

Programmable Attenuator

RCDAT-6000-110

50Ω 0 – 110 dB, 0.25 dB step 1 to 6000 MHz

The Big Deal

- Wide Attenuation range, 110 dB
- Fine attenuation resolution, 0.25 dB
- High speed attenuation switching (650 ns)
- Compact size, 2.5 x 3.0 x 0.85"
- **USB and Ethernet** control



Installation CD

Case Style: MS1897

Product Overview

Mini-Circuits' RCDAT-6000-110 is a general purpose programmable RF attenuator supporting frequencies from 1 to 6000 MHz with attenuation from 0 to 110 dB in 0.25 dB steps. Its unique design maintains linear attenuation change per dB, even at the highest attenuation settings. The attenuator is controlled via USB or Ethernet-TCP/IP connections and supports both HTTP and Telnet network protocols. It comes housed in a rugged, shielded metal case with input/output SMA(F) RF ports (input/output ports are interchangeable), a standard Ethernet port, and a USB type Mini-B power and control port.

The RCDAT-6000-110 is supplied with our easy-to-install, user-friendly GUI software, API objects for Windows® environments, and complete programming instructions for 32 and 64 bit Windows® and Linux® operating systems. See p. 8 for a complete list of included accessories.

Key Features

Feature	Advantages
Ethernet control	The RCDAT-6000-110 can be controlled from any Windows® or Linux® computer with a network connection using either HTTP or Telnet protocols, giving the user layout flexibility and freedom to operate a test setup remotely from almost anywhere.
USB control	The user may also control the RCDAT-6000-110 via USB connection. The device draws all power requirements through the USB port.
Programmable attenuation sweep and Hop sequences	The RCDAT-6000-110 can be programmed with a timed sequence of attenuation settings, to run without any additional external control.
Plug-and-Play – no additional device drivers required.	Fast and easy setup and installation. The RCDAT-6000-110 interfaces with various third-party software, making it easy to integrate into existing setups.
110 dB attenuation range.	The RCDAT-6000-110 provides high-accuracy attenuation up to 110 dB in 0.25 dB steps, allowing the user precise level control over a broad attenuation and frequency range.
High linearity	Typical input IP3 of +53 dBm up to 6000 MHz.

Trademarks: Windows is a registered trademark of Microsoft Corporation in the United States and other countries. Linux is a registered trademark of Linus Torvalds. Mac is a registered trademark of Apple Corporation. Pentium is a registered trademark of Intel Corporation. Neither Mini-Circuits nor the Mini-Circuits RCDAT-series attenuators are affiliated with or endorsed by the owners of the above referenced trademarks.

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Programmable Attenuator

RCDAT-6000-110

50Ω 0 – 110 dB, 0.25 dB step 1 to 6000 MHz

Features

- USB and Ethernet control (HTTP and Telnet)
- Very good attenuation accuracy, ± 0.45 dB typ.
- High speed attenuation switching (650 ns)
- Sweep and Hop attenuation sequences
- Extremely low leakage
- Interchangeable Input/Output ports
- Plug & Play device – no drivers required
- User-friendly Windows® Graphical User Interface
- Supports a wide range of programming environments
(See application note [AN-49-001](#) for details)
- Optional mounting bracket, see page 5

Applications

- Automated Test Equipment (ATE)
- WiMAX, 3G, 4G, LTE, DVB Fading Simulators
- Laboratory Instrumentation
- Production Test
- Handover system Evaluation
- Power level cycling



Installation CD

Case Style: MS1897

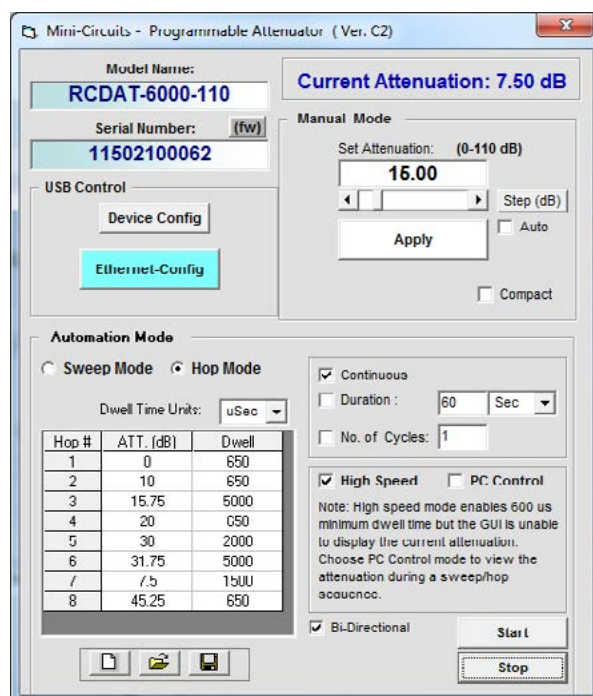
Included Accessories

Model No.	Description	Qty.
USB-AC/DC-5	AC/DC 5V adapter	1
MUSB-CBL-3+	2.6 ft. USB cable	1
PC-DAT-CD	Software Installation CD	1

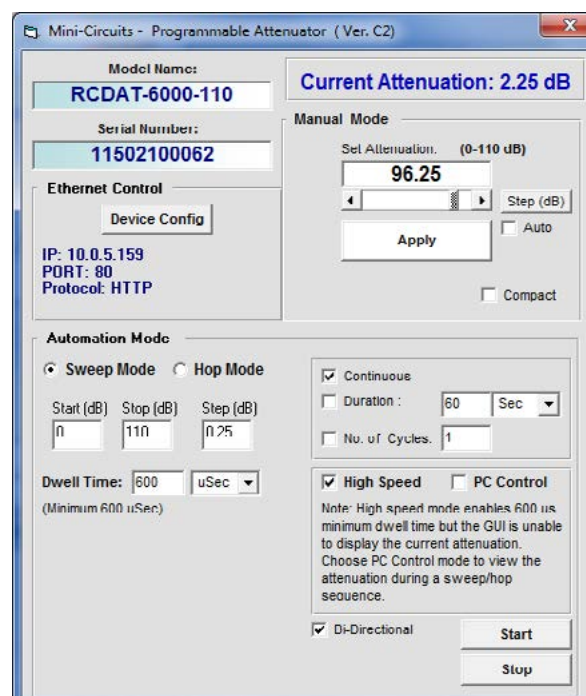
RoHS Compliant

See our web site for RoHS Compliance methodologies and qualifications

Mini-Circuits Graphical User Interface for RCDAT-Series Programmable Attenuator



RCDAT GUI screen (USB control, Hop mode)



RCDAT GUI screen (Ethernet control, Sweep mode)

For programming instructions, see [programming guide](#) on Mini-Circuits' website.



www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

Electrical Specifications ¹ at 0°C to 50°C

Parameter	Frequency range	Conditions	Min.	Typ.	Max.	Units
Attenuation range	1 - 6000 MHz	0.25 dB step	0	–	110	dB
Attenuation accuracy ²	1 - 2000 MHz	@ 0.25 - 10 dB	–	±0.15	±(0.25+8% of nominal value)	dB
		@ 10.25 - 40 dB	–	±0.55	±(0.4+5% of nominal value)	
		@ 40.25 - 90 dB	–	±0.50	±(0.8+2% of nominal value)	
		@ 90.25 - 110 dB	–	±0.70	±(-1.3+4% of nominal value)	
	2000 - 4000 MHz	@ 0.25 - 10 dB	–	±0.15	±(0.2+6% of nominal value)	
		@ 10.25 - 40 dB	–	±0.50	±(0.8+3% of nominal value)	
		@ 40.25 - 90 dB	–	±0.25	±(1.1+1% of nominal value)	
		@ 90.25 - 110 dB	–	±0.35	±(-1.2+3.5% of nominal value)	
	4000 - 6000 MHz	@ 0.25 - 10 dB	–	±0.10	±(0.2+6% of nominal value)	
		@ 10.25 - 40 dB	–	±0.40	±(0.55+5% of nominal value)	
		@ 40.25 - 90 dB	–	±0.60	±(1.7+1% of nominal value)	
		@ 90.25 - 110 dB	–	±0.80	±(-1.1+4% of nominal value)	
Insertion Loss	1 - 2000 MHz	@ 0 dB	–	6.5	8.5	dB
	2000 - 4000 MHz		–	9.0	10.5	
	4000 - 6000 MHz		–	9.5	11.5	
Isolation In-Out	1 - 6000 MHz	Note 3	–	124	–	dB
Input operating power ⁴ (RF In and RF Out out ports)	1 - 10 MHz	@ 0 - 110 dB	–	–	+10	dBm
	10 - 6000 MHz		–	–	+20	
IP3 Input ⁵	1 - 3000 MHz	@ 0 dB setting (P _{IN} =+10 dBm)	–	+53	–	dBm
	3000 - 6000 MHz		–	+51	–	
VSWR	1 - 500 MHz	@ 0 - 20 dB	–	1.30	–	:1
		@ 20.25 - 110 dB	–	1.05	–	
	500 - 4000 MHz	@ 0 - 20 dB	–	1.10	–	
		@ 20.25 - 110 dB	–	1.05	–	
	4000 - 6000 MHz	@ 0 - 20 dB	–	1.30	–	
		@ 20.25 - 110 dB	–	1.15	–	
Switching Speed	–	Note 6	–	650	–	nSec
Min Dwell Time	1 - 6000 MHz	High speed mode	–	600	–	µsec
Supply Voltage	–	via USB port	4.75	5	5.25	V
USB current draw	–		–	190	250	mA
Ethernet communication	Supports both Telnet and HTTP protocols over TCP/IP with dynamic(DHCP) or static IP					

¹ Attenuator RF ports are interchangeable, and support simultaneous, bidirectional signal transmission, however the specifications are guaranteed for the RF in and RF out as noted on the label. There may be minor changes in performance when injecting signals to the RF Out port.

² Max accuracy defined as ±[absolute error+% of attenuation setting] for example when setting the attenuator to 100 dB attenuation the maximum error at 5000 MHz will be: ±(-1.1+0.04x100)= ±(-1.1+4)= ± 2.9 dB

³ Isolation is defined as max attenuation plus insertion loss; this is the path loss through the attenuator when initially powered up. After a brief delay (~0.5 sec typically) the attenuator will revert to a user defined "power-up" state (either max attenuation or a pre-set value).

⁴ Total operating input power from both RF In and RF Out out ports. Compression level not noted as it exceeds max safe operating power level.

⁵ Tested with 1 MHz span between signals.

⁶ Switching speed specified without communication delays, USB communication delays (in PC Control mode) on the order of 3.5 msec.

Absolute Maximum Ratings

Operating Temperature	0°C to 50°C	
Storage Temperature	-20°C to 85°C	
V _{USB} Max.	6V	
Total RF power for RF In & RF Out	@ 10 to 6000 MHz	+23 dBm
	@ 1 to 10 MHz	+13 dBm

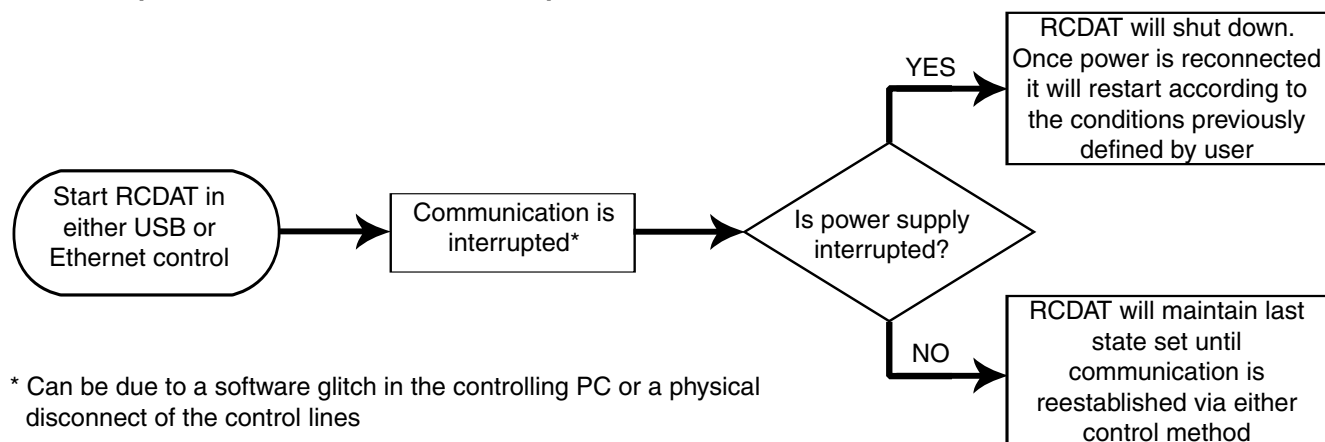
Permanent damage may occur if any of these limits are exceeded. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

Minimum System Requirements

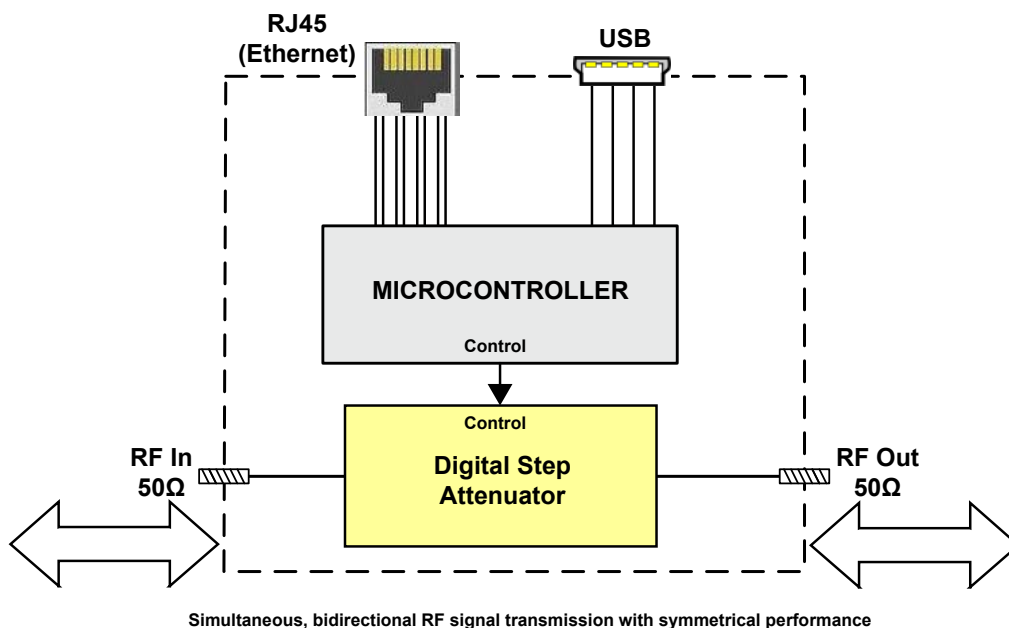
Interface	USB HID or HTTP Get/Post or Telnet protocols
Host operating system - USB Control	Windows 32/64 Bit operating system: Windows 98®, Windows XP®, Windows Vista®, Windows 7®, Windows 8® Linux® support: 32/64 Bit operating system
Host operating system - Ethernet Control	Any Windows®, Mac®, or Linux® computer with a network port and Ethernet-TCP/IP (HTTP or Telnet protocols) support
Hardware	Pentium® II or better



RCDAT response to communication interrupt



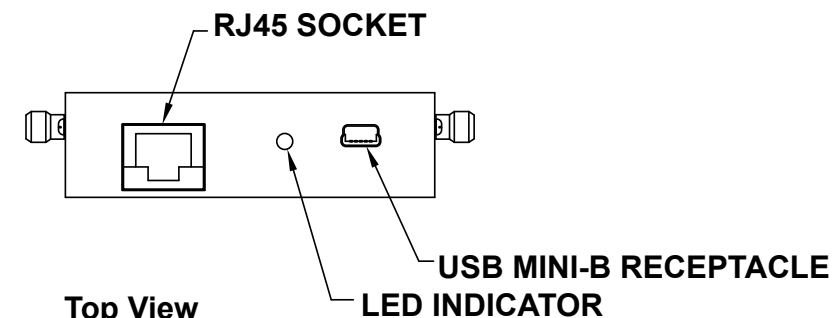
Block Diagram



Connections

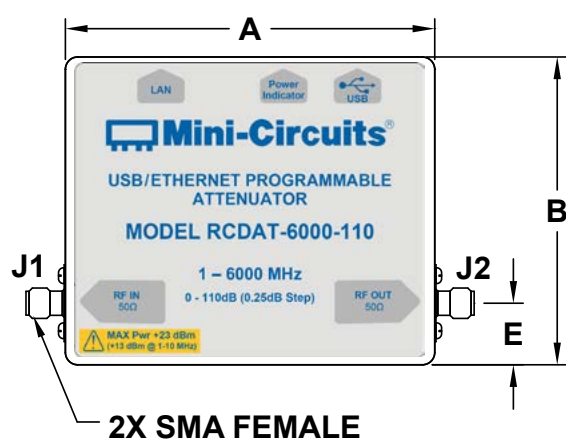
RF In	(SMA female)
RF Out	(SMA female)
USB	(USB type Mini-B female)
Network (Ethernet/LAN)	(RJ45 socket)

Outline Drawing (MS1897)

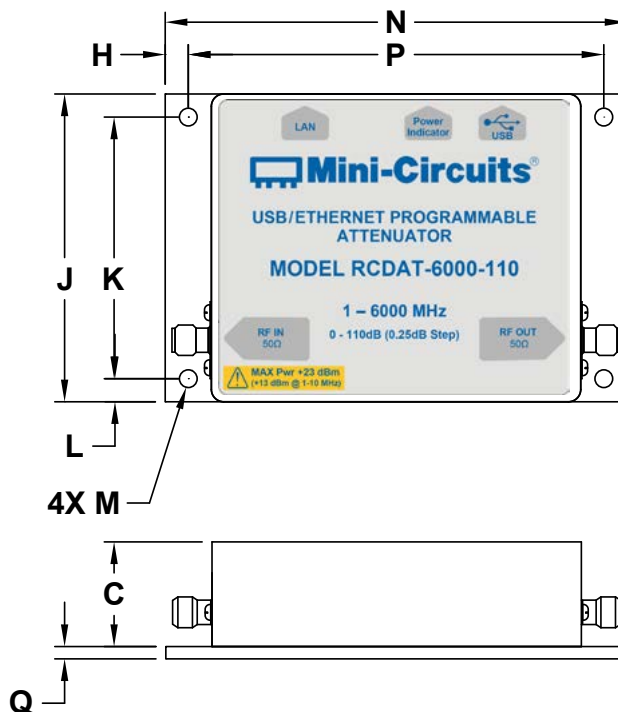


Connections

RF IN	(SMA female)
RF OUT	(SMA female)
USB	(USB type Mini-B female)
Network (Ethernet/LAN)	(RJ45 socket)



Bracket Option



Instruction for mounting bracket:

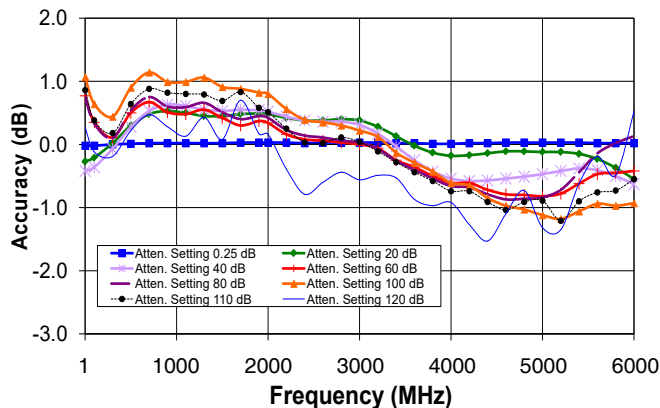
1. Tool required: Phillips head screwdriver
2. Mount the bracket over threaded holes on the bottom side with the fasteners provided with the bracket.

Outline Dimensions (inch mm)

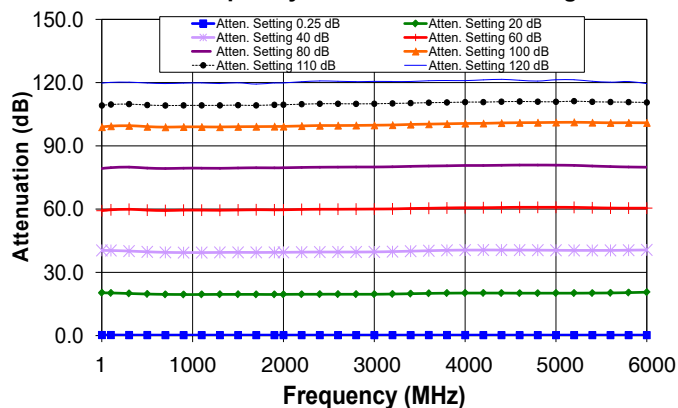
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	WT. GRAMS
3.00	2.50	0.85	0.28	0.50	2.200	2.700	0.188	2.50	2.125	0.188	0.144	3.75	3.375	0.100	200
76.2	63.5	21.6	7.1	12.7	55.88	68.58	4.76	63.5	53.98	4.76	3.66	95.3	85.72	2.54	

Typical Performance Curves

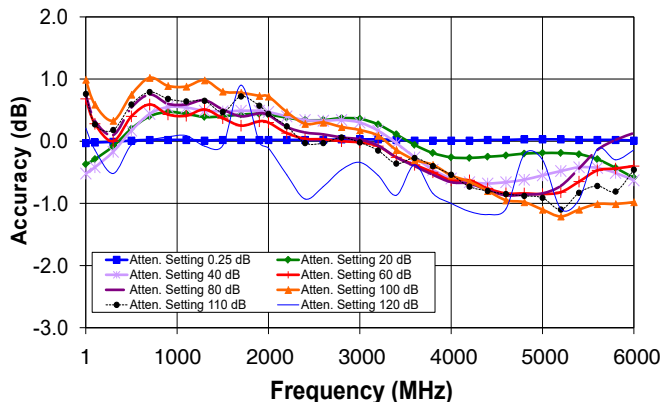
**Attenuation Accuracy @ +25°C
vs. Frequency over Attenuation settings**



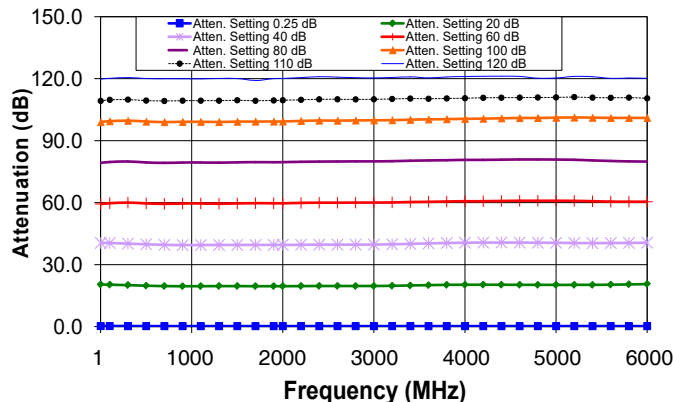
**Attenuation relative to Insertion Loss @ +25°C
vs. Frequency over Attenuation settings**



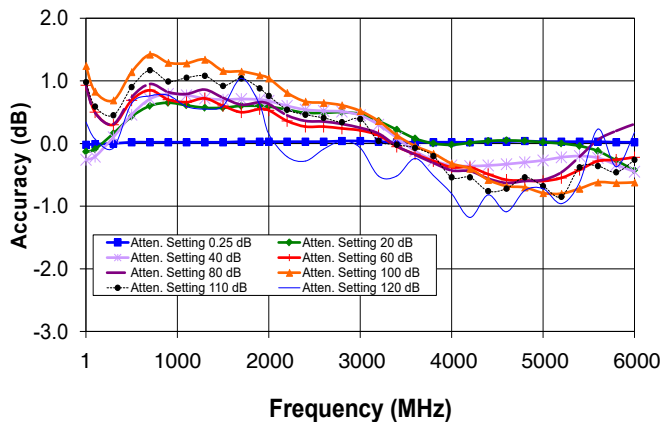
**Attenuation Accuracy @ 0°C
vs. Frequency over Attenuation settings**



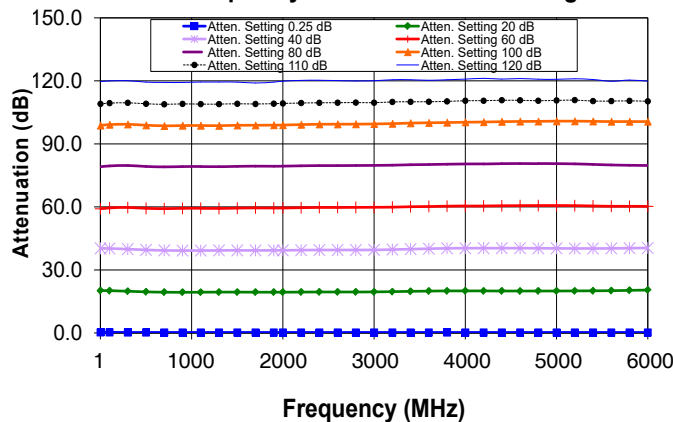
**Attenuation relative to Insertion Loss @ 0°C
vs. Frequency over Attenuation settings**



**Attenuation Accuracy @ +50°C
vs. Frequency over Attenuation settings**

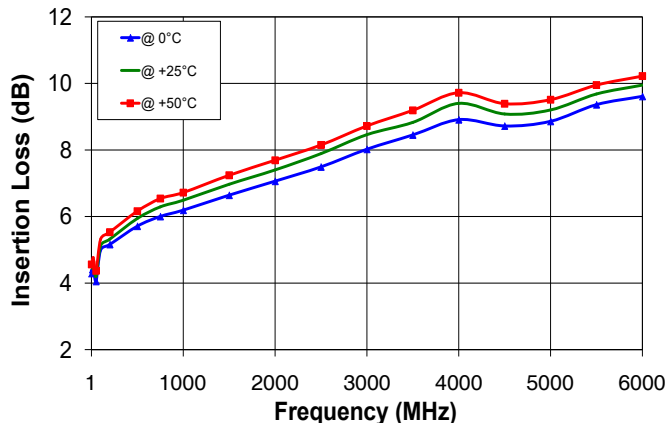


**Attenuation relative to Insertion Loss @ +50°C
vs. Frequency over Attenuation settings**

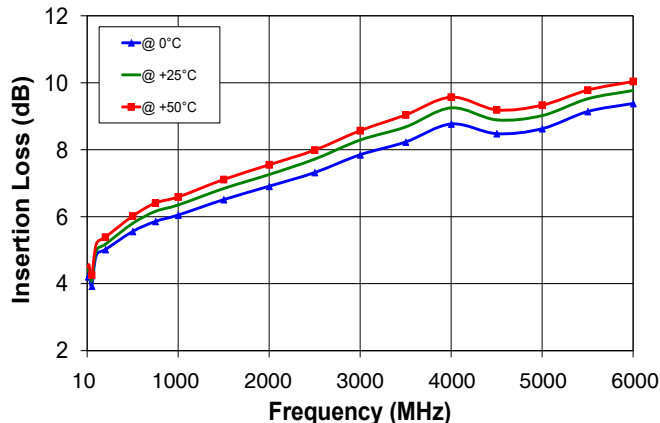


Typical Performance Curves (Continued)

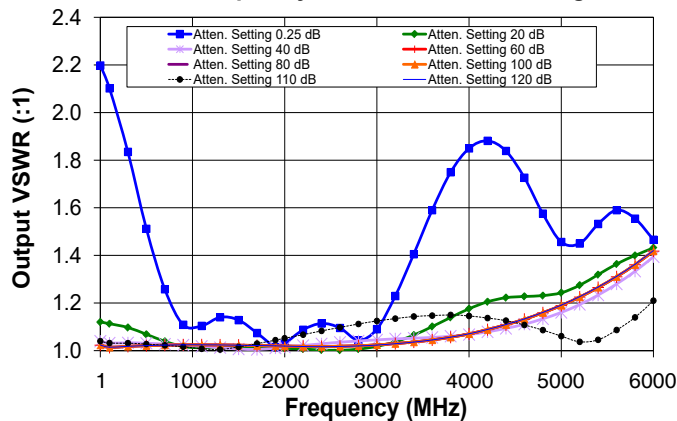
**Insertion Loss @ Input Power 0dBm
vs. Frequency over Temperatures**



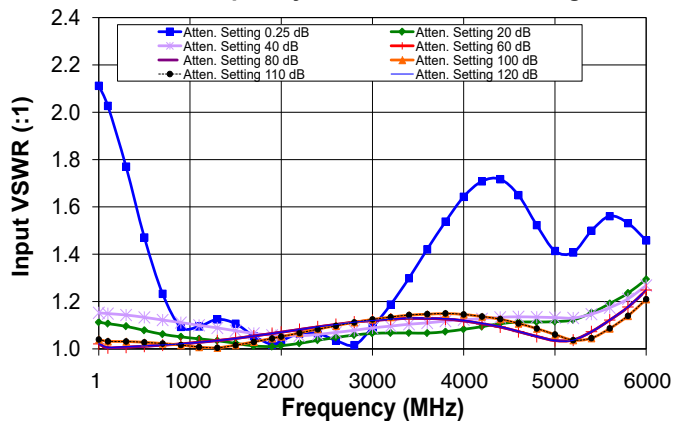
**Insertion Loss @ Input Power +20 dBm
vs. Frequency over Temperatures**



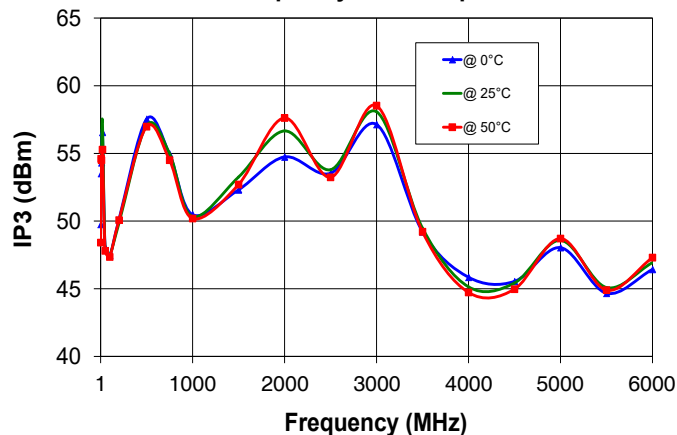
**Output VSWR @ +25°C
vs. Frequency over Attenuation settings**



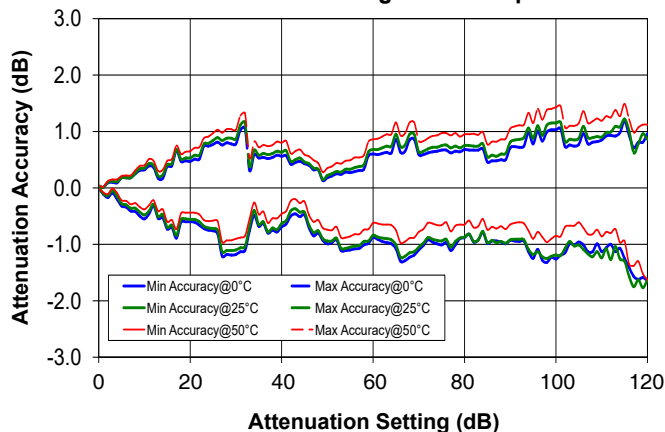
**Input VSWR @ +25°C
vs. Frequency over Attenuation settings**



**Input IP3 @ 0dB Attenuation
vs. Frequency over Temperatures**



**Typical Attenuation Accuracy
vs. Attenuation settings over Temperature**



Ordering Information

Model	Description
RCDAT-6000-110	USB/Ethernet Programmable Attenuator

Included Accessories	Part No.	Description
	USB-AC/DC-5+	AC/DC Power Adapter with US, EU, IL, UK, AUS, and China two pin power plugs ^{7,8} . Operating temperature: 0°C to +45°C, AC Input: 100-240V, 47-63 Hz, DC Output 5±0.25 V, I _{Max} =1A
	PC-DAT-CD	Software CD
	MUSB-CBL-3+	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)

⁷ The USB-AC/DC-5 may be used to provide the 5V_{DC} power input via USB port if operating the RCDAT with Ethernet control. Not required if using USB control.

⁸ Power plugs for other countries are also available, if you need a power plug for a country not listed in the table please contact apps@minicircuits.com or check <http://www.minicircuits.com/contact/offices.html> for regional offices e-mail and phone numbers.

Optional Accessories	Description
USB-AC/DC-5 (spare)	AC/DC 5V _{DC} Power Adapter with US, EU, IL, UK, AUS, and China power plugs
MUSB-CBL-3+ (spare)	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)
MUSB-CBL-7+	6.6 ft (2.0 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)
BKT-66-02+	Bracket kit including 3.75" x 2.50" bracket, mounting screws and washers

Additional Notes

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

