

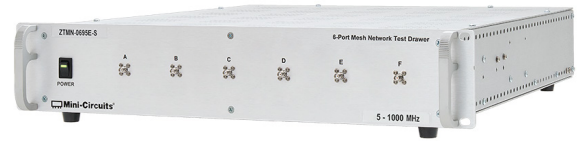


Mesh Network Emulator ZTMN-0695E-S

50Ω 5 to 1000 MHz 6-Port 0-95 dB Rack-Mount SMA Female

THE BIG DEAL

- 6 fully interconnected test ports (15 internal paths)
- 95 dB programmable attenuation per path
- Configure automated sweep / hop / fading sequences
- Ethernet & USB control

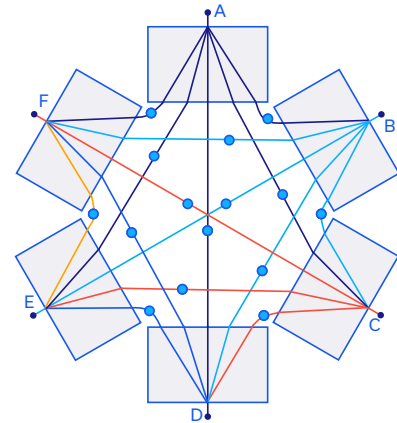


Generic photo used for illustration purposes only

APPLICATIONS

- Production, R&D, qualification testing
- ISM band fire & security monitoring
- Military VHF / UHF radio
- Smart home & energy monitoring systems
- Test & measurement systems

FUNCTIONAL BLOCK DIAGRAM



● = Programmable attenuator

PRODUCT OVERVIEW

Mini-Circuits' ZTMN series mesh network emulators are multi-port test systems with independently variable attenuation on each internal path. This concept allows simulation of a "real-world" mesh communication network within the confined space of a test environment. Path loss can be varied independently between any pair of devices on the network without affecting any other combination of devices, allowing simulation of a complex range of test cases.

ZTMN-0695E-S is a 6-port mesh covering the 5 MHz to 1 GHz band, with 0 to 95 dB attenuation range on each of the 15 internal paths. The model is housed in a compact, 2U height, 19-inch rack chassis with all RF connectors on the front panel. The ZTMN series also supports larger mesh network combinations, custom attenuation and frequency ranges available on request.

The system can be controlled via USB or Ethernet (supporting SSH, HTTP & Telnet protocols), allowing local control directly from a PC, or remotely over a network. Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments.

KEY FEATURES

Feature	Advantages
Wide attenuation range	Independently controllable 0-95 dB attenuators on each path allow simulation of a wide range of test scenarios including receiver sensitivity, device / base-station handovers, device failures, and interference effects.
Wide bandwidth	Operation from 30 MHz to 1 GHz incorporates the VHF, UHF & ISM bands, utilized by a wide range of commercial and military radio systems.
Rack-mount chassis	Compact 2U height, 19" rack-mountable chassis suits integration in automated production test environments.
Ethernet & USB control	USB HID and Ethernet (SSH / HTTP / Telnet) interfaces ensure compatibility with most software environments and connection requirements.

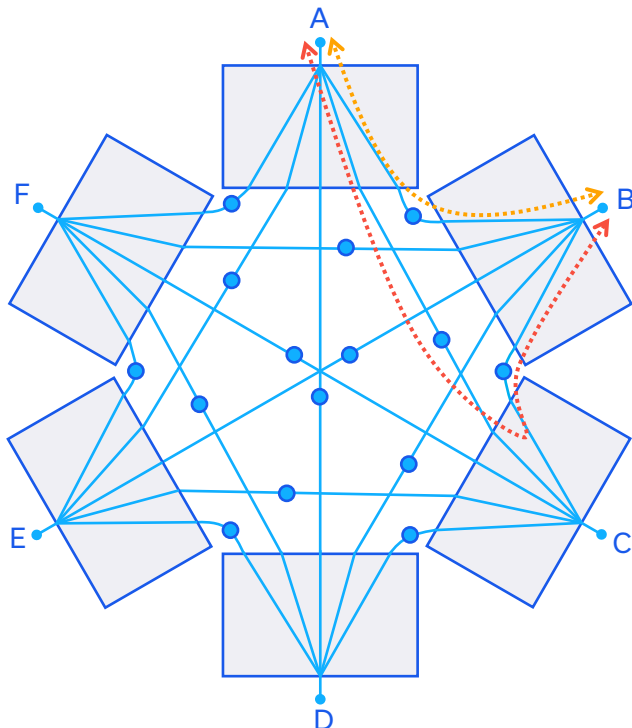


ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Conditions	Min.	Typ.	Max.	Units
Frequency Range	-	5		1000	MHz
Insertion Loss	5- 500 MHz		24	26	dB
	500 - 1000 MHz		27	29	
Isolation	Indirect path ^{2,4}	50	56		dB
	Direct path ³	95	110		
Return Loss			20		dB
Attenuation Range	0.25 dB steps	0	90		dB
	0.5 dB steps	90	95		
Attenuation Steps	Nominal		0.25		dB
Input Power	-			+27	dBm

1. Path loss on the direct path between 2 ports when the attenuator in path is at 0 dB.
2. Path loss on the indirect / unwanted path between 2 ports with the 2 attenuators in path at 0 dB and all others at 95 dB (limited by the isolation characteristic of the internal splitter / combiner component).
3. Path loss on the direct path between 2 ports with all attenuators at 95 dB.
4. It is recommended to set all attenuators to max attenuation initially due to the isolation effects described in note 2, then reduce the attenuation on specific paths as required by the test configuration.

FUNCTIONAL BLOCK DIAGRAM





CONTROL INTERFACES

Ethernet Control	Supported Protocols	TCP / IP, SSH, HTTP, Telnet, DHCP, UDP (limited)
	Max Data Rate	100 Mbps (100 Base-T Full Duplex)
USB Control	Supported Protocols	HID – High Speed
	Min Communication Time ⁵	400 μs typ

5. Based on the polling interval of the USB HID protocol (125 μs with 1024 bytes per packet) and no other significant CPU or USB activity

SOFTWARE & DOCUMENTATION

Mini-Circuits' full software and support package including user guide, Windows GUI, API, programming manual and examples can be downloaded free of charge (refer to the last page for the download path).

A comprehensive set of software control options is provided:

- GUI for Windows – Simple software interface for control via Ethernet and USB
- Programming / automation via Ethernet
 - Complete set of control commands which can be sent via any supported protocol – simple to implement in the majority of modern programming environments
- Programming / automation via USB
 - DLL files provide a full API for Windows with a set of intuitive functions which can be implemented in any programming environment supporting .Net Framework or ActiveX
 - Direct USB programming is possible in any other environment (not supporting .Net or ActiveX)

Please contact testsolutions@minicircuits.com for support

MINIMUM SYSTEM REQUIREMENTS

Hardware	Intel i3 (or equivalent) or later
GUI (USB or Ethernet Control)	Windows 7 or later
USB API DLL	Windows 7 or later with support for Microsoft .Net Framework or ActiveX
USB Direct Programming	Windows 7 or later; Linux
Ethernet	Windows, Linux or macOS with Ethernet TCP / IP support

PROGRAMMING COMMANDS

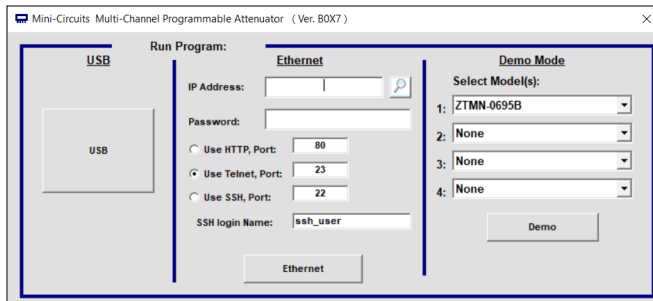
The key ASCII / SCPI commands for control of the system for control via the Ethernet or USB API are summarized below (refer to the programming manual for full details):

Command / Query	Description
:MN?	Read model name
:SN?	Read serial number
:FIRMWARE?	Read firmware version
:[address]:[channels]:SETATT:[value]	Set attenuation <ul style="list-style-type: none"> • [address] = Address of the attenuator module (refer to the Attenuator Path Map table) • [channels] = Channel number (1 to 4) within the 4-channel attenuator module. Multiple channels can be listed in a string, separated by colon ("."). • [value] = Attenuation value to set (from 0 to 95 dB) • Example 01:CHAN:1:2:3:SETATT:10.25
:[address]:[channels]:ATT?	Return a single attenuator value: <ul style="list-style-type: none"> • [address] = Address of the 4-channel attenuator module (refer to the Attenuator Path Map table) • [channels] = Channel number (1 to 4) within the 4-channel attenuator module • Example 01:CHAN:1:ATT?



GRAPHICAL USER INTERFACE (GUI) FOR WINDOWS

- Connect via USB or Ethernet
- Run GUI in demo mode to evaluate software without a hardware connection



- View and set all attenuator values, independently or in groups
- Configure automated sweep / hop / fading sequences
- Apply custom port / path names
- Configure system and Ethernet settings

Model Name: ZTMN-0695E-S
Serial Number: 02301030045
System Name: Attenuator System

Channels: 16
User Name: Admin
Connection: USB

Set Attenuation

Single Channel Multi Channels
 All Channels
 Group: []

Set Attenuation (0-95 dB):
 Auto Apply

Current Attenuation -
Channel: 02B: Path C<>D
Attenuation: 34.00 dB

ZTMN-0695E-S	A	B	C	D
01	Path D<>E 21.00	Path D<>F 95.00	Path E<>F 40.00	INACTIVE 95.00
02	Path B<>F 95.00	Path C<>D 34.00	Path C<>E 95.00	Path C<>F 95.00
03	Path A<>F 95.00	Path B<>C 95.00	Path B<>D 95.00	Path B<>E 95.00
04	Path A<>B 95.00	Path A<>C 95.00	Path A<>D 95.00	Path A<>E 95.00

Sweep Mode

Sweep Mode
Dwell Time: mSec (Minimum 5 msec)

Sequence #1
Start (dB):
Stop (dB):
Step (dB):
Select Channel or Group: 01A - Path D<>E

Sequence #2
Start (dB):
Stop (dB):
Step (dB):
Select Channel or Group: 02C - Path C<>E

Sequence #3
Start (dB):
Stop (dB):
Step (dB):
Select Channel or Group: ALL CHANNELS

Sequence #4
Start (dB):
Stop (dB):
Step (dB):
Select Channel or Group: []

Timing

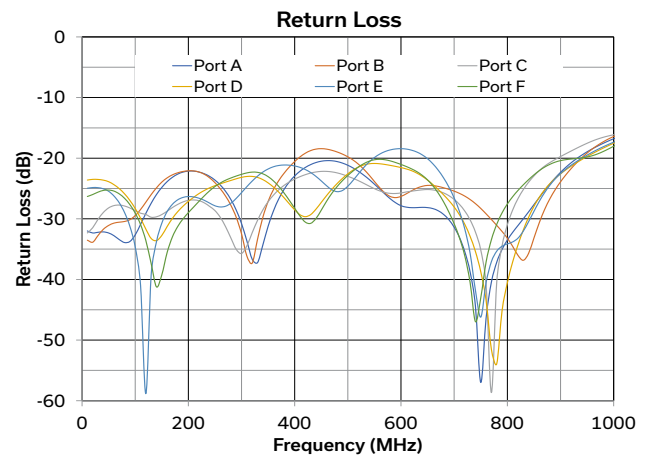
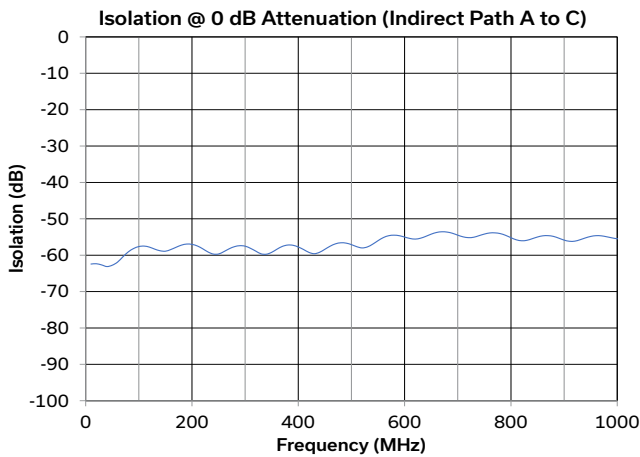
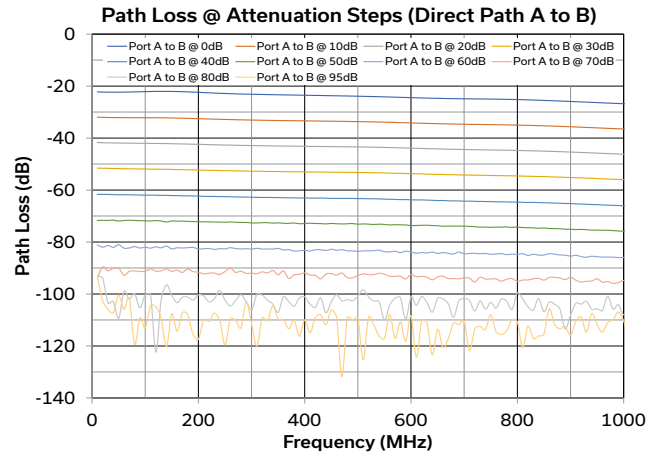
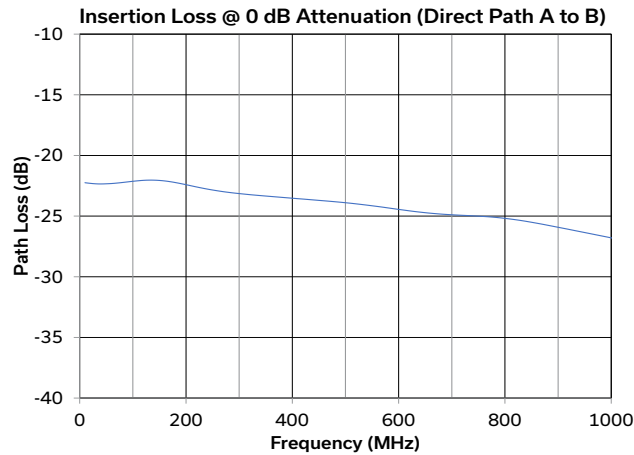
Continuous
 Duration: Sec
 No. of Cycles:
 Bi-Directional

Control Mode:
 High Speed PC Control

Note: High speed mode enables minimum dwell times in the order of micro seconds but the GUI is unable to display the current attenuation. Choose PC Control mode to view the attenuation during a sweep/hop sequence.



TYPICAL PERFORMANCE GRAPHS





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ABSOLUTE MAXIMUM RATINGS

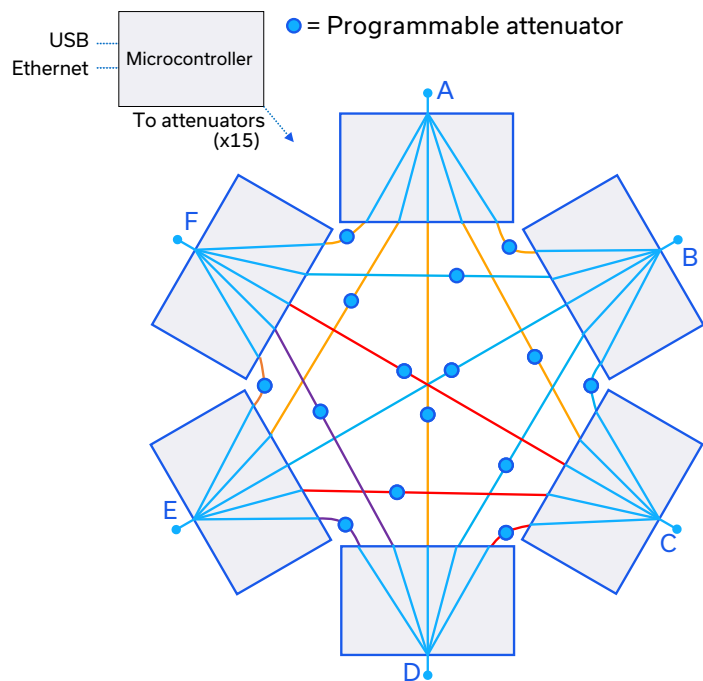
Parameter	Conditions	Limits	Units
Temperature	Operating	0 to +50	°C
	Storage	-20 to +60	
Input Power (No Damage)	Per port	+27	dBm

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.

POWER SUPPLY

Power Supply	AC mains input: 100-240 V, 50 / 60 Hz
Fuse	2A, 250V rating
Power Consumption	85W maximum

FUNCTIONAL BLOCK DIAGRAM



CONNECTIONS

Port	Connector
A to F	SMA female
USB	USB type B
Ethernet / LAN	RJ45
AC Input	IEC C14 inlet

ATTENUATOR / PATH MAP

- The mesh is constructed using 4-channel programmable attenuator blocks, addressed 01 to 04
- Each of the 4 channels within a block controls the path loss between a specific pair of ports, as shown below

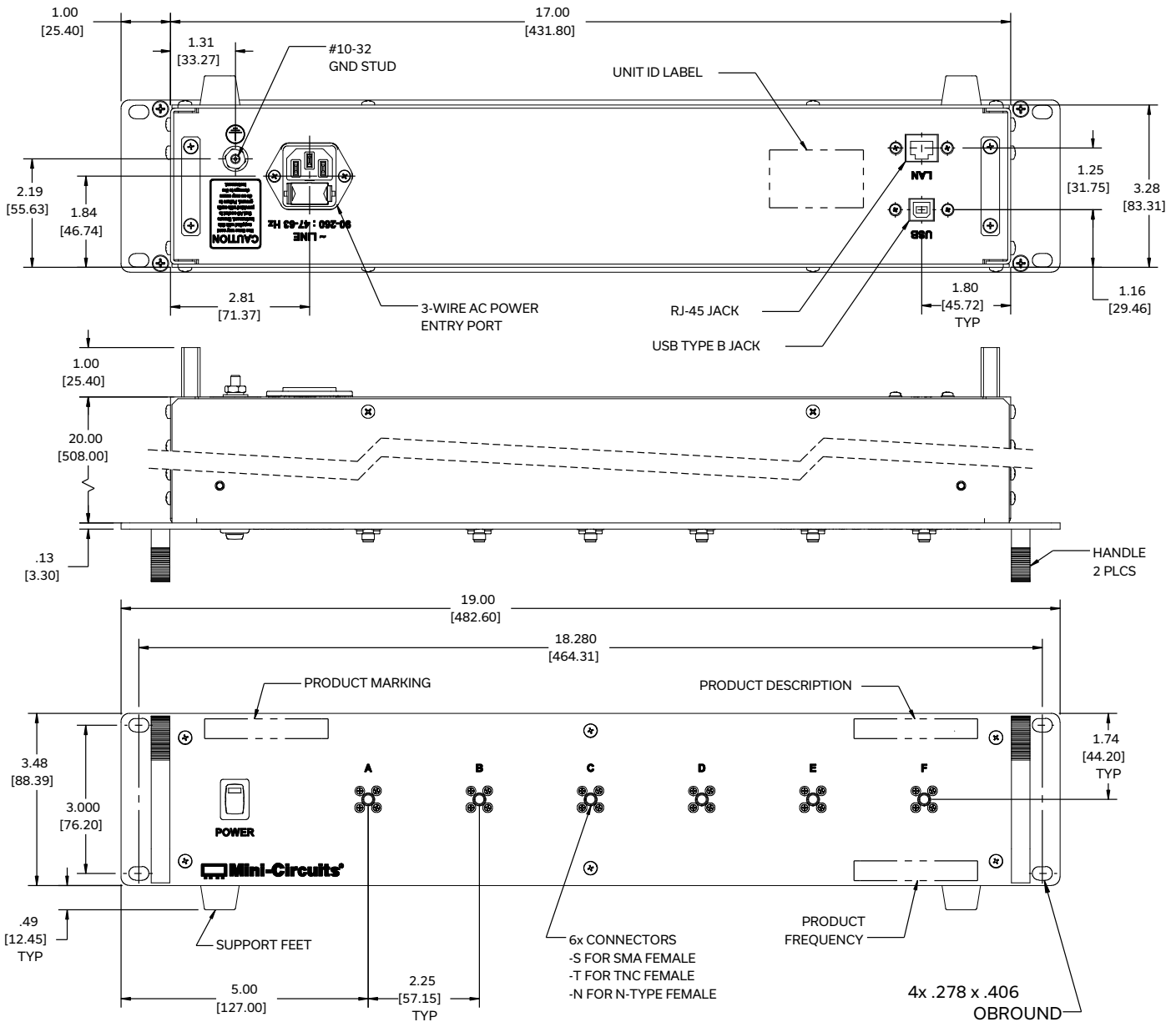
	Channel 1(A)	Channel 2(B)	Channel 3(C)	Channel 4(D)
Att 01	D ↔ E	D ↔ F	E ↔ F	Not used
Att 02	B ↔ F	C ↔ D	C ↔ E	C ↔ F
Att 03	A ↔ F	B ↔ C	B ↔ D	B ↔ E
Att 04	A ↔ B	A ↔ C	A ↔ D	A ↔ E



Mesh Network Emulator ZTMN-0695E-S

50Ω 5 to 1000 MHz 6-Port Rack-Mount SMA Female

OUTLINE DRAWING



Weight: 8560 grams.

Dimensions are in inches [mm]. Tolerances: 2 Pl. ±.03 inch; 3 Pl. ±.015 inch.

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PRODUCT MARKING*

Product Marking: ZTMN-0695E-S

Product Description: 6-Port Mesh Network Test Drawer

Product Frequency: 5 - 1000 MHz

Unit ID Label: Serial number and other identification marks

*Marking may contain other features or characters for internal lot control

Mesh Network Emulator **ZTMN-0695E-S**











50Ω 5 to 1000 MHz 6-Port 0-95 dB Rack-Mount SMA Female

DETAILED MODEL INFORMATION IS AVAILABLE ON OUR WEBSITE [CLICK HERE](#)

Case Style	YT2646		
Software, User Guide & Programming Manual	www.minicircuits.com/softwaredownload/multiatt.html		
Environmental Rating	ENV55		
Regulatory Compliance	Refer to our website for compliance methodologies and qualifications 	www.minicircuits.com/quality/environmental_introduction.html	

Contact Us: testsolutions@minicircuits.com

Included Accessories	Part Number	Description
	CBL-3W-xx	AC power cord (IEC C13 connector to local plug) Select one option from the list below. Please contact testsolutions@minicircuits.com if your region is not listed.
	USB-CBL-AB-7+	USB cable (6.8ft) type A to type B
	CBL-RJ45-MM-5+	Ethernet cable (5 ft)
	HT-4-SMA	SMA connector wrench (4" length)

AC Power Cord Options	Part Number	Description
	CBL-3W-US	USA NEMA 5-15 plug (type B) to IEC C13 connector
	CBL-3W-EU	Europe CEE 7/7 plug (type E/F) to IEC C13 connector
	CBL-3W-UK	UK BS-1363 plug (type G) to IEC C13 connector
	CBL-3W-AU	Australia & China AS/NZS 3112 plug (type I) to IEC C13 connector
	CBL-3W-IL	Israel SI-32 plug (type H) to IEC C13 connector

- 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