User Guide



Ethernet out-of service test training exercises

MT1000A Network Master Pro

MT1100A Network Master Flex



Training Exercise

MT1000A/MT1100A

Ethernet out-of service test training exercises



Overview

The MT1000A/MT1100A exercises below should help you to gain confidence in using these versatile test instruments for in-service and out-of-service troubleshooting, performance analysis and testing of Ethernet lines.

This Training Exercise will focus on the following out-of-service applications:

- How to use the instrument to verify the QoS (Quality of Service) of an 10 Gbps Ethernet line using the Ethernet Mon./Gen. application (see page 2)
- How to make a 10 Gbps Layer 2 BERT measurement with the instrument using the Ethernet BERT application (see page 15)

Preparation

For the exercise you will as a minimum need the following:

MT1000A exercise:						
Mainframe						
MT1000A Network Master Pro						
Test Module						
MU100010A	10G Multirate Module					
Options						
MU100010A-012	Ethernet 10G Dual Channel					

MT1100A exercise:

Mainframe							
MT1100A Network Master Flex							
Test Modules	(one of the following):						
MU110010A	10G Multirate Module						
MU110011A 100G Multirate Module							
Power Supply	Module (one of the following):						
MU110001A	Battery and AC Power Supply Module						
MU110002A	AC Only Power Supply Module						
Options (one of	the following):						
MU110010A-012	Ethernet 10G Dual Channel						
MU110011A-003	Up to 10G Dual Channel						

The following is also needed:

- Two optical modules G0315A, 10G LR/LW 1310 nm SFP+
- Two J1579A Optical Cable SM LC/PC to LC/PC 3 m
- The stylus
- The main adaptor (not for MU110002A) and an appropriate power cable.

Ethernet QoS verification

This exercise is an out-of-service QoS verification with a multi-stream test of an Ethernet line. The instrument will emulate 3 types of traffic (video, voice and data) with different priority settings.

How to set up the instrument for this exercise:

- Connect Tx to Rx on the optical module in port 1 with a J1579A optical cable.
- Power on the instrument
- You will now see the Application Selector screen.
- To simplify this procedure the Control Panel tab select the Setting and "Restore Applications Defaults" option.
- Select the Mon./Gen. application indicated in the Application Selector screen below.



Application Selector screen. Click on the left side of the highlighted soft key. If you click the right side you start a test with Ethernet embedded in OTN.

After selecting the Mon./Gen. application you get the following screen:

1	
	Select Port(s)
	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
	• • • • • • • • • • • • • • • • • • • •
	Accept Starting application: ETH-Mon./Gen Initializing
	🔐 🗃 🛜 🖁 🗸 🏹 🔰 13 56

Port Selection screen. When selecting a port the instrument will indicate all the physical ports that will be unavailable after your selection: When you select port 1 for Ethernet testing the BNC, Bantam and RJ48 port 1 connectors will be unavailable even though they are not used for Ethernet testing.

- Select port 1 as indicated in the Port Selector screen above.
- Then press the Accept soft key
- You now get the Port Setup screen:

	Port 1		Application	Selector			
Port	Streams	Settings Answer: Arp, Ping	SyncE Off	IEEE 1588v2 Off	OAM Off	Filter Off	
O SFP+	Force	d 10 Gbps LAN	•	_ Transceiver	minal)	 Link Speed: 10 Gbps 	₽
Off				1 310	nm	Duplex: FDX	
Electr	ical Full Auto	Negotiate		10G Base-LR]	Ethernet Traffic	
Electr	ical Forced 1	100 Mbps FDX		J		O MPLS frame	?
SEP	Forced 10	00 Mbps FDX		-		O MPLS-TP frame	
SEP	Forced 1	000 Mbps EDX				SyncE	E,
						IEEE 1588v2	É7
SFP	Auto Neg	otiate 1000 Mbps FDX		_		OH Capture	
SFP+	10 Gbps				_	MAO	X
					-	Frame Capture	
						Transceiver	1
	ETH-Mon./G	en. <u>SET</u>	UP TEST	RESULT	🕂 🕞 🖗 🕌	/ 🗾 💓 動 13 57	

Click the key and select SFP+ | 10 Gbps LAN

In the right side of the port setup screen you can see an indicator it is the Port Status indicator. The green color indicates that the received signal is OK. However there may be a red circle around it indicating that there was a problem earlier. To remove this indication: Click on the Port Status indicator. You will now see the fold-out below:



- Click the "Clear History" soft key and then click the Line Status indicator, which now will be all green.
- The Line Status indicator is visible in all Application related screens and gives a quick indication of the status of the received signal.

Port 1	Application S	Selector			
Port Streams Answer: Arp, Pin	ig SyncE Off	IEEE 1588v2 Off	OAM Off	Filter Off	
SFP+ Forced 10 Gbps LAN Clock Configuration Internal Timing source: Internal		Transceiver Wavelength(nor 1 310 r Compliance 10G Base-LR	ninal) Im E	Link peed: 10 Gbps FDX thernet Traffic MPLS frame MPLS-TP frame VLAN frame VLAN frame SyncE IEEE 1588v2 OH Capture OAM	 ₿ ? ₽ ₽
		- 11		Frame Capture Transceiver	
ETH-Mon./Gen.	ETUP TEST	RESULT	🕂 🕑 🔊 🖌	🗾 💓 🕼 13 57	

- In the right side of the setup screen you get more information on the current line status like line speed and traffic on the line. If you click on one of the fields you get additional information. E.g. from the optical Transceiver you can get information on level of received and transmitted signal.
- Click on the "Streams" soft key and then click the highlighted soft key (in the screen below the soft key shows the text "ETH/IPv4"; this will change with the settings of the instrument).

Port 1	Application	Selector			
Port + Streams	Settings Answer: Arp, Ping Off	IEEE 1588v2 Off	OAM Off	Filter Off	
1 ET	H/IPv4 ▼	Сору Т	Го т	Clink Speed: Duplex: EDX	₿
Dst MAC:	00-00-00-00-00		i	Ethernet	
Src MAC:	00-00-00-00-00	Default		ο MPLS frame	?
-IPv4				O MPLS-TP frame	
Dst IP:	0.0.0.0	DNS	Setup	O VLAN frame	Ĕ,
Src IP:	0.0.0.0	Онср (IEEE 1588v2	1
Payload pattern				OH Capture	
PRBS23				OAM	X
				Frame Capture	-
				Transceiver	
ETH-Mon	./Gen. <u>SETUP</u> TEST	RESULT	un 🖓 🖓 🖁	/ 💽 y 🕠 13:58	

• You now get the Stream Setup screen:

Layer 4	-Frame Content	Application Soloctor Stream Setup		? ×
None 💌	ЕТН	IPv4	Payload	Variable
Layer 3	Dst MAC:	00-00-00-00	-00-00	ARP !
IPv4	Broadcast:	0.0		%
SNAP	Src MAC:	00-00-00	-00-00	Default
LLC1	Ethertype	0x0800 (IPv4)		
VLAN				
РВВ				
MPLS-TP				
MPLS				
Stream 1 2	3 4 5 6	7 8 9 10 11	12 13 14 1	.5 16 Close
	<u>ت ا ا ا ا ا ا ا ا</u>		ويجاريها الما	

• In the Stream Setup screen you can independently configure the protocol structure of each stream; at the bottom of the screen you can see that the MT1000A supports up to 16 streams per port.

- You can select various layer 2 protocols: MPLS (with up to 8 layers of MPLS labels), MPLS-TP, PBB, VLAN (with up to 8 layers of VLAN tags), LLC1, SNAP, Layer 3 protocols: (IPv4 or IPv6) and Layer 4 protocols: TCP, UDP (or none).
- You can set Unicast, Multicast and Broadcast MAC addresses. Unicast and Multicast addresses are distinguished by the least significant bit in the first Dst MAC address – for Unicast the bit is 0, for Multicast the bit is 1. E.g. 00-00-00-00-00-00 in a Unicast address, while 01-00-00-00-00 is a Multicast address. You directly specify the % of Broadcast addresses to be included in the transmitted stream.
- With the "Variable" soft key you can automatically change a number of consecutive bits in an address field (including VLAN tags and MPLS labels). The screen shot below indicates the capabilities of this function (you can open this page see the function, but except for that this function will not be used in the exercise). Confirm the "Field:" section below is turned "Off" before moving on.

		Application	Setup		? ×
Layer 4	Frame Content				
None 💌	ETH	VLAN	IPv4	Payload	Variable
Layer 3	Variable No.	1	2		
Layer 2	Field:	VLAN ID		Level:	1
SNAP	_ Position				
шсі	Offset	4 bit	Length	8	bit
VLAN					
РВВ) (alua				
MPLS-TP	value				
MPLS	Change Type:	Increment	 ▼]		
	Start	0	End 2	55 St	ep 1
Stream 1 2	3 4 5 6	5 7 8 9	10 11 12 1	.3 14 15 1	.6 Close

In Ethernet based network VLANs (Virtual Local Area Networks) can be used to distinguish between different types of traffic. Each VLAN gets its own ID and a priority is also assigned to the VLAN. The network will use the priority setting to prioritize the traffic types on a line.

The MT1000A multistream function use addresses to distinguish between the streams: MAC addresses, IP addresses and/or VLAN IDs. For this exercise only the VLAN IDs are used to distinguish between the streams – all MAC and IP addresses must be all 0. Please observe that in a real network all 0 MAC and IP addresses must not be used – and source and destination addresses must be different. In the screens below you will see how to set VLAN IDs for 3 streams that will be used for the exercise. Priority will also be set to emulate a real network setup; however in the exercise the priority is not used.

- Click Stream 1 in the Stream Setup screen, then first click VLAN in the left column
- After that the VLAN soft key will appear in the top row. Click that and set ID to 1 and Priority to 1



• Do the same for Stream 2 and Stream 3, incrementing the number relative to the stream:

1				Stre	am Setup			? ×
	Layer 4		Frame Content					
	UDP	•	ETH	VLAN	IPv4	UDP	Payload	Variable
	Layer 3		Level count: 1	•				
9	IPv4	•	#1: ID: 2	CFI	Priority:	2 Ethertype	0x0800	
	Layer 2						(11-0.41)	
	SNAP							
	шсі							
	VLAN							
	PBB							
	MPLS-TP							
	MPLS							
	Stream 1	2	3 4 5 6	5 7 8	9 10 11	1 12 13 1	14 15 16	Close

• Close the Stream Setup screen

		Stream S	etup		?
Layer 4	Frame Content				
None 💌	ETH	VLAN	IPv4	Payload	Variable
Layer 3	Level count: 1				
IPv4 💌	#1: ID: 3	CFI Priori	ty: 3 Eth	ertype 0x0800	
Layer 2				(1794)	
SNAP					
LLC1					
VLAN					
PBB					
MPLS-TP					
MPLS					
ream 1 2	3 4 5 6	7 8 9 3	10 11 12	13 14 15 16	Close

• You now get a screen like the following:

		Port 1	l	Applica	tion Selector			-
	Port +	Streams	Settings Answer: Arp, Ping	SyncE Off	IEEE 1588v2 Off	OAM Off	Filter Off	
1	MAC	ETH/VL	AN/IPv4	•	Copy	/ To 🔻	Link Speed: Duplex: FDX	\$
	Dst MAC:		00-00-00	-00-00		!	Ethernet	
	Src MAC:	(00-00-00)-00-00	Default		Traffic MPLS frame MPLS-TP frame	?
	_IPv4			_			• VLAN frame	
	Dst IP:		0.0.0.0)		Setup	SyncE	5
	Src IP:		0.0.0.0)		•	IEEE 1588v2	É.
	_VLAN					rn	OH Capture	
	#1	ID	:	1	PRBS23		OAM	X
							Frame Capture	
	-						Transceiver	1
		ETH-Mon./	Gen. <u>SE</u>	<u>TUP</u> т	EST RESULT	💾 🗃 🛜 🕷	V 📑 🔉 🌒 14:04	

• Click on the top left tap and check that MAC and IP addresses for Streams 1, 2 and 3 are all 0:

		Port 1	ļ	Applic	ation Sele	ector			
	Port	Streams	Settings Answer: Arp, Ping	Synce		IEEE 1588v2 Off	OAM Off	Filter Off	
MA	с					> ▼]	1	Link Speed: 10 Chrs	₽
1:		Src M Dst M	AC: 00-00-00-00-00-0 AC: 00-00-00-00-0)0-00)0-00				Duplex: FDX	-
2:		Src M Dst M	AC: 00-00-00-00-0 AC: 00-00-00-00-0	00-00 00-00			!	Ethernet Traffic	
3:		Src M Dst M	AC: 00-00-00-00-0 AC: 00-00-00-00-0	00-00 00-00				O MPLS frame	?
4:		Src M Dst M	AC: 00-00-00-00-00-00-00-00-00-00-00-00-00-	00-00 00-00				 O MPLS-TP frame O VLAN frame 	
5:		Src N Dst N	AC: 00-00-00-00-0 AC: 00-00-00-00-0	00-00 00-00			Setup	SyncE	5
6:		Src M Dst M	AC: 00-00-00-00-00-0	00-00				IEEE 1588v2	Ĩ
7:		Src M Dst M	AC: 00-00-00-00-00-00-00-00-00-00-00-00-00-	00-00			rn	OH Capture OAM	
8:		Src N Dst N	AC: 00-00-00-00-0 AC: 00-00-00-00-0	00-00 00-00				Frame Capture	^
9:		Src N Dst N	AC: 00-00-00-00-00-0	00-00		•		Transceiver	_
I		ETH-Mon./Ge	n. <u>SE</u>	TUP T	EST	RESULT	🕌 🕬 🖗	V 💽 🔊 🌗 14:05	

• You switch between MAC and IP addresses by clicking on the area highlighted above.

• If an address is not 0 click on that stream. After 1-2 seconds the pop-out will disappear and you get a screen like the one below. Open the MAC and IP address(es) that are not all 0 and change them to all 0. Repeat this until all MAC and IP addresses in streams 1, 2 and 3 are 0.

		Port 1	J	Application	n Selector			
	Port +	Streams	Settings Answer: Arp, Ping	SyncE Off	IEEE 1588v2 Off	OAM Off	Filter Off	
1	MAC	ETH/V	LAN/IPv4	•	Copy	y To 🔻	D Link Speed: Duplex:	*
	Dst MAC:		00-00-00	-00-00	ARP	!	Ethernet	
	Src MAC:		00-00-00	-00-00	Default		O MPLS frame	?
	Dst IP:		0.0.0.0		DNS	Setup	O VLAN frame	E
	Src IP:		0.0.0.0			•	IEEE 1588v2	Î
	VLAN				Payload patte	ern	OH Capture	
	#1		D:	L	PRBS23		Frame Capture	
							Transceiver	
		ETH-Mon.	/Gen. <u>SE</u> 1	UP TEST	T RESULT	💾 🍽 🕈 🖁	V 🗾 🔉 🏟 14 05	

- Click on the lower right tap to switch to the Test Setup pages:
- The "Control" page should look like below; if not change the parameters to have the values shown in the screen below:

		Application Se	lector		
Control	Generator		Streams	Thresholds	
Interval length:	5 seconds				
Start action:	Immediate		Start at:	2001-01-01 00:00:00	¥
Stop function:	Manual stop		Stop at:	2001-01-01 00:00:00	
Memory allocation:	Continuous		Estimate of test duration	00d:03:25:45	0
Performance Parameters	i]		•
					Ĕ.
					Í
					X
ETH-Mon./Ge	en. SETU	JP <u>TEST</u>	RESULT 📑	» N ∑ < N 14:06	

- Click the Streams soft key at the top of the Test Setup page
- Set Stream 1 as indicated below:

	Port 1		Application 9	Selector			
	Control	Generator		Streams	Thres	holds	
1	Stream 1 profile	Video Void	e		Сору То		
	Encoding:	MPEG4 (H.264) SE	,	Stream 1 Measur	ement		
	Number of channels:	50		hreshold			
	Line load	Ramp 529.63	Mbps	Count	🗌 Ratio	0	?
	Frame size	Total: 628.93	Mbps	v litter	2.0	us	-
		Сору То	-	Latency —			9
	Constant			Pequires far-en	d is loop-back devi	ce E	≝
	Start: 1374	End: 1	374	hreshold	2.0	Jus 🔰	K
	Step: 64	Duration:	1 s				
	ETH-Mon./Ge	en. SETUP	<u>test</u>	RESULT	• 🕬 🕫 🛿 V 🗾	y 1 4:07	

During the programming of the instrument "dependency" windows will pop up. To simplify the operation the instrument suggests changes of other parameters if programming of a specific parameter conflicts with the setting of these other parameters. The user just has to accept the suggested changes to get the programming done.

		Port 1		Applica	ation Sele	ctor				
		Control		Generator		Streams		Thresholds		
1	-s	tream 1 profile Data	Video	O Voice		Stream 1 Measu	Copy To		-	
	E			Confirm I	Depen	dencies			×	
	N	In order to com	ply with the re	quested setup, these a	dditional	changes will be	carried out:			
		ETH Layer 4, Stre	eam 1				= UDP			?
	FI									Ĕ,
								Cancel	Ok	é
		Start: 137	4	End: 1374		✓ Threshold		2.0	us	X
		Step: 64			5					
- 11		ETH-Ma	on./Gen.	SETUP T	EST	RESULT	l 📑 🖗	V 💽 🔉 🕸) 14 07	

- To switch between streams: Click the tap at the top right in the screen. In the popout that appears click on the addresses of the stream you want and wait approx. one second. Then the screen for the selected stream will open.
- Set Stream 2 as indicated below:

Port 1	Application	Selector		
Control	enerator	Streams	Thresholds	
2 Stream 2 profile			Сору То	\bigcirc
Data Video	Voice	Stream 2 Measurer	nent	₽
Encoding: VolP C	5.723.1	Virame loss —		~
Number of channels:	1000	hreshold		
Line load	27.00 Mbps	Count	Ratio 0	2
Total:	556.63 Mbps	The second secon		•
Frame size		hreshold	2.0 us	E,
Сору То	•	A stangy		-7
Constant	▼]	Pequires far-end i	s loop-back device	Ē
Start: 82	End: 82	hreshold	2.0 us	X
Step: 64 D	Duration: 1 s			<u> </u>
]		
ETH-Mon./Gen.	SETUP <u>TEST</u>	RESULT 📑	🌬 🛜 🖹 V 🍱 📡 🏟 14:09	
Set Stream 3 as indica	ted below:			_
Port 1	Application	Selector		
Control	enerator	Streams	Thresholds	
3 Stream 3 profile			Сору То	\bigcirc
Data Video	Voice	Stream 3 Measurer	nent	*
Encoding:	(MPEG2)	rame loss		
Number of channels:	1	hreshold		
Line load	200.00 Mbpd	Count	Ratio 0	2
Total:	756.63 Mbps	itter —		
Frame size		hreshold	2.0 us	E,
Сору То	•	atency		r=97
Constant		Bequires far-end i	s loop-back device	
Start: 64	End: 64	hreshold	2.0 us	×
Start: 64 Step: 64 D	End: 64 Duration: 1 s	hreshold	2.0 us	×
Step: 64 C	End: 64 Duration: 1 s	hreshold	2.0 us	×

- The "Video" and "Voice" settings makes it easy to emulate traffic patterns that are similar to those of Video and Voice. Please observe however that you do not send real video and voice signals.
- When setting up the streams you also select which of the QoS parameters you want to measure: Frame Loss, Latency and Packet Jitter. Depending on configuration and application some of these parameters may not be relevant:
 - If you send the traffic through a pipe with less capacity than the Ethernet line rate (e.g. if the Ethernet traffic is carried over a lower capacity SDH link) you may want to test that the highest priority traffic has no frame loss, while you know that the lower priority traffic will have frame loss. In such a case it may be irrelevant to see frame loss for the lower priority traffic
 - The Latency measurement requires a far end loop back, which may involve a reflector device at the far end. If that is not available, the Latency should be disabled.
- When enabling the QoS parameters (Frame Loss, Latency and Packet Jitter) you can enable a threshold for each parameter. If you do that you will get a color indication in the result screens if the threshold is exceeded.
- Press the Start Traffic Generator icon



- Press the Start Measurement icon
- The instrument will now start the programmed measurement and automatically switch to the measurement summary screen for all streams:

Port 1	Result File Browser	
2015-01-21 14:10:24	00:00:08	
Summary		Statistics 📘 🔳
Utilization Trored frames	Transmit rate[bit rate]	8
20 80 1 10 90 90 1 10 90 90 1 10 90 90 1 10 90 90 1 10 90 10 10 10 10 10 10 10 10 10 10 10 10 10		
F 0 % 100 3	Gaps 10 3	?
Tx Rx Frames 2647399 2647	7399	
Errored frames	0	Í
Inresnoid		X
Stream Measurement		
1 2 3 4 5 6 7	8 9 10 11 12	13 14 15 16
ETH-Mon./Gen. SE	TUP TEST <u>RESULT</u>	🔐 🗃 🛜 🕅 🗸 🔀 🔉 📫 14:10

• In the summary screen you get an overview of the measurement results. Color indications will indicate if results are good (green) or bad (yellow or red, depending on severity) where it is relevant.





- In this screen you get the main QoS parameters per stream (Frame Loss, Latency and Packet Jitter). Click on the symbols for stream 2 and 3 to get the QoS parameters for these streams.
- When programming each stream thresholds for the QoS parameters were programmed. You now get green color indications making it easy to see that the QoS parameters are within the acceptance limits you entered.

• By selecting the Statistics soft key you can get a certain parameter shown for all streams. Below you can see the possible screens:

	Resul	t File Browser		
2015-01-21 14:10:24	00:00	0:53		
Summary			Statistics	
Total 2015-01-21	Ethernet - Performance	 ▼	SI prefix	8
14:10:25	Ethernet - Performance			
Back 2015-01-21	Ethernet - Frame			
14:10:30	Ethernet - Burst		7,5663 %	
2015-01-21 14:10:35	Ethernet - Size Distribution		7,5664 %	?
2015-01-21	Ethernet - Transmit		7.5664 %	
2015-01-21	Ethernet - Multi Stream Transmit			
14:10:45	Ethernet - Multi Stream Throughput			Î
2015-01-21 14:10:50	Ethernet - Multi Stream Frame Loss		696118208 bps	
Current	Ethernet - Multi Stream Latency		696130368 bps	X
2015-01-21 14:11:16	Ethernet - Multi Stream Jitter		696123253 bps 🔻	
	5 51			
ЕТН-	Mon./Gen. SETUP 1	rest <u>RESULT</u>	🖢 📾 🛜 🐉 🗸 🍱 💁 🕼 14:11	

 Select the "Ethernet – Frame" statistics and scroll down to the "Last Received" VLAN section. Here you will see first level VLAN ID (VLAN 1) switch between 1, 2 and 3 depending on which stream that was detected when the screen was last updated:

			Result File Brows	er				
2015-01-21 14:10):24		00:01:35					
Summary						Statistics 📃		
Total 2015-01-21	Ethernet - Frame				SI prefix			*
14.10.23				Port 1	1			
Back 2015-01-21 14:10:30	Last Received	ID		Pri	iority			
2015-01-21	VLAN 1			3		3		0
14:10:35	VLAN 2			N/A		N/A		
2015-01-21 14:10:40	VLAN 3			N/A		N/A		
2015-01-21	VLAN 4			N/A		N/A		
14:10:45	VLAN 5			N/A		N/A		Ē.
14:10:50	VLAN 6			N/A		N/A		
Current	VLAN 7			N/A		N/A		X
2015-01-21 14:11:58	VLAN 8			N/A		N/A	-	
E1	TH-Mon./Gen.	SETUP	test <u>R</u> I	ESULT	🔐 🕬 🕫 🛚 V	/ 📑 🔉 🕩 14	4:11	

BER test of an Ethernet line

This exercise shows how to do an out-of-service Layer 2 BERT (Bit Error Rate Test) of an Ethernet line. The exercise should come right after the Ethernet QoS verification exercise in the previous section, and the Ethernet QoS verification SHOULD NOT BE STOPPED when this exercise is made as the instrument can do two independent measurements simultaneously.

The requirements for this exercise are the same as those described on first page in this document.

To set up the instrument for this part of the exercise:

- It is assumed that you now are in one of the result screens after the Ethernet QoS verification exercise.
- Connect Tx to Rx on the optical module in port 2 with a J1579A optical cable.
- Click on the "Result File Browser" field in the top of the result screen. You then get to the Result File Browser. Here click on one of the taps in the lower left or right on the screen
- You are now at the Application Selector Screen on the instrument:



Application Selector screen. Click on the left side of the highlighted soft key. If you click the right side you start a test with Ethernet embedded in OTN. After selecting the Ethernet BERT application you get the following screen:



Port Selection screen. All port 1s are now red, as they are allocated by the Ethernet QoS exercise.

- Select port 2 as indicated in the Port Selector screen above.
- Then press the Accept soft key

• You now get the Port Setup screen:



- Click the key and select SFP+ | 10 Gbps LAN
- Please observe that the Line Status indicator is red. This is normal for the Ethernet BERT: The receiver expects to get a test pattern, but as you can see on the traffic indicator in the right side of the screen noting is received. This may be changed by starting the traffic generator depending on other settings. This can also be removed with a parameter in the Test Setup Control screen (see next page)
- Please observe that the background color is changed compared to the previous exercise. This will make it easier to identify which of the two applications you are looking at as you can easily switch back to the Ethernet QoS verification test (this will be shown at the end of this exercise).
- Click on the "Stream" soft key.

Port 2	Applicati	on Selector	
Port WAN	Stream Settings Answer: Arp, Ping	SyncE IEEE 1588v2 Off Off	OAM Filter Off Off
MAC	ЕТН	Сору То	Link Speed: Duplex:
Dst MAC:	00-00-00-00-00		Ethernet
Src MAC:	00-00-00-00-00	Default	 Traffic MPLS frame
Payload pattern			O MPLS-TP frame
PRBS23			SyncE
			IEEE 1588v2
			OH Capture
			OAM
			Frame Capture
			Transceiver

- Click the key and select ETH. Hereby only layer 2 is enabled in the test traffic. When you do this you should say that you can instead activate tests for layer 3 or layer 4 if that is required for the test application.
- Set Dst and Src MAC addresses to the same value e.g. all 0s as shown above (in the dialog where you program addresses a "CLR" soft key will change any other setting to all 0s)
- Click on the tap in the lower right corner to get to the Test Setup screens.
- The "Control" page should look like below; if not change the parameters to have the values shown in the screen below:

		Application Se	lector		
Control	Generator		Stream	Thresholds	
Interval length:	5 seconds	•			
Start action:	Immediate		Start at:	2001-01-01 00:00:00	1
Stop function:	Manual stop		Stop at:	2001-01-01 00:00:00	
Memory allocation:	Continuous	•	Estimate of test duration	00d:03:25:45	0
Performance Parameters			BERT	Options	0
ETH: M.2100			C C	ount lost frames as pattern errors	E
			✓ In fr	clude addresses in ame filter on receiver	1
				nly show BER Alarms hen measuring	
					X
					1
ETH-BERT	SETUP	<u>test</u>	RESULT 📑 🛱) 奈 🔰 🗸 💽 💉 📫 14:11	

- If the "Include addresses in frame filter on receiver" box is checked (as it is in the screen above) the receiver will check that the destination address in the received traffic matches the source address programmed into the instrument (which is why Dst and Src MAC addresses has to be identical in this exercise). If this box is not ticked the instrument will not check the addresses and just assumes that all traffic received is for the test.
- If the "Only show BER alarm when measuring" box is checked (as it is NOT in the screen above) the Line Status indicator will now turn green.
- Click the "Stream" soft key at the top of the screen.
- In the Stream setup screen select Data and Ramp. Then click the soft key with the text "Off":

Port 2	Application S	Selector		
Control	Generator	Stream	Thresholds	
Stream profile Stream profile Stream profile Stream profile Constant Stream profile Stream profile Stream profile Strea	Video Voice SDTV (MPEG2) 1	Stream Measurement Jitter Threshold Latency Requires far-end is lo	0,0 us pop-back device	 ** <
Frame size Stepped Start: 64 Step: 64	End: 1024 Duration: 1 s	Service disruption	0,0 us	
ETH-BERT	SETUP <u>TEST</u>	RESULT 🔐 🗅	奈 🖁 V 📑 y i t 14 12	

- In the pop-up screen that appears (see next page) first set "Line load end" to 100%. "Line load start" may default to 0.0008% (the minimum possible value). If not program the "Line load start" to the value 0.0008%.
- Set "Step size", "Step duration" and "Ramp mode" as shown in the screen below.
- Press close.

Port 2	Application Selector				
Control	Ramp	Thresholds			
Stream profile	bps ↑	~	/		
Data V Encoding:		\sim	- [c]	0.0 us	*
Number of channels:	-		→[5]		
Line load	Unit: 🔵	Percent OM	bps	ack device	0
Frame size	Line load start:	0.0008	%	0.0 us	•
Stepped	Line load end:	100.0000	%		
Start: 64	Step size:	10.0000	%	10 frames	Ĩ
Step: 64	Step duration:	3	s		
	Ramp mode:	Invert ramp)		X
	Off		Close		
ETH-BERT	SETUP	TEST RESULT	💾 🖬 🖘 🕷	V 📑 🔉 🌒 14:13	



Port 2	Result File Browser	
2015-01-21 14:14:08	00:00:15	
Summary		Statistics
BER Bit count Erro	r count Ratio	82
Pattern errors 32369359856	0.00	1
Threshold:	0	
Utilization Pattern erro	ors Errored frames	0
40 50 60 70 70 16-12	Patter	
20 80 10 90 1E-14	1E-2	3
E 0 % 100 7 116 0.00	160 % 100 F	attern Error Insertion
	Insert	ion: Off 🔽
Service disruption Avg.	Max. Burst	length: 1
Disruption time	I/A 0.0 us	
Threshold:	50.000	
ETH-BERT	SETUP TEST RESUL	T 🔐 🖬 🛜 🛿 V 💽 🔉 🕪 14:14

• The summary screen gives an overview of the most important BERT measurement results. Color indications will indicate if results are good (green) or bad (yellow or red, depending on severity) where it is relevant.

Port 2	Result File Brow	ser		
2015-01-21 14:14:08	00:00:28			
Summary			Statistics	
Utilization				₽
40 50 60				
E 30 70	80	Pattern		?
		PRBS23		E
	00	Pattern Error Insert	off	Í
95.92		Burst length:	1	X
ETH-BERT SE	TUP TEST	RESULT 📑 🛗 🛜	🖹 V 💽 🔉 🕩 14 14	

• Click on the utilization meter:

- Each of the 3 meters can be expanded, so they are easy to read from a distance.
- Click on the meter again to restore the summary screen

Port 2	Result File Brow	wser III
2015-01-21 14:14:08	00:01:15	
Summary		Statistics
BER Bit count Error	count Ratio	8
Pattern errors 274.201 G	3 1.09E-11	· · · · · · · · · · · · · · · · · · ·
Threshold:	0	
Utilization 💌 Pattern error	rs Errored frames	
	40 ⁵⁰ 60	Pattern
	E4 20 80 1	PRBS23
E 0 % 100 3 10 10 10 10	10 90 90 100 100 100 100 100 100 100 100	Fattern Error Insertion
50.00 0.00	0.00	Insertion: Manual
Service disruption Avg.	Max.	
Disruption time N	/A 0.0 us	
Threshold:	50.000	
ETH-BERT	SETUP TEST	<u>RESULT</u> 🛗 🛱 🕅 🛜 🛿 V 📑 🔊 🖷 <u>14 15</u>

- Now you can generate a couple of errors in the test pattern to show what happens in case errors are detected.
- Check the "Pattern error insertion" box
- Set insertion to "Manual"
- Click 2-3 times on the "Error Insert" soft key
- The Error count field will change color (to yellow) to make it easy to see that a problem has been detected on the line.
- The most relevant error insertion in a BERT application is pattern error insertion. This is why the error insertion type is directly visible in the BERT summary page. By pressing the tap at the top right of the screen the customer can open the application control pane where a number of different Ethernet errors and alarms can be injected.
- To show more on the detected errors click the "Statistics" soft key at the top of the Ethernet BERT Summary screen.
- First time you do this after start of measurement the instrument will open the "Ethernet – BERT" Statistical screen (see next page). In the upper part of the screen you can see the name of the screen (in this case "Ethernet – BERT"). If you click on this name you get a list of all available statistical screens with a color indication to show screens where problems are detected.
 - The color indication makes it easy to identify the screens indicating problems detected on the Ethernet line.

				Result File Br	rowser			
2015-01-21 14:	14:0	18		00:01:50				
Summary							Statistics 📃	
Total	<	Ethernet - BERT				SI prefix		8
14:14:08					Port 2			4
Back					FUIL 2		-	
2015-01-21 14:14:13		BERT	Count		Ratio)		
2015-01-21		Pattern bit count			469.392 G			0
14:14:18		Pattern errors			3		6.39E-12	
2015-01-21 14:14:23		Seq. errors			0			<u>~</u>
2015-01-21		Sea sync lost			0			
14:14:28								5
2015-01-21		Frame loss			0			
14:14:33	•	Frame loss secs.			0			V
Current								X
2015-01-21 14:15:58		Service disruption	Seconds		Coun	nt	-	
	ЕТН	I-BERT	SETUP	TEST	RESULT	讲 🖬 🖘 🖹 \	🖊 🗾 💓 動 14:16	

• Click on the Pattern errors field (containing the digit 3) in the screen above



- You now get a screen with graphical information on when during the measurement the error(s) occurred. Hereby it is easy to see how errors are distributed: In a burst (as in this case) or distributed all over the total measurement time.
- Click on the "Zoom" tab

	Result File Browser	
2015-01-21 14:14:0	08 00:02:25	
Summary	Statistics	
Total 2015-01-21 14:14:08	Port 2 - ETH - Pattern Errors Back	
Back 2015-01-21 14:14:13	Count	
2015-01-21 14:14:18		2
2015-01-21		
14:14:28 2015-01-21 14:14:33		
Current	5.38E-12	×
14:16:32		
ETH	H-BERT SETUP TEST <u>RESULT</u> 🔐 📾 😤 🛛 🗺 对 🐠 14	16

- You now get a screen focusing on a single parameter, easy to read from a distance: If you modify something on the equipment that is under test some meters away from the instrument you can use this display understanding what happens while making any modifications.
- Click the "Back" tap.
- Click on the Pattern bit count field



- You now can see the Ramp pattern that was programmed earlier.
- Click the "Back" tap.



- Click the tap in the upper left of the screen.
- Check the "Only show intervals that contains errors" box.

			Result File Br	owser					
2015-01-21 14:14:0	8		00:03:32						
Summary							Statistics		
Only show inte	rvals rrors					SI prefix		•	*
Time format:	Absolute 🔻			Port 2					
14:15:18		Count		Rat	tio				
	Pattern bit count			844.143 G					?
	Pattern errors			3			3.55E-1	2	
	Seq. errors			0					¥,
	Seq. sync. lost			0					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
	Frame loss			0					
•	Frame loss secs.			0					~
Current									~
2015-01-21 14:17:39	Service disruption	Seconds		Co	unt			•	
ЕТН	-BERT	SETUP	TEST	RESULT	î # (n 🗢 🖹 '	V 💽 对 🗤	14:17	

- You now see only the 5 second segment(s) of the test where errors were detected. You can look through the various statistical screens to find information on any other parameters in these segments allowing you to gain more insight on the cause of the error.
- The length of the segment is set in the Test Setup "Control" page with the parameter "Interval length". It can have values from 1 second to 12 hours or No intervals.
- At this time the Ethernet QoS verification demonstration should still be running on port 1. To get to the Ethernet QoS verification demonstration click on the Application indicator in the lower left of the screen.
- The Running Applications Pane will now appear as you can see on the next page
- Another way to get the Running Applications Pane on the screen is to press the Power On/Off button and then in the following pop-up press the "Apps Switcher" soft key

			Result File Browser							
20	15-01-21 14	:14:(08		00:04:47					
Su	immary							Statistics		
	Total		Ethernet - BERT			-	SI prefix		•	82
-	14:14:08				Por	t2				4
	Back 2015-01-21 14:14:13		BERT	Count		Ratio				
	2015-01-21		Pattern bit count		1.17165 T					2
	14:14:18		Pattern errors		3			2.56E-12		
	2015-01-21 14:14:23		Seq. errors		0					
	2015-01-21 14·14·28		Seq. sync. lost		0					-14
	2015-01-21		Frame loss		0					
	14:14:33	-	Frame loss secs.		0					
	-76	\bigcap	ETH-Mon./Gen.		ETH-BERT					X
	20	_	Port-1	_	Port-2					
1			Testing		Testing				P*	
1										m

• You can have two independent tests running simultaneously and switch between them at any time – like if you had two separate instruments at the test site – giving you the possibility to reduce the test time by up to 50% if several lines are to be tested at the test site.

You just click on the other test in the Apps Switcher pop up above to switch to that test (note the background color of the button is the same as the test background color.

• In this exercise both ports were used for Ethernet testing, but if required (and with the right configuration of the instrument) the two ports can be used for different technologies, like Ethernet on one port and SDH/ SONET on the other port.

NB: Screen shots in this document were made using a MT1000A with SW version 2.03. Screen layouts may change if other SW versions are used for the exercise. You can make similar screen shots with the MT1100A.

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