

# Network Master Pro MT1000A

10G Multirate Module MU100010A 100G Multirate Module MU100011A High Performance GPS Disciplined Oscillator MU100090A Scenario Environment Editing Kit (SEEK) MX100003A

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- Automation Testing (MX100003A)

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Redefining Transport Testing



### Market Situation—Historical

- Core network had multiple metro/access network subsets
  - Much of the network coming to the access network was muxed up to a larger metro network which was muxed up to the core network.
    - Not all traffic was transferred to the core, but a large percentage was.
    - To a large extent, the core was the size of the combined metro networks.

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### Market Situation—Current and Future

- Metro networks becoming same or larger size than core
  - Many services now require "near" real-time response (simultaneous multiple access to data)

Metro

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- Transferring data long distances to server not ideal
- Many services to many millions of users (apps) now truly global (apps)
  - A single or even two servers (back-up) isn't good enough to handle data
- Many services require very large data from millions of users (video)





Incitsu envision : ensure





## **Out-of-Service Installation Testing**

- Installing and commissioning new lines
  - Verify new-line quality/performance before service commissioning

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- Troubleshooting with test traffic
  - Test network functions under different loads
- Testing line quality
  - Perform far-end loopback tests using cable or special configuration (protocol dependent)



### **Out-of-Service Installation Testing**

- One-way testing using two instruments
  - Separate results for each line direction
  - Performed between MT1000A and MT1000A



MT1000A

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### **Out-of-Service Installation Testing**

- Efficient simultaneous out-of-service testing of up to two lines
  - Supports up to two fully independent ports at all rates



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# Out-of-Service Testing



- Network element installation/commissioning
- Error-performance
   measurements
- Propagation-time measurements

- Alarm, error, slip and frequency-deviation measurements
- System stressing through generation of alarms, errors, slip and frequency offset





# In-Service Troubleshooting and Analysis

- Monitoring both line directions simultaneously to troubleshoot communications path problems
  - Optimum communications requires smooth data transport in both directions

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# MT1000A Key Applications



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- Carrier Class Ethernet I&M and troubleshootir.
  - Ethernet testing up to 100 GigE
  - Include RFC 2544, and Y.1564
  - Include RFC 6349 (Up to 10Gbps)
  - Ethernet OAM
  - MPLS-TP and PBB
  - IP Channel statistics
  - Frame capture for advanced troubleshooting
- Core and Metro networks I&M
  - OTN up to OTU4
  - Mapping of Ethernet/CPRI/SDH/SONET/Fibre Channel client signals, multistage mapping
  - FEC (Forward Error Correction) and O.182 Poisson error insertion
- Mobile Backhaul installation and verification
  - Synchronous Ethernet testing up to 10 GigE (ITU-T G.826x and IEEE 1588 v2)
- Mobile Fronthaul installation and verification
  - CPRI testing up to 10 Gbps
  - OBSAI testing up to 6 Gbps
  - eCPRI/IEEE 1914.3 up to 100 Gbps

### MT1000A Key Applications



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- Powerful Storage Area Networking (SAN) testing
  - Fibre Channel up to 16 Gbps
  - Supports throughput, latency, and buffer credit performance verification
- Quick and easy testing of SDH/SONET, PDH/DSn Networks
  - SDH/SONET up to STM-64/OC-192
  - PDH/DSn (E1, E3, E4, DS1, DS3)
- Fiber endface inspection using VIP (Video Inspection Probe)
- Dual port at 10Gbps rates
  - Reduced testing time by simultaneous testing of two lines with one unit
  - In-service bi-directional monitoring

# MT1000A Key Benefits and Features



- Easy intuitive GUI
  - Large 9-inch touch screen
  - Eight languages (English, Chinese, Japanese, , Korean, German, French, Russian and Spanish)
- WLAN<sup>\*1</sup>/*Bluetooth*/LAN connectivity
- PDF, CSV and XML report generation for documentation of test results
- Remote operation
  - Using VNC or dedicated GUI operation software
  - Via Ethernet, WLAN
- Remote control (scripting) via Ethernet, WLAN, GPIB
- Hand-held product
  - Compact and lightweight design for maximum portability in field
  - Clam shell (single module installation)
  - Modular platform ensures maximum return on investment
- Battery-operated
- High performance in small form factor

\*1 Available for certified countries, including USA, Canada, Japan, all EU countries

### Network Master Family



• Transport







Network Master GigE MT9090A	Network Master Pro MT1000A	Network Master Flex MT1100A					
Dedicated field test solution for installation and troubleshooting Ethernet links in access network	All-in-one transport tester supporting from 1.5 Mbps to 100 Gbps including OTN, Ethernet, PTP, eCPRI/IEEE 1914.3/CPRI/OBSAI, Fibre Channel, SDH/SONET and PDH/DSn	All-in-one, up to 4-port transport tester supporting from 1.5 Mbps to 100 Gbps including OTN, Ethernet, eCPRI/IEEE 1914.3/CPRI/OBSAI, Fibre Channel, SDH/SONET and PDH/DSn					

### • Optical





Optical Channel Analyzer MT9090A	μOTDR MT9090A
Compact CWDM channel analyzer to verify power levels, drift and channel presence of CWDM networks	Compact OTDR for fully automatic verification of optical networks, FTTH PON, metro and core

Network Master Pro MT1000A

• Instrument Views



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### MT1000A Instrument Views

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• Front View



	Kg		lb	
Weight		2,7		6,0
	mm		inch	
Width		257		10,1
Height		164		6,5
Depth		77		3,0

• Other Views:









### Instrument Views 1/3

- Top (connector panel) View
  - MT1000A + MU100010A
- 1. Port 1, Tx Bantam (DS1)
- 2. Port 1, Tx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
- 3. Port 1, Rx Bantam (DS1)
- 4. Port 1, Rx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
- 5. Port 2, Tx Bantam (DS1)
- 6. Port 2, Tx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
- 7. Port 2, Rx Bantam (DS1)
- 8. Port 2, Rx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
- 9. Port 1, Tx/Rx RJ48 (E1 balanced)
- 10. Port 2, Tx/Rx RJ48 (E1 balanced)
- 11. Port 1, Tx/Rx SFP/SFP+ (optical OTN/Ethernet/CPRI/OBSAI/Fibre Channel/SDH/SONET)
- 12. Port 2, Tx/Rx SFP/SFP+ (optical OTN/Ethernet/CPRI/OBSAI/Fibre Channel/SDH/SONET)
- 13. Port 1, Tx/Rx RJ45 (Ethernet electrical)
- 14. Port 2, Tx/Rx RJ45 (Ethernet electrical)
- 15. Audio
- 16. AUX
- 17. Clock input
- 18. USB Mini-B
- 19. USB A
- 20. USB A
- 21. Ethernet service interface
- 22. DC input (18 VDC)



### Instrument Views 2/3

- Top (connector panel) View
  - MT1000A + MU100011A



- 23. Port 1, Tx/Rx CFP4 (optical OTN/Ethernet)
- 24. Port 1, Tx/Rx SFP/SFP+/SFP28 (optical OTN/Ethernet/eCPRI/RoE/CPRI/OBSAI/Fibre Channel/SDH/SONET)
- 25. Port 2, Tx/Rx SFP/SFP+/SFP28 (optical OTN/Ethernet/eCPRI/RoE/CPRI/OBSAI/Fibre Channel/SDH/SONET)
- 26. Port 1, Tx/Rx QSFP28 (optical 25G Ethernet)
- 27. Port 1, Sync Clock Out (CAUI4, 25GAUI, OTL 4.4)
- 28. Port 1, Tx/Rx RJ45 (Ethernet electrical)
- 29. Port 2, Tx/Rx RJ45 (Ethernet electrical)

### Instrument Views 3/3

- Top (connector panel) View
  - MT1000A + MU100010A
- 30. AUX D-SUB 9 pin
- 31. 1 pps Output
- 32. 10 MHz Output
- 33. OCS LED
- 34. GPS received LED
- 35. 1 pps Sync In
- 36. GPS Antenna Input



Network Master Pro MT1000A

Product Structure



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### • Mainframe and Accessories

Model/Order No.	Name								
MT1000A	Network Master Pro								
	Standard Accessories								
MT1000A-006*1	High Power Supply:	Installed							
	Line Cord* <sup>2</sup> :	1 рс							
B0690A	Softbag:	1рс							
B0728A*3	Rear Panel kit:	1рс							
G0385A*4	High Power AC Adaptor:	1 рс							
G0310A	Li-ion Battery:	1рс							
Z1746A	Stylus:	1 рс							
Z1747A*5	Carrying Strap:	1 рс							
Z1748A*6	Handle:	1рс							
Z1817A*7	Utilities ROM:	1рс							
Options									
MT1000A-003*8	Connectivity for WLAN/Bluetooth								
MT1000A-005*9	AUX I/O								

Model/Order No.	Name							
Optional Accessories								
B0691B*10	Hard Case							
B0720A	Rear Panel							
B0729A*11	Screw 1U							
B0730A*11	Screw 2U							
B0731A*11	Screw 3U							
B0732A*12	Screw Kit							
G0382A*13	Autofocus Video Inspection Probe							
G0306B* <sup>13</sup>	Video Inspection Probe							
G0309A*4	AC Adapter							
G0324A	Battery Charger							
G0325A	GPS Receiver							
J1569B	Car 12 Vdc Adapter							
J1667A* <sup>14</sup>	GPIB-USB Converter							
Z1821A*15	Utilities in USB Stick							

### Soft Bag B0690A (Standard Accessory)

This bag with shoulder strap can hold the MT1000A with up to three installed modules.



\*1: The presence of the MT1000A-006 option can be recognized at the top right of the front panel. To retrofit to the already shipped item, please contact us.





-006 With in MT1000A-006

\*2: One line cord is attached to the area to shipment.
\*3: Composed of B0720A, B0729A, B0730A and B0731A.

Refer to Module Composition for the module combination. \*4: The MT1000A with MT1000A-006 can be used. Use the AC adapter when using the MT1000A without MT1000A-006 installed.

\*5: Shoulder strap for MT1000A.

SU envision : ensure

\*6: Hand strap for MT1000A.

\*7: This DVD includes PDF files and formatting tools of each product's instruction manual (such as W3933AE, W3810AE, W3736AE, W3946AE).

Hard Case B0691B

This strong plastic case can hold the MT1000A with up to two installed modules.

462 (W) × 372 (H) × 207 (D) mm

- \*8: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.
- \*9: MT1000A-005 is required for MU100090A. To retrofit to the already shipped item, please contact us.
- \*10: Can use module 1 to 2 in combination
- \*11: Includes 4 bolts of same length
- \*12: Includes B0729A, B0730A and B0731A

\*13: This fiberscope uses the VIP function in the MT1000A Utility menu. Different tip types are used by the G0382A and G0306B.



\*14: J1667A is required for SCPI remote control via GPIB \*15: Include MT1000A Operation Manual and the Remote Script Manual.

1 pc

1 pc



# Standard Accessories W3935AE MT1000A Transport Quick Reference Guide: B0692A\* ESD Box (for optical modules):

10G Multirate Module

Name

### • 10G Multirate Module MU100010A

\*: Up to four SFP+/SFPs can be stored.

Model

MU100010A

MU100010A	Bit Rate	Less than 5G	From 60	G to 10G				
Transport Technology	No. of Measurement Ports*'	2 (Dual Channel)	1 (Single Channel)	2 (Dual Channel)				
Ethemet								
[Pv4/[Pv6, Y.1564, IEEE 1588 v2, RFC 2544, BER, Multistrean MPLS, MPLS-TP, Multistage VLAN, PBB, Ping/Traceroute, Ca In-band Control, Auto discovery, Path-through	n, OAM, SyncE, able Tests,	MU100010A-001 MU100010A-011 MU100010A-012 Up to 2.76 Dual Channel Ethernet 10G Single Channel Ethernet 10G Dual Cha						
TCP Throughput Test (RFC 6349, iPerf)		M	U100010A-020 TCP Throughp	ut				
OTN*2.*3								
Errors/Alarms, Error Performance/Delay/APS Test, FEC Test Overhead Editing/Capture, TCM Monitoring/Generation, Tr	t, O.182 Test, ributary Scan	MU100010A-001 Up to 2.7G Dual Channel	MU100010A-051 OTN 10G Single Channel	MU100010A-052 OTN 10G Dual Channel				
ODU Multiplexing Addition*1		MU	J100010A-061 ODU Multiplex	ing				
ODU Rex Addition**		_	-062 ODU Flex					
CPRI/OBSAI								
CPRI/OBSAI L1: Level/Bit Rate/Frequency deviation Measur Alarms/Errors Detection, Unframed BER CPRI L2: Link Status Monitoring, Alarms/Errors Detection, F Measurement, RTD Measurement, Monitoring usi	rement, Framed BER ng Passthrough	MU100010A-071 CPRI/OBSAIUp to 5G DualChannel	MU100010A-072 CPRI/OBSAI 6G to 10G Single Channel	MU100010A-073 CPRI/OBSAI 6G to 10G Dual Channel				
Fibre Channel								
Performance Test, Signal Generation/Monitoring, Latency, Line Alarm/Error Monitoring	BER,	MU100010A-002 FC1G 2G4G Dual Channel	MU100010A-091 FC 8G 10G Single Channel	MU100010A-092 FC 8 G 10 G Dual Channel				
SDH/SONET, PDH/DSn								
PDH/DSn Test, Tw-Way Monitoring/Mapping, Errors/Alarm Error Performance/Delay/APS Test, Header Monitoring/Ge Pointer Event Generation, Tributary Scan	s, neration,	MU100010A-001 Up to 2.7G Dual Channel	MU100010A-081 STM-64 0C-192 Single Channel	MU100010A-082 STM-64 0C-192 Dual Channel				

Notes:

\*1: The channel is not related to the physical port position. The user can freely choose either of the two physical ports assigned to the option via software. For a dual channel setup, the two different ports of one protocol can operate simultaneously, or two different single channel options can operate simultaneously.

\*2: Please see the datasheet for supported OTN mapping.

\*3: When using the OTN function, the channel can be used as client signal mapped to OTN. For example, when mapping STM-64/OC-192 to OTU2, both the MU100010A-051/052 (for physical port) and the MU100010A-081/082 (for client signal) are required.

\*4: When the ODU Multimapping option is installed, OTN multistage mapping measurements are supported. This one option supports both single channel and dual channel.

\*5: When the ODU Flex option is installed, since transport is over OTN networks, mappings based on used ODU Flex standard can be measured. This one option supports both single channel and dual channel.



Model		Name	
MU100011A*	100G Multirate Module		

100G Multirate Module

Standard Accessories

W3935AE MT1000A Transport Quick Reference Guide: 1 pc

### 100G Multirate Module MU100011A

\*: MT1000A-006 is required for MU100011A.

MU100011A	Bit Rate	Less th	an 10G	Up to 10G				
Transport Technology	No. of Measurement Ports*'	1 (Single Channel)	2 (Dual Channel)	1 (Single Channel)				
Ethemet								
				MU100011A-017 Ethernet 25G Single Channel				
IPv4/IPv6, Y.1564, IEEE 1588 v2, RFC 2544, BER, Multistrear MPLS, MPLS-TP, Multistage VLAN, PBB, Ping/Traceroute, Ci	n, OAM, SyncE, able Tests,	MU100011A-001 Up to 10G Single Channel	MU100011A-003 Up to 10G Dual Channel	MU100011A-013 Ethernet 40G Single Channel				
In-band Control, Auto discovery, Path-through				MU100011A-015 Ethernet 100G Single Channel				
TCP Throughput Test (RFC 6349, iPerf)		MU100011A-02	0 TCP Throughput	—				
				MU100011A-023 RS-FEC for 100GBASE-SR4				
RS-FEC for 100 GBASE-SR4		_	_	MU100011A-015 Ethernet 100G Single Channel				
OTN*2,*3								
Errors/Alarms, Error Performance/Delay/APS Test, FEC Tes	t, O.182 Test,	MU100011A-001	MU100011A-003	MU100011A-053 OTN 40G Single Channel				
Overhead Editing/Capture, TCM Monitoring/Generation, Ti	ributary Scan	Up to 10 G Single Channel	Up to 10G Dual Channel	MU100011A-055 OTN 100G Single Channel				
ODU Multiplexing Addition** **		MU100011A-063 ODU Multiplexing/Multi Stage						
ODU Rex Addition*2.*3		MU100011A-062 ODU Flex						
CPRI/OBSAI								
CPRI/OBSALL1: Level/Bit Rate/Frequency deviation Measur Alarms/Errors Detection, Unframed BER	rement,	MU100011A-071 CPRI/08SAI Up to 10G	MU100011A-072 CPRI/08SALUp to 10G	_				
Measurement, RTD Measurement, Monitoring usi	ng Passthrough	Single Channel	Dual Channel					
Fibre Channel				·				
Performance Test, Signal Generation/Monitoring, Latency,	BER,	MU100011A-004	MU100011A-005	MU100011A-091				
Line Alarm/Error Monitoring		Up to 10G FC Single Channel	Up to 10G FC Dual Channel	FC 16G Single Channel				
SDH/SONET								
PDH/DSn Test, Tw-Way Monitoring/Mapping, Errors/Alarm Error Performance/Delay/APS Test, Header Monitoring/Ge Pointer Event Generation, Tributary Scan	s, neration,	MU100011A-001 Up to 10G Single Channel	MU100011A-083** STM-256/0C-768 Client Signal					

Notes:

\*2: Please see the datasheet for supported OTN mapping.

\*3: When using the OTN function, the channel can be used as client signal mapped to OTN. For example, when mapping 100G Ethernet to OTU4, both the MU100011A-055 (for physical port) and the MU100011A-015 (for client signal) are required.

\*4: When the ODU Multiplexing/Multistage option is installed, OTN multistage mapping measurements are supported. This one option supports both single channel and dual channel.

- \*5: This mapping function is based on the ODUFlex standard for transmissions over OTN networks and supports client signals of any speed.
- \*6: The MU100011A has no STM-256/OC-768 PHY interface; it can be used for OTN client signals.

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<sup>\*1:</sup> The channel is not related to the physical port position. The user can freely choose either of the two physical ports assigned to the option via software. For a dual channel setup, the two different ports of one protocol can operate simultaneously, or two different single channel options can operate simultaneously.

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### • Optical Transceiver for Transport Module

WU110010A WU110011A	Madel/ Order Na.	Name	Fairm Facuar	100 Meg Elhernet	156 Meg ST W-1	614 Meg CPRI	622 Meg ST M-4	768 Meg OBSAI	1GPC	123Gig CPRI	125Gig Elheinet	1.54 Gig OBSAI	ZGPC	2.46 Gig CPRI	2.488 Gig ST M-16	2.67 Gig OTU1	3.07 Gig CPRI OBSA1	46FC	4.92 Gig CPRI	6.14 Gig CPRI OBSA1	9GPC	9.83Gig CPRI	9.95 Gig STM-64	10.1 Gig CPRI	10.3 Gig Elheinet	10GFC	10.7 Gig OTU2	11.05 Gig OT U1e	11.09 Gig OT U2e	11.27 Gig OT UT I	11 JGig OTU2	16GFC	25G Elheinet	40G Elhernet	40G OT N	100G Elhernel	100G OTH
<ul> <li></li> </ul>	G0332A	100M FX 1310 nm MM SFP	SFP	1310 14 14	2 cm																																
11	G0319A	Up to 2.7G 1310 mm 15 km SFP	SFP					_	1310	nnt :	SM, IS	5 670	_	_																							
11	G0.320A	Up to 2.7G 1310 mm 40 km SFP	SFP						1310	nnt :	san a	D sm		_																							
<b>/</b> /	G0.321A	Աթ. ւց 2.7G 1550 թ. m 80 km SFP	SFP						ISSO	nnt :	sm, a	D sm																									
1	G0.328A	1G/2G/4G FC 850 nm SFP	SFP							890	nnt	мм, і	DS en	n																							$\square$
1	G0.32.2A	1G/2G/4G FC 1310 nm SFP	SFP							1310	nnt :	SM( I	041																								
4	G0323A	1G/2G/4G FC 1550 nm SFP	SFP							1950	nnt :	s na m	0 6 m																								$\square$
11	G0315A	10G LR/LW 1310 om SFP+	SFP+																					13	10 nn	n SM	104	n j									
11	G0316A	10G ER/EW 1550 nm 40 km SFP+	SFP+																			_		13	50 nn	n SM	40 4	m j									
11	G0318A	10G ZR/ZW 1550 nm 80 km SFP4	SFP+																			_		13	50 nn	n SM	30 1	m j									
4	G0.329A	10G LR 1310 nm SFP+	SFP+								1310	nnt :	ың н	0.67																							$\square$
1	G0356A	8G FC/10G SR 850 nm SFP+	SFP+																		290 = 1414,0	n 13 m															
4	G0386A	16GFC SR 850 nm SFP4	SFP+																													250nm, NN, 05 km					
4	G0.387A	16GFC LR 1310 nm SFP+	SFP+																													1310nm, SN, 10km					
1	G0.388A	25G SR 850 nm SFP28	SFP28																														250 mm, NN, 05 km				
4	G0389A	25G LR 1310 nm SFP28	SFP28																														1510 m², 50, 10kw				
$\square$	G0296A	40G SR4 850 nm QSFP+	QSFP+																															290 - 1414,0	n Liten		$\square$
$\square$	G0334A	40G LR4 1310 nm QSFP+	QSFP+																															1310 SM 1	un O cin		$\square$
4	G0.366A	100G SR4850 nm QSFP28	QSF P28																																	250 mm, NN, 0.1 km	
<b></b>	G0.364A	100G LR4 1310 nm QSFP28	QSF P28																																	1310 mm, 514, 10 km	$\square$
Π-	G0365A	100G LR4 Dual Rate 1310 nm QSFP28	QSFP28																																$\square$	1310 am 10 cm	SH
4	G0.369A	100G LR4 Dual Rate 1310 nm CFR4	CFP4																																	1310 an. 10 cm	ડપ્

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• High Performance GPS Disciplined Oscillator MU100090A

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\*1: Excellent Eco Product non-compliant.

\*2: MT1000A-005 is required for MU100090A.

### • Transport Test Accessories

Model	Name	Notes
GD325A	GPS Receiver	It is required when measuring one-way latency at Ethernet tests. However, it is unnecessary when purchasing MU100090A.
W3933AE	MT1000A Transport Module Operation Manual	Printed manual
W3736AE	MT1000A/MT1100A Remote Scripting Operation Manual	Printed manual
Z1821A	Utilities in USB Stick	USB memory with operation manual, remote scripts instruction manual, etc.
J1583A	Optical Attenuator 10 d B LC/PC to LC/PC	
J1584A	Rj45 Cable 3 m	
J1585A	RJ48 to Crocodile Clips Cable 3 m	E1 interface cable.
J1586A	Rj48 to Crocodile Clips Cable 20 dB ATT 3 m	E1 interface cable.
J1588A	BNC Cable 2.5 m	E1, E3, E4, D53, STM-1e, STS-3 interface cable. Impedance: 75Ω
J1589A	BNC to 1.6/5.6 Cable 2.5 m	E1, E3, E4, DS3, STM-1e, STS-3 interface cable. Impedance: 75Ω
J1591A	RJ48 to Two 3-pin Banana Plug Cable 2.5 m	E1 interface cable.
J1597A	RJ48 Balanced PDH Cable Crossed 3 m	E1 interface cable.
J1598A	Bantam Cable 3 m	DS1 interface cable.
J1710A	BNC Cable D.2 m	BNC cable for MU100090A and main-frame external clock input connector. Impedance: 500
JD1278	COAXIAL CORD, 2.0 M	BNC cable for MU100090A and main-frame external clock input connector. Impedance: 500

### • Warranty Products

Model	Name
MT1000A	
MT1000A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MT1000A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MT1000A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)
MU100010A	
MU100010A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MU100010A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MU100010A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)
MU100011A	
MU100011A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MU100011A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MU100011A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)
MU100090A	
MU100090A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MU100090A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MU100090A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)

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Network Master Pro MT1000A

 Carrier Class Ethernet Installation and Troubleshooting



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# MT1000A Product Highlights

- Easy Ethernet test solution
  - Ethernet testing
    - at 100Gbps, 40Gbps, 25Gbps, 10Gbps, 1Gbps, 100Mbps and 10Mbps

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- Traffic generation up to full line rate
- Supports IPv4 and IPv6
- Ethernet Service Activation Test (Y.1564)
- Automated RFC 2544 testing
  - Throughput
  - Frame Loss
  - Latency or Packet Jitter
  - Burstability
- TCP Throughput option (RFC 6349) (Up to 10 Gbps)
- BER testing
  - Includes frame loss and sequence error tests
- Service disruption measurement

### MT1000A Product Highlights

- Easy Ethernet test solution—continued
  - Comprehensive statistics including:
    - Performance (utilization, Throughput, frame rate)

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- Frame statistics (frame types and errors)
- Burst statistics
- Frame size distribution
- Latency and Packet Jitter measurements
- Transmitted and received frames and bytes
- Filters to extract relevant parts of traffic
- Thresholds to highlight abnormal situations
- Simultaneous monitoring of both line directions
- IP Channel Statistics to identify error streams, top talkers, network attacks for up to 230 multiflow counters
- Ethernet OAM: IEEE 802.3 (IEEE 802.3ah), IEEE 802.1ag, ITU-T Y.1731

### MT1000A Product Highlights

- Easy Ethernet test solution—continued
  - Synchronous Ethernet Test (G.826x and IEEE 1588 v2) (Up to 10G bps)
    - For Mobile Backhaul testing
  - Ethernet Multistream: Up to 16 streams per port
    - Information on Throughput, Frame Loss, Packet Jitter and latency per stream

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- Stacked VLAN (Q-in-Q): Up to 8 levels of VLAN tags
- MPLS/MPLS-TP testing: Up to 8 levels of MPLS labels
- PBB testing
- 10G WAN PHY
- Ping testing
- Traceroute test
- Electrical cable test and optical signal level indication
- Frame capture for protocol analysis by Wireshark®

# MT1000A Applications – Out-of-Service Testing

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- Out-of-service Ethernet testing
  - Installation and commissioning of new lines
    - Verification of quality/performance of new lines before commercial operation
  - Troubleshooting with test traffic
    - Functional testing and network behavior at different loads
  - Testing line Quality of Service (QoS)
    - Loop-back MT1000A Ethernet test signal using cable or reflector at far end



Ethernet testing with far-end reflector

# MT1000A Applications – Out-of-Service Testing



- Ethernet end-to-end testing
  - Due to nature of IP/Ethernet networks key parameters like Throughput, Frame Loss and Packet Jitter may differ in two directions of connection
    - Two instruments needed to capture data for each direction



# MT1000A Applications – Out-of-Service Testing

- Typical applications<sup>1</sup>:
  - Dual-port testing of networks or network elements
  - One-way latency measurements
  - Router testing
  - QoS verification



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<sup>1</sup> Requires 10 Gbps dual-port option

### MT1000A Applications – In-Service Monitoring

- Typical applications<sup>1</sup>:
  - Rapid in-service diagnostics
  - In-service troubleshooting
  - Live traffic analysis and statistics



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<sup>1</sup> Requires 10 Gbps dual-port option

MT1000A in Pass-through mode
- IP Channel Statistics
  - Typical root causes of network issues
    - Top talker
      - Top talker occupies major bandwidth slowing it down
    - Network attack
      - One node accessed from many sites, occupying network
    - Error Frames
      - Error frames causes re-transmission and wasted network capacity







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- IP Channel Statistics
  - Finding top talker, network attack, and error frames quickly decreases downtime and recovers network performance
  - IP Channel Statistics offers simple method to top talker, network attack, and error frames just by selecting and starting filters
  - Field technicians analyze network easily without training

Analysis	IP Channel Stats Filter
Top talker	Source IP address
Network attack	Destination IP address
Error frames	(any parameter OK)

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- IP Channel Statistics
  - Combination of filters
    - IPv4, IPv6 or MAC address, VLAN ID or MPLS label, IP next header (protocol), TCP/UDP ports
  - Monitoring values
    - Frame counts/rate, Throughput, Error frames, Size distribution, IPv4/IPv6 statistics, TCP/UDP statistics, etc.
  - Added value of IP Channel Statistics
    - VLAN scan
      - Throughput per VLAN ID monitored by selecting VLAN ID as filter

- Setup screen for configuring channel definitions and displayed columns
- Result screen
  - Easy switching between results from two ports

	Modify shown colur	nns	? X
2014-10 Definitions	Statistics		
Summa 🗷 Channel No.	Frame statistics	X All of this category	
Modi MAC source address	IP size distribution	🕱 Frame count	107
MAC destination address	MPLS statistics	🕱 Frame rate (fps)	<b>A</b>
7 Protocol Info	IP statistics	🕱 Byte count (bytes)	
8 🗌 VLAN tag	IPv4 statistics	🕱 Throughput (bytes/s)	
9 🗌 MPLS label	IPv6 statistics	🕱 Undersize frames	?
<sup>10</sup> 🕱 IP source address	TCP statistics	🕱 Oversize frames	
IP destination address	UDP statistics		
No. IP next header			-47
8 TCP/UDP source port			
9 🗌 TCP/UDP destination port			×
	All result will b	oe reset after changing the active	definitions.
Select All Clear All		Cancel OK (Will reset a	ll result)



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#### MT1000A Ethernet Line Status

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- Line alarms as LED indicators
- Displays current line status



### MT1000A Cable Test for Electrical Ethernet

- Some problems on electrical Ethernet are basic:
  - Short in wire pair
  - Break in wire pair
- Cable test easily identifies such basic problems
- Cable test displays distance from instrument to fault



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MT1000A Signal Level Display for Optical Ethernet

- Some problems on optical Ethernet connection are basic:
  - Bent cables
  - Breaks in cable
  - Dirty connectors
- Optical signal level display easily identifies such problems



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- What is ITU-T Y.1564? •
  - Anritsu actively involved in creating Y.1564 standard
  - Defines new method for testing multiple Ethernet services on network simultaneously
  - Designed to allow service providers to assess customer end-to-end network performance including:
    - End-user traffic profiles with multiple frame sizes
    - Services with different traffic priorities on network
  - Verifies following for each surface:
    - Frame Loss, transfer time and jitter across network
    - Policing
    - Network ability to manage short-duration traffic bursts





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- What is ITU-T Y.1564?
  - ITU-T Y.1564 completes testing in two phases:
    - Phase 1: Service Configuration Test—confirms each service configured correctly throughout network at Committed Information Rate (CIR), and others rates as required
    - Tests one service at a time





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- What is ITU-T Y.1564?
  - ITU-T Y.1564 completes testing in two phases:
    - Phase 2: Service Performance Test—Transmits one or many services simultaneously at CIR confirming all traffic can transverse network under full service load
    - Default test time: 15 minutes, 2 hours, or 24 hours





- What is ITU-T Y.1564?
  - Test configurations:
    - One-way test, using two testers
      - Provides individual results for each direction
      - "Preferred configuration" in Y.1564
      - How to synchronize two instruments to test one-way FTD (Frame Transfer Delay) is an issue.



- Round-trip test
  - FDV (Frame Delay Variation) may be irrelevant





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- What is ITU-T Y.1564?
  - RFC 2544 often used for Service Activation Test
    - Not intended use for RFC 2544:
      - "Benchmarking Methodology for Network Interconnect Devices"
      - Defines number of tests used for describing performance characteristics of network devices
  - Y.1564 intended for Service Activation Test

Item	ITU-T Y.1564	RFC 2544		
Designed for	Service activation	Device performance		
<b>Concurrent services</b>	Multiple services simultaneously	One service at a time		
Simulates	Realistic network	One service on network		
Testing time	Short due to simultaneous testing	Long due to sequential test of		
	of services	parameters and services		
Test result	Directly related to SLA	Link performance limit		
	requirements			



- Supports tests specified in Y.1564
- Features:
  - Two-step test based on:
    - Bandwidth profile parameters: CIR, EIR, CBS, EBS

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- Performance parameters: FTD, FDV, FLR, AVAIL
- Includes support for CM ("Color Aware") and EMIX
- Local-Remote operation
  - One-way test results using two MT1000A units
  - GPS add-on option for one-way FTD measurements
- Round-trip measurements

- Results
  - On instrument display
    - Easy-to-understand GO/NO GO display
    - Full result details also available
  - As pdf reports

Result Files								Result	t Files			
Summar	<u>y</u>	Configuration Test	Performance Test	Statistics		Summary	Configurati	ion Test 🗧	Performance	Test	Statistics	
	Configuration Te	st 😑	Performa	ance Test 😑		Service	IR (Mbps)	FL	FTD (ms)	FDV (ms)	Avail (%)	
	Service	Status	Service	Status	2	Service 1	100.00	0	0.000	N/A	100	2
	Service 1		Service 1			Service 2	100.00	0	0.000	N/A	100	
	Service 2		Service 2		<b>E</b>	Service 3	125.00	0	0.000	N/A	100	<b>E</b>
	Service 3		Service 3			Service 4	150.00	0	0.000	N/A	100	
	Service 4		Service 4			Click on each cell to see	e the details					
					*	_Service 4: FTD						*
						Min 0.000	Max 0.001	Me 0.0	an 100	Threshold 0.500		
	🚟 SAT (Y.1564)	SETUP	test <u>RESULT</u>	💾 🗃 🛪 🛿	10:36	SAT (Y.156	;4)	SETUP TEST	r <u>RESULT</u>	🔐 🖸	: 🔿 <mark>%</mark> 10	37
		Resu	lt Summary					Result	Details			

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- Setup of overall test conditions
  - Display results from local and remote instruments on local instrument when one-way test (using two instruments) selected





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#### Result Summary on Local Instrument after Test

Test Setup

- Setup of each service
  - Graphical presentation of traffic profile for easy overview

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- Full flexibility in programming parameters



- GPS synchronization
  - Accurate information on one-way FTD with GPS synchronization option
    - Once synchronized, MT1000A holds synchronization for period of time

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- Relevant when difficult to get GPS signals at test site



#### MT1000A RFC 2544 Analysis

- ETF RFC 2544 "Benchmarking Methodology for Network Interconnect Devices"
  - Defines number of tests used to describe performance characteristics of network devices
  - Throughput for selected layer
  - Frame Loss
  - Latency
  - Packet jitter
  - Burstability
- Easy-to-interpret graphs
- Full-detail tables



Graphs are bar graphs with legends (where applicable), giving users a better overview of results



RFC 2544 tables fit the screen width - no need for horizontal scrolling

#### MT1000A RFC 2544 Reporting

- Report tables are organized like the GUI with Tx row followed by Rx row, making it easy to find faulty test areas with Frame loss.
  - New tables display per-port test results before actual results tables.
     Users can quickly identify combinations

of Frame sizes and utilizations with problems.



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RFC 2544 graphs same as GUI



PDF reports are displayed with the built-in PDF viewer

RFC 2544 Summary section with new table showing which tests completed

### Benefit of RFC 2544 End-to-End Test

• Typical test set-up with one instrument and reflector or loopback OK for symmetrical links:

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- For Ethernet links carried over asymmetrical connections (xDSL, WIMAX) throughput tests only reflect performance of link direction with lowest capacity
- Symmetrical typical test set-up does not identify transmission performance differences between two link directions

#### MT1000A RFC 2544 End-to-End Test

- RFC 2544 end-to-end test with Local–Remote relationship
  - Needed for test of Ethernet links over asymmetrical connections
  - Identifies transmission performance differences between two directions in link
  - User sets test at local master instrument which exchanges set-up and results with remote slave instrument

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- Tests Throughput, Frame Loss and Burstability
- Tests two lines simultaneously



#### MT1000A Ethernet Ping Test

- Ping test applications:
  - Installation and commissioning
  - Troubleshooting and maintenance
- Popular tool for testing:
  - Continuity
  - Connectivity
  - Response time





#### MT1000A Ethernet Traceroute Test

- Traces IP route over IP network
- Ping timing data per hop



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### MT1000A Ethernet BER Tests

- Traditional test of physical connection
- Generates and detects test patterns
- Counts errors in received test pattern
- Color-coded errors and alarms for easy overview
- Pattern generation:
  - Unframed
  - Layer 2 (Mac address)
  - Layer 3 (with IP header)
  - Layer 4 (with UDP/TCP header)
- Detects sequence errors and loss of sequence synchronization
- Frame loss count and frame loss seconds





#### MT1000A BER Tests

#### • Layered Throughput analysis

Frame representation	Throughput Calculation
IFG         Pre- amble         MAC         MPLS         EOMPLS         VLAN         LLC         SNAP         IP         UDP         PAYLOAD         CRC           amble         header         (opt)         (opt)         (opt)         (opt)         (opt)         head         TCP         PAYLOAD         CRC	Data layer
IFG         Pre- amble         MAC         MPLS         EOMPLS         VLAN         LLC         SNAP         IP         UDP         PAYLOAD         CRC	Network layer
IFG         Pre- amble         MAC         MPLS         EOMPLS         VLAN         LLC         SNAP         IP         UDP         PAYLOAD         GRC	Link layer
IFG Pre- MAC MPLS E0MPLS VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) (opt) (opt) (opt) (opt) PAYLOAD CRC	Physical layer no preamble
IFG         Pre- amble         MAC header         MPLS         EoMPLS         VLAN         LLC         SNAP         IP         UDP         PAYLOAD         CRC	Physical layer
min.         Pre- IFG         MAC header         MPLS         EoMPLS         VLAN         LLC         SNAP         IP         UDP         PAYLOAD         CRC	Utilization layer
CMA 3000 frame size (does not include Preamble) Area included in throughput calculation	Frame information



Why Service Disruption on Ethernet Links?

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- Many Ethernet links carried over OTN/SDH/SONET via backbone network
  - OTN/SDH/SONET networks sometimes have Automatic Protection Switching (APS)
  - If OTN/SDH/SONET network line fails, APS switches traffic to working line
  - Switch and service disruption should be completed in less than 50 ms

#### MT1000A Service Disruption Measurement

- Service disruption can be measured as part of BER test
  - Using far-end loopback or two MT1000A testers
  - Max. acceptable service disruption time can be set
    - Color-coded results when max. time exceeded



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#### MT1000A Ethernet Signal Analysis

- Frame performance
- Frame type statistics
- Frame size distribution statistics
- Burst statistics
- Transmit statistics
- Full-detail tables
- User-defined thresholds to highlight problems



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#### MT1000A Latency and Packet Jitter Measurements



- Latency and packet jitter can cause problems for real-time services like VoIP
  - Part of statistical measurements
  - User selects included information

		Ré	esult Files			Port 1	Application S	elector		
2014-04-04 12:05:06		00:00	0:29			Control	Generator	Streams	Thresholds	
Summary				Statistics		Stream 3 profile				
IIITotal	Ethernet - Multi Stream	1 Latency		SI prefix	P -	🔵 Data 🔷 Vid	leo 💛 Voice	Stream 3 measuremen	Jy IO	₽
Back		Por	t 1			Encoding:	SDTV (MPEG2)	Frame loss ——		
2014-04-04 12:05:11	atency(us) Min.	Max.	Avg.			Number of channels:	1	Threshold		
2014-04-04 St 12:05:16	tream 1	4	5 4		?	Line load		🔵 🤇 ount 🔵 R	atio 0	?
2014-04-04	tream 2	4	5 4			Constant OR Ram	np 17.0000 %	🖌 Jitler		<b></b>
2014-04-04 St	tream 4	4	5 4	-		1	Total: 73.0000 %	Threshold	0.0 us	- C
12:05:26 St	tream 5	N/A	N/A N/A			Frame size		✓ Latency		
12:05:31 T	tream 6	N/A	N/A N/A		*	Random		Requires far-end is lo	op-back device	×
Current St	tream 7	N/A	N/A N/A			Start: 64	End: 1250	Inreshold	0.0 us	
2014-04-04 12:05:33 St	tream 8	N/A	N/A N/A	<b>~</b>		Step: 64	Duration: 1 s			
Mon./0	Gen.	SETUP Т	est <u>RESULT</u>	- 🔐 🗃 🛪 🎖 12 05		Mon./Gen.	SETUP <u>TEST</u>	RESULT	🕂 🗃 🛪 🎗 12:10	

# Benefit of Ethernet Multistream Test

• By sending several traffic streams with different priority settings, the user can verify that high-priority traffic is transported better (i.e. has lower frame loss) through a congested network than low-priority traffic.

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- VoIP traffic is often given high priority to ensure service quality
  - Sometimes DSCP/TOS byte used to give high priority
  - Other times high priority given to selected TCP/UDP ports
- Some operators allocate certain traffic capacity to each traffic type on link with limited capacity
- User can verify that each traffic types gets allocated capacity by sending several traffic streams with different type indications
  - Traffic type indicated by VLAN tags

#### MT1000A Ethernet Multistream Test

- Using MT1000A, user can generate up to 16 streams per port on Ethernet link
  - Individual settings for traffic load and header information for streams, including DSCP/TOS byte and TCP/UDP port numbers for each stream

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Port 1			
Control	Generator	Streams	Thresholds
		▼ Percent	▼ 3
	Dst IP: 0.0.0.0	<u> </u>	
	Src IP: 2.0.0.0 Dst IP: 2.0.0.0	15.0000	
	Src IP: 3.0.0.0 Dst IP: 3.0.0.0	17.0000	o
	Src IP: 4.0.0.0 Dst IP: 4.0.0.0	21.0000	0 0
	Src IP: 0.0.0.0 Dst IP: 0.0.0.0	Off	
	Src IP: 0.0.0.0 Dst IP: 0.0.0.0	Off	0.0 us
	Src IP: 0.0.0.0 Dst IP: 0.0.0.0	Off	
	Src IP: 0.0.0.0 Dst IP: 0.0.0.0	Off	ck device
	Src IP: 0.0.0.0 Dst IP: 0.0.0.0	Off	0.0 us
		Total: 73.000	0
-			

Stream Selector and Overview

#### MT1000A Ethernet Multistream Test

 Multistream function displays frame loss for up to 16 streams per port, making it easy to spot whether high-priority traffic has lower frame loss than low-priority traffic



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#### Simple Stream Address Creation

• When generating Ethernet and IPv4/v6 test Frames, a function supports creation of [Increment], [Decrement], and [Random] streams for the address specified location, resulting in shorter test setting times.

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#### VLAN Background

- Virtual Local Area Networks (VLANs) IEEE 802.1Q
  - Segment LAN on organizational basis, by functions, project teams or applications
    - Each VLAN has ID and priority
      - 802.1p priority bits (3) segment traffic into eight Classes of Service (CoS), enabling traffic differentiation

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- 12-bit ID supports 4096 VLANs
- Stacked VLAN ("Q-in-Q") IEEE 802.1ad
  - VLAN carried on VLAN
    - Method to provide more VLAN IDs
    - Allows service provider to carry customer VLAN traffic transparently service provider VLAN
    - Sometimes service provider and/or customer use more than one VLAN tag

#### MT1000A Ethernet Stacked VLAN Function

• Insert up to eight layers of VLAN tags into Ethernet frame

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- Can be combined with Multistream function
- Special layer naming when two layers selected
  - S-VLAN Service provider VLAN
  - C-VLAN Customer VLAN

Layer 4	Frame Content	Application Selector Stream Setup	? ×	Layer 4	Frame Content	Stream Setup	? ×
None	ETH	VLAN IPv	4 Payload Variable	None 💌	ETH	VLAN IPv4	Payload Variable
1 IPv4	Level count: 8 ▼ #1: ID: 0	DEI Priority:	D Ethertype: 0x8100	1 IPv4 V	S-VLAN ID: 0	DEI Priority: 0	Ethertype: 0x8100
SNAP	#2: ID: 0	DEI Priority:	D Ethertype: 0x8100	SNAP	C-VLAN ID: 0	DEI Priority: 0	Ethertype: 0x0800 (IPv4)
VLAN	#3: ID: 0	DEI Priority:	D Ethertype: 0x8100	VLAN			
PBB	#5: ID: 0	DEI Priority:	D Ethertype: 0x8100	PBB			
MPLS-TP MPLS	#6: ID: 0	DEI Priority:	D Ethertype: 0x8100	MPLS-TP MPLS			
	#8: ID: 0	DEI Priority:	D Ethertype 0x0800 (IPv4)				
Stream 1 2	3 4 5 6	7 8 9 10 11	12 13 14 15 16 Close	Stream 1 2	3 4 5 6	7 8 9 10 11 12	2 13 14 15 16 Close

CFI bit renamed to DEI (Drop Eligible Indicator)

### MT1000A Ethernet Stacked VLAN Function

- VLAN information:
  - Indicates detected VLAN tagged frames in Status pane
  - Counts detected VLAN tagged frames and max. VLAN tag level in statistical measurements
  - Displays information on last received VLAN frame

		Port 1	Applicat	ion Selector			
	Port		Streams Settings Answer: Arp	SyncE IEEE 1 Off Mult	.588v2 OA icast 802.	M Filter 3ah Off	
3		ETH/VLAN/IPv4	•	Сору	То 🔻	Duplex:	*
	Dst MAC:		00-00-00-00-00		RP !	Ethernet	
	Src MAC:		00-00-00-00-00		efault	O Errored     O MPLS	?
	_IPv4					O EOMPLS	
	Dst IP:		3.0.0.0	DNS	Setup	O VLAN	9
						SyncE	-7
	Src IP:		3.0.0.0	Онср		IEEE 1588v2	⊒
	_VLAN				۱	OH Capture	$\sim$
	#1	ID:	0			MAO	~
				PRBS23		Frame Capture	
	#2	ID:	0			Transceiver	
		Mon./Gen.	<u>SETUP</u> τε	ST RESULT	<b>i</b> # C	🕅 🛪 🦹 12:19	




# MPLS Background

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- Multi-Protocol Label Switching (MPLS)
  - Carries data; considered to be between Layer 2 (Data Link Layer) and Layer 3 (Network Layer); often called "Layer 2.5".
  - Simplifies point-to-point routing
    - MPLS header has one or more 'labels' (label stack) and each label has four fields:
      - 20-bit label value
      - 3-bit field for QoS priority
      - 1-bit bottom of stack flag
      - 8-bit TTL (time to live) field
- EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo-Wire Emulation Edge-to-Edge)
  - Defines method to transport Layer 2 protocol across MPLS network

### MT1000A MPLS/MPLS-TP Function

- Stacked MPLS generation
  - Inserts up to 8 layers of MPLS labels into Ethernet frame
  - Can be combined with Multistream facility
  - EoMPLS Control word can be added with MPLS-TP

			Strea	m Setup				? X
Layer 4	Frame	Content						
None 💌	ET	гн	MPLS	MPLS-TP	IP	v4 Payloa	d Vari	able
Layer 3	Level co	ount: 8	•					
Layer 2	#1:	Label:	100	EXP:	0	Stack 0	TTL:	32
SNAP	#2:	Label:	200	EXP:	1	Stack 0	TTL:	32
ша	#3:	Label:	300	EXP:	2	Stack 0	TTL:	32
VLAN	#4:	Label:	400	EXP:	3	Stack 0	TTL:	32
РВВ	#5:	Label:	500	EXP:	4	Stack 0	TTL:	32
MPLS-TP	#6:	Label:	600	EXP:	5	Stack 0	TTL:	32
MPLS	#7:	Label:	700	EXP:	6	Stack 0	TTL:	32
	#8:	Label:	800	EXP:	7	Stack 1	TTL:	32
Stream	2 3	4 5	6 7	89	10	11 12 13	14 1	5 16
							(	Close



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### MT1000A MPLS/MPLS-TP Function

- MPLS information:
  - Indicates detection of MPLS and EoMPLS frames in Status pane
  - Counts detected MPLS and MPLS-TP (EoMPLS) frames and max. MPLS layer
  - Displays information on latest received MPLS frames

		Result	File Browser						Result File Brov	wser			
2014-07-03 10:37	7:58	00:00				2014-07-03 10:37:	58		00:00:36				
Summary				Sta	tistics 📕 🔲	Summary			4 Log			Statistics 📕	
<u>Total</u> 2014-07-03	Ethernet - Frame			SI prefix	▼ ₽	<u>Total</u> 2014-07-03	Ethernet - Fram	e			SI prefix	<ul><li>▼</li></ul>	<b>₽</b>
10:37:59		Port	1			10:37:59			Port 1				-
Back 2014-07-03	Pause frame	0	0.00 %			Back 2014-07-03	1	Label P	riority TTL				
10:38:04	VLAN frame	0	0.00 %			10:38:04	MPLS 1	100	0	32			
10:38:09	MPLS frame	173.611 M	100.00 %			10:38:09	MPLS 2	200	1	32			Ø
2014-07-03 10:38:14	MPLS-TP frame	173.611 M	100.00 %			2014-07-03 10:38:14	MPLS 3	300	2	32			<b></b>
	PBB frame	0	0.00 %			2014-07-03	MPLS 4	400	3	32			
	VLAN max level	N/A				10:38:19	MPLS 5	500	4	32			ľ
	VLAN min level	N/A				10:38:24	MPLS 6	600	5	32			
Current	MPLS max level	8			×	Current	MPLS 7	700	6	32			X
2014-07-03 10:38:14	MPLS min level	8				2014-07-03 10:38:34	MPLS 8	800	7	32		-	
Ш 📟 м	on./Gen.	SETUP T	est <u>RESULT</u>	📋 📑 🔊 🕅 V	10:38	Ш 💽 Мо	n./Gen.	SETUP	TEST	<u>RESULT</u>	🧻 📑 🔊	▶ ↓ 🗾 10 38	

#### MT1000A MPLS-TP Function

- MPLS-TP information:
  - Activation of MLPS-TP OAM function



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#### MT1000A PBB Function

- PBB (Mac-in-Mac) information:
  - Counts PBB frames at result page
  - Can be combined with Multistream facility



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### MT1000A TCP Function

- Set TCP connections before sending traffic with TCP headers
  - Allows traffic to pass firewalls using "state-full inspection"
  - Limited implementation:
     For example:
    - No retransmissions
    - No flow control

Layer 4	Frame Content_			· P		
ТСР	2777	IPv	4	тср	Payload	Variable
Layer 3	Auto conne	ct		Listen m	ode	
IPv4	Src rott		0	Dst Port:		0
Layer 2	Seq number:		0	Auto inc	rement	
SNAP	Ack number:		0			
LLC1	Data offset:	5				
VLAN	Reserved:		00h			
РВВ	Flags	CWR	ECE		ACK	
MPLS-TP		PSH		SYN	FIN	
MPLS	Window:		0	Urgent point	er:	0
	Checksum	#HB33E				
Stream 📘 2	3 4	5 6	7 8	9 10 11	12 13	14 15 16

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# MT1000A Ethernet Traffic Generator

• Ramp traffic: Increases traffic automatically until max. capacity exceeded

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- Programmable per stream
- Burst Traffic: Continuous sending at specified conditions
- Generate Tx rates above 100%
- Data type profiles (data, video, voice)

	Port 1	Ap	plication Selector					Port 1	Application S	Selector		
	Control	nump	Ente Loud Setup		Thresholds			Control	Generator	Streams	Thresholds	
1	Stream 1 profile	bps	$\wedge$	/			1	Stream 1 profile		C	ору То	
	Data O		$/ \setminus /$					Data Video		Stream 1 measureme	ent	- <b>*</b>
	Encoding:		· ·					Encoding:	SDTV (MPEG2)	🖌 Frame loss —		
	Number of channels:							Number of channels:	1	Threshold		
	Line load	Unit: 🦲	Percent OM	bps	0	?		Line load		Count 🔘	Ratio 0	?
	🔵 Constant 🌘	Line load start:	0.0008	%		<b></b>		🔵 Constant 🛛 🔵 Ramp	0.0008 %	Jitter —		
		Line load end:	100.0000	%	0.0 us			Tot	al: 100.0000 %	Threshold	0.0 us	
	Frame size	Step size:	Keep end	%				Frame size		✓ Latency		
	Constant	Step duration	Repeat ramp		ack device			Constant		Requires far-end is	oop-back device	
	Start: 72	Ramp mode:	Invert ramp		0.0 us	*		Start: 72	End: 100	Threshold	0.0 us	*
	Step: 64	Off		Close				Step: 64	Duration: 1 s			
	Mon./Gen.	SETUP	TEST RESULT	- Libse	💕 💸 🏌 12:38	3		Mon./Gen.	SETUP <u>TEST</u>	RESULT	🔐 🔿 🛪 🕅 12 3	88

# Custom Editing of Ethernet Header

- Free editing of the Ethernet Header in the Frame stream settings to support special protocols for R&D.
  - This function can be used with the following applications:
    - Ethernet BERT Application

A DEDT .	Stream	n Setup		? ×	
None Frame Conte	nt				
Layer 3	CUSTOM	Payload	Variabl	e	
None V Layer 2 SNAP LLC1 VLAN PBB	attern: Le Import ( Export (	40           00 XX XX XX         00 00 00 00           00 00 00 00 00         00 00 00 00           00 00 00 00 00         00 00 00 00           00 00 00 00         00 00 00           00 00 00 00         00 00 00           00 00 00 00         00 00 00           00 00 00 00         00 00 00	Byte		
MPLS-TP MPLS	ayer 4	Str	eam Setup		? ×
	lone V Prat	ETH stom pattern:	Length	Payload	Variable
	SNAP	File Import	00 XX XX XX 0 00 00 00 00 0 00 00 00 00 0 00 00 00	0 00 00 00 0 00 00 00 0 00 00 00 0 00 00	
Select Layer 2	AN BB		00 00 00 00 0	0 00 00 00	
or Layer 3	S-TP MPLS				
	ETH Custom				
			сот пероег	<b></b>	Close

- Edit Custom header with text editor for Save and Load
- ✓ Supports Header lengths up to 256 bytes

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- The following restrictions apply:
  - "Ethernet over OTN" not supported
  - Rx filters other than Layer 2 not supported when using Layer 3 Custom headers
  - No Rx filters supported when using Layer 2 Custom headers
  - Arp/Ping functions not supported when using Layer 2/3 Custom headers

# MT1000A Ethernet Frame Capture Function

- Protocol analysis
  - For advanced Ethernet troubleshooting
  - Captures frames in live traffic of monitored line
  - Analyzes captured frames using Wireshark<sup>®</sup> protocol analysis software

Back to

	Port 1		Applicatio	n Selector							Applicatio	n Selector	J		
Port	Streams	Settings Answer: Arp	SyncE	IEEE 1588v2 Unicast	OAM Off	Filter			i <b>dit ⊻iew <u>G</u>o ⊆</b> apture pply a display filter <ctrl-< th=""><th>Analyze <u>S</u>tatistics /&gt;</th><th>Telephony <u>H</u>elp</th><th></th><th></th><th>→</th><th>-</th></ctrl-<>	Analyze <u>S</u> tatistics />	Telephony <u>H</u> elp			→	-
								No.	√ Time 17, 09:03:02,291	Source	Destination	Protocol	Length	Info	<u> </u>
Capture	Setup	)	Trigger Setup			Speed:			18 09:03:03.231	326 0.0.0.0	0.0.0.0	PTPv2		110 Announce Message	
Frame slicing:	Whole f	rame 💌	Trigger:	Manual	<b>\</b>	Duplex: FDX			20 09:03:03:271 20 09:03:03:291 21 09:03:04.271	324 0.0.0.0 324 0.0.0.0 374 0.0.0.0	0.0.0.0	PTPv2 PTPv2 PTPv2		90 Sync Message 100 Delay_Resp Message 90 Sync Message	•
Buffer handling:	Stop wh	nen full 🛛 🔻	Trigger	Тор		Ethernet			22 09:03:04.291 23 09:03:05.231 24 09:03:05.271	400 0.0.0.0 415 0.0.0.0 445 0.0.0.0	0.0.0.0	PTPv2 PTPv2 PTPv2		100 Delay_Resp Message 110 Announce Message 90 Sync Message	
Buffer siz	e: IMB	<b>\</b>	Error Type:	Any Type		• MPLS frame	?		25 09:03:05.291 26 09:03:06.271 27 00:03:06.271	437 0.0.0.0 506 0.0.0.0	0.0.0.0	PTPv2 PTPv2		100 Delay_Resp Message 90 Sync Message	2
Capt	ure transmitted	frames		<u> </u>		O MPLS-TP frame	_		27 09:03:06:291 28 09:03:07.231 29 09:03:07.271	537 0.0.0.0 561 0.0.0.0	0.0.0.0	PTPv2 PTPv2 PTPv2		110 Announce Message 90 Sync Message	=1
-Frame Fi	ield Trigger Defi	nition				O VLAN frame	5	1	30 09:03:07.291	554 0.0.0.0	0.0.0.0	PTPv2		100 Delay_Resp Message	
	- 0 -	·	1 bytes			IEEE 1588v2	r=7	⊕-Fra ⊕-Eti	me 23: 110 bytes on wire (88 hernet II, Src: 00:00:00:00: ernet Protocol Version 4, Src:	0 bits), 110 bytes ca 01:00 (00:00:00:0 0 0 0 0 (0 0 0 0), [	ptured (880 bits) D:01:00), Dst: 00:00:0 Dst: 0 0 0 0 (0 0 0 0)	0:00:00:00 (00:00	):00:00:00:00)		-
Preamble			00		FCS	OH Capture		i∰… Us i∓… Pre	er Datagram Protocol, Src Por cision Time Protocol (IEEE15	t: 320 (320), Dst Po 88)	rt: 320 (320)				<u> </u>
	Buffer Usa	age(1,024 kByte)	:0%			OAM	×	0010 0020	00 5c 01 d9 40 00 20 11 5 00 00 01 40 01 40 00 48 e	8 b9 00 00 00 00 00 e 5f 0b 02 00 40 04	1000 .\@. X 100@.@.H@				
st	tart			Save	View	Frame Capture		0030 0040 0050	04 00 00 00 00 00 00 00 00 00 ff fe 00 01 00 00 01 00 3e cc 0d 42 fd 80 00 23 00	00 00 00 00 00 00 00 5f 05 01 00 00 54 ) ff ff 32 58 24 ff 00	32				
						Iransceiver		0060	00 00 ff fe 00 01 00 00 0	0 a0 47 ea 14 12					
	ETH-Mon./Ge	n. S	ETUP TES	T RESULT	👬 🗃 🖗 🖁	V 💽 🔉 🏟 09:02			📶 Wireshark				🔐 🔊	🗴 V 📑 🔉 🕪 👳	07

# Network Discovery and In-band Control

- No Need for Two Engineers for End-to-end Test
  - One engineer controls both local and remote testers without dedicated LAN for remote access

Back to

- Testing from one end cuts OPEX
- Process
  - Discover other "Network Master(s)" on network
  - Remote-control far-end tests, such as RFC2544, Y.1564, Reflector (L2/L3/L4 loopback) etc.
  - Generate report at local controller with results summarized at both local and remote testers





# Validating PCS at 10 GbE

- Validating PCS operation at the 10 GbE interface to support fast troubleshooting in the PCS layer:
   PCS Error/A
  - Error/Alarm Insertion
  - Error/Alarm Display/Count
  - Native 10G LAN PHY is supported





Alarms/Errors/C	thers		
Port 1	<ul> <li>Etherne</li> </ul>	t PCS alarms/errors	<b>_</b>
Alarms	•	Frrors	
Destination:		Insertion:	
No error		▼Off	<b>_</b>
No error			
Invalid block ty	pe(0x00)		
Invalid sync hea	der(00)		
Involid sums has	dor(11)		

 Does not support Stimuli function Invalid alignment marker/BIP error

### **10G WAN PHY Background**



- 10G WAN PHY
  - Mapping Ethernet frames to SONET/SDH



# MT1000A 10G WAN PHY Function

- WAN results
  - Bi-directional overhead byte capture (requires dual-port version)
  - Error and alarm statistics on WAN part of signal with Ethernet BERT application

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# MT1000A 10G WAN PHY Function

- WAN overhead byte generation
  - User programming of transmitted OH bytes
  - SDH or SONET terminology



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- TCP Throughput Option (RFC 6349) (Up to 10Gbps)



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- Optimized performance essential in modern communication networks
- IP network operators can test networks based on IETF RFC 2544 and ITU-T Y.1564
  - Even when network seems fine at these tests, customers may complain that achieved throughput below agreement with operator
  - Can be caused by non-optimal configuration of Transmission Control Protocol (TCP) providing higher-layer connections through network, or badly configured network element burst size settings
- TCP adds reliability to communication over IP network because data receiver acknowledges packets received correctly
  - To support this, network elements have buffering
    - Data throughput reduced if buffering sizes incorrect
- Operators use RFC 6349 test methodology to optimize TCP throughput

# RFC 6349 Testing – Benefit of TCP Throughput Test



• Eliminate end-user factors from test by emulating TCP host

Bi-directional TCP throughput test by emulating end user hosts



- MT1000A TCP throughput test hardware based
  - Always validate maximum TCP throughput potential possible on customer's network
  - Repeatable tests with consistent results
- MT1000A can perform bi-directional TCP throughput testing
  - More realistic test result
  - MT1000A can test up to four ports simultaneously
  - Can shorten multiple network commissioning test time



- TCP performance verification using RFC 6349 test methodology
- Client and server modes
- Connect to iPerf server as client
- Automated or manual testing
  - New installation mode
  - Troubleshooting mode
- Simultaneous bi-directional testing with independent settings
- Configuration of TCP Throughput (RFC 6349) test





- Measurements include:
  - MTU (Maximum Transmission Unit) based on RFC 4821
  - RTT (Round-Trip Time)
  - Window scan
  - Throughput
  - Multi-service (if selected)

2015-04-20 23:11:31	/indow Scan	Result File Br	owser	2015-04-20 23:15:					
Local->Remote									
Window Size	Connections	Threshold	Avg Throughput	Avg RTT	?				
2920 Bytes	1	95.00 % of Idea	al 949.284 Mbps	0.022 ms					
Network Parameters		Value	RFC6349 Metrics		<b>-</b> 7				
MTU / MSS	Measured	1500 / 1460 Bytes	Transfer Time Ratio	1.00					
RIT	Measured	0.022 ms	TCP Efficiency	100.00 %					
CIR	User Input	1000.000 Mbps	Buffer Delay	0.00 %					
ETH-RF	°C 6349	SETUP TEST	<u>RESULT</u> 🔐 🗃 🛜 🕻	3 V 💽 🔉 🛃 🏟 23	27				

- Measurement results include:
  - Transmitted and Retransmitted
     Bytes
  - TCP Transfer Time Ratio
  - TCP Efficiency
  - Retransmitted Percentage
  - Buffer Delay Percentage

20	15-04-20 23:11:31	dow Scan	Resu	Ilt File Brows	Service	2015-04-20 23:1 rent Log Statistics	5:09 •				
	Local->Remote Graph										
	Avg Throughput	949.284 M	bps	Wind	ow Size/Conn	2920 Bytes / 1	?				
	Ideal Throughput	949.285 M	bps	Trans	smitted Bytes	1.11 GB					
	Actual Transfer Time	e 10.00 s		Retrar	nsmitted Bytes	0 Bytes					
	Ideal Transfer Time	10.00 s		Retr	ansmitted %	0.00 %					
	Transfer Time Ratio	1.00		тс	P Efficiency	100.00 %					
	Baseline RTT	Min RTT	Av	g RTT	Max RTT	Buffer Delay	X				
	0.022 ms	0.015 ms	0.02	22 ms	0.023 ms	0.00 %					
	ETH-RFC	6349 SI	ETUP 1	rest <u>RE</u>	<u>SULT</u> 🔐 🗃	奈₿V 💽 🔀 📫 2	23 27				

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- Multi-service results (when selected)
  - Test up to 16 connections

	-		Re	sult File Browser				
2	015-04-20 23:11:31 Summary	Window Scan	Throughput	Multi-Serv	vice Event L	2015-04-20 2 og Statistic	23:15:09	
	Window Size/Conn:	2920 Bytes / 16	Local	->Remote		Graph		
	Connection	Min RTT	Avg RTT	Max RTT	TX THPT	TCP Efficiency		?
	11	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %		
	12	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %		5
	13	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %		Î
	14	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %		
	15	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %		
	16	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %	•	X
	Total	0.015 ms	0.027 ms	0.027 ms	949.284 Mbps	100.00 %		
	📗 🔂 ЕТН-	RFC 6349	SETUP	test <u>RESU</u>	LT 📑 🗗 🔿	IV 🗾 y 🛃 🛚	<b>))</b> 23 26	

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- Window Scan Result
  - MT1000A runs "Window Scan" test measuring TCP Throughput at each window size







Network Master Pro MT1000A



• Ethernet OAM Functionality



### Ethernet OAM background

• Ethernet moved from LAN technology to Carrier Class technology

Back to

- Ethernet Operations, Administration and Maintenance (OAM) developed to:
  - Ease operations, administration, and maintenance of complex Ethernet networks
  - Reduce operational expenses
- Ethernet OAM covers:
  - Link fault management
  - Connectivity fault management
  - Performance monitoring

### Ethernet OAM Layers



OAM layers	Functions	Standards
Transport layer	Ensures bi-directional communication between two directly connected devices Focuses on Ethernet First Mile (EFM) Link fault management	IEEE 802.3 (now includes IEEE 802.3ah)
Connectivity layer	Monitors path between two devices not directly connected Connectivity fault management incl. Link trace, continuity check and loopback protocols	IEEE 802.1ag ITU-T Y.1731
Service layer	Monitors status of services as seen by customer Performance monitoring including Frame Loss, Frame Delay and Throughput measurements	ITU-T Y.1731



# Ethernet OAM Y.1731 and IEEE 802.1ag

- Y.1731 and IEEE 802.1ag similar
  - Supported by both Y.1731 and IEEE 802.1ag:
    - Connectivity fault management
  - Supported by Y.1731 only:
    - Performance monitoring
  - Same frame format for OAM PDUs (Protocol Data Units)



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### Ethernet OAM IEEE 802.3ah

- Ethernet OAM IEEE 802.3ah functions:
  - Remote failure indication during fault
  - Remote loopback mode ("Real" loopback)
  - Fault isolation
  - Link performance and status monitoring
  - OAM discovery mechanism
    - Determines whether remote device has OAM enabled and configured parameters and supported functions compatible with requesting device

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- Optional activation of OAM
  - OAM can be enabled on ports subset or all ports
- Extension mechanism
  - Available for higher-level management applications

#### Ethernet OAM



• Ethernet OAM Y.1731 set-up and results:



Network Master Pro MT1000A

- Mobile Backhaul Installation and Verification
  - Synchronous Ethernet Test
  - Phase/Time Synchronization Test



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# Synchronous Ethernet Test

- Recently Ethernet become dominant technology for data transmission, due to simplicity and low cost
  - Started as LAN (Local Area Network) technology but now used for endto- end communications

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- Synchronous networks (PDH, SDH/SONET) migrating to Ethernetbased packet-switched network (PSN) are used for Mobile Backhaul network(MBH).
- Asynchronous nature of Ethernet causes challenges:
  - Mobile networks have strong requirement for frequency synchronization across entire network
  - TDD and LTE-Advanced technology pushes requirement for phase/time synchronization to the Ethernet-based MBH.

# Synchronous Ethernet Test

- Synchronization can be applied to Ethernet-based packet networks using Synchronous Ethernet
- Techniques under consideration for Ethernet synchronization are:
  - Physical synchronization signal forwarding as defined in ITU-T recommendations G.8261, G.8262 and G.8264 (in many cases now called SyncE)



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- Packet-based synchronization as defined in IEEE1588 v2 Precision Time Protocol (PTP)
  - ITU-T G.8265.1 telecom profile for frequency synchronization
  - ITU-T G.8275.1 telecom profile for phase/time synchronization



- SyncE (ITU-T G.826x) functions:
  - Detect ESMC messages and real time display of received SSM/QL byte
  - Record ESMC message log
  - Generate alarm when SSM/QL not received within 5 seconds
    - Clear alarm on SSM/QL reception
  - Transmit ESMC/SSM messages with user-defined QL
    - Four user-selectable QL interpretations
  - SyncE recovered frequency monitor and synchronized packet generation.

Port 1		Application S	elector				
Port + WAN Off	Stream Sett	tings Arp, Ping	SyncE Off	IEEE 1588v2 Off	OAM Off	Filter Off	
SFP Auto Ne	gotiate	•	Trans Wavele N/A	sceiver ngth(nominal)	Spee Dupl	nk ed: N/A ex:	*
Timing source:	Received		N/A	ance	Ethe	N/A rnet	
	External				r • 1 • 1 •	Traffic MPLS frame MPLS-TP frame	?
	Received					SyncE	Ĕ,
	IEEE 1588v2					EEE 1588v2	É
						OH Capture	
						MAO	X
					Fra	ame Capture	
						Transceiver	-
ETH-BERT	<u>SETI</u>	<u>JP</u> TEST	RESULT			10 46	

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Inritsu envision : ensure

- SyncE (ITU-T G.826x) results (per port):
  - Status information:
    - Rx SSM QL (current value)
  - Statistics on SSM QL messages and values



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- IEEE 1588 v2 (PTP) functions:
  - Support G.8265.1, G.8275.1 profile and 'User defined' one.
  - Emulating a master clock.
    - Selectable UTC source from internal instrument clock or GPS.

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- Configurable parameters of Announce message, etc.
- Emulating slave clock
  - Configurable parameters of message interval, etc.
  - Best master clock algorithm (BMC)
- Supported encapsulations: PTP-UDP-IP(IPv4 and IPv6) and PTP-MAC
- Support stacked VLAN and MPLS
- Real time PTP signaling sequence in ladder chart, off-line analysis by PCAP file capture, message statistics, message rate measurement.

For quick analysis and troubleshooting of IEEE 1588 v2 (PTP) signaling

- IEEE 1588 v2 (PTP) results statistics on:
  - Offset and offset variance
  - Path Delay Variation (PDV)
  - Messages
  - Clock state transitions

		Result Files			Result Files	
2014-04-04 12:53:3	37	00:00:33		2014-04-04 12:53:37	00:01:00	
Summary			Statistics	Summary		Statistics
Total	Ethernet - IEEE 1	.588v2	🔻 SI prefix 💌 😵	Ethernet - IEEE	1588v2	SI prefix
12.53.37		Port 1		Pack	Port 1	
2014-04-04 12:53:42	Offset Stat.	Min. Max. Avg.		2014-04-04 12:53:42 Mean Path Delay	Min. Max. Avg.	
2014-04-04	Offset	0 0 0		2014-04-04 Req./Resp.	0 0 0	
2014-04-04 12:53:52	Absolute Offset Deviation	0 0 0 0 0 0	E.	2014-04-04 12:53:52	0 0 0	
2014-04-04 12:53:57	Offset Variance	Min. Max. Avg.	<b>É</b>	2014-04-04 12:53:57 Path Delay	Min. Max. Avg.	
2014-04-04	Offset Variance	0 0 0	*	2014-04-04 12:54:02		\$
Current 2014-04-04 12:54:09	Mean Path Delay	Min. Max. Avg.	•	Current Message Stat. 2014-04-04 12:54:36 Announce count	Tx         Rx           58         0	•
Mor	n./Gen.	SETUP TEST <u>RESULT</u>	🔐 🙈 🛪 🔉 12 54	Mon./Gen.	SETUP TEST <u>RESULT</u>	🔐 🍽 🖘 🖇 12:54

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• IEEE 1588 v2 (PTP) clock status real time information



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- CDMA2000 and W-CDMA(TDD) require not only frequency synchronization but also phase/time synchronization among base stations. GPS has been used for that purpose.
- Expanding small cell deployment and technologies of LTE-TDD and LTE-Advanced cause increasing demands for packet-based phase/time synchronization by IEEE1588v2.
- New testing demands for mobile network installation and maintenance using IEEE1588v2 are rapidly increasing.



Distribution of Sync Signal to Base Stations

Application	Mobil	e Backhaul	Air Interface		
	Frequency	Phase	Frequency	Phase	
LTE FDD		N/A		N/A	
LTE TDD (large cell)		±1.1µs		±5µs	
LTE TDD (small cell)		±1.1µs		±1.5µs	
LTE-A MBSFN	±16ppb	±1.1µs	±50ppb	±1 to 5µs	
LTE-A CoMP		±500ns to 1.1µs		±500ns to 5µs	
LTE-A eICIC		±1.1µs		±1 to 5µs	

Synchronization requirement to MBH



- MT1000A is located at the service demarcation point between mobile backhaul and mobile service. It evaluates SLA of the backhaul.
- MT1000A measures max|TE|, cTE(Constant Time Error) and dTE(Dynamic Time Error) as metrics of phase/time synchronization.
- Supports GbE, 10GbE optical interfaces.





• Time Error method No.1: 1PPS Signal phase measurement Measuring the phase difference between the reference in the tester and 1PPS signal from the network under test.



- Time Error method No.2: By PTP timestamp (defined in ITU-T G.8273)
  - The tester emulates slave clock and has reference UTC from GPS.
  - The tester measures the difference between the timing of PTP message reception and the time
    - stamp inside the message (T1 and T4). This is observed as OWD(One-Way-Delay) .

- Because cable length is known the tester estimates the time error by deducting the cable delay from the OWD.

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MU100090A High Performance GPS Disciplined Oscillator is required for phase/time synchronization test.

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Network Master Pro MT1000A

- Mobile Fronthaul Installation and Verification
  - CPRI/OBSAI Test
  - eCPRI/IEEE 1914.3



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# CPRI Background



- Operators supporting explosive spread of smartphones and tablets by increasing bandwidth of mobile communications networks
- Driving complete change in mobile communications systems
  - Adoption of Centralized-Radio Access Networks (C-RAN).
    - Using C-RAN, the mobile fronthaul is configured from centralized Base Band Units (BBU) and multiple Remote Radio Head (RRH) units connected via general-purpose interfaces, such as the Common Public Radio Interface (CPRI) or Open Base Station Architecture Initiative (OBSAI).

#### **CPRI Bit Rates**

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- CPRI bit rates are referred to as "option #"
- There are now eight options (CPRI Specification V6.0)
- MT1000A supports Option 8, 10.1376 Gbps, reflecting marketing requirement of supporting exploring mobile network bandwidth.
- MT1000A can perform simultaneous testing up to 2 ports to reduce commissioning testing time.

Option	Bit Rate (Gbps)	Line Code
1	0.6144	8B/10B
2	1.2288	8B/10B
3	2.4576	8B/10B
4	3.0720	8B/10B
5	4.9152	8B/10B
6	6.1440	8B/10B
7	9.8304	8B/10B
8	10.1376	64B/66B

#### **OBSAI Bit Rates**

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- Four OBSAI bit rates are defined.
- MT1000A supports 6.144 Gbps, reflecting marketing requirement of supporting exploring mobile network bandwidth.<sup>\*1</sup>
- MT1000A can perform simultaneous testing up to 2 ports to reduce commissioning testing time.

Bit Rate (Gbps)	Line Code
0.768	8B/10B
1.536	8B/10B
3.072	8B/10B
6.144	8B/10B

\*1: Only Un Frame

#### C-RAN Market

- Market requirements
  - Minimizing number of BBUs per antenna cuts operator costs (rent, power, HW, etc.)
     Locating BBU 15 km or more from multiple RRH requires reliable connection i.e. C-RAN
  - CPRI runs over C-RAN with two main layers:
    - Layer 1: Physical transport
    - Layer 2: Several areas

C-RAN main interest is L1 in-band protocol; understanding this area allows operator to troubleshoot alarms and errors



In CPRI, BBU is called REC, and RRH is called RE (Fig. 1 from CPRI Specification V6.0)

envision: ensure





#### Test case 1





- Test case 1
  - Test line <u>between</u> REC(s) and RE(s)
    - System testing
    - Installation testing
  - Line can be
    - Optical
    - Carried over radio link or microwave link
    - CPRI over OTN
    - Instrument connected via optical interface to link
  - Terminate both sides of transmission line
    - BER test (Framed or unframed) \*1
      - One side could be loopback
    - Delay measurement
      - With one side in loopback

- Test case 2
  - CPRI Specification V6.0 defines
    - When both devices are in Operation state or in Passive link state, link is in normal operation
  - Operators find that up to 80% of CPRI turnup issues occur in lowest layers
  - Essential during installation to: confirm RRH/RE can communicate to ground even without BBU/REC
    - Confirming RRH/RE can connect to Passive link state
    - Confirming HDLC layer (Layer 2) network is connecting
  - Completing above minimizes chance of issues during BBU/REC installation



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Extract from Figure 30 in CPRI Specification V6.0: Start-up states and transitions

- Test case 2
  - Connect to actual equipment (REC or RE) to verify alive
    - Signal level and frequency measurement
      - Optical cable ends can be checked with Video Inspection Probe (VIP)
    - Monitor control word K30.7 indicates error in 8B/10B line code (CPRI option 1-7 only) and 8B/10B code violations
    - Check equipment behavior
      - Check that equipment can reach Passive link state
      - Confirm HDLC layer (Layer 2) network connecting
      - Check equipment behaviour at alarms



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- Test case 3
  - Monitoring actual line between REC (Radio Equipment Control) -(master) and RE (Radio Equipment) - (slave)
    - Using dual port in Pass-through mode or monitor
      - Monitor interactive behaviour of equipment
    - For maintenance or in-service troubleshooting



 Supports CPRI interface rate option 1 (614.4 Mbit/s) to option 8 (10.1376 Gbit/s) Back to

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- Ensures testing of current and future CPRI interfaces

Port 1	Application Selecto	or		
Port +	Unframed - PRBS15	Inverted		
Port mode:	Off 🛛	_ Transceiver		
Line rate:	614.4 Mbps (CPRI)	Wavelength(nominal) N/A	<ul> <li>Signal loss</li> </ul>	0
Clock Configuration	614.4 Mbps (CPRI)	Compliance N/A		
Timing source:	768 Mbps (OBSAI)		CPRI	¥,
	1228.8 Mbps (CPRI)			- Che
	1536 Mbps (OBSAI)		© LOS	1
	2457.6 Mbps (CPRI)		LOF	
	3072.0 Mbps (CPRI/OBSAI)			
	4915.2 Mbps (CPRI)		225	×
	6144.0 Mbps (CPRI/OBSAI)		Pattern error	~
	9830.4 Mbps (CPRI)		Transceiver	
CPRI-BER	10137.6 Mbps (CPRI)	ULT 🔐 🍽 🛜 🛚 V	DI 46 🏟 🛃 🔊	

- Testing at any rate
- Ability to exercise BBU or RRH up to Passive link status (as per latest CPRI standard)

Back to

- Support for Pass-through mode
  - Complete solution for detailed I&M testing

Port 1	Application Selector	
Port	CPRI Link - PRBS15 Inverted	
Content: CPRI Link		Signal loss
Start up:	Disabled 💌	9
Role:	Master	CPRI
Protocol:	Protocol version 2	• LOS
HDLC	Ethernet	• LOF
	Pointer: 20	• LSS
Pattern	Inverted Viser nattern: 32/32 Bits	Pattern error
inversion.		Transceiver
CPRI-BERT SET	UP TEST RESULT 🔐 🗃 🛜 🛚 V	💽 🔊 🕂 🍈 01: 48

• Displayed signal level and bit rate gives first verification of received- signal condition

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Port 1	Application Selector	
Port +	CPRI Link - PRBS15 Inverted	
Rx		<b>—</b>
Signal level 😑	-4.78 dBm	<ul> <li>Signal loss</li> </ul>
Bit rate	10 137 599 936 bps	?
Deviation	0 ppm	
	-64 bps	CPRI
Pattern bit rate	9 216 000 128 bps	
Тх		
Signal level	-2.49 dBm	• LOF
Bit rate	10 137 599 936 bps	
Deviation	0 ppm	
	-64 bps	• Pattern error
Pattern bit rate	9 216 000 000 bps	Transceiver
CPRI-BERT	<u>SETUP</u> TEST RESULT 🔐 🗃	奈 🛚 V 💽 🔊 🗜 🐗 01 48 🗍

• Using Video Inspection Probe (VIP) to check fiber endface confirms quality practices and removes key cause of turn-up failure.

 Checking for and inserting Layer-2 alarms and errors from BBU to RRH

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Ensures engineer can complete advanced fault finding and evaluate issue root cause



- Test results:
  - Summary screen with pattern error information and survey of result pages

Back to

- Alarms/Errors screen with details of detected CPRI alarms and errors
- Color coding highlights detected alarms and errors

Port 1 Result File B	rowser			Result File Browser	
2015-04-20 01:49:26 00:00:22			2015-04-20 01:49:26	00:01:21	
Summary	Event Log	Statistics	Summary		Event Log Statistics
BER Error count Rate			CPRI - Alarms/Erro	ors 🛛	SI prefix
Pattern error	_		01:49:26	Port 1	
Threshold:	0	•	Back 2015-04-20 01:49:31	Count Ratio	•
			2015-04-20 Signal loss	0	0.00
Challen Catalogue	_Pattern		LOS	0	0.00
Statistics category Status	PRBS15		01:49:41 LOF	0	0.00
CPRI - Alarms/Errors	Pattern Error Insertion		2015-04-20 Remote LOS 01-49-46	0	0.00
CPRI - Frames			2015-04-20 Remote LOF	0	0.00
CPRI - Round Trip Delay	Insertion: Off		01:49:51 <b>RAI</b>	0	0.00
		×	Current SDI	0	0.00
	Burst length:		2015-04-20 01:50:46 Reset	0	0.00
CPRI-BERT SETUP TEST	<u>RESULT</u> 🔐 🕬 🕾 V 💌 🗴	9 🕂 📦 01:49	CPRI-BERT	SETUP TEST <u>RESULT</u>	🝽 🕿 🕅 V 📧 🔊 😾 📦 01:50

- Test results:
  - CPRI Frames screen with counts of received and sent frames and code words
  - Delay screen showing measured Round Trip Delay



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- Added APS measurement function to CPRI BERT application
  - Sets any APS measurement start/stop trigger using checkbox, with APS measurement started/stopped at selected trigger OR condition
  - Choice of triggers for network configuration and hypothetical faults for analyzing how equipment and network perform at APS operation

Port 1 2016-02-16 04:15:25 Summary	Result File Browser	2016-02-16 04:18:22	
1: Swithing time 0.002 ms 2: Swithing time 0.002 ms 3: Swithing time 0.001 ms 4: Swithing time > 1 s 5: Swithing time > 1 s		tic Switching Time (ms)	· •
Minimum switching time Average switching time Maximum switching time Threshold Measurement count	0.001 ms 0.002 ms 5 0.000 ms 3 Port 1 Control Dela	10 15 20 Application Selector	Thresholds
	Peference events Alarms Signal loss LCV LOS LOS LOF Select all Default	error Rai	Reset
	Error free period: 100n Threshold: CPRI-BERT	ns  50.000 ms 5ETUP <u>TEST</u> RESULT <b># 0</b> % 0	X I S S E III 04 31

					Result File Browser		[
016-02	-16 04:15:25					2016-02-16 04:18	22
ummar	ry			NPS	Event Lo	Statistics	
	Filter				View: All ports	CSV export	
No.	Time	Port	Туре	Src.	Description	Dur./Count	
	2016-02-16 04:16:10	1	-	CPRI	APS switching time	0.002 ms	
	2016-02-16 04:16:10	1	•	CPRI	Pattern error	256	
	2016-02-16 04:16:25	1	-	CPRI	APS switching time	0.001 ms	
	2016-02-16 04:16:25	1	•	CPRI	Pattern error	50	1
	2016-02-16 04:17:35	1	•	CPRI	Signal loss	00:00:06	
	2016-02-16 04:17:36	1	-	CPRI	APS switching time, Overflow	1000.000 ms	
	2016-02-16 04:17:54	1	٠	CPRI	Signal loss	00:00:02	
	2016-02-16 04:17:55	1	-	CPRI	APS switching time, Overflow	1000.000 ms	
12	2016-02-16 04:18:22			Test	Stopped		-
	CPRI-BERT			SE.	TUP TEST <u>RESULT</u> <mark> T</mark> 🖗 🕅 🗇 🕅	V 💽 yx 🛃 🗤 🕫	4 29

Graph and Event log screens for easy viewing and analysis

CPRI over OTN



- Market requirements
  - CPRI over OTN:
    - Transport raw radio (CPRI) data from RE over optical fiber to central location for baseband processing
      - Single location serving multiple REs
      - Consolidation has huge power and cost savings over distributed approach without impacting network scalability
  - OTN supports transport of several protocols over same fiber
    - Same management system across network

Support for CPRI over OTN enables tests of latest CPRI implementations

Back to



#### eCPRI/IEEE1914.3

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- Market
  - Most MFH networks are based on CPRI and will have to move to these new frame formats for 5G or before allowing the operator to manage the massive increase in data throughput requirements.
  - IEEE 1914.3 frames will likely also to be utilized back into the MBH as the architecture as the connection from Core / Metro to the MFH will evolve.

#### MT1000A support BER test of eCPRI/IEEE 1914.3

Application Stream	Selector	<b>? X</b>	ladio Frame	_Frame Content	Application Selector Stream Setup	? X
		Maniah Ia	EEE 1914.3 🔻	ЕТН	IEEE 1914.3	Variable
CPRI     ETH     VLAN     I       Layer 4     Common Header     Message Header       Layer 3     Protocol revision:     0001b       Hyud     Message type     IQ Data       VLAN     Length:     28 Byte	V4 UDP CCR1 Payload Reserved: 000b C:	Variable ) Li	ayer 4 Jone V ayer 3 Jone V ayer 2 VLAN	Dst MAC:	00-00-00-00-00 0.0 00-00-00-00-00 FC3D	% Default
	AESULI 📑 🖬 🖓 🕼 V 🖂 🖉 🗮	Close	ecpki/ku	e beni <u>se</u>	<u>TUP</u> IEST KESULI	Close
eCPRI Frar	ne Setting		IE	EE1914.	3 Frame Se	etting

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Network Master Pro MT1000A

Powerful Storage Area Networking (SAN) Tests
 – Fibre Channel Functions



- Powerful tests of Fibre Channel links
  - Test of 1 GFC, 2 GFC, 4 GFC, 8 GFC, 10 GFC and 16GFC

Back to

- Optional mapping to OTN
- Performance Test
- Latency measurement
- BER testing including service disruption measurement
- Line alarm and error monitoring
- Normal or Reflector mode

- Color-coded displays give easy overview of GO/NO-GO results on Fibre Channel links
- Powerful Fibre Channel statistics include Latency, Packet Jitter and service disruption information

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- Optional threshold settings for easy understanding of results

Port 1			Result File Browser		
2014-10-02 14:18:22 00:00:12		2014-10-03 07:45:36	00:00:49		
Summary Statistics		Summary		·····	Statistics 📕 🔳
BER Bit count Error count Rate	3	III Total Fibre Channel - B	IERT	SI prefix	<b>▼</b> 32.
Pattern errors 88962404480 1 112E-11		07:45:37	Por	:1	
Threshold:		Back 2014-10-03 07:45:42	Min. Max.	Avg.	
Utilization Pattern errors Errored frames	?	2014-10-03 Latency(us)	0.0 us	0.0 us	0.0 us
30 50 60 70 16-10 <sup>16-0</sup> 16-4 50 60 70 70 70 16-10 <sup>16-0</sup> 16-4 16-4 70 70 70 70 70 70 70 70 70 70 70 70 70		2014-10-03			
		07:45:52	Min. Max.	Avg.	
Pattern Error Insertion		07:45:57	0.0 us	U.I US	0.0 us
Service disruption Avg Max		2014-10-03 07:46:02	Seconds	Count	
Disruption time N/A 0.0 us Burst length: 1	×	Current Max. disruption	0.0 us		×
Threshold: 50,000		2014-10-03 07:46:25 Avg. disruption	N/A		0
		FC-BERT	SETUP TEST <u>RESUL</u>	L 🔐 🕬 🕫 🛚 V	/ 🗾 y 🛊 07 46 🛛 🗰

- Point-to-point and Fabric topology
- Latency, Packet Jitter and service disruption measurements

Back to





- Performance test application to Fibre channel interface
  - Supports throughput, latency, and buffer credit performance verification for Fibre channel networks and Fibre channel equipment



Network Master Pro MT1000A

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• OTN Metro and Core Network Installation and Maintenance



# OTN Background

- Back to Index page
- ITU-T defines an Optical Transport Network (OTN) as a set of Optical Network Elements (ONE) connected by optical fiber links, able to provide functions of transport, multiplexing, switching, management, supervision and survivability of optical channels carrying client signals.
  - Typical signals carried by OTN are:
    - SONET/SDH
    - Ethernet
    - Fibre Channel
    - CPRI
  - Key OTN functions include:
    - Mapping/demapping of non-OTN signals
    - Multiplexing and demultiplexing of OTN signals
    - Forward Error Correction

# OTN Background

- OTN networks first designed for submarine sections
  - Quickly moved to Core  $\rightarrow$  Metro  $\rightarrow$  Access
    - Operators can implement more services, control and management
- Simplifying network management is key for operators
  - Control customer traffic from access point and across network (single system, single management)
  - Greater insight about faults, quick repair and fewer maintenance issues
  - Single management of all legacy and replacement technologies



Back to

#### MT1000A OTN Test Function

- Comprehensive OTN testing for metro and core network I&M
  - OTU1, OTU2, OTU3, OTU4, OTU1e, OTU2e, OTU1f, OTU2f, OTU3e1, OTU3e2 tests
  - ODU0, ODUflex<sup>\*1</sup>, ODU1, ODU2, ODU3, ODU4.
     ODU0 to ODU4 multistage mapping
  - Test Ethernet, CPRI, Fibre Channel and SDH/SONET client signals mapped to OTN signal
  - OTN tests with bulk signals at OTN level
  - Comprehensive OTN error and alarm statistics
  - OTN error performance measurement (G.8201 or M.2401)
  - ITU-T O.182-compliant FEC test
  - Delay measurement
  - OTN header edit and capture
  - OTN TCM monitoring and generation
  - Service disruption analysis using APS application
  - OTN tributary scan

Back to

## MT1000A OTN Test configuration (1/3)

- OTN out-of-service testing
  - For installation and commissioning
  - For troubleshooting
  - OTN testing with far-end loopback



- OTN testing with two instruments
  - Separate results for each side of line



Back to

## MT1000A OTN Test configuration (2/3)

- OTN in-service testing
  - Troubleshooting live traffic
  - Connected at monitoring point



Back to

### MT1000A OTN Test configuration (3/3)

- OTN in-service pass-through testing
  - Troubleshooting live traffic when no monitoring point



Back to
## MT1000A OTN Mapping OTU1/OTU2

ODU/ GMP BMP PRBS/Null **OPU Fle** Largest Range of FC-400 Mappings and FC-800 CPRI Opt. 7/6 **Supported Clients** CPRI Opt. 5/4 Extended BMP GFP-F MAC/IP ODU/OPU2 GFP-F 10GbE BMP OTU2 ODU/OPU2 PRBS/Null AMP STM-64/OC-192 ODTU12 AMP BMP (PT=20) PRBS/Null ODTU12 AMP STM-16/OC-48 AMP (PT=21) OTU1 ODU/OPU1 FC-200 GMF CPRI Opt. 3 ODTU01 AMP (PT=20) BMP PRBS/Null GFP-T GiaE ODTU2.1 GMP DDU/OPU GMP ODU AIS FEC Com STM-4/STM-1 ODTU12 (PT=20) 0001 0PU1 COTTUD1 GM /OC-12/OC-3 FC-100 CPRI Opt. 2/ 🕝 SETUP TEST RESULT 🔛 🗖 🐄 🖪 V 🖼 🗤 🛱 ODU/OPU BMP 10 GigE OTU2e/1e 2e/1e PRBS/Null ODU/OPU BMP TC FC-1200 OTU2e (Only MU100011A) ODU/OPU FC-1200 OTU2f/1f BMP 2f/1 PRBS/Null MU100010A-001 Up to 2.7G Dual Channel MU100010A-002 FC 1G 2G 4G Dual Channel MU100011A-001/003 Up to 10G Single/Dual Channel MU100011A-004/005 Up to 10G FC Single/Dual Channel MU100010A-011/012 Ethernet 10G Single/Dual Channel MU100010A-061 ODU Multiplexing MU100011A-001/003 Up to 10G Single/Dual Channel MU100011A-063 ODU Multiplexing/Multi Stage MU100010A-051/052 OTN 10G Single/Dual Channel MU100010A-062 ODU Flex MU100011A-001/003 Up to 10G Single/Dual Channel MU100011A-062 ODU Flex MU100010A-081/082 STM-64 OC-192 Single/Dual Channel MU100010A-071 CPRI/OBSAI Up to 5G Dual channel MU100011A-001/003 Up to 10G Single/Dual Channel MU100011A-071/072 CPRI/OBSAI Up to 10G Single/Dual channel MU100010A-091/092 FC 8G 10G Single/Dual Channel MU100010A-072/073 CPRI/OBSAI 6G to 10G Single/Dual channel MU100011A-004/005 Up to 10G FC Single/Dual Channel MU100011A-071/072 CPRI/OBSAI Up to 10G Single/Dual channel

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#### MT1000A OTN Mapping OTU3



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#### Ancitsu envision : ensure

0TU2 00L2 0DTU12 (PT=20)

#### MT1000A OTN Mapping OTU4





- OTN statistics
  - Summary page with main results
  - Additional pages with detailed statistics
  - GO/NO GO color coding gives easy overview of results



Back to

OH capture

Tributary

scan

Transceiver

.

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X

• Ethernet in OTN

/Inritsu

- Statistics for OTN and embedded Ethernet signal in same measurement
- Client signal frequency
- Intuitive configuration map



envision:ensure



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ОН

TP #1

ETH-BERT

OH

SETUP TEST

RESULT

#### SDH/SONET/DSn/PDH in OTN

 BERT applications and upgraded to switch without closing BERT, APS and RTD applications to improve operation efficiency

Back to



#### SDH/SONET in OTN

 Upgraded Client signal selection method used for ATN mappings at SDH-OTN-BERT application, and enabled Client SDH and Client PRBS signal switching without closing applications to improve operation efficiency

Back to



- OTN status information
  - Overview of current status of alarms and errors
  - Optical level and rate information
  - GO/NO GO color coding gives easy overview of line status



Back to

- OTN Over Head (OH) Byte capture
  - Inspect OH bytes for detailed troubleshooting
    - Updates about every 1 second



Back to

- Comprehensive OTN Testing—continued
  - ODUflex testing
    - ODUflex: New feature of OTN
    - Method for flexible allocation of bandwidth to client signal

Back to

- Makes most efficient use of OTN capacity
- Capacity of ODU2 split into eight 1.25G ODUflex time slots



- In above example, FC-400 (4GFC) Fibre Channel signal occupies four ODUflex time slots, freeing other four ODUflex time slots in ODU2 for other payloads
- MT1000A supports ODUflex testing, allowing operators deploying new technology to verify working correctly throughout network

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- ODUflex
  - Configuration and results



#### MT1000A OTN FEC Test

- ITU-T O.182 Compliant FEC Test
  - Anritsu's proposed FEC performance tests using Poisson distribution random errors adopted by ITU-T 0.182 in July 2007
  - Reproducible/accurate FEC error correction tests by generating random signal errors (Poisson distribution)







#### MT1000A OTN FEC Test

- ITU-T O.182 Compliant FEC Test
  - FEC error insertion with MT1000A



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Network Master Pro MT1000A

 Quick and Easy Tests of SDH/SONET/PDH/DSn Networks



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Back to Index page

- Quick and easy tests of SDH/SONET/PDH/DSn
  - Testing of SDH/SONET systems at STM-64/STM-16/STM-4/STM-1/OC-192/OC-48/OC-12/OC-3/STS-3 and embedded PDH (E1/E3/E4) and DSn (DS1/DS3) systems
  - Powerful PDH (E1/E3/E4) and DSn (DS1/DS3) testing
  - Simultaneous bi-directional monitoring of SDH/SONET/PDH/DSn lines
  - SDH/SONET mapping and de-mapping
  - Comprehensive error and alarm statistics
    - G.826/G.828/G.829/M.2100 error-performance measurements on SDH/SONET traffic
    - G.826/M.2100 error-performance measurements on PDH/DSn traffic
  - SDH/SONET OH byte testing and monitoring
  - SDH/SONET trouble scan
  - SDH/SONET pointer event generation and monitoring
  - SDH/SONET/PDH/DSn delay measurements



• SDH mappings





• SONET mappings



# MT1000A SDH/SONET In-Service Measurements



- Alarm and error monitoring for both sides of SDH/SONET line
- Frequency-deviation measurements

• G.826/G.828/G.829/M.2100 error-performance measurements on live traffic



## MT1000A SDH/SONET Out-of-Service Testing



- Installing, commissioning and troubleshooting SDH/SONET lines
- Stressing system by generating alarms, errors, pointer operations, slip and frequency offset
- Testing synchronization circuits

- Generating embedded PDH/DSn signals
- G.826/G.828/G.829/M.2100 error performance
- Propagation time
- Alarm, error, slip and frequencydeviation measurements



## MT1000A SDH /SONET Out-of-Service Testing



- Installing/commissioning
- G.826/G.828/G.829/M.2100 error-performance measurements
- System stressing by generating alarms, errors, slip and frequency offset

- Testing synchronization circuits
- Alarm, error, drift and frequency-deviation measurements
- Propagation time measurements





#### MT1000A SDH/SONET Line Status

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• Physical line information

• Current alarms and errors

	Port 1		pplication Selector				Port 1		Application Sel	lector		
Тх	× +	STM64 - AU4#All - VC-4 - C-12	2 ←	El	Follows		Tx ←	STM64 - AU4#All	- VC-4 - C-12 -	El	Follows	
R>	∝→[	STM64 - AU4#1 - VC-4 - C-12		El	None 🔻		Rx →	STM64 - AU4#1 -	· VC-4 - C-12 →	E1	None 🔻	
Rx Si Devi	1 Signal Level	• -3 0	dBm ppm		Optical transmitter Normal LOS Rx Signal Level -3 dBm SDH	•	Alarms LOS LOF OOF MS-AIS	<ul> <li>TU-LOM</li> <li>LP-TIM</li> <li>LP-UNEQ</li> <li>LP-RDI</li> </ul>	Errors A1A2 B1 B2 MS-REI	AU-NDF     TU-NDF     Switch	Optical transmitter Normal LOS Rx Signal Level -3 dBm SDH	•
Bit Ra	Rate	0   9 953 280 000	bps		<ul> <li>LOF</li> <li>B1</li> <li>AU-LOP</li> <li>E1</li> <li>No Frame</li> </ul>		MS-RDI AU-AIS AU-LOP HP-TIM HP-PIM	LP-PLM LSS TC-UNEQ	<ul> <li>B3</li> <li>HP-REI</li> <li>V5/B3</li> <li>LP-REI</li> <li>PRBS Errors</li> </ul>	<ul> <li>TC-IEC</li> <li>TC-BIP-2</li> <li>TC-REI</li> <li>TC-OEI</li> </ul>	LOF     B1     AU-LOP E1     No Frame	E Z
Patter Tx Si	ern Bit Rate Signal Level	64 000 -2	dBm		AIS     Distant     OH Capture     Tributary	*	HP-UNEQ HP-RDI TU-AIS TU-LOP	TC-TIM TC-AIS TC-RDI TC-ODI	Pointer information _	TU-Positive	AIS     Distant     OH Capture     Tributary     Control	*
	BERT	<u>SETUP</u>	TEST RESUL	т 🔐	Transceiver		BERT		AU-Negative	TU-Negative	Transceiver	

#### **Ancitsu** envision : ensure

### MT1000A SDH/SONET Tributary scan

- Quick overview of problems in monitored SDH/SONET signals
- Detailed problem description when required
  - Click tributary for more details



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### MT1000A SDH/SONET Performance Measurements

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- Bi-directional performance measurement
  - Easy information switching between two ports
- BER measurements of embedded PDH/DSn signal



### MT1000A SDH/SONET Overhead Byte Analysis

YSIS

Back to

- Bi-directional OH byte capture
- User-programmable transmitted OH bytes



### MT1000A SDH/SONET Event Insertion

- Stress-test network elements by inserting events in test signal
- Inserted Events:
  - Alarms
  - Errors
  - Frequency deviations
  - Pointer operations



Back to

### MT1000A SDH/SONET APS Test Application

- Max switchover time measurement
  - User-defined max. time
  - User-defined switching criteria: APS measurement triggered by SDH/SONET or E1/DS1 events
  - Average time display
- APS protocol events can be generated and detected
  - No. of switchovers based on APS protocol events count
- Measurement at two receivers for simultaneous APS protocol event monitoring and switch time measurement



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### MT1000A SDH/SONET Pointer Movement Graph

- Graph of pointer movements
  - Good overview of pointer operations
- Information on AU and TU pointer
- Magnify graph points of interest
- Results stored in MT1000A memory





### MT1000A SDH/SONET TCM Functions

- Analyze TCM (Tandem Connection Monitoring) function in SDH/SONET systems
  - Simultaneous bi-directional monitoring of TCM information on SDH/SONET lines
  - Comprehensive TCM error and alarm statistics
  - Inject TCM events to stress-test network elements

			Result Files					
2014-04-03 09:27	:36	00	:00:23					_
Summary			)	Pointer Mov	ement	Statistics		
Total	SDH - TCM				SI prefix			
Back		P	ort 2					2
2014-04-03	Alarms	Count	Ratio					
2014-04-03	TC-UNEQ		0	0				Ĕ.
09:27:46	тс-цтс		0	0				
2014-04-03 09:27:51	TC-TIM		0	0				
2014-04-03	TC-AIS		0	0				
09:27:56	TC-RDI		0	0				
-	TC-ODI		0	0				×
Current 2014-04-03 09:27:58	Errors	Count	Ratio				-	
BEI	RT	SETUP	test <u>Re</u>	SULT	💾 📑	🛪 ∦	09:27	

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### MT1000A PDH/DSn Out-of-Service Testing



- Installing, commissioning and troubleshooting PDH/DSn lines
- Stress system by generating alarms, errors, slip and frequency offset
- Testing synchronization circuits

- G.821(E1/DS1)/G.826/M.2100 error performance
- Alarm, error, slip and frequency-deviation measurements
- Propagation time with far-end loopback



### MT1000A PDH/DSn In-Service Measurements

- Alarm and error monitoring at both sides of PDH/DSn line
- Frequency-deviation measurements
- G.821(E1/DS1)/G.826/M.2100 error-performance measurements on live traffic

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## MT1000A E1/DS1 Network-Element Testing

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- Installing/commissioning
- G.821, G.826 or M.2100 errorperformance measurements
- System stressing by generating alarms, errors, slip and frequency offset

- Testing synchronization circuits
- Alarm, error, slip and frequency-deviation measurements
- Propagation time measurements



### MT1000A E1/DS1 Drop-and-Insert Testing



- Pseudo in-service testing on live PCM systems
- Add and drop N\*64 kbps signals
- Alarm, error and slip generation and measurement
- Inject errors in live traffic channel
- G.821, G.826 or M.2100 errorperformance
- Frequency deviation



#### MT1000A PDH/DSn Line Status

- Physical line information display of current:
  - Input frequency and deviation
  - Input-level indication
  - Pattern bit rate
- Current alarms and errors

Port 2	Application Selector	
Tx	El	Follows
	El	
Alarms LOS AIS No Frame No CRC4 MF Distant No Sync No CAS MF Distant MF	Errors • FAS • Pattern • CRC4 • CRC4 MFAS • E-Bit • Code • Pattern Slip • Frame Slip	Transmission On LOS Deviation Oppm ? E1 • No Frame • AIS • Distant Alignment CAS Audio Traffic
BERT	SETUP TEST RESULT 🔐 🕻	» 🐟 ∦ 09 30 🗍

		Port 2		Application Selector			
		Tx →		El	_	Follows	
l		Rx →		E1		Tx 🔻	
		-E1				Transmission Or	
		Signal Level	• 1	dB		<ul> <li>LOS</li> <li>Deviation</li> <li>Oppn</li> </ul>	. ?
	F	Deviation	0	ppm		F1	
			0	bps			5
	¢	Propagation Delay	0	ms		No Frame	-7
	,	Pattern Bit Rate	64 000	bps		AIS	
	Ċ	Bit Rate	2 048 000	bps		<ul> <li>Distant</li> </ul>	
		APS	N/A			Alignment	$\sim$
						CAS	~
						Audio	
	L					Traffic	
		BERT	SETUP	TEST RESUL	r 🔐 C	<b>} ≈ <mark>∦</mark> 09:30</b>	

### MT1000A PDH/DSn Alarm and Error Statistics

- Alarm-second counts and ratios
- Error counts and ratios
- M.2100, G.826 or G.821 parameters

- Histograms show measurement overview
  - Click parameter to activate histogram







### MT1000A E1 Alignment and CAS Displays



- Information on FAS words and Sa bits
- Information on CAS bits
  - User-selectable bit pattern for red and yellow colors



### MT1000A DS1 Alignment and CAS Displays



- Information on F-bits and S-bits
- Information on CAS bits
  - User-selectable bit pattern for red and yellow colors




#### MT1000A E1/DS1 Channel Status Display

• Fast overview of E1/DS1 line status



Back to

#### MT1000A E1/DS1 Audio Display

- Details on contents of one selected traffic channel
  - Displays information from two ports for bidirectional monitoring

Tx +		E1					
Rx →		El					
Audio Channel			Transmission				
	Port 1	Port 2	<ul> <li>LOS</li> <li>Deviation</li> </ul>				
Content	10011100	01010101	0 pp				
Content(inv.)	11001001	1001001         00000000           -81 - 88         + 0 - 0           9         -66					
Peak(pos. and neg.)	+81 -88						
Level	-9						
Tone frequency	495	427	No frame				
Coder offset	-7	2	- No manie				
			No Sync				
			Alignment				
ort 1 Audio level		· · · · · · · · · · · · · · · · · · ·	CAS				
	-30 -25 -20	0 5- 01- 51	Audio				
ort 2 Audio level	-30 -25 -20	-15 -10 -5 0	5 Traffic				

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Network Master Pro MT1000A

• VIP: Video Inspection Probe



Back to

## VIP: Video Inspection Probe

- VIP Video Inspection Probe
  - Judge quality of optical fiber and module endface
  - Find trouble in optical fiber and module endface Reduce degraded signal transmission and effect on measurement results
  - Prevent connected optical fiber and module endface damage
- Dirty connector endface...
  - Dirty connector endface causes more reflection
  - Cleaning connector endfaces maintains good connection
- Damaged connector endface...
  - Damaged connector endface has greater reflection and larger ORL (Optical Return Loss)
- MT1000A supports G0382A/G0306B VIP option
  - Table View identifies endface "defects" or "scratches"
  - Automatic fiber endface pass/fail determination made in accordance with IEC61300-3-35 standard





Back to







#### VIP - Ordering items 1/2 -

Model No.				
G0382A		Autofocus Video Inspection	Probe	
- Standard acce	tandard accessories*1 - Soft Bag Seven Connector Tips - 1.25mm PC Male, - 2 - 2.5mm PC Female(FC Quick Reference Guide A¢ Odel No. 0382A 2.5PC-M (2.5mm PC Male)	Soft Bag Seven Connector Tips - 1.25mm PC Male, - 2.5mm - 2.5mm PC Female(FC), - 2.5 Quick Reference Guide	PC Male, - 2.5mr mm PC Female(S0	m APC Male, - 1.25mm PC Female(LC), C), - 2.5mm APC Female(SC)
		Applicat	ion Parts	
Model No.			Model No.	
H0382A	2.5PC-M (2	.5mm PC Male)	H0395A	FC-APC-F (FC APC Female)
H0383A	1.25PC-M (	1.25mm PC Male)	H0385A	LC-PC-F (LC PC Female)
H0387A	2.5APC-M (	2.5mm APC Male)	H0393A	LC-PC-F-L (LC PC Long Female)
H0388A	1.25APC-M	(1.25mm APC Male)	H0394A	LC-APC-F-L (LC APC Long Female)
H0384A	SC-PC-F(SC	PC Female)	H0396A	ST-PC-F (ST PC Female)
H0398A	SC-APC-F (S	5C APC Female)	H0397A	MU-PC-F (MU PC Female)
H0386A	FC-PC-F (SC	PCFemale)	H0390A	E2000-PC-F (E2000 PC Female)
			H0392A*2	MPO-PC/APC-F (MPO PC/APC Female)

\*1: Operation manual and MX900031A Autofocus VIP Software (For PC) can be downloaded from Anritsu public Web site.

\*2: H0392A MPO tip does not have Autofocus and Pass/Fail functions.





#### VIP - Ordering items 2/2 -

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page

Model No.				
G0306B		400x Video Inspectior	n Probe	
- Standard accessories -		Operation manual (Prin Soft Bug Seven Connector Tips - 1.25mm PC Male, - - 1.25mm PC Female( - 2.5mm PC Female(S	ted) 2.5mm PC Male, - 2.5mm APC LC), - 2.5mm PC Female(FC) C), - 2.5mm APC Female(SC)	: Male
	•	Applicat	ion Parts	
Model No.			Model No.	
H0360A	2.5P	C-M	H0366A	SC-APC-F
H0361A	1.25	PC-M	H0372A	E2000-PC-F
H0362A	2.5A	PC-M	H0373A	FC-APC-F
H0363A	LC-P	°C-F	H0374A	MU-PC-F
H0364A	FC-F	°C-F	H0375A	ST-PC-F
H0365A	SC-F	°C-F	H0376A	1.25APC-M
			H0380A	LC65-PC-F





#### Network Master Pro MT1000A

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• Operation and Presentation



## MT1000A Operation and Presentation

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- Easy operation
  - Simple, intuitive GUI
  - Loading and transferring configurations
  - Go/No Go testing
- Touch-screen based operation
- Automation Testing
- Remote operation
  - Via Ethernet interface
- Setup transfer/data transfer/firmware upgrade
  - Via USB interface



#### Five main groups

#### **Results Files** thernet SDH/SONE RTD Set Results Folder OTN ACCURACY OF A DESCRIPTION OF A DESCRIPTI BERT 2014-03-24@09-00-3 Select All Files Unselect All Files Create Report BERT 2014-03-25@10-29-54 Ethernet Mon./Gen. BERT 2014-03-25@10-30-41 ..... SAT (Y 1564 **Č** 📩 SDH/SONET PDH/DSn BERT 2014-03-24@09-00-3 Folder: /property/mnt/internal BERT 2014-03-25@10-29-54 Total Space: 0.562572 GB BERT 2014-03-25@10-30-41 Free Space: 0.558651 GB 🚰 🖼 🖘 🛙



**Application Selector** 

#### Anritsu envision : ensure

Back to Index page

- Application selector
  - Intuitive launch of new test
  - "Double" keys for starting tests of client signals in OTN
    - Right side of key starts test of client signals in OTN
    - Left side of key starts test of client signals directly



- Select Port display
  - Displayed after selecting application
    - Select one port or two if available and press Accept

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- Result pages:
  - Summary page
  - Event log
  - Statistics page(s)
    - Color-coded GO/NO GO indications



- Several pages in each main group
  - Selected with tabs
  - Selected from drop-down menu



Back to

#### MT1000A Histograms for General Statistics

• User sees distribution over time for selected parameter easily

Back to

- Click parameter and select histogram
- Click Zoom: Large numeric makes distance reading easy



## **Test Applications Summary**

- Summarizes measurement results for all current Test Applications (applications using port resources) **belonging to one user –** using Remote GUI software up to two users can use MT1000A
- Test Application Summary and Overall Test Status updates only during testing:
  - Green: No trouble •
  - Yellow: Errors (but no alarms) pending or occurred in past
  - Threshold violation or Alarms pending or occurred in past Red:

Port 1		Result File Brows	ser	
2015-05-21 10:02:0	09	00:01:35		
Summary			Event Log Statistics	
BER	Bit count Error count	Ratio		8
Pattern errors	190.238 G	1 5.26E-12		4
Threshold:		0		
Utilization	Pattern errors	Errored frames		0
40 50 60	16-10 16-8	A	_ Pattern	
20 E 10	80 1 90 1 1E-12 1E-4 1E-24 1E-2-		PRBS23	¥,
E .	1110 100	N 100 2	Pattern Error Insertion	4
100.00			Insertion: Manual	
Service disrupti	on Avg. Max.		Burst length: 1	X
Disruption time				
Threshold:		50.000		
📗 🚥 етн	1-BERT 🥊 S	TUP TEST <u>RE</u>	SULT 📑 🖬 🗢 🕅 V 💽 💁 📫 10 03	

Shows worst Status of all test applications.



All applications OK



One or more applications have Yellow Test Status (and no Red) Back to

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Clicking Test Applications Summary icon opens Overall Test Status screen

#### **Overall Test Status**

- For remote viewing test status for all current Test Applications
- Test Application Summary and Overall Test Status has no current/history distinction—basically show history.

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- To "clear" Test Status: Restart test.
- User-configurable to show Test Application Summary indicator—and to access Overall Test Status screen



- Overall Test Status updates only during <u>testing</u>:
  - Green: No trouble
  - Yellow: Errors (but no Alarms) pending or occurred in past
  - Red: Threshold violation or Alarms pending or occurred in past

#### **Overall Test Status**

• Adapts to number of running test applications



#### One test application

#### Two test applications

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Ancitsu envision : ensure



- Event Log gives users powerful means to analyze problems of long -term testing
- Records what/when problem happened and how long/often been happening

						Result File Browser		
2015	-03	-28 07:34:03				00:05:48		
Sum	mai	ry				Event Log	Statistics	
	•	Filter				View: All ports	CSV export	*
No		Time	Port	Туре		Description	Dur./Count 🔺	
	32	2015-03-28 07:37:06	1		ETH	Link	00:00:09	$\bigcirc$
		2015-03-28 07:37:06	1	•	ETH	Invalid blocks	14	2
		2015-03-28 07:37:07	1		ETH	Frame Loss Secs.	00:00:09	U
		2015-03-28 07:37:15	1	•	ETH	Seq. Sync. Lost	00:00:01	i i i
		2015-03-28 07:37:15	1	•	ETH	Pattern Errors	311	
		2015-03-28 07:37:15	1	•	ETH	Invalid blocks	2.451 k	E E
		2015-03-28 07:37:15	1	•	ETH	Preamble violations	260	V
		2015-03-28 07:37:15	1	•	ETH	Rx FCS Errored Frame	634 📐	
		2015-03-28 07:37:15	1	•	ETH	Fragmented	82 🔻	
		ETH-BERT			SETU	р теят <u>RESULT</u> 🔐 🗖 🖘 🛚 V	/ 💽 yx 🖳 🕠 07:3	39

#### • GUI filter function and CSV export

Summary		Event Log	Statistics 📕	
✔ Filter Clear filter		Time format: Absolute	CSV export	
V Event	🗸 Number	range	Dur./Count 🔺	<u> </u>
Exclude specific event(s)	From:	1		
Specify	To:	100		a,
ETH 10G LFS Remote Fault	🗸 Date/Tir	ne range		Eventling cav
ETH Frame Loss	From:	2001-01-01 00:00:00		EventLog.csv
	To:	2001-02-01 00:00:00		
▶				
			-	

• Logged events included in report



No.	Time	Port	Туре	Src.	Description	Dur./Count
1	2015-03-28 07:41:40		Test	Test	Started	
2	2015-03-28 07:41:49	1	Alarm	ETH	10G LFS Remote Fault	00:00:03
3	2015-03-28 07:41:49	1	Error	ETH	Invalid blocks	73.566 k
4	2015-03-28 07:41:50	1	Alarm	ETH	Frame Loss Secs.	00:00:03
5	2015-03-28 07:41:51	1	Error	ETH	Invalid blocks	22
6	2015-03-28 07:41:52	1	Alarm	ETH	Seq. Sync. Lost	00:00:01

#### Time stamp shows relation between event and statistics

-	No.						Descript		Dur./Count	
	1	2015-03-28 0	07:41:40			Test	Started			
	2	2015-03-28 0	97:41:49	1	•	ETH	10G LFS Remote Fault		00:00:03	3
	3	2015-03-28 0	97:41:49	1	•	ETH	Invalid blocks		73.566	c
<b>~</b>	4	2015-03-28 0	07:41:50	1	•	ETH	Frame Loss Secs.		00:00:03	3
2015-03-28 07:41:51	5	2015-03-28 0	97:41:51	1	•	ETH	Invalid blocks		22	2
	6	2015-03-28 0	97:41:52	1	•	ETH	Seq. Sync. Lost		00:00:01	L
	7	2015-03-28 0	97:41:52	1	•	ETH	Pattern Errors		72	2
	8	2015-03-28 0	97:41:52	1	•	ETH	Invalid blocks		5.763	c
	9	2015-03-28 0	97:41:52	1	•	ETH	Preamble violations		5	•
							1			Records and
_	2015-0	03-28 07:41:40	)				00:01:57			
<b>•</b>	Summ	nary						Event Log	Statistics	
		nary Total 15-03-28	Ethern	et - Tra	insmit			Event Log	Statistics	
		Total 15-03-28 7:41:40	Etherno	et - Tra	nsmit		Por	Event Log	Statistics	
2015-03-28		Total 15-03-28 7:41:40 Back 15-03-28	Ethern Fraffic	et - Tra	insmit T)		Por	Event Log	Statistics	
2015-03-28	Summ 203 0 200 0 200	Total 15-03-28 7:41:40 Back 15-03-28 7:41:49 15-03-28 7:41:49	Etherne Traffic Frames	et - Tra	nsmit Tን	x	Por 14.4442 M	Event Log SI prefix	Statistics	<ul> <li>▼</li> </ul>
2015-03-28 07:41:51	Summ 201 0 201 0 201 0 201 0	Total 15-03-28 7:41:40 Back 15-03-28 7:41:49 15-03-28 15-03-28 7:41:49 15-03-28 7:41:50	Etherno Traffic Frames Bytes	et - Tra	nsmit T	x	Por 14.4442 M 924.427 M	Event Log SI prefix	Statistics 0 0	<ul> <li>▼</li> </ul>
2015-03-28 07:41:51	Summ 201 0 202 0 202 0 202 0	Total 15-03-28 7:41:40 Back 15-03-28 7:41:49 T 15-03-28 7:41:50 F 7:41:50 F 7:41:50 F 7:41:50 F F 7:41:50 F F 7:41:50 F F F F F F F F F F F F F F F F F F F	Etherno Fraffic Frames Bytes Jnicast	et - Tra	nsmit	x	Por 14.4442 M 924.427 M 14.4442 M	Event Log SI prefix	Statistics 0 0 0	
2015-03-28 07:41:51	Summ 201 0 202 0 202 0 202 0 202 0 202 0 202	Total 15-03-28 7:41:40 Back 15-03-28 7:41:40 Back 15-03-28 7:41:50 E 15-03-28 7:41:50 E 15-03-28 N 15-03-28 N 15-03-28 N	Etherno Fraffic Frames Bytes Jnicast Multicast	et - Tra	nsmit	X	Por 14.4442 M 924.427 M 14.4442 M 0	Event Log SI prefix t1 Ax	Statistics 0 0 0 0	
2015-03-28 07:41:51	Summ 201 0 202 0 0 2 0 0 2 0 0 2 0	Total 15-03-28 7:41:40 Back 15-03-28 7:41:40 15-03-28 7:41:50 F 15-03-28 15-03-28 15-03-28 15-03-28 15-03-28	Etherno Traffic Frames Bytes Jnicast Multicast Broadcast	et - Tra	nsmit	x	Por 14.4442 M 924.427 M 14.4442 M 0 0	Event Log	Statistics           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0	
2015-03-28 07:41:51	200 200 200 200 200 200 200 200 200 200	Total 15-03-28 7:41:40 Back 15-03-28 7:41:49 15-03-28 7:41:50 E 15-03-28 7:41:50 E 15-03-28 7:41:52 E 15-03-28 7:41:52 E 15-03-28 7:41:52 E 15-03-28 7:41:52 E 15-03-28 7:41:52 E 15-03-28 7:41:52 E 15-03-28 7:41:52 E 15-03-28 15-03-2	Etherno Fraffic Frames Bytes Jnicast Julicast Broadcast Errored	et - Tra	nsmit	κ	Por 14.4442 M 924.427 M 14.4442 M 0 0 0	Event Log SI prefix t1 Xx	Statistics 0 0 0 0 0 0 0	
2015-03-28 07:41:51	Summ 201 201 201 201 201 201 201 201 201 201	Total 15-03-28 7:41:40 Back 15-03-28 15-03-28 15-03-28 7:41:50 15-03-28 7:41:50 E 15-03-28 7:41:51 Lurrent 5-03-28 F 15-03-	Etherno Fraffic Frames Bytes Jnicast Multicast Broadcast Errored	et - Tra	nsmit	×	Por 14.4442 M 924.427 M 14.4442 M 0 0 0 0 0	Event Log SI prefix	Statistics           0	

- Control panes
  - Control applications in work space



Back to

- Control panes
  - Control applications in work space
    - Click to expand



Back to

- Control panes
  - Control applications in work space expanded

Back to



- Control panes
  - Control instrument in application work space expanded
    - Click to expand instrument control



- Control panes
  - Control instrument in application work space

Back to



- Control panes
  - Control instrument in Application selector and test Result pages

Back to



- Power button menu
  - Pressing Power button while instrument on displays menu to:
    - Switch applications (when two applications running)
    - Take screen shot
    - Activate screen lock can be password protected
    - Power-down

Apps Switcher Capture Screen Lock Screen Back to



- Switch applications by clicking running applications at screen bottom
- Running applications window always accessible



#### MT1000A Instrument Setup

- Password protection
  - Prevent unintended changes to parameters and measurement start/stop
  - Enabled/disabled by user



Network Master Pro MT1000A

• Report Generation



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#### **Report Generator**

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- Generates reports:
  - Summary page only
  - Summary and Statistics pages
  - Port setup and Application setup included as option
  - User-customized report including:
    - Logo in .png format
    - Customer ID, Operator ID, notes, and similar information in measurement .pdf reports
  - Output report in .pdf, .CSV or .XML format to USB port

#### **Report Generator**

## **Anritsu** envision : ensure

2015-05-26 14:08:55

#### **Document Information**

Report Name	BERT
Customer	Customer 001
Project	Testing of line 1
Operator	Operator 001
Notes	This is a sample report

Module Type	Serial no	Software Version
MT1000A	6D60000101	3.01
MU100010A	6D6000087	

#### **Report Layout**



**Report Generator** 

Report has been successfully generated.

ОК

View PDF

• Look of pages like Ethernet stats, event log and port settings



• Look of reports from other applications.

/1	ritsu	envision : ensure	e	2014-00-01 22-09		/INFITSU envision ::	ensure	2016-09-04 10 17:54		/In	ritsu	envision:	ensure				2014-00-00 12 12	
			Test Summary				OTN: Alarms/Errors(Port 1					RF	-C2544 Th	roughput Re	sults - Port	L.		
		Start at		2015-09-04 09:56:21		OTU alarms	Court	Rutio						Frien	re size			
		Skop at		2015-09-04 09:58:20		Signal	OTU2				net (ai)	64	128	256	768	1004	1280	
		GPS status		Not available		LOS	0	0.00			100.00	Pini	Past	Pass	Pass	Pass	Pass	
		Annual Test Date of		PASE		OTU-MS	0	0.00			90.00	PAR	Pass	Pass	Pass	Pass	Pass	
				17000		OTU LOF	0	0.00			80.00	Pays.	Pens	Pare	Pass	Pets	Pass	
			Test Sequence Summary	S		OTU OOF	0	0.00			70.00	Patt	Pass	Pass	Pass	Pass	Pass	
<b>Net</b>	oork Parameter	Source	1.0.al = Falman	Rance + Local		OTU LOM	0	0.00			60.00	Page	Pass	Pass	Pass	Pase	Pala	
	CIR	User input	1000.000 Mbps	2000.000 Mbps		OTU DOM	0	0.00			50.00	Pans	Pensi	Pana	Pass.	Pess	Pass	
	laseline RTT	Measured	0.0	225 mi		SM-BIAE	0	0.00						Fran	14 1024			
	BOP	Calculated	3125 Bytes	3125 Bytes		SM-BDI	0	0.00			URI (96)	1582						
	W107M55	Mozoured	1500/ 1400 Bytes	10007 1400 BYUS		SM-IAE	0	0.00			100.00	Parts						
						OTU errors	Count	Ratio			90.00	Pass				8 1		
						Signal	OTU2				80.00	Piece	5			1		- 1
						OTU FAS	0	0.00			70.00	Pare						- 1
						MEAS	0	0.00			60.00	Pass				10		- 1
					~	SM-BIP8	0	0.00			50.00	Page .	- 1					- 1
						SM-BEI	0	0.00										
					-	FEC corrected	0	0.00	-									

- Reports can be viewed in the built-in PDF viewer immediately after they are generated
  - This makes it simple and easy for the user to inspect the report

## Filtering Results Display at Report Output

• The user can select the information to output when reporting statistical test results. As a result, file save times are shortened and files sizes are smaller.

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#### **Report Generator**

- Optionally includes Performance Verification information in reports
  - User-programmable performance verification period







2015-05-26 14:11:03

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# Report Name BERT Customer Customer 001 Project Testing of line 1 Operator Operator 001 Notes This is a sample report

**Document Information** 

Module Type	Serial no	Performance Verification Date	Performance Verification Due Date	Software Version
MT1000A	6D60000101	2014-05-06	2016-05-06	3.01
MU100010A	6D6000087	2014-05-06	2016-05-06	

Network Master Pro MT1000A

Automation Testing



Back to
Remote Operation



Back to

### Three Remote Control Types



	Function	Multi- user	File Sharing
VNC	Control from remote site	No	No
Remote GUI (MX100001A)	Control from remote site Port sharing File sharing	ОК	ОК
SCPI	Automation Control from remote site	ОК	ОК

### MT1000A Remote Operation – Applications

- Remote access
- Troubleshooting spurious errors
- Long-term surveillance and stability tests
- Multi-site surveillance
- Multi-user access
- Display screens via projector
- Documentation and training
- Operate MT1000A from PC with VNC client or new Remote GUI app

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- Remote GUI application runs on Windows 7/8/8.1
- Port-oriented connection not unit-oriented
- Multiple users share same unit and use separate ports



Back to

• Connect one application to up to two GUIs



Back to

- Only one GUI can change settings and start test (Read/Write)
- Next user just observes (Read only)
- Any user can take right to change settings with exchangeable rights

- Remote GUI can run as 'Standalone' viewer
- Users can:

- Generate report(s)
- Analyze results offline
- Create setup file(s) for deployment
- Remote GUI supports
  - Firmware update via LAN
  - Remote unit reset

envision: ensure







- Share file system—user can access file system from Windows Explorer
- Access PC file system—user can save/load file to/from Windows memory

General	File Sharing	× Network					Anritsu
Ethernet	Share File System	Bluetooth		444.000			
	IP Address 172.29.2.45						
Remote Control	Remote Control Domain	File Sharing	2				
	User				ATTENDED AND AND AND AND AND AND AND AND AND AN		NETWORK MASTER 700
	Password				M		
	Folder Name						
	Mount Status NOT CONNECTED						
	Defaults Cancel OK Apply					<b>1</b>	
	ĺ	 ₩ █ � 8 V ☑ № ₩ ₩ ₩	93:11				1

- Remote GUI supports:
  - Firmware update via LAN
  - Remote unit reset

Result files Setting files Report files Capture files Back to

Back to Index page

Remote Control–Scripting



# **Remote Control Scripting Option**

- Automated testing for developing applications •
- Remote control commands/replies as ASCII format strings
  - SCPI 1999.0 compliant with IEEE 488.2 mandatory common commands
- Fast command response
  - Execute up to 8 commands per second
    - Reduces test time at mass production
- Communication between controller (PC) and MT1000A:
  - Via MT1000A Ethernet Service Interface
    - TCP/IP connection
      - Test facility can be isolated LAN
  - Via WLAN
  - Via GPIB
- Includes documentation and scripting example
- LabVIEW driver sample

IP

Network





Device

under test





• Remote Control – GUI & Scripting



Back to

## Remote Control GUI & Scripting Option

- Execution became possible simultaneously about remote GUI (MX100001A) control and SCPI control at each port.
  - Customer can use one facility more effectively by being able to use two kinds of control commands at the same time.

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Automation Testing



Back to

### Automation Testing (1/3)

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NA

NA

NA

- Installation and maintenance tests have several challenges.
  - Varying Work Time and Test Results Quality Dependent on Technician's Experience
  - Increasing Risk of Work Errors as Test Items increase
  - Reducing work burn to minimize errors
- Network Master have the One-Button Test Mode by creating a settings file for each manual procedure enables field technicians to run tests and complete pass/fail evaluations with a single click.



## Automation Testing (2/3)

• Anritsu's Automated testing cuts timing time



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#### Automation Testing (3/3)

- Scenario Environment Editing Kit (SEEK) MX100003A
  - Free tool for creating automatic test scenarios for use on the MT1000A

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Test scenarios are created using the PC SEEK GUI with drag and drop operations







