Test Solutions & Portable Test Equipment

- USB & Ethernet control
- Full software support
- Catalogue models available from stock
- Custom developments with fast turnaround times

Mesh Network Test Systems - Introduction

Multi-Port Networks for Interconnecting 3 to n Devices

Mesh networks allow simultaneous interconnection of 3 to n devices or test systems. Common applications include testing of Bluetooth and Zigbee devices, wireless handsets and Wi-Fi systems.

Mini-Circuits has developed a range of mesh networks with independently variable attenuation on every path. This concept allows simulation of a "real-world" mesh communication network in the confined space of a production environment. Path loss can be varied independently between any pair of devices, simulating the effects of distance and interference, without affecting any other paths.

Number of ports, operating frequency and path attenuation range (up to 120 dB) can be tailored to the specific test requirement.


⊙ = programmable attenuator

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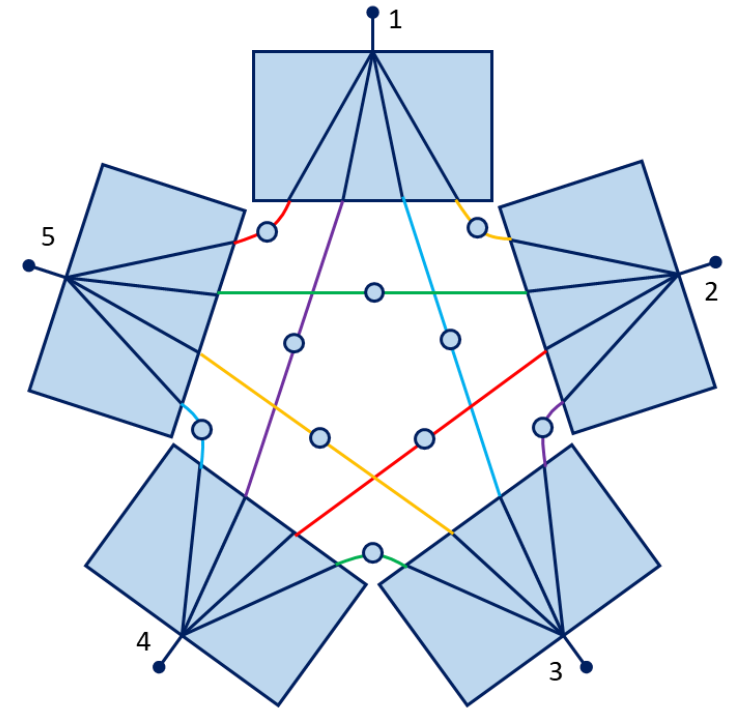
Mesh Network Test Systems - Summary

- Simultaneous interconnection of 3 or more devices
- Goal:
  1. Allow all devices to "talk" to each other in a test environment
  2. Independently vary "transmission loss" between any pair of devices
     - Simulates different signal strengths / distances / obstacles
- Common applications:
  – Bluetooth and Zigbee devices
  – Private Mobile Radio (PMR), eg: TETRA
  – Any application where devices connect in a mesh / hive (all talking to each other) rather than bi-directional communication with a base-station
- Solution: Mesh network tester constructed from splitters and programmable attenuators

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Mesh Network Test Systems - 4-Port Example

- ## ZTMN-0495AS
  - 4-port mesh network test system
  - Compact 2U height rack chassis
  - 0 to 95 dB attenuation range per path
    - 4-port mesh = 6 unique paths
  - 350-6000 MHz
  - 19 dB typ insertion loss
  - USB & Ethernet control

= programmable attenuator
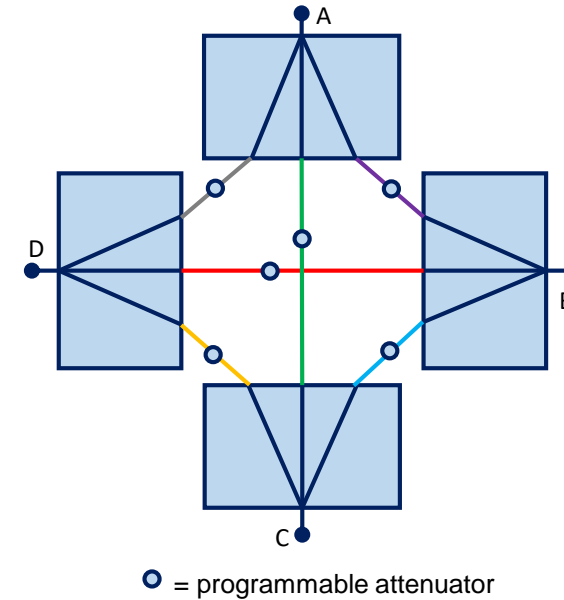
Mesh Network Test Systems - 6-Port Example

- ## ZTMN-0695B-S
  - 6-port mesh network test system
  - Compact 2U height rack chassis
  - 0 to 95 dB attenuation range per path
    - 6-port mesh = 15 unique paths
  - 600-6000 MHz
  - 28 dB typ insertion loss
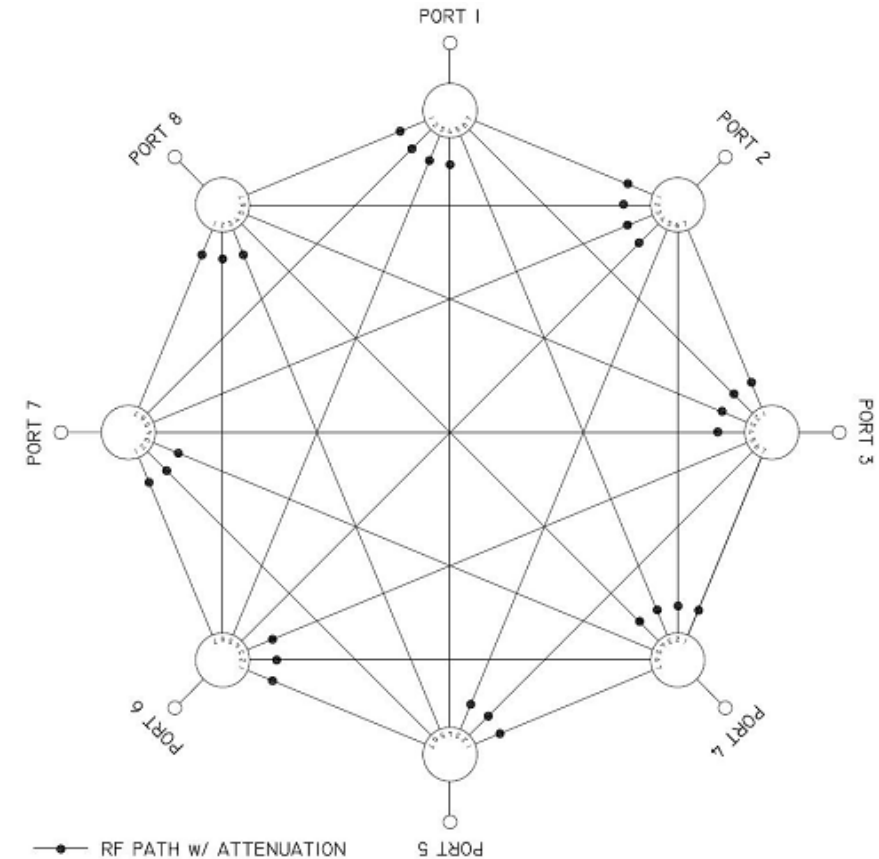 - USB & Ethernet control
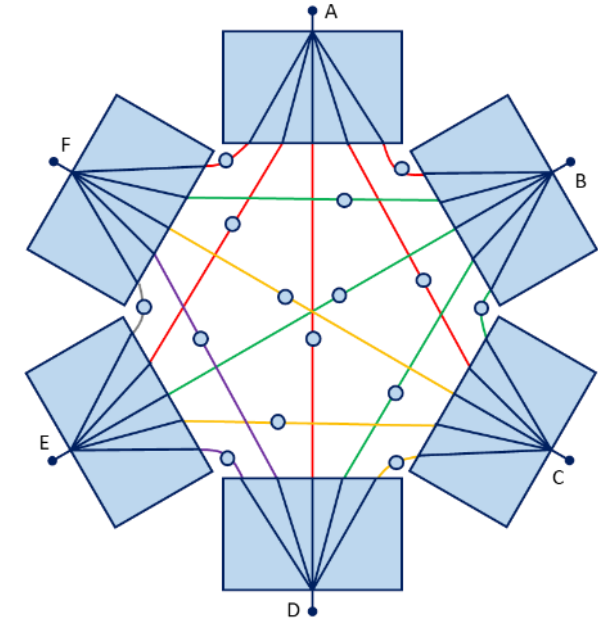
○ = programmable attenuator

Mesh Network Test Systems - 8-Port Example

- ## ZTMN-0895A
  - 8-port mesh network test system
  - Compact 2U height rack chassis
  - 0 to 95 dB attenuation range per path
    - 8-port mesh = 28 unique RF paths
  - 30-2000 MHz
    - Other frequency bands can be achieved
  - 33 dB typ insertion loss
  - USB & Ethernet control

Mesh Network Test Systems - API Software

- Simple customer programming / automation
- Programming examples provided
- Ethernet control:
  - HTTP & Telnet protocols supported
  - Interoperability with most programming environments
  - Allows remote automation across a network
- USB control:
  - ActiveX and .Net DLLs provided
    - Interoperability with the majority of Windows based programming environments
  - USB interrupt command codes
    - Applicable to Linux operating systems
- Compatibility with most common programming environments
  - LabVIEW, VEE, MatLab, Python, C#, VB, C++…

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Mesh Network Test Systems - GUI Software

- Graphical User Interface (GUI) provided for Windows systems:
  - USB & Ethernet control
  - Set path loss individually, in groups or for all paths at once
  - Configure automated attenuation sweep or hop sequences

Mesh Network Test Systems - Size Versus Cost

- Relationship between number of ports to number of paths within a full mesh network follows a square rule

- Each path includes a programmable attenuator; these are the significant BOM cost elements within the mesh

- Important to consider the benefit to the test environment of having more ports, relative to the additional complexity / cost

Number of Ports	Number of Paths / Attenuators
4	6
6	15
8	28
12	66
16	120
32	496

Comparison of mesh size (number of ports) vs number of paths (attenuators)

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Mesh Network Test Systems - Simplified Configurations

- To reduce cost, consider whether all internal paths are required
- Does each port need to "talk" to all other ports?
- Or, does each port only need to talk to a small number of other ports?
- Reducing number of paths, reduces number of attenuators / cost

Example 9-port mesh where all ports are interconnected:
36 paths / attenuators
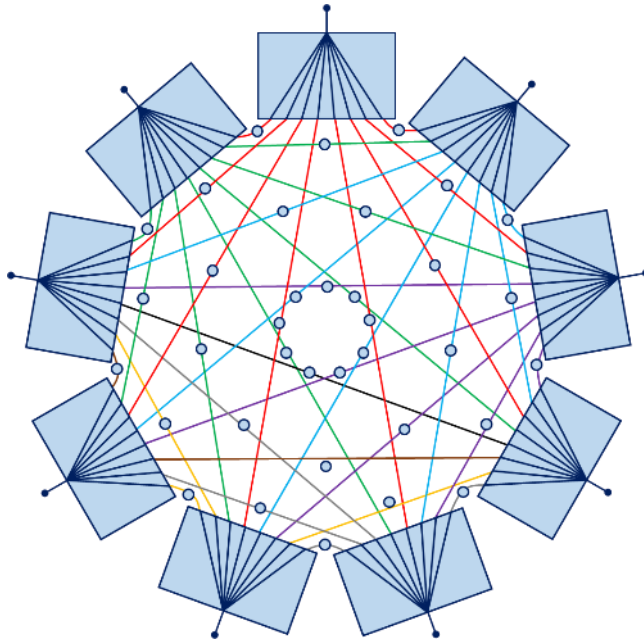
Example 9-port mesh where each port is only connected to
its 4 nearest "neighbours": 18 paths / attenuators

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