

# Ethernet Backhaul Testing

## Ensuring Reliable and Efficient Transport

### MT9090A/MU909060A Network Master Gigabit Ethernet Tester

By Stephen Colangelo

#### Background

As Ethernet becomes a more common technology for wireless backhaul, certification testing needs to be performed to ensure effective, reliable operation. As such, a portable, handheld tool such as the MT9090A Network Master with MU909060A Gigabit Ethernet Tester is a required. The MT9090A is an easy to use and versatile test instrument for the installation, troubleshooting, performance analysis and testing of Ethernet lines.

#### Purpose

This application note will show you how to certify an Ethernet link for reliable wireless backhaul operation:

- How the instrument makes it easy to execute a series of tests to verify the performance of an Ethernet line including a ping test, RFC 2544 tests and a BER test.
- How you can use the multistream option to verify priority handling in the network.

#### Required Equipment

- Network Master Gigabit Ethernet Tester:
  - MT9090A Mainframe
  - MU909060A1 Gigabit Ethernet Module
  - G0240A 1000 Mbps SX SFP
  - MU909060A1-001 RFC 2544 Test Option
  - MU909060A1-002 Multi-stream Option
- A LC to LC simplex optical cable (e.g. J1344A LC•PC-LC•PC-1M-SM)



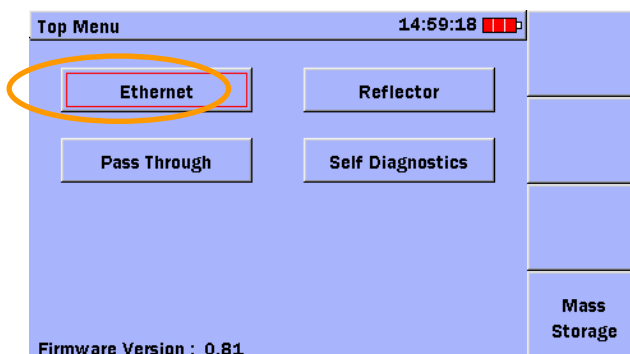
## Ethernet Testing with the Network Master

This procedure “emulates” out-of-service testing of an Ethernet line. The suggested test sequence is executed in a couple of minutes.

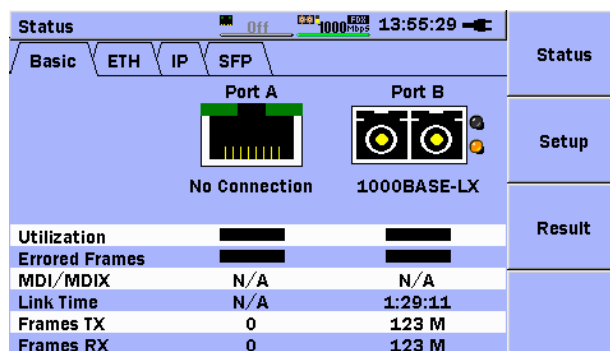
NOTE: a loop back at the far end of the line, either with a simple loop-back with a cable or with a reflector device, depending on what network elements the Ethernet line goes through is required.

How to set up the instrument:

- Power on the instrument.
- Connect the receiver to the cable or fiber under test.
- Select Ethernet in the instruments top menu and set the Port B as shown on the following pages.

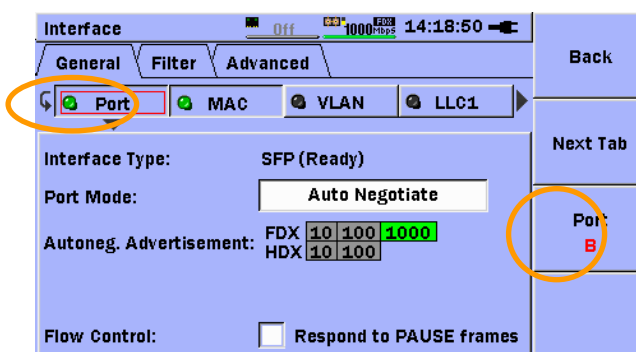


Network Master Gigabit Ethernet Tester top menu. Select Ethernet to start the Ethernet application.



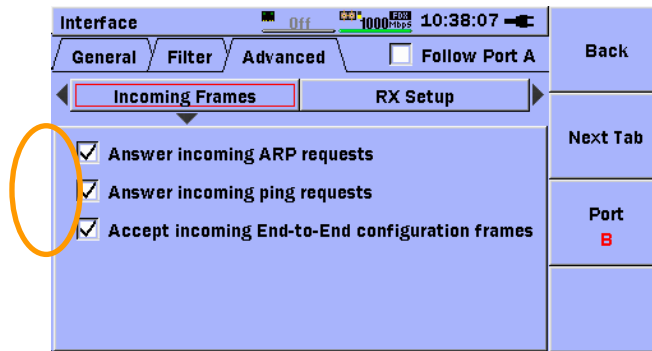
First screen you see in the Ethernet application is the Status/Basic screen.

- Press Setup (F2) and then select Interface to program the Port B (F3) setup pages as shown in the next pictures.



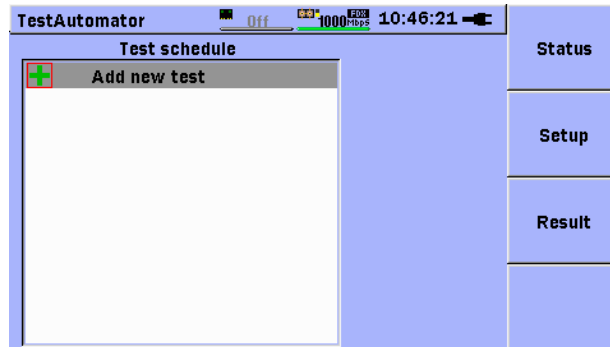
Port B Interface General screen for port B Frame. Select the Port field, which makes the soft LED in the field green. There must be green soft LEDs in the Port, Mac and IPv4 field only. Use the cursor right key to check the fields.

- Press Next Tab (F2) twice and set the Interface Advanced screen as shown below:

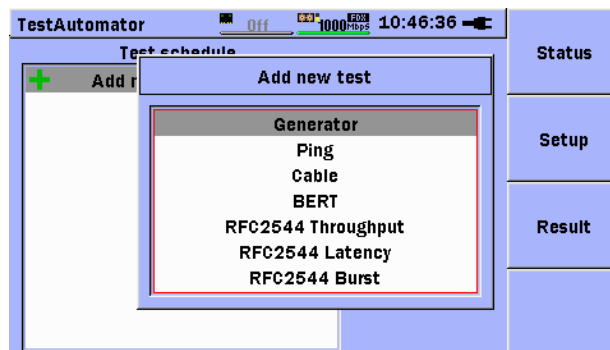


*The Interface Advanced screen.*

- Press Back (F1), Setup (F2) then select TestAutomator to set up a sequence of tests:



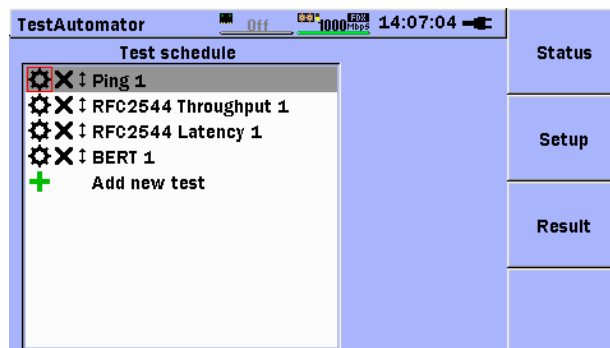
- Select Add new test to get the pop up with the tests that can be inserted in the test sequence:



*The Add new test pop up screen.*

#### Tips:

- The Test Automator allows the customer to set up a sequence of tests. The sequence can be stored in the instrument for recall at a later time, ensuring that tests needed to verify the performance of a line is always executed. The tests can be executed several times with different setup conditions.
- Add tests until you have the following setup:



*The suggested test sequence to be used for Ethernet backhaul.*

- The Test Automator sequence shown will allow the customer to do a typical series of tests: First ping an IP address to verify that you basically can access it, then do RFC 2544 tests to verify throughput and latency (also known as Round Trip Time) and finally to do a BER test to verify the transmission quality of the line.
- Please observe that there is a number (1) after the name of each test. This is because each test can be executed several times, so if this is selected next tests of same type will be numbered 2, 3 etc.
- Select Ping 1 and make sure the Ping 1 setup screens look as the screens below. Change the settings where necessary:

*Ping 1 setup Test Config. screen*

*Ping 1 setup Test Destination screen*

*General note on destination MAC addresses: When you check the “Use ARP” box the instrument will resolve the destination MAC address when the test starts. The instrument will also resolve the destination MAC address when the “Use ARP” box is checked. The dimmed value shown next to “Destination MAC” is the value found when the box was checked. If you load a stored setup or power the instrument on with the “Use ARP” box checked, the soft LED is dark.*

*General note on Dest. IP Address: For the demonstration the value 0.0.0.0 is used. Please observe that this value should not be used when sending traffic into a network.*

- Press Back (F1), select RFC2544 Throughput 1 and make sure the Throughput 1 setup screens look as the screens below. Change the settings where necessary:

*RFC 2544 Throughput 1 Test Mode screen*

*RFC 2544 Throughput 1 Duration screen*

*RFC 2544 Throughput 1 Destination screen*

*RFC 2544 Throughput 1 Frame Size screen*

Throughput 1 Off 1000Mbps 14:04:07 Back

Duration Destination Frame Size **Line Load**

Line Load [Mbps]

☐ Stop on no frame loss

Line Load unit: Percent

Min: 90.0000 %

Max: 100.0000 %

Step: 10.0000 %

☐ Auto Search

RFC 2544 Throughput 1 Line Load screen

Throughput 1 Off 1000Mbps 14:04:17 Back

Destination Frame Size Line Load **Advanced**

Miscellaneous

☒ Transmit learning frames prior to test

☒ Include addresses in frame filter on receiver

☐ Accumulate repeated steps

Throughput Calculation

Calculation Layer: Physical layer

Throughput Type: Maximum

RFC 2544 Throughput 1 Advanced screen

- Press Back (F1), select RFC2544 Latency 1 and make sure the Latency 1 setup screens look as the screens below. Change the settings where necessary:

Latency 1 Off 1000Mbps 14:04:46 Back

**Test Mode** Duration Destination Frame Size

Select Test Mode

Mode: Single Ended Network Test

Port

Select Port: Port B

RFC 2544 Latency 1 Test Mode screen

Latency 1 Off 1000Mbps 14:04:54 Back

Test Mode **Duration** Destination Frame Size

Test Duration

Step Duration: 10 Seconds

Test Repetitions: 1

RFC 2544 Latency 1 Duration screen

Latency 1 Off 1000Mbps 14:05:08 Back

Test Mode Duration **Destination** Frame Size

MAC

Destination MAC: 00-00-91-04-E5-0F

ARP: ☒ Use ARP

IP

Dest. IP Address: 0.0.0.0

DNS: ☐ Use DNS

RFC 2544 Latency 1 Destination screen

Latency 1 Off 1000Mbps 14:05:17 Back

Test Mode Duration Destination **Frame Size**

Frame Sizes (Bytes)

☒ 64 ☐ 128

☐ 256 ☐ 512

☐ 768 ☐ 1024

☐ 1280 ☐ 1518

☒ Jumbo Frame 1519

RFC 2544 Latency 1 Frame Size screen

Latency 1 Off 1000Mbps 14:05:24 Back

Duration Destination Frame Size **Line Load**

Line Load [Mbps]

☐ Only run steps where preceding test passed

Line Load unit: Percent

Min: 90.0000 %

Max: 100.0000 %

Step: 10.0000 %

RFC 2544 Latency 1 Line Load screen

Latency 1 Off 1000Mbps 14:05:35 Back

Destination Frame Size Line Load **Advanced**

Miscellaneous

☒ Transmit learning frames prior to test

☒ Include addresses in frame filter on receiver

☐ Accumulate repeated steps

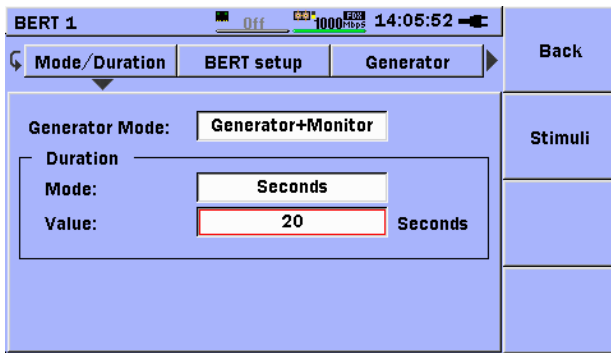
Throughput Calculation

Calculation Layer: Physical layer

Throughput Type: Maximum

RFC 2544 Latency 1 Advanced screen

- Press Back (F1), select BERT 1 and make sure the BERT 1 setup screens look as the screens below. Change the settings where necessary:



BERT 1 Off 1000Mbps 14:06:52

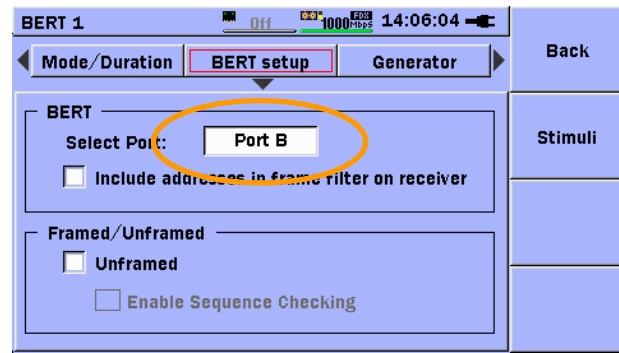
Mode/Duration BERT setup Generator Back

Generator Mode: Generator+Monitor

Duration Mode: Seconds Value: 20 Seconds

Stimuli

BERT 1 Mode/Duration screen



BERT 1 Off 1000Mbps 14:06:04

Mode/Duration BERT setup Generator Back

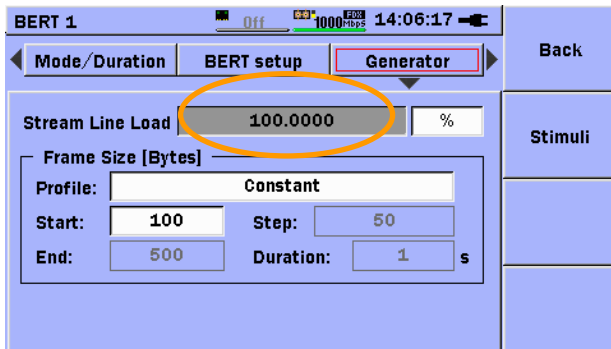
BERT Select Port: Port B

☐ Include addresses in frame filter on receiver

Framed/Unframed ☐ Unframed ☐ Enable Sequence Checking

Stimuli

BERT 1 setup screen



BERT 1 Off 1000Mbps 14:06:17

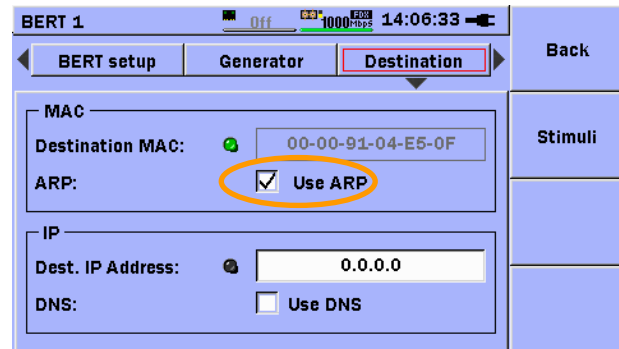
Mode/Duration BERT setup Generator Back

Stream Line Load 100.0000 %

Frame Size [Bytes] Profile: Constant Start: 100 Step: 50 End: 500 Duration: 1 s

Stimuli

BERT 1 Generator screen



BERT 1 Off 1000Mbps 14:06:33

BERT setup Generator Destination Back

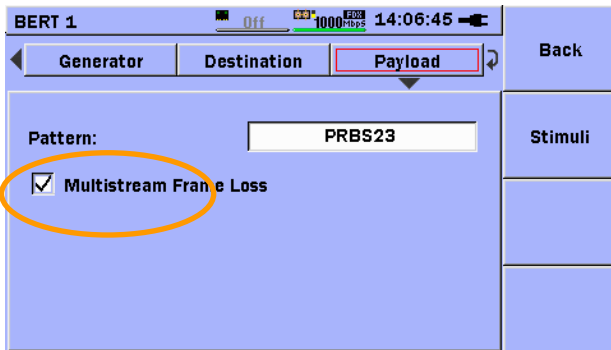
MAC Destination MAC: 00-00-91-04-E5-0F

ARP: ☒ Use ARP

IP Dest. IP Address: 0.0.0.0 DNS: ☐ Use DNS

Stimuli

BERT 1 Destination screen



BERT 1 Off 1000Mbps 14:06:45

Generator Destination Payload Back

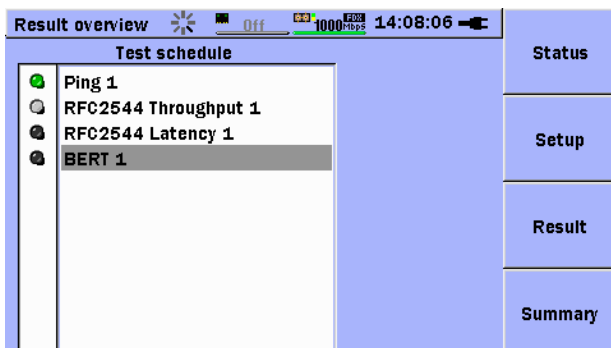
Pattern: PRBS23

☒ Multistream Frame Loss

Stimuli

BERT 1 Generator screen

- Start the test by pressing the Start key. After a short while the result overview screen will appear:



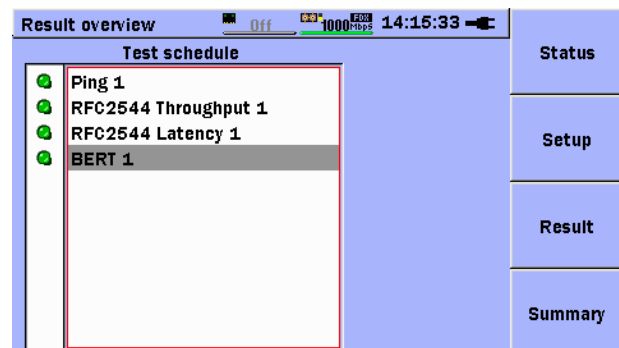
Result overview Off 1000Mbps 14:08:06

Test schedule

- Ping 1
- RFC2544 Throughput 1
- RFC2544 Latency 1
- BERT 1

Status Setup Result Summary

During the test you can follow the progress: A soft-LED flashes for the on-going test



Result overview Off 1000Mbps 14:15:33

Test schedule

- Ping 1
- RFC2544 Throughput 1
- RFC2544 Latency 1
- BERT 1

Status Setup Result Summary

After the test you get a pass/fail overview of the executed tests

During and after the tests you can look at the status page and the results pages to show the customer all the important information that has been gathered. You get to the Status screen by pressing the Status key (F1).

Status	Off	1000Mbps	13:56:41	Status
Basic	ETH	IP	SFP	Status
Port A	Port B			Setup
No Connection	1000BASE-LX			Result
Utilization				
Errored Frames				
MDI/MDIX	N/A	N/A		
Link Time	N/A	1:20:33		
Frames TX	0	87.9 M		
Frames RX	0	87.9 M		

Hint: It is best to open the status screen during the RFC 2544 tests as there will be most activity in the Utilization indicator.

You get from the Status screen to the result pages by pressing the Result key (F3) and then select the test for which you want to see results. After showing one result screen you get back to the result overview screen by pressing the Back key (F1). You can now select another test to show results for:

Ping 1	Off	1000Mbps	14:15:44	Back
Port B ping results				
2: Reply, 0.504 ms				
3: Reply, 1.025 ms				
4: Reply, 1.089 ms				
5: Reply, 0.506 ms				
6: Reply, 0.558 ms				
7: Reply, 0.541 ms				
8: Reply, 0.556 ms				
9: Reply, 0.503 ms				
10: Reply, 0.581 ms				
---- Test ended ----				
Summary				Summary
Sent: 10				
Received: 10				
Lost: 0				
Round trip time				
Min: 0.503 ms				
Max: 5.388 ms				
Avg: 1.125 ms				

Ping result screen

Throughput 1	Off	1000Mbps	14:12:27	Back
Repetition:Step				
1: 1				
1: 2				
Tx (Port B)				
Tx Utilization(Mbps)	1000.0000			
Tx Frame Size(bytes)	64			
Tx Total Frames	14.880952 M			
Tx Frame Rate(Fps)	1.488095 M			
Rx (Port B)				
Rx Total Frames	14.880952 M			
Rx Utilization(%)	100.0000			
Rx Throughput(Mbps)	857.1433			
Rx Frames Lost Min	0			
Rx Frames Lost Max	0			
Rx Frames Lost Avg	0			
Rx Lost Rate Min(%)	0.0			
Rx Loss Rate Max(%)	0.0			
Rx Loss Rate Avg(%)	0.0			
Summary				Summary

RFC 2544 Throughput result screen

Latency 1	Off	1000Mbps	14:16:18	Back
Repetition:Step				
1: 1				
1: 2				
Tx (Port B)				
Tx Utilization(Mbps)	900.0000			
Tx Frame Size(bytes)	64			
Tx Total Frames	13.392857 M			
Tx Frame Rate(Fps)	1.339285 M			
Rx (Port B)				
Rx Total Frames	13.392857 M			
Rx Utilization(%)	90.0001			
Rx Throughput(Mbps)	771.4293			
Rx Jitter Min(us)	0.0			
Rx Jitter Max(us)	0.0			
Rx Jitter Avg(us)	0.0			
Rx Latency Min(us)	1.5			
Rx Latency Max(us)	1.5			
Rx Latency Avg(us)	1.5			
Summary				Summary

RFC 2544 Latency result screen

BERT 1	Off	1000Mbps	14:16:34	Back
Port B Results				
Pattern Bit Count	7.04306 G			
Pattern Errors	0			
Pattern Errors(%)	0.00000			
Seq. Errors	0			
Seq. Sync. Lost	0			
Frame Loss	0			
Frame Loss Seconds	0			
Stimuli				

BERT result screen

By pressing the summary key (F4) you get information for the total test sequence:

Summary	Off	1000Mbps	14:16:56	Back
Event Log	Statistics			
Port A	Port B			
Total	0	77.385955 M		
Unicast	0	77.385924 M		
Multicast	0	0		
Broadcast	0	31		
FCS Errors	0	0		
Fragmented	0	0		
Oversized	0	0		
Undersized	0	0		
Collisions	0	0		
Preamble violations	0	0		
IFG violations	0	-		
Severe IFG violations	-	0		

Statistics result screen with information on total traffic during the entire test, Unicast, Multicast and

Summary	Off	1000Mbps	14:18:08	Back
Event Log	Statistics			
Time	Description			
14:07:16	Ping test started			
14:07:53	Ping test stopped			
14:07:53	RFC2544 Throughput test started			
14:08:23	RFC2544 Throughput test stopped			
14:08:23	RFC2544 Latency test started			
14:08:53	RFC2544 Latency test stopped			
14:08:53	BERT test started			
14:09:15	BERT test stopped			
14:09:17	Mon Feb 09 2009 Test stopped			

The Event Log screen where you can see the most important events that happened during the

- After the test is completed, it is possible to get a PDF report of the results:
- In one of the result screens press the Menu key and select PDF report (top item in the list that appears). Then the following screen appears:

PDF report

Off 1000 Mbps 14:49:36

Basic Comment Logo

Receivers/Transceivers

☐ Port A ☒ Port B

General

☒ Include Setup ☒ Include Comment

Back

Next Tab

Generate

PDF report configuration. You can choose for which ports you make the report, if the Setup information for the test should be included and if a comment section should be included. The comment is entered in the Next Tab screen. Finally you can import a logo to the instrument. The logo can be included in the report.



- To get the report out of the instrument insert a USB memory stick in the Type A USB port of the instrument. After a short while a message will indicate that a USB device has been detected and is ready for use. Select OK to close the message. Then press the menu key and select Mass Storage. Switch to the instruments internal memory (Device Internal), select the report (extension is pdf), press the File Operations key (F1) and select copy. In the next screen that appears select the USB memory stick (device USB) and press the Paste key (F1). The report will be copied to the USB memory stick.



: 2009-02-09 15:06:55

## Document Information

Comment

Customer: customer

Project/Description: test

Operator:

Notes:

Ex

*Sample of a PDF report header with a customer logo inserted.*

## Save and load setups

To simplify field operation, the setup can be saved and loaded on multiple units to ensure consistency in testing.

- To save a setup you press the Menu key and select Save. The screen that appears allows you to give the setup a name. It is stored in a file with the name you have given and the extension cfg, when you press the SAVE SETUP key (F1).
- To load a setup you press the Menu key and select Load. You then select the relevant setup and press the LOAD SETUP key (F1).

Mass Storage		10:39:52	SAVE SETUP
Save As:	setups		
Device:	Internal		
Folder:	/Data/		
Files	Date		
[Network Master]			
[results]			
setup_demo.cfg	2009-02-12		
setup_demo1.cfg	2009-02-10		
setup_multi.cfg	2009-02-13		EXIT

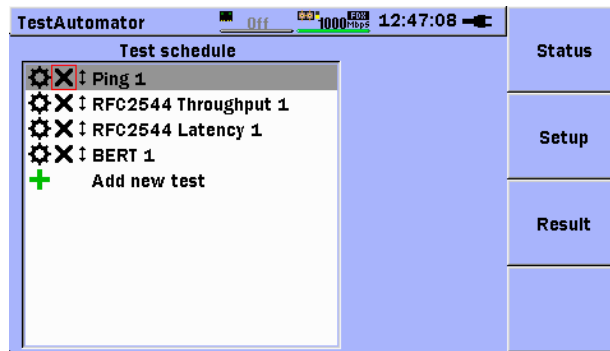
Save setup screen

Mass Storage		10:39:32	LOAD SETUP
Device:	Internal		
Folder:	/Data/		
Files	Date		
[Network Master]			
[results]			
factory_default.cfg	2009-02-16		
setup_demo.cfg	2009-02-12		
setup_demo1.cfg	2009-02-10		
setup_multi.cfg	2009-02-13		
setups_demo.cfg	2009-02-12		EXIT

Load setup screen

## To Remove Tests from the TestAutomator

To go from one setup to another it can sometimes be required to remove tests from the TestAutomator. To do that you open the TestAutomator screen, move the cursor (red box) to the X in the line for each test and press the Set key. This will take the tests out of the TestAutomator one by one.



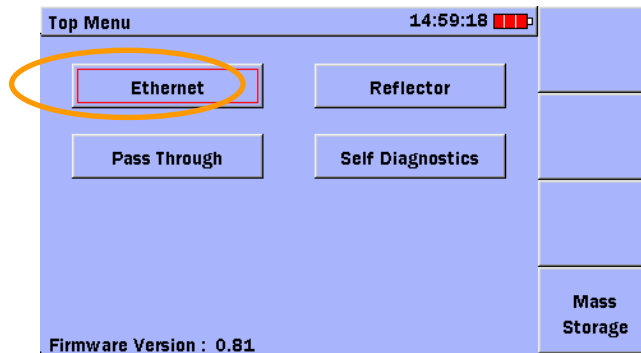
## Demonstrating Multistream Testing with the Network Master

This demonstration “emulates” multistream testing of an Ethernet line; the suggested test sequence is executed in approx. 20 seconds.

The Ethernet multistream option for the Network Master Gigabit Ethernet tester allows the user to test a congested networks ability to transport high priority traffic rather than lower priority traffic. Typically VoIP and IPTV signals are sent with higher priority than other types of traffic to ensure good quality. The user can activate up to 8 streams with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network. In the demonstration example two streams are used.

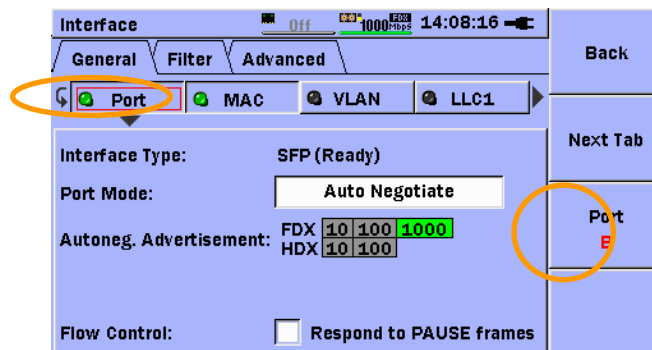
How to set up the instrument:

- Power on the instrument
- Connect the receiver to the fiber or cable under test.
- Select Ethernet in the instruments top menu and set the Port B as shown on the following pages.



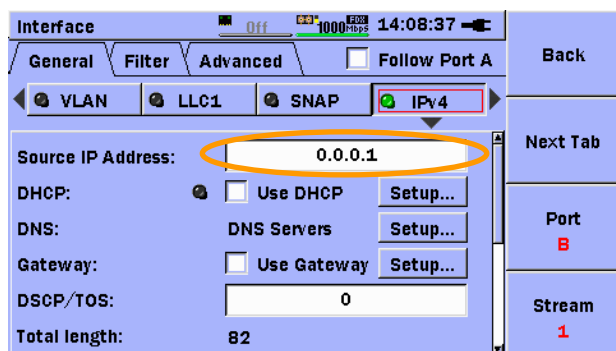
*Network Master Gigabit Ethernet Tester top menu. Select Ethernet to start the Ethernet application.*

- Press Setup (F2) and select Interface. Make sure the Interface setup screens look as the screens below. In the screens individual for stream 1 and 2 you get from one stream to the other by pressing Stream (F4) and then select the stream you want. Change the settings where necessary:

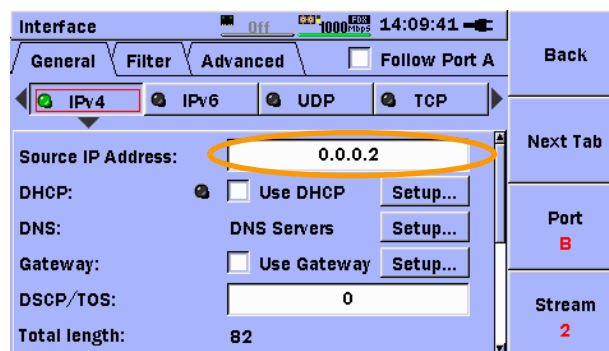


*Interface General screen*

Note: You can add a VLAN tag and set its priority individually for each stream. In some cases priority is controlled using the VLAN priority field.

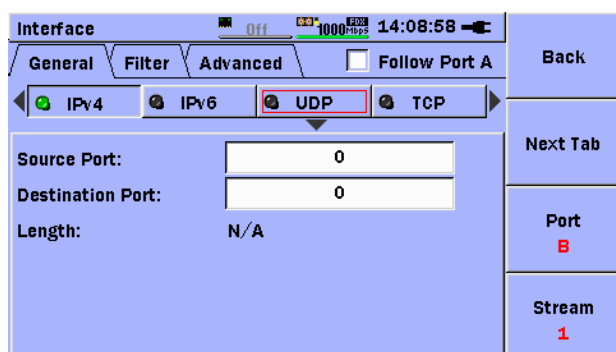


Interface IPv4 screen for stream 1

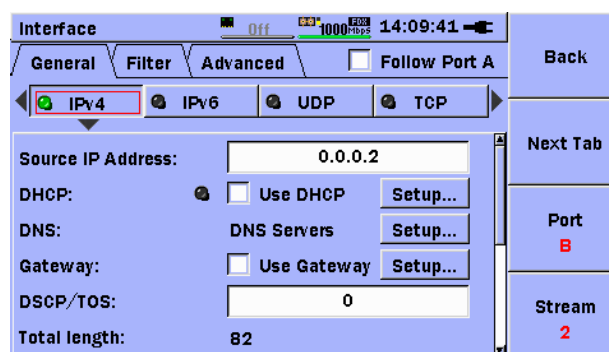


Interface IPv4 screen for stream 2

Note: You can program DSCP/TOS byte individually for each stream. In some cases priority is controlled using the DSCP/TOS byte.



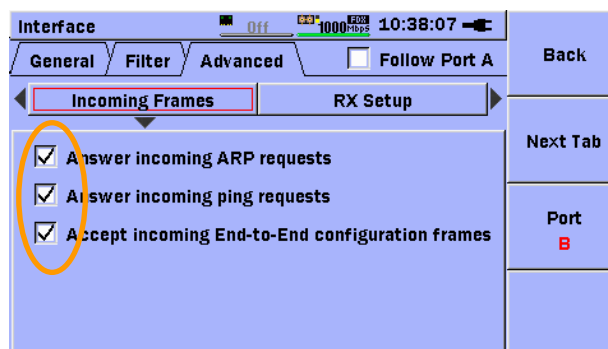
Interface UDP screen for stream 1



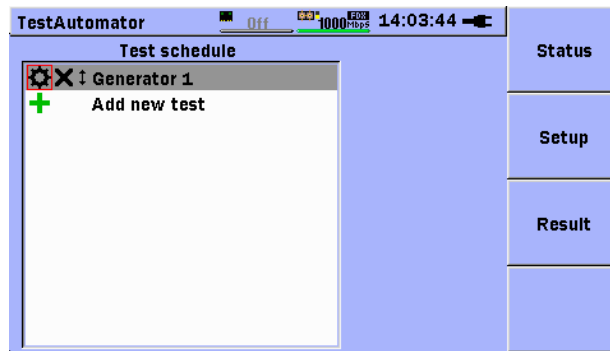
Interface TCP screen for stream 1

Note: You can add a UDP or TCP header and set them individually for each stream. In some cases priority is controlled by port addresses in the UDP or TCP header.

- Press Next Tab (F2) twice and set the Interface Advanced screen as shown below:

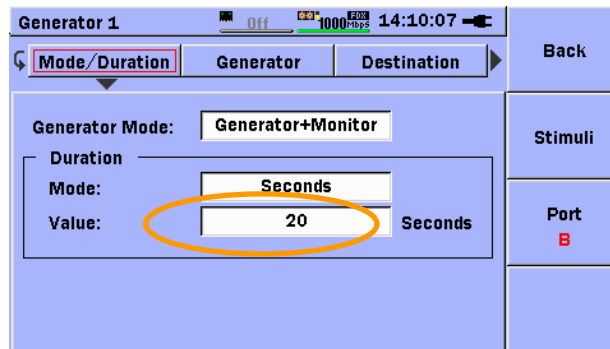


- Open the TestAutomator screen and add a Generator test

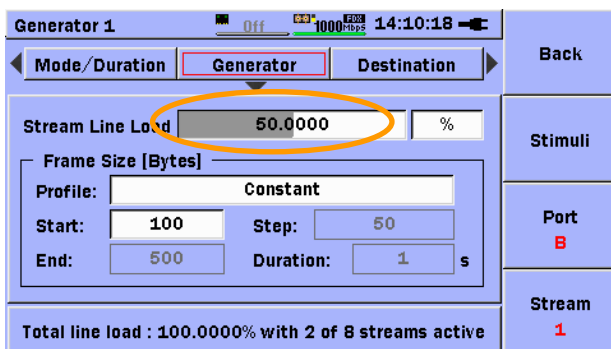


*TestAutomator with Generator test added*

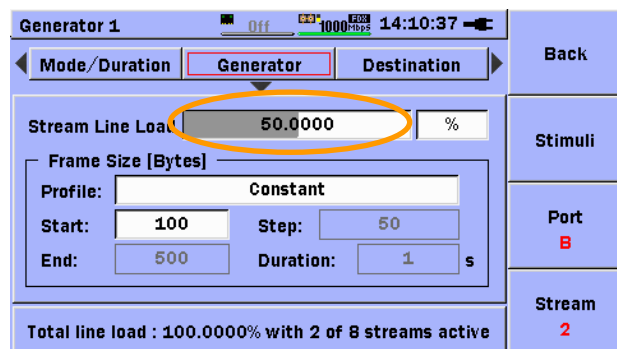
- Select Generator 1. Make sure the setup screens look as the screens below. In the screens individual for stream 1 and 2 you get from one stream to the other by pressing Stream (F4) and then select the stream you want. Change the settings where necessary:



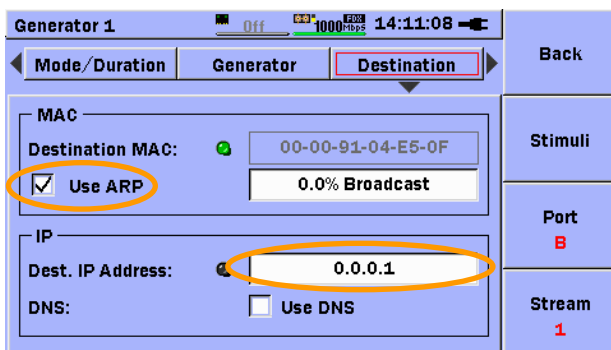
*Generator 1 Mode/Duration screen*



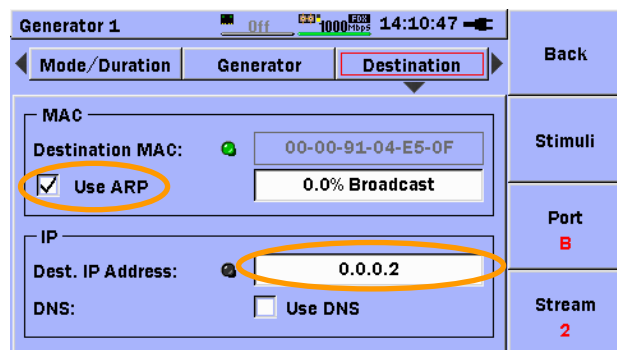
*Generator 1 Generator screen for stream 1*



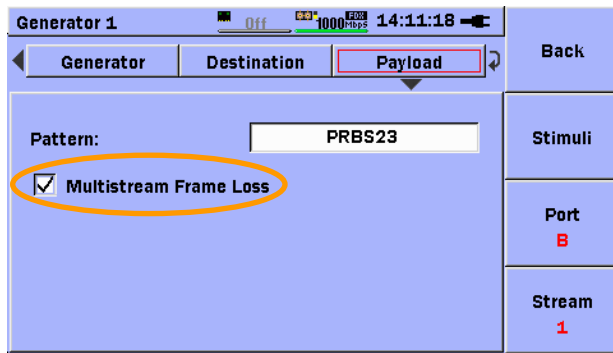
*Generator 1 Generator screen for stream 2*



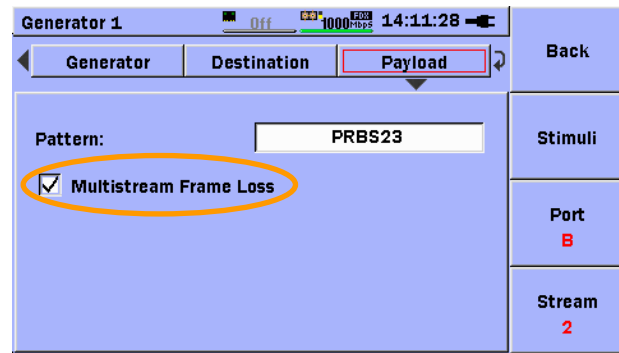
*Generator 1 Destination screen - stream 1*



*Generator 1 Destination screen - stream 2*

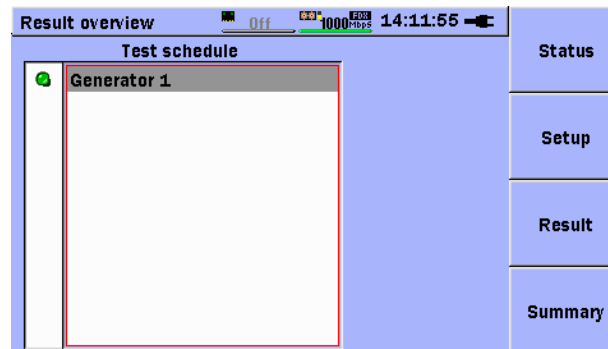


Generator 1 Payload screen for stream 1



Generator 1 Payload screen for stream 2

- Make sure that other streams than the two selected ones are turned off. This is done by decreasing Stream Line Load to 0 in the Generator screen for each stream.
- Start the test by pressing the Start key. After a short while the result overview screen will appear:



Result overview screen after end of test

- Select Generator 1 to re results for the streams. You get from one stream to the other by pressing Stream (F4) and then select the stream you want:

Generator results		Off	1000-bps	14:12:05	
Tx results					Back
Tx Total Frames	10.412095 M				Stimuli
Tx Total Bytes	1.041209 G				
Tx Broadcast Frames	0				
Tx Broadcast Bytes	0				
Rx results					Port B
Rx Total Frames	10.412095 M				
Rx Total Bytes	1.041209 G				
Rx Errored Frames	0				
Frame loss					Stream 1
Frames lost	0				
Frame loss(%)	0				

Result screen for stream 1

Generator results		Off	1000-bps	14:12:22	
Tx results					Back
Tx Total Frames	10.412095 M				Stimuli
Tx Total Bytes	1.041209 G				
Tx Broadcast Frames	0				
Tx Broadcast Bytes	0				
Rx results					Port B
Rx Total Frames	10.412095 M				
Rx Total Bytes	1.041209 G				
Rx Errored Frames	0				
Frame loss					Stream 2
Frames lost	0				
Frame loss(%)	0				

Result screen for stream 2

Note: Multi-stream testing is important to verify priority mechanisms in the network.

## Conclusion

With an easy to use instrument like the Network Master Gigabit Ethernet tester, installation, commissioning and troubleshooting or Ethernet backhaul can easily be performed.

Network\_Master\_Gigabit\_E



Specifications are subject to change without notice.

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