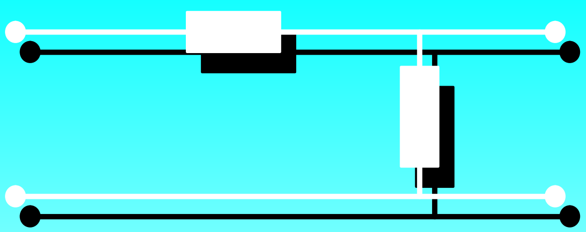
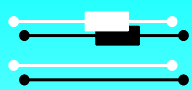
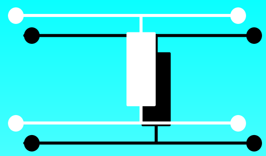
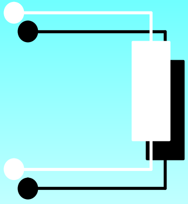
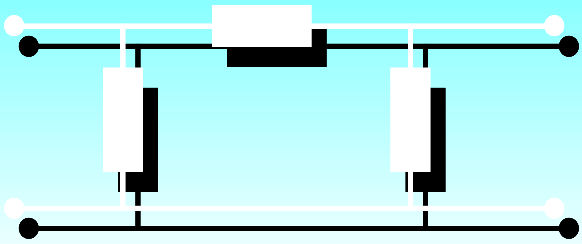










$$a_{dB} = 20 \times \log \frac{U_1}{U_2}$$

Attenuators and Matching Pads, Terminations

175 mW to 1000 W / DC to 18 GHz

ROHDE & SCHWARZ

Attenuators

As a rule, the reflection coefficient of commercial signal generators or test receivers is about 20%. This value may be too high for precise measurements. To **improve matching,** an attenuator should be inserted after the signal generator output and another one ahead of the receiver input. In this way, the reflection coefficients of both the generator and the receiver will be reduced.

Signal generators often do not have a defined source impedance. In these cases, it is advisable to insert a 16-dB (10 + 6 dB) attenuator. The internal reflection coefficient of such a signal source is thus reduced to about 3%, which is small enough for accurate measurements.

Attenuators can also be used as reference standards for attenuation and gain measurements according to the substitution method, for precise voltage division, and as buffers to isolate test circuits.

DNF, 1 W / 2 W

Small attenuation error, largely frequency-independent attenuation and low VSWR are special features of the **Attenuators DNF.** They are sturdy, immune to vibration (complying with MIL-A-3933), only slightly temperature-dependent and resistant to short-term overloading. Attenuators DNF are equipped with N connectors (male, female) and available with 3/6/10/20 and 30 dB attenuation.

High-power attenuators

High-power attenuators are used as dummy loads for transmitters and amplifiers in the frequency range 0 to 6 GHz. Their constant attenuation permits harmonics measurements to be performed on transmitters, TV transposers and other equipment. Thus, the high-power attenuator is superior to a simple termination. The power applied can be accurately determined from the power measured at the test output and the known attenuation. Moreover, a frequency counter or analyzer can be connected to the test output.

RBU, 50 W / 100 W

High-power Attenuators RBU with 3/6/10/20 and 30 dB attenuation are ideal for applications in the frequency range up to 2 GHz, which is of particular interest for mobile radio measurements. The attenuators are characterized by low VSWR and a small attenuation error throughout the frequency range.

Due to the large-area heat sink, the attenuator surface temperature does not rise above 75 °C (at 25 °C ambient temperature) even under full load.

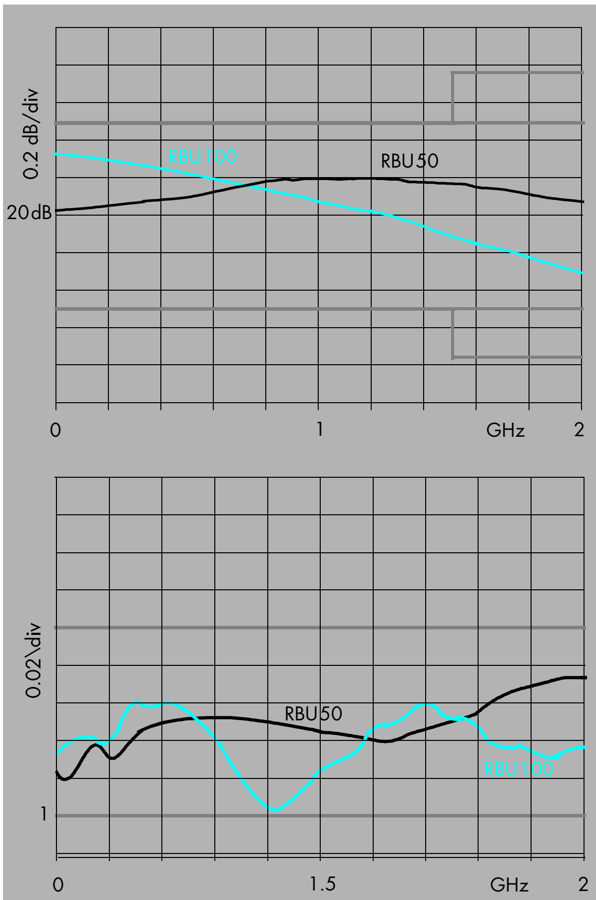
RDL50, 50 W

High-power Attenuator RDL50 is suitable for the frequency range up to 6 GHz. A special feature is its constant low attenuation over the whole frequency range.

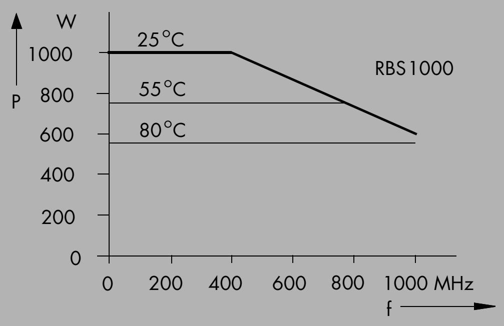
RBS1000, 1000 W

Attenuator RBS1000 is of planar design using special manufacturing techniques. The energy-absorbing thin-film layer is deposited on a ceramic substrate, so the heat generated can directly dissipate without having to penetrate any heat-insulating air layer. The result is a considerable reduction in size while maintaining the same power-handling capacity as conventional attenuators.

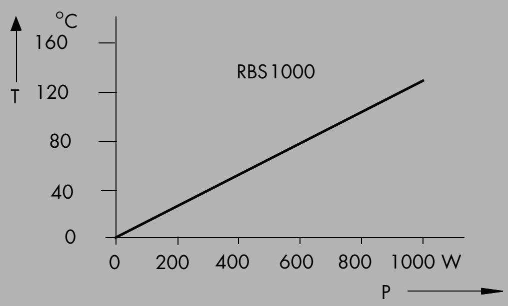
DNF, 3/6/10/20/30 dB



Typical attenuation (top) and VSWR (bottom) characteristics of Attenuators RBU50 and RBU1000 (attenuation 20 dB)



Power handling capacity as a function of frequency and ambient temperature



Overtemperature as a function of the power applied

RBS1000, 1000 W

RDL50, 50 W

Terminations

RNA and RNB, 1 W

The 50-Ω **Terminations RNA and RNB** are versatile line terminations used in 3/7-mm coaxial line systems. A special feature is their very low reflection over a wide frequency range. The use of high-grade metal-film resistors affords a continuous power-handling capacity of 1 W.

Precision Termination RNA features extremely low VSWR over the whole frequency range from DC to 18 GHz and is therefore especially suitable for measurement applications. Termination RNB is for general use in the frequency range DC to 4 GHz.

RMF, 500 mW

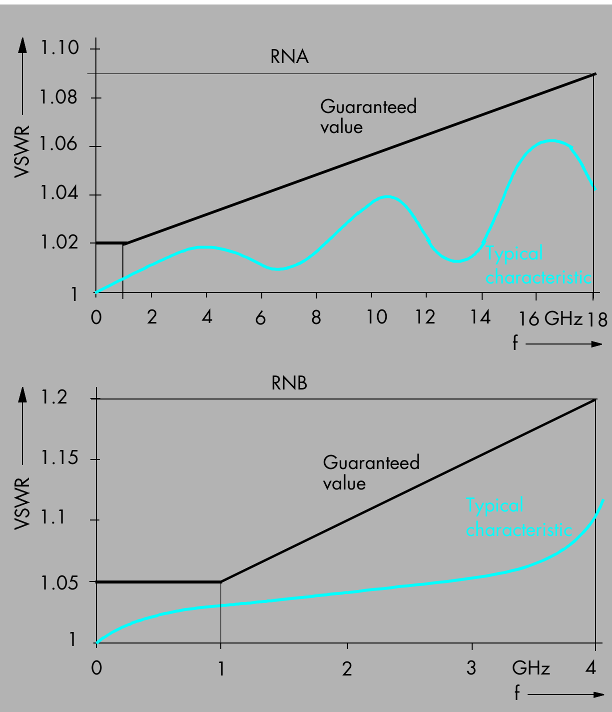
Termination RMF is a termination for instruments and test setups. It has a nonwound resistor whose inductive reactance is compensated up to about 50 MHz. The model with BNC connector permits the reflection-free termination of TV video transmission lines with a VSWR of ≤1.02 up to 10 MHz.

RMF 75, 175 mW

Termination RMF75 is an extremely low-reflection 75-Ω termination. Due to its narrow-tolerance impedance it fully meets the stringent requirements of insertion signal testing. Its power-handling capacity is adequate for the voltages encountered in semiconductors. RMF75 is a metal-film resistor. As it is only 23 mm in length it does not protrude beyond the rear panel and therefore need not be removed for transport..

RAU, 100 W

Termination RAU is mainly used as a dummy antenna for mobile and stationary transmitters. Its low VSWR makes it also suitable for TV equipment.



Guaranteed and typical VSWR characteristics of RNA (top) and RNB (bottom)

Feedthrough Terminations, Matching Pads

Feedthrough Terminations RAD, 500 mW, RAD 50 and RAD 600, 2 W

The **Feedthrough Terminations RAD** are used for matching 50-Ω lines to measuring equipment of high input impedance (eg oscilloscopes or Tuner ZPV-E1 with 1-MΩ input impedance). The feedthrough terminations must be plugged directly onto the input connector of the measuring device to ensure optimum matching.

Matching Pads RAM and RAZ, 2 W

Matching Pad RAM provides the match between 50-Ω and 75-Ω impedance systems in both directions up to 2.7 GHz, causing minimum attenuation. Care should be taken that ports with the same characteristic impedances be connected to one another.

Voltage transformation is defined as the ratio in dB of the voltages at the connectors:

$$A_{50\,\Omega \rightarrow 75\,\Omega} = 20 \cdot \lg \frac{U_{50\,\Omega}}{U_{75\,\Omega}} = 4\ \text{dB}$$

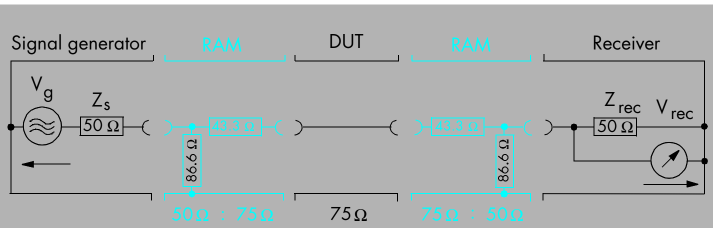
$$A_{75\,\Omega \rightarrow 50\,\Omega} = 20 \cdot \lg \frac{U_{75\,\Omega}}{U_{50\,\Omega}} = 7.5\ \text{dB}$$

For the precise measurement of insertion loss and phase shift, the signal generator, DUT and receiver must be well matched to one another. Matching pads permit systems of different characteristic impedance to be connected without involving costly retrofits.

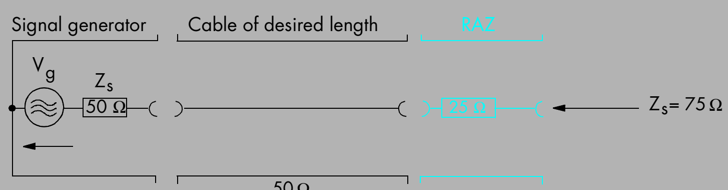
Power attenuation is the same in both directions:

$$A_P = 10 \cdot \lg \frac{U^2_{75\,\Omega} \cdot 50\,\Omega}{75\,\Omega \cdot U^2_{50\,\Omega}} = 5.72\ \text{dB}$$

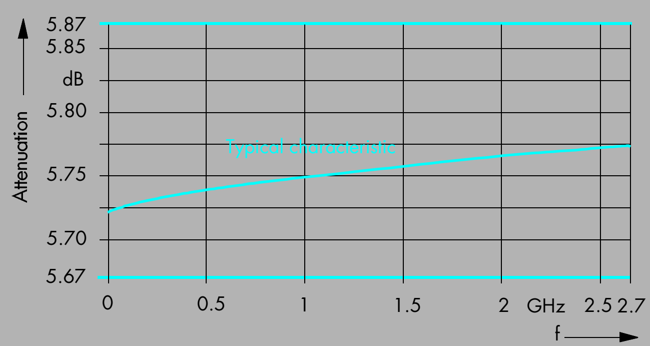
Matching Pad RAZ is particularly suitable for the matching of signal generators. Signal and sweep generators have in most cases a source impedance of 50 Ω. They can be adapted to feed 75-Ω systems by means of Matching Pad RAZ involving extremely low power loss. The output voltage read on the generator is also valid for the 75-Ω system without requiring correction.



Two Matching Pads RAM to match a 75-Ω DUT to a signal generator and receiver each having a characteristic impedance of 50 Ω



By connecting a Matching Pad RAZ consisting of a 25-Ω series resistor, a signal generator with a 50-Ω output is given an output impedance of 75 Ω



Frequency response and error limits of power attenuation of Matching Pad RAM

Specifications/Ordering information

	Type Order No.	Characteristic impedance	Power rating	Nominal attenuation	Frequency range	VSWR	Attenuation (N=nominal value)	Max. peak pulse voltage	Connectors	Dimensions, weight
Attenuators	**DNF** 272.4010.50	50 Ω	2 W[1]	3 dB	0 to 12.4 GHz	≤1.1 (up to 4 GHz) ≤1.2 (up to 10 GHz) ≤1.25 (up to 12.4 GHz)	N ± 0.3 dB up to 8 GHz[2] N ± 0.5 dB up to 12.4 GHz[2]		N male, N female	20.5 mm ∅ x 55 mm, 69 kg
	DNF 272.4110.50			6 dB						
	DNF 272.4210.50		1 W[1]	10 dB			N ± 0.3 dB up to 8 GHz[2] N ± 0.6 dB up to 12.4 GHz[2]			
	DNF 272.4310.50			20 dB			N ± 0.5 dB up to 4 GHz[2] N ± 0.6 dB up to 8 GHz[2] N ± 0.8 dB up to 12.4 GHz[2]			
	DNF 272.4410.50			30 dB			N ± 1 dB up to 12.4 GHz[2]			
High-power Attenuators	**RBU 50** 1073.8895.03	50 Ω	50 W[3]	3 dB	0 to 2 GHz	≤1.1	N ± 0.5 dB[4]	5 kW/5 µs	N male, N female to MIL-STD 348A	180 mm x 77 mm x 90 mm, 0.8 kg
	RBU 50 1073.8895.06			6 dB						
	RBU 50 1073.8895.10			10 dB						
	RBU 50 1073.8895.20			20 dB						
	RBU 50 1073.8895.30			30 dB						
	RBU 100 1073.8820.03	50 Ω	100 W[5]	3 dB	0 to 2 GHz	≤1.1	N ± 0.5 dB up to 1.5 GHz[4] N ± 0.75 dB up to 2 GHz[4]	5 kW/5 µs	N male, N female to MIL-STD 348A	236 mm x 140 mm x 141 mm, 2.8 kg
	RBU 100 1073.8820.06			6 dB						
	RBU 100 1073.8820.10			10 dB						
	RBU 100 1073.8820.20			20 dB						
	RBU 100 1073.8820.30			30 dB						
	RDL50 1035.1700.52	50 Ω	50 W (input), 10 W (output)[1]	20 dB	0 to 6 GHz	≤1.15 (up to 2 MHz) ≤1.25 (up to 6 MHz)	N ± 0.5 dB	2 kW/5 µs	N male, N female	114 mm x 89 mm x 68 mm, 0,5 kg
	RBS 1000 207.4010.55	50 Ω	1000 W see Fig. on p. 3	40 dB	0 to 0.4 (1) GHz see Fig. on p. 3	≤1.2 input	N ± 1 dB[6]	10 kW/1 µs	N female	500 mm x 285 mm x 152 mm, 12 kg

	Type Order No.	Characteristic impedance	Power rating	Nominal attenuation	Frequency range	VSWR	Attenuation (N=nominal value)	Max. peak pulse voltage	Connectors	Dimensions, weight
Terminations	**RNA** 272.4510.50	50 Ω ± 1%	1 W[1]		0 to 18 GHz	≤1.02 (up to 1 GHz) ≤1.02 + 0.004 f/GHz			N male	21 mm ∅ x 46 mm, 36 g
	RNA 1028.4994.72	75 Ω	1 W[1]		0 to 3 GHz	≤1.02			N male	21 mm ∅ x 46 mm, 65 g
	RNB 272.4910.50	50 Ω	1 W[1], 2 W peak		0 to 4 GHz	≤1.05 (up to 1 GHz) ≤1.1 (up to 2 GHz) ≤1.2 (up to 4 GHz)			N male	20.5 mm ∅ x 35 mm, 36 g
	RMF 100.2927.50	50 Ω	500 mW		0 to 30 MHz	≤1.02 (up to 10 MHz) ≤1.04 (up to 15 MHz) ≤1.06 (up to 30 MHz)			BNC male	16 mm ∅ x 55 mm, 25 g
	RMF 100.2927.70	75 Ω								
	RMF75 2060.8000.02	75 Ω ± 0.02%	125 mW		0 to 30 MHz	<1.01	Return loss: 0 to 10 MHz >56 dB 10 to 30 MHz >40 dB		BNC male	14.5 mm ∅ x 23 mm, 15 g
	RAU 200.0019.55	50 Ω	100 W[7]		0 to 2 GHz	≤1.05 (0 to 1 GHz) ≤1.1 (1 to 1.5 GHz) ≤1.4 (1.5 to 2 GHz)		2 kV	N female	95 mm x 152 mm x 235 mm, 2 kg
Feedthrough Termination	**RAD** 289.8966.00	50 Ω	500 mW[8]		0 to 1 GHz	≤1.05 (up to 0.1 GHz)[9] ≤1.1 (up to 0.5 GHz) ≤1.2 (up to 1 GHz)			BNC male, BNC female	14.5 mm ∅ x 50.5 mm, 22 g
	RAD50 844.9352.02	50 Ω ± 0.1%	2 W[8]		0 to 500 MHz	≤1.1 (up to 0,2 GHz)[9] ≤1.25 (up to 0,5 GHz)[9]			BNC male, BNC female	15.3 mm ∅ x 50.5 mm, 22 g
	RAD600 844.9452.02	600 Ω ± 0.1%			0 to 10 MHz					
Matching Pads	**RAM** 358.5414.02	50 Ω → 75 Ω	2 W[10]	5.72 dB	0 to 2.7 GHz	≤1.06 (up to 2 GHz) ≤1.2 (up to 2.7 GHz), both terminals	5.72 + 0.15/–0.05 dB		N male, N female at 75-Ω end	21 mm ∅ x 73 mm, 105 g
	RAZ 358.5714.02			1.76 dB		≤1.06 (up to 2 GHz) ≤1.2 (up to 2.7 GHz), at 75-Ω end	1.76 ± 0.2 dB			

1) At a max. ambient temperature of 30°C; decreasing linearly to 0 W at 130°C.
2) Attenuation change at a temperature change of 1 K: ≤0.0001 dB/dB. At a load change of 1 W: ≤0.001 dB/dB.
3) Input overload capacity up to 150 W at 20°C ambient temperature (max. 10 min); output overload capacity up to 20 W.
4) Attenuation change at a temperature change of 1 K: ≤0.0001 dB/dB. At a load change of 1 W: ≤0.0004 dB/dB.
5) Input overload capacity up to 250 W at 20°C ambient temperature (max. 10 min); output overload capacity up to 20 W.
6) The frequency response of the attenuation is specified on a label on RBS1000 with a measurement accuracy of 0.1 dB.
7) Overload capacity 100% (max. 5 s).
8) Continuous power rating up to a maximum ambient temperature of 70°C; decreasing linearly to 0 W at 130°C.
9) Measured with open-circuit output.
10) Ambient temperature 25°C.

Certified Quality System
ISO 9001
DQS REG. NO 1954-04

Fax Reply (Attenuators, ...)

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❑ **I would like a demo**

❑ **Please call me**

❑ **I would like to receive your free-of-charge CD-ROM catalog**
(including Test&Measurement Products +
Sound and TV Broadcasting)

Others: ______________________________
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Name: ______________________________
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