USB / Ethernet

Programmable Attenuator RC4DAT-6G-60

50Ω 0 – 63 dB, 0.25 dB step 1 to 6000 MHz

The Big Deal

- Four independently programmable channels
- Wide attenuation range, 63 dB
- Fine attenuation resolution, 0.25 dB
- Short attenuation transition time (650 ns)
- Compact size, 5.17 x 3.00 x 0.85”
- **USB** *and* **Ethernet** control

Software Package Case Style: QE2249

Product Overview

Mini-Circuits’ RC4DAT-6G-60 is a 4-channel programmable attenuator suitable for a wide range of signal level control applications from 1 MHz to 6 GHz. Each independently controlled channel provides 0 to 63 dB attenuation in 0.25 dB steps with more than 100 dB isolation between channels. Its unique design maintains linear attenuation change per dB, even at the highest attenuation settings.
All 4 bi-directional RF channels are housed in a single, compact and rugged package with SMA female connectors on all RF ports, a standard Ethernet port (RJ45) and a USB type Mini-B power and control port.

The attenuator can be controlled via USB or Ethernet (supporting both HTTP and Telnet network protocols). Full software support is provided and can be downloaded from our website any time at **http://www.minicircuits.com/softwaredownload/patt.html**. The package includes our user-friendly GUI application for Windows® and a full API with programming instructions for Windows® and Linux® environments (both 32-bit and 64-bit systems).

Key Features

Feature	Advantages
Ethernet control	The RC4DAT-6G-60 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 RC4DAT-6G-60 via USB connection. The device draws all power requirements through the USB port.
Programmable attenuation sweep and Hop sequences	The RC4DAT-6G-60 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 RC4DAT-6G-60 interfaces with various third-party software, making it easy to integrate into existing setups.
63 dB attenuation range.	The RC4DAT-6G-60 provides high-accuracy attenuation up to 63 dB, 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

USB / Ethernet

Programmable Attenuator

RC4DAT-6G-60

50Ω 0 – 63 dB, 0.25 dB step 1 to 6000 MHz

Features

- Four independently programmable channels
- USB and Ethernet control (HTTP and Telnet)
- Very good attenuation accuracy, ±0.6 dB typ.
- Short attenuation transition time (650 ns)
- Extremely low leakage
- Plug & Play device – no drivers required
- Supports a wide range of programming environments (See application note **AN-49-001** for details)

Software Package Case Style: QE2249

Included Accessories

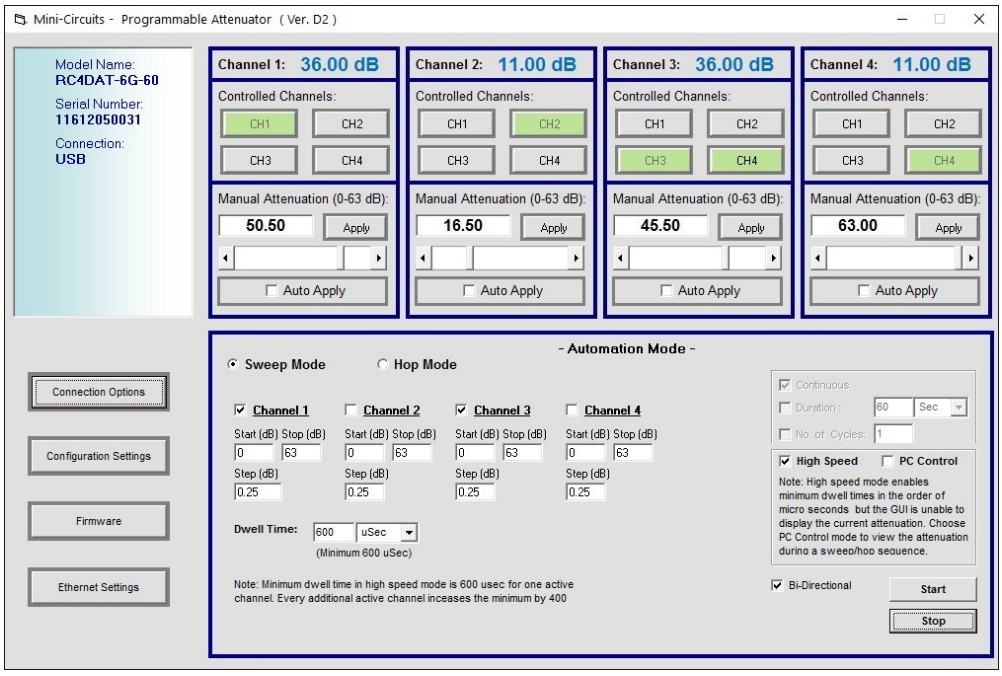
Model No.	Description	Qty.
USB-AC/DC-5	AC/DC 5V adapter	1
MUSB-CBL-3+	2.6 ft. USB cable	1

Applications

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

RoHS Compliant
See our web site for RoHS Compliance methodologies and qualifications

Mini-Circuits Graphical User Interface for RC4DAT-Series Programmable Attenuator



RC4DAT GUI screen in Sweep mode (USB control)

For programming instructions, see **programming guide** on Mini-Circuits' website.

Electrical Specifications [1,2] at 0°C to 50°C

Parameter	Frequency range	Conditions	Min.	Typ.	Max.	Units
Attenuation range	1 - 6000 MHz	0.25 dB step	0	–	63	dB
Attenuation accuracy [3]	1 - 2000 MHz	@ 0.25 - 20 dB	–	±0.25	±(0.45+4.5% of nominal value)	dB
		@ 20.25 - 63 dB	–	±0.85	±(0.75+2% of nominal value)	
	2000 - 4000 MHz	@ 0.25 - 20 dB	–	±0.35	±(0.45+4.5% of nominal value)	
		@ 20.25 - 63 dB	–	±0.70	±(0.85+1.5% of nominal value)	
	4000 - 6000 MHz	@ 0.25 - 20 dB	–	±0.25	±(0.5+4.5% of nominal value)	
		@ 20.25 - 63 dB	–	±0.55	±(0.7+2.5% of nominal value)	
Insertion Loss	1 - 2000 MHz	@ 0 dB	–	3.0	5.0	dB
	2000 - 4000 MHz		–	4.7	6.5	
	4000 - 6000 MHz		–	6.2	7.5	
Isolation In - Out (within a channel)	1 - 6000 MHz	Note 4	–	67	–	dB
Isolation (between channels)	1 - 6000 MHz	@ 0 - 63 dB	100	–	–	
Input operating power [5] (RF In and RF Out out ports)	1 - 10 MHz	@ 0 - 63 dB	–	–	Note 6	dBm
	10 - 6000 MHz		–	–	+23	
IP3 Input [7]	1 - 3000 MHz	@ 0 dB setting (P_{IN}=+5 dBm)	–	+53	–	dBm
	3000 - 6000 MHz		–	+51	–	
VSWR	1 - 4000 MHz	@ 0 - 63 dB	–	1.25	–	:1
	4000 - 6000 MHz		–	1.40	–	
Min Dwell Time per channel [8]	1 - 6000 MHz	High speed mode	–	600	–	µsec
Channel Synchronization [9]	1 - 6000 MHz	–	–	400	–	µsec
Attenuation Transition Time [10]	–	via USB port	–	650	–	nsec
Supply Voltage	–	–	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] RF performance specified per channel, performance of all four channels is identical.
[3] Max accuracy defined as ±[absolute error+% of attenuation setting] for example when setting the attenuator to 55 dB attenuation the maximum error at 5000 MHz will be: ±(0.7+0.025x55)= ±(0.7+1.375)= ± 2.075 dB
[4] Isolation In-Out 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).
[5] Total operating input power per channel from both RF In and RF Out out ports. Compression level not noted as it exceeds max safe operating power level.
[6] Derate linearly from +23 dBm at 50 MHz to +9 dBm at 1 MHz.
[7] Tested with 1 MHz span between signals.
[8] Minimum Dwell Time is the time the RC4DAT will take to respond to a command to change attenuation states in a channel without communication delays. In PC control add communication delays (on the order of msec for USB) to get actual response time.
[9] Channel Synchronization is the delay between the first and last attenuator transitions beginning, in response to a command to set all channels.
[10] Attenuation Transition Time is specified as the time between starting to change the attenuation state and settling on the requested attenuation state.

Absolute Maximum Ratings

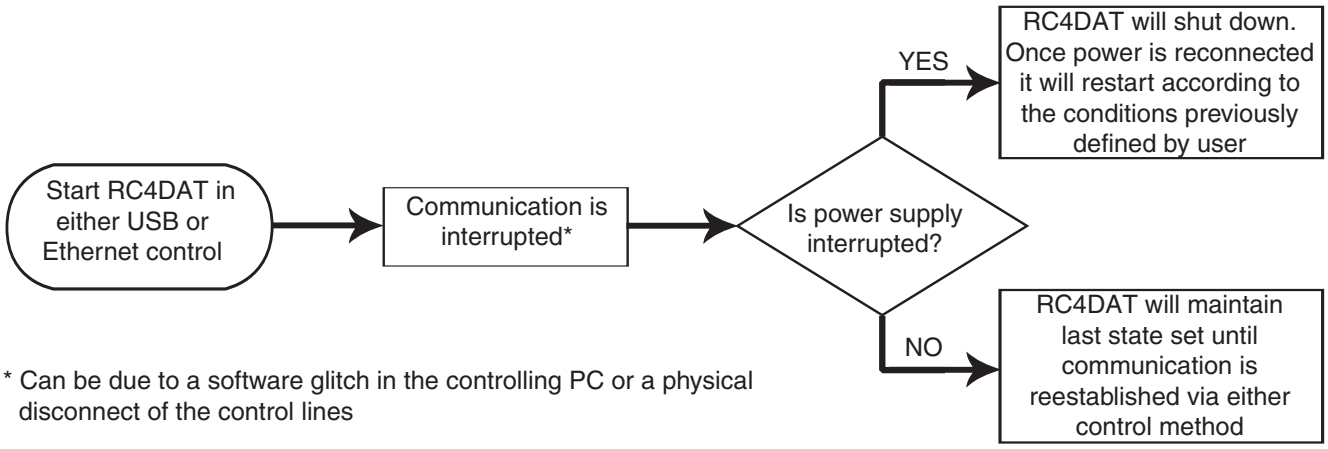
Operating Temperature		0°C to 50°C
Storage Temperature		-20°C to 85°C
V_{USB} Max.		6V
Total RF power for RF In & RF Out	@ 1 to 50 MHz	Derate linearly from +12 dBm@ 1 MHz to +26 dBm@50 MHz
	@ 50 to 6000 MHz	+26 dBm

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

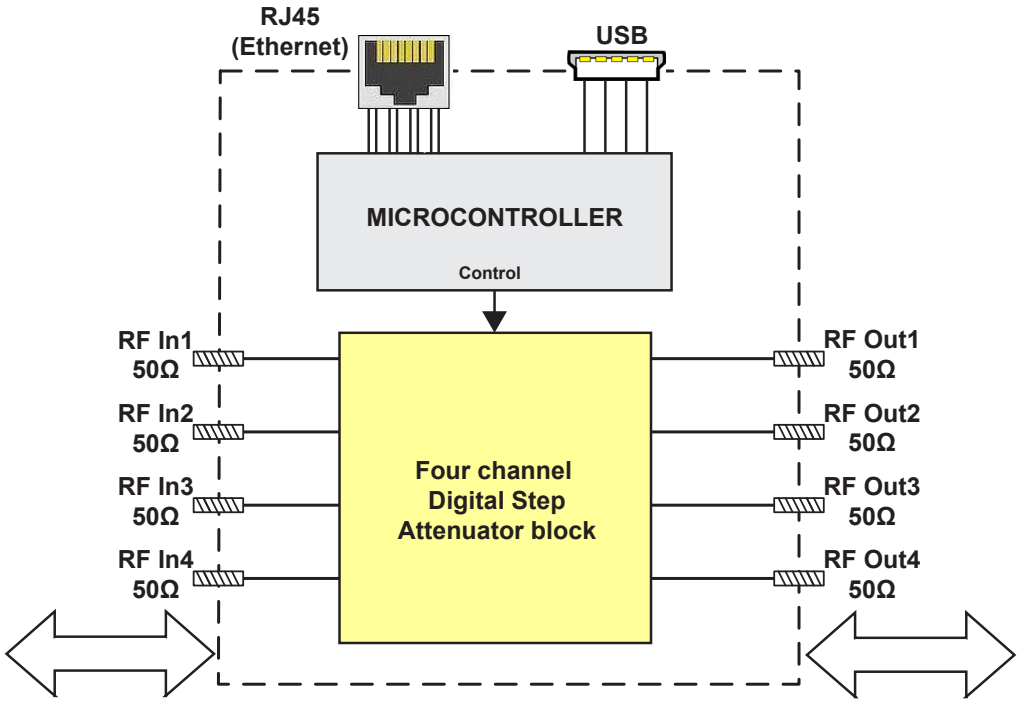
Interface	USB HID or HTTP Get/Post or Telnet protocols
Host operating system - USB Control	**Windows 32/64 Bit operating system:** Windows 98®, Windows XP®, Windows Vista®, Windows 7®, Windows 8®, Windows 10 ® **Linux® support:** 32/64 Bit operating system
Host operating system - Ethernet Control	Any Windows®, Mac®, or Linux® computer with a network port and Ethernet-TCP/IP (HTTP or Telnet protocols) support
Hardware	Pentium® II or better

RC4DAT response to communication interrupt



* Can be due to a software glitch in the controlling PC or a physical disconnect of the control lines

Block Diagram



Simultaneous, bidirectional RF signal transmission with symmetrical performance

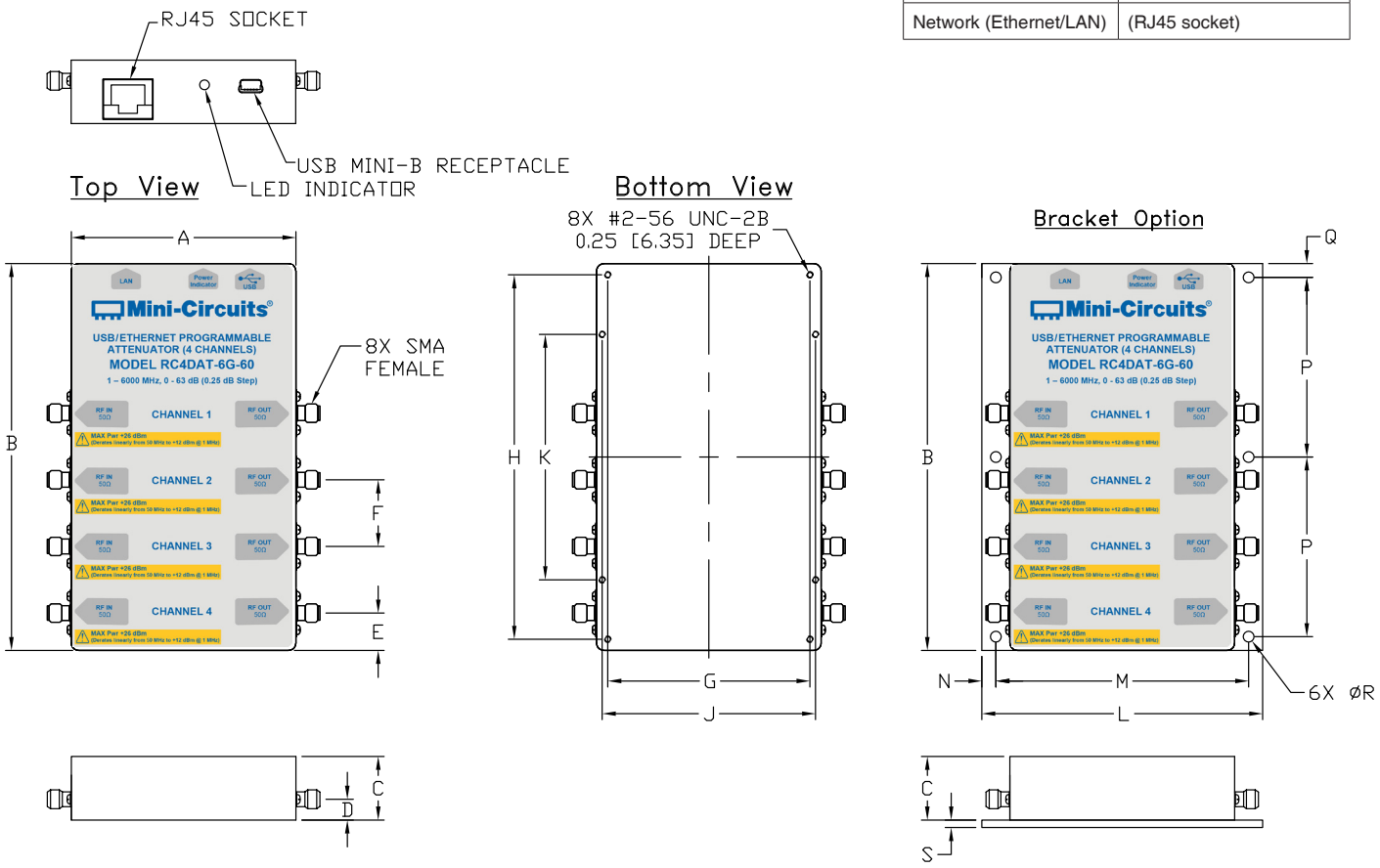
Connections

RF In 1,2,3,4	(SMA female)
RF Out 1,2,3,4	(SMA female)
USB	(USB type Mini-B female)
Network (Ethernet/LAN)	(RJ45 socket)

Outline Drawing (QE2249)

Connections

RF IN 1, 2, ,3, 4	(SMA female)
RF OUT 1, 2, ,3, 4	(SMA female)
USB	(USB type Mini-B female)
Network (Ethernet/LAN)	(RJ45 socket)



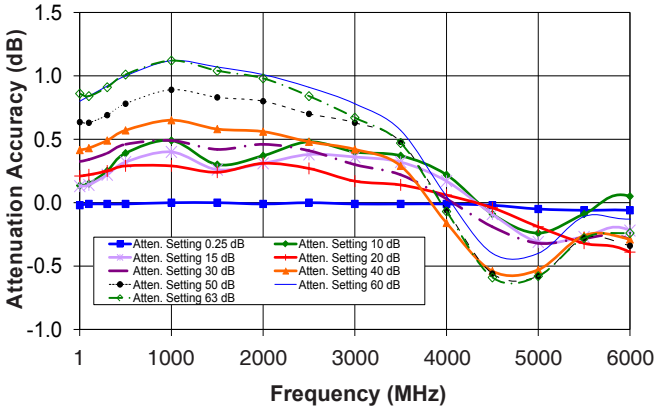
Instruction for mounting bracket:
1. Tool required: Phillips head screwdriver
2. Mount the bracket over threaded holes on the bottom side with the fasteners provided with the bracket.

Outline Dimensions (inch / mm)

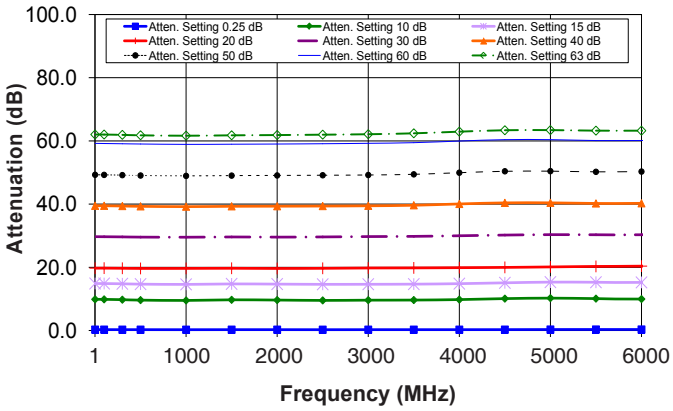
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	WT. GRAMS
3.00 76.2	**5.17** 131.3	**0.85** 21.6	**0.28** 7.1	**0.50** 12.7	**0.89** 22.6	**2.700** 68.58	**4.870** 123.7	**2.850** 72.39	**3.280** 83.31	**3.75** 95.25	**3.375** 85.72	**0.188** 4.76	**2.400** 60.96	**0.185** 4.70	**0.144** 3.66	**0.100** 2.54	**0.185** 4.70	400

Typical Performance Curves in a given channel

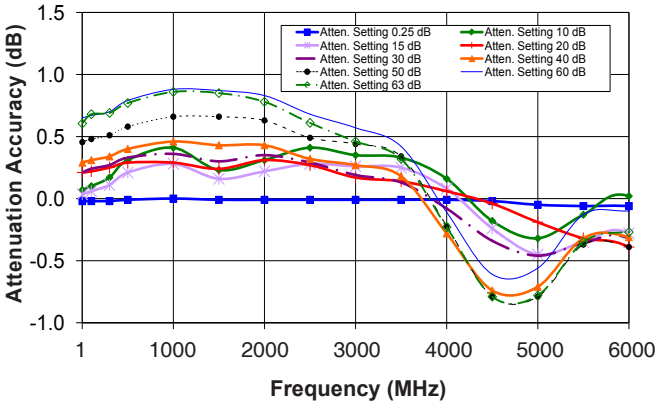
Attenuation Accuracy @ +25°C vs. Frequency over Attenuation settings



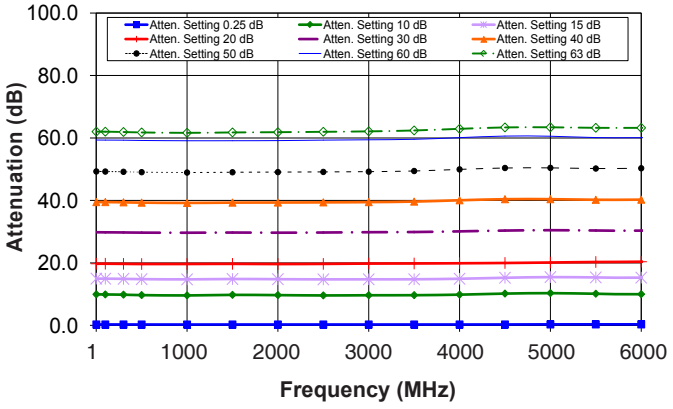
Attenuation relative to Insertion Loss @ +25°C vs. Frequency over Attenuation settings



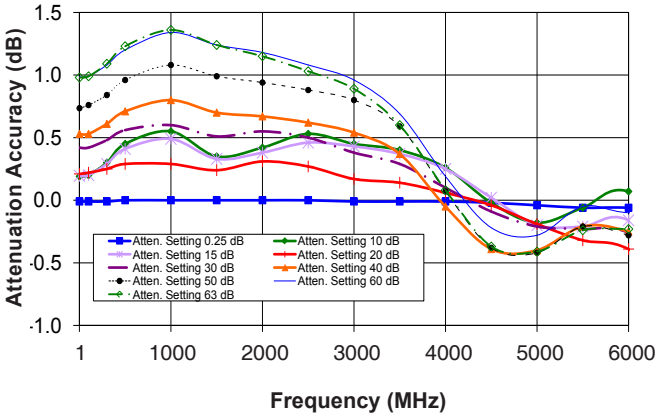
Attenuation Accuracy @ 0°C vs. Frequency over Attenuation settings



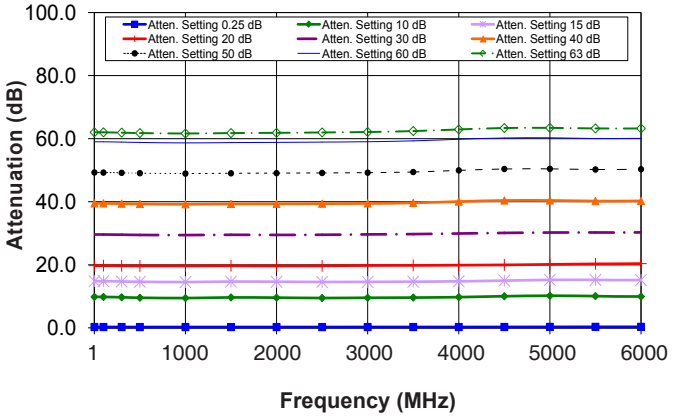
Attenuation relative to Insertion Loss @ 0°C vs. Frequency over Attenuation settings



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

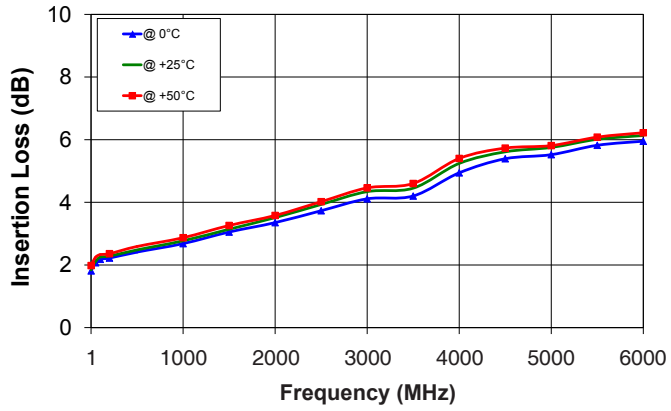


Attenuation relative to Insertion Loss @ +50°C vs. Frequency over Attenuation settings

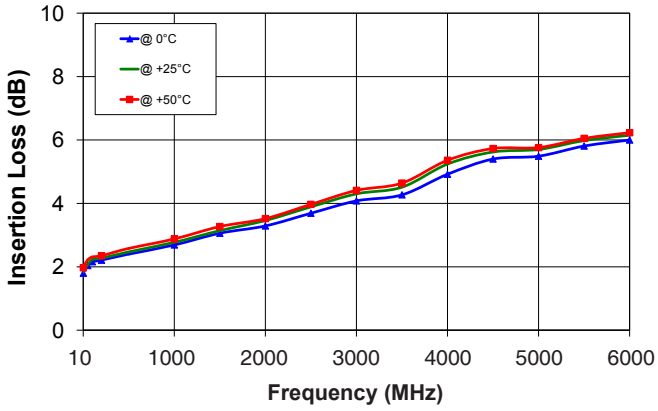


Typical Performance Curves in a given channel (Continued)

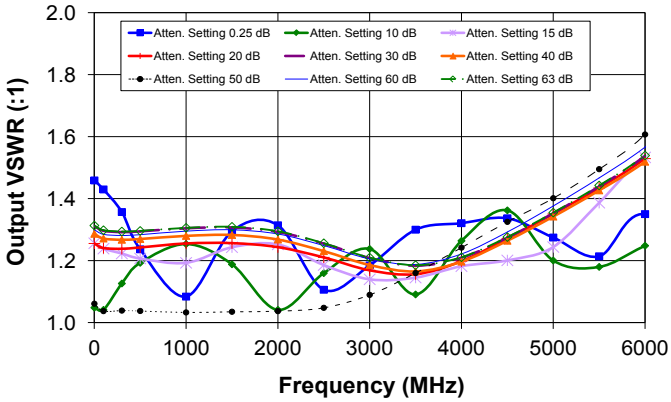
Insertion Loss @ Input Power 0dBm vs. Frequency over Temperatures



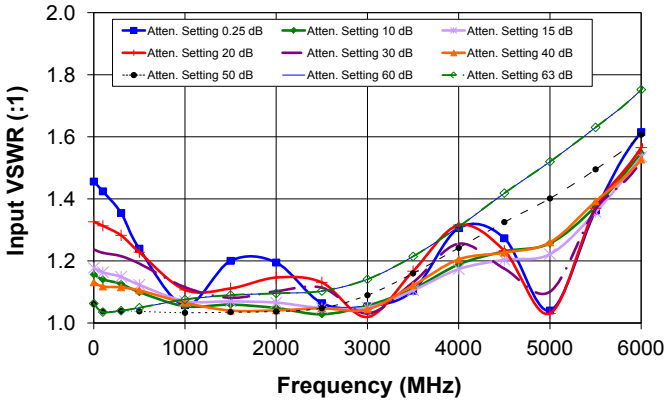
Insertion Loss @ Input Power +23 dBm vs. Frequency over Temperatures



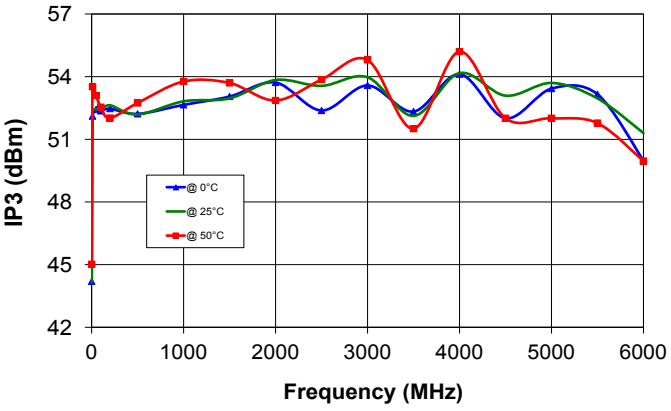
Output VSWR @ +25°C vs. Frequency over Attenuation settings



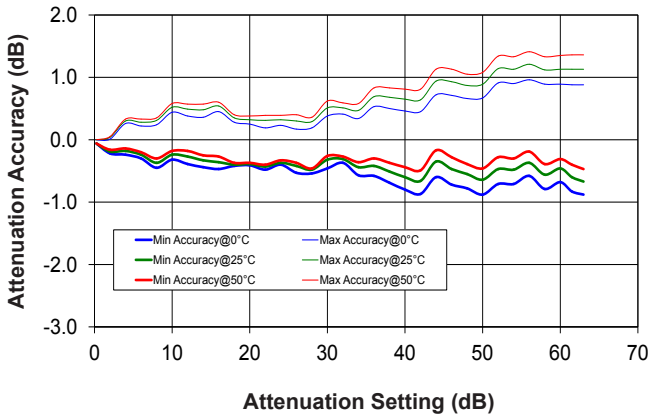
Input VSWR @ +25°C vs. Frequency over Attenuation settings



Input IP3 @ 0dB Attenuation vs. Frequency over Temperatures

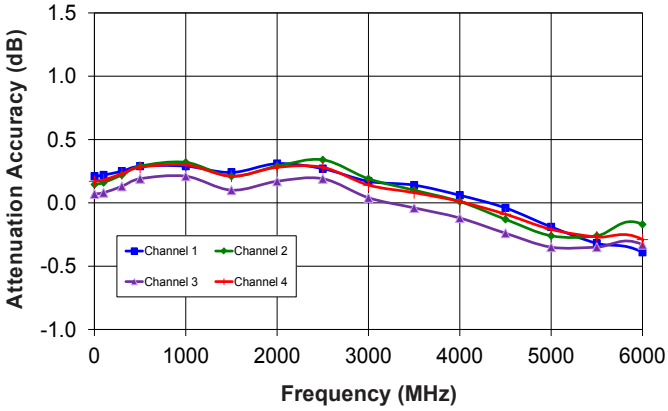


Typical Attenuation Accuracy vs. Attenuation settings over Temperature

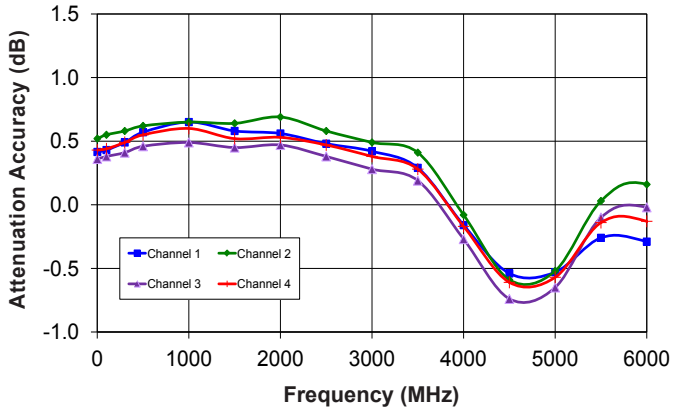


Typical Performance Curves between channels

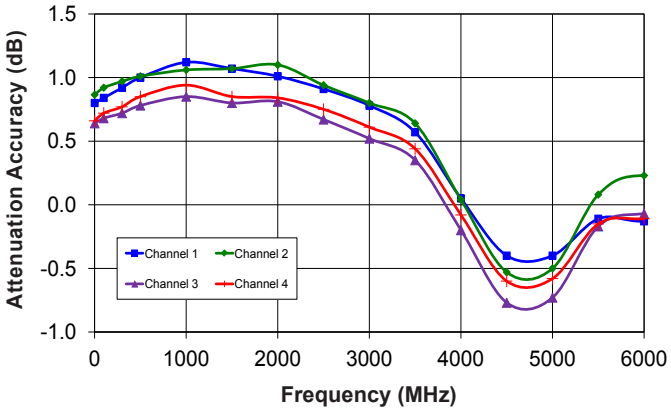
Attenuation Accuracy @ 20dB setting vs. Frequency at four channels



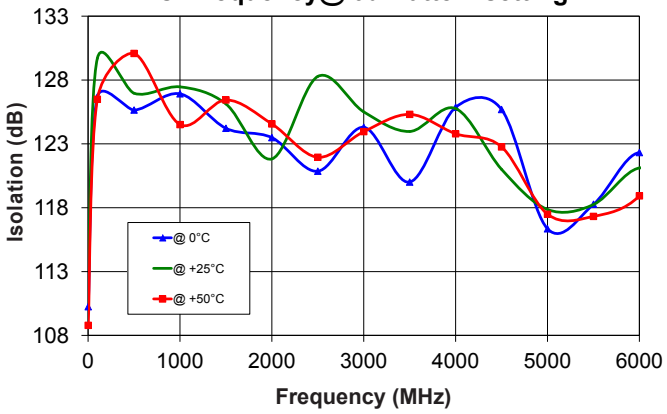
Attenuation Accuracy @ 40dB setting vs. Frequency at four channels



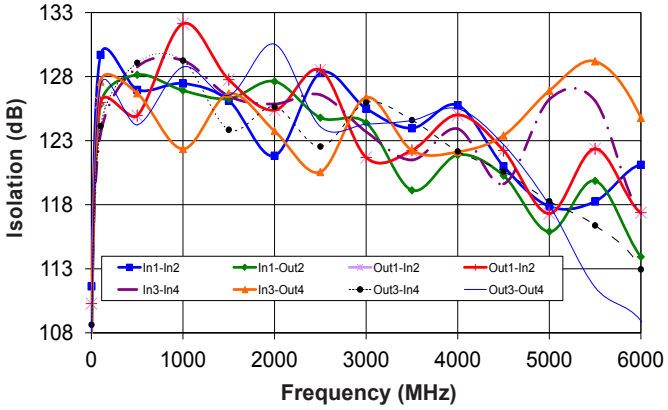
Attenuation Accuracy @ 60dB setting vs. Frequency at four channels



Isolation between RF In 1 and RF In 2 vs. Frequency@ 0dB atten. setting



Isolation between channels vs. Frequency



Ordering Information

Model	Description
RC4DAT-6G-60	USB/Ethernet four channel 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 [11,12]. Operating temperature: 0°C to +45°C, AC Input: 100-240V, 47-63 Hz, DC Output 5±0.25 V , I_{Max}=1A
	MUSB-CBL-3+	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male)

[11] The USB-AC/DC-5 may be used to provide the $5V_{DC}$ power input via USB port if operating the RC4DAT with Ethernet control. Not required if using USB control.

[12] Power plugs for other countries are also available, Plugs for other countries are also available, if you need a power plug for a country not listed please contact testsolutions@minicircuits.com

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)
PC-DAT-CD [13]	Software CD
BKT-355-02+	Bracket kit including 3.75” x 5.17” bracket, mounting screws and washers

[13] To receive the CD at no extra cost, request when placing order. CD contents can be downloaded from Mini-Circuits website at http://www.minicircuits.com/softwaredownload/patt.html

Additional Notes

A. 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.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit’s applicable established test performance criteria and measurement instructions.

C. 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