Agilent 8494/95/96A/B Attenuators

Operating and Service Manual

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Notices

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This manual contains operating instructions for the Agilent 8494/95/96A/B Attenuators. Included in the manual is information required to install and test these attenuators.

Product Overview

Agilent 8494A/B, 8495A/B, and 8496A/B are 50-ohm coaxial step attenuators.

For the 8494A/B, the attenuation can be varied in 1 dB steps, or 10 dB steps for the 8495A/B and 8496A/B. The attenuation shown on the control knob is the additional attenuation added in the signal path over the insertion loss of the attenuator in the 0 dB position.

- Agilent 8494A/B instruments are four-section attenuators with a range of 0 dB to 11 dB in 1 dB steps.
- The 8495A/B is a three-section attenuator with a range of 0 dB to 70 dB in 10 dB steps.
- The 8496A/B is a four-section attenuator with a range of 0 dB to 110 dB in 10 dB steps.

The attenuator sections are connected in cascade. Each section consists of a precision, thin-film attenuator card, a lossless thru-line and a ganged pair of edge line transmission lines. The edge lines are flexed to make contact with either the attenuator card or the thru-line. The edge line contacts are gold-plated leaf springs which ensure long life and high repeatability. Low-torque cams flex the edge lines. Table 8, “Attenuator Switching Order,” on page 22 shows the switching arrangements.

CAUTION Do not exceed the RF power rating of 1 W average or 100 W peak with a maximum pulse width of 10 µs. Do not connect an attenuator RF input or output connector to greater than ±7 Vdc. If the attenuator must be connected to a device with a potential greater than ±7 Vdc, use a blocking capacitor.

Instrument Options

Each instrument is specified with an option number which denotes the configuration of the input and output connectors.

Table 1 Instrument Options

Option	Connector Description
001	Both connectors type-N female
002	Both connectors SMA female
003[1]	Both connectors APC-7

[1] Option 003 is not available with the 8494A, 8495A, and 8496A.

Specifications

Frequency Range and Attenuation

Table 2 Frequency Range and Attenuation

Product	8494A	8494B	8495A	8495B	8496A	8496B
Frequency Range	dc to 4 GHz	dc to 18 GHz	dc to 4 GHz	dc to 18 GHz	dc to 4 GHz	dc to 18 GHz
Attenuation	0 dB to 11 dB	0 dB to 11 dB	0 dB to 70 dB	0 dB to 70 dB	0 dB to 110 dB	0 dB to 110 dB
Steps	1 dB	1 dB	10 dB	10 dB	10 dB	10 dB

Attenuation Accuracy

(±dB): (Referenced from 0 dB)

Table 3 Attenuation Accuracy

8494A/B	8495A/B 8496A/B	8494A	8494B		8495A	8495B		8496A	8496B	
Attenuation Selection (dB)		dc–4 GHz	dc–12.4 GHz	12.4–18 GHz	dc–4 GHz	dc–12.4 GHz	12.4–18 GHz	dc–4 GHz	dc–12.4 GHz	12.4–18 GHz
1	10	0.2	0.3	0.7	0.2	0.5	0.6	0.2	0.5	0.6
2	20	0.2	0.3	0.7	0.4	0.7	0.8	0.4	0.7	0.8
3	30	0.3	0.4	0.7	0.5	0.9	1.2	0.5	0.9	1.2
4	40	0.3	0.4	0.7	0.7	1.2	1.6	0.7	1.2	1.6
5	50	0.3	0.5	0.7	0.8	1.5	2.0	0.8	1.5	2.0
6	60	0.3	0.5	0.8	1.0	1.8	2.4	1.0	1.8	2.4
7	70	0.4	0.6	0.8	1.2	2.1	2.8	1.2	2.1	2.8
8	80	0.4	0.6	0.8	–	–	–	1.3	2.4	3.2
9	90	0.4	0.6	0.8	–	–	–	1.5	2.7	3.6
10	100	0.4	0.6	0.9	–	–	–	1.6	3.0	4.0
11	110	0.5	0.7	0.9	–	–	–	1.8	3.3	4.4

Maximum SWR

Table 4 Maximum SWR

Instrument	Frequency Range (GHz)	Maximum SWR
8495A	dc to 4	1.35
8495B	dc to 8 8 to 12.4 12.4 to 18	1.35 1.5 1.7
8494A, 8496A	dc to 4	1.5
8494B, 8496B	dc to 8 8 to 12.4 12.4 to 18	1.5 1.6 1.9

Maximum Residual Attenuation

Table 5 Maximum Residual Attenuation

Instrument	Maximum Residual Attenuation
8494A, 8494B	0.6 dB + 0.09 dB/GHz
8495A, 8495B	0.4 dB + 0.07 dB/GHz
8496A, 8496B	0.6 dB + 0.09 dB/GHz

Attenuation Repeatability

±0.03 dB max (5 million cycles per section).

RF Power Handling Capability

1 W average, 100 W peak with maximum pulse width of 10 microseconds (all models).

Operating Life

5 million cycles per section.

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Environmental Specifications & Physical Dimensions

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Physical Dimensions 17

This chapter contains the environmental tests on the Agilent 8494/95/96A/B Attenuators that fully comply with Agilent Technologies' product operating environmental specifications. The physical dimensions are illustrated in the later section.

Environmental Specifications

The Agilent 8494/95/96A/B Attenuators are designed to fully comply with Agilent Technologies' product operating environmental specifications as shown in Table 6.

Table 6 Environmental Specifications

Temperature:	
• Operating	0 °C to +55 °C
• Storage	–40 °C to +75 °C
Humidity:	
• Operating	<95% relative
• Storage	<95% relative
Altitude:	
• Operating	<4600 m (15000 ft)
• Storage	<7600 m (25000 ft)
Shock:	
• Operating	10 Gs, six ms, on six sides, three blows
• Non-operating	500 Gs, 1.8 ms, in six directions
Vibration:	
• Operating	5 Gs, 34 Hz to 2000 Hz
EMC	Radiated interference is within the requirements of MIL-STD-461, RE02

Physical Dimensions

Table 7 shows the physical dimensions of the Agilent 8494/95/96A/B Attenuators.

Table 7 Physical Dimensions

Instrument	Dimensions[1]	Weight[2]
8494A/B	Per Figure 1	15 oz 425 g
8495A/B	Per Figure 1	11 oz 312 g
8496A/B	Per Figure 1	15 oz 425 g

[1] Dimensions are for general information only. If dimensions are required for building special enclosures, contact your Agilent field engineer.

[2] Weight and width of the instrument varies with the option selected due to the type of connectors.

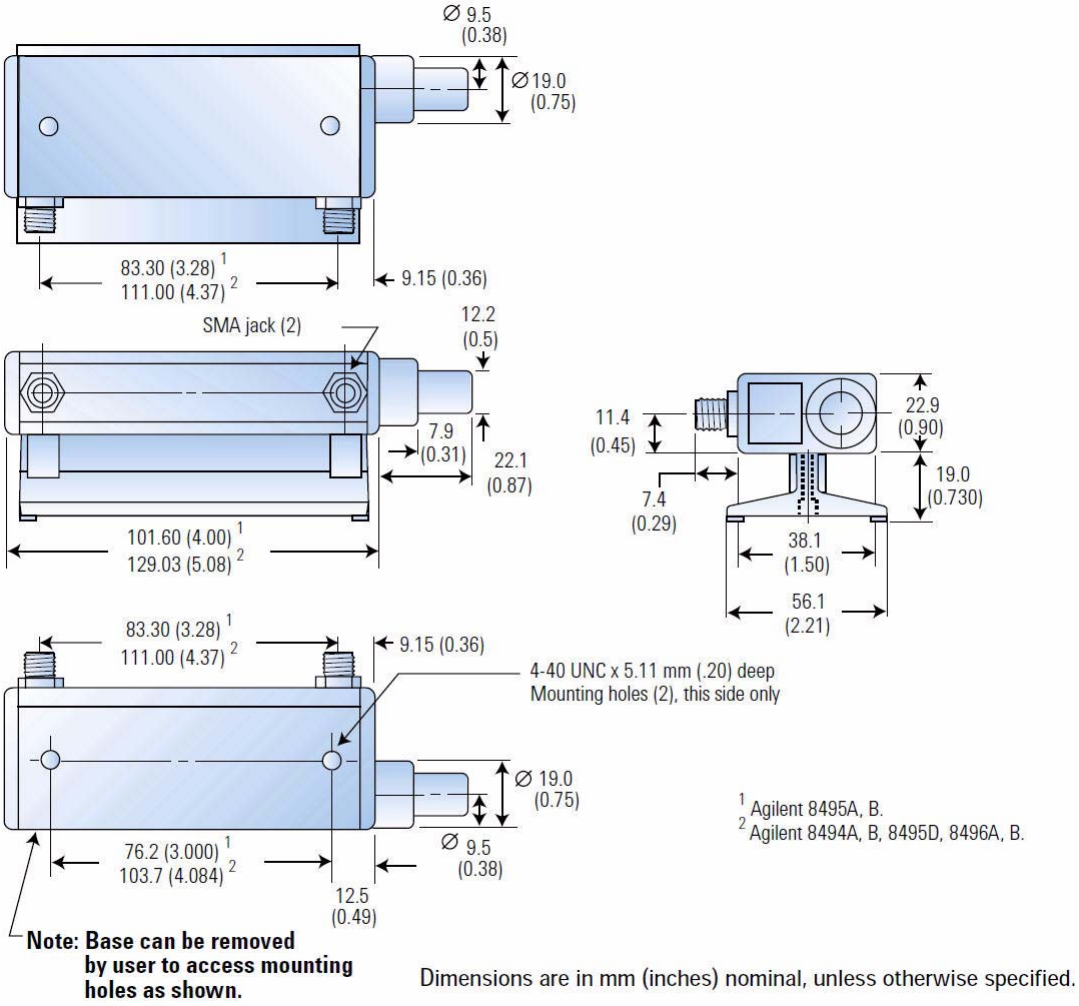

Figure 1 Dimensions of Agilent 8494/95/96A/B Attenuators

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This chapter describes the installation of the Agilent 8494/95/96A/B Attenuators. The operating instruction quick-check procedure is included for verification test prior to usage. Service instructions on the repair and maintenance of the Agilent 8494/95/96A/B Attenuators are also included in this chapter.

Installation

Initial Inspection

1. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.
   - Check for mechanical damage such as scratches or dents.
   - Procedures for checking electrical performance are given under "Operator's Check" on page 23 or "Performance Tests" on page 25.
2. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Agilent Technologies Sales and Service office. Refer to the Service and Support information in the front matter of this manual. Agilent Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier's inspection.
3. If you are returning the instrument under warranty or for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Agilent Technologies can provide packaging materials identical to the original materials. Refer to Service and Support information in the front matter of this manual for the Agilent Technologies nearest to you. Attach a tag indicating the type of service required, return address, model number and serial number. Mark the container ***FRAGILE*** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

Mating Connectors

Mating RF connectors used with the Option 001 must be type-N male connectors, which comply with U.S. military standard MIL-C-39012. For Option 002, male SMA connectors must be used. For Option 003, APC-7 mating connectors must be used.

CAUTION When installing the instrument, make sure that the connectors do not support weight or bear torque. The preferred procedure is to set up all equipment in position before connecting the instrument. Either connector may be used as the input or output connector.

Installation Instructions

The attenuators may be installed with or without the base. The base is removed by unscrewing the two fillister head screws from the bottom of the base. The attenuator may be mounted without the base by inserting two 4-40 screws into the screw holes in the bottom of the attenuator. Removing the base and mounting the attenuator does not affect the performance of the attenuator.

Operating Instructions

CAUTION Do not apply RF power greater than 1 W average, or 100 W peak with a maximum pulse width of 10 microseconds. If these limits are exceeded, the attenuators may be damaged.

After the instrument is connected, the attenuation may be selected. Turn counterclockwise to increase attenuation or clockwise to decrease attenuation. Either connector may be used as the input or output. Table 8 lists the attenuator switching order.

Table 8 Attenuator Switching Order

8494A/B Attenuator Sections					8495A/B Attenuator Sections				8496A/B Attenuator Sections				
Atten (dB)	1 1 dB	2 2 dB	3 4 dB	4 4 dB	Atten (dB)	1 10 dB	2 20 dB	3 40 dB	Atten (dB)	1 10 dB	2 20 dB	3 40 dB	4 40 dB
0					0				0				
1	×				10	×			10	×			
2		×			20		×		20		×		
3	×	×			30	×	×		30	×	×		
4				×	40			×	40				×
5	×		×		50	×		×	50	×		×	
6		×	×		60		×	×	60		×	×	
7	×	×	×		70	×	×	×	70	×	×	×	
8			×	×					80			×	×
9	×		×	×					90	×		×	×
10		×	×	×					100		×	×	×
11	×	×	×	×					110	×	×	×	×

CAUTION Do not attempt to force the switch between 0 and the highest value position as there is a stop between these switch positions.

Operator's Check

The operator's check allows the operator to make a quick check of the instrument prior to use or if a failure is suspected.

Description

The attenuator is driven from a 50-ohm signal source at 1 kHz. The output level from the attenuator is detected by a narrow-bandwidth voltmeter. The attenuator and detector range switches are stepped together and the variations in level noted. This verifies that each attenuator section is being properly switched and checks the low-frequency accuracy of the attenuator.

NOTE The SWR meter used in this check is calibrated for a square-law detector. Therefore, the range changes and errors (read in dB) are twice that indicated by the meter.

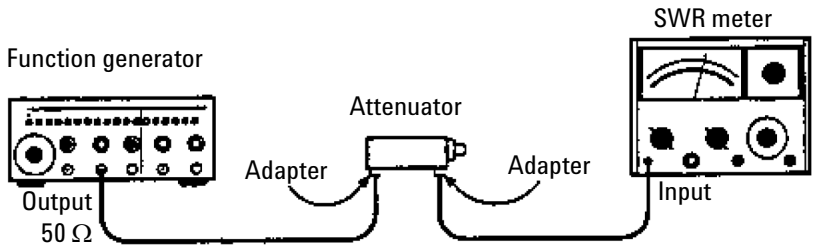

Figure 2 Operator's Check Setup

Procedure

1. Connect equipment as shown in Figure 2 on page 23 with the attenuator set to 0 dB attenuation.
2. Set the test oscillator to 0.3 Vrms at 1 kHz.
3. Set SWR meter range to 2 dB (expanded) [or for the 8494A/B to 10 dB (expanded)] and adjust its bandwidth to the center of the adjustment range. Fine-tune the oscillator frequency to obtain maximum meter indication.
4. Set attenuator and SWR meter range switch as listed in Table 9 and verify that the SWR meter indicates within the limits shown.

Table 9 Attenuator and SWR Settings

SWR Meter Range (dB)		Attenuation (dB)			Meter Indication (dB)					
					Minimum		Actual		Maximum	
8494A/B	8495A/B 8496A/B	8494A/B	8495A/B	8496A/B	8494A/B	8495A/B 8496A/B	8494A/B	8495A/B 8496A/B	8494A/B	8495A/B 8496A/B
10	2	0	0	0	–	–	Set to 0.0	Set to 0.5	–	–
10	6	1	10	10	0.40	1.40	–	–	0.60	1.60
10	12	2	20	20	0.90	0.30	–	–	1.10	0.70
10	16	3	30	30	1.35	1.25	–	–	1.65	1.75
10[1]	22	4	40	40	1.85	0.15	–	–	2.15	0.85
12	26	5	50	50	0.35	1.10	–	–	0.65	1.90
12	32	6	60	60	0.85	0.00	–	–	1.15	1.00
12	36[1]	7	70	70	1.30	0.90	–	–	1.70	2.10
12[1]	42[1]	8	–	80	1.80	–0.15	–	–	2.20	1.15
14	46[1]	9	–	90	0.30	0.75	–	–	0.70	2.25
14	52[1]	10	–	100	0.80	–0.30	–	–	1.20	1.30
14	56[1]	11	–	110	1.75	0.60	–	–	1.75	2.40

[1] Adjust range by 2 dB, if needed, to obtain an on-scale indication.

Performance Tests

The Agilent 8494/95/96A/B Attenuators can be tested to the accuracy of the specifications with a network analyzer or equivalent equipment of suitable accuracy. If a network analyzer is available, test instrument using the procedure in the analyzer's operating manual.

Service Instructions

Adjustment

The Agilent 8494/95/96A/B Attenuators do not have internal adjustments and should not be opened.

Repair

The Agilent 8494/95/96A/B Attenuators are not recommended for repair as most components are not easily removed.

Maintenance

The connectors, particularly the connector faces, must be kept clean. For instruction on connecting and care of your connectors, refer to Microwave Connector Care Quick Reference Card (08510-90360).

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