function.
(Contents)
Send a multicast stream from Port1 and perform Join/Leave (Zapping) at Port2. In this condition, monitor the transmission delay time. The dispersion in the transmission delay time of multicast address “224.1.1.1” is monitored.
(Results)
You will learn how to measure packet jitter of a multicast stream under Channel Zapping conditions.

- ✧ Sending Multicast Stream from Port1 (Starting Output of Emulated Host)
  - ➢ Select Port1 and press the “Transmit” button at the top of the screen.

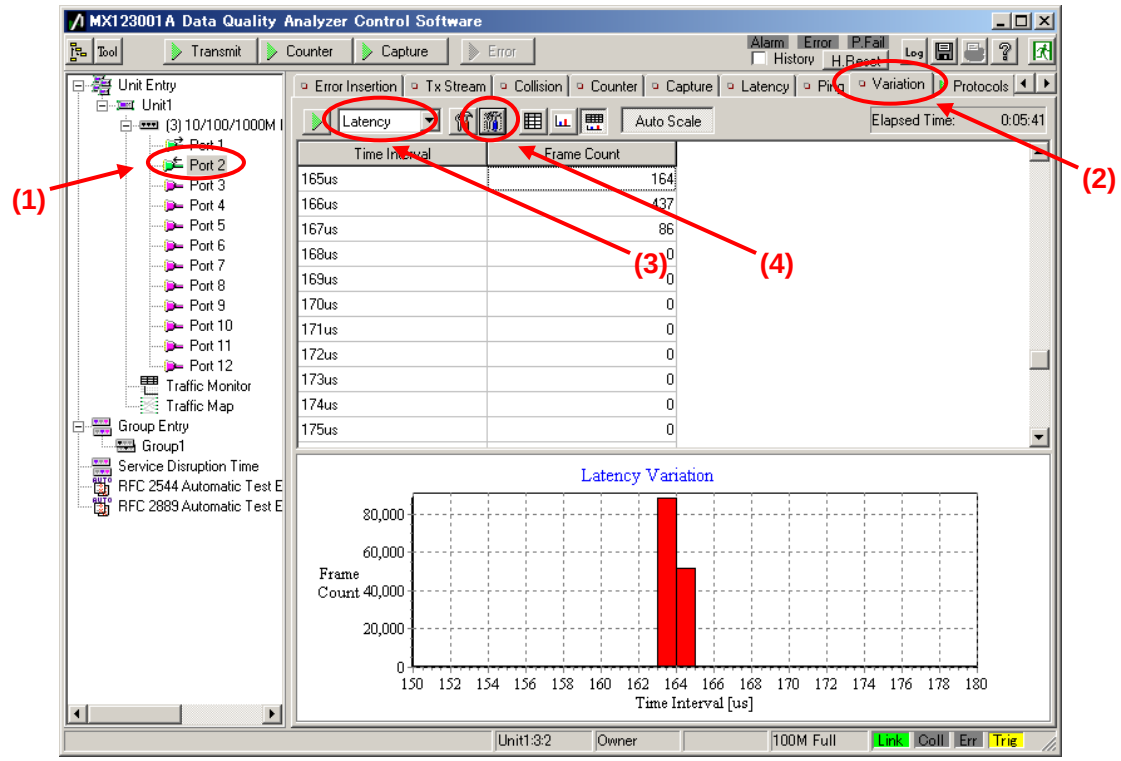


- ✧ Starting Join/Leave Operation at Port2 (Starting Emulated Host Operation)
  - ➢ Select Port2 and press the “IGMP” button at [IGMP] of the Protocol screen (starts repeated Join/Leave operation).



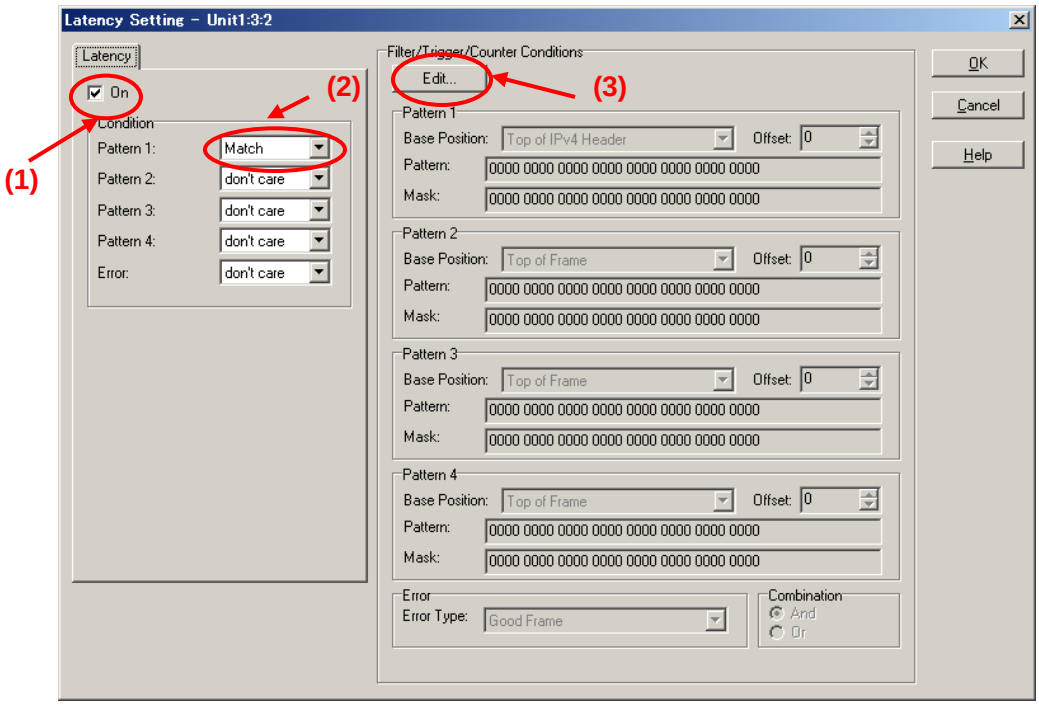
✧ Set the Variation filter at Port2. (This monitors the Latency dispersion of the flow for multicast address “224.1.1.1”.)

➢ Select Port2 and select “Latency” at the Variation screen. Press the “Latency Setting” button to open the “Latency Setting” screen.

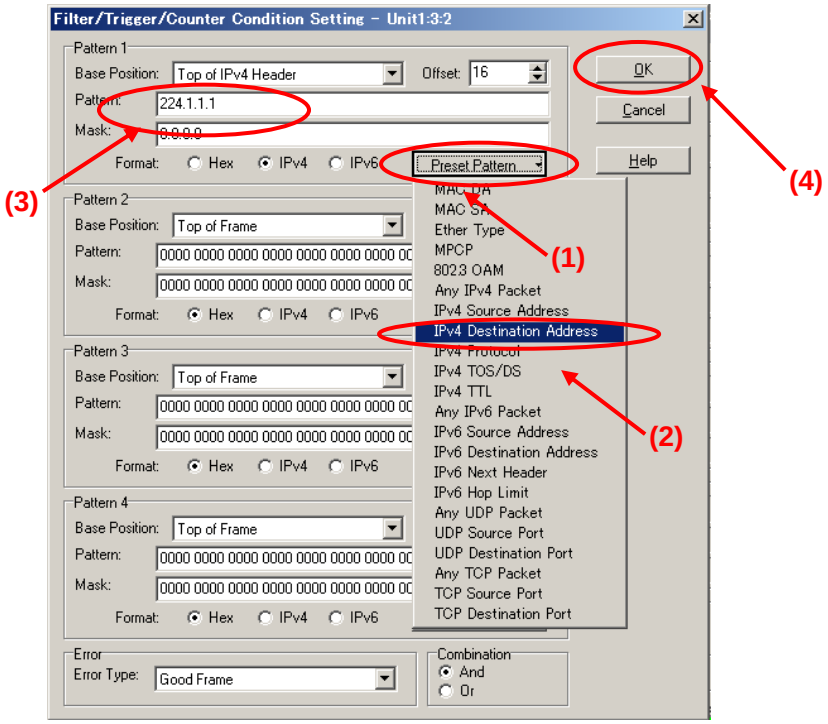


➢ Place a checkmark in “On” at the Latency Setting screen and set “Pattern1” of “Conditions” to “Match”.

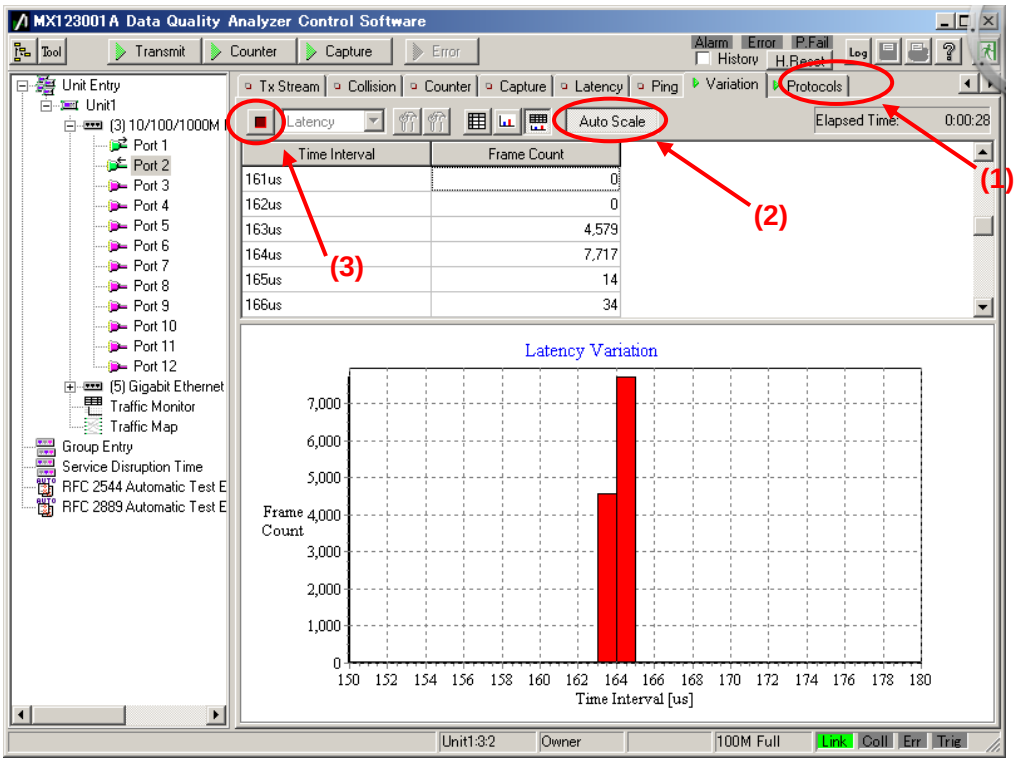
➢ Press “Edit…” to open the “Filter/Trigger/Counter Condition” screen.



- Select “IPv4 Destination Address” from “Preset Pattern” at Pattern1 of the Filter/Trigger/Counter Condition Setting screen.
- Set the value of “Pattern:” at Pattern1 to “224.1.1.1”.
- Press the “OK” button to close the screen.



- Select Port2 and press the “Auto Scale” button at the Variation screen.
- Press the “Variation” start button to start monitoring Packet Jitter.
- The Packet Jitter changes over time as shown below, and can be monitored on the graph.


MX123001A Data Quality Analyzer Control Software
Transmit
Counter
Capture
Error
Alarm
Error
P.Fail
History
H.Reset
Unit Entry
Unit1
(3) 10/100/1000M
Port 1
Port 2
Port 3
Port 4
Port 5
Port 6
Port 7
Port 8
Port 9
Port 10
Port 11
Port 12
(5) Gigabit Ethernet
Traffic Monitor
Traffic Map
Group Entry
Service Disruption Time
RFC 2544 Automatic Test E
RFC 2889 Automatic Test E
Tx Stream
Collision
Counter
Capture
Latency
Ping
Variation
Protocols
Latency
Auto Scale
Elapsed Time:
0:00:28
Time Interval
Frame Count
161us
0
162us
0
163us
4,579
164us
7,717
165us
14
166us
34
(1)
(2)
(3)
Latency Variation
Frame Count
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
150 152 154 156 158 160 162 164 166 168 170 172 174 176 178 180
Time Interval [us]
Unit1:3:2
Owner
100M Full
Link
Coll
Err
Trig

4.7. Analysing Measurement Results

(Outline)
Analyze the multicast stream transmission delay results.
(Contents)
Examine the measurement results on the sample screen.
(Results)
You will learn how to evaluate the multicast stream transmission delay measurement results.

The transmission delay times displayed on the example screen range from 163.496 to 167.676 us.
This shows the packet arrival time when hosts (subscribers) are performing Channel Zapping on a video streaming service using multicast streaming typically used by IPTV. Since multicast communications require real-timeness, transmission delay and dispersion are important factors in network QoS. The actual transmission varies with the number of routers and their performance on the multicast streaming network as well as with the subscriber behavior (Channel Zapping conditions) and rich content (network load). When monitoring the overall service, it is very important to remember that the network performance is impacted by all the users.
The purpose of this measurement is evaluation of network performance. Evaluating network performance in advance can help prevent problems before they occur and plan future network development.

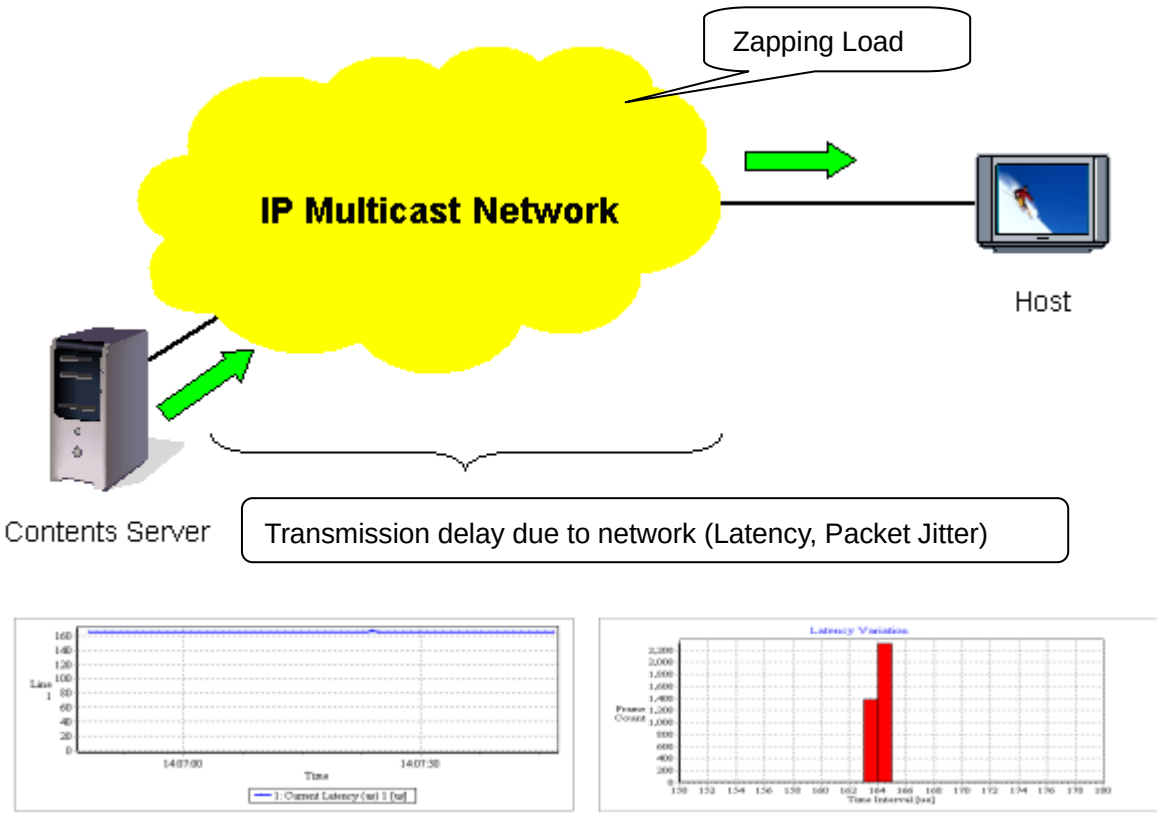


Fig. 11 Transmission Delay Time due to Network

5. Evaluation Example 3…QoS Measurement

5.1. Connecting DUT

(Outline)
Connect an IP multicast network to the MD1230B.
(Contents)
First, provide an IP multicast network environment using a router. (This guide describes an IPv4 network using the IGMP protocol (at host side) and PIM-SM protocol (at network side).
When connected to the MU120131A, Port 1 emulates a server and Port 2 emulates a host.
(Results)
You will learn about connecting the DUT with measuring equipment.

- Connecting Multicast Routers
  - Connect Port1 of the MU120131A to the server-side router. (In this guide, the server-side network is “192.168.4.0/24”.)
  - Connect Port2 of the MU120131A to the host-side router. (In this guide, the host-side network is “192.168.1.0/24”.)

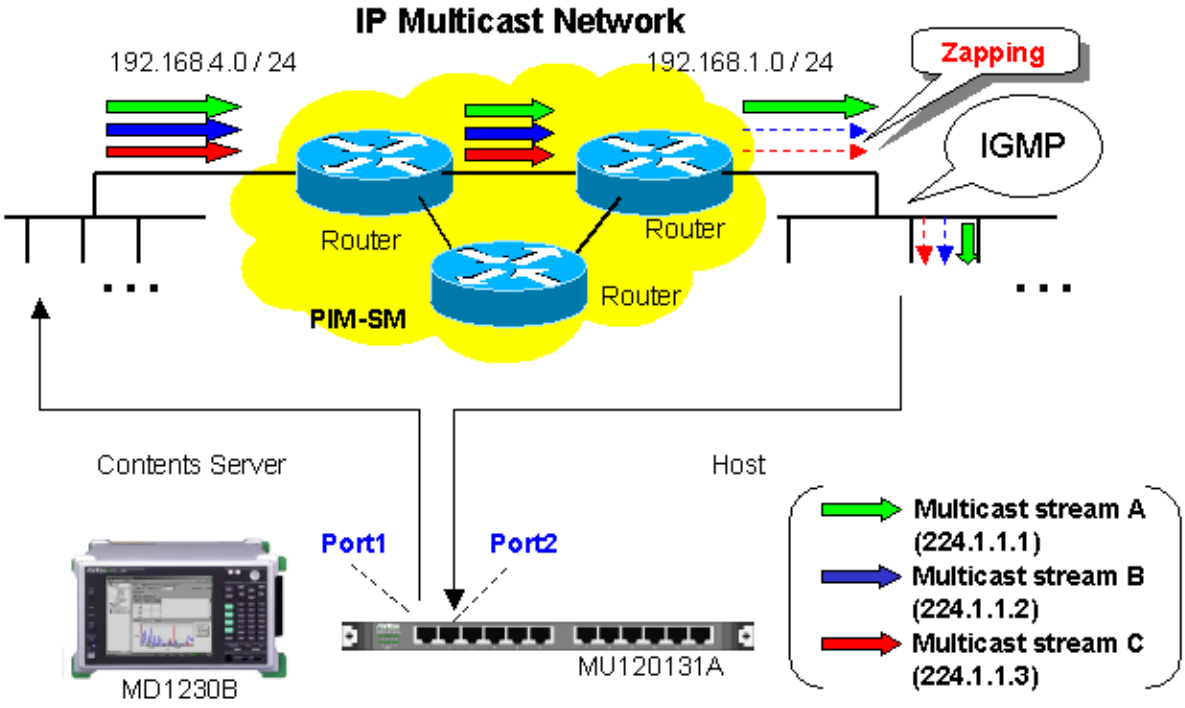


Fig. 12 Connecting DUT

5.2. Setting Measurement Ports

(Outline)
Perform the basic settings for the ports operating as the emulated server and emulated host.
(Contents)
Set the following port numbers and addresses for the emulated server and host.
In addition, perform settings for ARP and Ping.

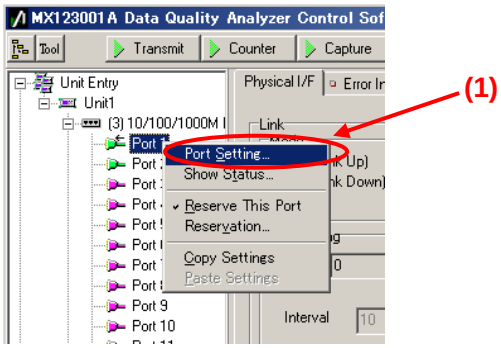
[Emulated Server]
Port number: Port1
MAC Address: 00-00-91-01-01-01
IPv4 Address: 192.168.4.10
Netmask: 255.255.255.0
Gateway: 192.168.4.254

[Emulated Host]
Port number: Port2
MAC Address: 00-00-91-01-01-02
IPv4 Address: 192.168.1.10
Netmask: 255.255.255.0
Gateway: 192.168.1.254

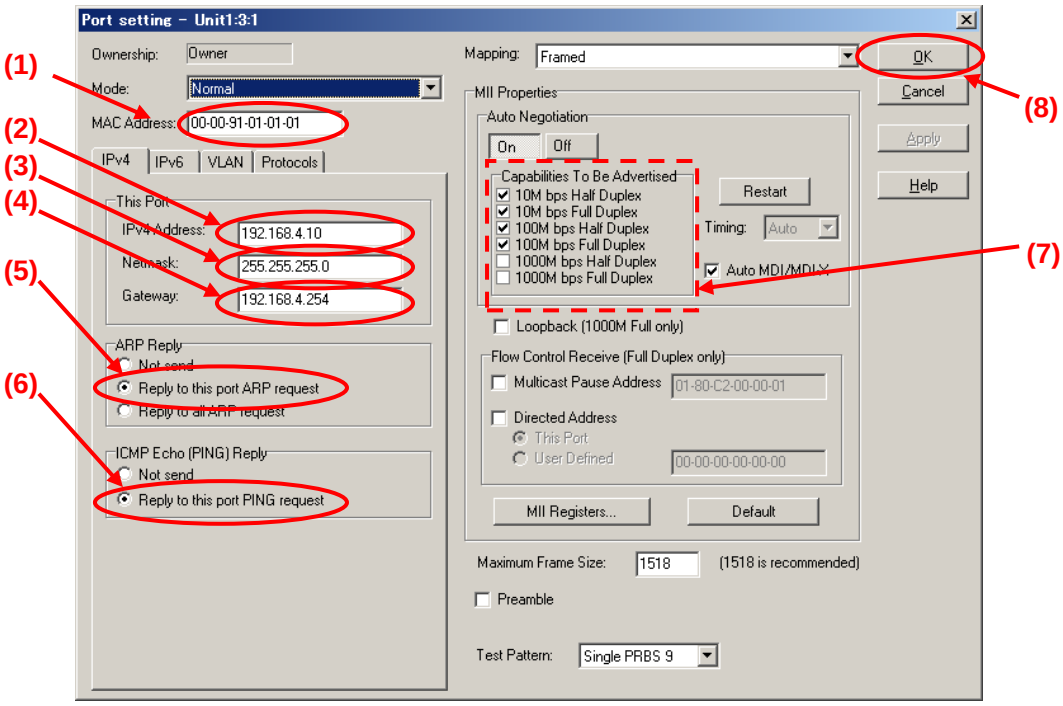
(Results)
You will learn basic settings for using ports for measurement.

✧ Setting Port Operating as Emulated Server

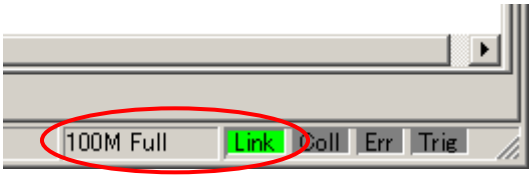
➢ Select Port1 and right-click to select “Port Setting” (opens “Port Setting” window).



➢ Set “MAC Address:” to “00-00-91-01-01-01”.
➢ Set “IPv4 Address:” to “192.168.4.10”.
➢ Set “Netmask:” to “255.255.255.0”.
➢ Set “Gateway:” to “192.168.4.254”.
➢ Select “Reply to this port ARP request”.
➢ Select “Reply to this port PING request”.
➢ Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).
➢ Press the “OK” button.

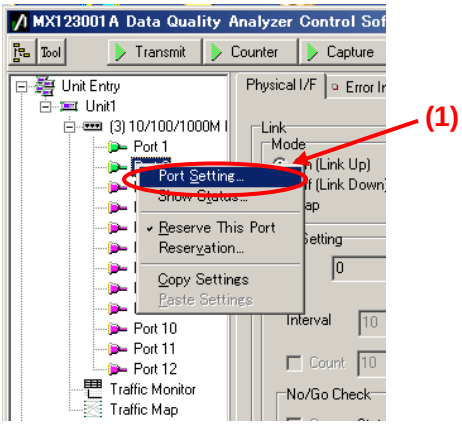


- Check that 100M Full is displayed at the screen bottom right and that the Link LED is green. (Confirm that the connection between the router and instruments is Link Up at “100Mbps Full Duplex”.)



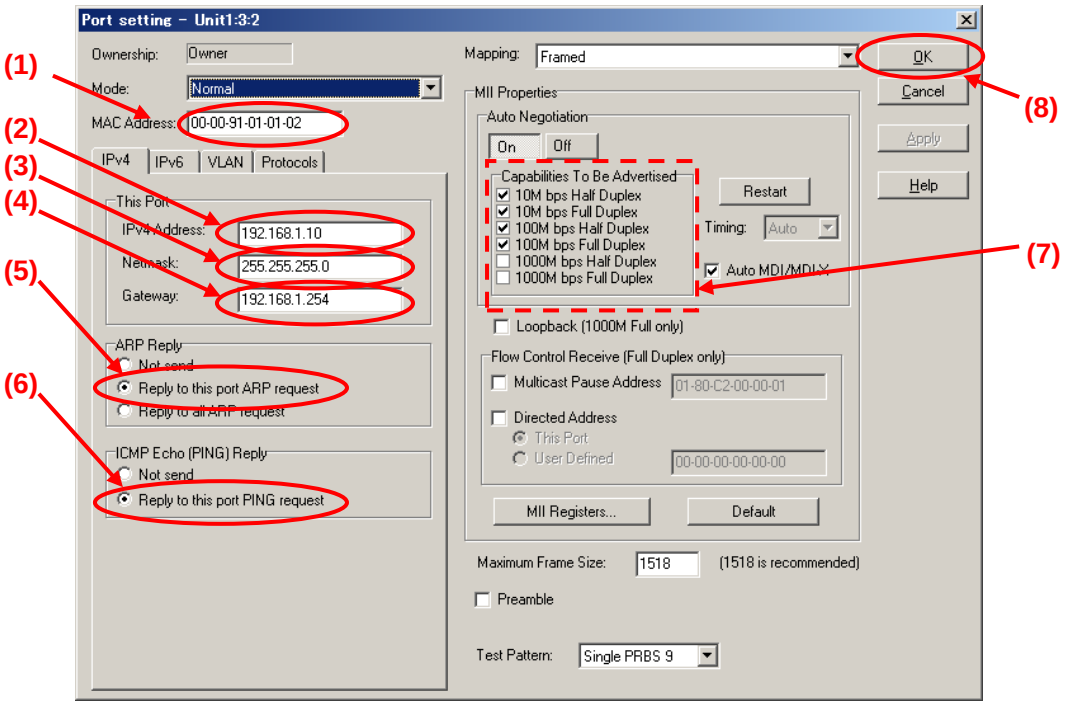
✧ Setting Port Operating as Emulated Host

- Select Port2 and right-click Port Setting (opens “Port Setting” window).

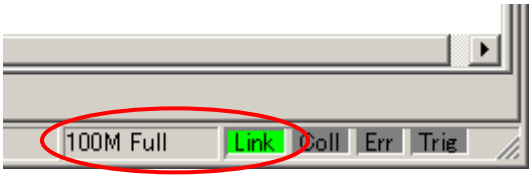


- Set “MAC Address:” to “00-00-91-01-01-02”.
- Set “IPv4 Address:” to “192.168.1.10”.
- Set “Netmask:” to “255.255.255.0”.
- Set “Gateway:” to “192.168.1.254”.
- Select “Reply to this port ARP request”.
- Select “Reply to this port PING request”.

- Remove the checkmarks in “1000 Mbps Half Duplex” and “1000 Mbps Full Duplex” of “Auto Negotiation” (when the router connection port is 100 Mbps Full Duplex).
- Press the “OK” button.

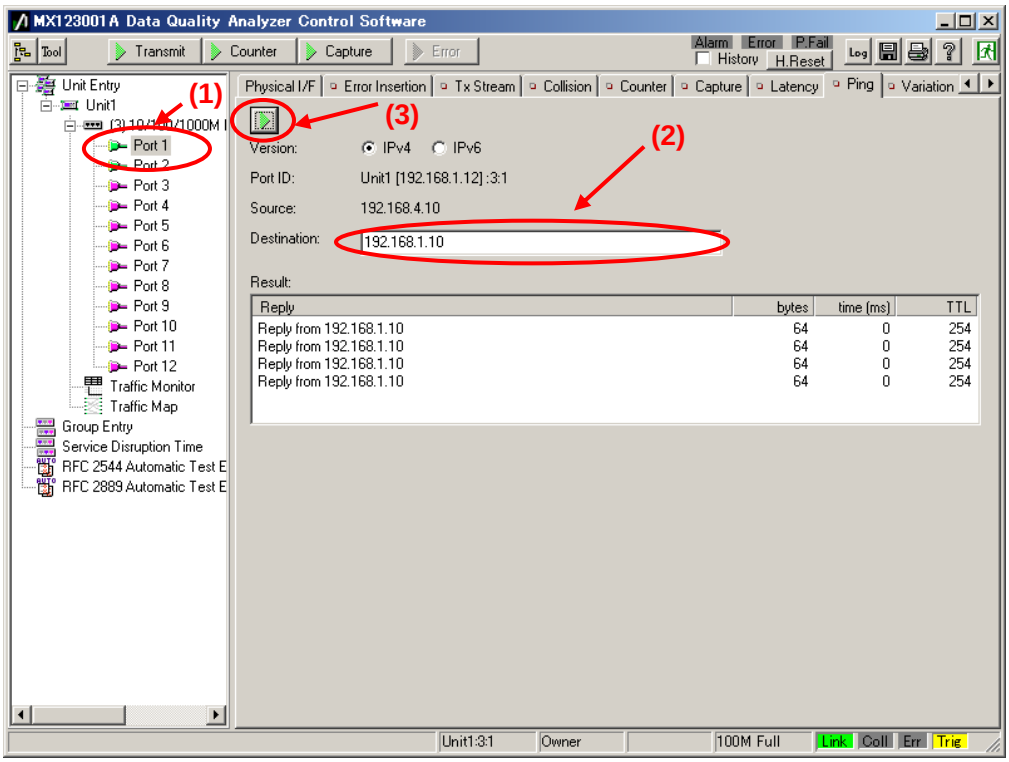


- Check that 100M Full is displayed at the screen bottom right and that the Link LED is green. (Confirm that the connection between the router and instruments is Link Up at “100Mbps Full Duplex”.)



✧ Checking Connection

- Display the Ping screen for Port1, set the value of “Destination:” to “192.168.1.10” and press the “Ping” button.

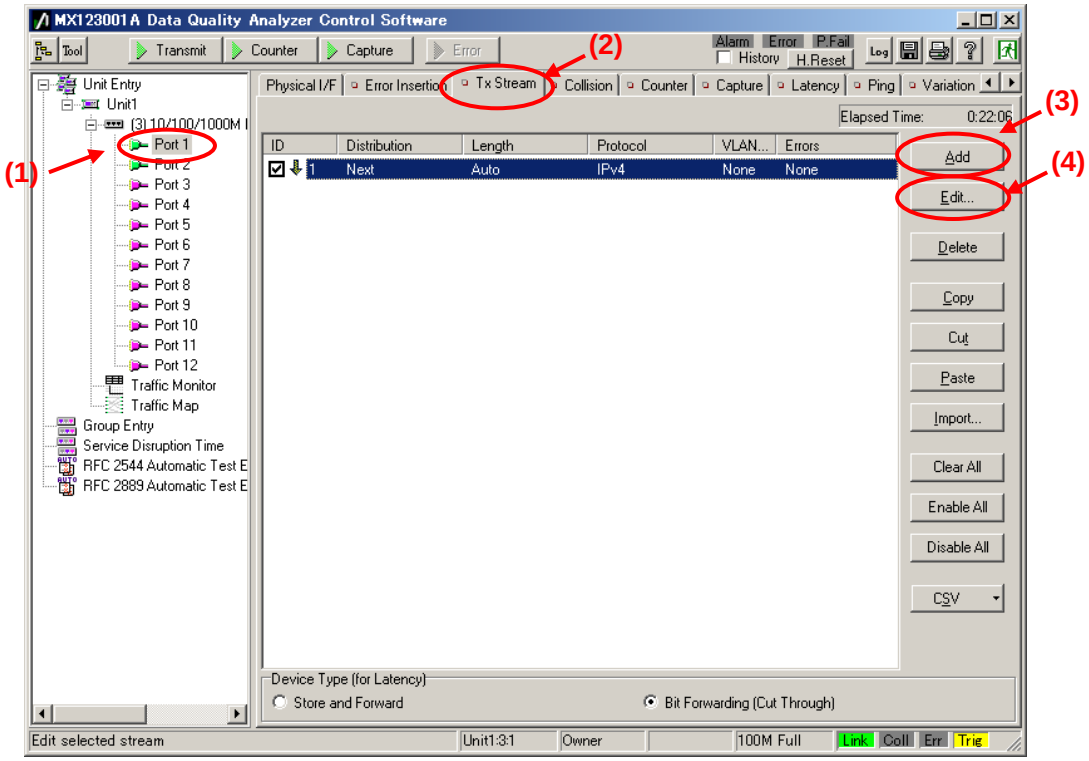


- Check that “Reply from 192.168.1.10” is displayed in “Result:”. (This checks the connection over the router.)

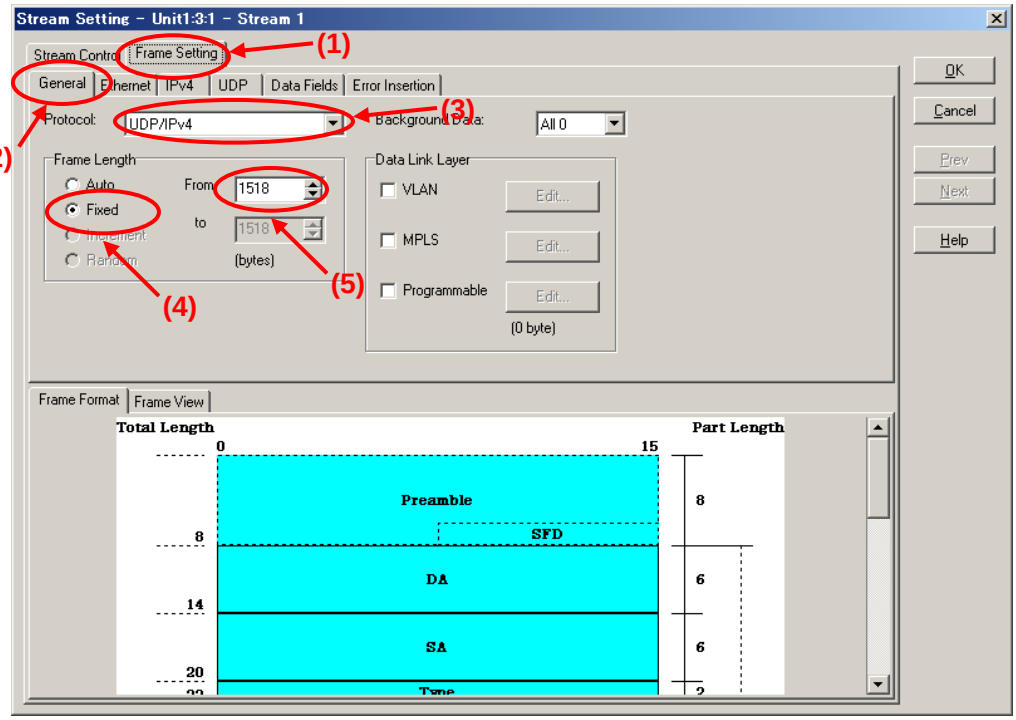
5.3. Setting Tx Stream

(Outline)
Create multicast stream data for operating as emulated server.
(Contents)
Broadcast a multicast stream using the MD1230B Tx Stream generation function.
In this example, three multicast streams are prepared (multicast addresses: “224.1.1.1” / “224.1.1.2” / “224.1.1.3”). The traffic for each stream is 5 Mbps. To measure the delay time, a timestamp is buried in the stream with multicast address “224.1.1.1”.
(Results)
You will learn how to set up an emulated server broadcasting video on three channels each with a bandwidth of 5 Mbps. (One channel will have a timestamp.)

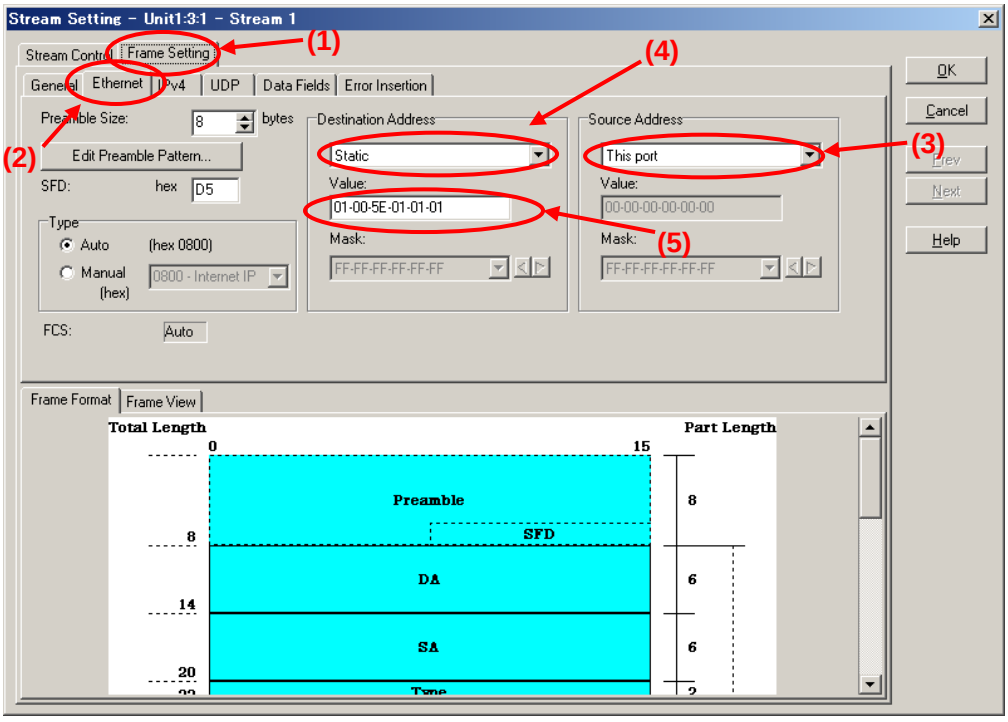
- Creating Multicast Stream Data 1 Generated from Port1 at Server Side (Multicast Address: 224.1.1.1)
  - Select Port1 and press “Add” at the Tx Stream screen to add one stream.
  - With the added stream selected, press “Edit...” to edit the stream.



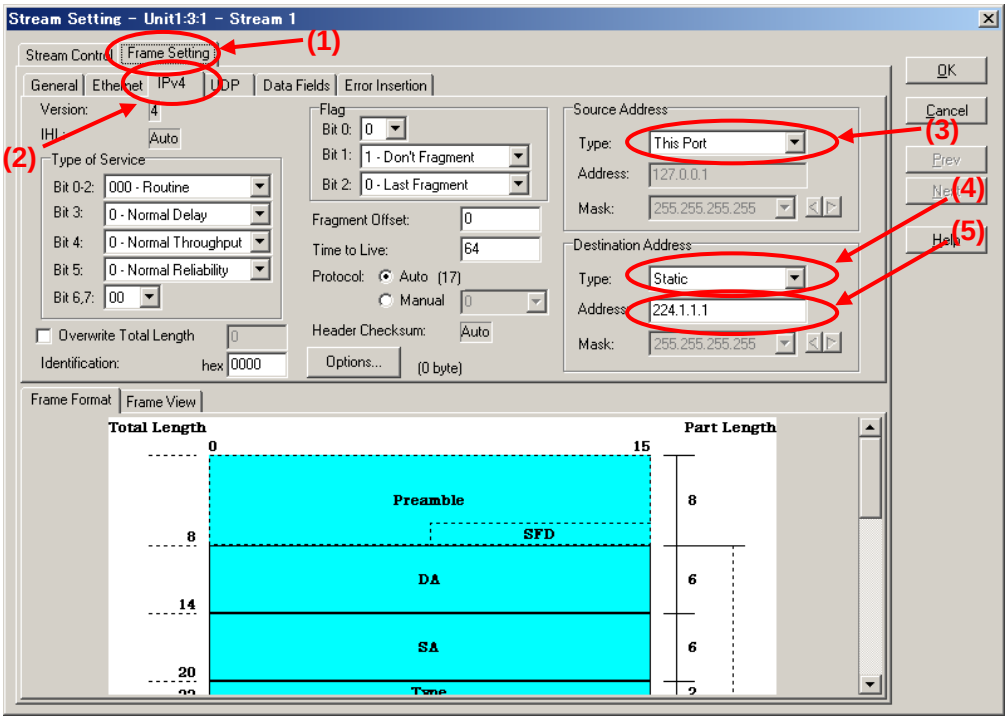
  - Set “Protocol” at [General] of the Frame Setting screen to “UDP/IPv4”. (Multicast broadcasts generally use the UDP protocol.)
  - Set “Frame Length:” to “Fixed” and a value of “1518”. (The maximum length of Ethernet frames is 1518 bytes.)



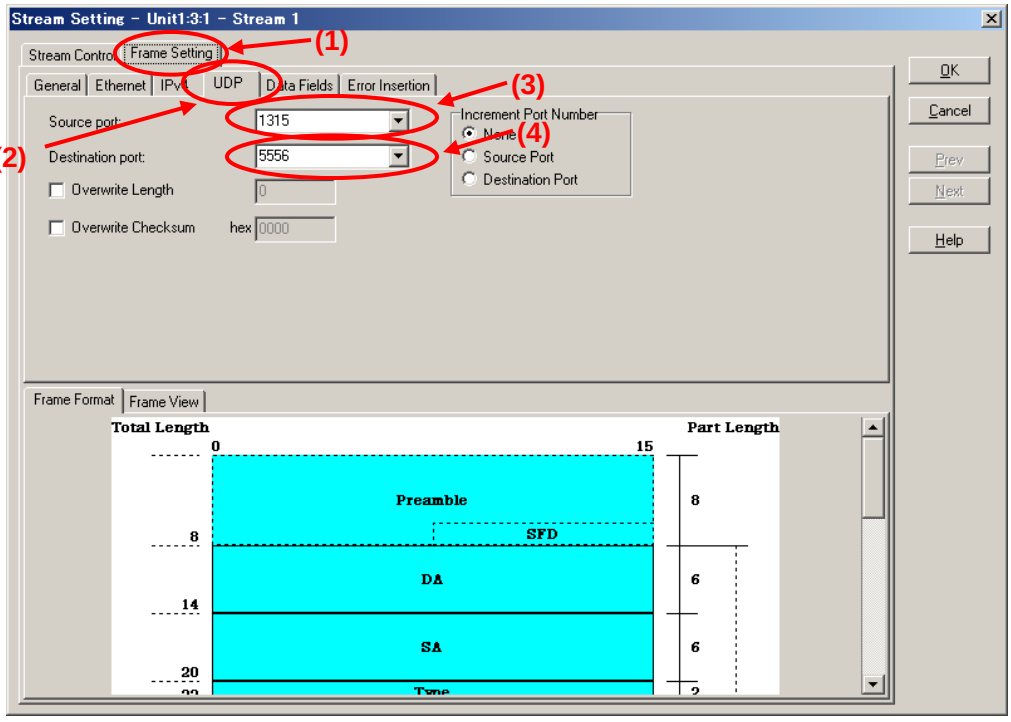
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified by “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-01”. (“01-00-5E-01-01-01” is the MAC address used by multicast address “224.1.1.1”.)



- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.1”.



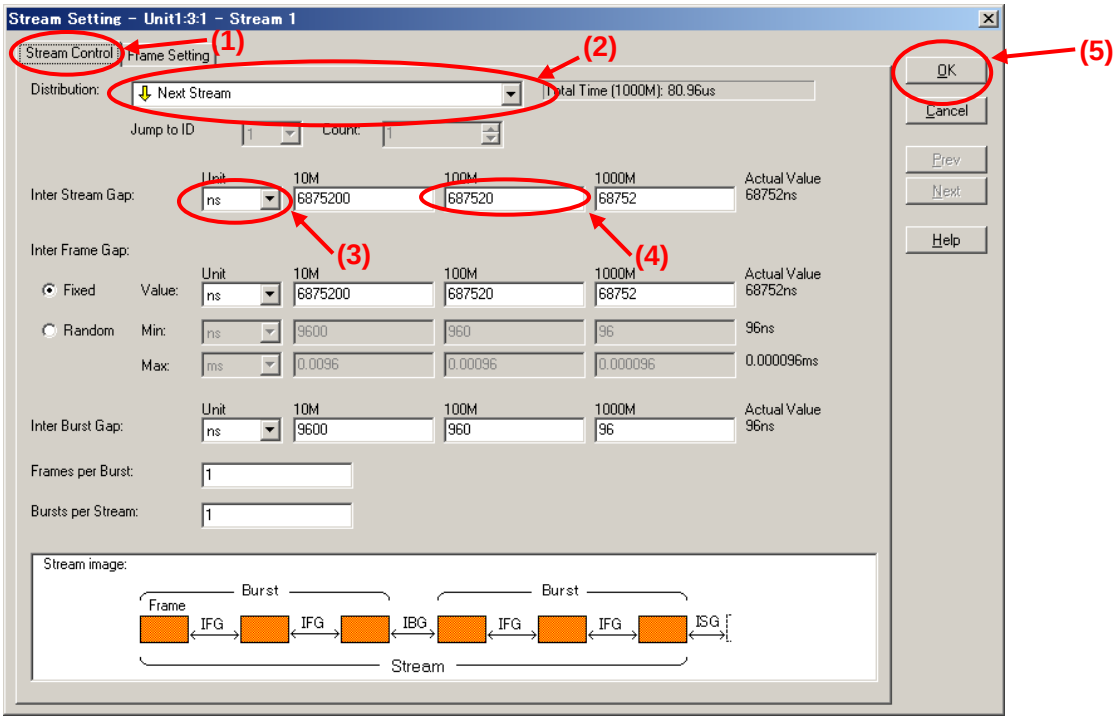
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1315”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5556”. (This specifies the undefined UDP port address.)



- Select “Next Stream” at “Distribution:” on the Stream Control screen.
- Set “Unit” of “Inter Stream Gap:” to “ns” and set the value of “100M” to “687,520”. (Setting the inter-frame gap to 687,520 ns means sending the stream over the 15 Mbps band at a 100M Link speed.) Since three streams are created in this example and are broadcast sequentially, the actual output for this setting is 5 Mbps.

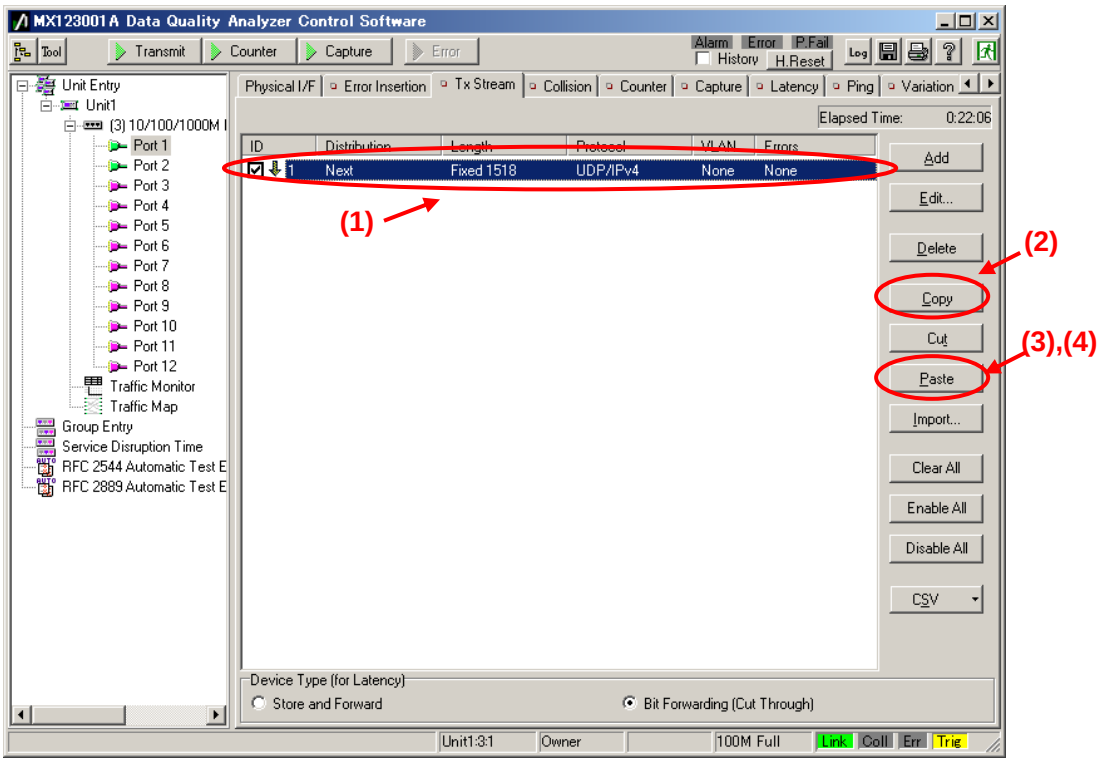
After setting “Unit” of “Inter Frame Gap:” to “bit/s” and inputting “15,000,000”, return “Unit” to “ns” and confirm that the 15-Mbps equivalent gap time is 687,520 ns.

- Press the “OK” button to close the setting screen.

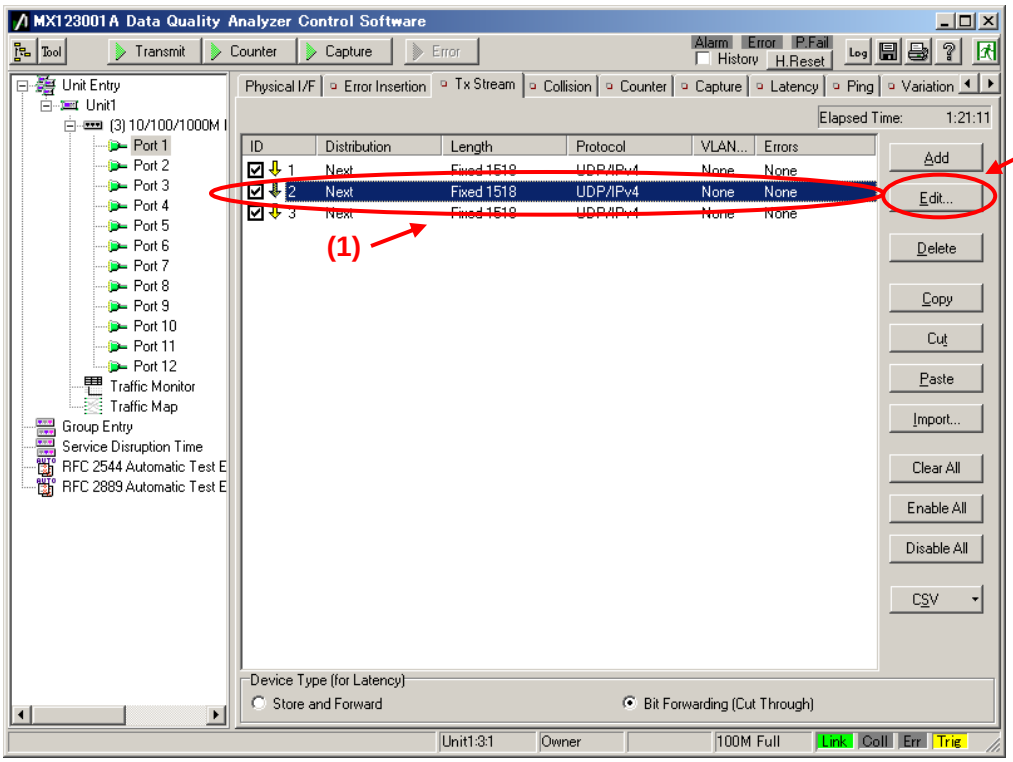


✧ Creating Multicast Stream Data 2 and Multicast Stream Data 3 from Server-side Port1 (Multicast address: “224.1.1.2”/“224.1.1.3”)

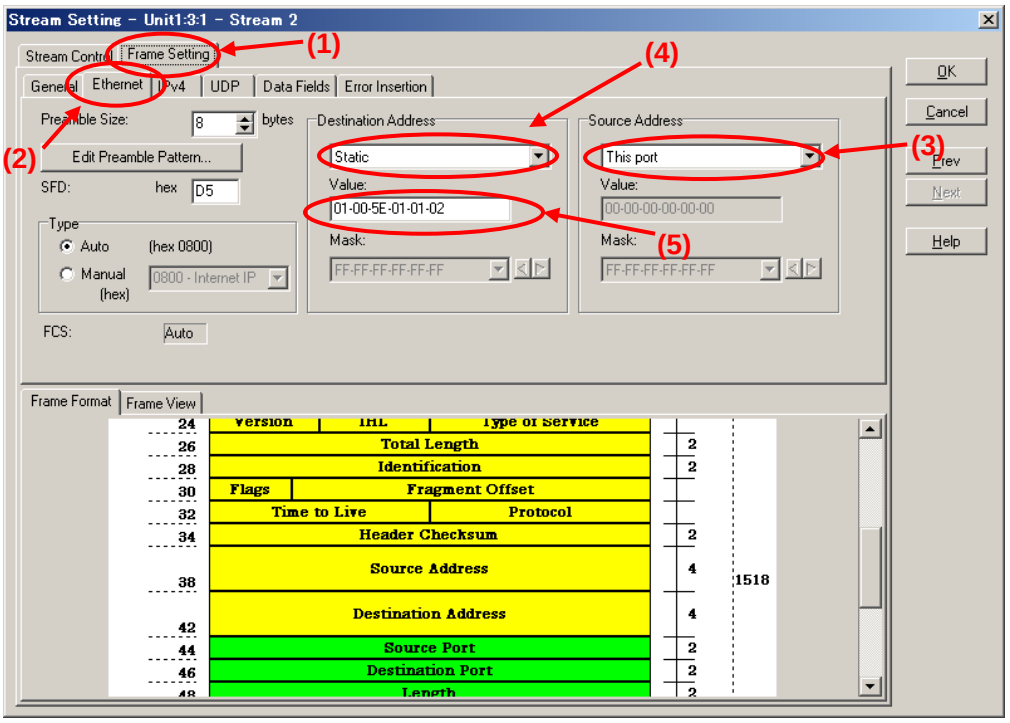
- With the stream select at the Tx Stream screen, press “Copy” and then press “Paste” two times (makes two copies of stream).



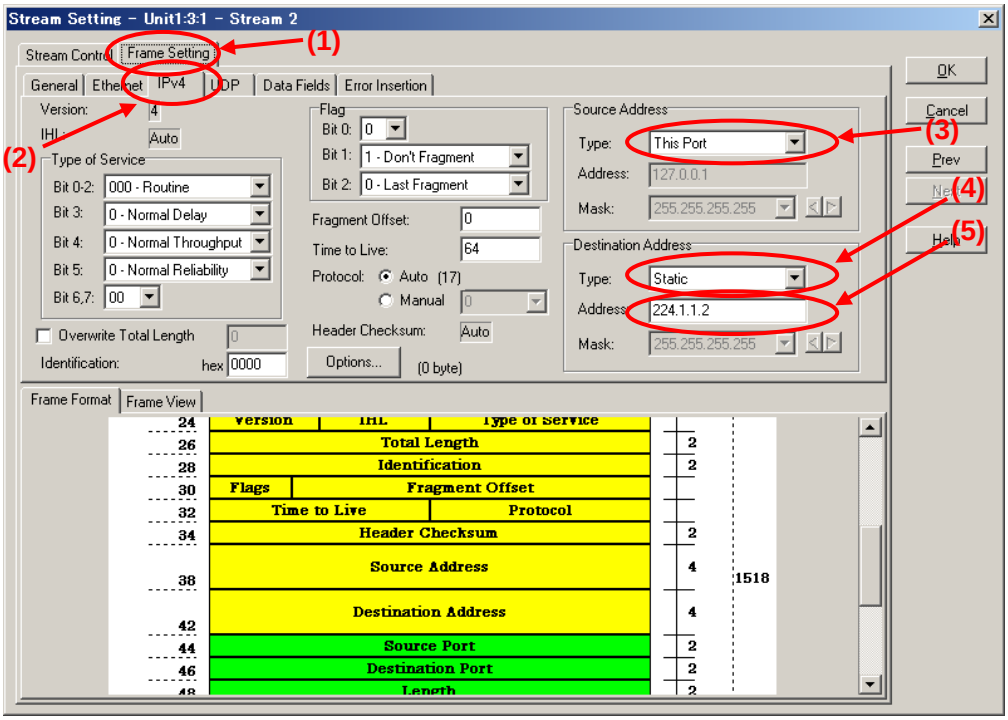
- With the second stream selected, press “Edit...” to edit the stream.



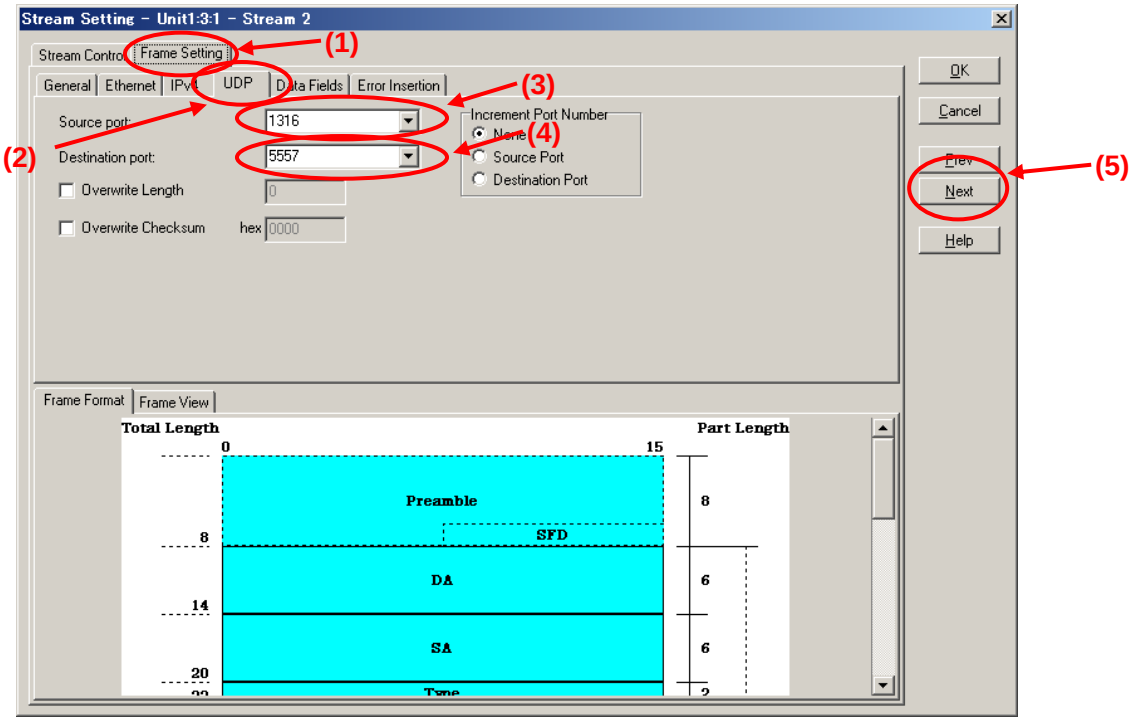
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This Port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-02”. (“01-00-5E-01-01-02” is the MAC address used by multicast address “224.1.1.2”.)



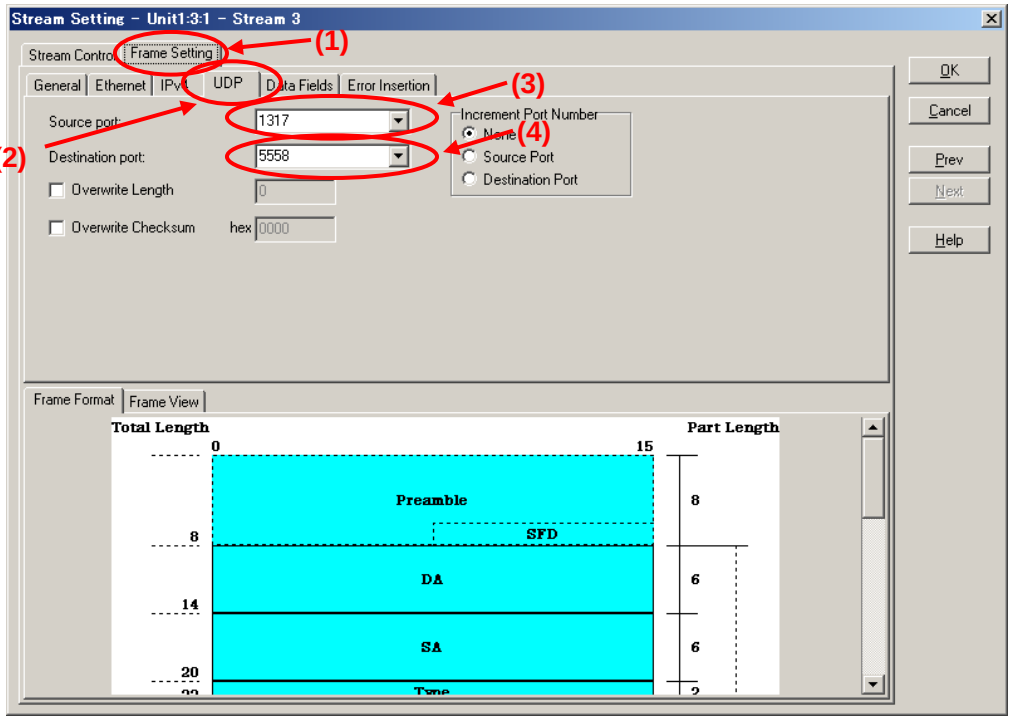
- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.2”.



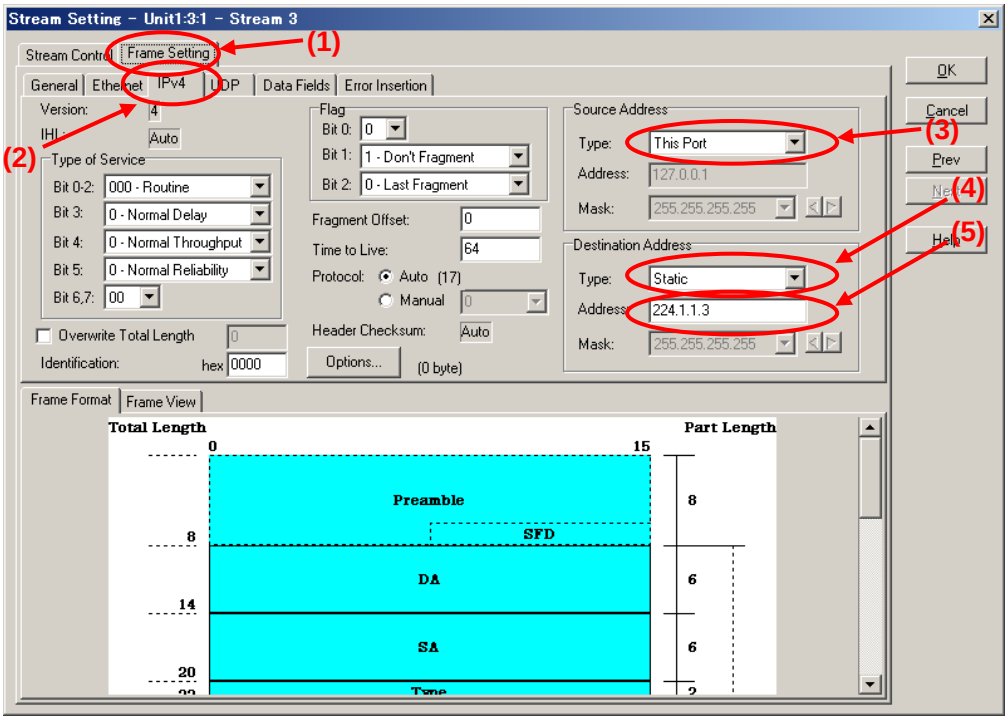
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1316”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5557”. (This specifies the undefined UDP port address.)
- Press “Next” to open Stream3 setting screen.



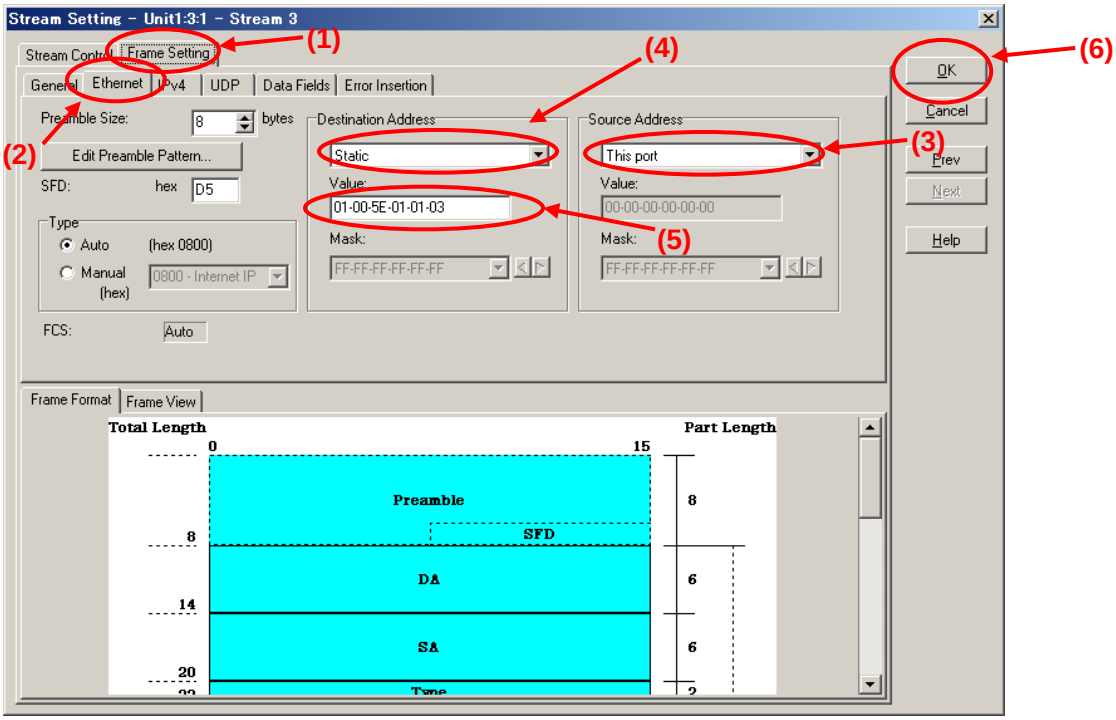
- Set the value of “Source Port:” at [UDP] of the Frame Setting screen to “1317”. (This specifies the undefined UDP port address.)
- Set the value of “Destination port:” to “5558”. (This specifies the undefined UDP port address.)



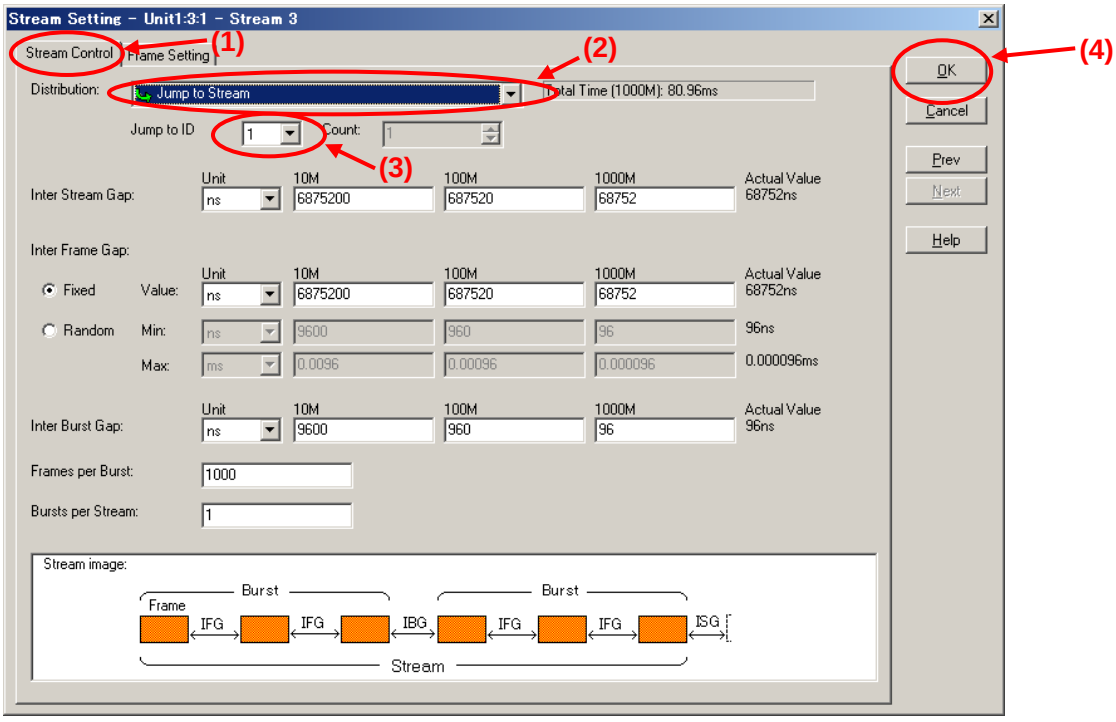
- Set “Source Address” at [IPv4] of the Frame Setting screen to “This port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “224.1.1.3”.



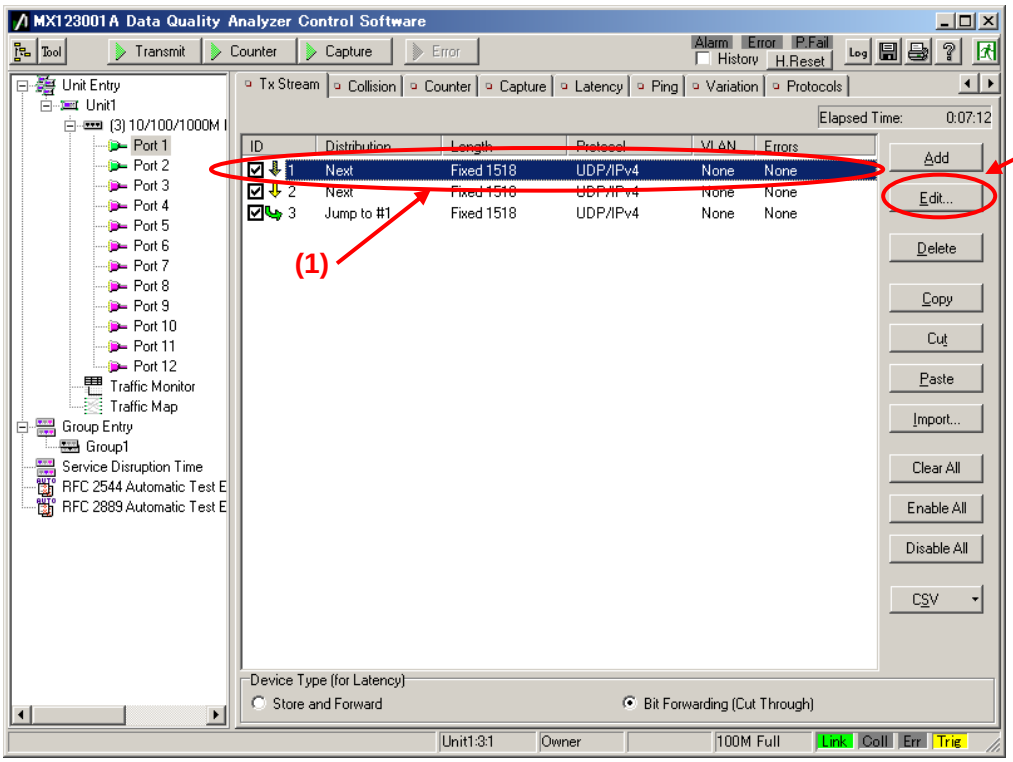
- Set “Source Address” at [Ethernet] of the Frame Setting screen to “This Port”. (When “This port” is selected, the address specified at “Port Setting” is enabled.)
- Set “Destination Address” to “Static” and “Value:” to “01-00-5E-01-01-03”. (“01-00-5E-01-01-03” is the MAC address used by multicast address “224.1.1.3”.)



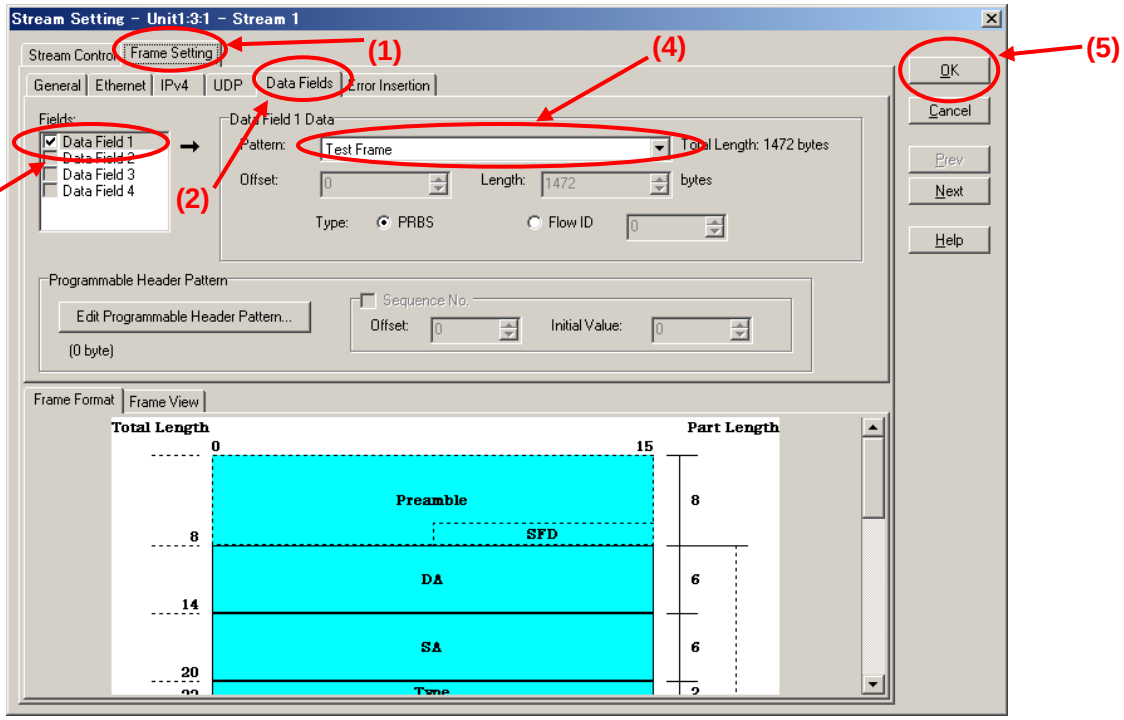
- Select “Jump to Stream” at “Distribution:” of the Stream Control screen.
- Set the value “Jump to ID” to “1” (sets jump stream destination to stream 1).
- Press “OK” to close the setting screen.



- ✧ Burying Sequence number in Multicast Stream Data Generated at Server-side Port1 (Multicast address: “224.1.1.1”)
  - With the first stream selected, press the “Edit...” button to edit the stream.



- Place a checkmark in “Data Field 1” of [Data Fields] at the Frame Setting screen and set “Pattern:” to “Test Frame”.
- Press “OK” to close the setting screen.



5.4. Setting Host Emulation

(Outline)
Create an IGMP protocol sequence for operation as an emulated host.
(Contents)
Use the MD1230B protocol emulation function to assemble a Join/Leave sequence for the multicast group.
In this example, the following three multicast groups are created.

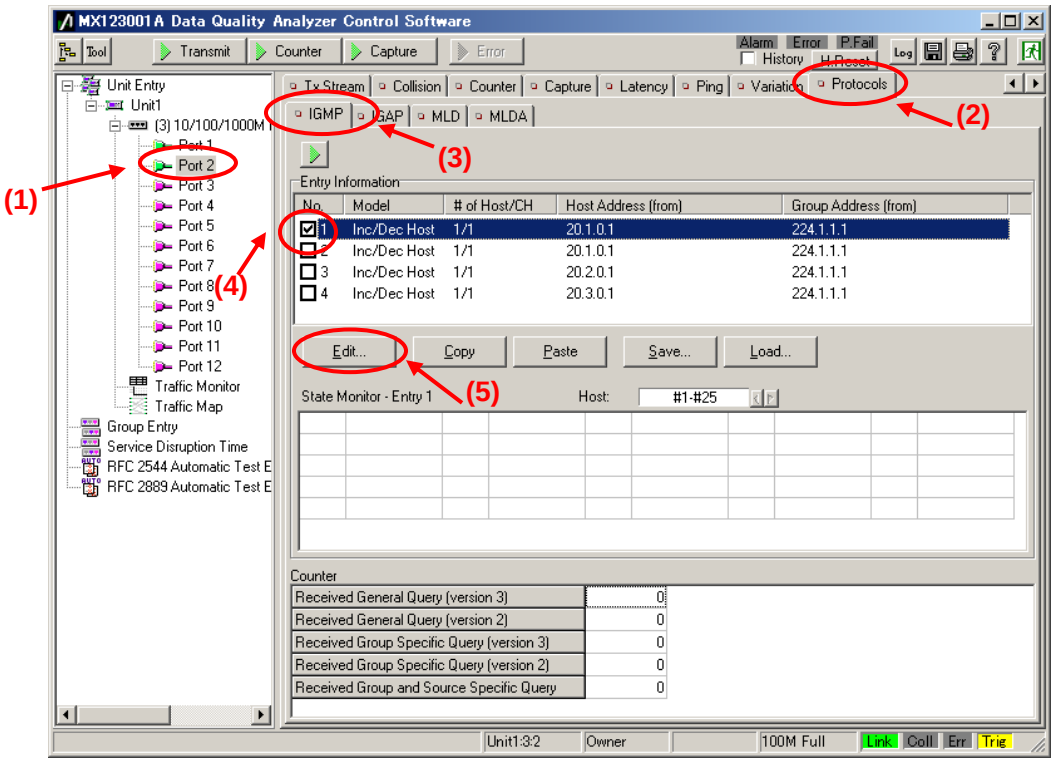
- ✓ Sequence 1: Join multicast address “224.1.1.1” and hold this status for “100,000” seconds. (This is the multicast stream for measuring QoS.)
- ✓ Sequence 2: Join multicast address “224.1.1.2” and perform repeated “connect for 8 seconds/Disconnect for 7 seconds” operations.
- ✓ Sequence 3: Join multicast address “224.1.1.3” and” perform repeated “connect for 8 seconds/Disconnect for 7 seconds” operations.

Sequences 2 and 3 are for emulating Channel Zapping by performing repeated channel switching operations.

(Results)
You will learn how to continuously receive video data for one channel in the Channel Zapping condition and how to configure the emulated host sequence.

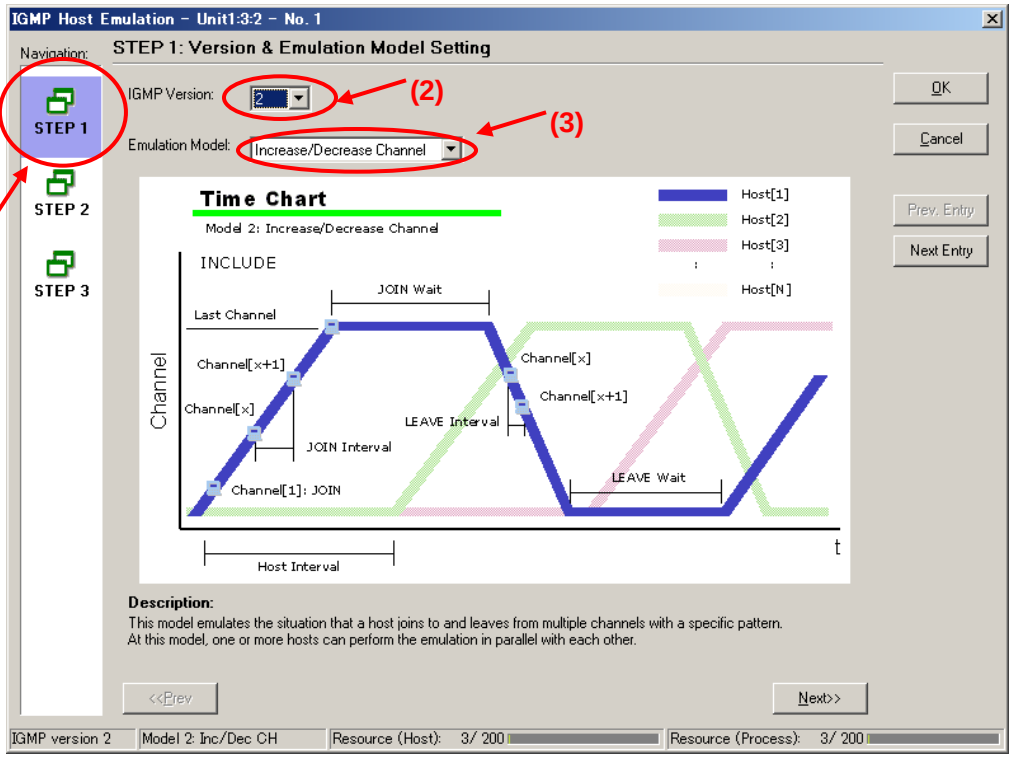
✧ Setting Port2 as Emulated Host Supporting IGMP (Sequence 1)

➢ Select Port2 and place a checkmark in the first “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.

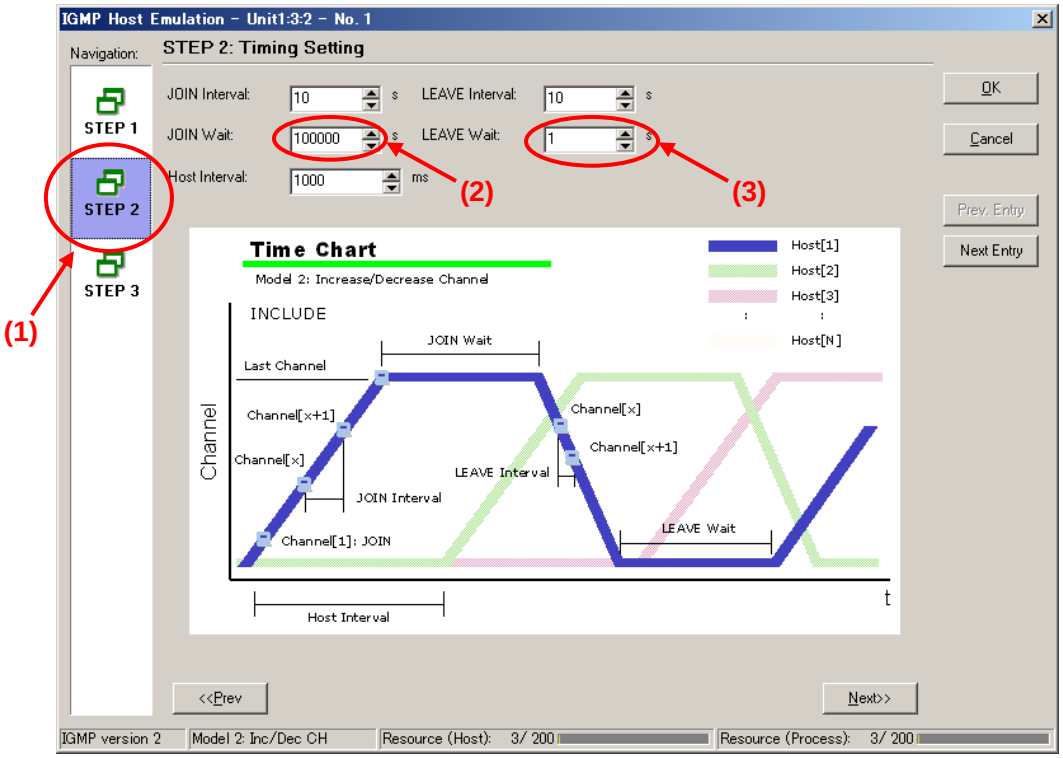


➢ At [Step1] on the IGMP Host Emulation screen, set “IGMP Version:” to “2” and “Emulation Model:” to “Increase/Decrease Channel” (supports IGMP-v2 channel

joining).



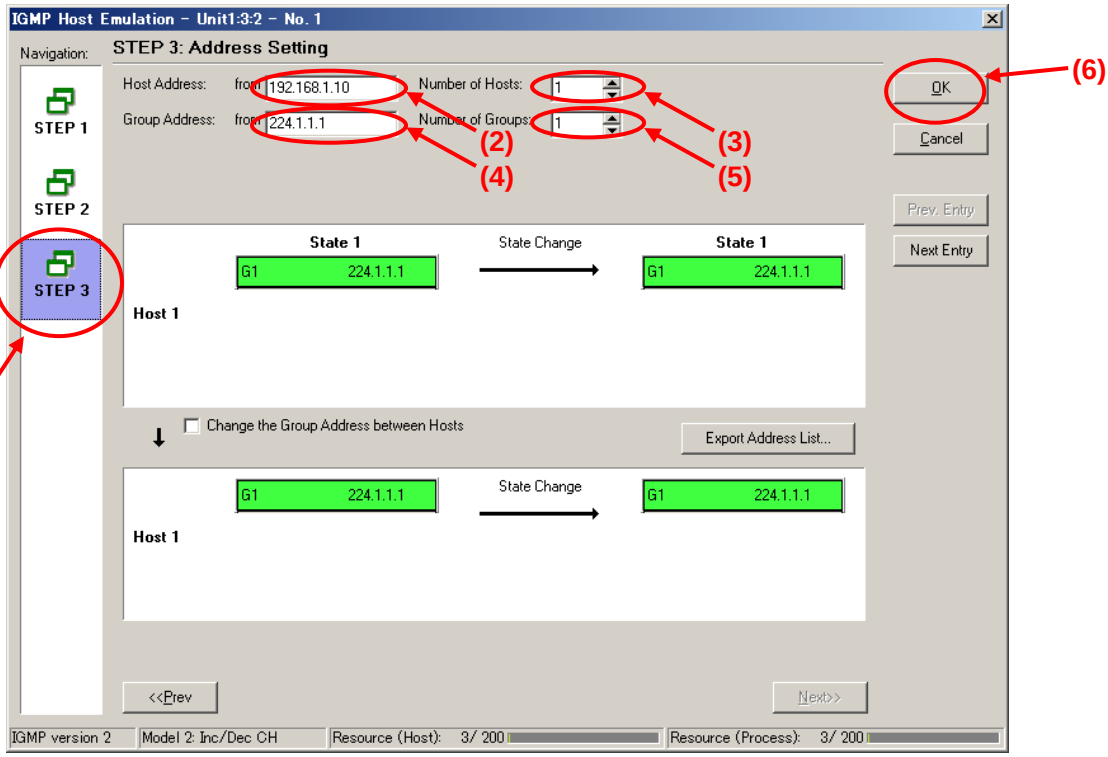
- At [Step2] of the IGMP Host Emulation screen, set “Join Wait:” to “100000s” and “LEAVE Wait:” to “1s”. (This holds the connection for 100,000 s after joining the channel.)



- Set the value of “Host Address:” at [Step3] of the IGMP Host Emulation screen to “192.168.1.10”.
- Set the value of “Number of Host:” to “1”.

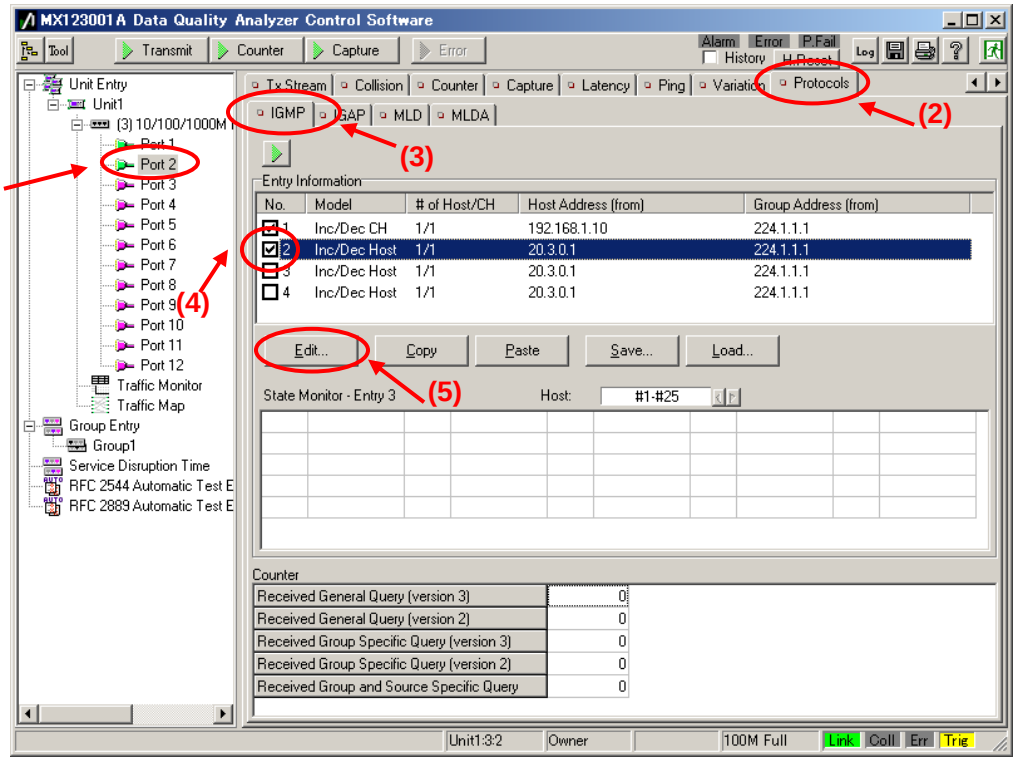
- Set the value of “Group Address:” to “224.1.1.1”.
- Set the value of “Number of Group:” to “1”.
- Press “OK” to close the setting screen.

This setting performs the Join/Leave to multicast address “224.1.1.1” with one emulated host (“192.168.1.10”).

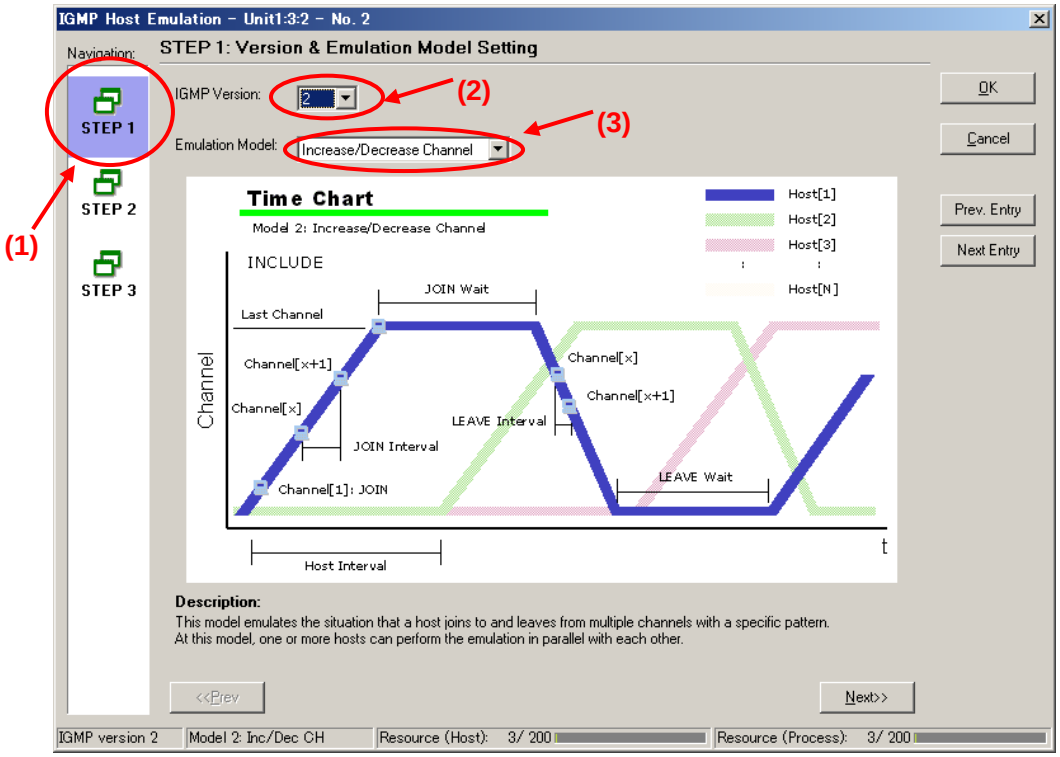


✧ Setting Port2 as Emulated Host Supporting IGMP (Sequence 2)

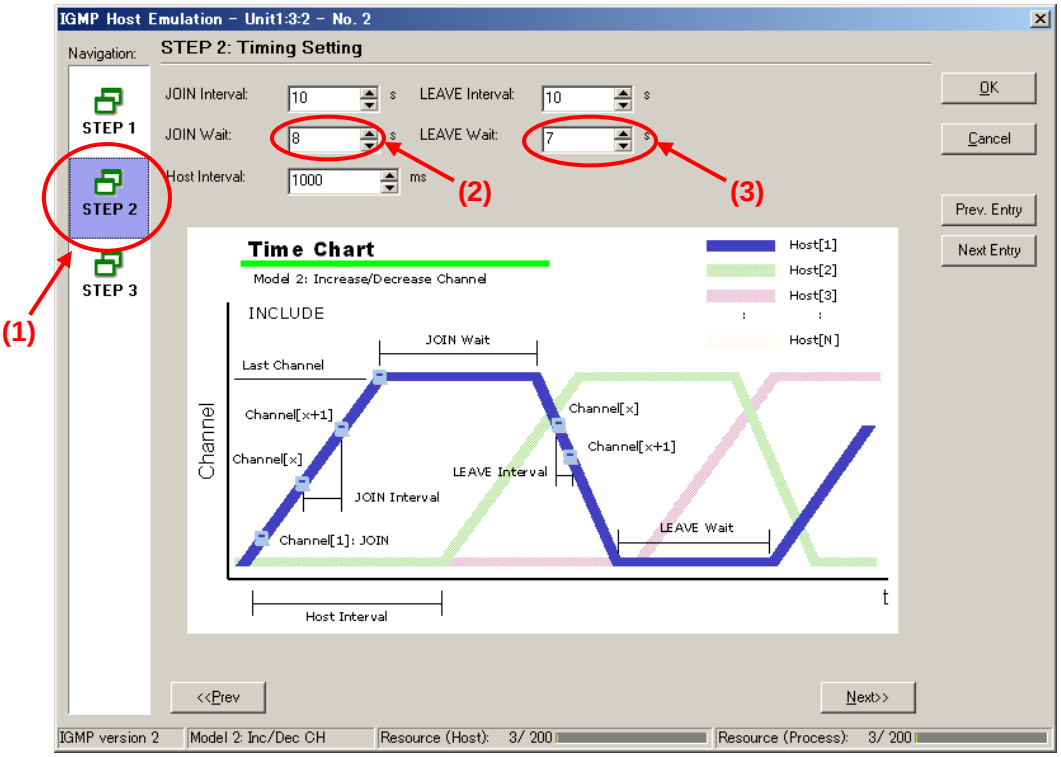
- Select Port2 and place a checkmark in the second “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.



- At [Step1] on the IGMP Host Emulation screen, set "IGMP Version:" to "2" and "Emulation Model:" to "Increase/Decrease Channel" (supports IGMP-v2 channel joining).



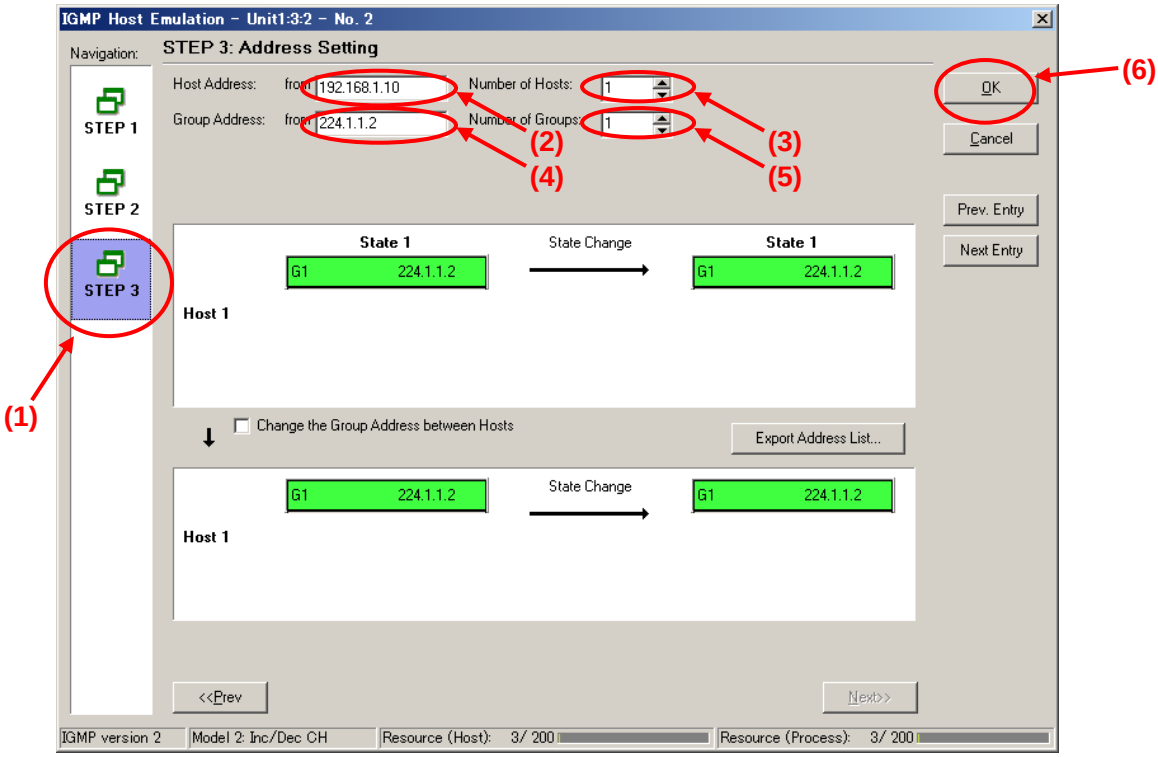
- At [Step2] of the IGMP Host Emulation screen, set "Join Wait:" to "8s", and "LEAVE Wait:" to "7s". (After joining the channel, this performs repeated "Connect for 8 seconds/Disconnect for 7 seconds" operations.)



- Set the value of "Host Address:" at [Step3] of the IGMP Host Emulation screen to "192.168.1.10".
- Set the value of "Number of Host:" to "1".

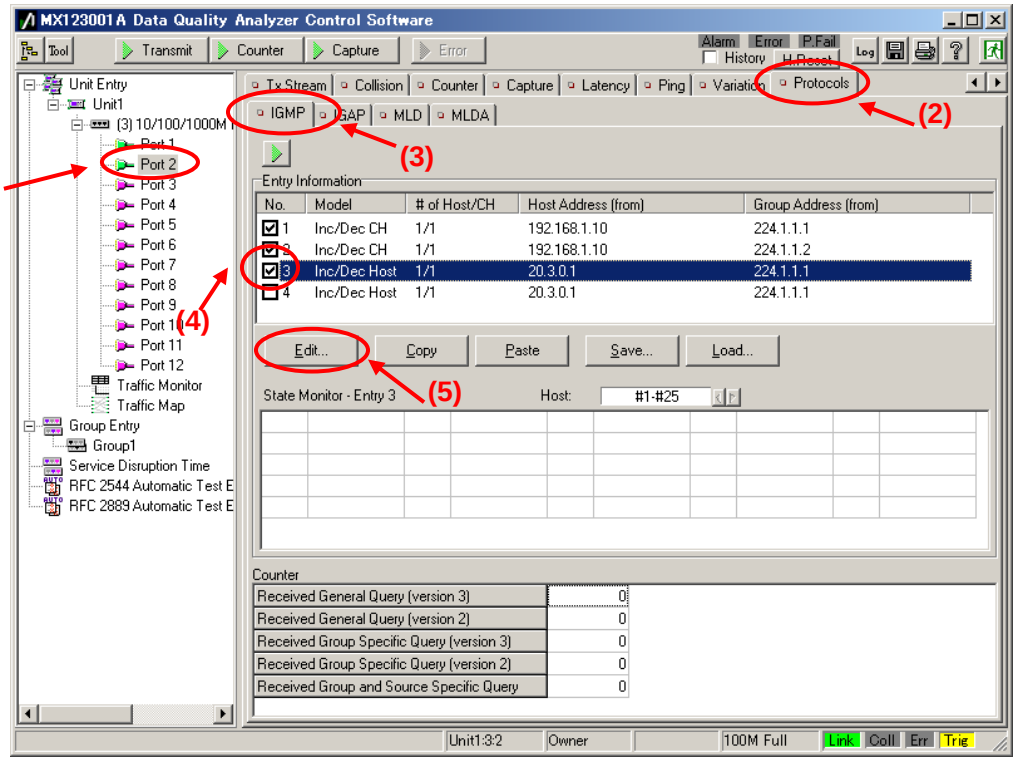
- Set the value of “Group Address:” to “224.1.1.2”.
- Set the value of “Number of Group:” to “1”.
- Press “OK” to close the setting screen.

This setting performs repeated Join/Leave operations to multicast address “224.1.1.2” with one emulated host at “192.168.1.10”.

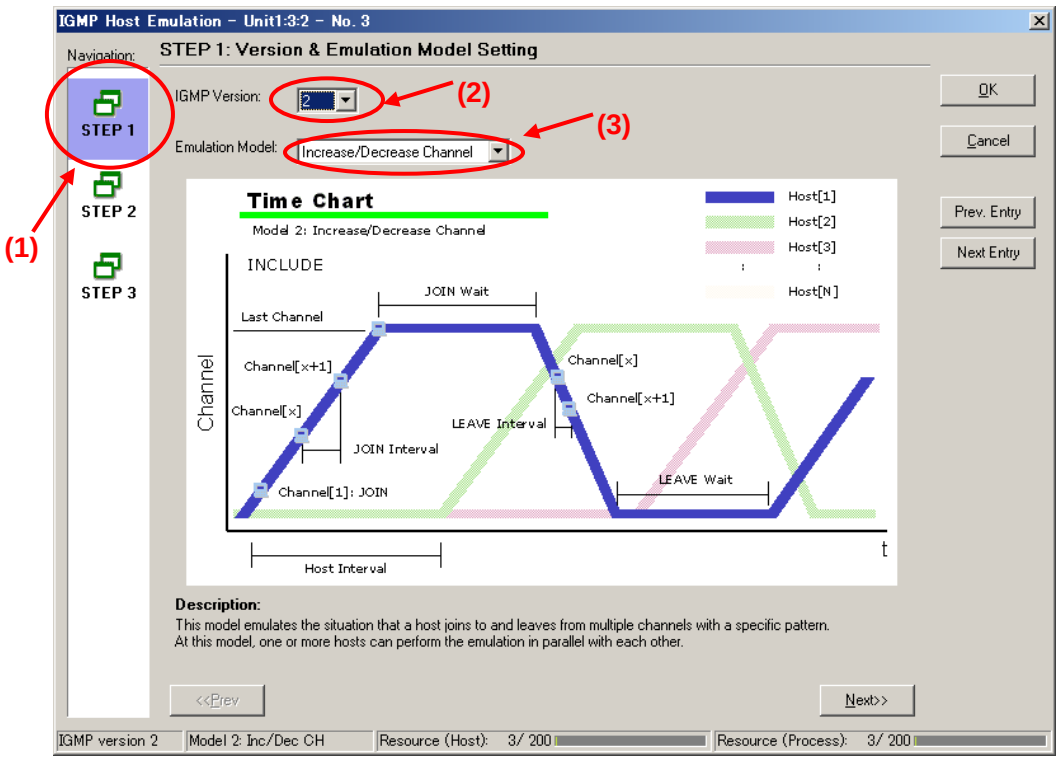


✧ Setting Port2 as Emulated Host Supporting IGMP (Sequence 3)

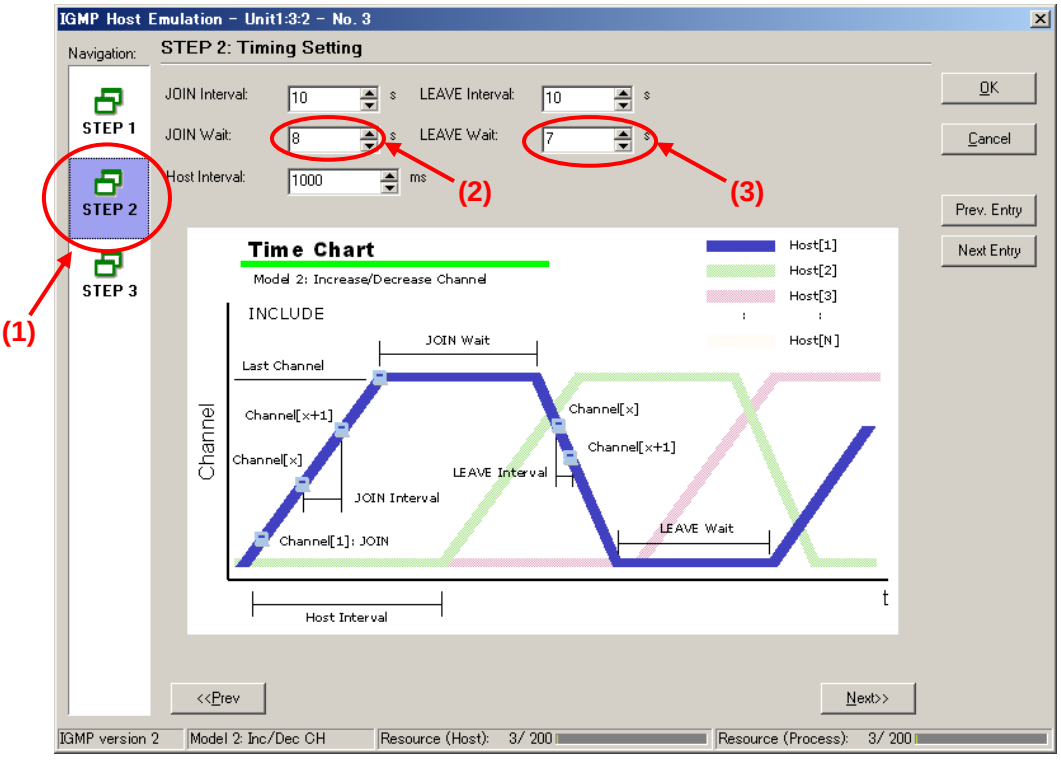
- Select Port2 and place a checkmark in the third “Entry Information” at [IGMP] in the Protocol screen. Press “Edit...” to edit the IGMP protocol sequence.



- At [Step1] on the IGMP Host Emulation screen, set “IGMP Version:” to “2” and “Emulation Model:” to “Increase/Decrease Channel” (supports IGMP-v2 channel joining).

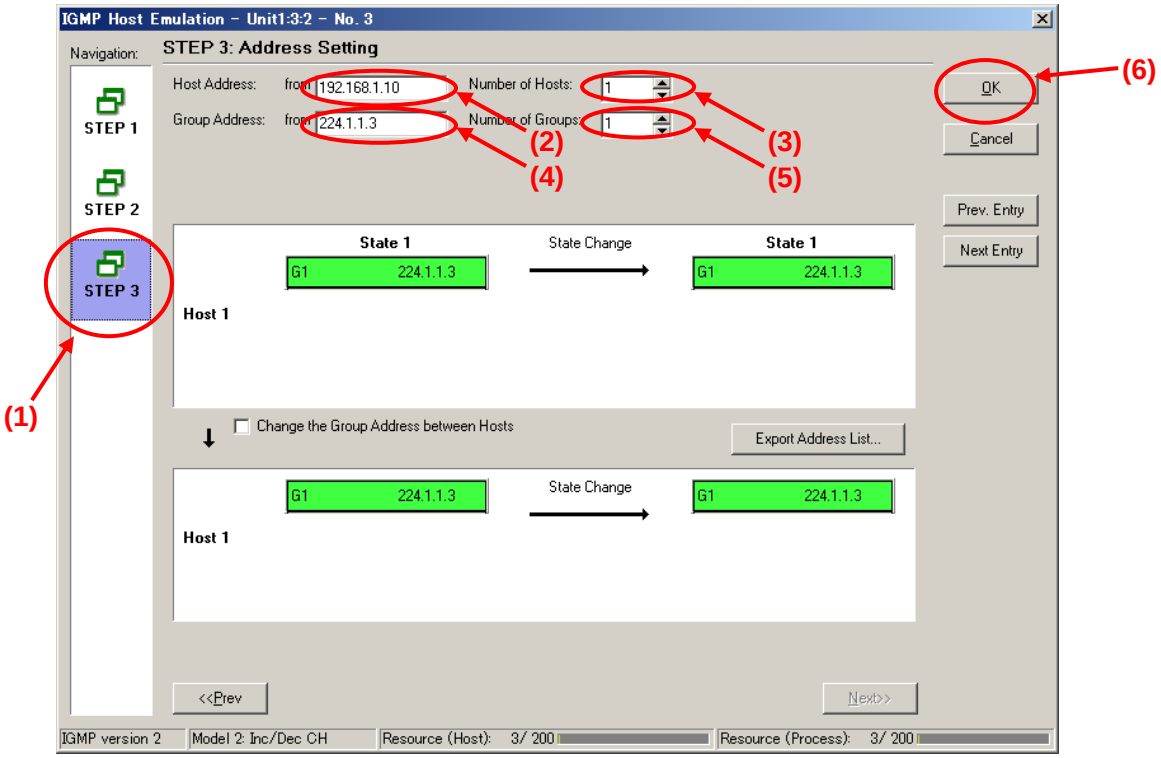


- At [Step2] of the IGMP Host Emulation screen, set “Join Wait:” to “8s”, and “LEAVE Wait:” to “7s”. (After joining the channel, this performs repeated “Connect for 8 seconds/Disconnect for 7 seconds” operations.”)



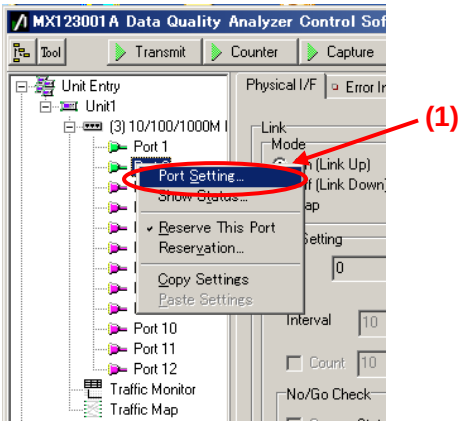
- Set the value of “Host Address:” at [Step3] of the IGMP Host Emulation screen to ”192.168.1.10”.
- Set the value of “Number of Host:” to “1”.
- Set the value of “Group Address:” to “224.1.1.3”.
- Set the value of “Number of Group:” to “1”.
- Press “OK” to close the setting screen.

This setting performs repeated Join/Leave operations to multicast address “224.1.1.3” with one emulated host at “192.168.1.10”.

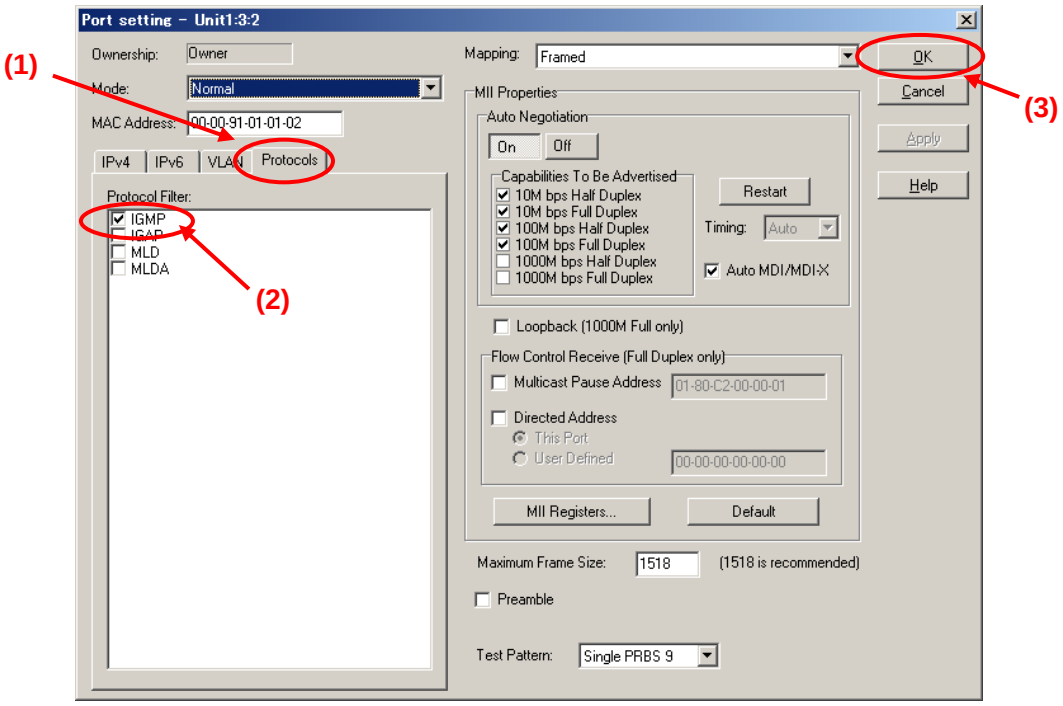


✧ Enabling IGMP Protocol at Port2

- Select Port2 and right-click to select “Port Setting” (opens “Port Setting” window).



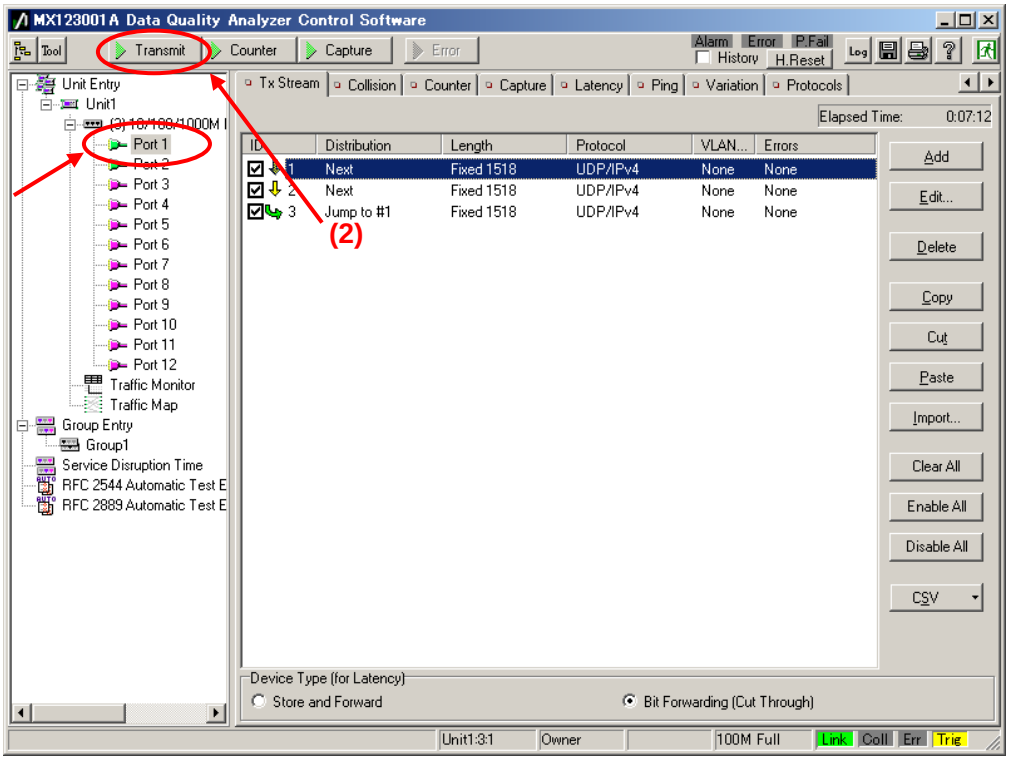
- Place a checkmark in “IGMP” of “Protocol Filter:” at [Protocol] of the Port Setting screen.
- Press the “OK” button.


Port setting – Unit1:3:2
Ownership:
Owner
Mode:
Normal
MAC Address:
00-00-91-01-01-02
IPv4
IPv6
VLAN
Protocols
Protocol Filter:
IGMP
IGAP
MLD
MLDA
Mapping:
Framed
MII Properties
Auto Negotiation
On
Off
Capabilities To Be Advertised
10M bps Half Duplex
10M bps Full Duplex
100M bps Half Duplex
100M bps Full Duplex
1000M bps Half Duplex
1000M bps Full Duplex
Restart
Timing:
Auto
Auto MDI/MDI-X
Loopback (1000M Full only)
Flow Control Receive (Full Duplex only)
Multicast Pause Address
01-80-C2-00-00-01
Directed Address
This Port
User Defined
00-00-00-00-00-00
MII Registers...
Default
Maximum Frame Size:
1518
(1518 is recommended)
Preamble
Test Pattern:
Single PRBS 9
OK
Cancel
Apply
Help
(1)
(2)
(3)

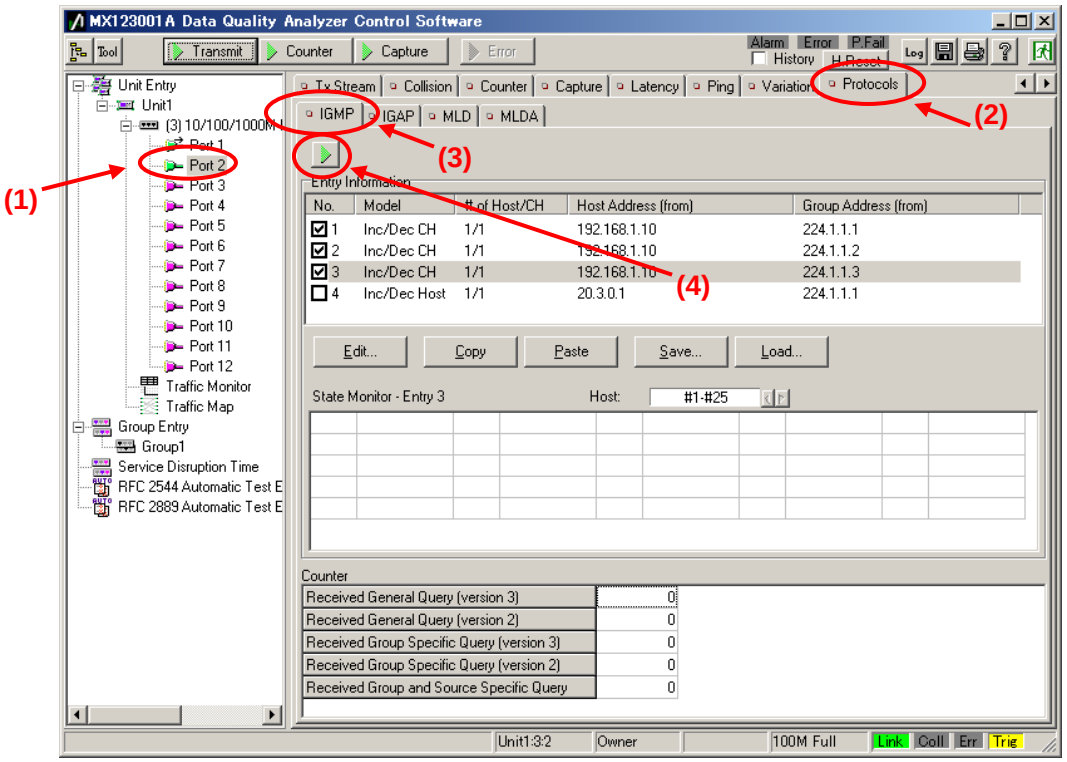
5.5. Monitoring Packet Loss

(Outline)
Run the emulated server and hosts and use the Multi Flow Counter function to monitor the traffic of each multicast stream and packet loss.
(Contents)
Send the multicast stream from Port1 and perform Join/Leave (Zapping) operations at Port2. In this condition, monitor the traffic of each multicast address “224.1.1.1”.
(Results)
You will learn how to perform QoS measurement of a multicast stream in the Channel Zapping condition.

- Send a multicast stream from Port1. (Start the emulated server.)
  - Select Port1 and press the “Transmit” button at the top of the screen.

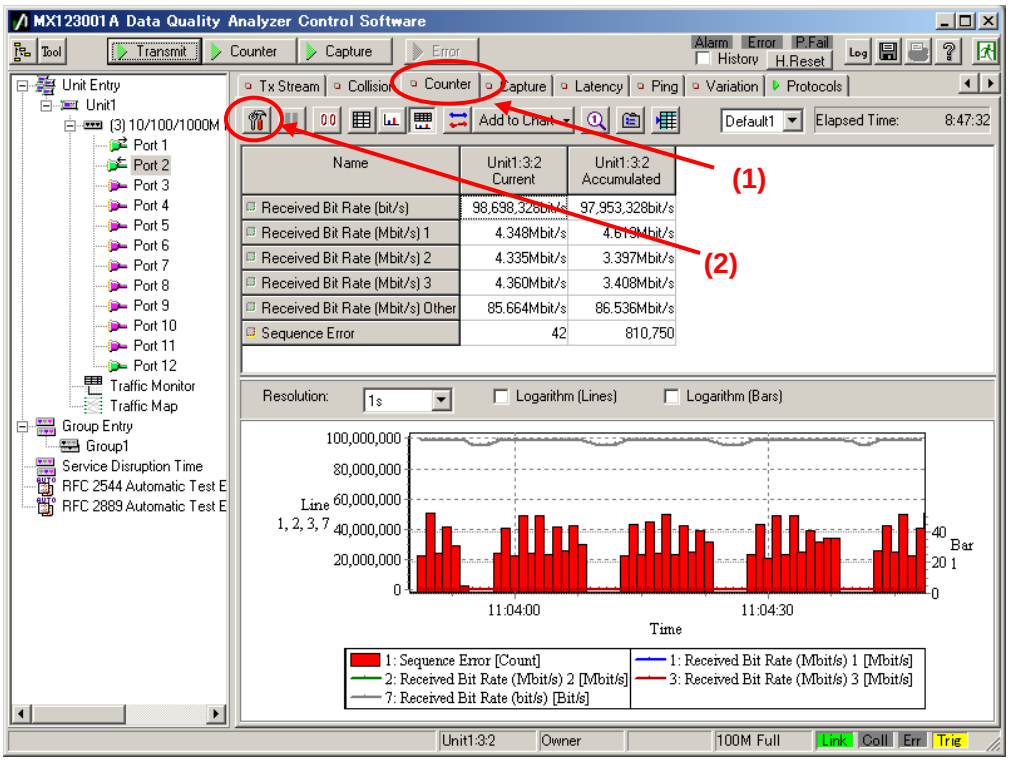


- Start the Join/Leave operations at Port2. (Start the emulated host operation.)
  - Select Port2 and press the IGMP start button at [IGMP] of the Protocol screen. (This starts the repeated Join/Leave operation.)



✧ Set the Multi Flow Counter filter at Port2. (This enables Latency counting for the flow at multicast address “224.1.1.1”.)

➢ Select Port2 and press the “Counter Setting” button at the Counter screen to open the “Counter Setting” screen.

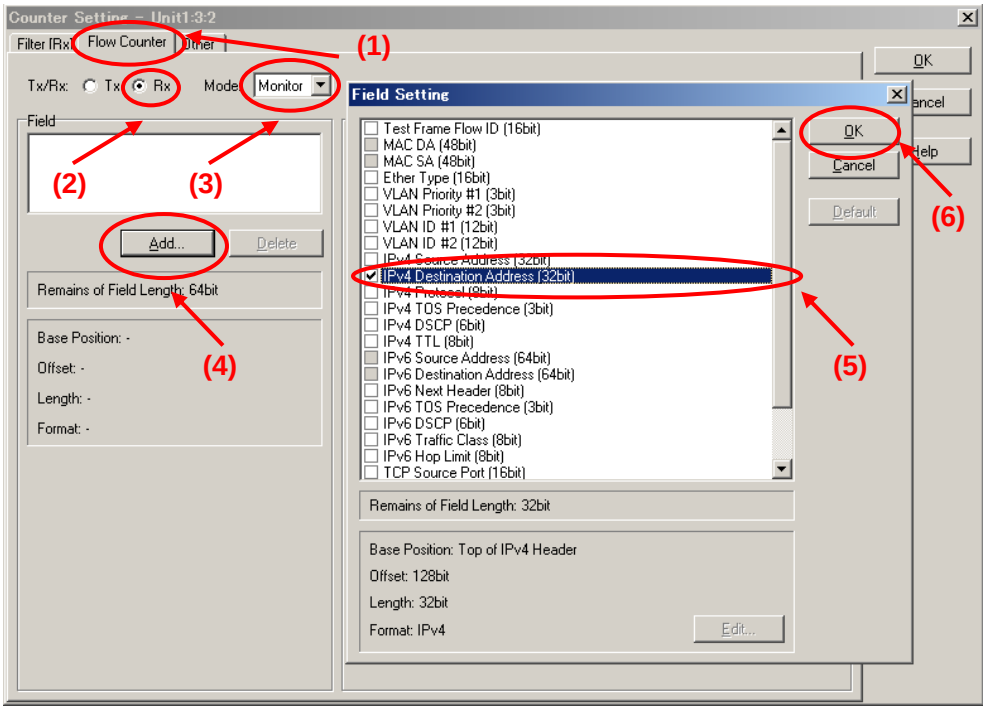


➢ Set “Tx/Rx” at “Flow Counter” of the Counter Setting screen to “Rx”.

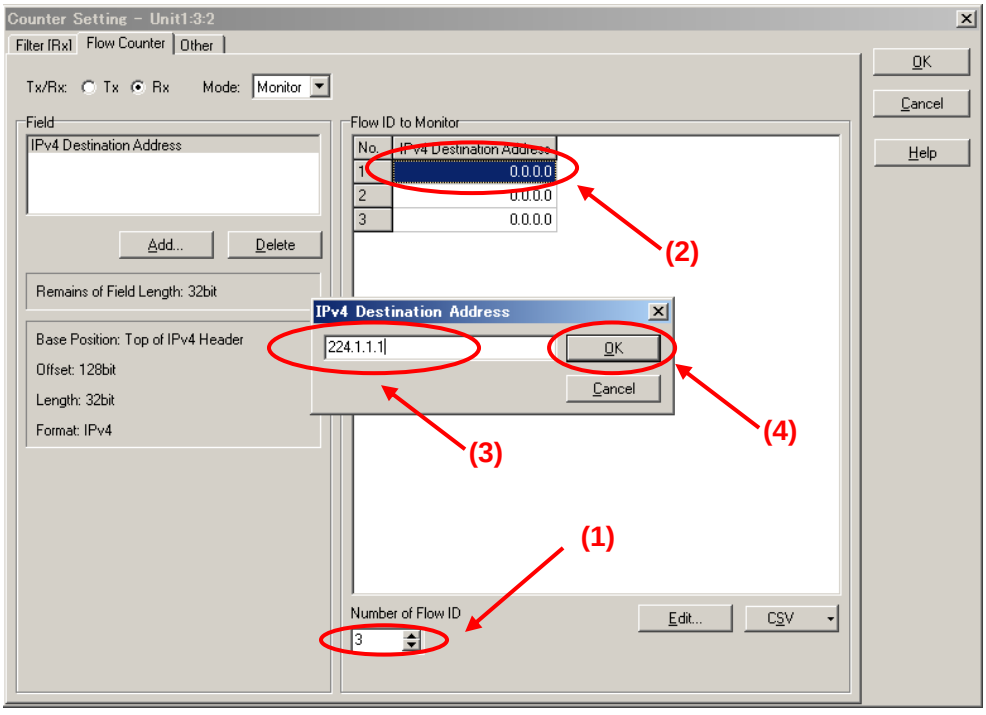
➢ Set “Mode:” to “Monitor”.

➢ Press the “Add…” button to open the “Field Setting” screen.

- Place a checkmark in “IPv4 Destination Address [32bit]” at the Field Setting screen and press the “OK” button to close the window.



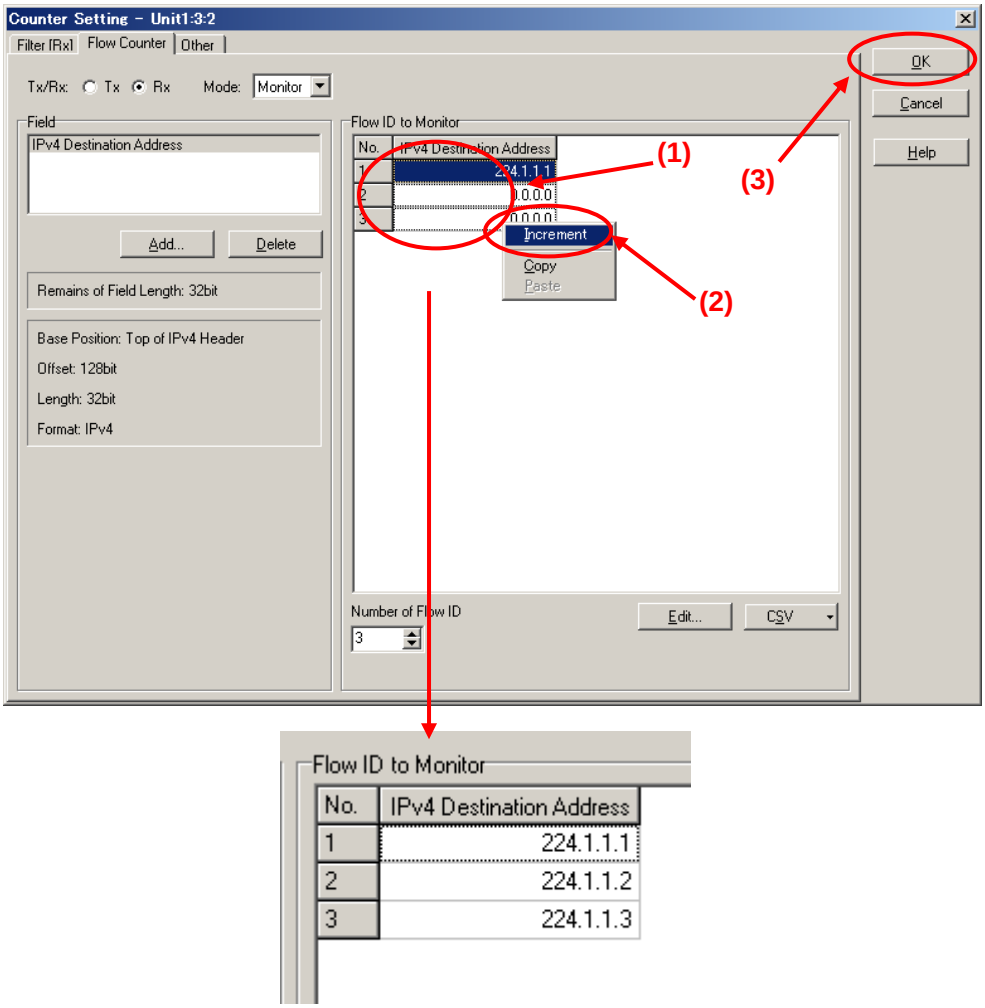
- Input “3” at “Number of Flow ID” at “Flow Counter” of the Counter Setting screen.
- Select “IPv4 Destination Address No.1” and press the “Edit…” button to open the “IPv4 Destination Address” input window.
- Input “224.1.1.1” at the “IPv4 Destination Address” input window and press the OK button.
- Press the “OK” button to close the Counter Setting screen.



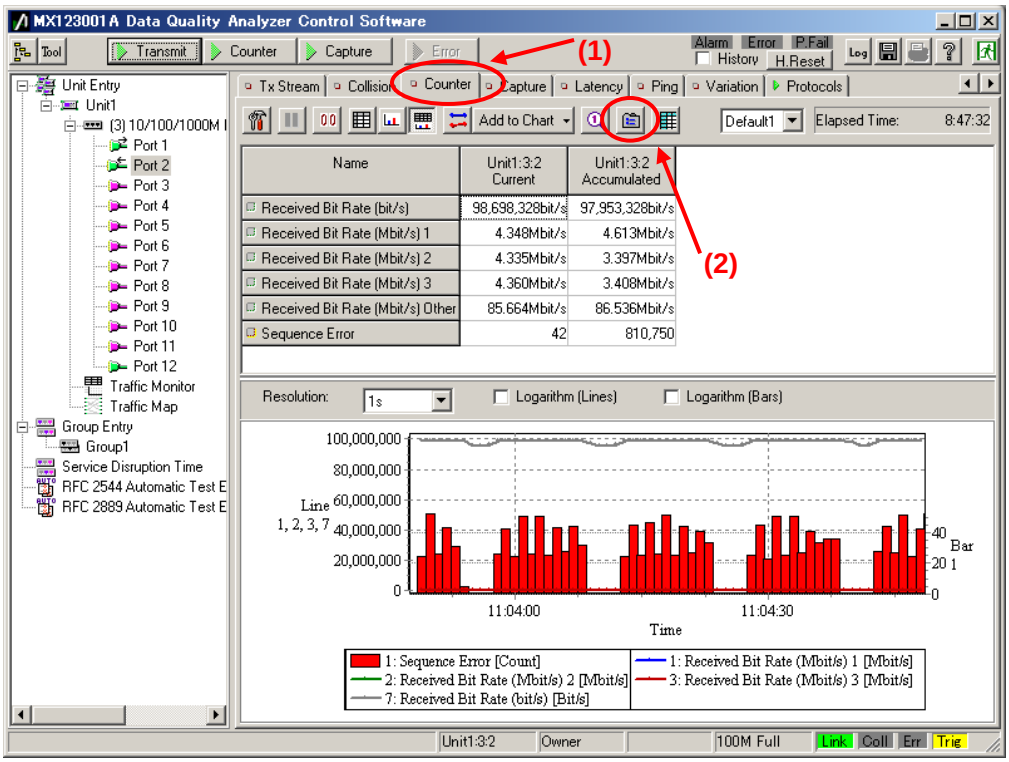
- Drag from “IPv4 Destination Address No.1” to “IPv4 Destination Address No.3” and

right-click to select “Increment” from the menu. (This automatically inserts the incremented value from “224.1.1.1”.)

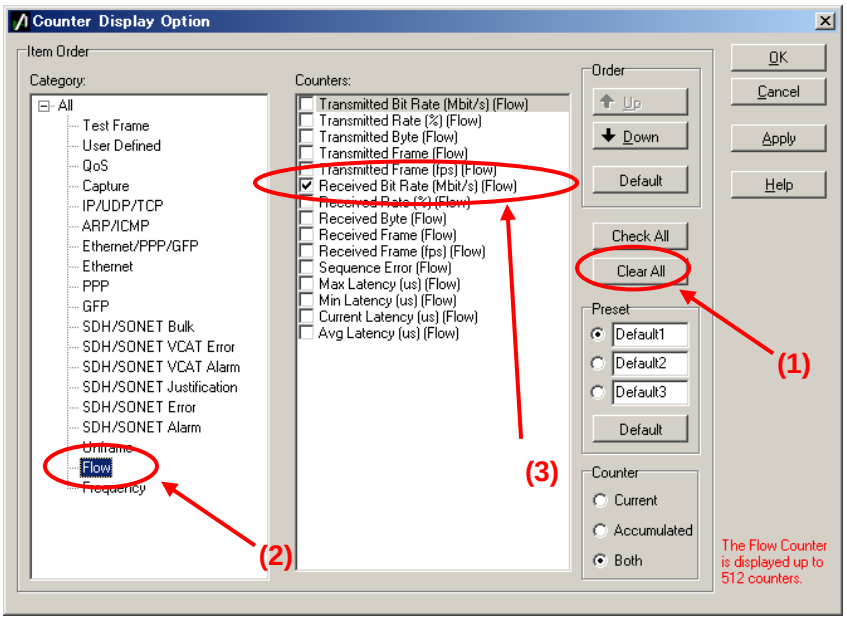
- Press the “OK” button to close the Counter Setting screen.



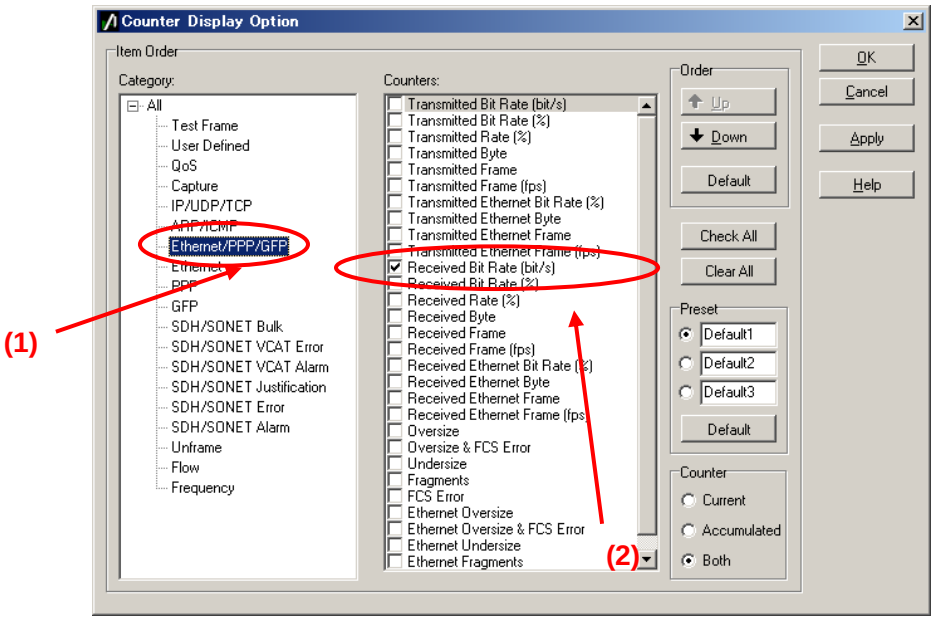
- Select Port2 and press the “Counter Display Option” button at the Counter screen to open the “Counter Display Option” screen.



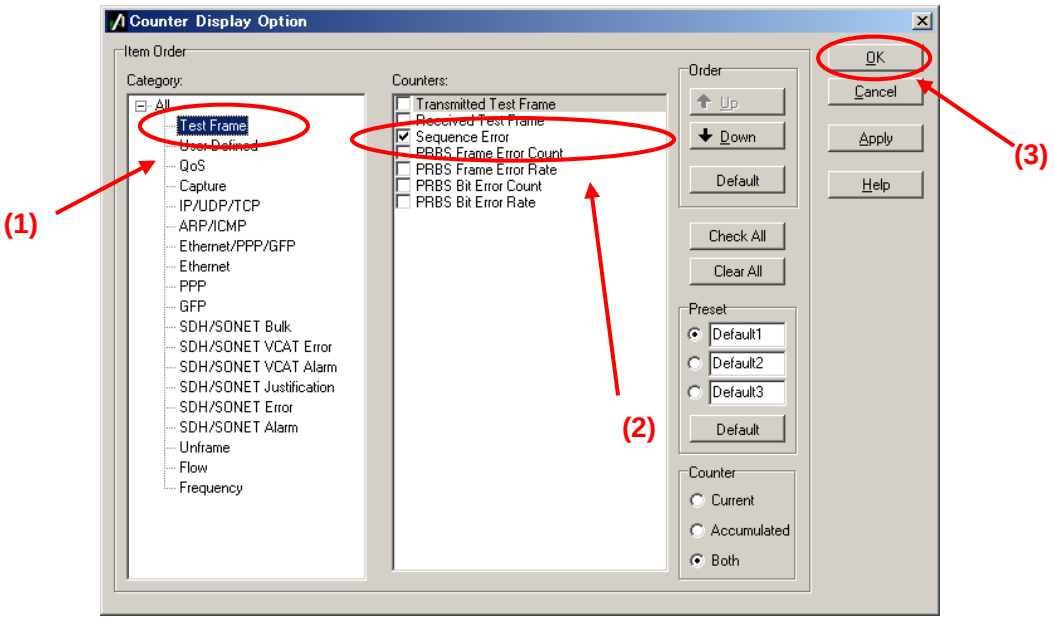
- Press "Clear All" at the Counter Display Option screen to clear all the displayed counter items at once.
- Select "Flow" of "Category" and place checkmarks in the following items (so that each multicast flow traffic can be seen individually.)
  - ✓ "Received Bit Rate (Mbit/s) [Flow]"



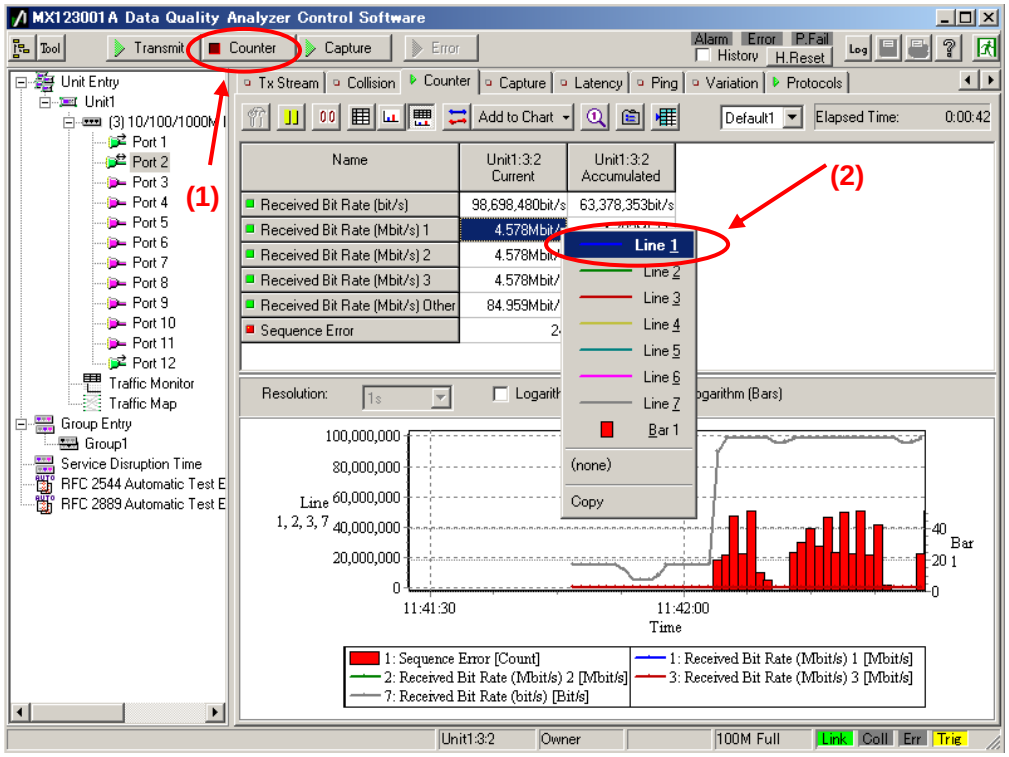
- Select "Ethernet/PPP/GFP" of "Category" and place checkmarks in the following items (so that the total traffic received at Port2 can be seen).
  - ✓ "Received Bit Rate (bit/s)"



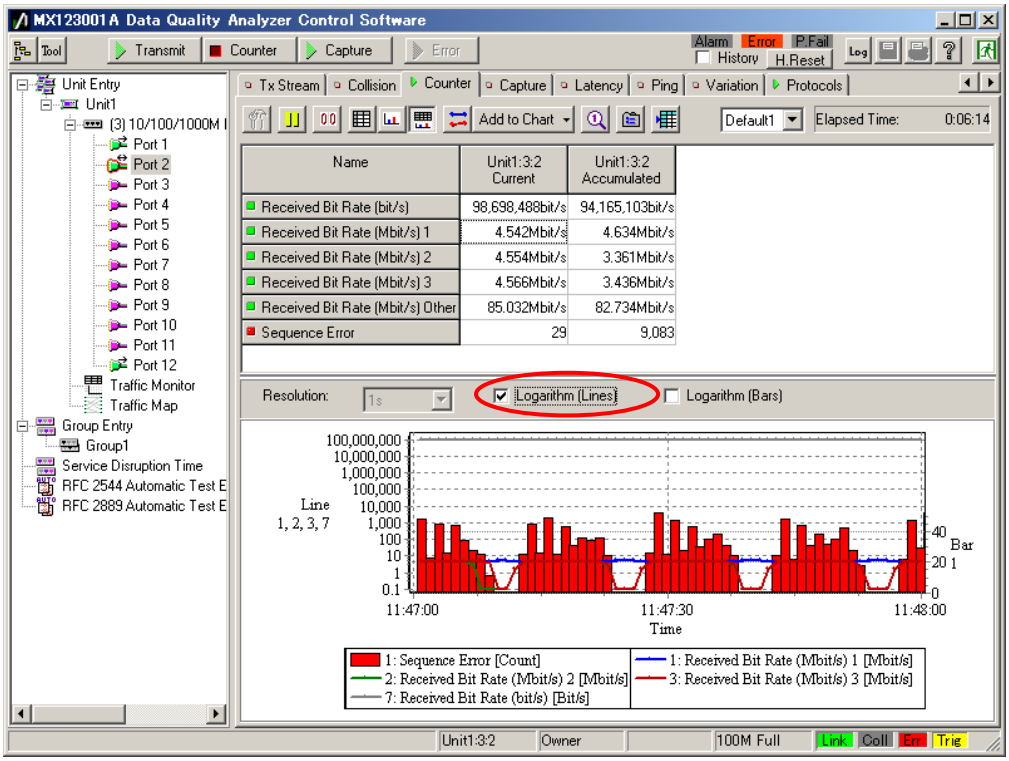
- Select “Test Frame” of “Category” and place checkmarks in the following items (so that the packet loss for multicast address 224.1.1.1 can be seen).
  - ✓ “Sequence Error”
- Press the “OK” button to close the screen.



- Select Port2 and press the “Counter” button at the top of the screen to start measurement.
- Choose “Received Bit Rate (Mbit/s) 1” of the counter items and select “Line1” from the menu by right-clicking.
- Similarly, set “Line2”, “Line3”, “Line7” and “Bar 1” for “Received Bit Rate (Mbit/s) 2”, “Received Bit Rate (Mbit/s) 3”, “Received Bit Rate (bit/s) ”, and “Sequence Error”, respectively.



- The transmission delay time varies with time as shown below and can be monitored on the graph. (If the graph is hard to see, place a checkmark in “Logarithm”.)



5.6. Analysing Measurement Results

(Outline)
Analyze the multicast stream QoS measurement results.
(Contents)
Analyze the measurement results displayed on the screen.
(Results)
You will learn how to perform evaluation of multicast stream QoS measurement results.

The displayed QoS measurement results (packet loss) are the packet loss that occurs when a multicast stream is broadcast with Channel Zapping.
This shows the QoS when hosts (subscribers) are performing Channel Zapping on a video streaming service using multicast streaming typical used by IPTV. QoS control is commonly used because multicast communications require real-timeness. If packet loss occurs, it is important reconsider the design of the network including monitoring routers performing QoS control and the content bandwidth. Actual networks are complex and QoS varies with the number of routers and their performance on the multicast streaming network as well as with the subscriber behavior (Channel Zapping conditions) and rich content (network load). When monitoring the overall service, it is very important to remember that the network performance is impacted by all the users.
The purpose of this measurement is evaluation of network performance. Evaluating network performance in advance can help prevent problems before they occur and plan future network development.

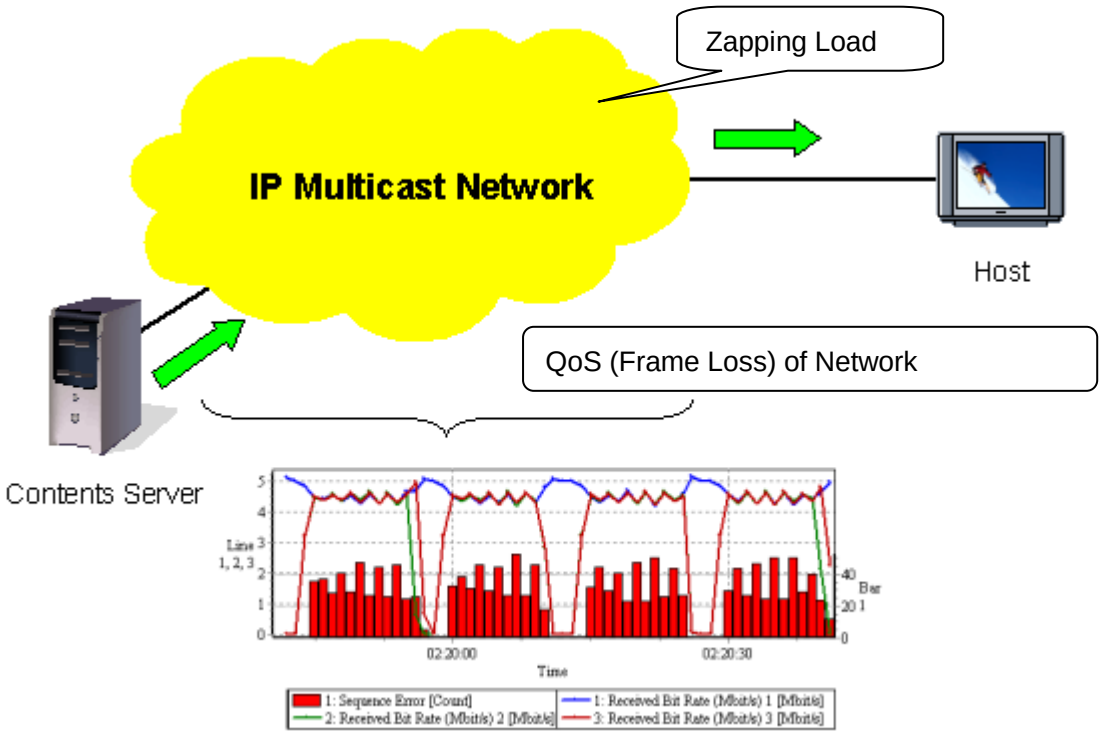


Fig. 13 QoS (Frame Loss) due to Network

6. Summary

The MD1230B and MP1590B simulate a server and connected hosts to verify and evaluate the multicast network before the start of service. Testing that previously required large amounts of test equipment and personnel can now be done quickly and at low cost, offering providers the ideal solution for assuring multicast QoS.

Product Features

- ✓ Supports IPv4/IPv6 multicasting
- ✓ Supports IGMPv3/MLDv2 protocol
- ✓ Multiple virtual host operation supporting verification without previous need for large number of terminals, cutting costs
- ✓ Automated virtual host increase/decrease and channel changing for easy creation of high load conditions that are hard to create intentionally on an in-service network

Composition	Mainframe: MD1230B, MP1590B Pulugin Module: MU120131A or MU120132A Software version: Ver. 7.0 or later
Protocols	IPv4: IGMPv2, IGMPv3 IPv6: MLDv1, MLDv2 Note: Support for IPv6 requires the IPv6 expansion option.
Host Emulation	No. of Virtual Hosts: Up to 2000 (IGMPv2/MLDv1) Up to 200 (IGMPv3/MLDv2)

Note

Anritsu

Specifications are subject to change without notice.

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