Anritsu Advancing beyond

MN4775A

MN4775A-0040 40 GHz 850 nm E/O Converter
MN4775A-0070 70 GHz 1550 nm E/O Converter
MN4775A-0071 70 GHz 1310 nm E/O Converter
MN4775A-0072 70 GHz 1310/1550 nm E/O Converter
MN4775A-0110 110 GHz 1550 nm E/O Converter
MN4775A-0111 110 GHz 1310 nm E/O Converter

Introduction

The MN4775A is an electrical to optical converter that uses an RF input signal to intensity modulate an internal laser. The E/O converter is used in conjunction with the VectorStar MS464xB or the Shockline MS4652xB series VNAs and the MN4765B optical to electrical (O/E) converter to perform highly accurate and stable optoelectronic measurements of both modulators (E/O) and photoreceivers (O/E). The MN4775A includes a laser, an optical Mach-Zehnder intensity modulator and a variable optical attenuator to control its output power. Internal circuitry provides various power and modulation configurations as well as stabilizes overall performance. Options determine the wavelength of operation:

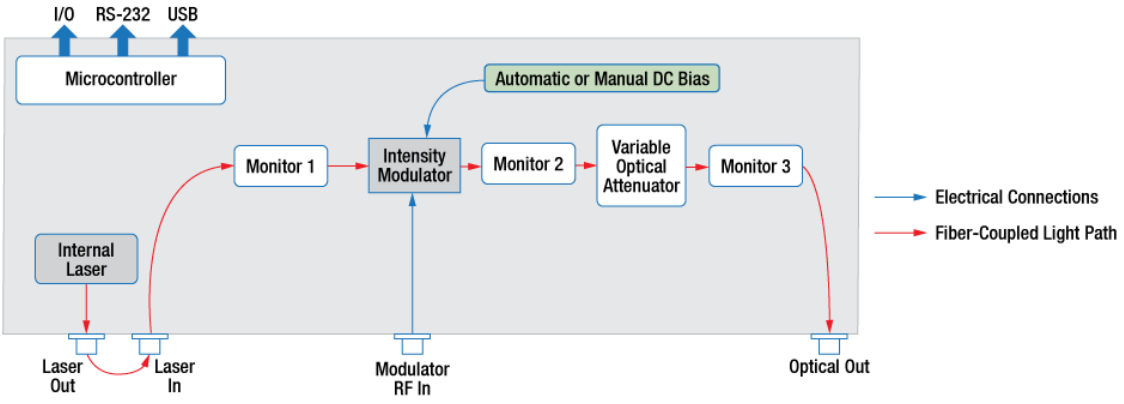
- 850 nm for Option 0040
- C-band (1527.6 to 1565.5 nm) for Option 0070 and Option 0110
- 1310 nm for Option 0071 and Option 0111
- Both a C-band and a fixed 1310 nm laser connected by an optical switch for Option 0072.

Configuration Options

- MN4775A-0040 40 GHz modulation bandwidth and internal 850 nm laser
- MN4775A-0070 70 GHz modulation bandwidth and internal C-Band laser set to 1550 nm
- MN4775A-0071 70 GHz modulation bandwidth and internal 1310 nm fixed laser
- MN4775A-0072 70 GHz modulation bandwidth and internal 1310 nm fixed laser and internal C-Band laser set to 1550 nm (optically switched)
- MN4775A-0110 110 GHz modulation bandwidth and internal C-Band laser set to 1550 nm
- MN4775A-0111 110 GHz modulation bandwidth and internal 1310 nm fixed laser

Features

- Fully integrated E/O to support a complete optoelectronic characterization system
- Mach-Zehnder intensity modulator and bias controller with manual and fully automatic operation modes
- Variable Optical Attenuator (VOA) for automatic or manual power control
- Internal biasing for stable operation and temperature compensation
- Internal optical power detection/monitoring
- Configurability for adapting to measurement applications
  - Optical output power control
  - Modulator biasing alternatives
  - Intuitive Touchscreen Front panel control of optical components as well as remote control via rear panel USB or RS-232 connections
  - In Options -007x and -011x, a jumper loop is provided which enables using an external laser (with the internal modulator and output control) from 1250 nm to 1610 nm.



Note: The MN4775A-0040 850 nm E/O Converter does not have an external jumper for the optical path. The MN4775A-0072 has two lasers switched into the internal laser path in the diagram.

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Definitions

	All specifications and characteristics apply under the following conditions, unless otherwise stated:
Warm-Up Time	After 10 minutes of warm-up time, where the instrument is left in the on state.
Temperature Range	Over the 23 °C ±5 °C temperature range.
Typical Performance	Typical specifications in parenthesis () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted.
	Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of the nominal characteristic performance.
Uncertainty	A coverage factor of K=2 is applied to the measurement uncertainties.
	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

MN4775A-0040 40 GHz 850 nm E/O Converter

All Specifications are at 850 nm and warm-up at 25 °C ambient temperature, unless otherwise noted.

General System Specifications

	Typical Values	Notes
Internal Laser Power (Max)	6 dBm	From Internal Laser
Internal Laser Wavelength	852 nm	Fixed Wavelength
Optical Extinction Ratio	13 dB Min	
Input RF Connector Type	2.92 mm Connector[a]	Same as Anritsu K
Frequency Response	DC - 40 GHz	
Modulator RF Input	±1 V Max for Linear Response[b] ±5 V Absolute Max	
Optical Insertion Loss[c]	5.0 dB at 850 nm	Laser to Optical Output
Modulation Stability (Abs)[d]	0.1 dB (Dither Mode) 0.2 dB (Ratio Mode)	Stability of Modulation Amplitude at any Single Frequency Point
Modulation Stability (Rel)[d]	0.02 dB (Dither Mode) 0.02 dB (Ratio Mode)	Stability of Modulation Amplitude between Frequency Points (Response Shape)

a. The 2.92 mm connector can also mate directly to an SMA, 3.5 mm or K-connector.
b. With Bias Point at Quadrature (50% Transmission).
c. Insertion loss typically 3dB higher when bias set for quadrature mode operation.
d. Over 4 hrs & 3 °C range.

Internal Control Specifications

	Typical Values	Notes
Power Monitors Accuracy	±0.5 dBm	Each Monitor
Power Monitors Resolution	0.01 dBm	Each Monitor
Power Monitor Insertion Loss	0.1 dB	Per Monitor
VOA Insertion Loss	0.4 dB	
VOA Response Time	1 s	

Internal Modulator Specifications

	Typical Values	Notes
Electro-Optic Bandwidth	40 GHz	Usable bandwidth
DC Optical On/Off Extinction Ratio	18 dB	
RF Drive Voltage (V_{pi})	2.3 Vpp	At 1 GHz
Insertion Loss (at Max. Transmission)	3.5 dB (850 nm)	Modulator Only

Internal Laser Specifications

	Min	Typ	Max	Unit
Optical Output Power	-	6	-	dBm
Central Wavelength	-	852	-	nm
SMSR	35	-	-	dB
Intrinsic Linewidth	-	2	3	MHz
PER at Fiber Output	-	20	-	dB

MN4775A-0070 70 GHz 1550 nm E/O Converter
MN4775A-0071 70 GHz 1310 nm E/O Converter
MN4775A-0072 70 GHz 1310/1550 nm E/O Converter

All Specifications are at 1550 nm for the 0070 or at 1310 nm for the 0071, and warm-up at 25 °C ambient temperature, unless otherwise noted.

General System Specifications

	Typical Values	Notes
Internal Laser Power (Max)	13.5 dBm	From Internal Laser
Laser Input Power (Max)	20 dBm	From External Laser
Internal Laser Wavelength		
MN4775A-0070	1527.6 – 1565.5 nm	C-Band Tunable
MN4775A-0071	1310 nm	Fixed Wavelength
MN4775A-0072	Includes both of the above wavelength ranges	
External Laser Wavelength Range	1250 -1650 nm	
Optical Extinction Ratio	13 dB Min	
Input RF Connector Type	1.85 mm Connector[a]	same as Anritsu V
Frequency Response	DC - 70 GHz	See Spec. Rails Below
Modulator RF Input	±1 V Max for Linear Response[b] ±5 V Absolute Max	
Optical Insertion Loss[c]	5 dB at 1550 nm 7 dB at 1310 nm	Laser IN to Optical OUT Bias set for peak transmission
Optical Return Loss	-35 dB typ, -25 dB max	Optical ports
Optical Output Power Stability	0.1 dB 0.2 dB	Over 4 hrs & 3 °C range Over 12 hrs & 10 °C range
Modulation Stability (Abs)[d]	0.1 dB (Dither Mode) 0.2 dB (Ratio Mode)	Stability of Modulation Amplitude at any Single Frequency Point
Modulation Stability (Rel)[d]	0.02 dB (Dither Mode) 0.02 dB (Ratio Mode)	Stability of Modulation Amplitude between Frequency Points (Response Shape)
Electrical Return Loss	-10 dB -7.5 dB -3 dB	up to 20 GHz 20 GHz to 50 GHz 50 GHz to 70 GHz

a. The 1.85 mm connector (aka Anritsu V connector) can also mate directly to a 2.4 mm connector.
b. With Bias Point at Quadrature (50% Transmission).
c. Insertion loss typically 3dB higher when bias set for quadrature mode operation.
d. Over 4 hrs & 3 °C range.

Internal Control Specifications

	Typical Values	Notes
Power Monitors Accuracy	±0.5 dBm	Each Monitor
Power Monitors Resolution	0.01 dBm	Each Monitor
Power Monitor Insertion Loss	0.1 dB	Per Monitor
VOA Insertion Loss	0.4 dB	
VOA Response Time	1 s	

Internal Modulator Specifications

	Typical Values	Notes
Electro-Optic Bandwidth	70 GHz	Usable bandwidth
DC Optical On/Off Extinction Ratio	20 dB	
RF Drive Voltage (V_{pi})	5.5 Vpp	At 1 GHz
Insertion Loss (at Max. Transmission)	4 dB (1550 nm) 6 dB (1310 nm)	Modulator Only

Internal Laser Specifications

MN4775A-0070

	Min	Typ	Max	Unit
Optical Output Power	12.5	13.5	14.5	dBm
Wavelength Range	1527.6	-	1565.5	nm
Frequency Range	191.50	-	196.25	THz
Frequency Accuracy	-1.5	-	1.5	GHz
Coarse Tuning Resolution	-	50	-	GHz
Coarse Tuning Time		10		s
Fine Tuning Range (at any ITU channel)	-30	-	+30	GHz
Fine Tuning Resolution	1	-		MHz
Fine Tuning Speed		1		GHz/s
SMSR	40	55	-	dB
OSNR	40	60		dB
RIN	-	-	-145	dB/Hz
Intrinsic Linewidth	-	10	15	kHz
PER at Fiber Output	18	-	-	dB

MN4775A-0071

	Min	Typ	Max	Unit
Optical Output Power	12.5	13.5	14.5	dBm
Central Wavelength	-	1310	-	nm
SMSR	35	-	-	dB
OSNR	40	60		dB
RIN	-	-	-145	dB/Hz
Intrinsic Linewidth	-	2	3	MHz
PER at Fiber Output	18	20	-	dB

Both tables above apply, at the respective wavelengths, for the MN4775A-0072, except the optical output powers are reduced by 1 dB.

S21 Frequency Response Specification Response curves all normalized to 3 GHz

Freq. Range (GHz)	Min Rail (dB)	Max Rail (dB)
0 – <= 2.5	-2.5	2.0
> 2.5 – <= 20	-2.5	1.0
> 20 – <= 38	-4.0	0.5
> 38 – <= 50	-5.5	-0.5
> 50 – <= 65	-9.0	-1.5
> 65 – <= 70	-10.0	-3.0

MN4775A-0110 110 GHz 1550 nm E/O Converter

All Specifications are at 1550 nm and warm-up at 25 °C ambient temperature, unless otherwise noted.

General System Specifications

	Typical Values	Notes
Internal Laser Power	17 dBm (Max)	From Internal Laser
Input Power from External Laser	17 dBm (Max) 20 dBm (Absolute Max)	
Internal Laser Wavelength	1527.6 – 1565.5 nm	C-Band Tunable
External Laser Wavelength Range	1525 -1575 nm	
Output Power at Quad Bias	3 dBm	Using Internal Laser
Optical Extinction Ratio	20 dB (Typ)	at DC
Input RF Connector Type	1 mm (W) Connector	F
RF Drive Voltage (V_{pi})	3.3 Vpp	At 1 MHz
Frequency Response	-8 dB to 70 GHz -12 dB to 110 GHz	Relative to 2 GHz Relative to 2 GHz
Modulator RF Input	±0.3 V Max for Linear Response[a] ±2.5 V Absolute Max	
Optical Insertion Loss[b]	11 dB	Laser IN to Optical OUT Bias set for peak transmission

a. With Bias Point at Quadrature (50% Transmission).
b. Insertion loss typically 3dB higher when bias set for quadrature mode operation.

Internal Control Specifications

	Typical Values	Notes
Power Monitors Accuracy	±0.5 dBm	Each Monitor
Power Monitors Resolution	0.01 dBm	Each Monitor
Power Monitor Insertion Loss	0.1 dB	Per Monitor
VOA Attenuation Range	1 dB to 20 dB	
VOA Response Time	1 s	

Internal Laser Specifications

MN4775A-0110

	Min	Typ	Max	Unit
Optical Output Power	-	17	-	dBm
Wavelength Range	1527.6	-	1565.5	nm
Frequency Range	191.50	-	196.25	THz
Frequency Accuracy	-1.5	-	1.5	GHz
Coarse Tuning Resolution	-	50	-	GHz
Coarse Tuning Time	-	10	-	s
Fine Tuning Range (at any ITU channel)	-30	-	+30	GHz
Fine Tuning Resolution	-	1	-	MHz
Fine Tuning Speed	-	1	-	GHz/s
SMSR	40	55	-	dB
OSNR	40	60	-	dB
RIN	-	-	-145	dB/Hz
Intrinsic Linewidth	-	10	15	kHz
PER at Fiber Output	18	-	-	dB

S21 Frequency Response Specification

Response curves all normalized to 2 GHz

Freq. Range (GHz)	Min Rail (dB)	Max Rail (dB)
0 – <= 70	-8	-
> 70 – <= 110	-12	-

MN4775A-0111 110 GHz 1310 nm E/O Converter

All Specifications are at 1310 nm and warm-up at 25 °C ambient temperature, unless otherwise noted.

General System Specifications

	Typical Values	Notes
Internal Laser Power	17 dBm (Max)	From Internal Laser
Input Power from External Laser	17 dBm (Max) 20 dBm (Absolute Max)	
Internal Laser Wavelength	1310 nm	
Output Power at Quad Bias	3 dBm	Using Internal Laser
Optical Extinction Ratio	15 dB (Typ)	at DC
Input RF Connector Type	1 mm (W) Connector	F
RF Drive Voltage (V_{pi})	3.3 Vpp	At 1 MHz
Frequency Response	-8 dB to 70 GHz -12 dB to 110 GHz	Relative to 2 GHz
Modulator RF Input	±0.3 V Max for Linear Response[a] ±2.5 V Absolute Max	
Optical Insertion Loss[b]	11 dB	Laser IN to Optical OUT Bias set for peak transmission

a. With Bias Point at Quadrature (50% Transmission).
b. Insertion loss typically 3dB higher when bias set for quadrature mode operation.

Internal Control Specifications

	Typical Values	Notes
Power Monitors Accuracy	±0.5 dBm	Each Monitor
Power Monitors Resolution	0.01 dBm	Each Monitor
Power Monitor Insertion Loss	0.1 dB	Per Monitor
VOA Attenuation Range	1 dB-20 dB	
VOA Response Time	1 s	

Internal Laser Specifications

MN4775A-0111

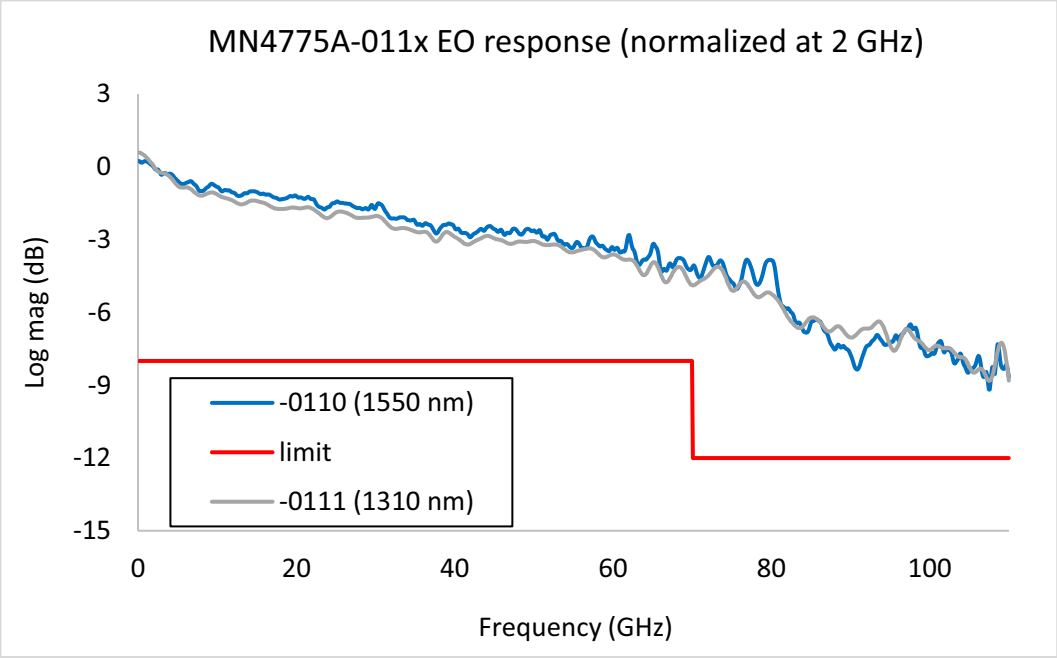
	Min	Typ	Max	Unit
Optical Output Power	-	17	-	dBm
Wavelength	-	1310	-	nm
Frequency	-	228.85	-	THz
SMSR	-	45	-	dB
RIN	-	-	-145	dB/Hz
Intrinsic Linewidth	-	-	10	kHz
PER at Fiber Output	18	-	-	dB

S21 Frequency Response Specification

Response curves all normalized to 2 GHz

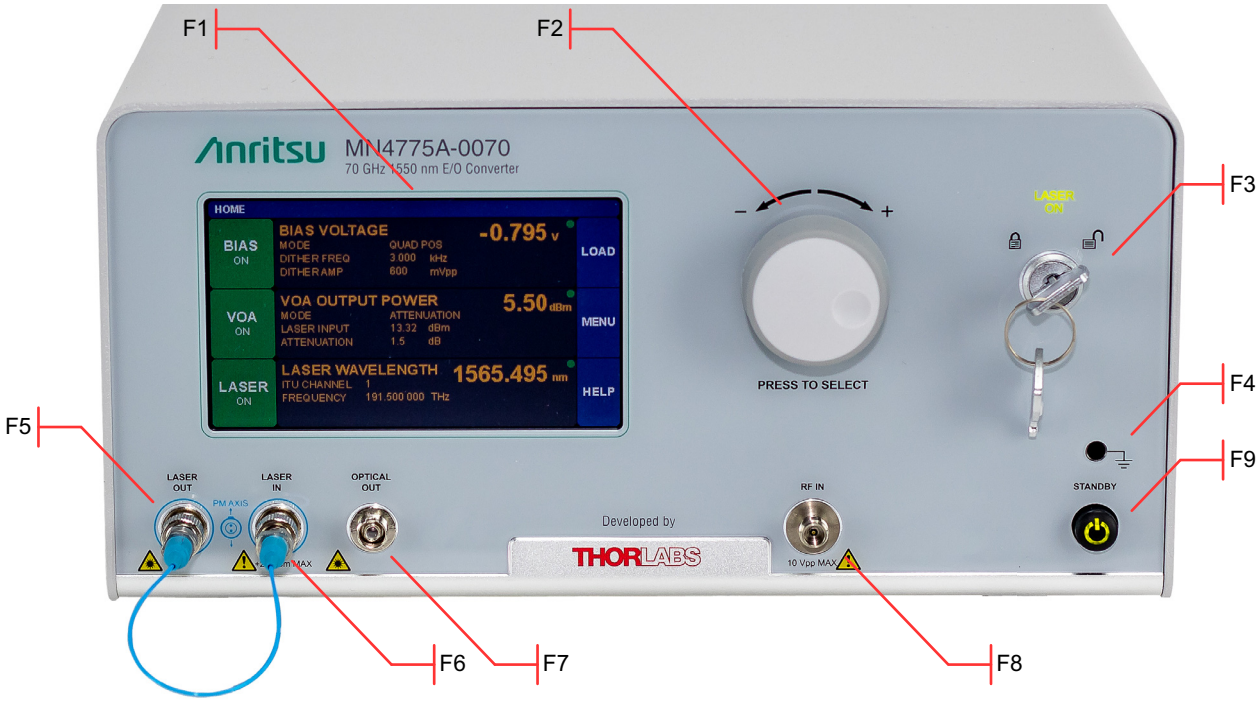
Freq. Range (GHz)	Min Rail (dB)	Max Rail (dB)
0 – <= 70	-8	-
> 70 – <= 110	-12	-

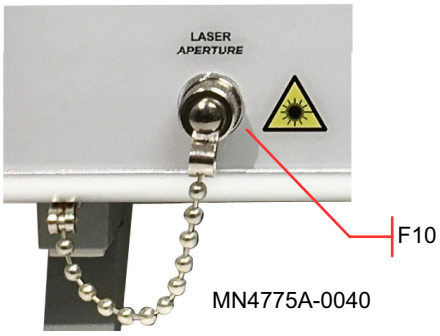
Typical Data with Prescribed Rails



Front and Back Panel Overview

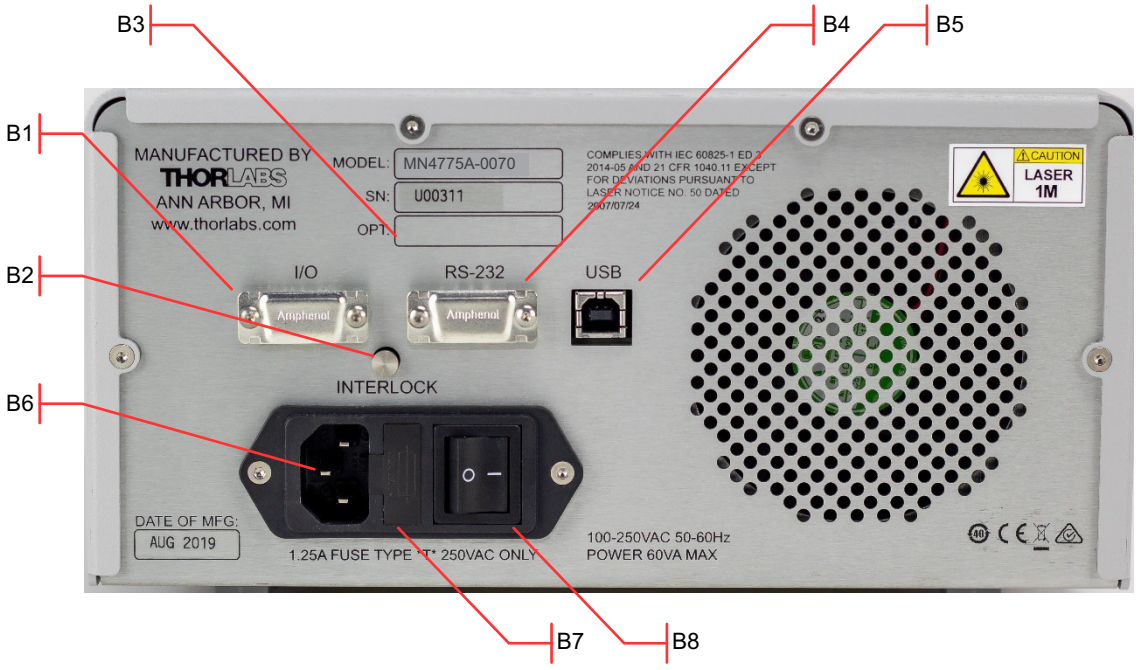
Front Panel





F1	Touchscreen Display
F2	Adjustment Knob
F3	Key Switch and Status Indicator Lasing Disabled; Lasing Enabled
F4	Grounding Jack (Banana Connector) Earth Ground
F5	Laser Output (PM FC/PC Connector) (Not available on -0040 model)
F6	Laser Input (PM FC/PC Connector) (Not available on -0040 model)
F7	Optical Output (FC/PC Connector)
F8	Modulator RF Input MN4775A-0040: 2.92 mm Connector MN4775A-007x: 1.85 mm Connector MN4775-011x: 1 mm Connector
F9	Standby Button
F10	Laser Aperture and Cap (FC/PC Connector) (Only available on -004x models)

Rear Panel



B1	I/O Port (DB15 Connector)
B2	Laser Interlock (2.5 mm Connector)
B3	Option Label
B4	RS-232 Port (DB9 Connector)
B5	USB Port (USB Type B Connector)
B6	Power Connector
B7	Fuse Tray
B8	Power Switch ▌Supply On; ○ Supply Off

Mechanical Specifications

Dimensions	Width: 250 mm (9.84 in.) Height: 134.8 mm (5.31 in.) Depth: 300 mm (11.81 in.) Height without feet: 122 mm (4.8 in.)
Weight	< 4 kg (< 8.5 lbs.)

Power and Environmental Specifications

	Min	Max
Main AC Voltage	100 VAC	250 VAC
Power Consumption	-	60 VA
Line Frequency	50 Hz	60 Hz
Operating Temperature	10 °C	40 °C
Storage Temperature	0 °C	50 °C
Relative Humidity	5%	85%

Regulatory Compliance

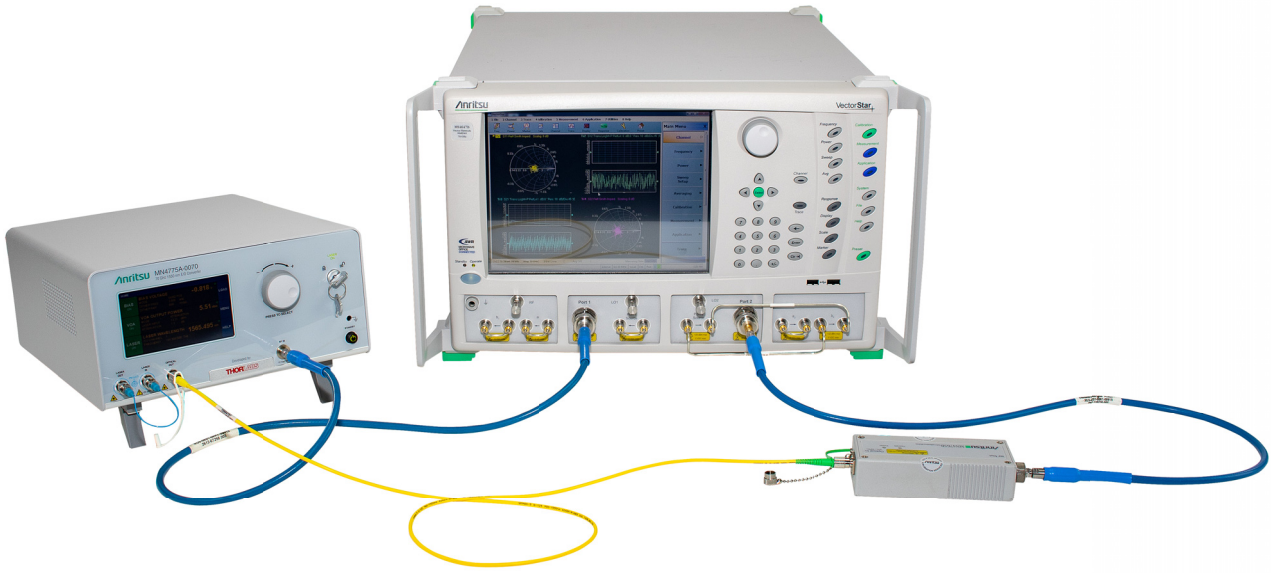
European Union	EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS Directive 2011/65/EU & Amendment 2015/863
Canada	ICES-1(A)/NMB-1(A)
United Kingdom	EMC SI 2016/1091; BS EN 55011 & BS EN 61000-4-2/3/4/5/6/8/11 Consumer Protection (Safety) SI 2016/1101; BS EN 61010-1:2010 Environmental Protection SI 2012/3032; 2011/65/EU & 2015/863
Australia and New Zealand	RCM AS/NZS 4417:2012

Warranty and Calibration

Standard Warranty	One year from date of shipment

System Configuration

A typical configuration of the E/O converted is shown in the figure below. This is an example of an ME7848A Opto-electronic Network Analyzer measurement system. With this configuration it is possible to make accurate frequency response characterization of photo diode detectors, Optical modulators, and RF intensity modulated optical sources. Refer to the ME7848A/E user documentation for information regarding this set of measurements.



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• United States

Anritsu Americas Sales Company
490 Jarvis Drive, Morgan Hill, CA 95037-2809, U.S.A.
Phone: +1-800-Anritsu (1-800-267-4878)

• Canada

Anritsu Electronics Ltd.
Americas Sales and Support
490 Jarvis Drive, Morgan Hill, CA 95037-2809, U.S.A.
Phone: +1-800-Anritsu (1-800-267-4878)

• Brazil

Anritsu Eletronica Ltda.
Praça Amadeu Amaral, 27 - 1 Andar
01327-010 - Bela Vista - Sao Paulo - SP, Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

• Mexico

Anritsu Company, S.A. de C.V.
Blvd Miguel de Cervantes Saavedra #169 Piso 1,
Col. Granada, Mexico, Ciudad de Mexico,
11520, MEXICO
Phone: +52-55-4169-7104

• United Kingdom

Anritsu EMEA Limited
900 Capability Green,
Luton, Bedfordshire, LU1 3LU, U.K.
Phone: +44-1582-433200
Fax: +44-1582-731303

• France

Anritsu SA
12 avenue du Québec, Immeuble Goyave,
91140 VILLEBON SUR YVETTE, France
Phone: +33-1-60-92-15-50

• Germany

Anritsu GmbH
Nemetschek Haus, Konrad-Zuse-Platz 1,
81829 München, Germany
Phone: +49-89-442308-0
Fax: +49-89-442308-55

• Italy

Anritsu S.R.L.
Spaces Eur Arte, Viale dell'Arte 25, 00144 Roma, Italy
Phone: +39-6-509-9711

• Sweden

Anritsu AB
Kistagången 20 B, 2 tr, 164 40 Kista, Sweden
Phone: +46-8-534-707-00

• Finland

Anritsu AB
Technopolis Aviapolis, Teknobulevardi 3-5 (D208.5.),
FI-01530 Vantaa, Finland
Phone: +358-20-741-8100

• Denmark

Anritsu A/S
c/o Regus Winghouse, Ørestads Boulevard 73, 4th floor,
2300 Copenhagen S, Denmark
Phone: +45-7211-2200

• Spain

Anritsu EMEA Ltd.
Representation Office in Spain
Calle Manzanares 4, Primera planta, 28005
Madrid, Spain
Phone: +34-91-572-6761

• Austria

Anritsu Pty Ltd
Am Belvedere 10, A-1100 Vienna, Austria
Phone: +43-(0)1-717-28-710

• United Arab Emirates

Anritsu EMEA Ltd.
Anritsu A/S
Office No. 164, Building 17, Dubai Internet City
P. O. Box – 501901, Dubai, United Arab Emirates
Phone: +971-4-3758479

• India

ANRITSU INDIA PRIVATE LIMITED
6th Floor, Indiqube ETA, No.38/4, Adjacent to EMC2,
Doddanekundi, Outer Ring Road,
Bengaluru – 560048, India
Phone: +91-80-6728-1300
Fax: +91-80-6728-1301

• Singapore

ANRITSU PTE LTD
1 Jalan Kilang Timor, #07-04/06 Pacific Tech Centre
Singapore 159303
Phone: +65-6282-2400
Fax: +65-6282-2533

• Vietnam

ANRITSU COMPANY LIMITED
16th Floor, Peakview Tower, 36 Hoang Cau Street,
O Cho Dua Ward, Dong Da District, Hanoi, Vietnam
Phone: +84-24-3201-2730
Fax: +84-24-3201-2740

• P.R. China (Shanghai)

Anritsu (China) Co., Ltd.
Room 2701-2705, Tower A, New Caohejing
International Business Center No. 391 Gui Ping Road
Shanghai, 200233, P.R. China
Phone: +86-21-6237-0898
Fax: +86-21-6237-0899

• P.R. China (Hong Kong)

ANRITSU COMPANY LIMITED
Unit 1302, 13th Floor, New East Ocean Center,
No.9 Science Museum Road, TsimShaTsui East,
Kowloon, Hong Kong
Phone: +852-2301-4980
Fax: +852-2301-3545

• Japan

Anritsu Corporation
8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016 Japan
Phone: +81-46-296-6509
Fax: +81-46-225-8352

• South Korea

Anritsu Corporation, Limited
8F, A TOWER, 20, Gwacheondaero 7-gil, Gwacheon-si,
Gyeonggi-do, 13840, Republic of Korea
Phone: +82-2-6259-7300
Fax: +82-2-6259-7301

• Australia

Anritsu Pty. Ltd.
Unit 20, 21-35 Ricketts Road,
Mount Waverley, Victoria 3149, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

• Taiwan

ANRITSU COMPANY, INC.
7F, No. 316, Sec. 1, NeiHu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

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