



Anritsu

MG9541A Tunable Laser Source

ME7894A Optical Component Tester



*For Evaluating Passive Optical Devices such as WDM and Fiber Amplifiers*

# MG9541A Tunable Laser Source

The MG9541A features a wide wavelength range (1510 to 1640 nm) and three optical outputs: variable level (1st port), high power (2nd port) and high signal-to-noise ratio (3rd port) respectively. Just one unit is all that is needed to perform a variety measurements such as performance evaluation of optical amplifier systems and optical components used in WDM transmission systems.

## Covers C- and L-Bands (1510 to 1640 nm)

The MG9541A has a turnable wavelength range of 1510 to 1640 nm, offering ideal support for the C-band (1530 to 1565 nm) and L-band (1565 to 1625 nm) wavelengths used in WDM communications and for evaluating the performance of optical components and transmission systems.

## Variable Optical Level (1st port)

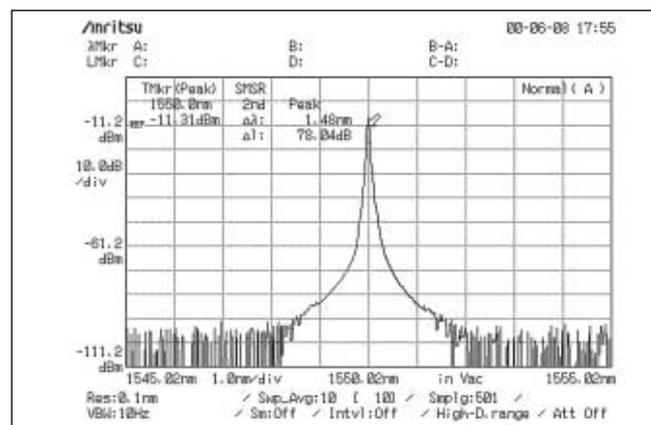
The MG9541A can output any optical level in the range of 0 to -30 dBm with very high stability using the built-in optical attenuator. This is useful for evaluating optical input level characteristics of optical amplifier systems, etc.

## +7 dBm High-Power Output (2nd port)

The optical power is better than +6 dBm in the C- and L-bands and better than +7 dBm in the wavelength range from 1530 to 1580 nm. In addition to use as a saturation signal for optical amplifier systems, this output also supports saturation tests of optical amplifiers and WDM transmission systems.

## High-Signal-to-Noise Ratio (approx. 70 dB) Optical Output (3rd port)

This port has a signal-to-noise ratio of approx. 70 dB. The source spontaneous emission (SSE) generated by the MG9541A itself is lower than the measuring instrument detection limit. It can be used to measure the performance of passive optical components, such as optical filters, optical isolators, optical couplers, etc.



MG9541A optical output

## Continuous Sweeping and High-Speed Wavelength Sweeping

The MG9541A optical outputs are level interruption free and continuous sweeping is performed at high speeds. The wavelength characteristics of optical components can be evaluated at high speed when the MG9541A is used in conjunction with the MT9810B Optical Test Set and the MA9332A Optical Sensor.

## Tracking Measurement with MS9710B/C

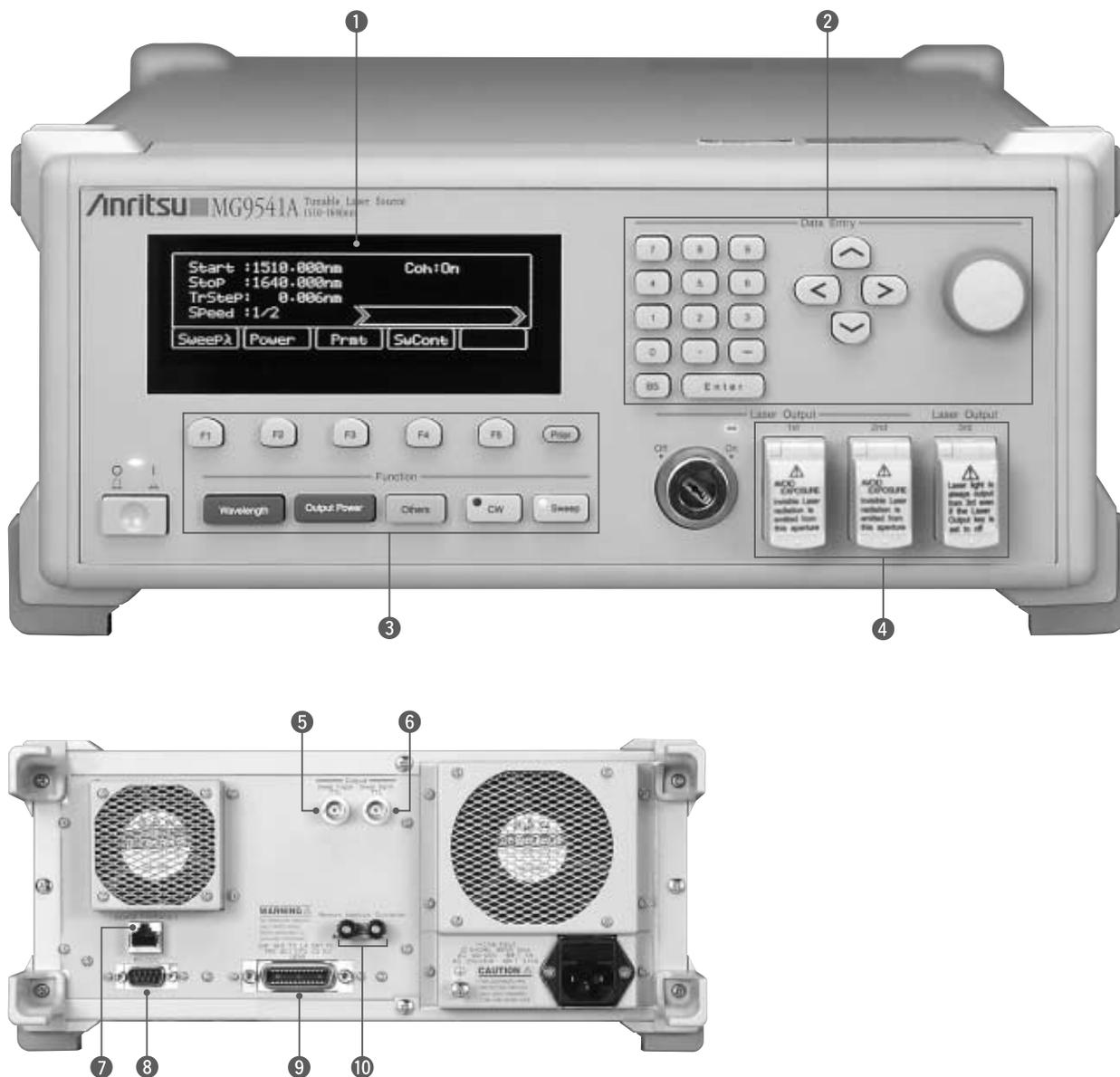
The MG9541A can perform tracking measurement when connected to the MS9710B/C. At tracking measurement, the wavelength of the MG9541A output is controlled by the MS9710B/C and measurement is performed while synchronized with the set measurement range. Wide-dynamic range measurement is possible when using the MG9541A with the MS9710B/C.

## ITU-T Wavelength Grid Setting Functions

The WDM wavelength grid (ITU-T Rec., 50 GHz spacing) is easy to set, and a user-specified wavelength grid can also be registered.

## External Control via Built-in (as Standard) Ethernet

In addition to built-in support for GPIB and RS-232C, an Ethernet interface (10BASE-T, 100BASE-TX) is provided as standard equipment, offering easy external remote control over a network.

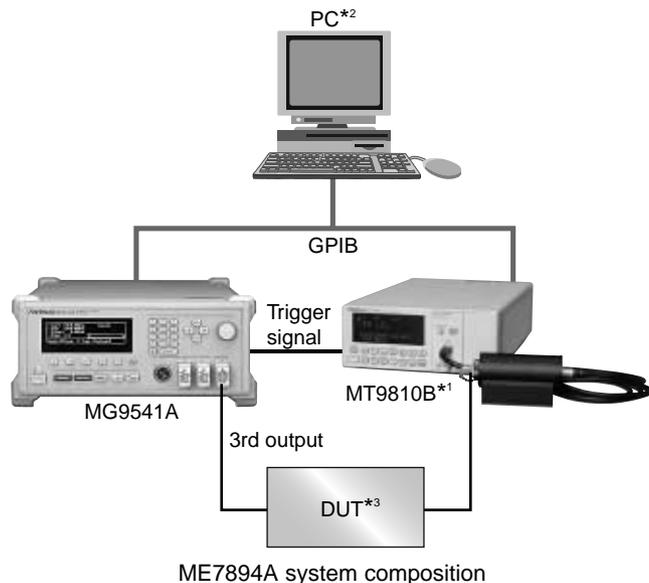


- ❶ **Display:** Uses high visibility fluorescent display tube indicating wavelength, optical output, function keys, etc.
- ❷ **Measurement items and numeric input keys:** For selecting measurement items and inputting numeric values, such as wavelength, optical output, etc.
- ❸ **Direct measurement keys:** Selects commonly used functions directly as keys to simplify basic operations
- ❹ **Three output types:** Variable level from 0 to  $-30$  dBm, high power of  $+7$  dBm and high signal-to-noise ratio of approx. 70 dB
- ❺ **Sweep Trigger Output:** Outputs TTL level trigger signal at each wavelength step during sweeping or each trigger step

- ❻ **Sweep Signal Output:** During sweeping, sets start wavelength to 0 V and stop wavelength to 5 V and outputs voltage proportional to sweep wavelength at each wavelength step
- ❼ **Ethernet:** 10BASE-T/100BASE-T Ethernet connector
- ❽ **RS-232C Interface:** Tracking with optical spectrum analyzer, external PC connection
- ❾ **GPIB Interface:** external PC connection
- ❿ **Remote Interlock Terminal:** Sets optical output ON/OFF through interlock with external switch

# ME7894A Optical Component Tester

The ME7894A is used in conjunction with the MG9541A Tunable Laser Source, the MT9810B Optical Test Set and the MA9332A Optical Sensor to configure a high-speed measurement system for optical components (filters, couplers, isolators, etc.) used in WDM transmission systems. The measurement can be easily set up over a wide wavelength range from C-band (1530 to 1565 nm) to L-band (1565 to 1625 nm).



- \*1: With adapter units and optical sensors
- \*2: MX789400A is installed in PC. The PC is not included in ME7894A.
- \*3: Optical fiber, coupler, isolator, etc.

## C- and L-Bands (1510 to 1640 nm)

The ME7894A has a signal-to-noise ratio of approx. 70 dB over a wide wavelength range from the C-band (1530 to 1565 nm) to the L-band (1565 to 1625 nm) using the 3rd port of the MG9541A Tunable Laser Source. It is ideal for measuring the wavelength characteristics of WDM optical components.

## High-Speed Measurement

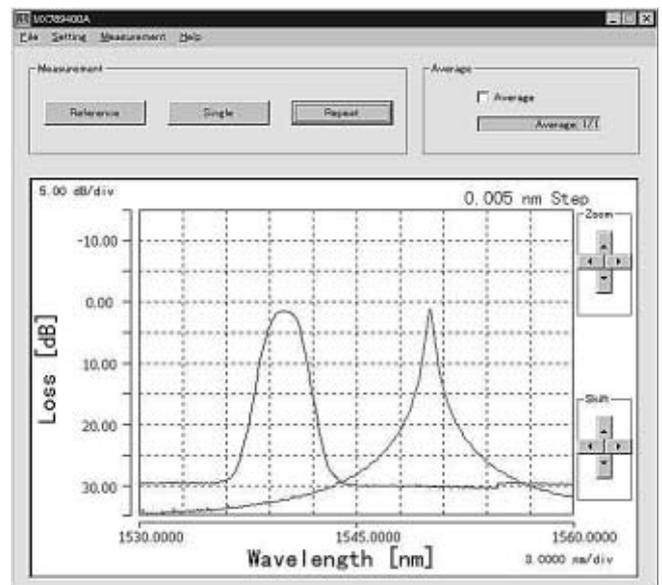
Combining the ME7894A with the MA9332A Optical Sensor makes high-speed measurement possible. For example, 5001 data points can be measured in less than 10 seconds. (wavelength sweep range: 20 nm, span: 4 pm, bandwidth: Auto)

## High Dynamic Range

A measurement range of more than 50 dB is achieved from 1530 to 1625 nm (C-and L-bands) by using the high-signal-to-noise ratio (approx. 70 dB) optical output (3rd port) and high sensitive sensor.

## 2-Channel Automatic Measurement

Measurement conditions can be input directly into the settings screen displayed on a PC. The ME7894A can measure up to two sensor channels automatically and display the results as a graph.



## Bare Fiber Support

A bare fiber can be connected to the MA9332A Optical Sensor, greatly reducing the inspection time on optical component production lines, etc., and increasing the work efficiency. Moreover, measurement is possible using only the MA9332A with no need to move main power meter.

## MX789400A Optical Component Tester Control Software

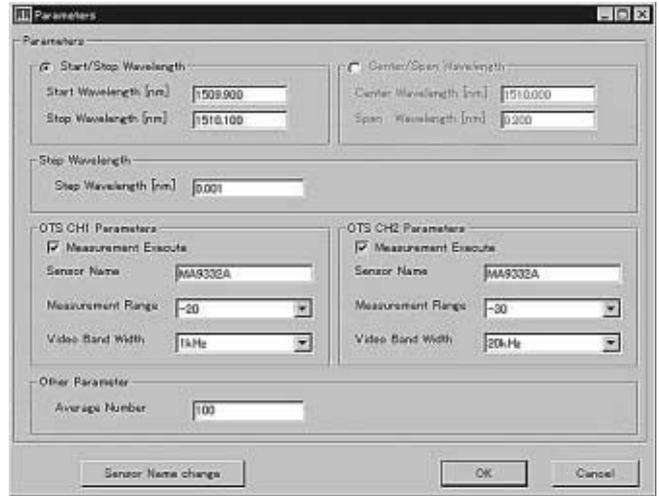
When the MX789400A software is installed in a PC, the MG9541A and MT9810B can be controlled via the GPIB. The software has functions to calculate the data before and after the DUT is inserted, measure the DUT loss wavelength characteristics, and display the results graphically. It makes evaluation of components easier and the measured data can be saved as a text file for importing into spreadsheet applications, etc.

## Versatile Control Functions

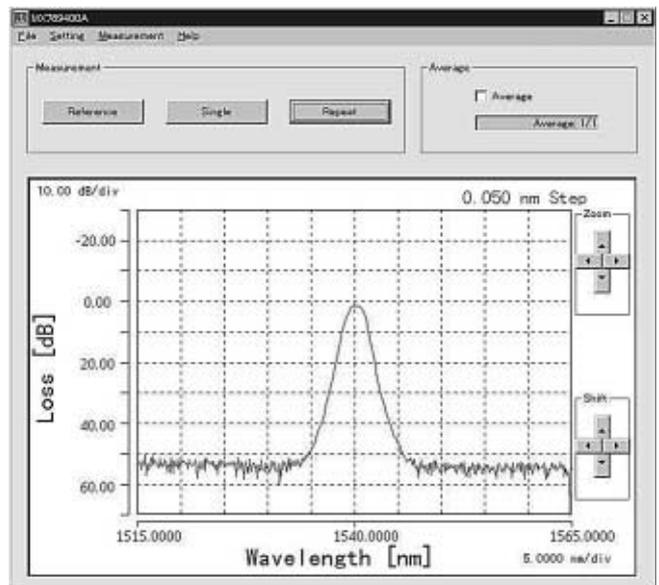
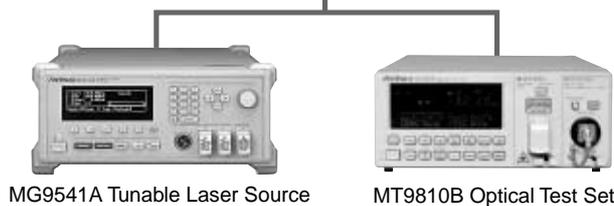
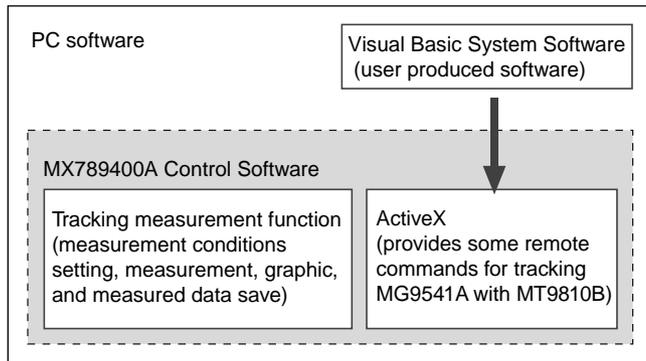
The MX789400A\*4 has both detailed setting functions and ActiveX\*5 for required control. The software manages timing during tracking measurement with the MG9541A and MT9810B. By using Visual Basic\*5, etc., it is possible to create powerful software applications for the required evaluation.

\*4: For the performance of recommended PC, refer to the note \*5 in page 9.

\*5: Registered trademark of Microsoft Corporation



Measurement conditions setting windows



Optical filter measurement example

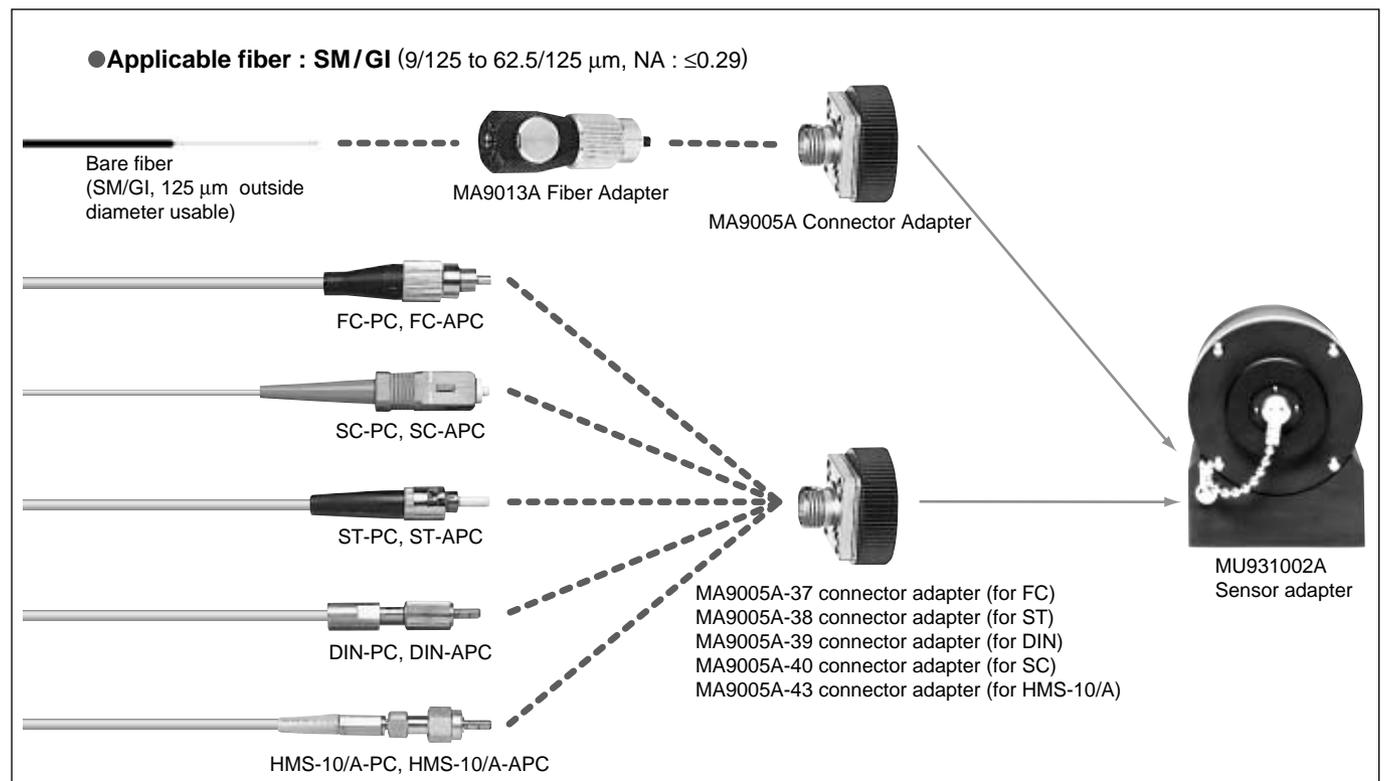
# MT9810B Optical Test Set and MA9332A Optical Sensor

The receiver side of the optical component tester is composed of the MT9810B (main frame), MU931002A Sensor Adapter, and MA9332A Optical Sensor. High-speed measurement is achieved by using new high-speed data transfer technology. For example, 5001 data points can be measured in less than 10 seconds.

Since the MA9332A has a simple standalone structure, it can be transported easily to the evaluation site. And the exchangeable connector adapter supports connection of bare fiber and other types of optical connectors.



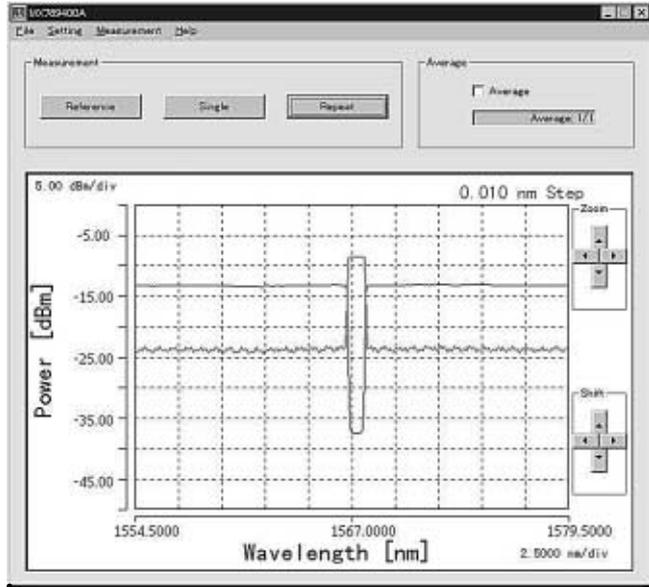
## Supports Optical Fiber Connectors



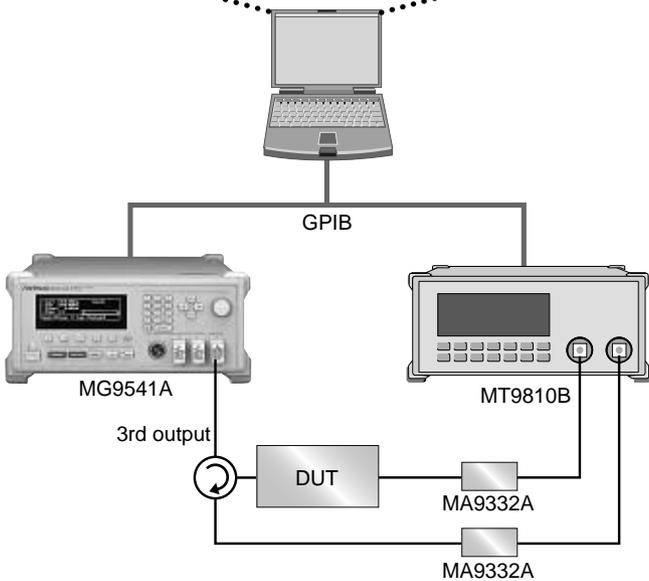
# Applications

## Measuring Wavelength Characteristics of Fiber Bragg Grating

When the high-signal-to-noise ratio optical output of 3rd port of the MG9541A is input to a fiber Bragg grating, the MT9810B can measure the transmitted and reflected light. The measurement results are displayed graphically on a PC.

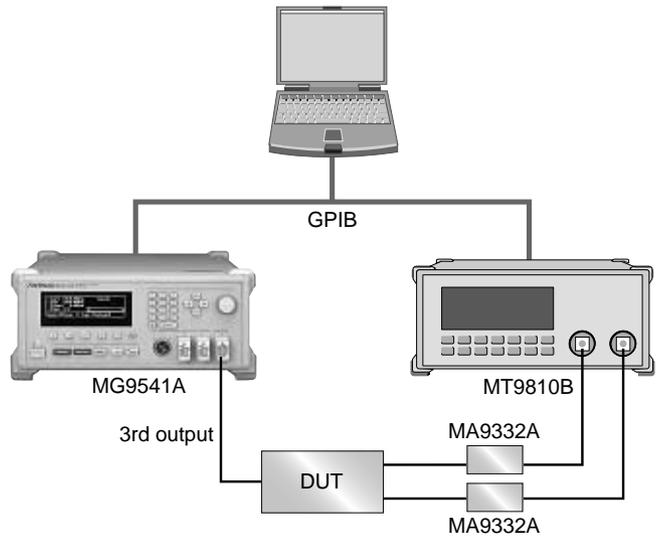


Coupler measurement example



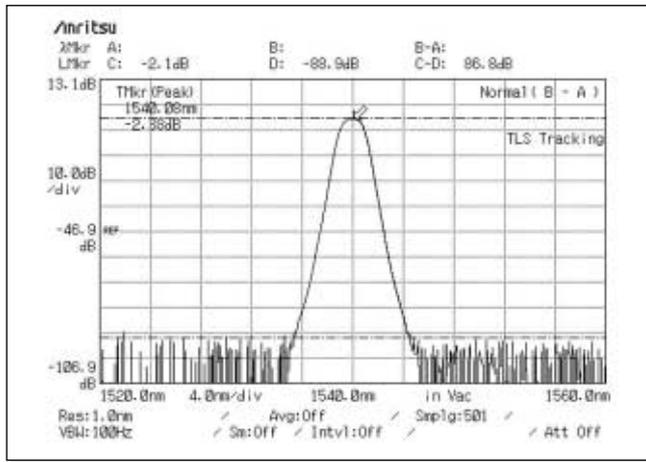
## Measuring Wavelength Characteristics of Optical Coupler

The signal-to-noise ratio of the optical output of 3rd port of the MG9541A is 70 dB (typ.). When this high-signal-to-noise ratio optical signal is input to an optical coupler, the wavelength characteristics of the branch ratio can be measured by the MT9810B and the results displayed as a graph on a PC.

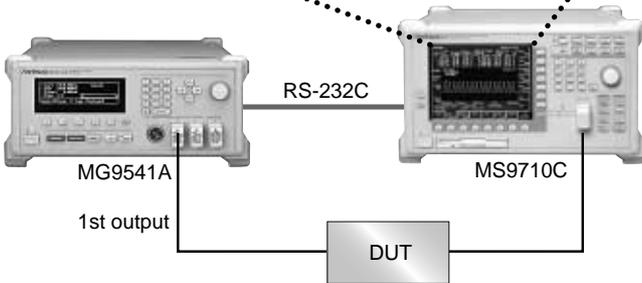


## High-Dynamic-Range Measurement of Wavelength Characteristics

Tracking measurement is supported by connecting the optical output (1st port) of the MG9541A and MS9710B/C using the RS-232C interface. This eliminates the need for an external controller and permits high-dynamic range measurement (approx. 80 dB typ.) of the wavelength loss characteristics of optical components.

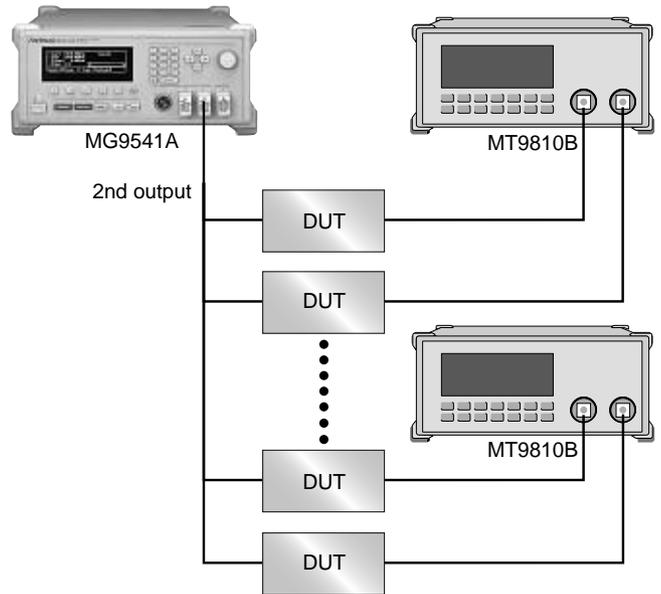


High-dynamic-range measurement



## Multiple Light Sources

The characteristics of optical components can be checked efficiently by branching the high-power optical output (2nd port) of the MG9541A. For example, several test-stations can use one MG9541A by branching the high-power output.



# Specifications

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## ● ME7894A Optical Component Tester

Configuration instruments	MG9541A, MT9810B, MU931002A, MA9332A
Wavelength measurement range	1510 to 1640 nm
Minimum wavelength resolution	1 pm
Absolute wavelength accuracy *1	±55 pm
Wavelength repeatability *2	±35 pm
Loss measurement dynamic range	≥50 dB (1530 to 1625 nm)
Loss measurement accuracy	≤±0.3 dB (-10 dBm)
Loss measurement linearity *3	≤±0.1 dB ±5 nW (-10 to -50 dBm)
Loss measurement repeatability	≤±0.1 dB ±5 nW (-10 to -49 dBm)
SNR *4	≥69 dB/0.1 nm (MG9541A 3rd output)
Measurement time	≤10 s (wavelength span: 20 nm, wavelength resolution: 4 pm, using 1 channel)
Number of channels	Max. 2 channels
Operating temperature	+10° to +35 °C
Software *5	MX789400A Optical Component Tester Control Software

\*1: After wavelength calibration, <10 h, constant temperature

\*2: Constant temperature

\*3: -10 dBm reference

\*4: Signal-to-noise ratio

\*5: PC required for MX789400A

IBM-PC AT compatible with CPU equivalent of Intel Celeron 450 MHz or higher (with FPU), 64 Mbytes of RAM min., 100 MB or more of free disk space, 1024 x 768 pixel min. display, running Microsoft Windows 95 service pack 1 or later, or Windows 98 and Microsoft Internet Explorer V.4.01 or later, with National Instrument PCI-GPIB or PCMCIA-GPIB installed

Microsoft Windows and Internet Explorer are registered trademarks of Microsoft Corporation in the USA and other countries.

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## ● MG9541A Tunable Laser Source

Optical output port *1	1st output (variable level over wide range )	2nd output (high-power)	3rd output (high signal-to-noise ratio)
Wavelength range	1510 to 1640 nm (>130 nm)		
Wavelength setting resolution	1 pm		
Absolute wavelength accuracy	±55 pm (valid for 10 h after wavelength calibration and at constant temperature)		
Relative wavelength accuracy	±45 pm (constant temperature)		
Wavelength repeatability	±35 pm (constant temperature)		
Wavelength stability	±8 pm (approx. 1000 MHz, 0 to 10 min after changed the parameter, constant temperature) ±0.8 pm (approx. 100 MHz, 10 min to 1 h after changed the parameter, constant temperature)		
Maximum output power	≥+1 dBm (1530 to 1580 nm) ≥0 dBm (1530 to 1625 nm) ≥-2 dBm (1510 to 1640 nm)	≥+7 dBm (1530 to 1580 nm) ≥+6 dBm (1530 to 1625 nm) ≥+4 dBm (1510 to 1640 nm)	≥-15 dBm (1530 to 1625 nm) ≥-20 dBm (1510 to 1640 nm)
Minimum output power	≤-30 dBm (1510 to 1640 nm)	2 dB down from the maximum output power (1510 to 1640 nm)	≤-30 dBm (1510 to 1640 nm)
Power linearity	±0.30 dB (constant temperature)	±0.60 dB (constant temperature)	±0.3 dB (constant temperature)
Power repeatability	±0.02 dB (≥-20 dBm, constant temperature) ±0.04 dB (<-20 dBm, constant temperature)	±0.22 dB (constant temperature)	±0.02 dB (≥-20 dBm, constant temperature) ±0.04 dB (<-20 dBm, constant temperature)
Power stability	±0.01dB (≥-20 dBm, 1 h, constant temperature)*2 ±0.02 dB (<-20 dBm, 1 h, constant temperature)*2	±0.20 dB (0 to 10 min. after changing setting, constant temperature) ±0.05 dB (10 min. to 1 h after changing setting, constant temperature)	±0.01 dB (≥-20 dBm, 1 h, constant temperature)*2 ±0.02 dB (<-20 dBm, 1 h, constant temperature)*2
Level flatness	±0.30 dB (constant temperature)	±0.60 dB (1530 to 1580 nm, 1570 to 1625 nm, constant temperature)	±0.30 dB (constant temperature)
Signal-to-noise ratio	≥47 dB/0.1 nm (1530 to 1620 nm) ≥40 dB/0.1 nm (1520 to 1620 nm) ≥37 dB/0.1 nm (typical, 1510 to 1640 nm)	≥47 dB/0.1 nm (1530 to 1620 nm) ≥40 dB/0.1 nm (1520 to 1620 nm) ≥37 dB/0.1 nm (typical, 1510 to 1640 nm) *At maximum output	≥69 dB/0.1 nm (1520 to 1620 nm) ≥66 dB/0.1 nm (typical, 1510 to 1640 nm)
Spectrum line width	Coherence control off: ≤800 kHz (typical), coherence control on: ≥10 MHz (typical)		
Polarization extinction ratio	15 dB (typical, when FC-PANDA or SC connector is used and Anritsu specified polarization-maintaining optical fiber is used.)		
Tuning speed	<2200 ms/100 nm, <1200 ms /10 nm, <1200 ms /1 nm		
Power	85 to 132 Vac/170 to 250 Vac, 47.5 to 63 Hz, <190 VA		
Warming-up time	<1 h (power on at room temperature)		
Temperature range	+10° to +35°C (operating), -20° to +60°C (storage)		
Dimensions and mass	320 (W) x 133 (H) x 451 (D) mm, ≤16.5 kg		
EMC	EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A)		
LVD	EN61010-1:1993/A2: 1995 (Installation category II, Pollution degree 2)		
Laser safety	IEC-60825-1: Class 3B, FDA (21CFR1040.10): Class III b		

\*1: The specifications for 3 kinds of optical output ports are applied for the selected one port.

\*2: When the supplied terminator is connected to the 2nd output.

## ● MT9810B Optical Test Set

Display resolution	dBm: 0.001, 0.01, 0.1 dB: 0.001, 0.01, 0.1 Watt: 5 digits
Display range	-199.999 to +199.999 dBm, ±0.0001 pW to ±10000 W
Display	Fluorescent character display tube
Remote control	GPIB, RS-232C
External trigger input connector	BNC type (MG9541A dedicated)
Laser safety mechanism	Remote interlock, optical output control (key control)
Environmental conditions	Operating temperature and humidity: 0° to +50°C/≤90% (no condensation), Storage temperature: -25° to +71°C
Plug-in units	Max. 2
Dimensions and mass	213(W) x 88(H) x 351(D) mm, ≤3.5 kg (excluding plug-in units)
Power	85 to 132 Vac/170 to 250 Vac, 47.5 to 63 Hz, ≤70 VA
EMC	EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A)
LVD	EN61010-1:1993/A2: 1995 (Installation category II, Pollution degree 2)

## ● MA9332A Optical Sensor

This specifications are available combined with MT9810B Optical Test Set.

Element	InGaAs-PD
Input type	Fiber (with using MA9005A connector adapter)
Applicable optical fiber	9/125 to 62.5/125 mm (NA: $\leq 0.29$ )
Wavelength range	750 to 1700 nm
Optical power measurement range *1	+5 to -80 dBm (continuous light)
Noise level *2	$\leq -76$ dBm
Polarization dependency *3	$\leq \pm 0.017$ dB (typ: $\leq \pm 0.01$ dB)
Optical power measurement uncertainty *4	Reference conditions: $\pm 2\%$ , operating conditions: $\pm 3.5\%$
Linearity *5	$\leq \pm 0.05$ dB $\pm 50$ pW (+7 to 0 dBm), $\leq \pm 0.01$ dB $\pm 30$ pW (0 to -70 dBm)
Optical connector *6	FC-PC, ST, DIN, HMS-10/A, SC
Environmental conditions	Operating temperature and humidity: 0° to +50°C/ $\leq 90\%$ (no condensation) Storage temperature: -40° to +71°C
Dimensions and mass	45 (W) x 60 (H) x 110 (D) mm, $\leq 500$ g
Connection with MT9810B	Requires MU931002A

\*1: 1550 nm

\*2: Peak-to-peak noise, measurement interval: 100 ms, averaging: 10 times, 1550 nm

\*3: Using SM fiber (ITU-T G.652), return loss:  $\geq 45$  dB, 1550 nm

\*4: Reference conditions

SM fiber (ITU-T G.652), master FC connector, power level: 100  $\mu$ W (-10 dBm), continuous light, 1550 nm, 23°  $\pm 2^\circ$ C, at day of calibration, after 30 min warm-up  
Operating conditions

SM fiber (ITU-T G.652), master FC connector, power level: 100  $\mu$ W (-10 dBm), continuous light, any wavelength in 1000 to 1650 nm range, 23°  $\pm 5^\circ$ C, within 1 year after calibration, after 30 min warm-up, add 1% to accuracy for a fiber other than SM fiber (ITU-T G.652)

\*5: Measurement conditions

Constant temperature within 23°  $\pm 5^\circ$ C, bandwidth: auto/0.1 Hz/1 Hz/10 Hz, any wavelength in 1000 to 1650 nm, continuous light, power level: 100  $\mu$ W (-10 dBm) reference, after 30 min warm up

\*6: Specify connector for optical connector option supplied as standard accessory. If connector not specified, FC-PC (Option 37) supplied as standard.

# Ordering Information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	Model/Order No.	Name
MG9541A	<b>Main frame</b>	J1084	SC-PC-SC-PC-1M-PM13 (SC-PC polarization-maintaining optical fiber cord, 1 m)
	Tunable Laser Source	J0575	FC-PC-FC-PC-2M-SM (FC-PC optical fiber cord, 2 m, SM)
	<b>Standard accessories</b>	J0006	GPIB cable, 0.5 m
	Power cord, 2.6 m :	J0007	GPIB cable, 1 m
	Optical connector *1:	J0008	GPIB cable, 2 m
	F0013	J0009	GPIB cable, 4 m
	Fuse, 5 A:	J0654A	Serial interface cable (9P-9P)
	MG9541A operation manual:	J0655A	Serial interface cable (9P-25P)
	W1814AE	J0739G	Replaceable optical connector (FC-PANDA)
	W1815AE	J0618D	Replaceable optical connector (ST)
S0003	J0618E	Replaceable optical connector (DIN)	
B0329F	J0618F	Replaceable optical connector (HMS-10/A)	
J1076	J0619B	Replaceable optical connector (SC)	
		B0498	Rack mount kit
MS9710B	<b>Peripheral instruments</b>		<b>Options</b>
MS9710C	Optical Spectrum Analyzer	MG9541A-29	Tunable laser source (FC-PANDA connector)
	Optical Spectrum Analyzer	MG9541A-38	Tunable laser source (ST connector)
	<b>Application parts</b>	MG9541A-39	Tunable laser source (DIN connector)
Z0282	Ferrule cleaner	MG9541A-40	Tunable laser source (SC connector)
Z0283	Ferrule cleaner tape	MG9541A-43	Tunable laser source [HMS-10/A (DIAMOND) connector]
Z0284	Adapter cleaner		
J1082	FC-PC-FC-PC-1M-PM13 (FC-PC polarization-maintaining optical fiber cord, 1 m)		
J1083	FC-PC-SC-PC-1M-PM13 (FC-PC-SC-PC polarization-maintaining optical fiber conversion cord, 1 m)		

Model/Order No.	Name
	<b>Main frame</b>
ME7894A	Optical Component Tester
	<b>Configuration instruments</b>
MG9541A	Tunable Laser Source: 1 unit
MT9810B	Optical Test Set: 1 unit
MU931002A	Sensor Adapter: 1 unit
MA9332A	Optical Sensor: 1 unit
	<b>Standard accessories</b>
J0008	GPIB cable, 2 m: 2 pcs
J0775D	Coaxial cable, 2 m: 1 pc
	<b>Option</b>
ME7894A-01	2 channel option (able to use two units of MU931002A or MA9332A simultaneously)
	<b>Main frame</b>
MT9810B	Optical Test Set
	<b>Standard accessories</b>
W1886AE	MT9810B operation manual: 1 copy
W1887AE	MT9810B remote control operation manual: 1 copy
J0895	RCA short pin: 1 pc
J0896	RCA plug (for remote interlock): 1 pc
Z0391	Key (for optical output control): 1 pc
F0011	Fuse, 2 A: 2 pcs
	Power cord, 2.6 m: 1 pc
B0425	Blank panel: 1 pc
	<b>Plug-in unit</b>
MU931002A	Sensor Adapter
	<b>Standard accessories</b>
J1073A	Optical sensor connection cable, 1.5 m: 1 pc
MX789400A	Optical Component Tester Control Software (FD): 1 set
W1926AW	MX789400A operation manual: 1 copy

Note: For personal computer, please contact your nearest Anritsu representative.

Model/Order No.	Name
	<b>Optical sensor head</b>
MA9332A	Optical Sensor (MA9005A Connector Adapter standard equipment)*2
	<b>Options</b>
MA9332A-37	FC-PC connector
MA9332A-38	ST connector
MA9332A-39	DIN connector
MA9332A-40	SC connector
MA9332A-43	HMS-10/A connector
	<b>Application parts</b>
MA9005A-37	Connector adapter (FC-PC)
MA9005A-38	Connector adapter (ST)
MA9005A-39	Connector adapter (DIN)
MA9005A-40	Connector adapter (SC)
MA9005A-43	Connector adapter (HMS-10/A)

\*1: Connector for specified options at ordering supplied as standard. Specify by appending number after model. If connector not specified, FC-PANDA (Option 29) supplied as standard.

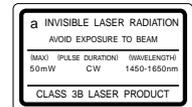
\*2: Connector for specified options at ordering supplied as standard. Specify by appending number after model. If connector not specified, FC-PC (Option 37) supplied as standard.

#### Safety measures for laser products

MG9541A complies with optical safety standards of the IEC pub. 60825-1 and the FDA (21CFR1040.10, USA). The following descriptive labels are affixed to the product.



21CFR1040-10, label



IEC-60825-1, label

# Anritsu

Specifications are subject to change without notice.

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