



Mini-Circuits

USB &amp; ETHERNET

# 6-Port Mesh Network Emulator ZTMN-0695C-S

50Ω 2000 to 8000 MHz Rack-Mount SMA

## 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

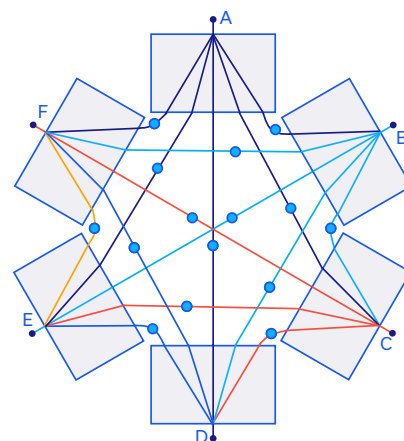


Generic photo used for illustration purposes only

## APPLICATIONS

- 5G FR1 / WiFi 6E / IoT / Zigbee device testing
- Production, R&D, qualification testing
- 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 production 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-0695C-S is a 6-port mesh covering the 2-8 GHz bands, 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). 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 (both 32-bit and 64-bit systems).

## 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 2 to 8 GHz incorporates most of the key commercial wireless mesh network applications, including WiFi 6E, 5G FR1 and Zigbee.                                                                                |
| 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.                                                                                    |

REV. A  
ECO-017289  
ZTMN-0695C-S  
MCL NY  
230330





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## ELECTRICAL SPECIFICATIONS @ +25°C

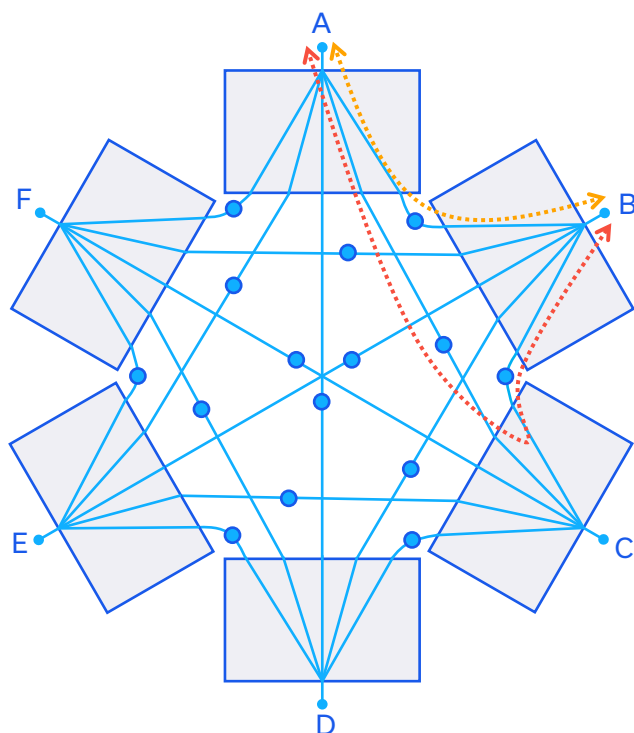
| Parameter         | Conditions                   | Min. | Typ. | Max. | Units |
|-------------------|------------------------------|------|------|------|-------|
| Frequency Range   |                              | 2000 |      | 8000 | MHz   |
| Insertion Loss    | Direct path <sup>1</sup>     |      | 30   | 35   | dB    |
| Isolation         | Indirect path <sup>2,4</sup> | 55   | 70   |      | dB    |
|                   | Direct path <sup>3</sup>     | 95   | 110  |      |       |
| Return Loss       |                              |      | 17   |      | dB    |
| Attenuation Range | 2000 - 7200 MHz              | 0    |      | 95   | dB    |
|                   | 7200 - 8000 MHz              | 0    |      | 90   |       |
| Attenuation Steps |                              |      | 0.25 |      | dB    |
| Input Power       |                              |      |      | +25  | 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 95 dB

4. It is recommended initially to set all attenuators to max attenuation due to the isolation effects described in note 2, then reduce the attenuation on specific paths as required by the test configuration



● = Programmable attenuator

↔ = Direct / wanted path

↔ = Indirect / unwanted path



**CONTROL INTERFACES**

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

5. Based on the polling interval of the USB HID protocol (125 μs with 64 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](mailto:testsolutions@minicircuits.com) for support

**MINIMUM SYSTEM REQUIREMENTS**

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



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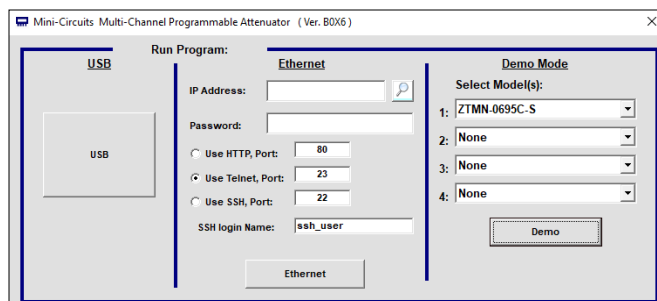
## USB &amp; ETHERNET

6-Port Mesh Network Emulator **ZTMN-0695C-S**

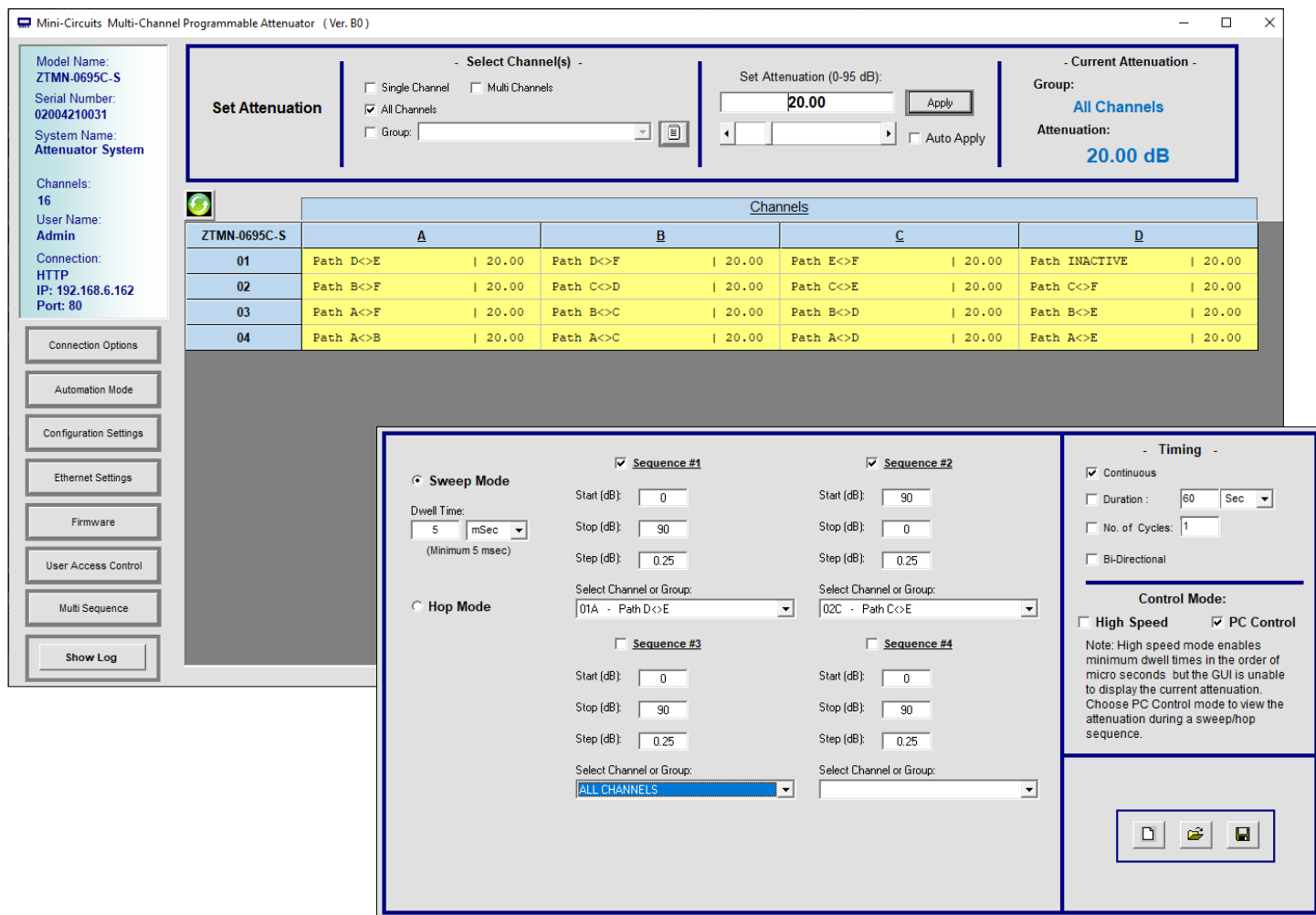
50Ω 2000 to 8000 MHz Rack-Mount SMA

## 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 switch states at the click of a button
- Configure automated / times switching sequences
- Configure Ethernet settings
- Update firmware





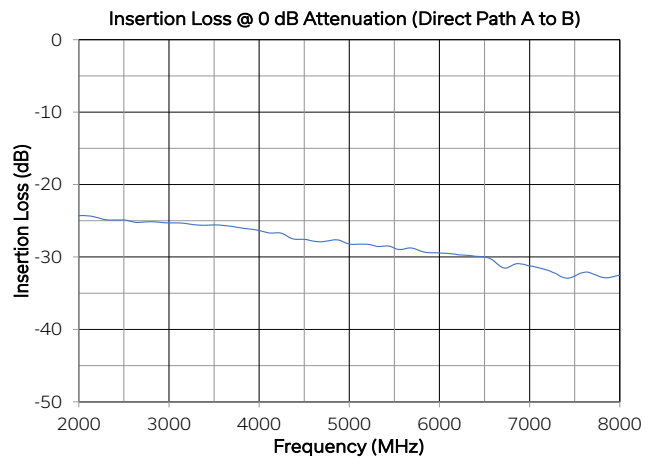
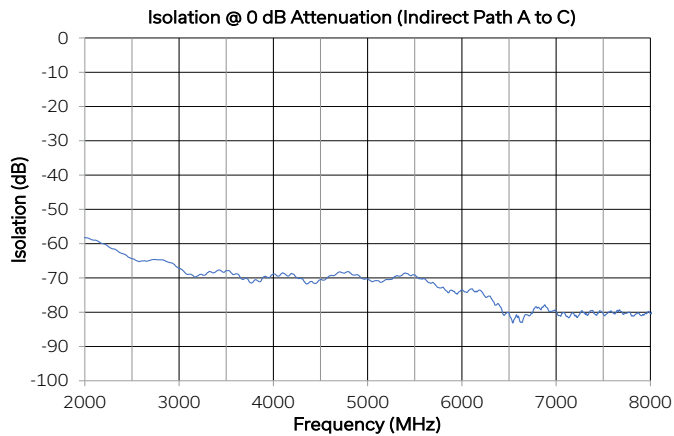
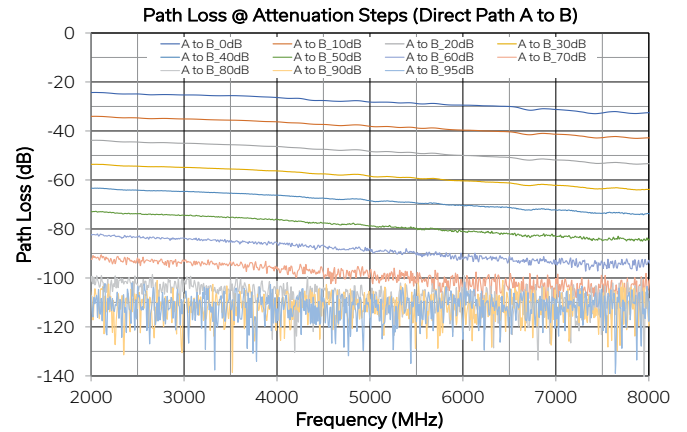
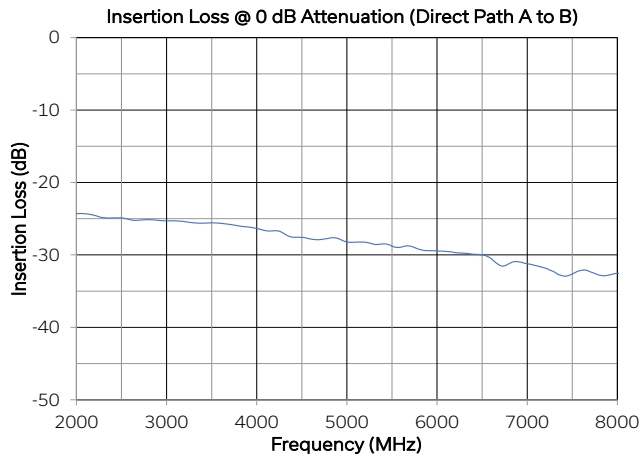
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# 6-Port Mesh Network Emulator ZTMN-0695C-S

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## TYPICAL PERFORMANCE GRAPHS





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ABSOLUTE MAXIMUM RATINGS<sup>6</sup>

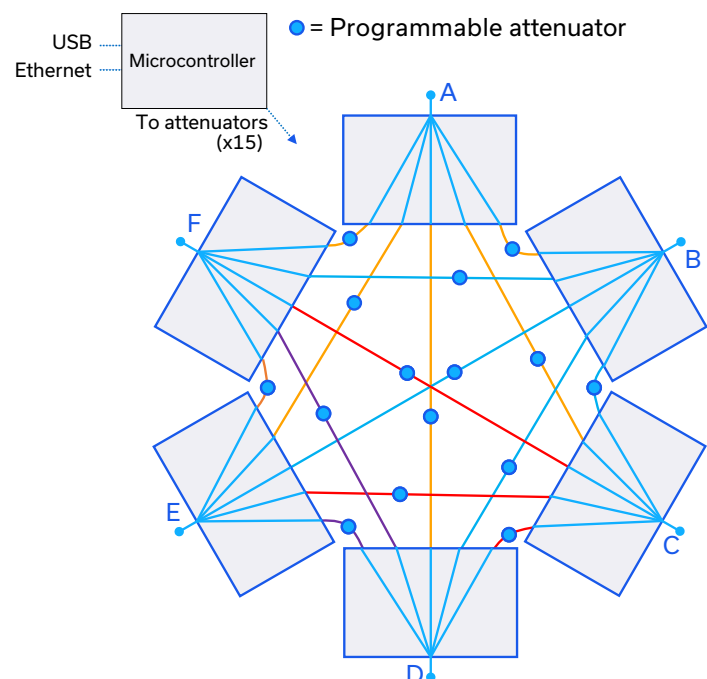
| Parameter               | Conditions | Limits     | Units |
|-------------------------|------------|------------|-------|
| Temperature             | Operating  | 0 to +50   | °C    |
|                         | Storage    | -20 to +60 |       |
| Input Power (No Damage) | Per port   | +25        | dBm   |

6. 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:<br>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 four 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         |



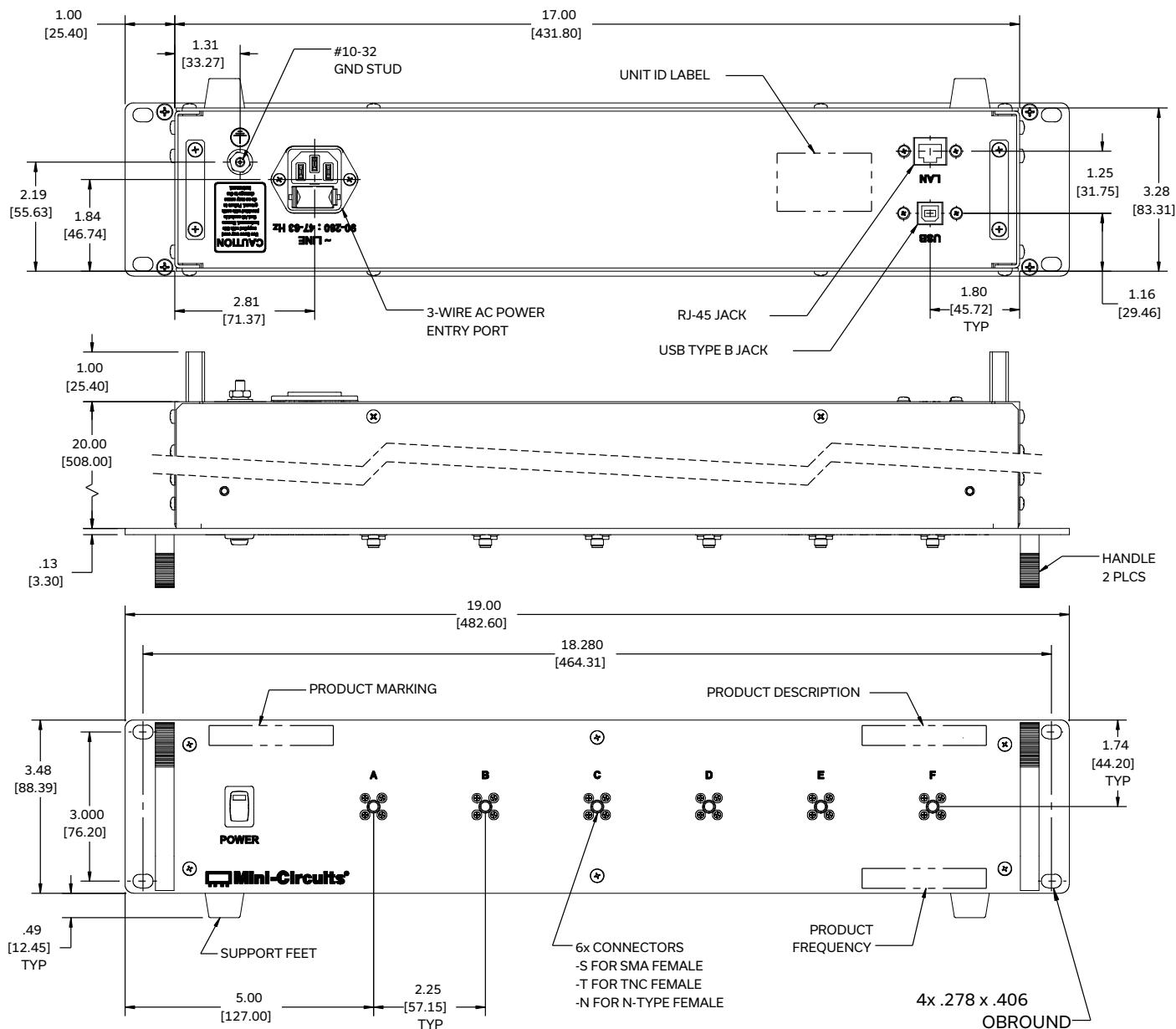


## USB & ETHERNET

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### OUTLINE DRAWING



Weight: 8560 grams.

Dimensions are in inches [mm]. Tolerances: 2 Pl.  $\pm 0.03$  inch; 3 Pl.  $\pm 0.015$  inch.

### PRODUCT MARKING

Product Marking: ZTMN-0695C-S

Product Description: 6-Port Mesh Network Test Drawer

Product Frequency: 2000-8000 MHz

Unit ID Label: Serial number and other identification marks





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

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Case Style                                | YT2646                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Software, User Guide & Programming Manual | <a href="http://www.minicircuits.com/softwaredownload/multiatt.html">www.minicircuits.com/softwaredownload/multiatt.html</a>                                                                                                                                                                                                                                                                                                                                                     |
| Environmental Rating                      | ENV56                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Regulatory Compliance                     | <p>Refer to our website for compliance methodologies and qualifications</p>    <a href="http://www.minicircuits.com/quality/environmental_introduction.html">www.minicircuits.com/quality/environmental_introduction.html</a> |

Contact Us: [testsolutions@minicircuits.com](mailto:testsolutions@minicircuits.com)

| Included Accessories                                                                | Part Number    | Description                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | CBL-3W-xx      | AC power cord (IEC C13 connector to local plug)<br>Select one option from the list below. Please contact<br>Please contact <a href="mailto:testsolutions@minicircuits.com">testsolutions@minicircuits.com</a> if your regions 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)                                                                                                                                                                                                             |

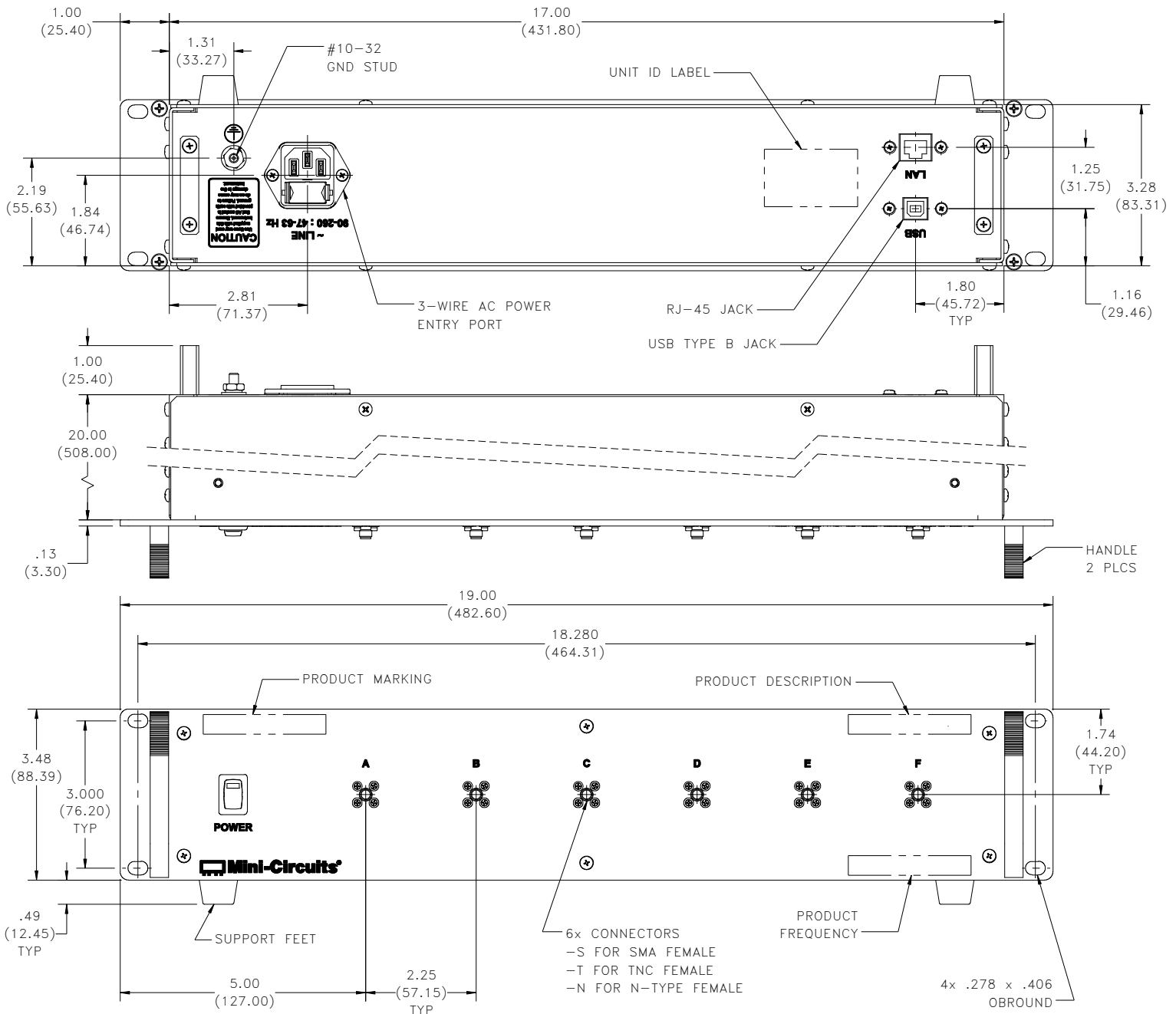
| AC Power Cord Options                                                               | Part Number | Description                                                         |
|-------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------------|
|  | CBL-3W-US   | USA<br>NEMA 5-15 plug (type B) to IEC C13 connector                 |
|  | CBL-3W-EU   | Europe<br>CEE 7/7 plug (type E/F) to IEC C13 connector              |
|  | CBL-3W-UK   | UK<br>BS-1363 plug (type G) to IEC C13 connector                    |
|  | CBL-3W-AU   | Australia & China<br>AS/NZS 3112 plug (type I) to IEC C13 connector |
|  | CBL-3W-IL   | Israel<br>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](http://www.minicircuits.com/MCLStore/terms.jsp)

## Outline Dimensions

YT2646



### Notes:

1. Case material: Aluminum (with protective coating to prevent corrosion).
2. Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .03$  inch; 3 Pl.  $\pm .015$  inch.
3. Weight: 8560 grams.
4. Marking may contain features or characters for internal lot control.

**Mini-Circuits®**  
ISO 9001 ISO 14001 CERTIFIED

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RF/IF MICROWAVE COMPONENTS



## Environmental Specifications ENV56

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification                  | Test/Inspection Condition            | Reference/Spec              |
|--------------------------------|--------------------------------------|-----------------------------|
| Operating Temperature          | -0° to 40° C<br>Ambient Environment  | Individual Model Data Sheet |
| Storage Temperature            | -15° to 85° C<br>Ambient Environment | Individual Model Data Sheet |
| Operating and Storage Humidity | 5% to 85% RH (non-condensing)        | Ambient                     |
| Bench Handling Test            | Bench Top Tip 45° & Drop             | MIL-PRF-28800F              |
| Transit Drop Test              | Free Fall Drop, 20 cm (7.9 inches)   | MIL-PRF-28800F Class 3      |