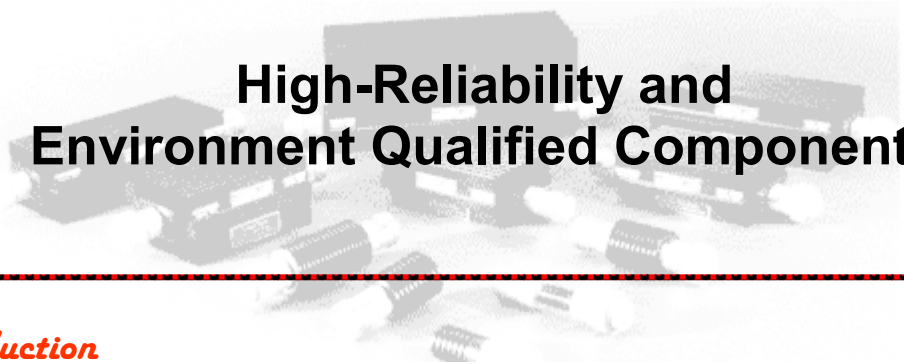
High-Reliability and Environment Qualified Components



Introduction

Ruggedness and reliability have been designed in across our product lines and proven in the field. This section of our catalog provides a brief overview of our capabilities and a sampling of our products that have undergone formal qualification testing.

Designed In

All of our connector interfaces have been designed for compliance to MIL-PRF-39012 and MIL-STD-348A standards. The materials and construction techniques employed are targeted towards compliance with MIL-DTL-3933 (Fixed Attenuators), MIL-DTL-24215 (Variable Attenuators), or MIL-DTL-39030 (Terminations) standards as applicable.

Proven Out

Our products have undergone qualification and screening tests for a variety of environments including:

- Naval Shipboard
- Aircraft, Fixed Wing and Rotary Wing
- Satellite and low out-gassing environments

Standard testing is performed using MIL-STD-202 and MIL-STD-810 methodologies as applicable either at our facility in Gaithersburg, Maryland, or at a certified environmental test lab.

Sample of High-Reliability/Qualified Products

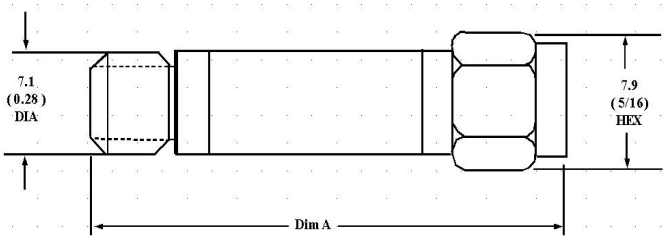
Model Number	Product Type	Frequency Range (GHz)	Connectors	Page No.
WA32	Attenuator	DC-18	SMA	172
WA200271	Attenuator	DC-3	SMA	173
WA200434	Attenuator	DC-18	SMA	174
WA200441	Attenuator	DC-26	SMA	175
WA200461	Attenuator	DC-40	2.92mm	176
VA-02	Variable Attenuator	DC-2	SMA, N	177
VA-04	Variable Attenuator	DC-4	SMA, N	177
WA9426	Variable Attenuator	DC-1	SMA	178
WA200446	Termination	DC-1	SMA	179

Fixed Coaxial Attenuator
High Reliability

MODEL WA32

DC - 18.0 GHz

2 WATTS



Features

Type SMA; stainless steel M/F connectors per MIL-STD-348A, interface dimensions mate nondestructively with MIL-PRF-39012. Designed to meet MIL-DTL-3933 environmental specification. Suitable for space & airborne applications.

Specifications

Nominal Impedance: 50 ohms

Frequency Range: DC -18.0 GHz

Nominal dB Values: 0.1 - 30 dB

Power Sensitivity: < 0.005 dB/dB x W; Bidirectional in power.

Power Rating: 2 watts average power to 25°C ambient temperature, de-rated linearly to 1.25 watts at 75°C and 0.5 Watts at +125° C; 500 watts peak (5 µsec pulse width; 0.2% duty cycle).

Temperature Range: -55°C to +125° C

Standard Nominal Values and Deviations:

Attenuation (dB)	Accuracy (±dB)
0	0.3
0.5-6	0.3
7-12	0.5
20	0.7

Temperature Coefficient: < 0.0004 dB/dB x °C

Construction: Passivated stainless steel body and connectors. Gold plated beryllium copper contacts.

Screening Tests: These units are screened and tested as follows:

Thermal Shock Test: 10 cycles, ½ hour each, -55° C to +125° C. Attenuation is taken before and after thermal shock.

Peak Power: 500 watts, 6000 cycles, 5µsec pulse width; 0.2% duty cycle at each end.

Burn-In: 120 Hours each connector at rated power and elevated temperature.

Final Test: Attenuation and VSWR are performed for final electrical test. Test data is available at additional cost.

Maximum VSWR:

Frequency (GHz)	VSWR
DC - 4.0	1.15
4.0 - 8.0	1.20
8.0 - 12.4	1.25
12.4 - 18.0	1.35

Weight:

0-12 dB	3.9 gm/ 0.14 oz.
13-20 dB	4.3 gm/ 0.15 oz.

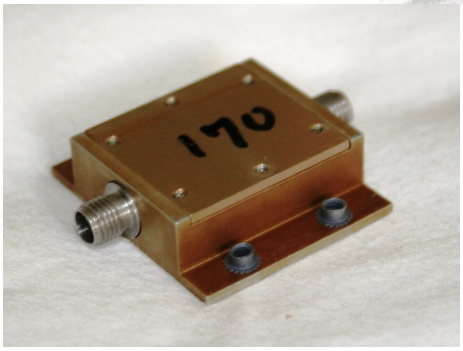
Physical Dimensions:

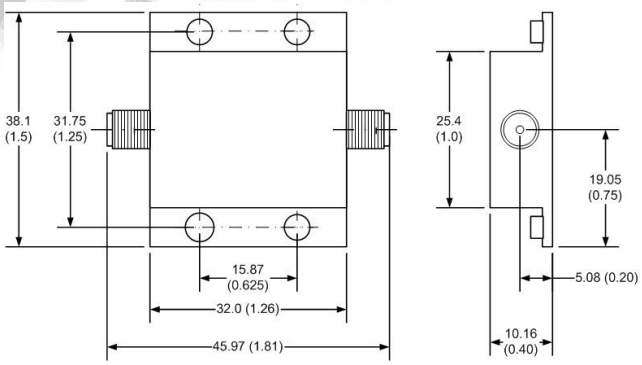
Attenuation (dB)	Dimension "A"
0 – 12	31.24 (1.23)
13 – 20	33.27 (1.31)

Note: Dimensions are given in mm (inches). Dimensions are maximum, unless otherwise specified.

Low-Profile Fixed Coaxial Attenuator
MODEL WA200271

DC – 3.0 GHz **10 WATTS**





Features

SMA, stainless steel, F/F connectors per MIL-STD-348A, interface dimensions mate nondestructively per MIL-PRF-39012.

Designed and tested to meet the standards of MIL-DTL-3933. Suitable for airborne applications.

Specifications

Nominal Impedance: 50 ohms

Frequency Range: DC –3.0 GHz

Insertion Loss: 3 dB ± 0.25 dB

Power Sensitivity: < 0.0005 dB/dB x W; Bidirectional in power.

Power Rating (over temperature):
10 W CW
800 W pk, 33 microsec pulse width, 1% Duty Cycle
1.8 kW pk, 1 microsec pulse width, .025% Duty Cycle

Temperature Range:
-65°C to +125°C, Storage
-54°C to +95°C, Operating

Temperature Coefficient: < 0.0004 dB/dB/°C

Construction: Gold Iridite aluminum alloy body with passivated stainless steel connectors. Gold plated beryllium copper contacts.

Screening Tests: These units are screened and tested as follows:

Thermal Shock Test: 10 cycles, ½ hour each, -55° C to +125° C. Attenuation is taken before and after thermal shock.

Burn-In: 120 Hours each connector at rated power and elevated temperature.

Final Test: Attenuation and VSWR are performed for final electrical test. Test data is available at additional cost.

Maximum VSWR: 1.40:1

Weight: 0.14 kg/5 oz max

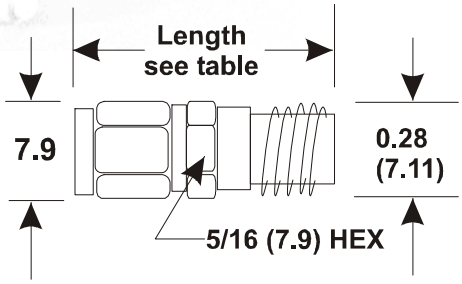
Physical Dimensions:
45.97 x 38.1 x 10.16 mm
1.81 x 1.50 x 0.40 inches

Mounting: Flange mount with four (4) 4-40 self-clinching fasteners.

Note: Dimensions are given in mm (inches) and are maximum, unless otherwise specified

Fixed Coaxial Attenuator MODEL WA200434
High Reliability

DC – 18.0 GHz 2 WATTS



Features

Type SMA; stainless steel M/F connectors per MIL-STD-348A, interface dimensions mate nondestructively with MIL-PRF-39012. Designed to meet MIL-DTL-3933 environmental specification. Suitable for Shipboard and airborne applications. Usable to 26 GHz.

Specifications

Nominal Impedance: 50 ohms

Frequency Range: DC-18.0 GHz

Nominal dB Values: 1 - 60 dB

Power Sensitivity: < 0.005 dB/dB/W; Bidirectional in power.

Power Rating: 2 watts average, 500 watts peak to 25°C ambient temperature, de-rated linearly to 1.25 watts at 75°C and 0.5W at +125° C.

Temperature Range: -55°C to +125° C

Standard Nominal Values and Deviations:

Attenuation (dB)	Accuracy (± dB)
3	0.50
6	0.60
10	0.80
20, 30	1.00
40, 50, 60	2.00

Temperature Coefficient: < 0.0004 dB/dB x °C

Construction: Passivated stainless steel body and connectors. Gold plated beryllium copper contacts.

Maximum VSWR:

Frequency (GHz)	VSWR, Max
DC-4.0	1.15
4.0-8.0	1.20
8.0-12.4	1.25
12.4-18.0	1.35

Weight:

1-12 dB	3.9 gm/ 0.14 oz.
13-25 dB	4.3 gm/ 0.15 oz.
26-30 dB	4.9 gm/ 0.17 oz.
31-60 dB	6.5 gm/ 0.23 oz.

Physical Dimensions:

Attenuation (dB)	Dimension "A"
1 – 12	22.35 (0.88)
13 – 25	24.38 (0.96)
26 – 30	26.92 (1.06)
31 – 60	34.54 (1.36)

Note: Dimensions are given in mm (inches) and are ± 0.8 (0.03), unless otherwise specified.

Fixed Coaxial Attenuator MODEL WA200441
High Reliability

DC – 26.5 GHz 2 WATTS

Features

Type SMA; stainless steel M/F connectors per MIL-STD-348A, interface dimensions mate nondestructively with MIL-PRF-39012. Designed to meet MIL-DTL-3933 environmental specifications. Suitable for Satellite and Airborne applications. Usable to 30 GHz.

Specifications

Nominal Impedance: 50 ohms

Frequency Range: DC-26.5 GHz

Nominal dB Values: 0.0 - 60 dB

Power Sensitivity: < 0.005 dB/dB/W; Bidirectional in power.

Power Rating: 2 watts average, 500 watts peak to 25°C ambient temperature, de-rated linearly to 1.25 watts at 75°C and 0.5W at +125° C.

Temperature Range: -55°C to +125° C

Standard Nominal Values and Deviations:

Attenuation (dB)	Accuracy (±dB)
3, 6	+0.7/-0.3
10	+0.7/-0.5
20	+0.9/-0.6
30	+1.5/-1.0
40, 50, 60	2.00

Temperature Coefficient: < 0.0004 dB/dB x °C

Construction: Passivated stainless steel body and connectors. Gold plated beryllium copper contacts.

Maximum VSWR:

Frequency (GHz)	VSWR
DC-4.0	1.15
4.0-8.0	1.20
8.0-12.7	1.25
12.7-18.0	1.35
18.0-26.5	1.55

Weight:

0-12 dB	3.9 gm/ 0.14 oz.
13-25 dB	4.3 gm/ 0.15 oz.
26-30 dB	4.9 gm/ 0.17 oz.
31-60 dB	6.5 gm/ 0.23 oz.

Physical Dimensions:

Attenuation (dB)	Dimension "A"
1 – 12	22.35 (0.88)
13 – 25	24.38 (0.96)
26 – 30	26.92 (1.06)
31 – 60	34.54 (1.36)

Note: Dimensions are given in mm (inches) and are ± 0.8 (0.03), unless otherwise specified.

Fixed Coaxial Attenuator MODEL WA200461

High Frequency / High Reliability

DC – 40.0 GHz **2 WATTS**

Features

Connectors: Type 2.92 mm stainless steel M/F connectors per MIL-STD-348A, interface dimensions mate nondestructively with MIL-PRF-39012 connectors. Designed to meet MIL-DTL-3933 environmental specifications.

Specifications

Nominal Impedance: 50 ohms

Frequency Range: DC - 40.0 GHz

Nominal dB Values: 0 - 30 dB

Power Sensitivity: < 0.001 dB/dB/W; Bidirectional in power.

Power Rating: 2 watts average, 200 watts peak to 25°C ambient temperature, de-rated linearly to 0.1 watts at 100°C.

Temperature Range: -55°C to +125° C

Standard Nominal Values and Deviations:

Attenuation (dB)	Accuracy (±dB)	
	DC—26.5	26.5—40
3, 6	0.50	1.00
10, 20	1.00	1.00
30	2.00	2.00

Temperature Coefficient: < 0.0004 dB/dB x °C

Construction: Passivated stainless steel body and connectors. Gold plated beryllium copper female contacts.

Maximum VSWR:

Frequency (GHz)	VSWR
DC - 26.5	1.25
26.5 - 40.0	1.45

Physical Dimensions:

Model/dB/Connector	Dimension "A"
-12 (F/M)	36.07 (1.42)
-11 (F/F)	34.80 (1.37)
-22 (M/M)	37.34 (1.47)

Note: Dimensions are given in mm (inches) and are maximum unless otherwise specified.

Screening Tests: These units are screened and tested as follows:

Thermal Shock Test: 10 cycles, ½ hour each, -55° C to +125° C. Attenuation is taken before and after thermal shock.

Burn-In: 120 Hours each connector at rated power and elevated temperature.

Final Test: Attenuation and VSWR are performed for final electrical test. Test data is available at additional cost.

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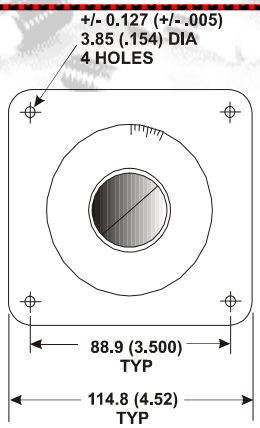
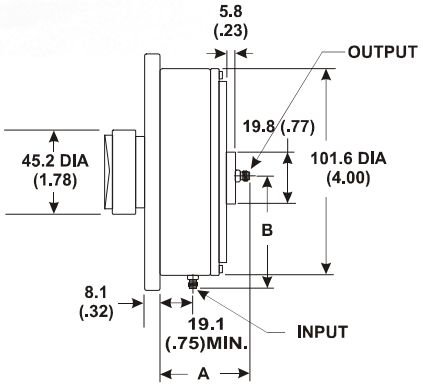
VARIABLE ATTENUATOR MODEL VA-02 & VA-04

High Reliability

DC – 2.0 GHz VA-02
DC – 4.0 GHz VA-04

5 WATTS





Features

Wide Attenuation Range: *Variable Attenuation ranges up to 90 dB on 4 GHz Models and 115 dB on 2 GHz Models.*

Low Residual Insertion Loss: *3 dB nominal on 30 dB Model and 5 dB nominal on wider range Models*

Rugged Construction: *Designed and tested to meet the environmental requirements of MIL-DTL-24215.*

Long Life: *10,000 cycles standard, 50,000 optional.*

Specifications

Nominal Impedance: 50 ohms

Frequency Range: VA-02 DC - 2.0 GHz
VA-04 DC - 4.0 GHz

Residual Insertion Loss: 5 dB, nominal
(3 dB, nominal on 30 dB version)

Attenuation Range:

VA-02	30, 60, 90, 100, or 115 dB
VA-04	30, 60, or 90 dB

VSWR:

FREQ RANGE (GHz)	SWR, Max
DC - 1.0	1.50
1.0 - 2.0	1.60
2.0 - 3.0	1.70
3.0 - 4.0	1.80

Accuracy: ± 0.25 dB or 0.4% at midband

Dial Calibration: 1 dB increments at midband

Resolution:

VA-02-30	3 to 33 dB	~120°
VA-02-60	5 to 65 dB	~180°
VA-02-100	5 to 105 dB	~270°
VA-02-115	5 to 120 dB	~285°
VA-04-30	3 to 33 dB	~120°
VA-04-60	5 to 65 dB	~180°
VA-04-90	5 to 95 dB	~240°

Power Rating: 5 watts average, 0.5 kW peak, to 40°C ambient temperature, de-rated linearly to 0 watts at 85°C.

Power Coefficient: <0.005 dB/dB/Watt

Phase Shift: 1° / dB x f (GHz) maximum

Temperature Range:

Operating:	0°C to +85°C
Non-Operating:	-55°C to +125°C

Temperature Coefficient: <0.001 dB/dB/°C

Connectors: Type N and SMA connectors per MIL-STD-348A, interface dimensions per MIL-PRF-39012.

Connector Option	DIM "A" mm (in.)	DIM "B" mm (in.)
-34	66.0 (2.6)	68.1 (2.68)
-44	66.0 (2.6)	71.9 (2.83)
-33	61.0 (2.4)	68.1 (2.68)
-12	55.6 (2.19)	58.2 (2.29)
-22	55.6 (2.19)	61.5 (2.42)
-11	52.3 (2.06)	58.2 (2.29)

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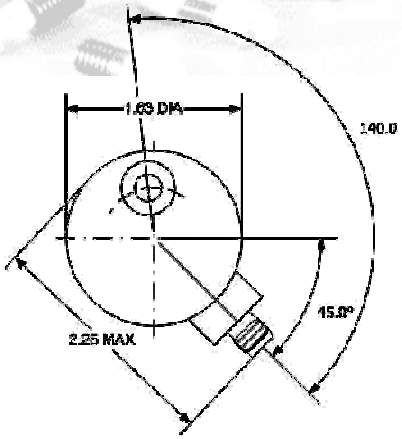
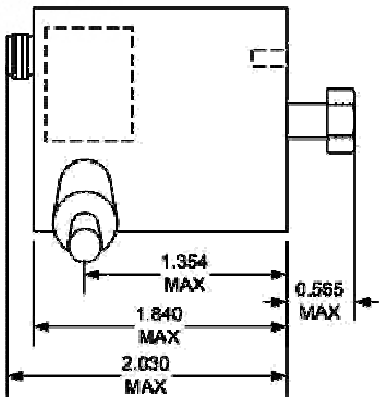
VARIABLE ATTENUATOR MODEL WA9426

High Reliability

DC – 1.0 GHz **1 WATT**





Features

Attenuation Range: *15 dB*

Low Residual Insertion Loss: *<0.5 dB nominal*

Rugged Construction: *Designed to meet the environmental requirements of MIL-DTL-24215. Tested for Shipboard environments.*

Connectors: *SMA Connectors per MIL-PRF-39012 and MIL-STD-348*

Excellent Reset-ability: *10:1 Turns Ratio*

Panel Mount Configuration

Specifications

Nominal Impedance: 50 ohms

Frequency Range: DC - 1.0 GHz

Attenuation Range: 0 to 15 dB

Insertion Loss: 0.5 dB, nominal

Insertion Loss Variation:

Phase Linearity:

VSWR: 1.5:1, max

Power Rating: 1 watts average, 0.5 kW pk, to 25°C ambient temperature, de-rated linearly to 0.5 watts at 85°C.

Power Coefficient: 0.005 dB/dB/W, max

Temperature:
Operating: 0°C to +85°C
Non-Operating: -55°C to +125°C

Temperature Coefficient: 0.001 dB/dB/° C, max

Phase Shift with Change in Attenuation:
1° / dB x f (GHz) maximum

Connectors: SMA Female connectors per MIL-STD-348A, interface dimensions mate nondestructively with MIL-PRF-39012.

Construction: Aluminum body, stainless steel connectors, gold-plated beryllium copper contacts.

Weight: 0.23 kg (0.5 lb), max

Note: Dimensions are given in inches, unless otherwise specified.

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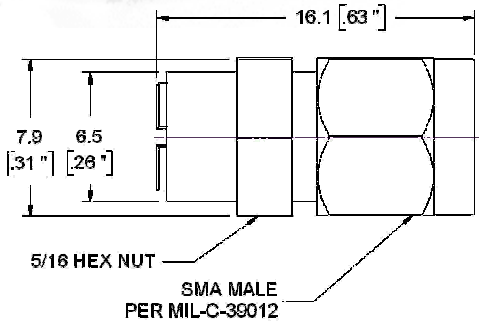
TERMINATION, 93 OHMS MODEL WA200446
High Reliability

DC – 1.0 GHz 5 WATTS



Features

Type SMA stainless steel male connector per MIL-STD-348A, interface dimensions mate non-destructively with MIL-PRF-39012. Designed to meet MIL-DTL-39030 environmental specification. Suitable for Shipboard environments.

Specifications

Nominal Impedance: 93 ohms ± 9 ohms

Frequency Range: DC - 1.0 GHz

Power Rating: 2 watts average power to 25°C ambient temperature, de-rated linearly to 0.5 watts at +85°C.

Temperature Range:
Operating: -20°C to +85°C
Non-Operating: -65°C to +125°C

Construction: Passivated stainless steel body and connectors. Gold plated beryllium copper or stainless steel contact.

Weight: .005 kg, max

VSWR: 1.68:1, minimum
2.04:1, maximum

Physical Dimensions:
Diameter: 8.9 (0.35), maximum
Length: 16.0 (0.63), nominal

Note: Dimensions are given in mm (inches) and are maximum, unless otherwise specified

Qualification Tests

Thermal Shock: 5 cycles, 1 hour soak times, -65° C to +85° C.

Temperature, Operating: 0°C to +85°C

Altitude, Operating: MIL-STD-202, Method 105C

Altitude, Non-Operating: MIL-STD-202, Method 105C, Test Condition B

Vibration, Random: MIL-STD-202, Method 201A

Shock: MIL-STD-202, Method 213B, Test Condition I

Humidity: MIL-STD-202, Method 106G

Salt Atmosphere: MIL-STD-202, Method 101E, Test Condition B