octoScope Introduction

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octoScope Company Summary

Company

Wireless test solutions and services for Wi-Fi, LTE, IoT and other wireless markets
→ Founded in 2006 as a wireless technology consulting company
→ Transitioned to product revenue in 2013
→ Now offering test solutions for Wi-Fi, 4G, 5G, IoT (Bluetooth, Nest), wireless broadband, connected car, medical devices, robotics, public safety, military

Product

Compact, modular, completely isolated and controllable wireless testbed
→ Automated, repeatable and accurate metrics of wireless performance & behavior
→ Patented novel technology for emulating real-life RF environment
→ Wireless performance, coexistence, behavior testing in controlled RF environment

Team

Wireless test, channel emulation, wireless protocols and RF
→ Track record of delivering successful communications and wireless test products
→ Key team members worked together going back to mid-1980s at prominent test equipment companies including Teradyne, HP/Agilent, Tektronix and Spirent
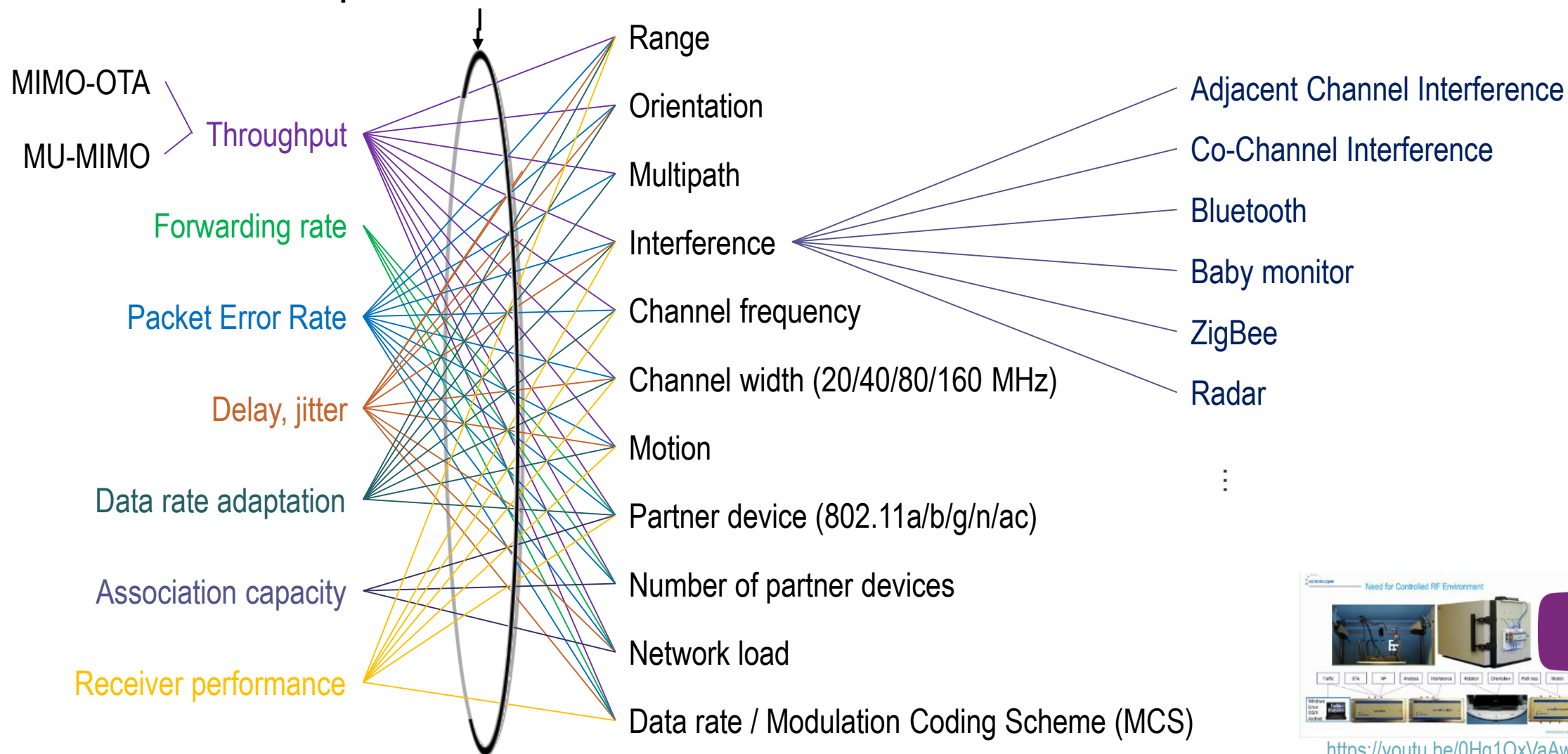
https://youtu.be/0Hq1OxVaAwk

Tests Supported by the octoBox Testbed

Exponential number of tests vs. variables

MIMO-OTA

MU-MIMO

Throughput

Forwarding rate

Packet Error Rate

Delay, jitter

Data rate adaptation

Association capacity

Receiver performance

Range

Orientation

Multipath

Interference

Channel frequency

Channel width (20/40/80/160 MHz)

Motion

Partner device (802.11a/b/g/n/ac)

Number of partner devices

Network load

Data rate / Modulation Coding Scheme (MCS)

Adjacent Channel Interference

Co-Channel Interference

Bluetooth

Baby monitor

ZigBee

Radar

MIMO = multiple input multiple output
MU-MIMO = multi-user MIMO
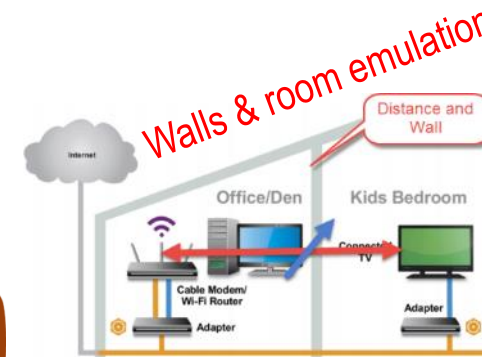
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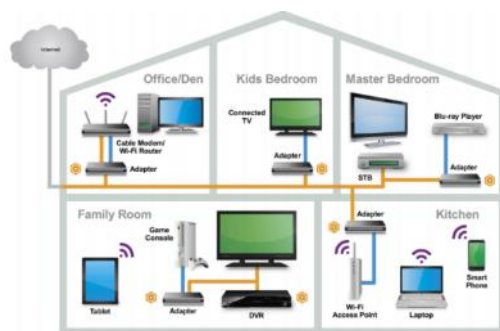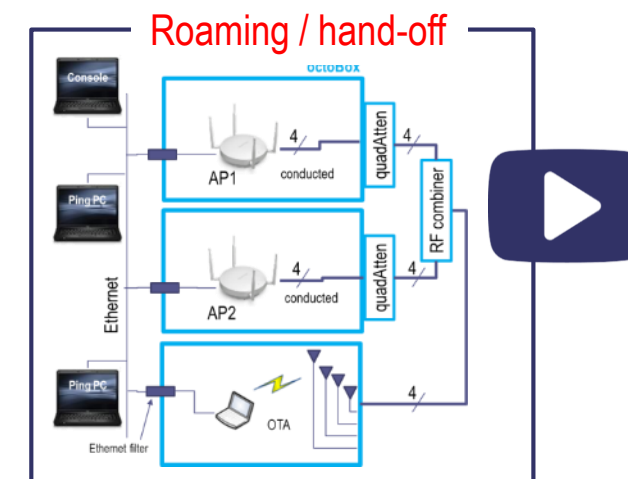# octoBox Testbed Summary

Throughput
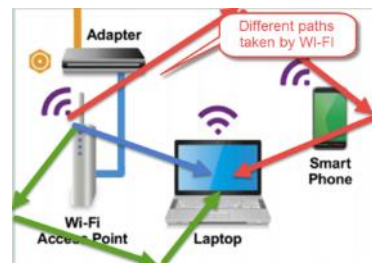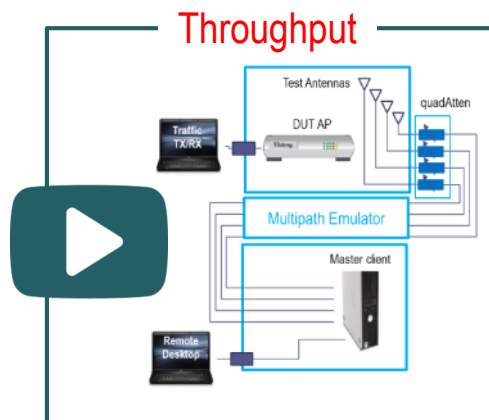
Multipath emulation
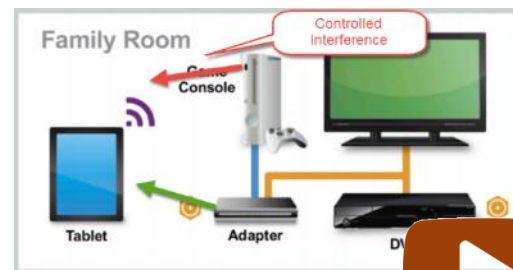
Interference generation

Walls & room emulation

Video and multi-room emulation

Roaming / hand-off

octoBox Benefits

- Reduce wireless test time from weeks to hours
  - Complete isolation and repeatable RF environment minimizes time-consuming open-air testing
  - Automation accelerates data collection, improves test coverage and product quality

- Demonstrate highest achievable performance
  - Ideal MIMO environment for highest possible throughput
  - Supports latest technologies, such as 160 MHz 802.11ac, 802.11ax, MU-MIMO, Beamforming, and beyond

- Demonstrate handling real-world challenges
  - Real devices = real behaviors
  - Programmable range of condition from best MIMO environment to challenging real-life impairments
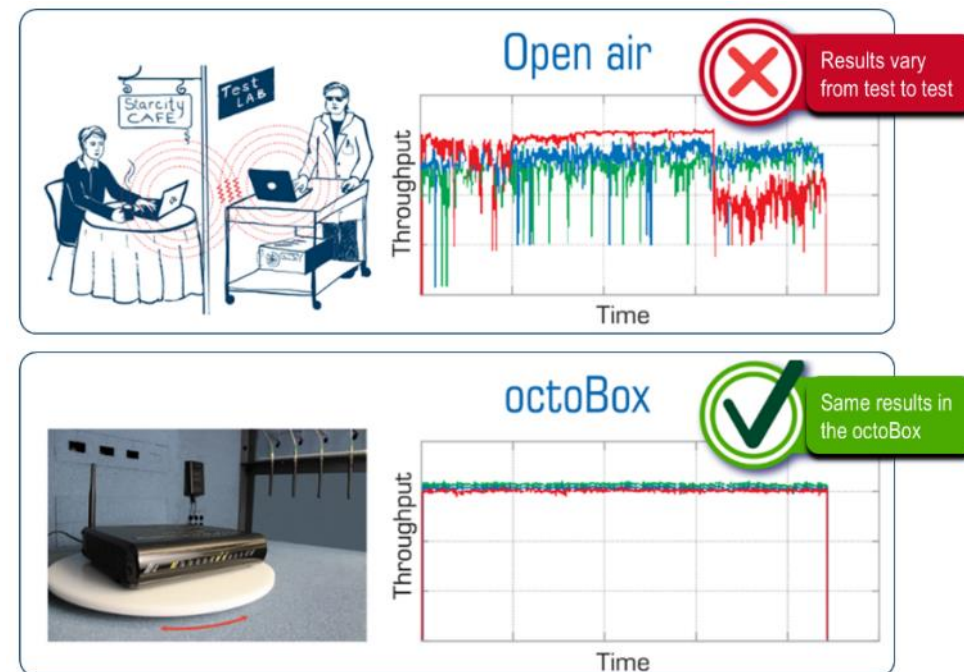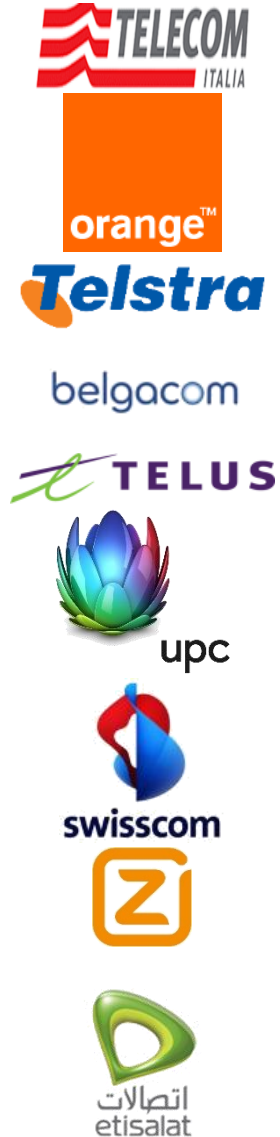
octoScope Customers

Equipment vendors

Operators

Labs

Chipset vendors

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Wireless Test Applications

- Performance testing
  - MIMO OTA throughput
  - MU-MIMO gains
  - Load testing
  - Roaming
  - RX sensitivity

- Behavior testing
  - Adaptation to impairments, such as path loss, interference, multipath, load
  - Roaming behavior – find sticky clients
  - DFS (dynamic frequency selection)

Pal-1 and Pal-2 Partner Devices
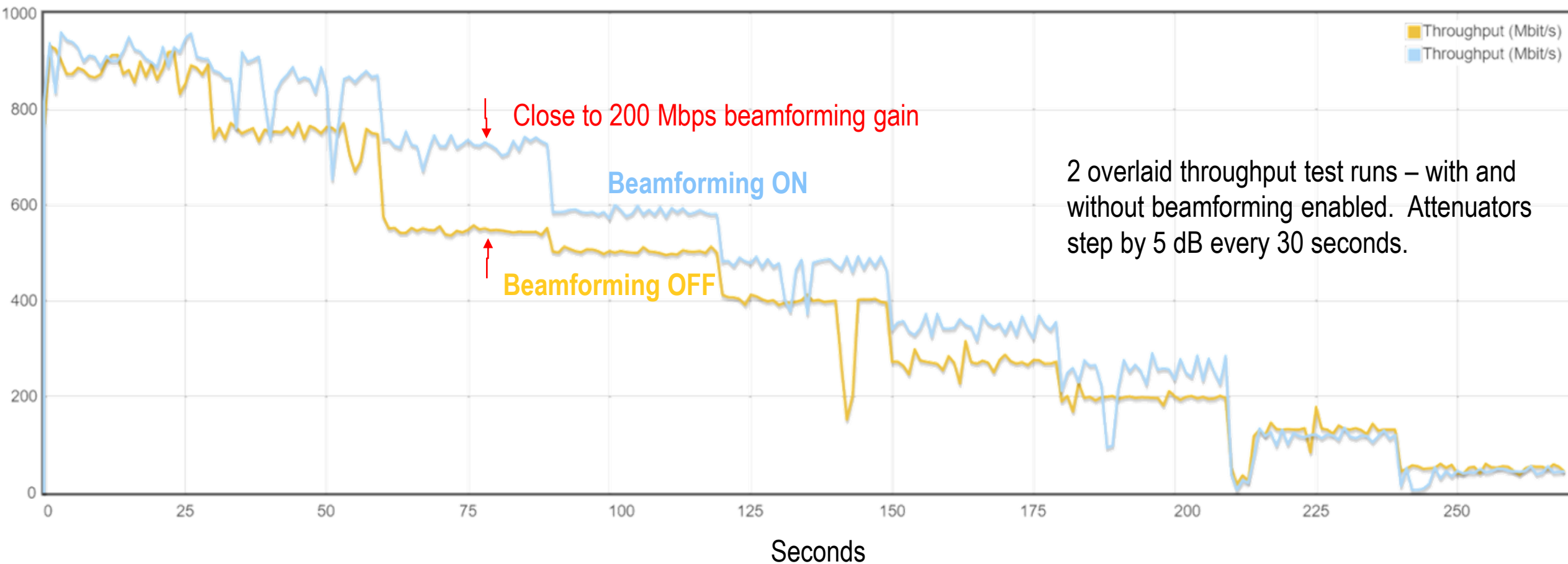

Throughput
Band steering
Roaming
Etc.

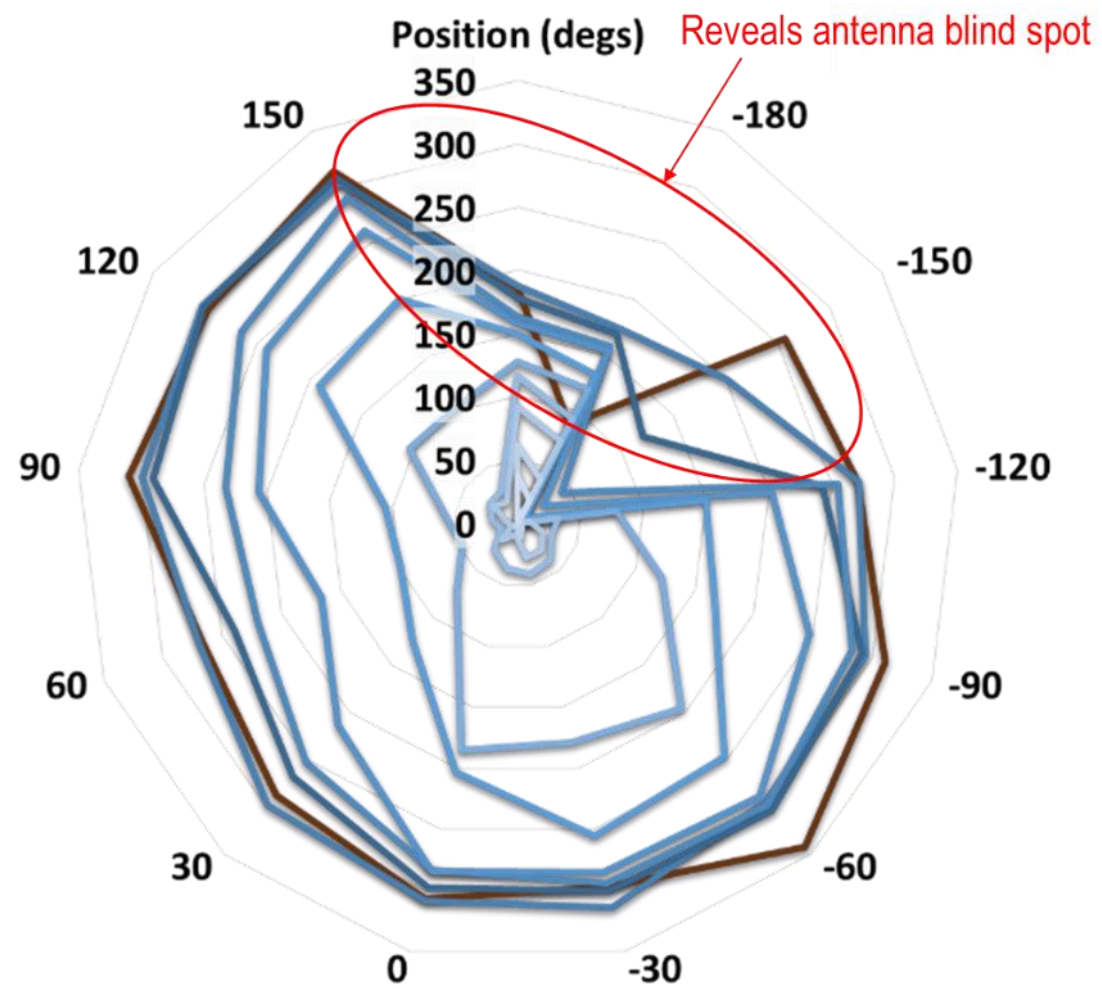|	Pal-1	Pal-2
MIMO OTA	x	x
MU-MIMO, beamforming	x	x
Channel width	20/40/80 MHz	20/40/80/80+80/160 MHz
AP	x	x
STA (client)	x	x
Virtual STA, vSTA	32	32
Traffic replay	x	x
Monitoring	x	x
2.4 GHz	x	
5 GHz	x	x

Throughput Script Browser Based User Interface

Automation: Throughput vs. Orientation vs. Path Loss

octoPal Partner Device

Mode	Station
SSID	octoscope-5G
Security	WPA2
Security Password	0cto$cope
IP Address	10.100.100.89
IP Subnet Mask	255.255.255.0
802.11 Interface	802.11ac
Channel Width	80 MHz
Guard Interval	Short
MCS (Mbps)	Adapt
Primary Channel	Scan
Secondary Channel	
Priority (WMM)	Best Effort
Maximum Number of Streams	3

Association Status:	Associated
Channel:	149 (5745 MHz)
Beacon RSSI:	-20 dBm
Data RSSI:	-20 dBm
TX Rate:	1.3 Gb/s
RX Rate:	65 Mb/s

Benchtop PAL testbed

iGen Interference Generator

Traffic interference

| System | ● Traffic | ● Monitor | ● Waveform | File Manager |

802.11 Interface	802.11ac
Channel width	40 MHz
Guard Interval	Short
MCS (Mbps)	0 (15 Mbps)
Primary Channel	124 (5620 MHz)
Secondary Channel	128
Input file	single_TCPPacket_3128B.pcap
Play Mode	Loop until <stop>
Priority (WMM)	Best Effort
Inter-Packet Gap (300µsec minimum)	300	µsec
Attenuation (0dB to 60dB)	0

Waveform interference

Help

● Traffic   ● Capture

Interference Type

Bluetooth Low Energy
Microwave Oven
Baby Monitor
802.11 FHSS
ZigBee
Custom CSV File
Pulse
Continuous Wave
Frequency Sweep

| Attenuation 0 to 60 dB | 0 |
| Frequency 500 to 6000 MHz | 5625 |

octoBox iGen

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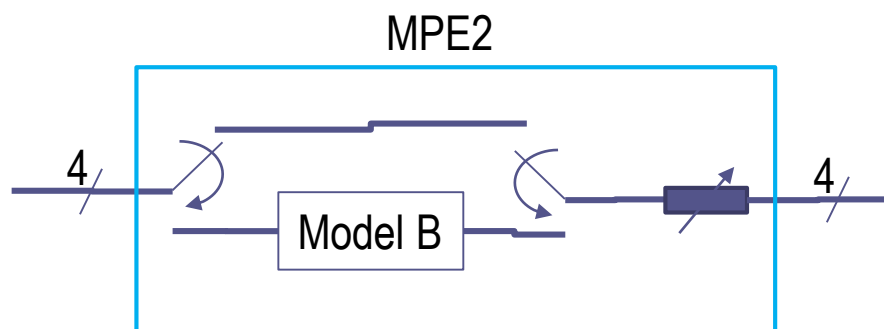# Roaming, Coexistence, Mesh, Large Scale Network Testing, …

Interference can easily be added using the octoScope iGen interference generator.
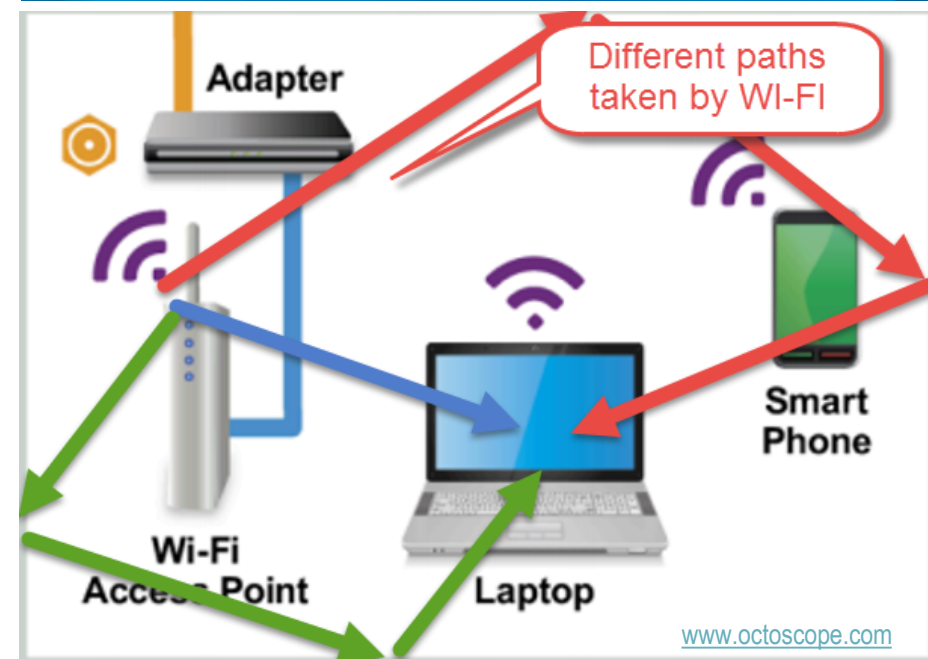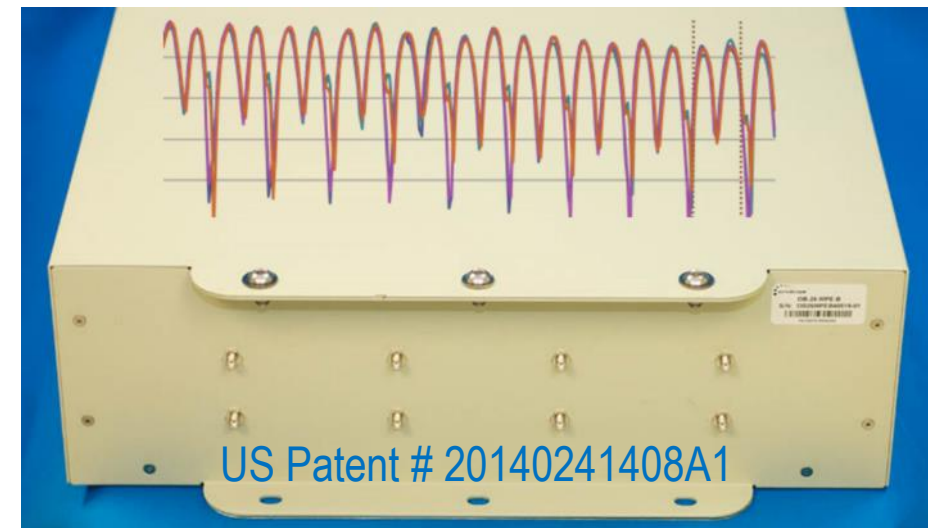

Flexible network topology configurations are possible with octoScope's completely isolated MIMO splitters.

Unique Patented Multipath Emulator (MPE) Technology

- Broadband (DC – 6 GHz) multipath emulator

- Accurately emulates a home channel model (IEEE 802.11 model B)

- Built-in bypass switch for LOS conditions

- Built-in programmable attenuators for range testing

- 4x4 MIMO link

US Patent # 20140241408A1

MPE2

4 / ... 4 /

Model B

LOS = line of sight

Different paths taken by WI-FI

Adapter

Wi-Fi Access Point

Laptop

Smart Phone

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