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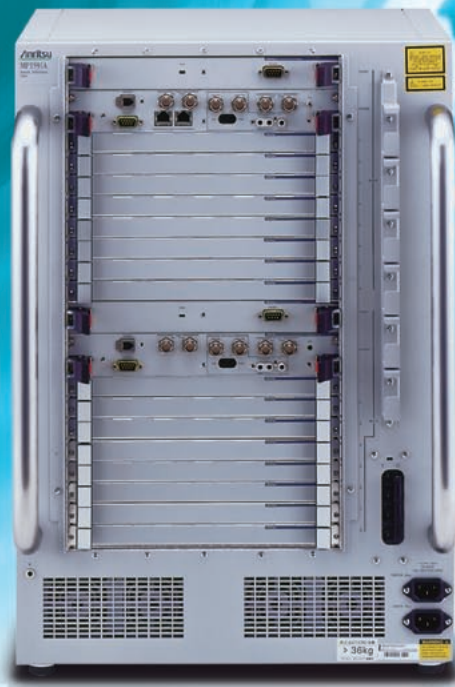
MP1591A
Network Performance Tester

All-In-One Next-Generation Network Testing
SDH/SONET/OTN/PDH/DSn/Jitter/EoS/Ethernet/IP Analyzer

The dawn of the NGN era and the spread of high value-added and seamless networks are driving the need for high-level testing and evaluation of these networks and their network devices.

Using modular plug-in units, Anritsu's MP1591A supports performance, jitter, and EOS measurements of networks, equipment and devices with SDH/SONET/OTN/PDH/DSn interfaces. The MP1591A also supports both Ethernet and IP technologies with a variety of applications such as QoS and IPTV streaming service tests.

This tester is the perfect tool for performing the wide range of measurements covering the physical to application layers needed for constructing next-generation networks.

■ **An all-in-one instrument for measuring SDH/SONET/OTN/PDH/DSn/Jitter performance**
■ **Supports EoS (VCAT, LCAS, Differential Delay) measurements**
■ **Supports 10/100/1000M, Gigabit, and 10 Gigabit Ethernet measurements**
■ **One unit supports measurement of up to 128 Ethernet ports**

MP1591A Main Frame

Rack-mount 16-slot model
Controlled by external PC
Supports Windows® XP and Windows® 2000 operating systems
Dimensions: 426 (W) x 596 (H) x 350 (D) mm
Mass: 28 kg max. (excl. options and units)

∗: Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

SDH/SONET/OTN/PDH/DSn/Jitter/EoS Unit

■ **Measurement Units: Frame Generation/Detection**

MU150100A 10/10.7G Unit

• PDH/DSn Measurement
• SDH/SONET (STM-0/OC-1 to STM-64/OC-192) Measurement
• OTN (OTU1, OTU2) Measurement (Option-05)
• 10.3G Measurement (Option-08)

MU150101A 2.5/2.6G EoS Unit

• PDH/DSn Measurement
• SDH/SONET (STM-0/OC-1 to STM-16/OC-48) Measurement
• OTN (OTU1) Measurement (Option-05)
• EoS Measurement (Option-06, 07, 11, 12, 13, 14)

MU150125A 10/10.7G Jitter Unit

• Bit Rate: 52 Mbit/s to 10.7 Gbit/s
• Jitter Generation Measurement
• Jitter Tolerance Measurement
• Jitter Transfer Measurement

Interface Units: 10/10.3/10.7G Optical/Electrical Interfaces

MU150121A 10/10.7G Optical Unit (Tx)

Interface: Optical Output
Bit rate: 9.95328 Gbit/s, 10.709225 Gbit/s

MU150121B 10/10.7G Optical/Electrical Unit (Tx)

Interface: Optical/Electrical Differential Output
Bit rate: 9.95328 Gbit/s, 10.3125 Gbit/s, 10.709225 Gbit/s

MU150123A 10/10.7G Optical Unit (Rx Wide)

Interface: Optical Input
Bit rate: 9.95328 Gbit/s, 10.709225 Gbit/s

MU150123B 10/10.7G Optical/Electrical Unit (Rx Wide)

Interface: Optical/Electrical Differential Input
Bit rate: 9.95328 Gbit/s, 10.3125 Gbit/s (without jitter measurement), 10.709225 Gbit/s

MU150124B 10.3G Optical/Electrical Unit (Rx Wide)

Interface: Optical/Electrical Differential Input
Bit rate: 9.95328 Gbit/s (without jitter measurement), 10.3125 Gbit/s, 10.709225 Gbit/s (without jitter measurement)

MU150135A 10/10.7G Optical Unit (XFP)

Interface: Optical Input/Output (XFP Module)
Bit rate: 9.95328 Gbit/s (without jitter measurement), 10.3125 Gbit/s (without jitter measurement), 10.709225 Gbit/s (without jitter measurement)

Ethernet Units

Express Flow Module: High-port-density models supporting Multiflow Counter, High Resolution. Traffic Monitor, Ethernet OAM, Link Flap

MU120131A 10/100/1000M Ethernet Module

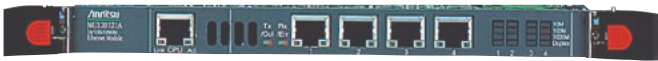Interface: 10BASE-T, 100BASE-TX, 1000BASE-T
Port Number: 12

MU120132A Gigabit Ethernet Module

Interface: 1000BASE-SX/LX/LE/LR (SFP Module)
Port Number: 8

Power Protocol Module: High-performance protocol models supporting Multiflow Counter, High Resolution Traffic Monitor, Ethernet OAM, Traffic Impairment Emulator

MU120121A 10/100/1000M Ethernet Module

Interface: 10BASE-T, 100BASE-TX, 1000BASE-T
Port Number: 4

MU120122A Gigabit Ethernet Module

Interface: 10BASE-T, 100BASE-TX, 1000BASE-T, 1000BASE-SX/LX/LE/LR (SFP Module)
Port Number: 4 (Electrical: 2; Optical: 2)

Basic Module: Basic-performance models

MU120111A 10/100M Ethernet Module

Interface: 10BASE-T, 100BASE-TX
Port Number: 8

MU120112A Gigabit Ethernet Module

Interface: 1000BASE-SX/LX/LH/ZX/T (GBIC Module)
Port Number: 2

MU120118B/C 10 Gigabit Ethernet Module

Interface: 10GBASE-SR/LR/ER (XENPAK Module)
Port Number: 2 (MU120118B), 1 (MU120118C)

Ethernet Unit Functions

Model	MU120111A	MU120121A	MU120131A	MU120112A	MU120122A	MU120132A	MU120118B/C
Interface	10/100BASE-T	10/100/1000BASE-T		1000BASE-X, T	10/100/1000BASE-T 1000BASE-X	1000BASE-X	10GBASE-R
Ports (Connector)	8 (RJ-45)	4 (RJ-45)	12 (RJ-45)	2 (GBIC)	2 (RJ-45) 2 (SFP)	8 (SFP)	2 (XENPAK)/ 1 (XENPAK)
Clock Variation		√	√ *1		√	√ *1	√ *2
Link Flap			√			√	
Auto MDI/MDI-X		√	√		√		
Frame Generation							
Stream Generation (Tx Stream)	√	√	√	√	√	√	√
Multi-Layer VLAN		√	√		√	√	
MAC Address Increment	√	√	√	√	√	√	√
IP Address Increment	√	√	√	√	√	√	√
TCP/UDP Port Number Increment	√	√	√	√	√	√	√
Test Frame Addition	√	√	√	√	√	√	√
Hardware Random Pattern		√	√		√	√	√
Measurement							
Counter	√	√	√	√	√	√	√
Multi-Flow Counter		√ *6	√		√ *6	√	
Capture	√	√	√	√	√	√	√
Decode	√	√	√	√	√	√	√
Latency	√	√	√	√	√	√	√
Ping	√	√	√	√	√	√	√
Ping6 (Option-12)	√	√	√	√	√	√	√
Arrival Time Variation/Latency Variation	√ *3	√	√	√ *3	√	√	√ *3
Through Mode	√	√	√	√	√	√	√
Monitor Mode	√	√	√	√	√	√	√
Address Swap Mode	√	√	√	√	√	√	
Unframe BER Test	√	√	√	√	√	√	√ *4
Packet BER Test (Option-11)	√	√	√	√	√	√	√
Auto Negotiation Analysis (Option-15) *5				√	√	√	
Application Traffic Monitor (Option-20)		√	√	√	√	√	
Link Fault Signalling (Option-16)							√
XENPAK Test (Option-13)							√
Clock Measurement		√	√ *1		√	√ *1	
PoE (Module Option-02)			√				
Ethernet OAM (Option-28)	√ *7	√	√	√ *7	√	√	√ *7
Automatic Test							
RFC2544 with VLAN	√	√	√	√	√	√	√
RFC2889 with VLAN (Option-10)	√	√	√	√	√	√	√
Protocol Emulation							
ARP	√	√	√	√	√	√	√
ICMP	√	√	√	√	√	√	√
OSPF (Option-07)	√	√		√	√		√
BGP-4	√	√		√	√		
ICMPv6 (Option-12)	√	√	√	√	√	√	√
IGMPv2/IGMPv3	√	√	√	√	√	√	√
IGAP (Option-14)	√	√	√	√	√	√	√
MLD/MLDv2 (Option-12)	√	√	√	√	√	√	√
MPLS (LDP/CR-LDP) (Option-08)	√	√		√	√		√
MPLS (RSVP-TE) (Option-09)	√	√		√	√		√
Other							
Traffic Impairment Emulator (Option-17) *6		√			√		

*1: Requires MU120131A/32A-01 Clock Measurement option.
*2: Requires XENPAK Test (Option-13). However, the variable clock of this module supports only the XAUI interface.
*3: Supports only Arrival Time Variation Measurement.
*4: Requires XENPAK Test (Option-13).
*5: Supports SX/LX/LH/ZX for GBIC or SX/LX/LE/LR for SFP.
*6: Supported by ports 1 and 2. Electrical ports (10/100/1000BASE-T) for MU120121A and optical ports (1000BASE-X) for MU120122A.
*7: Supports OAM frame send and protocol analysis of captured frame only.

SDH/SONET/OTN/PDH/DSn/Jitter/EoS Interface List

Typical Configuration

Model/Slot Position			For SDH/SONET/OTN/PDH/DSn Performance Measurement		For SDH/SONET/OTN/Jitter Measurement				For EoS Measurement	For Ethernet Measurement
	MP1591A	Slot1	MU150100A	MU150100A	MU150100A	MU150100A	MU150100A	MU150101A	MU150101A	Blank
		Slot2								Blank
		Slot3	MU150135A	Blank	MU150121A	MU150121B	MU150121B	Blank	Blank	Blank
		Slot4	Blank	Blank	MU150123A	MU150123B	MU150124B	Blank	Blank	Blank
		Slot5	Blank	Blank	MU150125A	MU150125A	MU150125A	MU150125A	Blank	Blank
		Slot6	Blank	Blank					Blank	Blank
		Slot7	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank
		Slot8	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank

Item		Bit Rate	Interface	For SDH/SONET/OTN/PDH/DSn Performance Measurement		For SDH/SONET/OTN/Jitter Measurement				For EoS Measurement	For Ethernet Measurement
Performance Measurement	PDH/DSn	1.5 Mbit/s to 139 Mbit/s	Electrical	√	√	√	√	√	√	√	
	SDH/SONET	52 Mbit/s to 156 Mbit/s	Electrical • Optical	√	√	√	√	√	√	√	
		622 Mbit/s to 2488 Mbit/s	Optical	√	√	√	√	√	√	√	
		9953 Mbit/s	Electrical	√	√	√	√	√			
			Electrical differential				√	√			
			Optical	√		√	√	√			
	OTN	2666 Mbit/s	Optical	√ *2	√ *2	√ *2	√ *2	√ *2	√ *2	√ *2	
		10.7 Gbit/s	Electrical	√ *2	√ *2	√ *2	√ *2	√ *2			
			Optical	√ *2		√ *2	√ *2	√ *2			
	Others	10.3 Gbit/s	Electrical	√ *1	√ *1	√ *2	√ *2	√ *2			
			Electrical differential				√ *2	√ *2			
			Optical	√ *1		√ *2	√ *2	√ *2			
	Ethernet	10 Mbit/s to 10 Gbit/s	Electrical • Optical	√ *3	√ *3	√ *3	√ *3	√ *3	√ *3	√ *3	√ *3
	EoS	156 Mbit/s to 2488 Mbit/s	Optical						√ *2	√ *2	
Jitter Measurement	PDH/DSn	1.5 Mbit/s to 139 Mbit/s	Electrical								
	SDH/SONET	52 Mbit/s to 156 Mbit/s	Electrical • Optical			√	√	√	√		
		622 Mbit/s to 2488 Mbit/s	Optical			√	√	√	√		
		9953 Mbit/s	Electrical			√	√				
			Electrical differential				√				
			Optical			√	√				
	OTN	2666 Mbit/s	Optical			√ *2	√ *2	√ *2	√ *2		
		10.7 Gbit/s	Electrical			√ *2	√ *2				
			Optical			√ *2	√ *2				
	Others	10.3 Gbit/s	Electrical					√ *2			
			Electrical differential					√ *2			
			Optical					√ *2			

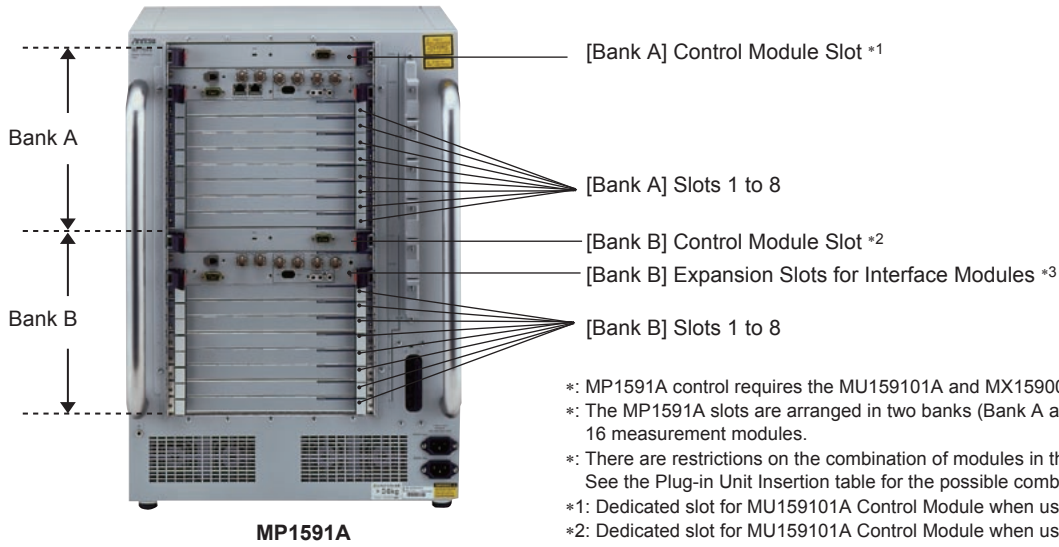*1: Requires addition of separate option and another external clock source.

*2: Requires addition of separate option.

*3: Supports installation of Ethernet units in blank slots but with restrictions on position and number. See page 6 of the Selection guide for more details.

Selection Guide

■ Unit Insertion Positions

[Bank A] Control Module Slot *1

[Bank A] Slots 1 to 8

[Bank B] Control Module Slot *2

[Bank B] Expansion Slots for Interface Modules *3

[Bank B] Slots 1 to 8

Bank A

Bank B

MP1591A

∗: MP1591A control requires the MU159101A and MX159001B.
∗: The MP1591A slots are arranged in two banks (Bank A and Bank B) that can accept up to 16 measurement modules.
∗: There are restrictions on the combination of modules in the MP1591A.
   See the Plug-in Unit Insertion table for the possible combinations.
∗1: Dedicated slot for MU159101A Control Module when using Bank A
∗2: Dedicated slot for MU159101A Control Module when using Bank B
∗3: Dedicate slot for MU159103A Expansion Interface Module when using Bank B

■ Plug-in Unit Insertion Table

Model/Order No.	Module Name	No. of Slots Required	No. of Ports	Max. No. Modules (Bank A/Bank B) *1	Supported Slots (Bank A/Bank B)
MU120111A	10/100M Ethernet Module	1	8	8	1 to 8
MU120112A	Gigabit Ethernet Module	1	2	8	1 to 8
MU120121A	10/100/1000M Ethernet Module	1	4	4	1 to 4
MU120122A	Gigabit Ethernet Module	1	4	4	1 to 4
MU120131A	10/100/1000M Ethernet Module	1	12	5	1 to 6
MU120132A	Gigabit Ethernet Module	1	8	6	1 to 6
MU120118B	10 Gigabit Ethernet Module	2	2	4 *2	1 to 8*3
MU120118C	10 Gigabit Ethernet Module	2	1	4 *2	1 to 8*3
MU150100A	10/10.7G Unit	2		1	1 to 2
MU150101A	2.5/2.6G EoS Unit	2		1	1 to 2
MU150121A	10/10.7G Optical Unit (Tx)	1		1	3
MU150121B	10/10.7G Optical/Electrical Unit (Tx)	1		1	3
MU150123A	10/10.7G Optical Unit (Rx Wide)	1	−	1	4
MU150123B	10/10.7G Optical/Electrical Unit (Rx Wide)	1		1	4
MU150124B	10.3G Optical/Electrical Unit (Rx Wide)	1		1	4
MU150135A	10/10.7G Optical Unit (XFP)	1		1	3
MU150125A	10/10.7G Jitter Unit	2		1	5 to 6
MU159101A	Control Module	1		1	Dedicated Slot
MU159103A	Interface Module for Expansion Slot	1		1 *4	Dedicated Slot

∗1: There are limits on each bank for the MP1591A as follows:
 • Only inserted MU120XXXX and MU159XXXX units support configuration up to 64 ports.
 • Only inserted MU150XXXX and MU159XXXX units support configurations up to 48 ports.
∗2: Value when MP1591A Option-50 and -51 installed. Up to 2 units when not installed.
∗3: Limited to slots 4 to 8 when MP1591A Option-50 and 51 not installed.
∗4: Only inserted in Bank B of MP1591A. Not required for Bank A.

■ Main Frame Options

Name	Model/Order No.
RS-232C Control	MX159001B-01
GPIB Control	MX159001B-02
Ethernet Control	MX159001B-03
OSPF Protocol	MU159101A-07
MPLS (LDP/CR-LDP) Protocol	MU159101A-08
MPLS (RSVP) Protocol	MU159101A-09
RFC2889 Benchmarking Test	MU159101A-10
Packet BER Test	MU159101A-11
IPv6 Expansion	MU159101A-12
XENPAK Test	MU159101A-13
IGAP Protocol	MU159101A-14
Auto Negotiation Analysis	MU159101A-15
Link Fault Signalling	MU159101A-16
Traffic Impairment Emulator	MU159101A-17
Application Traffic Monitor	MU159101A-20
Ethernet OAM	MU159101A-28
High Precision Jitter Analysis	MU159101A-30
10GbE Slot Expansion for Bank A	MP1591A-50
10GbE Slot Expansion for Bank B	MP1591A-51

■ Plug-in Unit Options

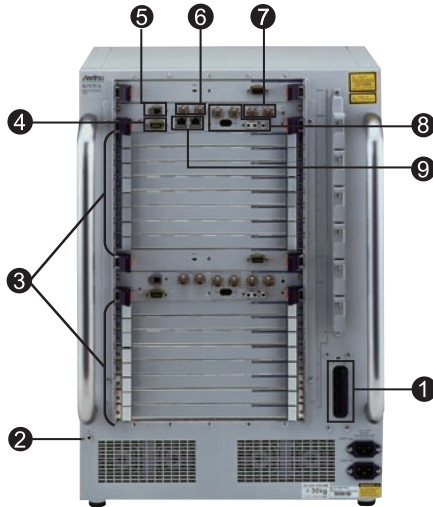|	Model/Order No.	Name	MU120131A	MU120132A	MU150100A	MU150101A	MU150121A/21B	MU150123A/23B	MU150124B	MU150135A	MU150125A
Ethernet Unit	MU120131A/32A-01	Clock Measurement	√	√							
	MU120131A-02	PoE	√								
SDH/SONET/OTN/PDH/DSn/Jitter/EoS Unit	MU150100A/01A/21A/21B-01	Wave length 1.31 µm			√	√	√				
	MU150100A/01A/21A/21B-02	Wave length 1.55 µm			√	√	√				
	MU150100A/01A/21A/21B-03	Wave length 1.31/1.55 µm			√	√	√				
	MU150100A/01A/21A/21B-04	Optical Output Power Adjustable			√	√	√				
	MU150100A/25A-05	OTU1/OTU2			√						√
	MU150101A-05	OTU1				√					
	MU150123A/23B-05	OTU2						√			
	MU150101A-06	GFP-F/LEX/LAPS				√					
	MU150101A-07	POS				√					
	MU150101A-11	HO Virtual Concatenation				√					
	MU150101A-12	LO Virtual Concatenation				√					
	MU150101A-13	LCAS				√					
	MU150101A-14	Differential Delay				√					
	MU150125A-01	Wander Measurement									√
	MU150100A-07	10/10.7G Minus Option			√						
	MU150100A-08, MU150125A-06	10.3G			√						√
	MU150100A-09	Insert/Extract			√						
	MU150100A/01A/21A/21B/23A/23B/24B-38	ST Connector			√	√	√	√	√		
	MU150100A/01A/21A/21B/23A/23B/24B-39	DIN Connector			√	√	√	√	√		
	MU150100A/01A/21A/21B/23A/23B/24B-40	SC Connector			√	√	√	√	√		
	MU150100A/01A/21A/21B/23A/23B/24B-43	HMS-10/A Connector			√	√	√	√	√		

∗: Order additional J1349A when Ethernet unit installed simultaneously in SDH/SONET/OTN/PDH/DSn unit and jitter unit configurations.
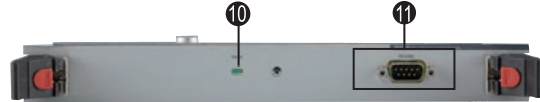
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∗: Refer to the MP1595A Catalog for specifications related to MU150100A and MU150135A.
∗: Refer to the MP1590B Catalog for specifications related to SDH/SONET/OTN/PDH/DSn/Jitter/EoS Units except MU150100A and MU150135A.
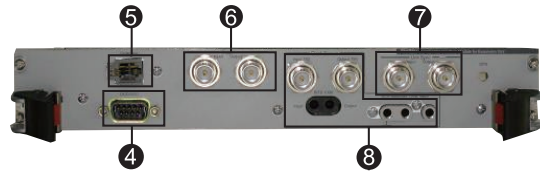∗: Refer to the MD1230 Family Catalog for specifications related to Ethernet Plug-in Units.

MP1591A Network Performance Tester

MU159101A Control Module

MU159103A Interface Module for Expansion Slot

1	Power (main)	Switches main power on and off
2	Functional Ground Terminal	Terminal for grounding frame to earth
3	Plug-in slot	Slot for plug-in unit
4	DCC/GCC	I/O connector for DCC (SDH/SONET) and GCC (OTN) bytes, and for data and clock for add/drop
5	Order Wire (RJ11)	SDH/SONET E1, E2 byte order wire interface connector
6	Trigger	Input: Connector for inputting external trigger for running APS test and capture Output: Connector for outputting errors/alarms and capture trigger
7	Unit Sync. Input/Output	Clock I/O connector for time syncing daisy chained MP1591A units (used with MP1591A IP/EoS function)
8	CLK Source	Input: Connector for inputting reference signal for syncing Tx signal to reference signal Output: Connector for outputting reference signal synchronized to Tx signal
9	Ethernet	10BASE-T/100BASE-TX Ethernet connector. MP1591A uses to connect external controller
10	LED	Light green when control module ready
11	RS-232C	RS-232C Interface connector MU159101A uses to connect external controller

Specifications

• MP1591A Network Performance Tester

Interface		Ethernet (RJ-45) × 2

	Reference Clock Input	Frequency
		  Clock: 1.544 MHz, 2.048 MHz, 64 kHz + 8 kHz, 5 MHz, 10 MHz
		  Data: 1.544 Mbit/s (BITS), 2.048 Mbit/s
		  Input Range: ±50 ppm
		Level/Code
		  1.544 Mbit/s: ANSI T1.403 (B8ZS)
		  2.048 Mbit/s: ITU-T G.703 Table 10 (HDB3)
		  1.544 MHz, 2.048 MHz, 5 MHz, 10 MHz: TTL (Rectangular, Sine Wave)
		  64 kHz + 8 kHz: 0.63 to 1.1 Vo-p (AMI, 8 kHz violation)
		Connector
		  1.544 MHz, 2.048 MHz, 2.048 Mbit/s, 5 MHz, 10 MHz: BNC (75 Ω)
		  2.048 MHz, 2.048 Mbit/s, 64 kHz+8 kHz: Siemens (120 Ω)
		  1.544 Mbit/s: BANTAM (100 Ω)
		Effective SDH/SONET/OTN Bit Rate.

	Reference Clock Output	Frequency
		  Clock: 1.544 MHz, 2.048 MHz, 5 MHz, 10 MHz
		  Data: 1.544 Mbit/s (BITS), 2.048 Mbit/s
		Level/Code
		  1.544 Mbit/s: ANSI T1.403 (B8ZS)
		  2.048 Mbit/s: ITU-T G.703 Table 10 (HDB3)
		  1.544 MHz, 2.048 MHz, 5 MHz, 10 MHz: TTL (Rectangular)
		Connector
		  1.544 MHz, 2.048 MHz, 2.048 Mbit/s, 5 MHz, 10 MHz: BNC (75 Ω)
		  1.544 Mbit/s: BANTAM (100 Ω)
		Effective SDH/SONET/OTN Bit Rate.

	Trigger	Trigger Input: For capture/APS Measurement Trigger Output: Transmit error/alarm, Receive error/alarm, Capture trigger Level: TTL (Active High) Connector: BNC (75 Ω)

	Unit Sync. Input/Output	Time Synchronization
		  Level: TTL
		  Connector: BNC (75 Ω)

	DCC/GCC	Data Input/Output: D1-D3 (192 kbit/s), D4-D12 (576 kbit/s), GCC0-2 (1312.4 kbit/s, 326.7 kbit/s) Clock Output: 192 kHz , 576 kHz, 1312.4 kHz, 326.7 kHz Level: V.11 Connector: 9-pin D-sub
Remote Control		Remote control using MX159001B via LAN (10BASE-T/100BASE-TX, Auto MDI/MDI-X) (MP1591A control requires MX159001B)
Power		100 to 120/200 to 240 Vac (autoswitching), 50 Hz to 60 Hz
Power Consumption		≤2200 VA
Operational Temperature and Humidity		5° to 40°C, 20% to 80%
Dimensions and Mass		426 (W) × 596 (H) × 350 (D) mm, ≤28 kg (excluding options and plug-in units)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1
Laser Safety		Depends on installed module. Refer to the safety standards for each module.
Number of Slots		16

• MU159101A Control Module

LED	Ready (lit after startup completed)
Interface	RS-232C (Self test, Download)
Number of Support Modules	8

• MU159103A Interface Module for Expansion Slot

Interface	Reference Clock Input/Output	Same as MP1591A
	Trigger	
	Unit Sync. Input/Output	
	DCC/GCC	

• MU159101A-30 High Precision Jitter Analysis

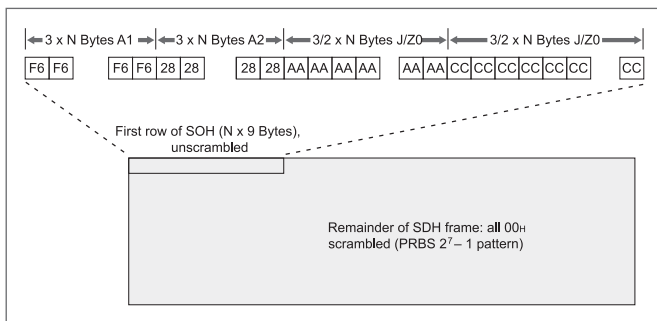|	
Overview	Option for performing calibration of main frame using Phase Analysis calibration method outlined in ITU-T O.172 2005 April Appendix VIII standard with following specifications (requires both Bank A and Bank B for MP1591A)

Jitter Generation Measurement Accuracy	Accuracy: ±20 mUIp-p
	    (Approaches transmitter jitter (≤100 mUIp-p) standardized by Phase Analysis calibration method)
	Bit Rate: 9953.28 Mbit/s, 2488.32 Mbit/s
	Interface: Optical
	Measurement Condition
	  Optical Input Power: –12 to –10 dBm
	  Measurement Period: 60 s/1 time
	  Measurement Method: Phase Analysis calibration method (Appendix VIII)
	  Accuracy Calculation: Measured 5 times at 60 s/time to calculate mean of measurement results
	      Mean value accuracy of ±20 mUIp-p for Tx jitter of 100 mUIp-p max. standardized by phase analysis method
	  Filters: 20 kHz to 80 MHz/50 kHz to 80 MHz (9953 M), 5 kHz to 20 MHz/12 kHz to 20 MHz (2488 M)
	  Tx Unit: MU150121A/B (9953 M), MU150100A (2488 M)
	  Frame: Appendix VIII compliant (margin reference format)

Jitter Generation Measurement Repeatability	Accuracy: ±5 mUIp-p (Average of five measurements under constant measurement condition)
	Bit Rate: 9953.28 Mbit/s, 2488.32 Mbit/s
	Interface: Optical
	Measurement Condition
	  Optical Input Power: –12 to –10 dBm
	  Measurement Period: 60 s/1 time
	  Measurement Method: Loop-back
	  Filters: 20 kHz to 80 MHz, 50 kHz to 80 MHz/4 MHz to 80 MHz (9953 M), 5 kHz to 20 MHz, 12 kHz to 20 MHz/1 MHz to 20 MHz (2488 M)
	  Tx Unit: MU150121A/B (9953 M), MU150100A (2488 M)
	  Mapping: STS192c/STM-64c-Bulk (PRBS 2^{23}–1 Inv.) (9953 M), OC-48c/STM-16c-Bulk (PRBS 2^{23}–1 Inv.) (2488 M)

Transmitter Output Jitter	Jitter Value: < 60 mUIp-p (MU150121A/B)
	Bit Rate: 9953.28 Mbit/s, 2488.32 Mbit/s
	Interface: Optical
	Measurement Condition
	  Measurement Method: Phase analysis calibration method (Appendix VIII)
	  Accuracy Calculation: Mean of three measurements
	  Filters: 20 kHz to 80 MHz/50 kHz to 80 MHz (9953 M), 5 kHz to 20 MHz/12 kHz to 20 MHz (2488 M)
	  Tx Unit: MU150121A/B (9953 M), MU150100A (2488 M)
	  Sampling Oscilloscope: >20 GHz bandwidth
	  Frame: Appendix VIII compliant (margin reference format)

General Specification	Operating Temperature: 20˚ to 30˚C Recommended Calibration Interval: 1 year after shipment and annually thereafter

Precautions for Option-30

This option can only be installed in the following configurations. Other combinations cannot be installed. (The MU150101A is not supported.)
This option is managed by equipment model and serial number. Accordingly, if it is installed in a unit with the same model number but different serial number, it will be disabled. When changing to a configuration that is different from the configuration with the option installed, the MP1591A functions and performance operate normally based on the switched configuration.
This option is only enabled when options supporting 9953.28 Mbit/s are installed; it cannot be installed with options supporting only 2488.32 Mbit/s.

    MP1591A: Network Performance Tester
    MU150100A: 10/10.7G Unit
    MU150121A/B: 10/10.7G Optical (/Electrical) Transmitter Unit (Install either one.)
    MU150123A/B: 10/10.7G Optical (/Electrical) Receiver Unit (Wide) (Install either one.)
    MU150125A: 10/10.7G Jitter Unit
The Transmission Output Jitter is specified in the certificate attached to the option. The recommended calibration interval for Option-30 is 1 year after shipment and annually thereafter.

Frame Format

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
Main Frame		
MP1591A	Network Performance Tester *1	
Standard Accessories		
J1211	Shielded Power Cord, 3 m *2:	2 pcs
Z0917A	LAN Cable (Shielded CAT5e), 5 m *2:	1 pc
J1221B	RS-232C Crossover Cable *2:	1 pc
Z0847A	MD1230/MP1590 Family Software CD *2, *3:	1 pc
J0617B	Replaceable Optical Connector (FC-PC) *4, *5:	1 pc/2 pcs
J0747B	Fixed Optical Attenuator (10 dB, FC connector) *6:	1 pc
J0747C	Fixed Optical Attenuator (15 dB, FC connector) *7:	1 pc
J1003N	Semi-rigid Cable (136.6 mm) *8:	2 pc
J1003P	Semi-rigid Cable (96 mm) *8:	1 pc
J1003Q	Semi-rigid Cable (75.6 mm) *9, *10:	1 pc/2 pcs
J1003R	Semi-rigid Cable (55.3 mm) *11:	1 pc
J1003S	Semi-rigid Cable (56.5 mm) *7:	1 pc
J1003T	Semi-rigid Cable (67 mm) *11:	2 pcs
J1383A	Semi-rigid Cable (105.7 mm) *12:	1 pc
J1384A	Semi-rigid Cable (90 mm) *12:	1 pc
J0500A	Semi-rigid Cable, 50 cm *11:	1 pc
J0994	Terminator (50 Ω) *11:	1 pc
J0775B	Coaxial Cable (BNC-P620 • 3C-2WS • BNC-P620, 75 Ω), 0.5 m *13:	1 pc
Plug-in Units		
MU159101A	Control Module	
MU159103A	Interface Module for Expansion Slot	
MU150100A	10/10.7G Unit *14	
MU150101A	2.5/2.6G EoS Unit *14	
MU150121A	10/10.7G Optical Unit (Tx) *14	
MU150121B	10/10.7G Optical/Electrical Unit (Tx) *14	
MU150123A	10/10.7G Optical Unit (Rx Wide)	
MU150123B	10/10.7G Optical/Electrical Unit (Rx Wide)	
MU150124B	10.3G Optical/Electrical Unit (Rx Wide)	
MU150125A	10/10.7G Jitter Unit	
MU150135A	10/10.7G Optical Unit (XFP) *15	
MU120111A	10/100M Ethernet Module *16	
MU120112A	Gigabit Ethernet Module *16, *17	
MU120118B	10 Gigabit Ethernet Module *16, *18	
MU120118C	10 Gigabit Ethernet Module *16, *18	
MU120121A	10/100/1000M Ethernet Module *16	
MU120122A	Gigabit Ethernet Module *16, *19	
MU120131A	10/100/1000M Ethernet Module *16	
MU120132A	Gigabit Ethernet Module *16, *19	
Options		
MP1591A-50	10GbE Slot Expansion for Bank A	
MP1591A-51	10GbE Slot Expansion for Bank B	
MU159101A-07	OSPF Protocol	
MU159101A-08	MPLS (LDP/CR-LDP) Protocol	
MU159101A-09	MPLS (RSVP) Protocol	
MU159101A-10	RFC2899 Benchmarking Test	
MU159101A-11	Packet BER Test	
MU159101A-12	IPv6 Expansion	
MU159101A-13	XENPAK Test	
MU159101A-14	IGAP Protocol	
MU159101A-15	Auto Negotiation Analysis	
MU159101A-16	Link Fault Signalling	
MU159101A-17	Traffic Impairment Emulator *20	
MU159101A-20	Application Traffic Monitor	
MU159101A-28	Ethernet OAM	
MU159101A-30	High Precision Jitter Analysis *21	
MU150100A-01	Wavelength 1.31 μm	
MU150100A-02	Wavelength 1.55 μm	
MU150100A-03	Wavelength 1.31/1.55 μm	
MU150100A-04	Optical Output Power Adjustable	
MU150100A-05	OTU1/OTU2	
MU150100A-07	10/10.7G Minus Option *22	
MU150100A-08	10.3G	
MU150100A-09	Insert/Extract *22	
MU150100A-38	ST Connector *23	
MU150100A-39	DIN Connector *23	
MU150100A-40	SC Connector *23	
MU150100A-43	HMS-10/A Connector *23	

Model/Order No.	Name
MU150101A-01	Wavelength 1.31 μm
MU150101A-02	Wavelength 1.55 μm
MU150101A-03	Wavelength 1.31 /1.55 μm
MU150101A-04	Optical Output Power Adjustable
MU150101A-05	OTU1
MU150101A-06	GFP-F/LEX/LAPS
MU150101A-07	POS
MU150101A-11	HO Virtual Concatenation
MU150101A-12	LO Virtual Concatenation
MU150101A-13	LCAS
MU150101A-14	Differential Delay *24
MU150101A-38	ST Connector *23
MU150101A-39	DIN Connector *23
MU150101A-40	SC Connector *23
MU150101A-43	HMS-10/A Connector *23
MU150121A-01	Wavelength 1.31 μm
MU150121A-02	Wavelength 1.55 μm
MU150121A-03	Wavelength 1.31 /1.55 μm
MU150121A-04	Optical Output Power Adjustable
MU150121A-38	ST Connector *23
MU150121A-39	DIN Connector *23
MU150121A-40	SC Connector *23
MU150121A-43	HMS-10/A Connector *23
MU150121B-01	Wavelength 1.31 μm
MU150121B-02	Wavelength 1.55 μm
MU150121B-03	Wavelength 1.31/1.55 μm
MU150121B-04	Optical Output Power Adjustable
MU150121B-38	ST Connector *23
MU150121B-39	DIN Connector *23
MU150121B-40	SC Connector *23
MU150121B-43	HMS-10/A Connector *23
MU150123A-05	OTU2
MU150123A-38	ST Connector *23
MU150123A-39	DIN Connector *23
MU150123A-40	SC Connector *23
MU150123A-43	HMS-10/A Connector *23
MU150123B-05	OTU2
MU150123B-38	ST Connector *23
MU150123B-39	DIN Connector *23
MU150123B-40	SC Connector *23
MU150123B-43	HMS-10/A Connector *23
MU150124B-38	ST Connector *23
MU150124B-39	DIN Connector *23
MU150124B-40	SC Connector *23
MU150124B-43	HMS-10/A Connector *23
MU150125A-01	Wander Measurement
MU150125A-05	OTU1/OTU2
MU150125A-06	10.3G
MU120131A-01	Clock Measurement
MU120131A-02	PoE
MU120131A-12	PoE Retrofit
MU120132A-01	Clock Measurement
Software	
MX159001B	Network Performance Tester Control Software *25
MX159001B-05	Network Performance Tester Control Software (5 licenses)
MX159001B-08	Network Performance Tester Control Software (8 licenses)
Software Options	
MX159001B-01	RS-232C Control
MX159001B-02	GPIB Control
MX159001B-03	Ethernet Control
Optional Accessories	
G0105A	GBIC SX 850 nm *26
G0106A	GBIC LX 1310 nm *26
G0107A	GBIC LH 1310 nm *26
G0108A	GBIC ZX 1550 nm *26
G0124A	GBIC T (1000BASE-T) *26
G0181A	SFP SX 850 nm *27
G0182A	SFP LX 1310 nm *27
G0183A	SFP LE 1310 nm *27
G0184A	SFP LR 1550 nm *27

Model/Order No.	Name
G0132	XENPAK (10 GBASE-SR) [28]
G0192A	XENPAK (10 GBASE-LR) [28]
G0193A	XENPAK (10 GBASE-ER) [28]
G0194A	1310 nm XFP Module [29]
G0195A	1550 nm XFP Module [29]
J0796A	ST Connector (replaceable, with protective caps, 1 set)
J0796B	DIN Connector (replaceable, with protective caps, 1 set)
J0796C	SC Connector (replaceable, with protective caps, 1 set)
J0796D	HMS-10/A Connector (replaceable, with protective caps, 1 set)
J0796E	FC Connector (replaceable, with protective caps, 1 set)
J0617B	Replaceable Optical Connector (FC-PC)
J0747B	Fixed Optical Attenuator (10 dB, FC connector)
J0747C	Fixed Optical Attenuator (15 dB, FC connector)
J0747D	Fixed Optical Attenuator (20 dB, FC connector)
J1049A	Fixed Optical Attenuator (SC, 5 dB)
J1049B	Fixed Optical Attenuator (SC, 10 dB)
J1049C	Fixed Optical Attenuator (SC, 15 dB)
J1376A	Fixed Optical Attenuator (5 dB, LC connector)
MZ1221A	XAUI Extender [30]
MZ1222A	XENPAK Interface [31]
J1163A	XAUI Cable, 0.5 m
J1164A	MDIO Cable, 0.5 m
J0635A	Optical Fiber Cable (SM, FC-SPC connector both ends), 1 m
J0635B	Optical Fiber Cable (SM, FC-SPC connector both ends), 2 m
J0635C	Optical Fiber Cable (SM, FC-SPC connector both ends), 3 m
J0660B	Optical Fiber Cord (SM, SC-SC connector), 2 m
J0773B	Optical Fiber Cord (GI, SC-SC connector), 2 m
J1344A	Optical Fiber Cord (Simplex, SM, LC-LC connector), 1 m
J1327B	Optical Fiber Cord (Simplex, SM, LC-LC connector), 2 m
J1119B	Optical Fiber Cord (Duplex, MM), 2 m
J1271	Optical Fiber Cord (Duplex, SM, LC-LC connector), 2 m
J1272	Optical Fiber Cord (Duplex, SM, LC-SC connector), 2 m
J1273	Optical Fiber Cord (Duplex, GI, LC-LC connector), 2 m
J1274	Optical Fiber Cord (Duplex, GI, LC-SC connector), 2 m
J1139A	Optical Fiber Cord (Simplex, SM, LC-FC connector), 1 m
J1003N	Semi-rigid Cable (136.6 mm)
J1003P	Semi-rigid Cable (96 mm)
J1003Q	Semi-rigid Cable (75.6 mm)
J1003R	Semi-rigid Cable (55.3 mm)
J1003S	Semi-rigid Cable (56.5 mm)
J0775B	Coaxial Cable (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 0.5 m [32]
J0775D	Coaxial Cable (BNC-P620 · 3 -2WS · BNC-P620, 75 Ω), 2 m [32]
J0776D	Coaxial Cable (BNC-P-3W · 3 D-2W · BNC-P-3W, 50 Ω), 2 m
J0322B	Coaxial Cable (11 SMA · SUCOFLEX104 · 11 SMA), 1 m
J0696A	Coaxial Cable (AA-165 -500), 0.5 m
J1349A	Coaxial Cable, 0.3 m
J1268	Semiflexible Coaxial Cable
J1173	6020180 Power Divider
J0845A	Balanced Cable (BANTAM 3P/BANTAM 3P), 6 ft
J0162A	Balanced Cable (Siemens 3P- Siemens 3P), 1 m
J0162B	Balanced Cable (Siemens 3P- Siemens 3P), 2 m
J0008	GPIB Cable, 2 m
J1109B	LAN Cable (CAT5, cross), 5 m
J1110B	LAN Cable (CAT5, straight), 5 m
J1275	LAN Cable (CAT5E, straight), 1 m
J1275B	LAN Cable (CAT5E, straight), 5 m
J1275C	LAN Cable (CAT5E, cross), 1 m
J1275D	LAN Cable (CAT5E, cross), 5 m
Z0989A	1310 nm XFP Kit [33]
Z0990A	1550 nm XFP Kit [34]
Z0282	Ferrule Cleaner
Z0283	Ferrule Cleaner Replacement Tape
Z0284	Adapter Cleaner
Z0838A	Stick Cleaner 1.25 mm (250 pcs/set)
B0571A	Blank Panel [35]
B0572A	Blank Panel [36]
B0593A	Blank Panel [37]
B0590A	Rack Flange [38]
Z0849A	MD1230/MP1590 Family Manual CD
W2735AE	MP1591A Operation Manual
W2421AE	MX159001B Operation SDH Edition Manual
W2422AE	MX159001B Operation SONET Edition Manual
W2423AE	MP1590B/MP1591A Remote Control Operation Manual

Model/Order No.	Name
W2134AE	Application Traffic Monitor Operation Manual
W1931AE	Ethernet Module Operation Manual
W2424AE	MU150100A Specifications Operation Manual
W2425AE	MU150101A Specifications Operation Manual
W2426AE	MU150125A Specifications Operation Manual
W2427AE	MU150121/2/3/34A Specifications Operation Manual
W2589AE	MU150121B/123B Specifications Operation Manual
W2590AE	MU150124B Specifications Operation Manual
W2870AE	MU150135A Operation Manual

[1]: MU159101A and MX159001B required to control MP1591A.
[2]: Supplied with main frame.
[3]: CD includes installer, release notes and operation manual.
[4]: Supplied with MU150100A, MU150101A, MU150121A/B, MU150123A/B, and MU150124B.
[5]: Two pieces of MU150100A, and MU150101A.
[6]: Supplied with MU150123A/B, and MU150124A.
[7]: Supplied with MU150100A, and MU150101A.
[8]: Supplied MU150125A.
[9]: Supplied with MU150121A/B, MU150123A/B, and MU150124B.
[10]: One piece of MU150123A/B, and MU150124B, and two pieces of MU150121A/B.
[11]: Supplied with MU150121B.
[12]: Supplied with MU150135A.
[13]: Supplied with MU159103A.
[14]: Requires any one of Option-01, 02, 03.
[15]: Requires XFP module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
[16]: Order additional J1349A when Ethernet unit is installed simultaneously in SDH/SONET/OTN/PDH/DSn unit and jitter unit configurations.
[17]: Requires GBIC module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
[18]: Requires XENPAK module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
[19]: Requires SFP modules (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
[20]: Only ports 1 and 2 of the MU120121A/122A support the MU159101A-17 Traffic Impairment Emulator option. Moreover, only MU120121A/122A models shipped after March 7, 2008 with the "Supports Opt.17" sticker support the option.
[21]: MU159101A-30 option can be added to the main frame before delivery. But it cannot be added after.
[22]: MU150100A-07 is factory installed only. MU150100A-07 and MU150100A-09 cannot both be installed simultaneously.
[23]: Exchangeable.
[24]: Requires either MU150101A-11 or MU150101A-12.
[25]: MX159001B-03 not required.
[26]: GBIC modules sold as single units. Two can be mounted in MU120112A.
[27]: SFP modules sold as single units. Two can be mounted in MU120112A and eight in MU120132A.
[28]: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C.
G0192A and G0193A only supported by MU120118A/B/C units with "With APS" sticker attached. DO NOT install in MU120118A/B/C without "With APS" seal. G0192A and G0193A have "Only for APS" stickers attached.
[29]: XFP modules sold as single units. One can be mounted in MU150135A.
[30]: When using XAUI extender, MZ1222A XENPAK interface, J1163A XAUI cable, and J1164A MDIO cable required along with separate external power supply (5 V, 4 A)
[31]: MZ1222A supplied by 1.8-V APS.
[32]: Required for synchronizing time between several units.
[33]: G0194A and J1344A included in Z0989A.
[34]: G0195A, J1344A, and J1376A included in Z0990A.
[35]: Blanking panel for MP1591A CPU slot.
[36]: Blanking panel for MP1591A DCS slot.
[37]: Blanking panel for slot 1 to slot 8 of MP1591A Bank A/B.
[38]: Rack mount kit for MP1591A.

• Software Upgrade Service

Model/Order No.	Name
MP1591A-40	Annual Software Upgrade Service

∗: Option for latest versions of main frame, plug-in units and software.
  Purchased annually; no multi-year contracts. Can also be purchased at any
  time after main-frame purchase.

• Maintenance Service

Model/Order No.	Name
∗∗∗-ES210	2 Years Extended Warranty Service
∗∗∗-ES310	3 Years Extended Warranty Service
∗∗∗-ES510	5 Years Extended Warranty Service

∗: Extends standard 1-year warranty service period on new main frame and
  plug-in units to 2, 3, or 5 years.
  Purchased separately at new purchase. (Cannot be purchased mid-contract,
  at contract renewal or in multi-year combinations.)

∗∗∗-ES210 : MP1591A-ES210, MU159101A-ES210, MU159103A-ES210, U150100A-ES210,
             MU150101A-ES210, MU150121A-ES210, MU150121B-ES210, MU150123A-ES210,
             MU150123B-ES210, MU150124B-ES210, MU150135A-ES210, MU150125A-ES210,
             MU120111A-ES210, MU120112A-ES210, MU120118B-ES210, MU120118C-ES210,
             MU120121A-ES210, MU120122A-ES210, MU120131A-ES210, MU120132A-ES210
∗∗∗-ES310 : MP1591A-ES310, MU159101A-ES310, MU159103A-ES310, MU150100A-ES310,
             MU150101A-ES310, MU150121A-ES310, MU150121B-ES310, MU150123A-ES310,
             MU150123B-ES310, MU150124B-ES310, MU150135A-ES310, MU150125A-ES310,
             MU120111A-ES310, MU120112A-ES310, MU120118B-ES310, MU120118C-ES310,
             MU120121A-ES310, MU120122A-ES310, MU120131A-ES310, MU120132A-ES310
∗∗∗-ES510 : MP1591A-ES510, MU159101A-ES510, MU159103A-ES510, MU150100A-ES510,
             MU150101A-ES510, MU150121A-ES510, MU150121B-ES510, MU150123A-ES510,
             MU150123B-ES510, MU150124B-ES510, MU150135A-ES510, MU150125A-ES510,
             MU120111A-ES510, MU120112A-ES510, MU120118B-ES510, MU120118C-ES510,
             MU120121A-ES510, MU120122A-ES510, MU120131A-ES510, MU120132A-ES510

Note:

Note:

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Printed on Recycled Paper   Catalog No. MP1591A-E-A-1-(1.00)   Printed in Japan   13/JUL/2009 ddch