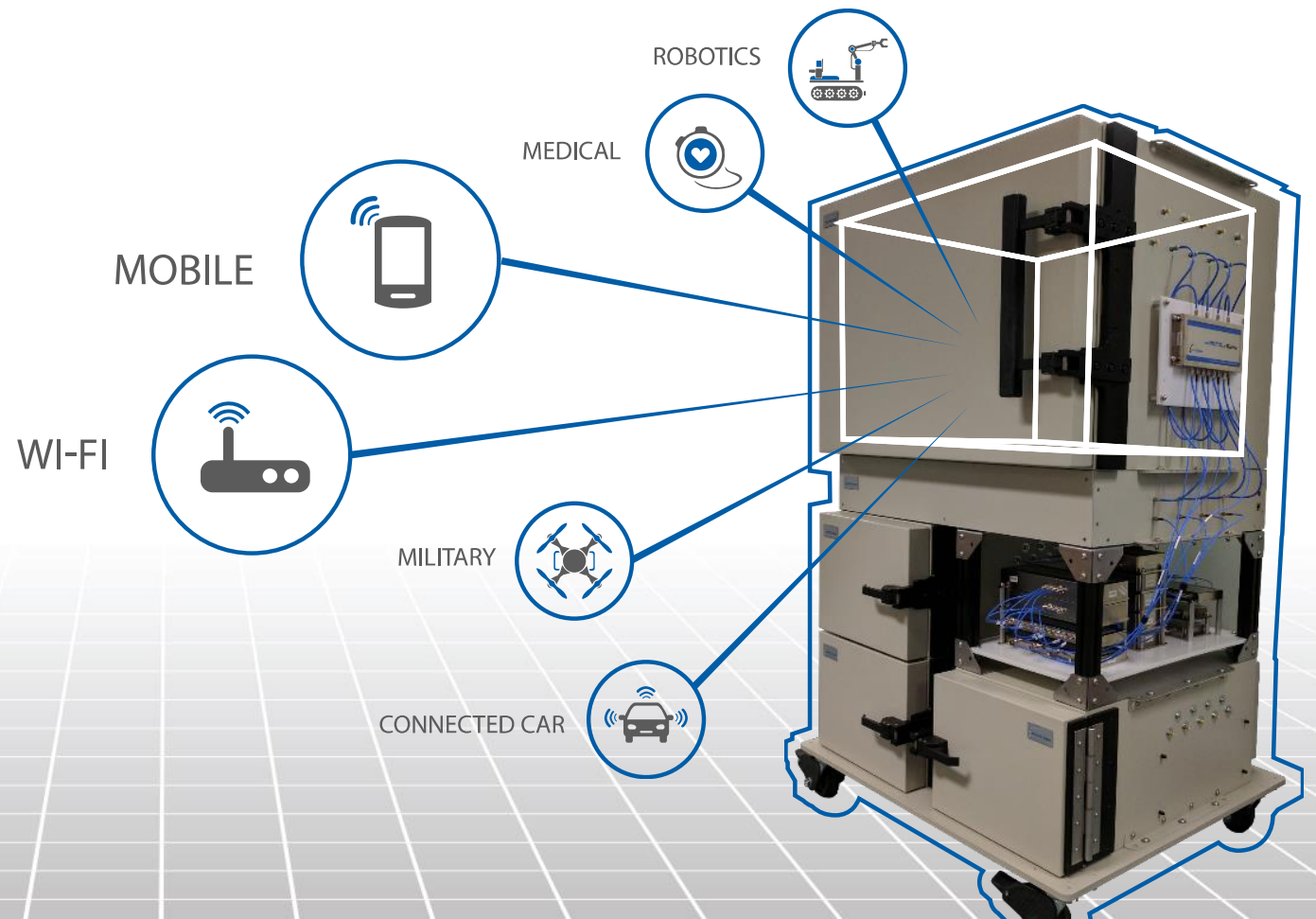




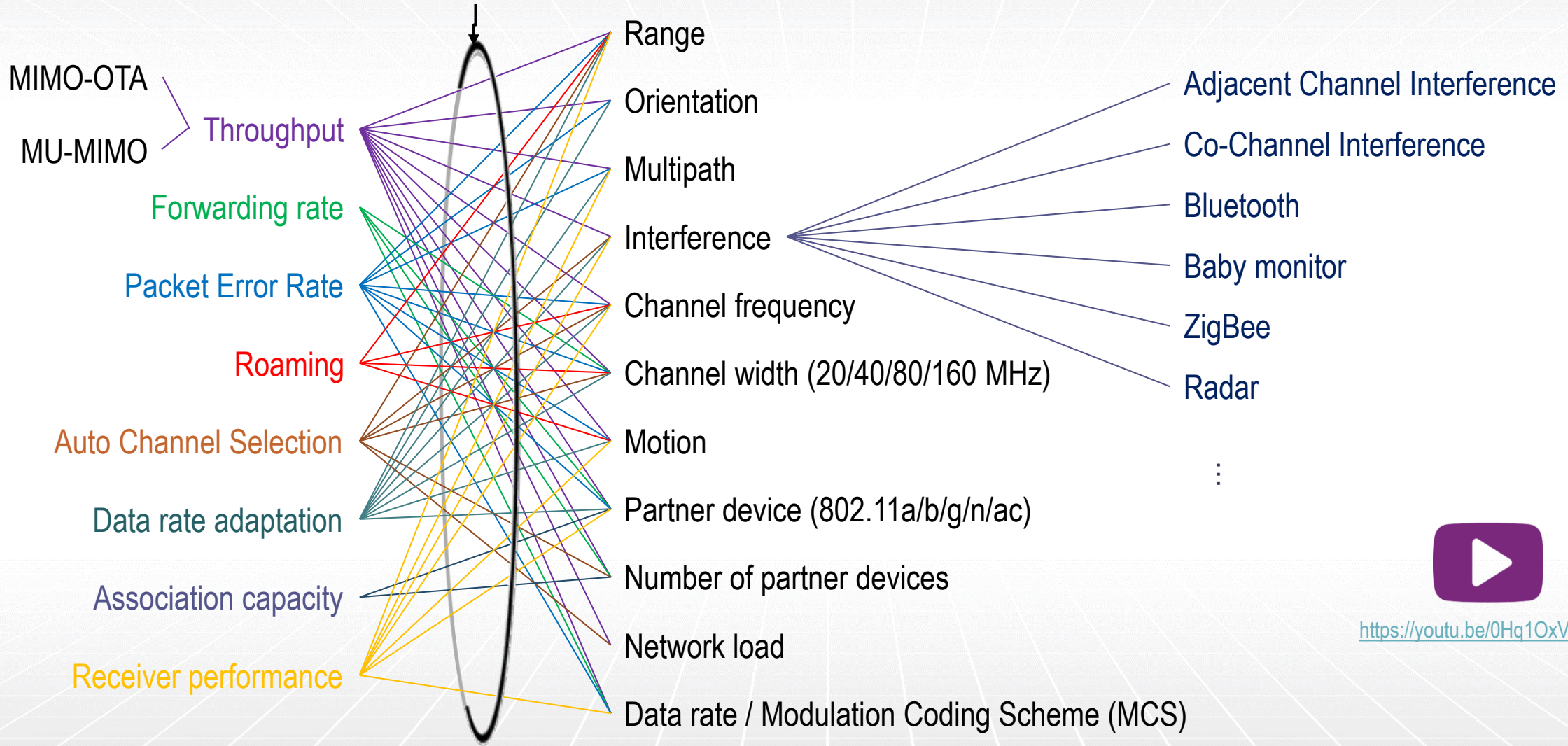
Testbed Overview

June 2018



octoScope Tests supported by the octoBox testbed

Exponential number of tests vs. variables



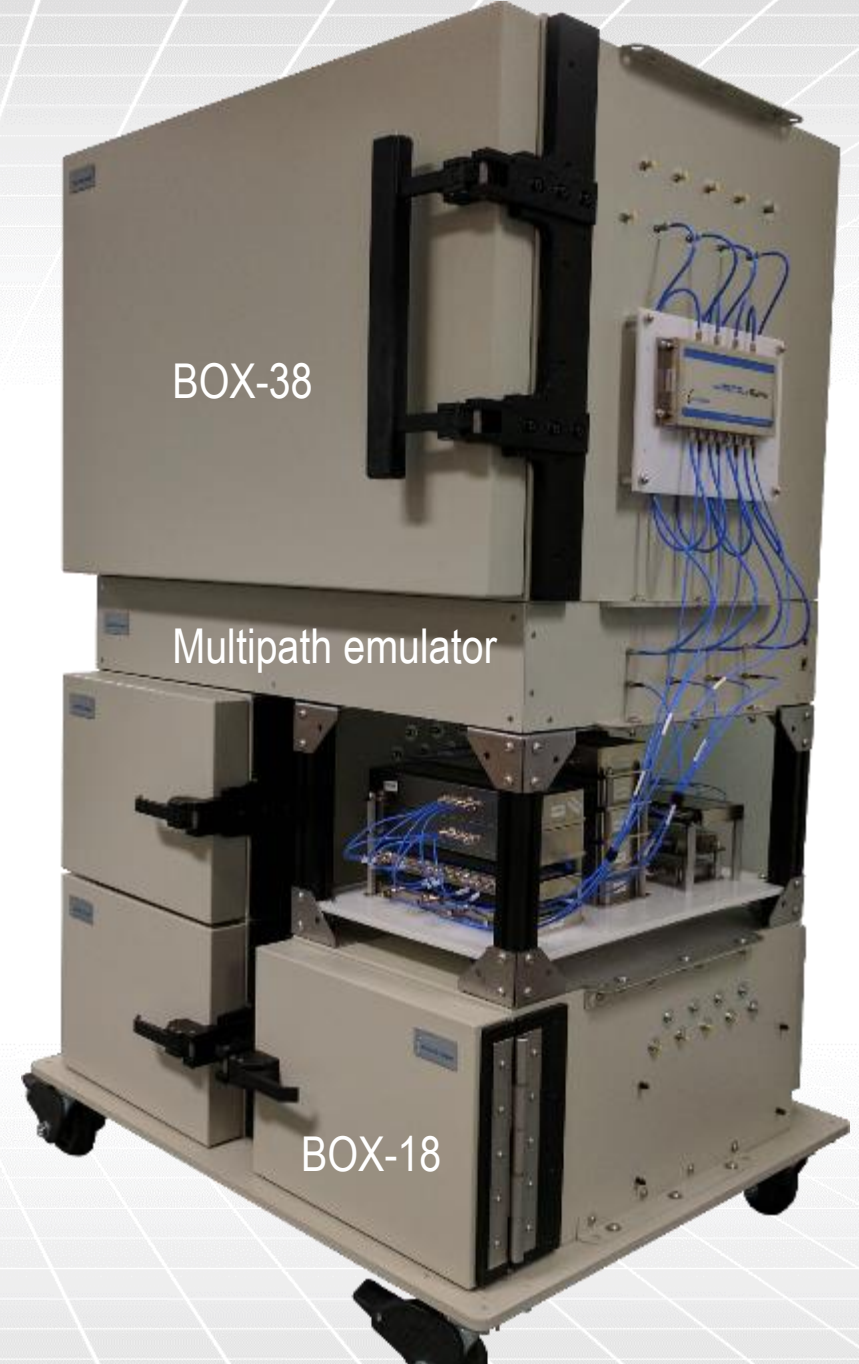
MIMO = multiple input multiple output
MU-MIMO = multi-user MIMO



<https://youtu.be/0Hq1OxVaAwk>

octoScope 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 and Beamforming
- Qualify User Experience
 - Emulate real-world challenges
 - Programmable range of condition from best MIMO environment to challenging real-life impairments



octoScope octoScope customers

Operators



Labs



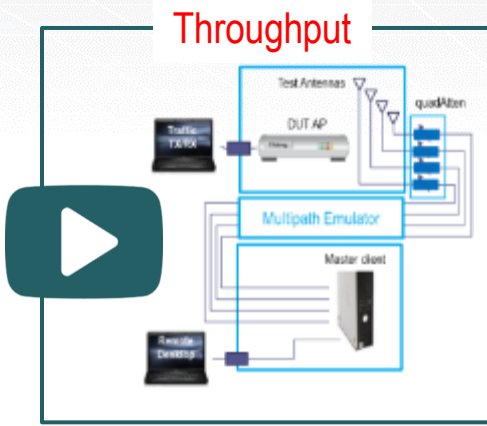
Chipset vendors



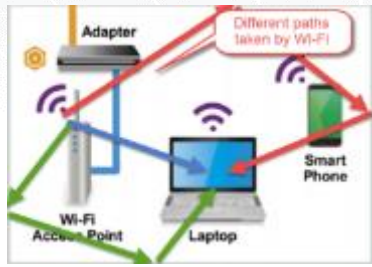
Equipment vendors



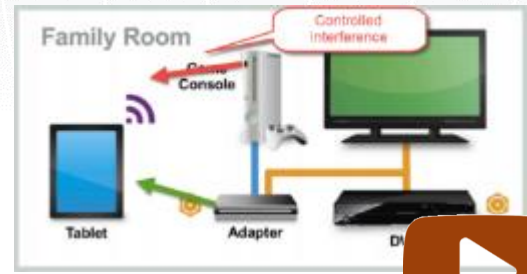
octoScope octoBox personal testbed summary



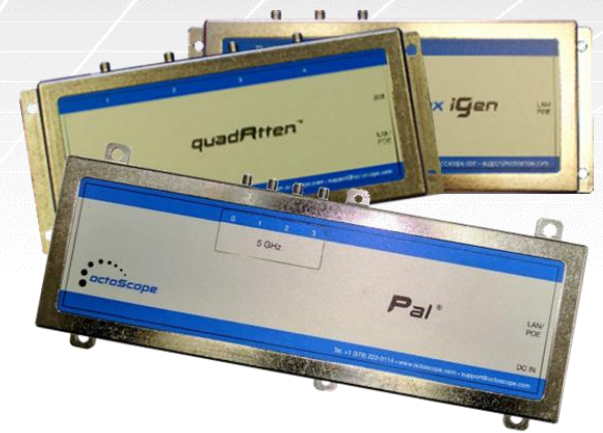
Throughput



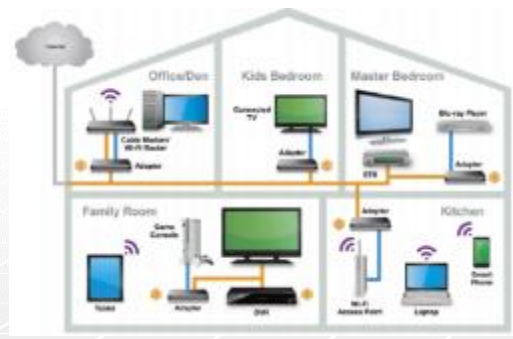
Multipath emulation



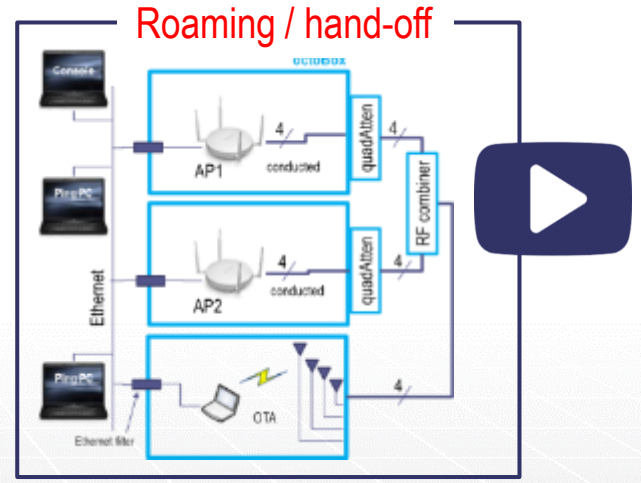
Interference generation



Traffic partner, station emulation



Video and multi-room emulation



Roaming / hand-off

Functionality
AP
STA (client)
Virtual STA, vSTA
Traffic replay
Monitoring
Wireshark captures

MU-MIMO
 Beamforming
 20/40/80/80+80/160 MHz channels



Qualcomm
 QCA9984 4x4 160 MHz
 Wave 2 radio

Linux Yocto OS
 Quad-core 2 GHz Intel Atom

Cloud based
architecture for
worldwide
distributed teams

- Remote controllable via any browser
- Database for test records and testbed building blocks
- API for test automation

Note: Based on the MEAN stack (Node.js, mongo.DB and Angular)

Autotest Dashboard

Traffic

Training duration: 2 Step duration: 10

Active	Name	From To	Protocol	IP Streams	Offered load (kbps)	Buffer (kb)	Window (kb)
<input checked="" type="checkbox"/>	Traffic-1	Local Traffic Endpoint 192.168.15.6@Pa2-PU	tcp	4	0	0	0

Configuration elements:

Add new...

Monitor

Range

Range (dB): 0 dB 20 dB 60 dB Step (dB): 5

Primary quadAtten	Series quadAtten	Max attenuation	Delete
QA601010-20 @192.168.15.20	No series quadAtten	60	<input type="checkbox"/>

Orientation

Turntable: Turntable octoScope 0 [turntable] @0

Rotate during test

Polar plot

Rotation step: 30

Start position (deg): 0

End position (deg): 300

Home turntable

Filter by model: Choose model filter

Filter by revision: Choose revision filter

Select test results: Choose test results name Load

Current test: Model: Netgear Revision: Test: octoBox-test-new

Run Save as... New... Export PDF Export CSV Clear

LIVE DATA AVERAGE DATA DIAGRAM

Mbit/s

Seconds

Polar data

Polar plot

Atten - 0
Atten - 5
Atten - 10
Atten - 15
Atten - 20

octoScope Wireless test applications

- Performance
 - MIMO OTA throughput
 - MU-MIMO gains
 - Load testing
 - Roaming
 - RX sensitivity
- User Experience
 - Adaptation to impairments, such as path loss, interference, multipath, load
 - Roaming behavior – find sticky clients
 - DFS (dynamic frequency selection)



Radio 1 Global Configuration

Mode: Station

Stations Count: 4

802.11 Interface: 802.11ac

Channel Width: 80 MHz

Primary Channel: Scan

Guard Interval: Short

MCS (Mbps): Adapt

Max. MIMO Streams: 4

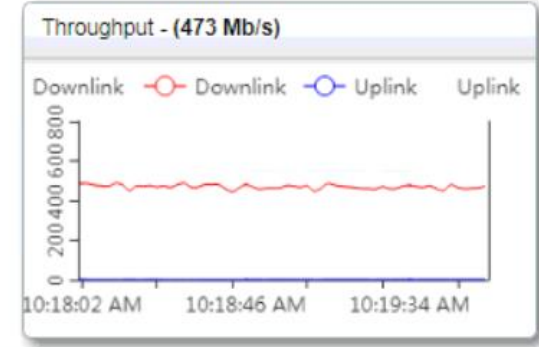
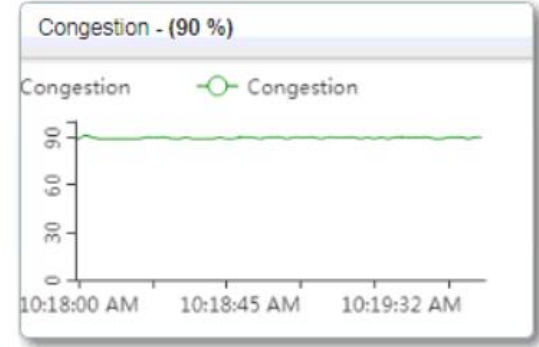
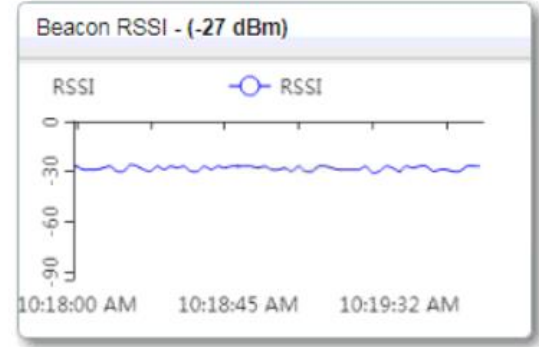
Priority (WMM): Best Effort

MU-MIMO: Disable

Beamforming: Disable

Roam Threshold: -95

Roam Target Threshold: -95



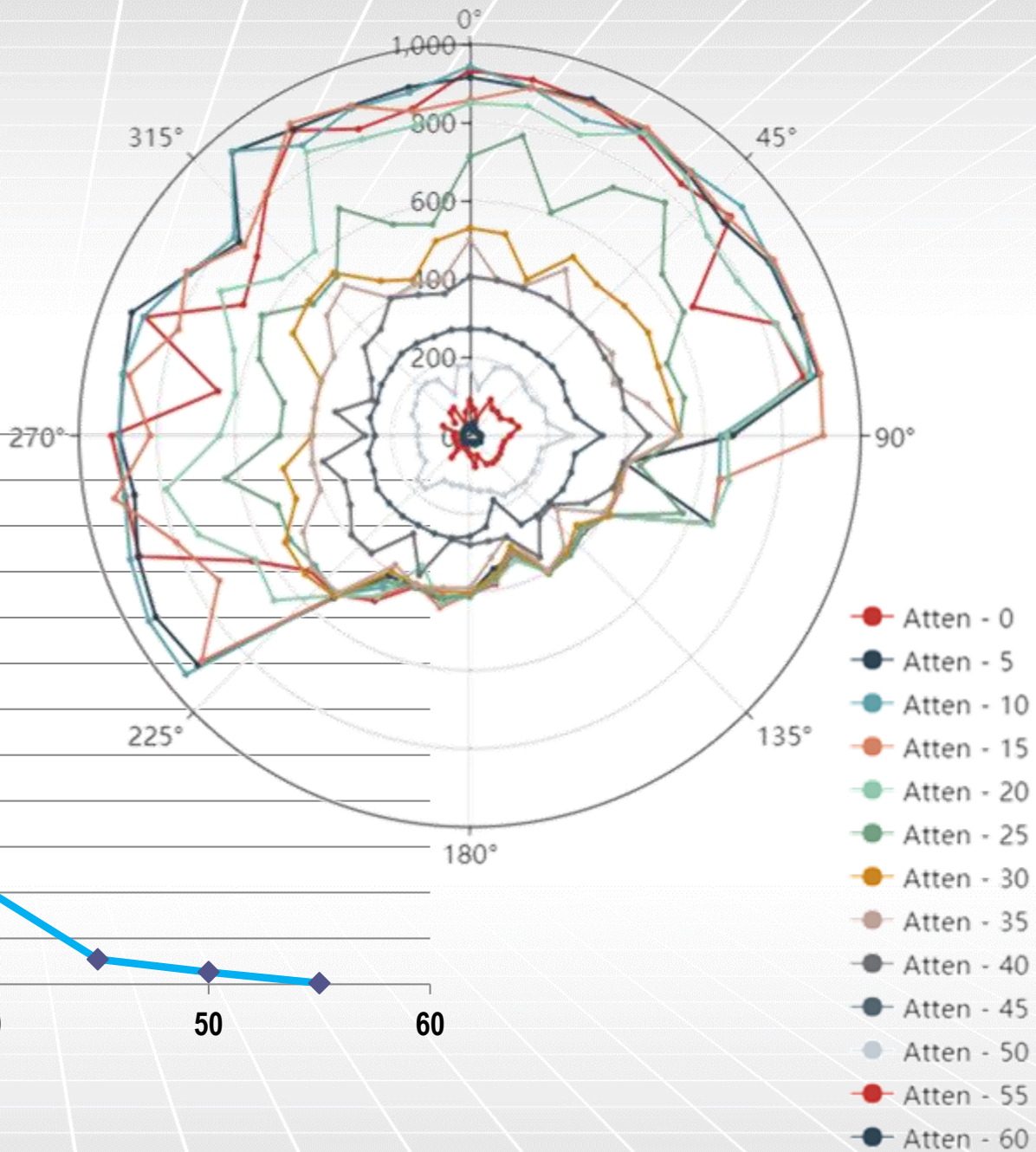
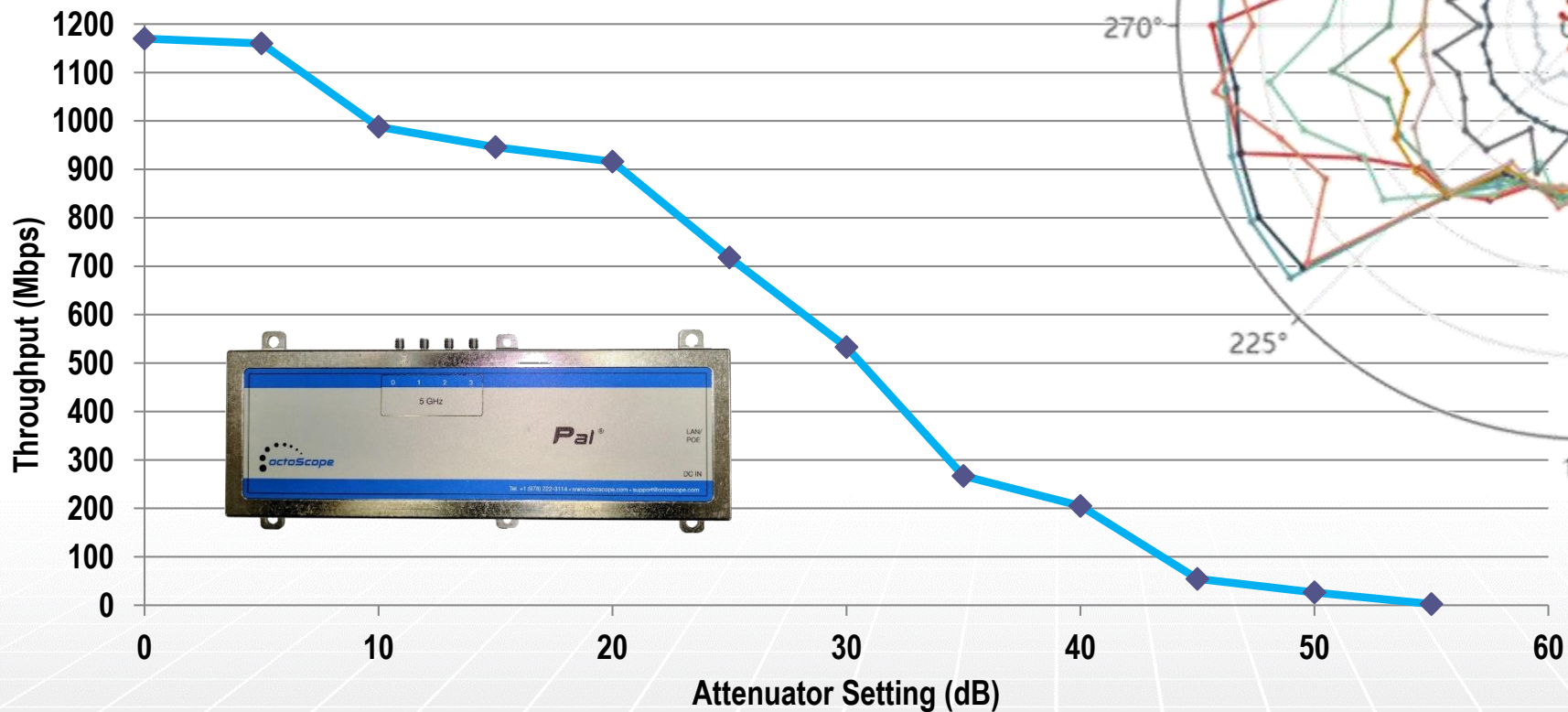
Status: **Associated** Channel: [149 153 157 161] BSSID: 10:da:43:18:ed:a7 4 of 4 Associated

	MAC / IP	Interface	Bandwidth	Streams	WMM	Tx Power	RSSI	Tx Rate	Rx Rate	Actions
<input checked="" type="checkbox"/>	04:F0:21:2B:7F:00 192.168.15.90	ac	80	4	Best Effort	0 dB	-40 dBm	1560 Mb/s	1560 Mb/s	
<input checked="" type="checkbox"/>	04:F0:21:2B:7F:01 192.168.15.91	n	40	3	Voice	-13 dB	-35 dBm	405 Mb/s	405 Mb/s	
<input checked="" type="checkbox"/>	04:F0:21:2B:7F:02 192.168.15.92	a	20	1	Voice	-21 dB	-31 dBm	54 Mb/s	54 Mb/s	
<input checked="" type="checkbox"/>	04:F0:21:2B:7F:03 192.168.15.93	ac	20	2	Background	-25 dB	-35 dBm	173 Mb/s	173 Mb/s	



Throughput vs. Range vs. Orientation

Pal TCP Throughput



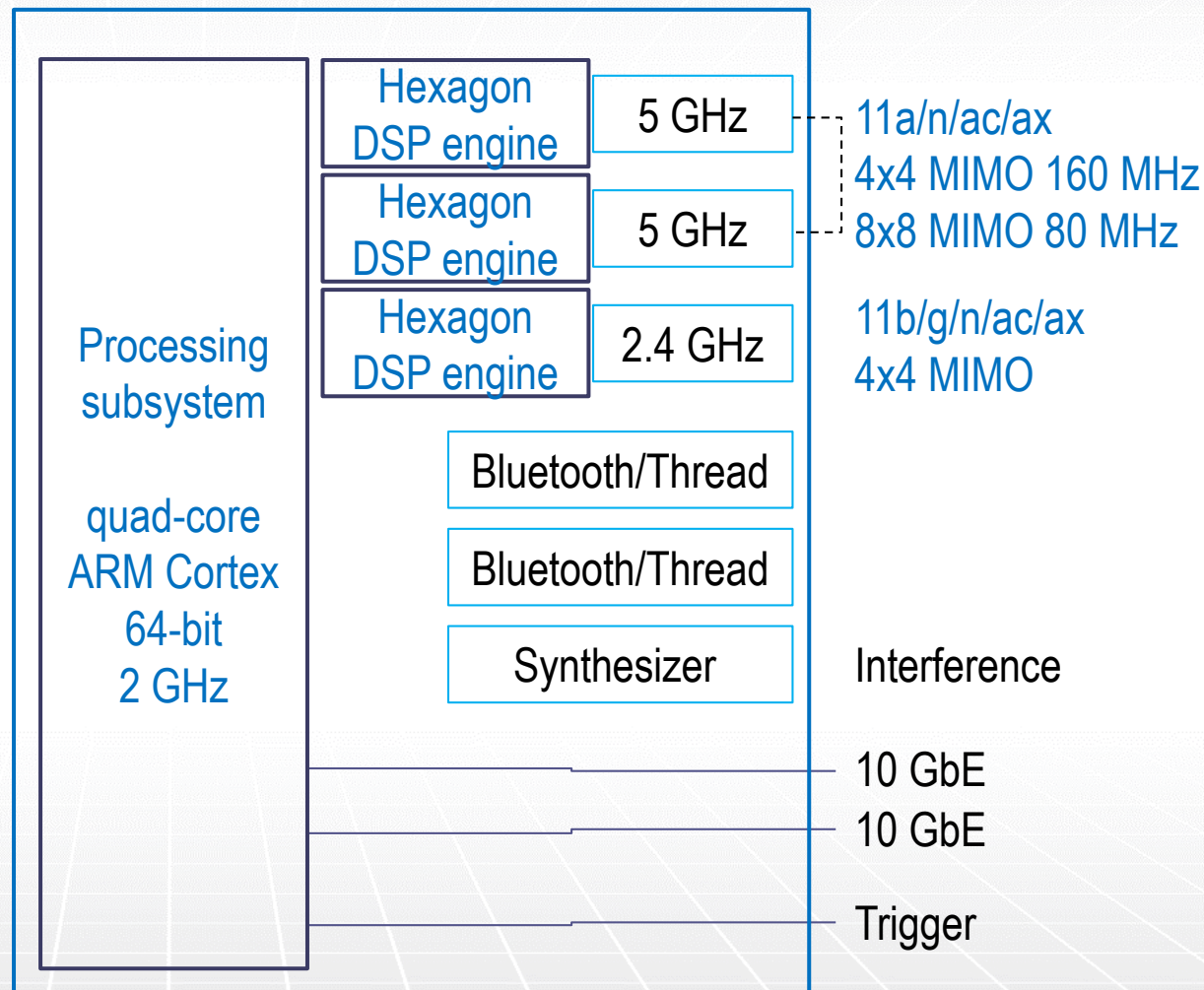
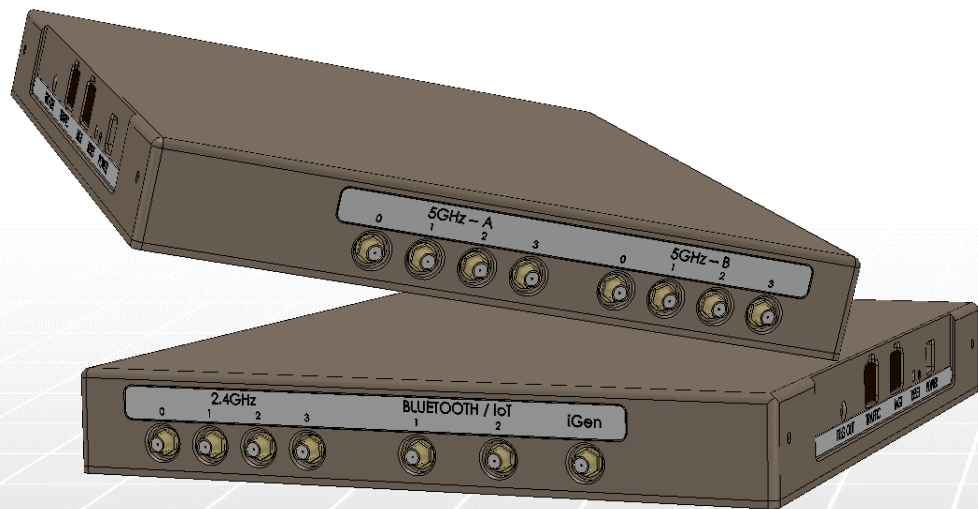
octoScope superPal™

Preliminary

Based on Qualcomm Hawkeye QCN5054
 Three 4x4 11ax capable radios

Two Silicon Labs EFR32 BT/Thread radios

Interference generator



Power and data cables feed through the center of the platter and are secured with a tie wrap.

Plastic cable shaft

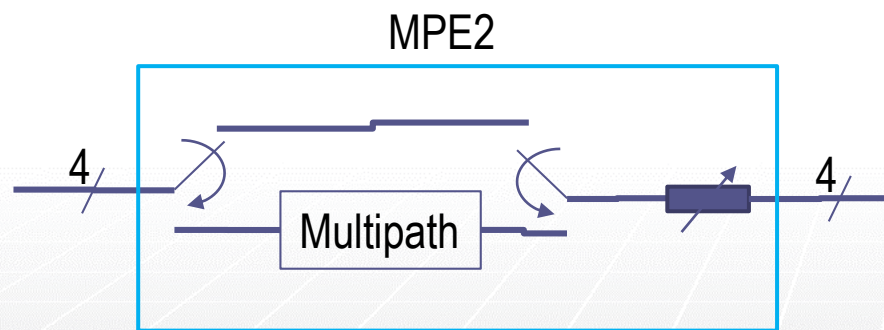
DUT platter

Cables feed through a plastic tunnel and get attached for tangle-free back and forth rotation under the DUT platter.

The DUT platter can be customized to clamp the DUT in a fixed location.

octoScope Multipath Emulator (MPE)

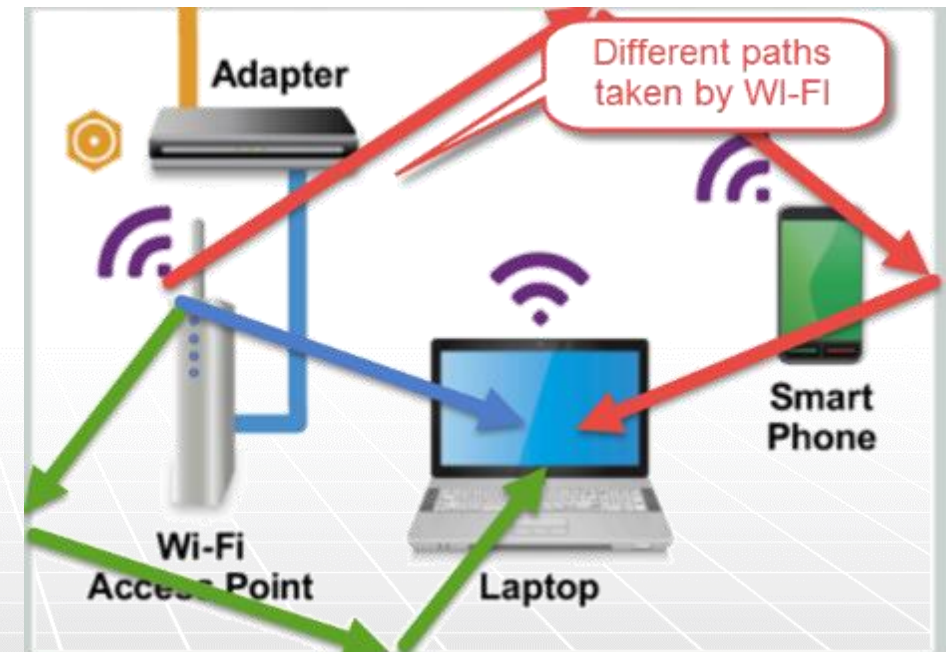
- Broadband (DC – 6 GHz) multipath emulator
- Accurately emulates a home channel model (IEEE 802.11 model B)
- Built-in bypass switch for LOS conditions
- Built-in programmable attenuators for range testing
- 4x4 MIMO link



LOS = line of sight
MPE = multipath emulator



US Patent 9,130,667





STACK-BENCHTOP



STACK-16



STACK-MESH

octoScope Test applications focus

Throughput

Roaming

Mesh

DFS

Interference

Capacity

Band steering

Load balancing

RX sensitivity

Rate/MCS adaptation

MIMO adaptation

MU-MIMO

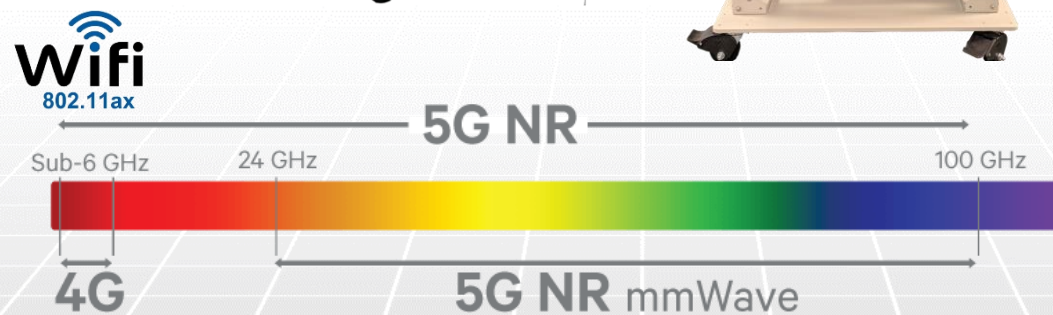
Capture/replay

Beamforming

700 MHz – 6 GHz
mmWave 24 – 86 GHz



octoBox
Wireless personal testbeds



Tests supported by standard octoBox testbeds

	STACK-BENCHTOP	STACK-MESH	STACK-16
MIMO-OTA	Y	Y	Y (up to 16 streams)
MU-MIMO	Y	Y	Y
Beamforming	Y	Y	Y
Throughput vs. range	Y	Y	Y
Throughput vs. orientation		Y	
Packet capture (PCAP Wireshark format)	Y	Y	
Multipath		Y	
Mesh		Y	
Interoperability		Y	Y
Interference	Y	Y	
Network load (ACI, CCI)	Y	Y	
DFS, ACS	Y	Y	
Expert monitoring and analysis	Y	Y	
Mobility / roaming	Y	Y	
Receiver performance	Y	Y	Y
Association capacity (vSTA)	Y	Y	
Multi-channel aggregate throughput	Y	Y	Y
Roaming / band steering	Y	Y	

Most tests are supported over both Wi-Fi and LTE; LTE instrumentation (e.g. call box) or base station required for LTE testing

ACI = adjacent channel interference
 CCI = co-channel interference
 DFS = dynamic frequency selection
 ACS = auto channel selection
 vSTA = virtual stations



*Linux Yocto OS
Quad-core 2 GHz Intel Atom*

Summary of Pal capabilities

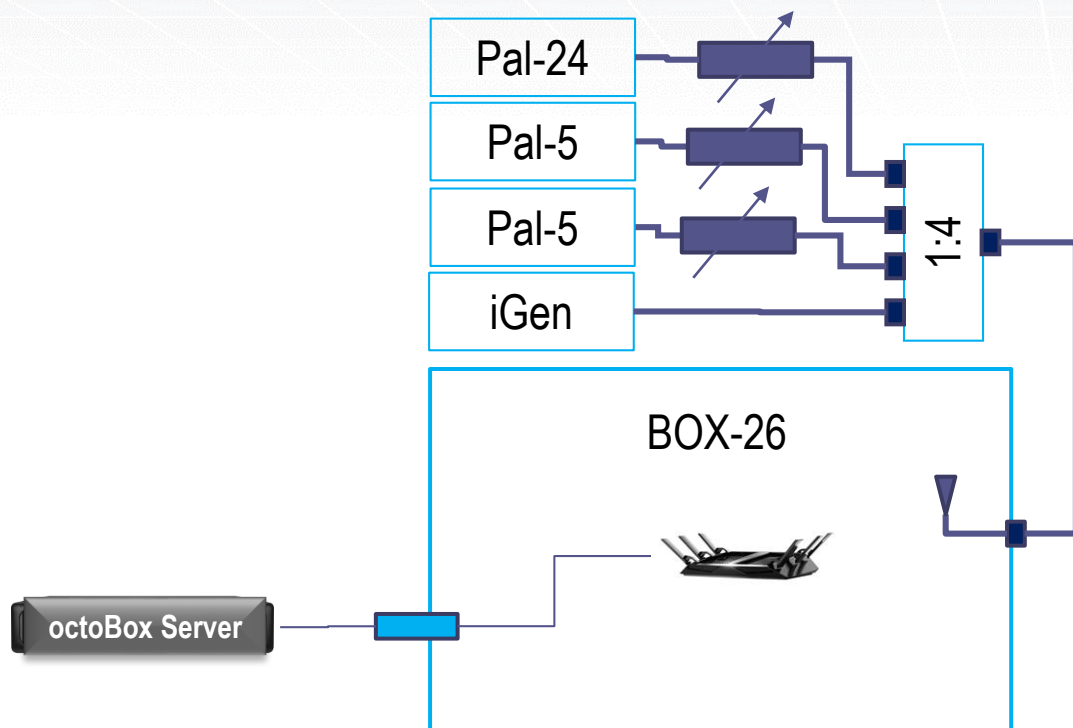
Pal-245

Pal-24

Pal-5

	2.4/5 GHz 3x3 radio <i>QCA9880 3x3 80 MHz</i>	2.4 GHz 4x4 radio (wave 2) <i>QCA9984 4x4 40 MHz</i>	5 GHz 4x4 radio (wave 2) <i>QCA9984 4x4 160 MHz</i>
MIMO-OTA	✓	✓	✓
MU-MIMO			✓
Beamforming		✓	✓
Channel width	20/40/80 MHz	20/40 MHz	20/40/80/80+80/160 MHz
AP	✓	✓	✓
STA (client)	✓	✓	✓
Virtual STA, vSTA		32	32
Traffic replay	✓		
Monitoring	✓	✓	✓
Wireshark captures	✓	✓	✓
2.4 GHz	✓	✓	
5 GHz	✓		✓

octoScope STACK-BENCHTOP



STACK	STACK DIMENSION	TOTAL WEIGHT
STACK-BENCHTOP	24.8"H x 26.4"W x 25.2"D (63cm x 67 x 64)	123.5 LBS (56 kg)

Legend:

■ 4 SMA connectors

— 4 RF cables

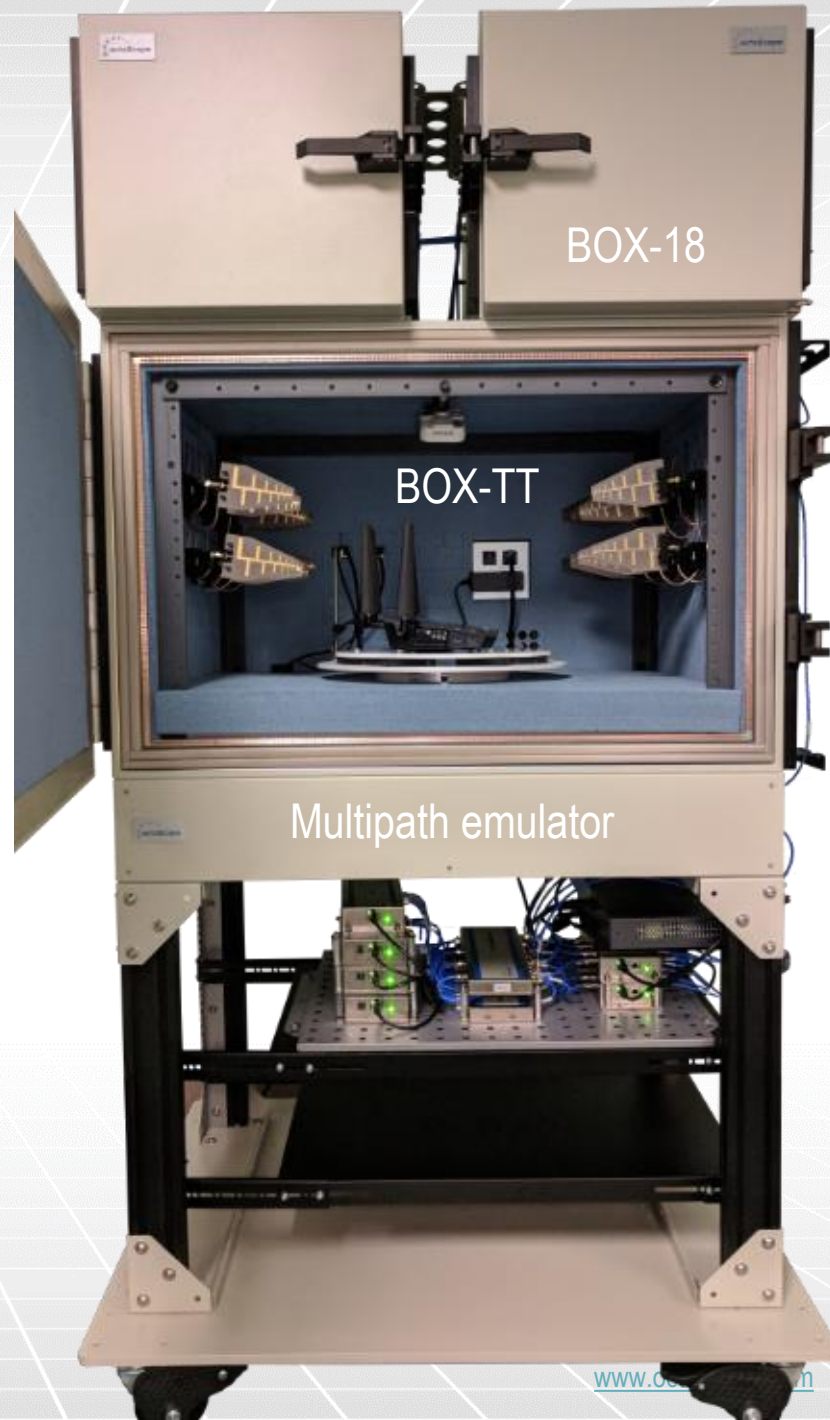
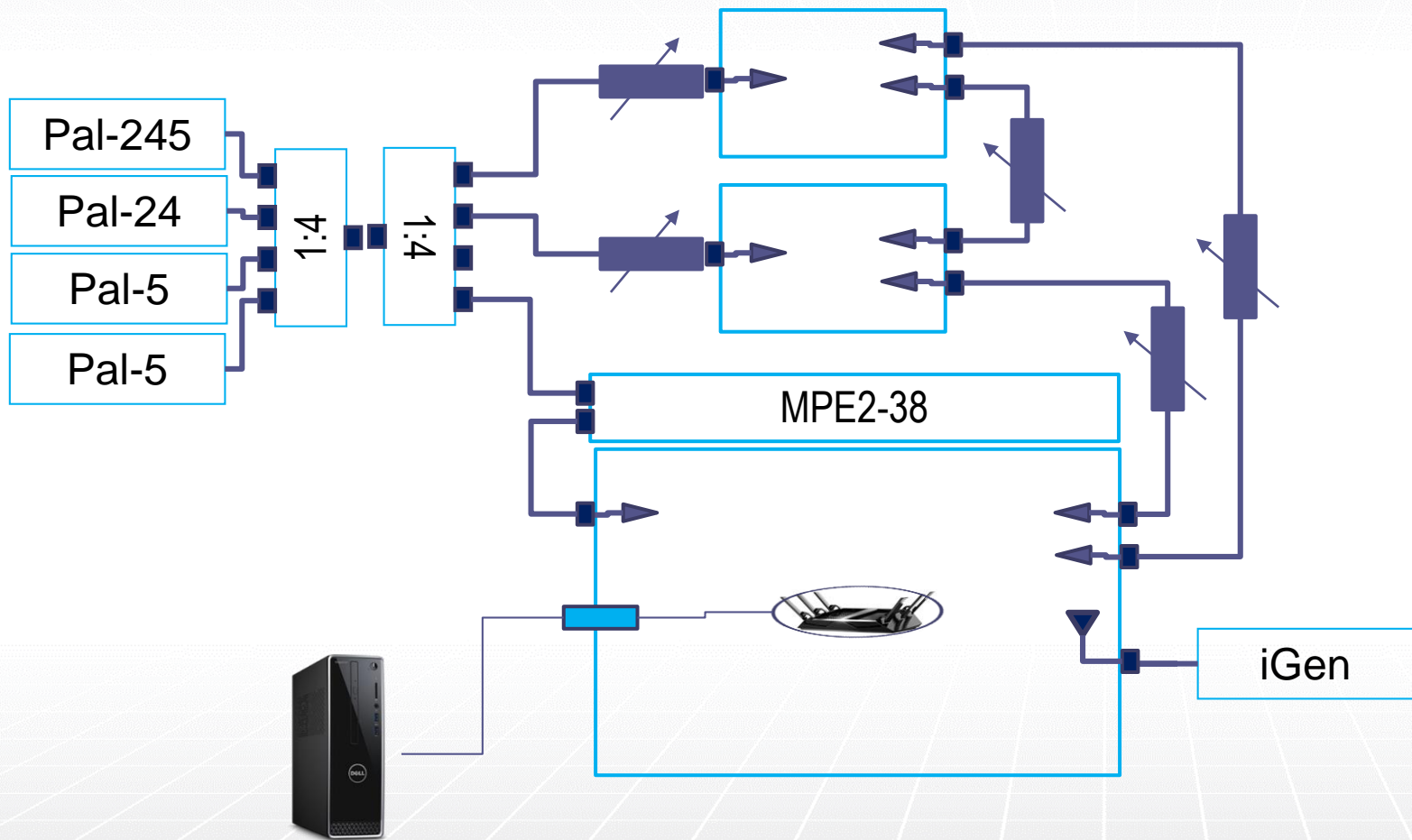


4x4 MIMO 1:4 Splitter

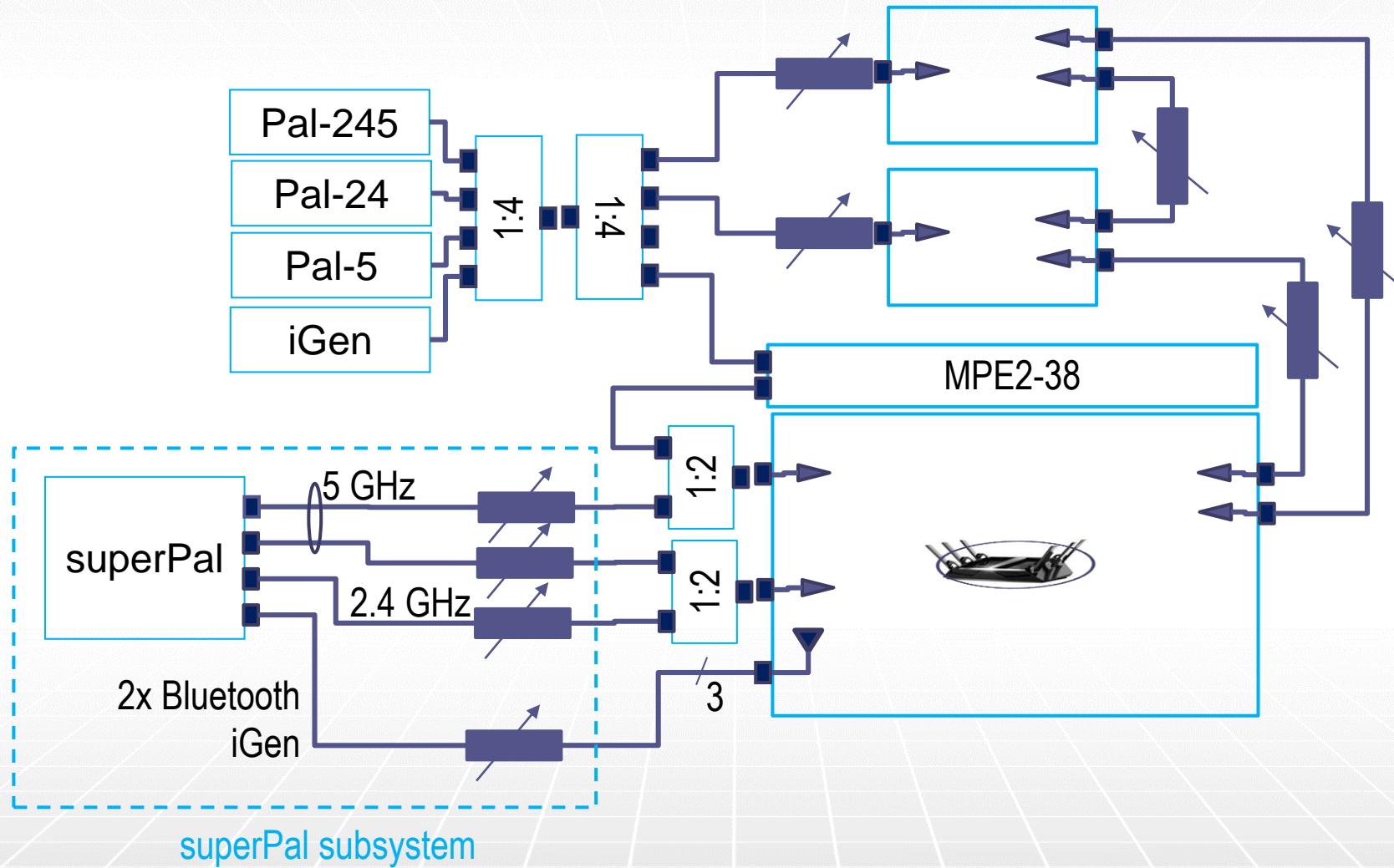
▼ 4 dipole antennas

quadAtten
www.octoscope.com

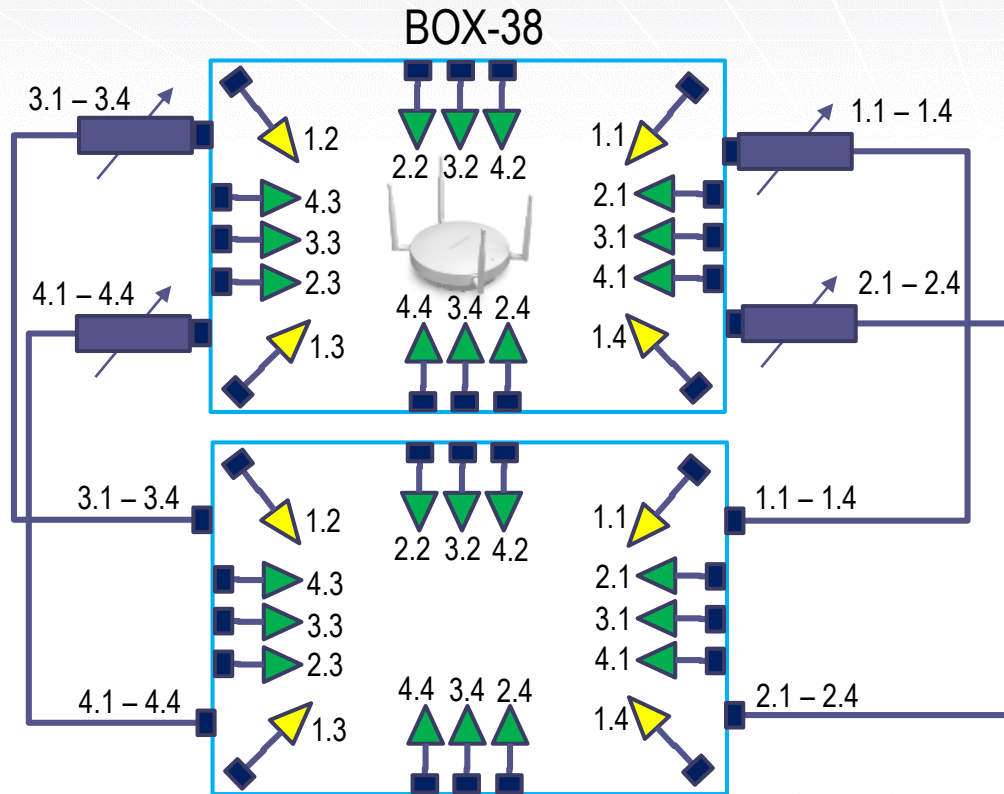
octoScope STACK-MESH





octoScope STACK-MESH + superPal



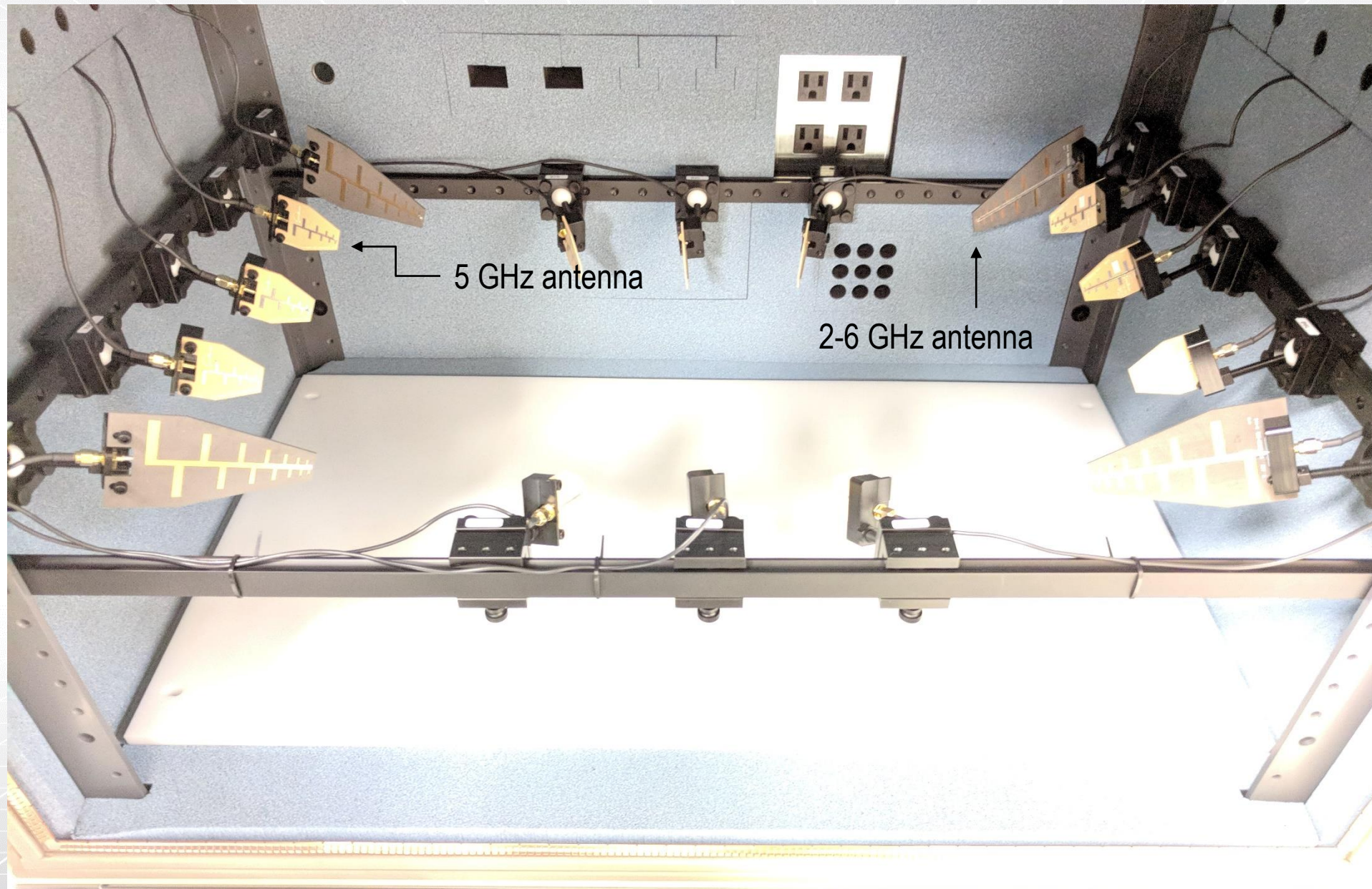
octoScope STACK-16



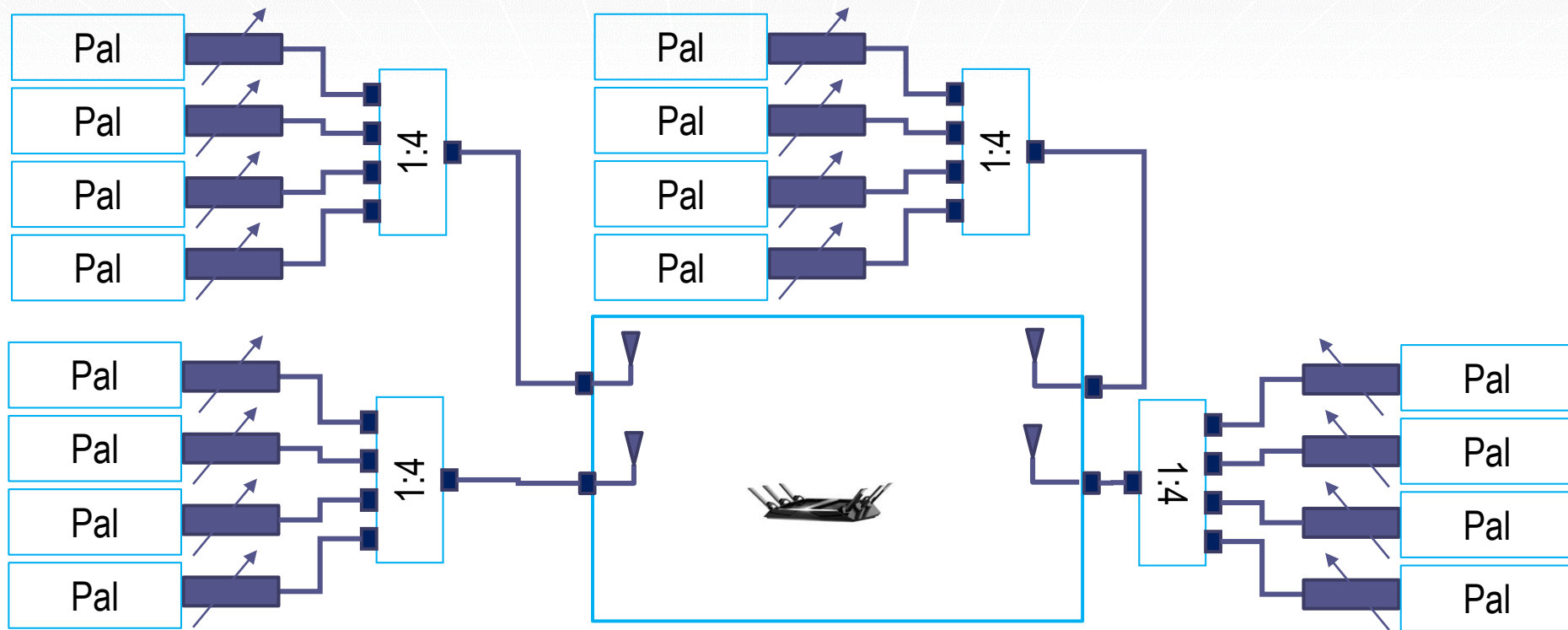
-  High Gain - Dual Band
-  High Gain - 5 GHz Only



octoScope STACK-16 antenna arrangement



octoScope 16-Pal multiPal™ configuration for AP capacity testing



octoScope Instruments



octoScope Web UI and API for all accessories

- All octoBox accessories include browser UI and REST API for all browser controls.

octoScope

Welcome to the octoBox quadSwitch!

Name: SW70721-07 IP Address: 169.254.21.7
Serial: SW70721-07 Subnet: 255.255.0.0
Firmware: 3.2.18-mh11 Gateway: 0.0.0.0
MAC: 2C:27:9E:90:04:BF

A 1A 2A 3A 4A
 B 1B 2B 3B 4B

IP Settings:

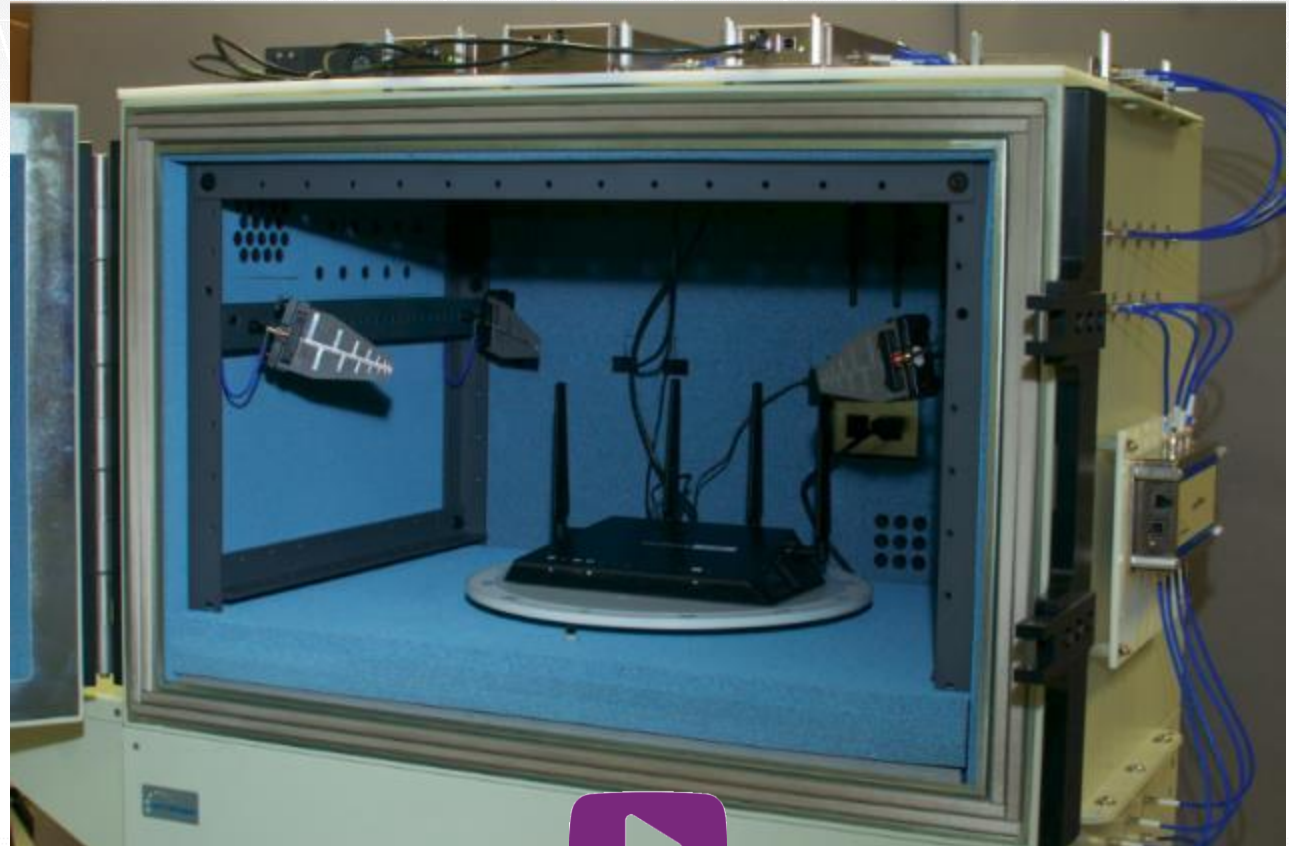
IPv4 Address

Subnet Mask

Default Gateway

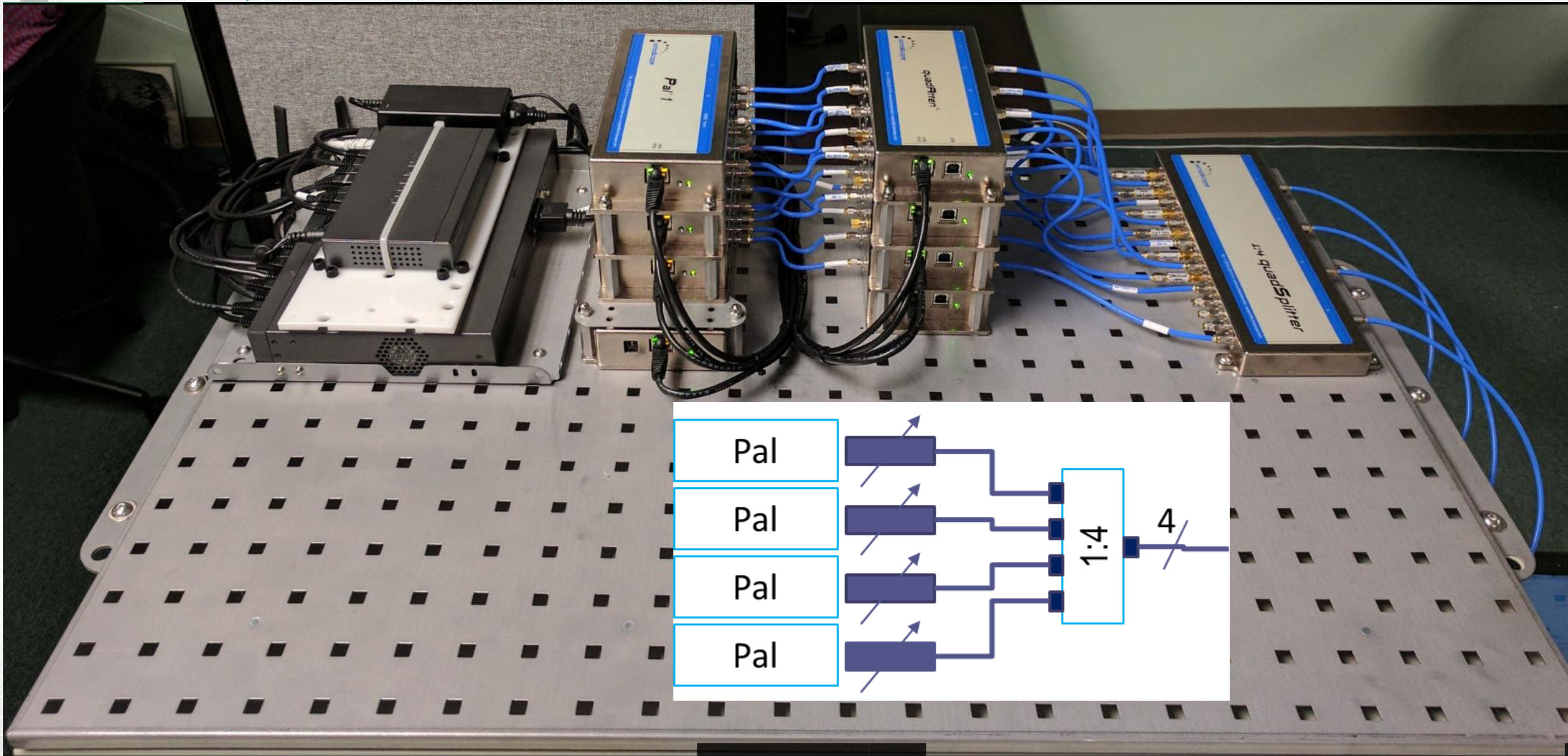
octoScope Throughput testing

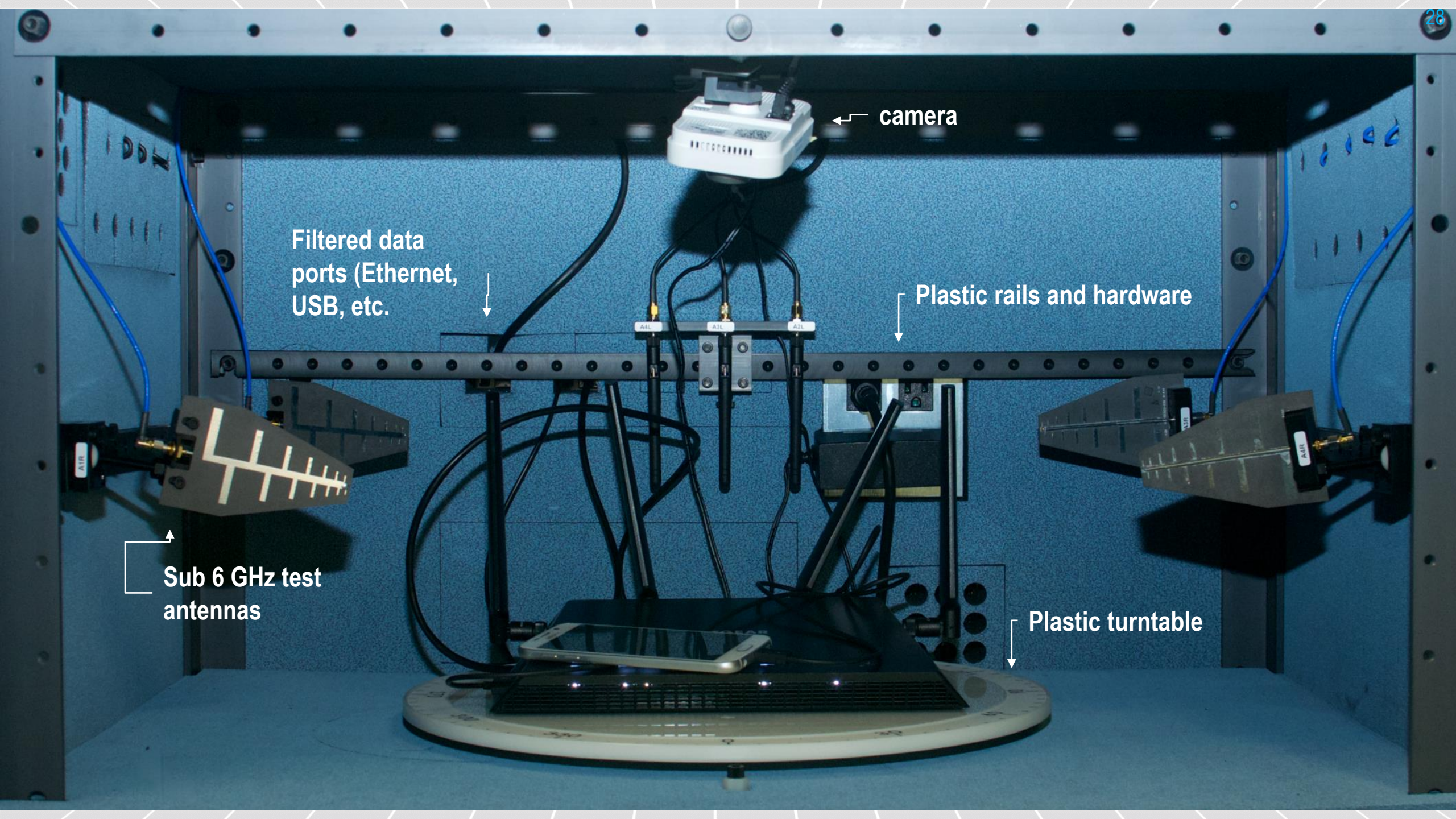
- ✓ Throughput performance
- ✓ Complete isolation
- ✓ Controlled interference
- ✓ Roaming behavior (sticky clients)
- ✓ Interoperability (vendor to vendor)
- ✓ Emulate a multi-room house



<https://youtu.be/0Hq1OxVaAwk>

octoScope Test subsystem





← camera

Filtered data ports (Ethernet, USB, etc.) ↓

↓ Plastic rails and hardware

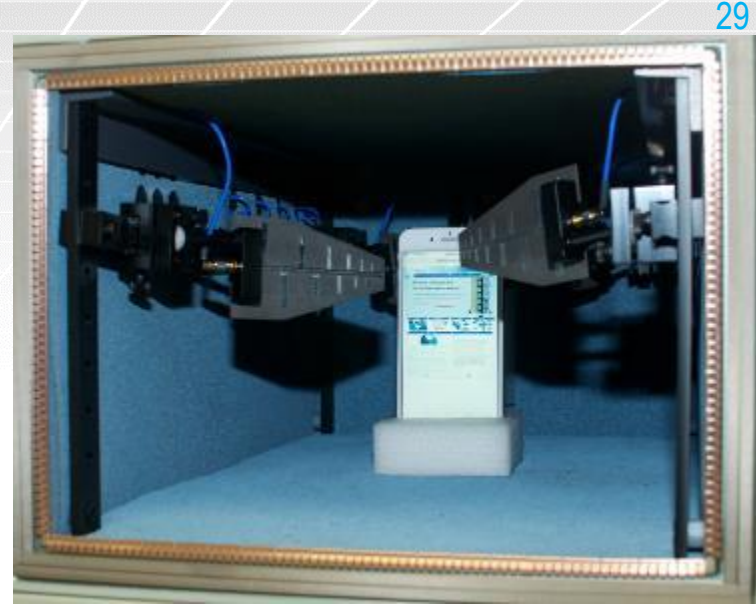
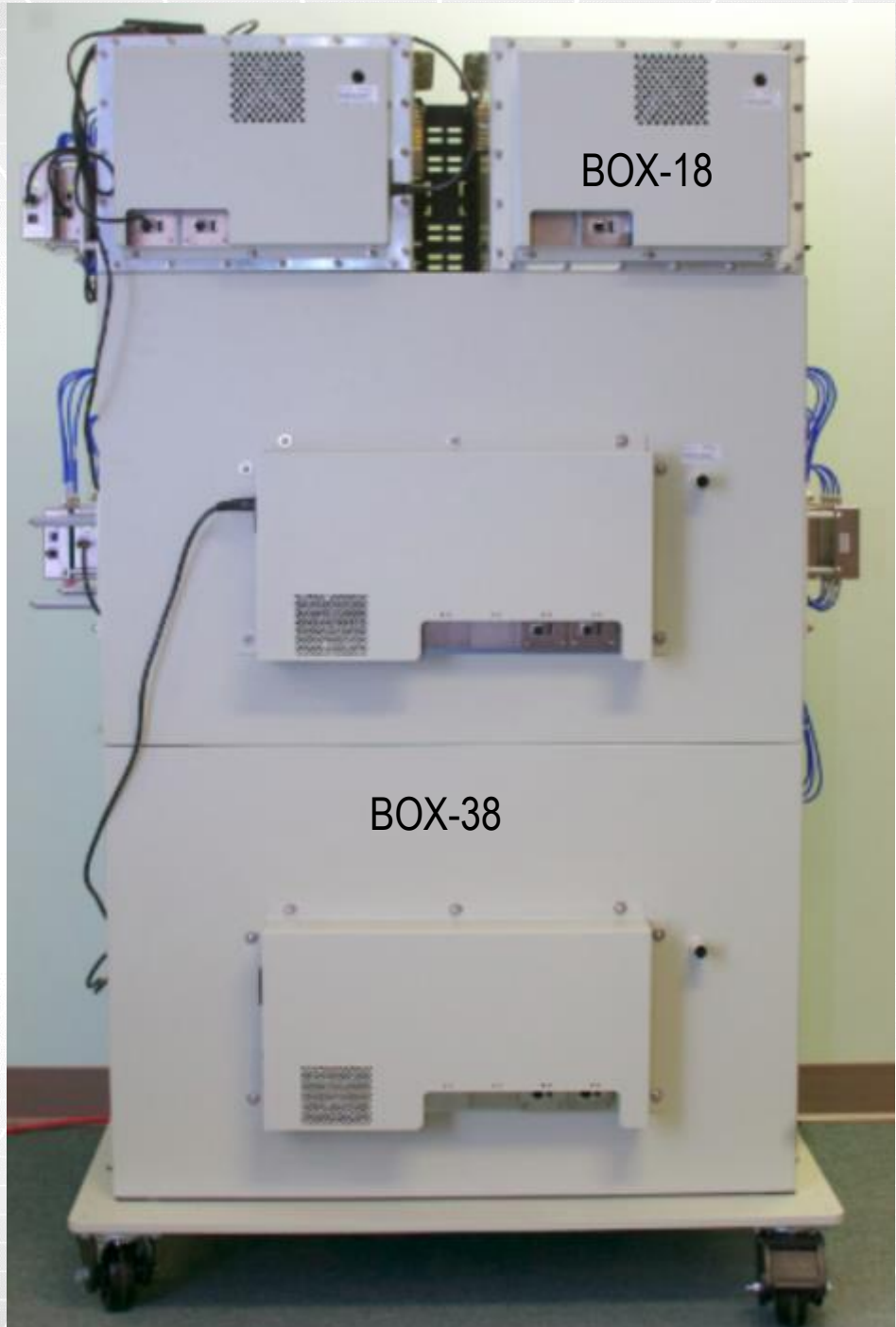
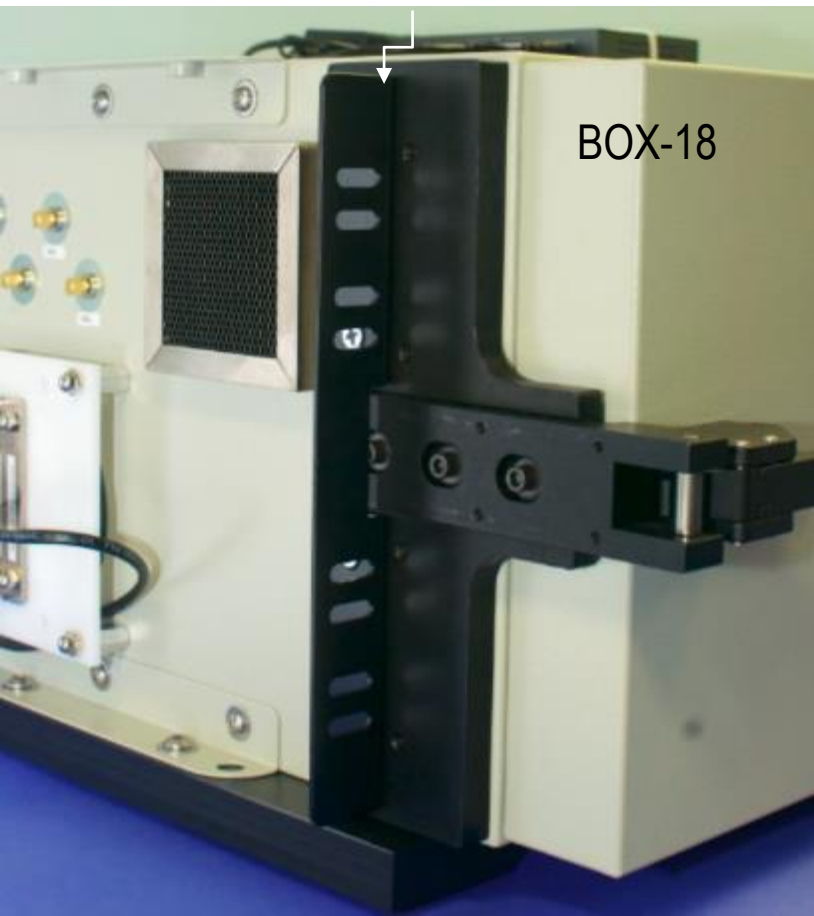
↖ Sub 6 GHz test antennas

↓ Plastic turntable

octoScope BOX-18

Inside dimensions:
9.6" H x 13.6" W x 21.5" D

Rack-mounting brackets for a 19" rack



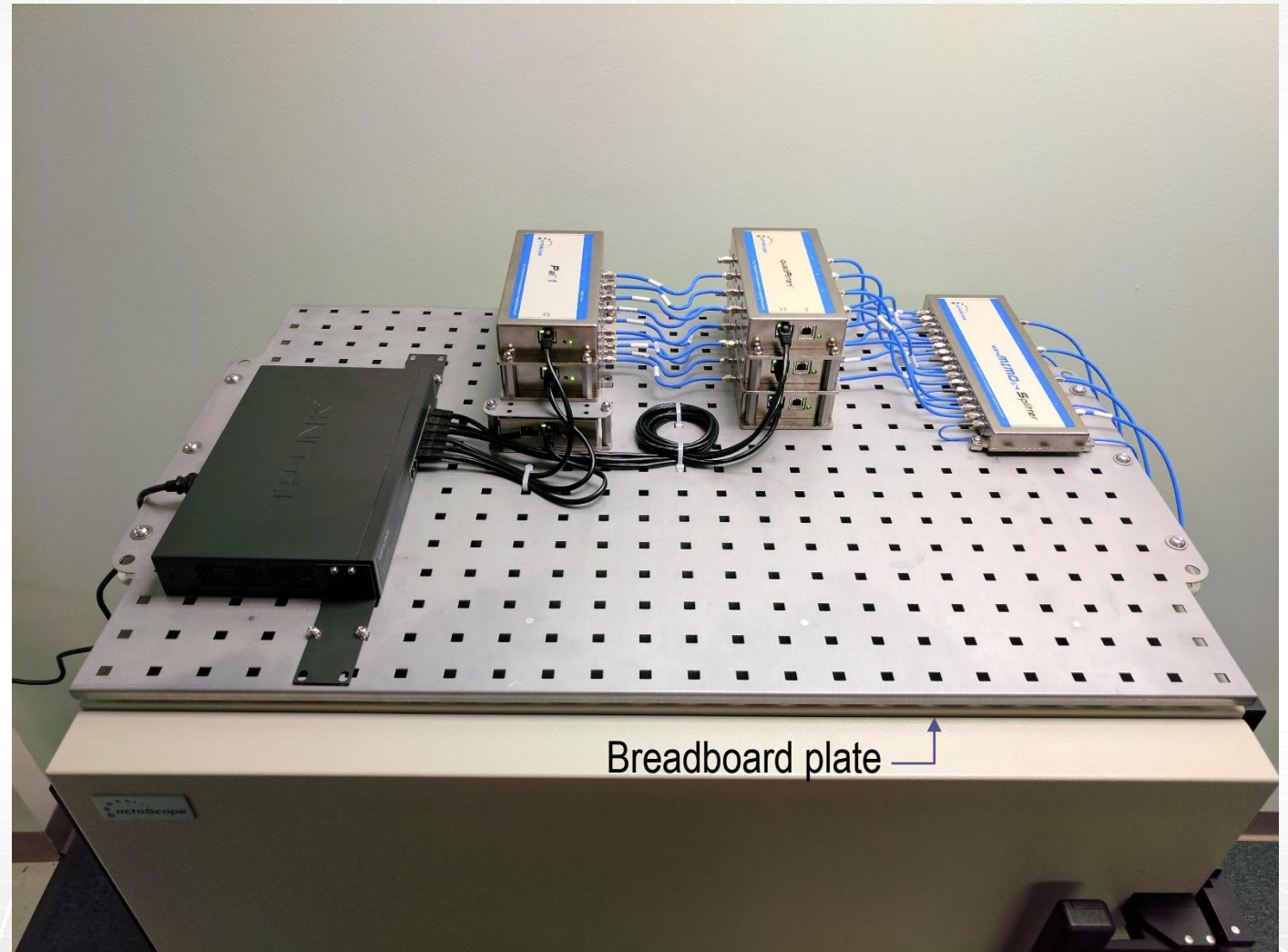
octoScope Combine emulated and real device



- Create powerful testbeds with real-life traffic, load and airtlink impairments
- Mix of emulated Pal based traffic partners and real devices in octoBoxes
- Use iGens for interference generation and monitoring



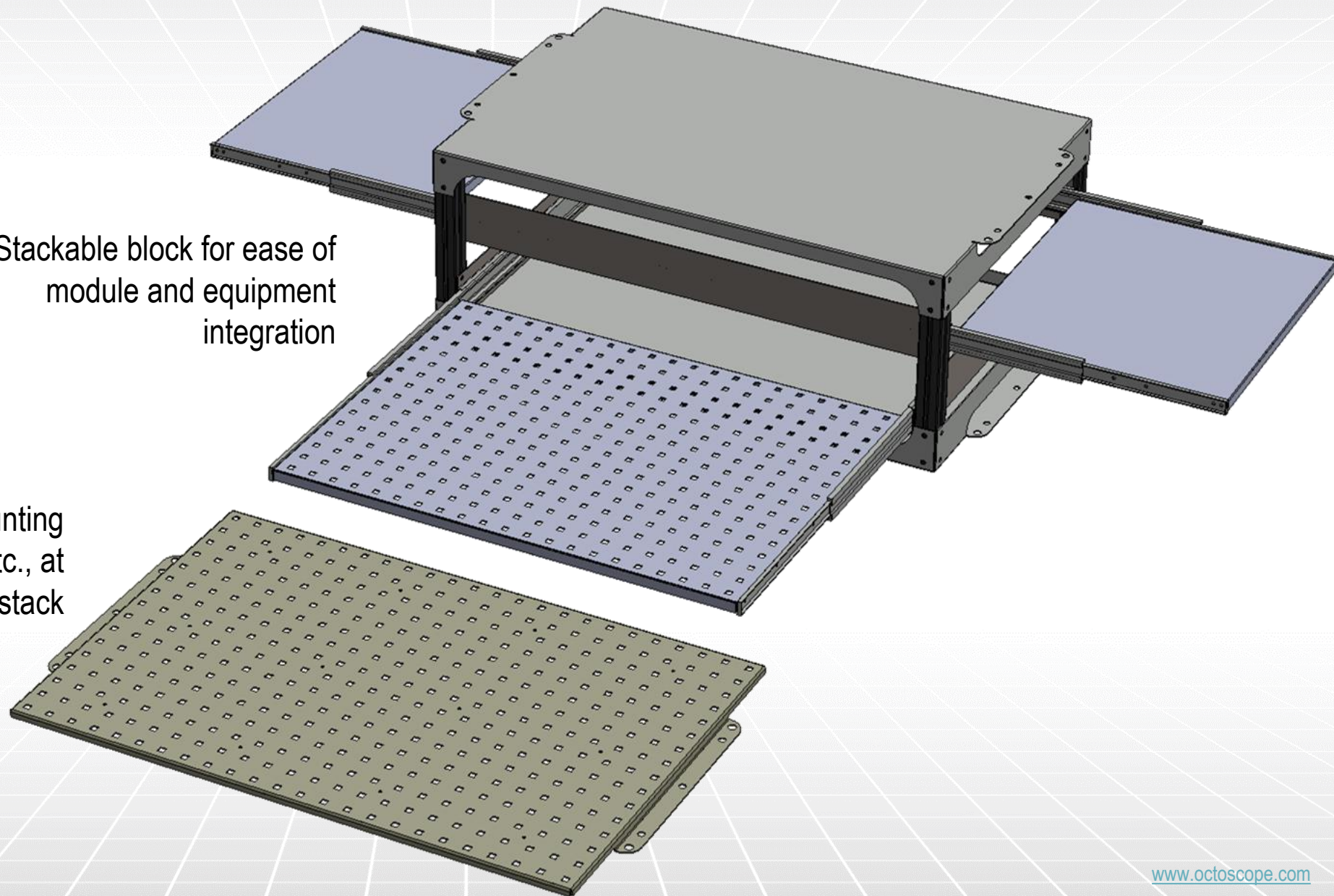
octoScope Mounting modules at the top of the stack



Retractable shelves for modules and equipment

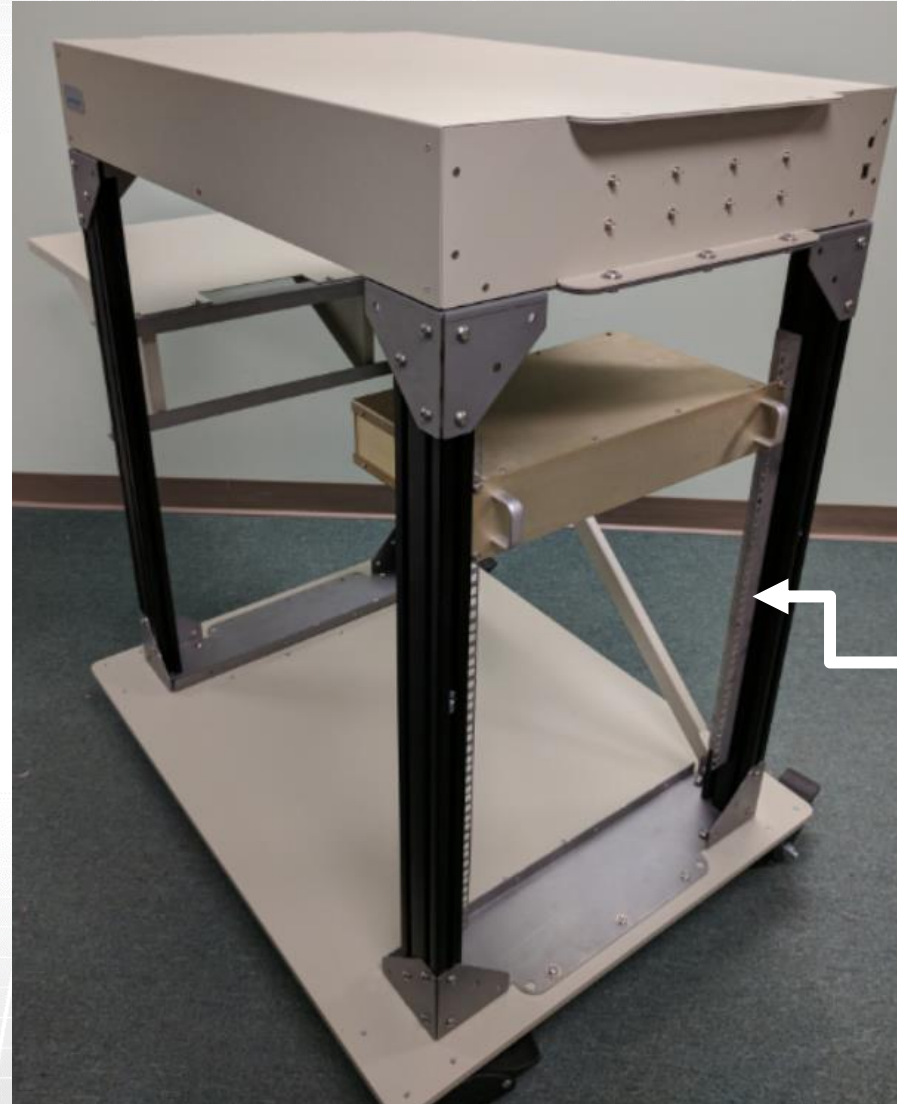
Stackable block for ease of
module and equipment
integration

Breadboard plate for mounting
modules, Eth switches, etc., at
the top of the stack

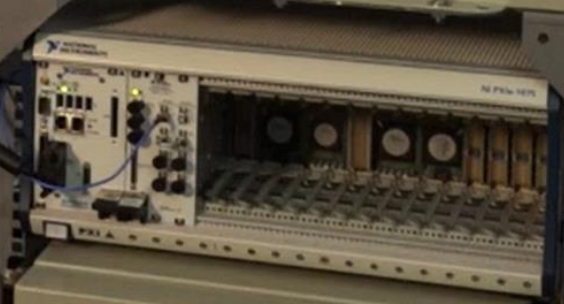


octoScope Rack-mountable components integrate seamlessly

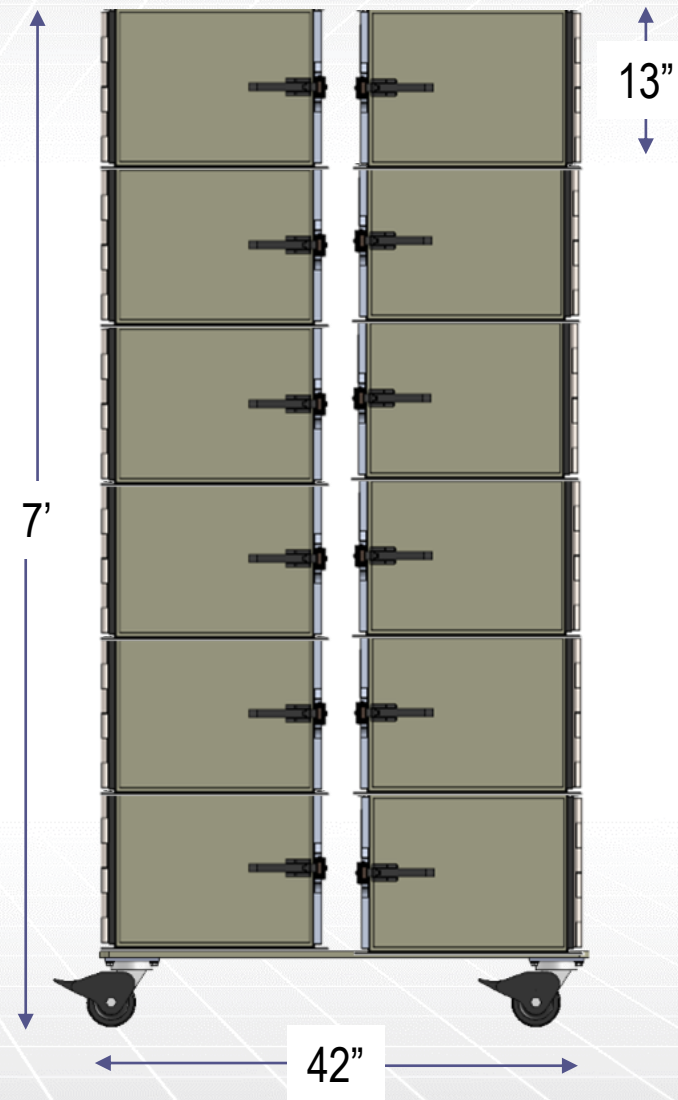
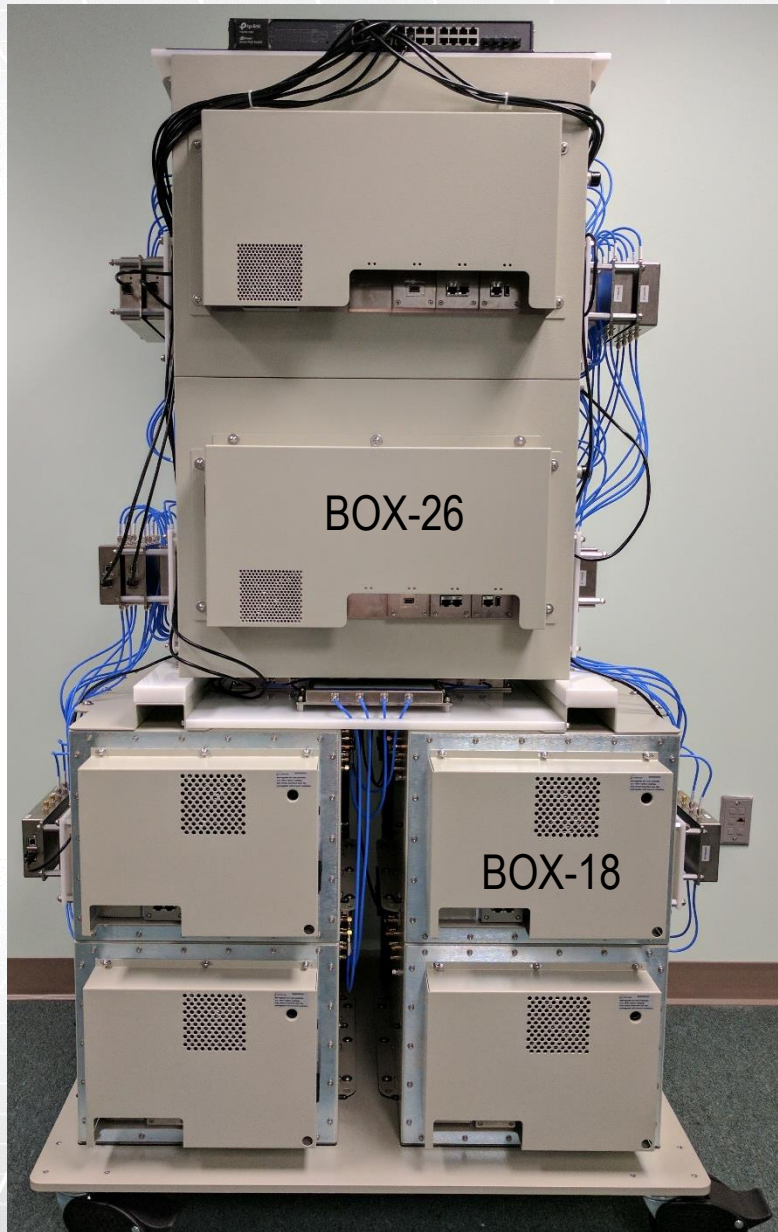
BOX-26s can be stacked under BOX-38 components using the bracket structure.



19 inch rack brackets are available and height-configurable to integrate rack-mountable instruments into the testbed as needed.

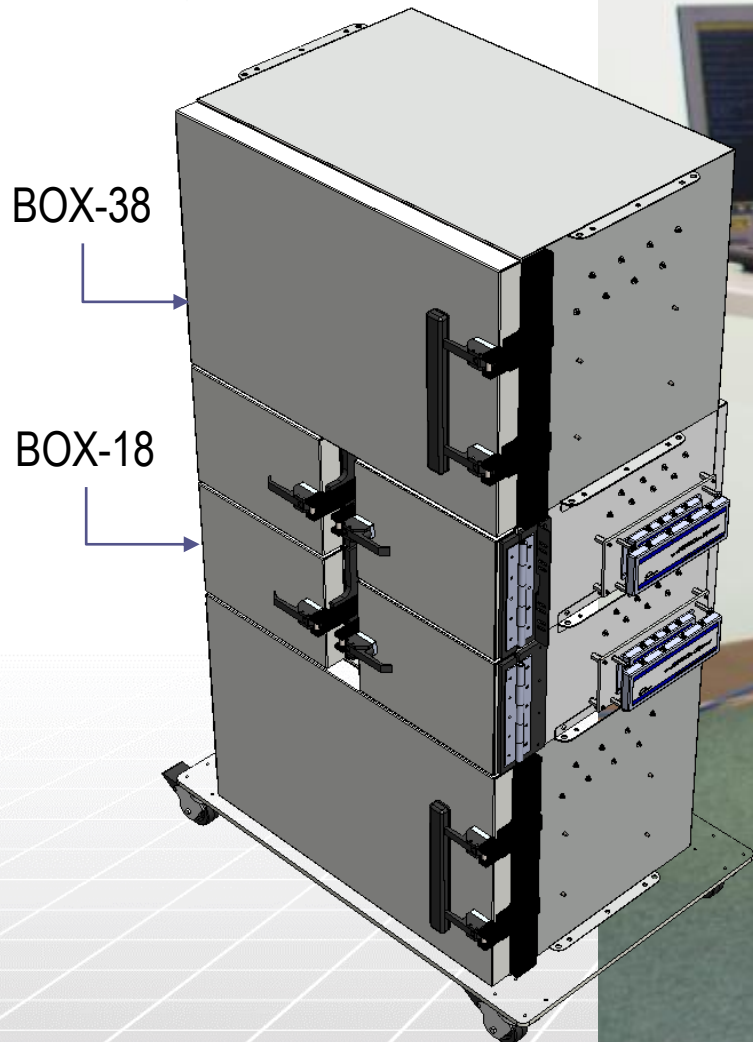


octoScope Mixed box sizes in the testbed – mesh example



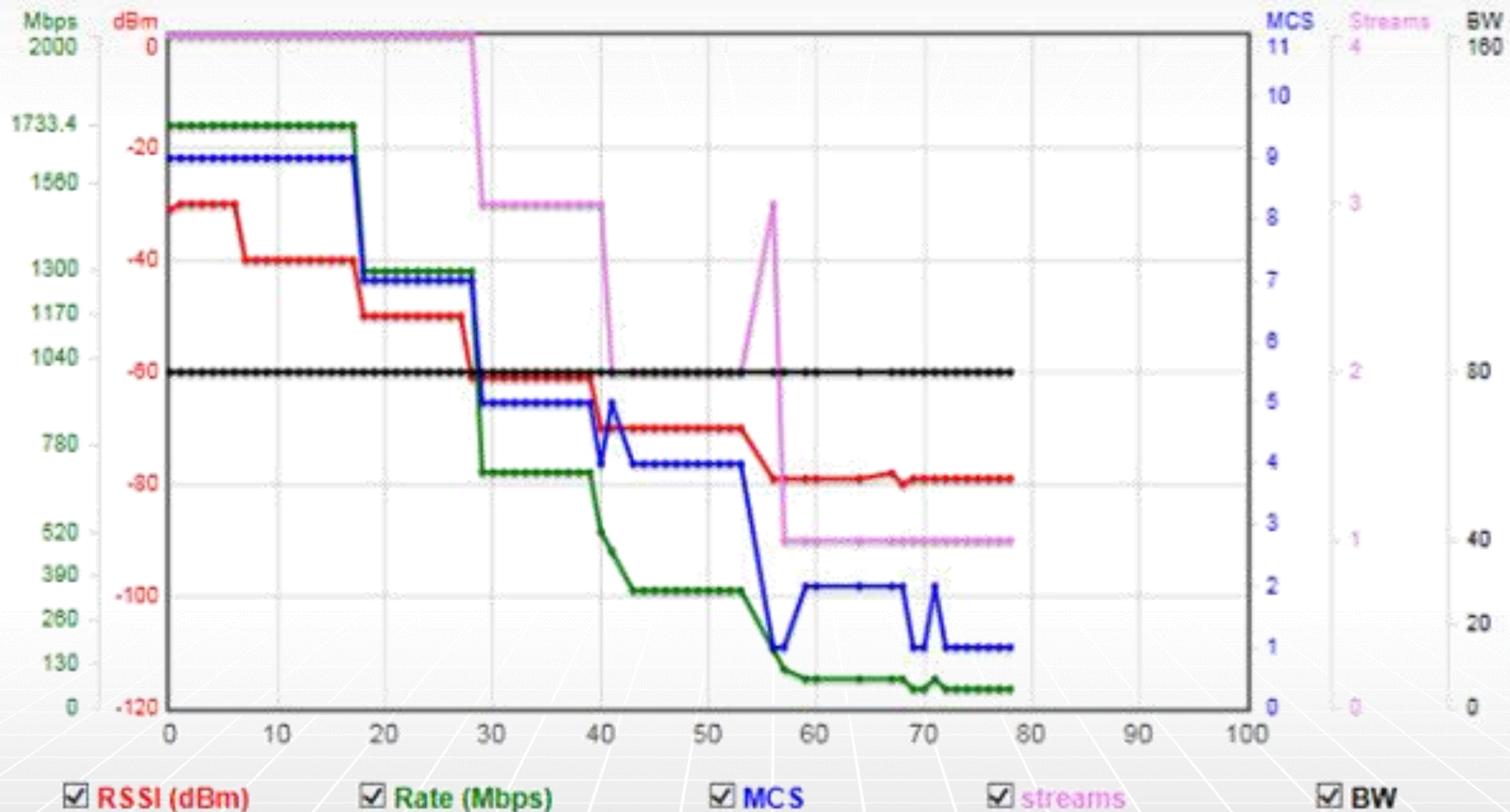
octoScope

Three sizes: -38, -26, -18

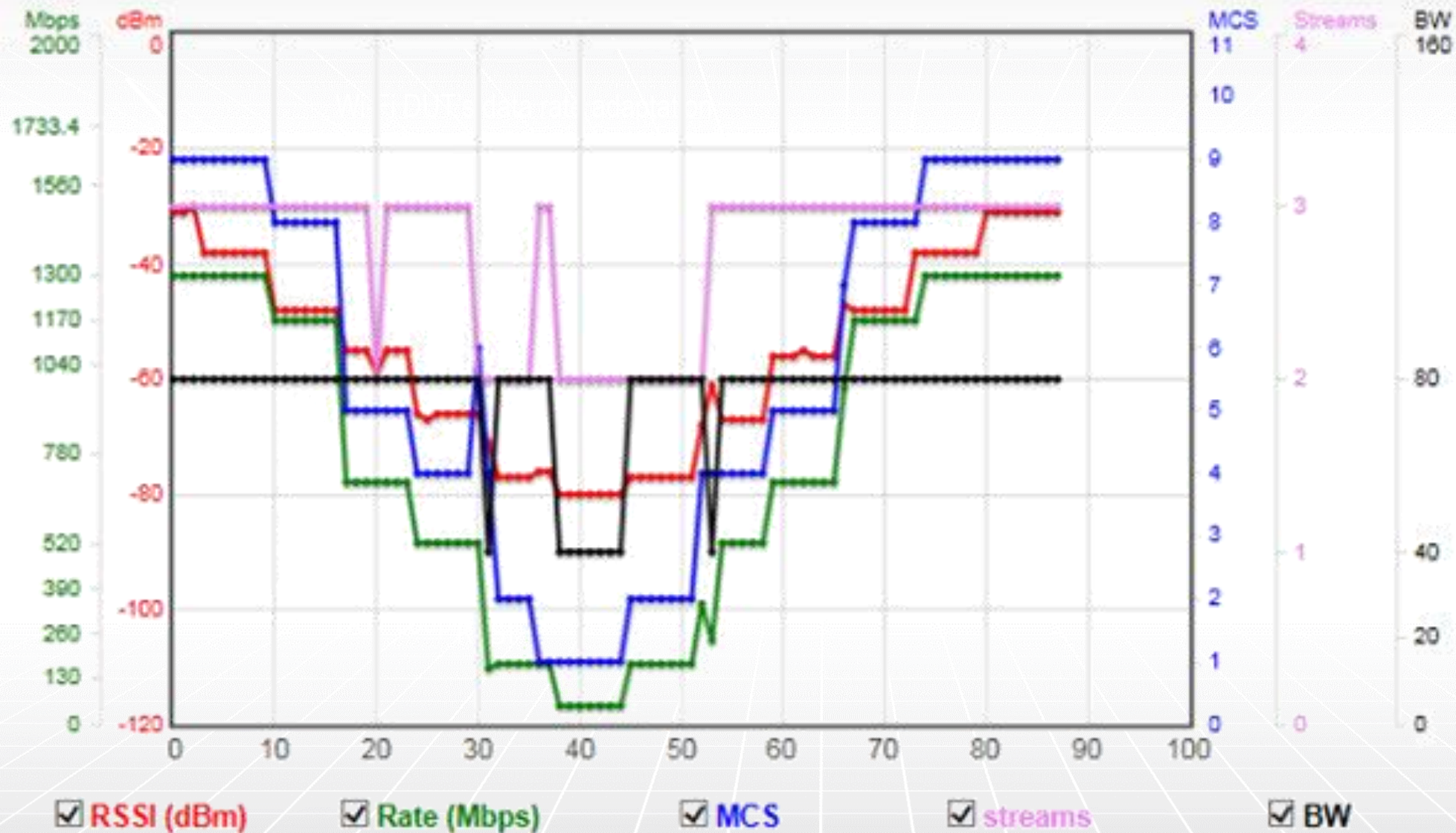




octoScope Pal data rate adaptation monitoring

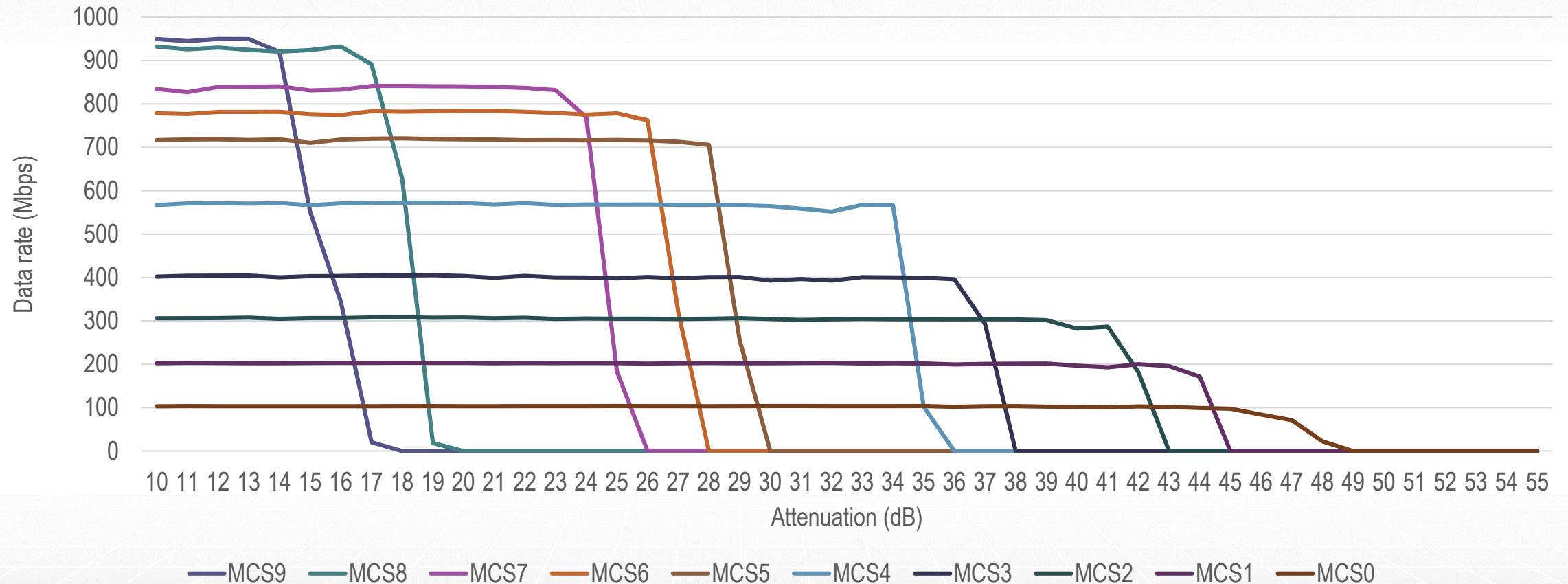


octoScope Pal data rate adaptation monitoring



octoScope RX sensitivity test - MCS sweep

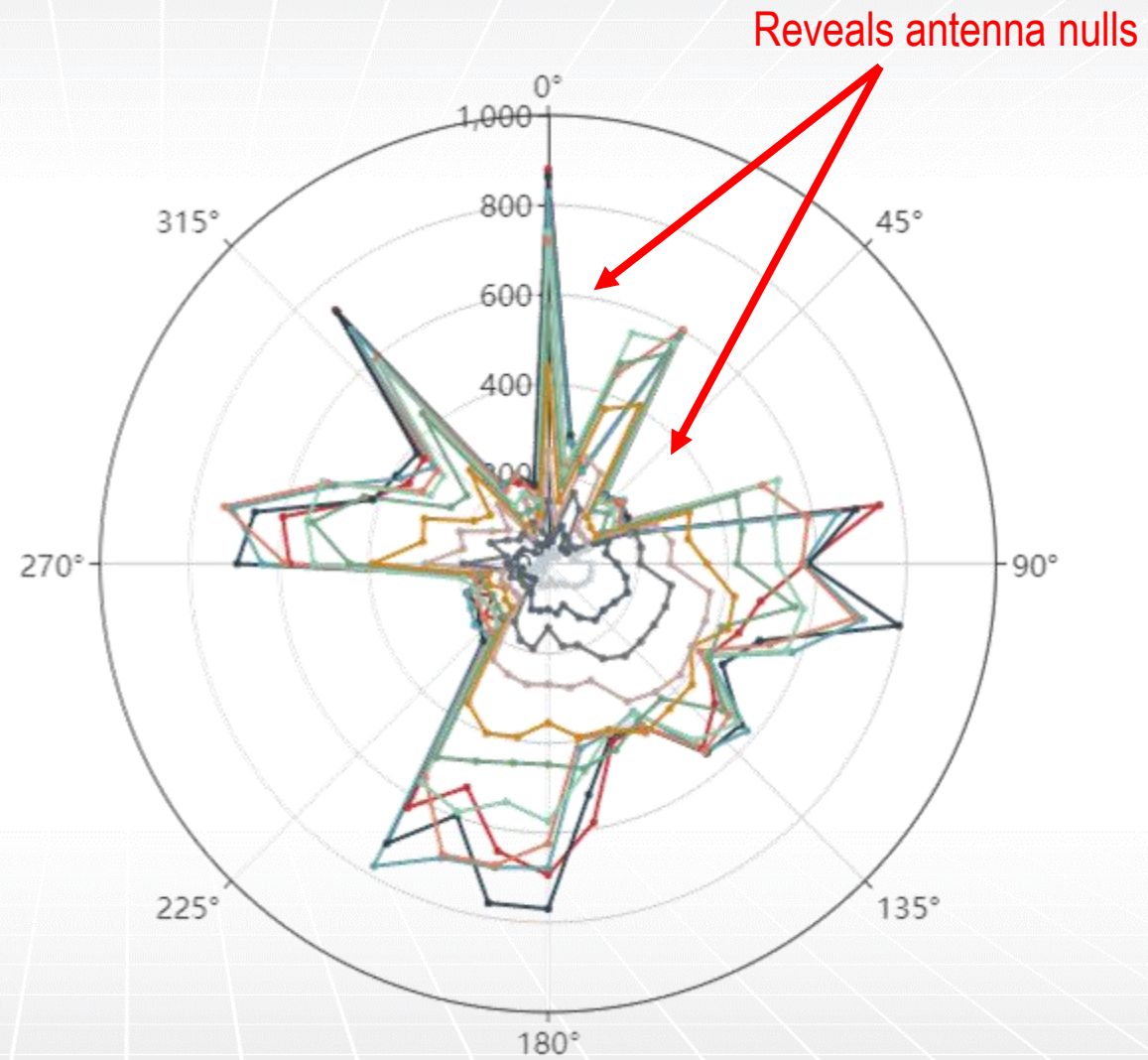
Fixed MCS vs Range



MCS = modulation coding scheme

Throughput vs. range vs. orientation

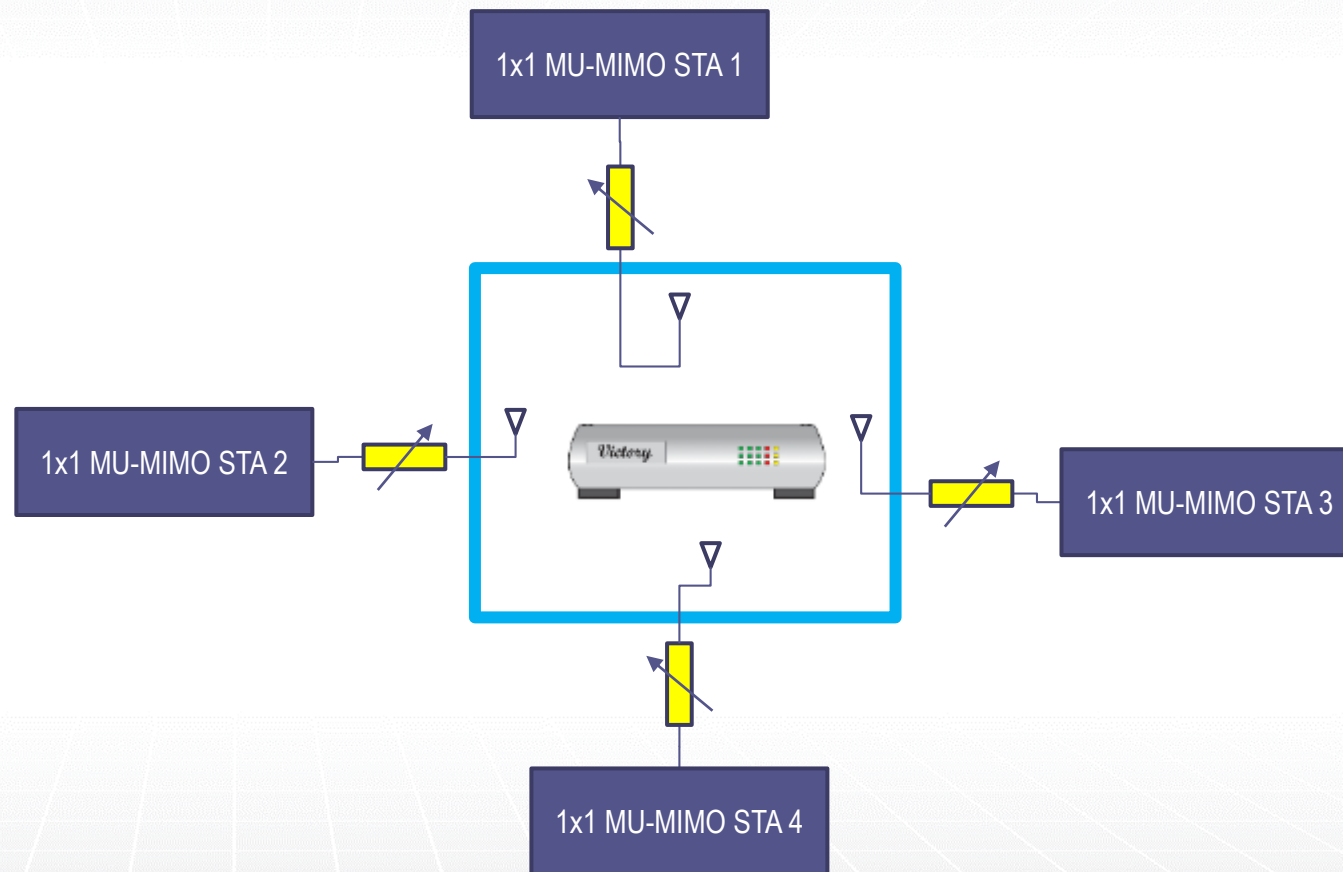
- Atten - 0
- Atten - 5
- Atten - 10
- Atten - 15
- Atten - 20
- Atten - 25
- Atten - 30
- Atten - 35
- Atten - 40
- Atten - 45
- Atten - 50



octoScope MU-MIMO testbed



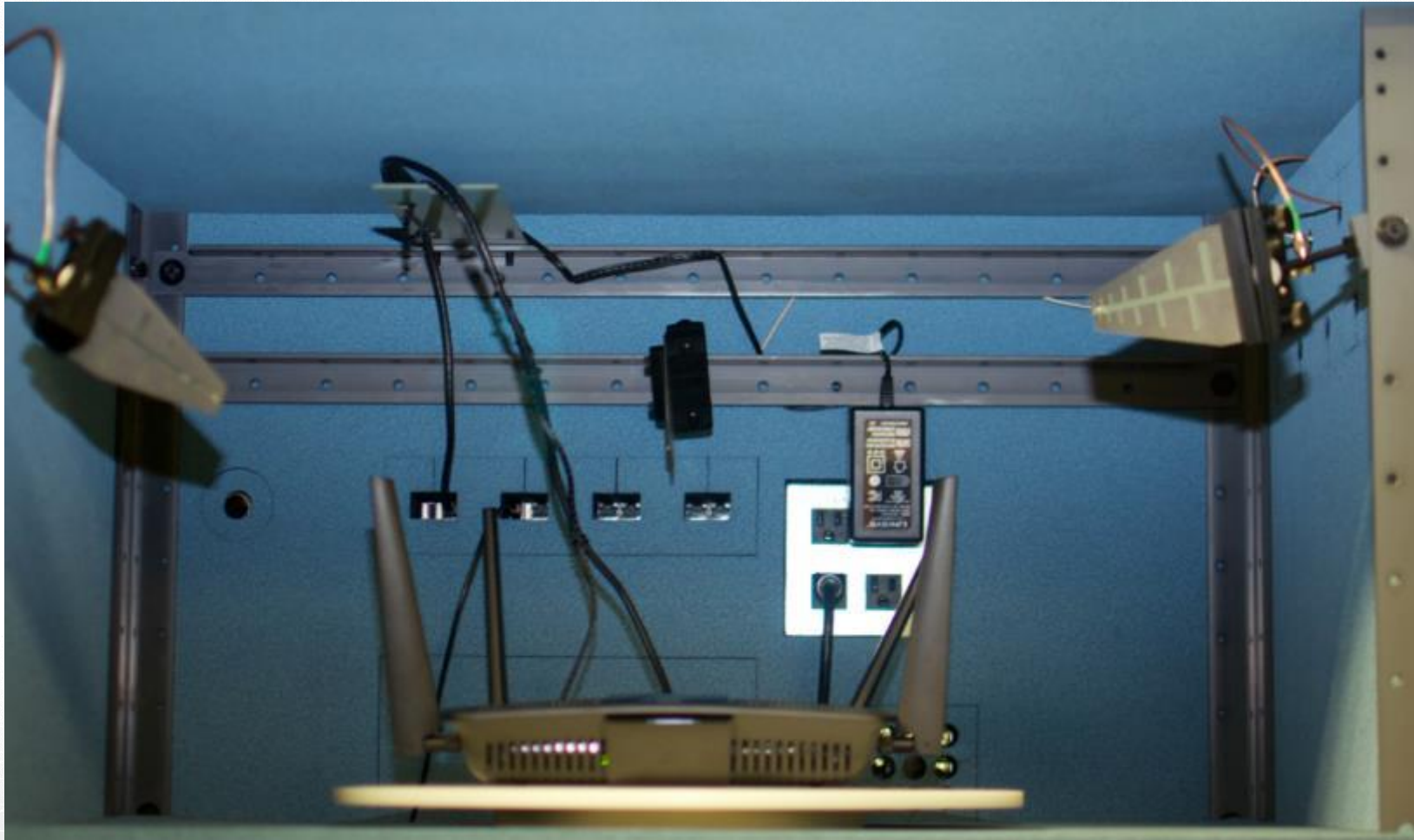
<https://youtu.be/6JhzmlmqGwc?t=232>



PATENT PENDING

MU-MIMO = multi user MIMO

octoScope MU-MIMO gains – measurement example



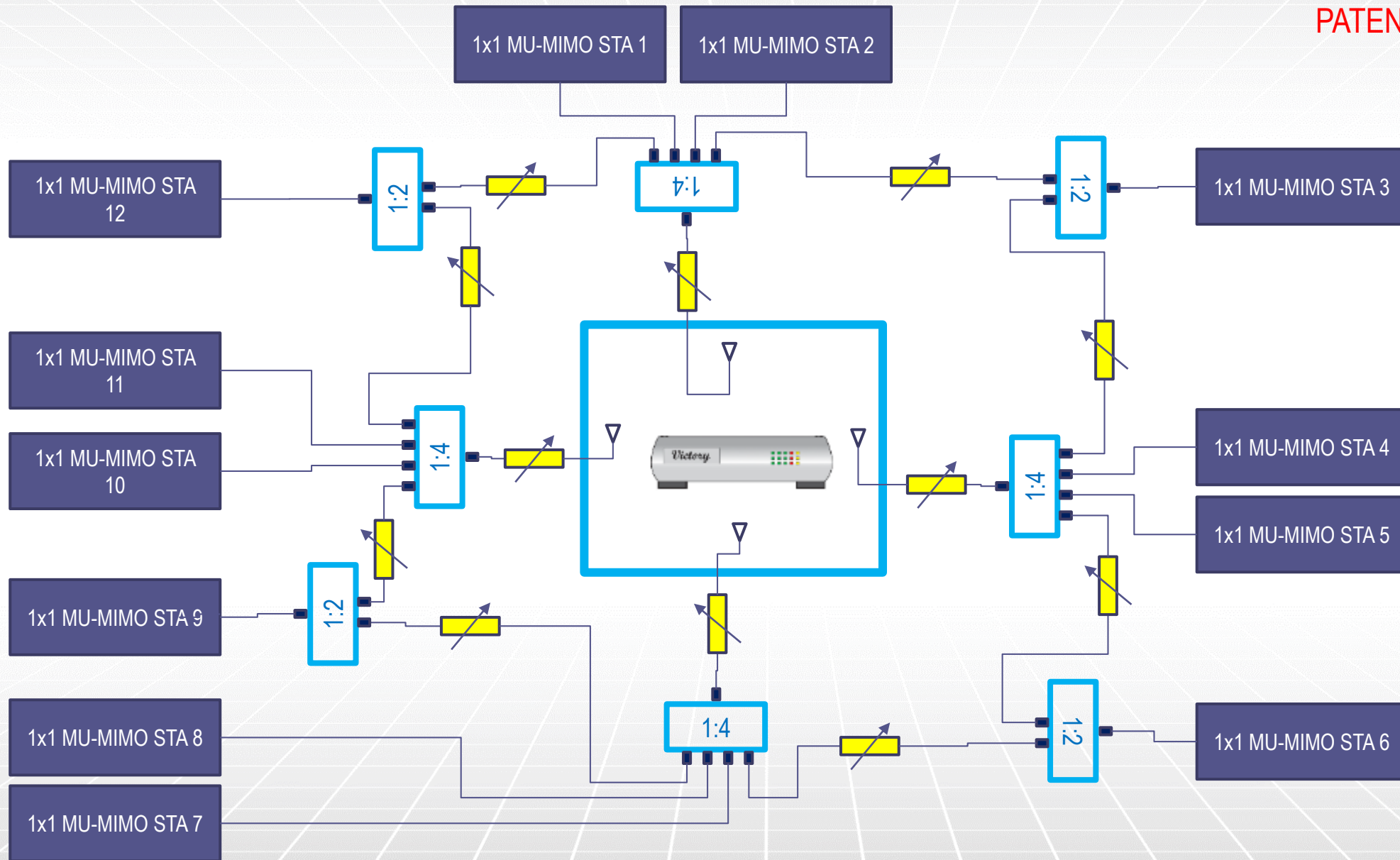
Run #	MU-MIMO OFF (Mbps)	MU-MIMO ON (Mbps)
1	360	935
2	355	935
3	358	934
4	361	938
5	357	946
6	357	946

Over 2.6x gain

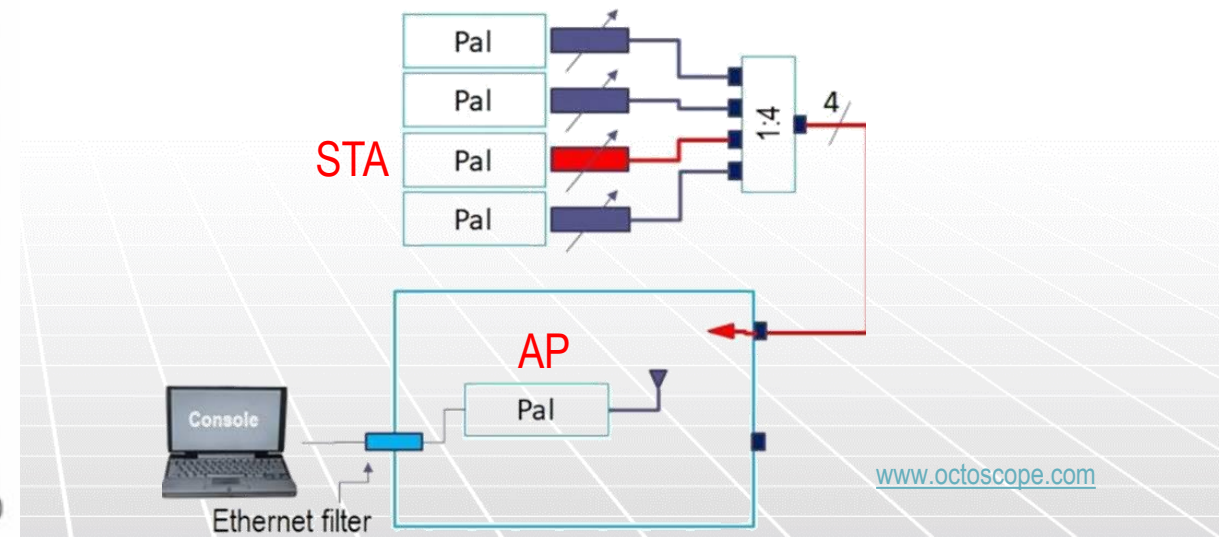
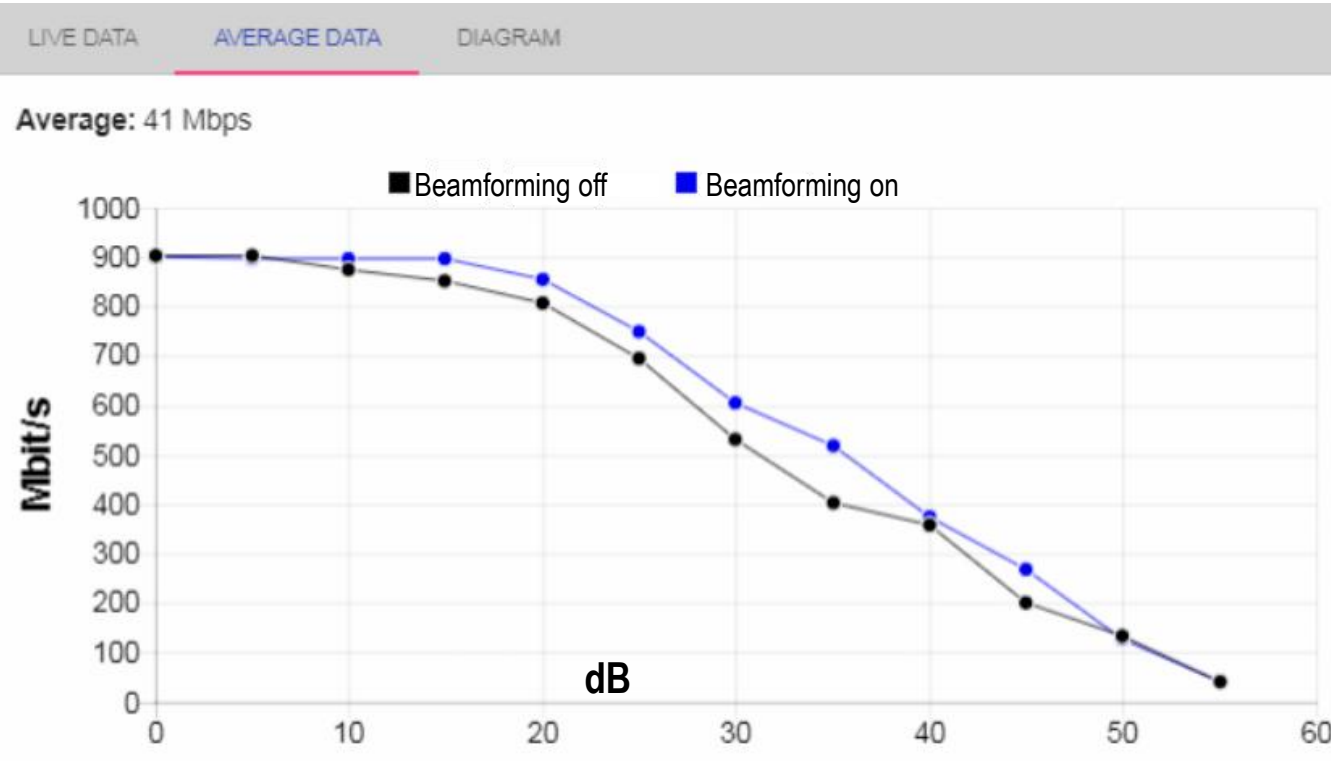
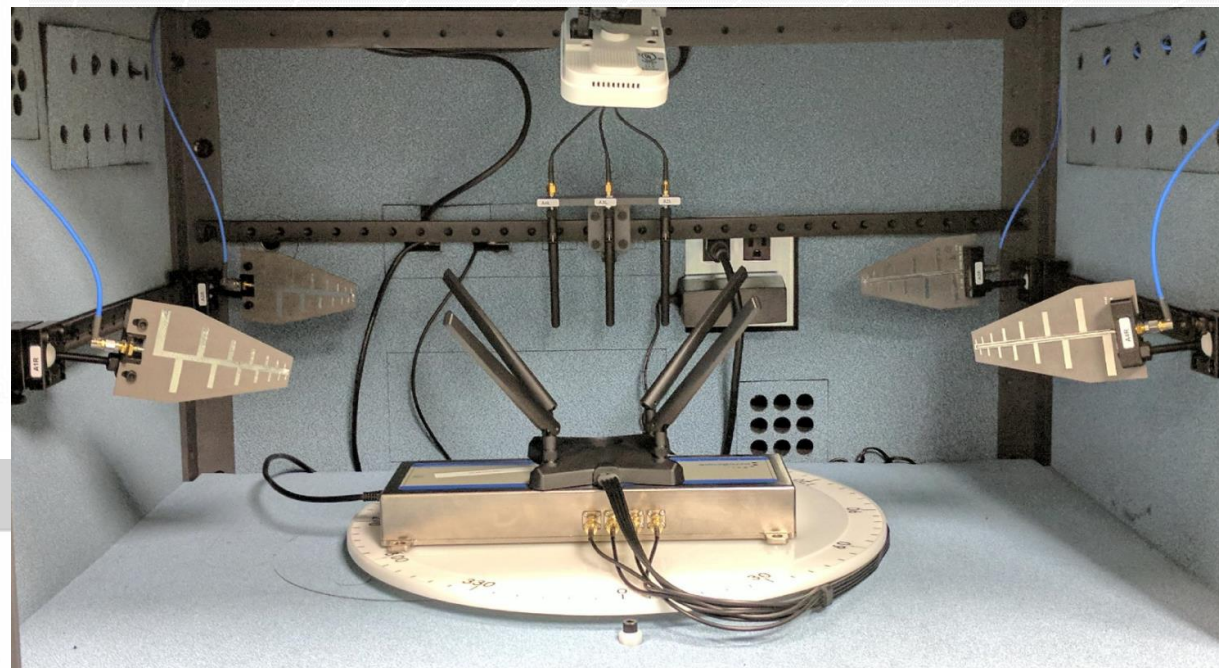
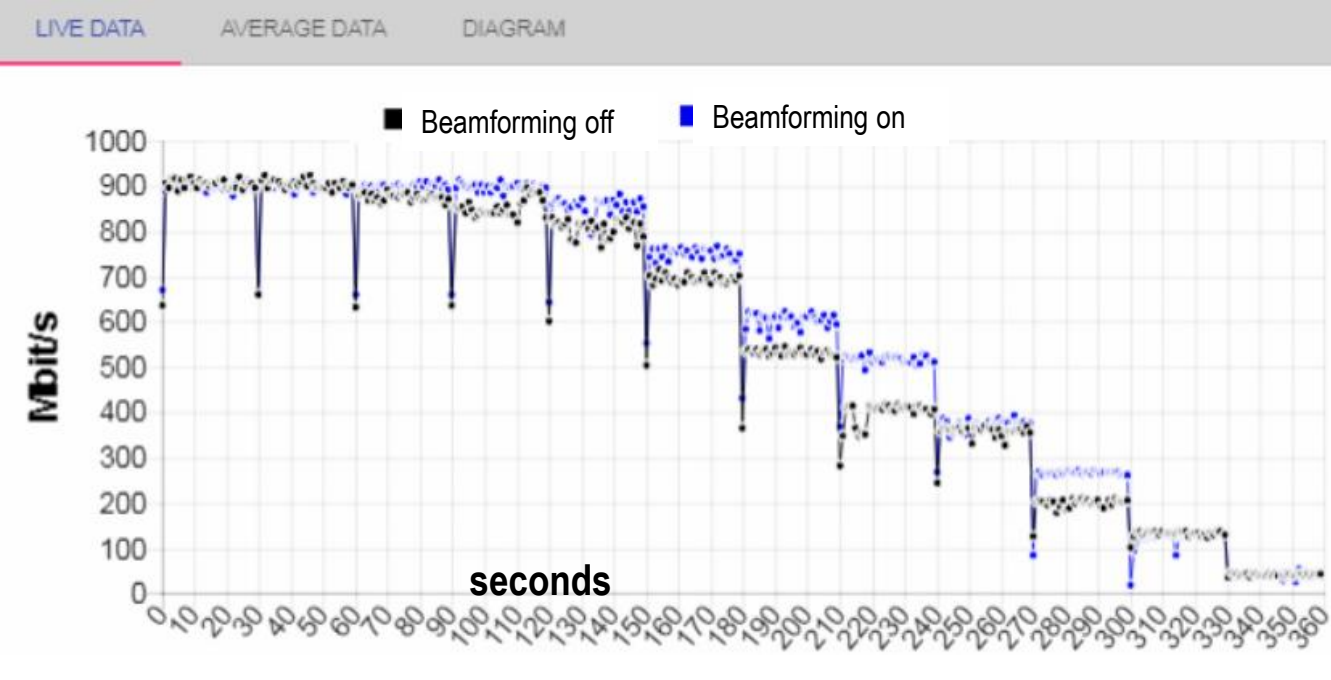
PATENT PENDING

MU-MIMO with controllable correlation (position of station)

PATENT PENDING



MIMO-OTA beamforming gains in the octoBox



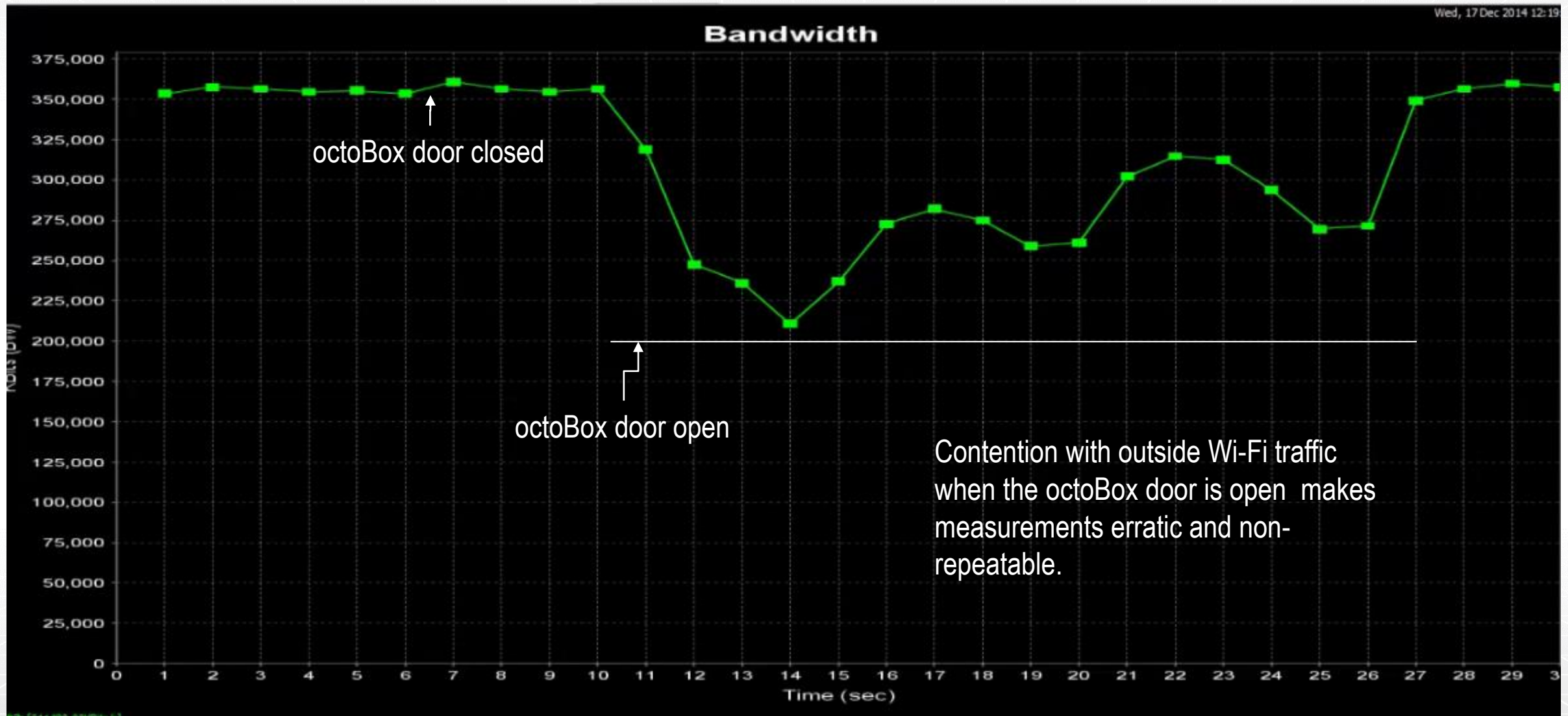
octoScope Key wireless test capabilities

- ✓ Throughput performance
- ✓ Complete isolation
- ✓ Controlled interference
- ✓ Roaming behavior (sticky clients)
- ✓ Interoperability (vendor to vendor)
- ✓ Emulate a multi-room house

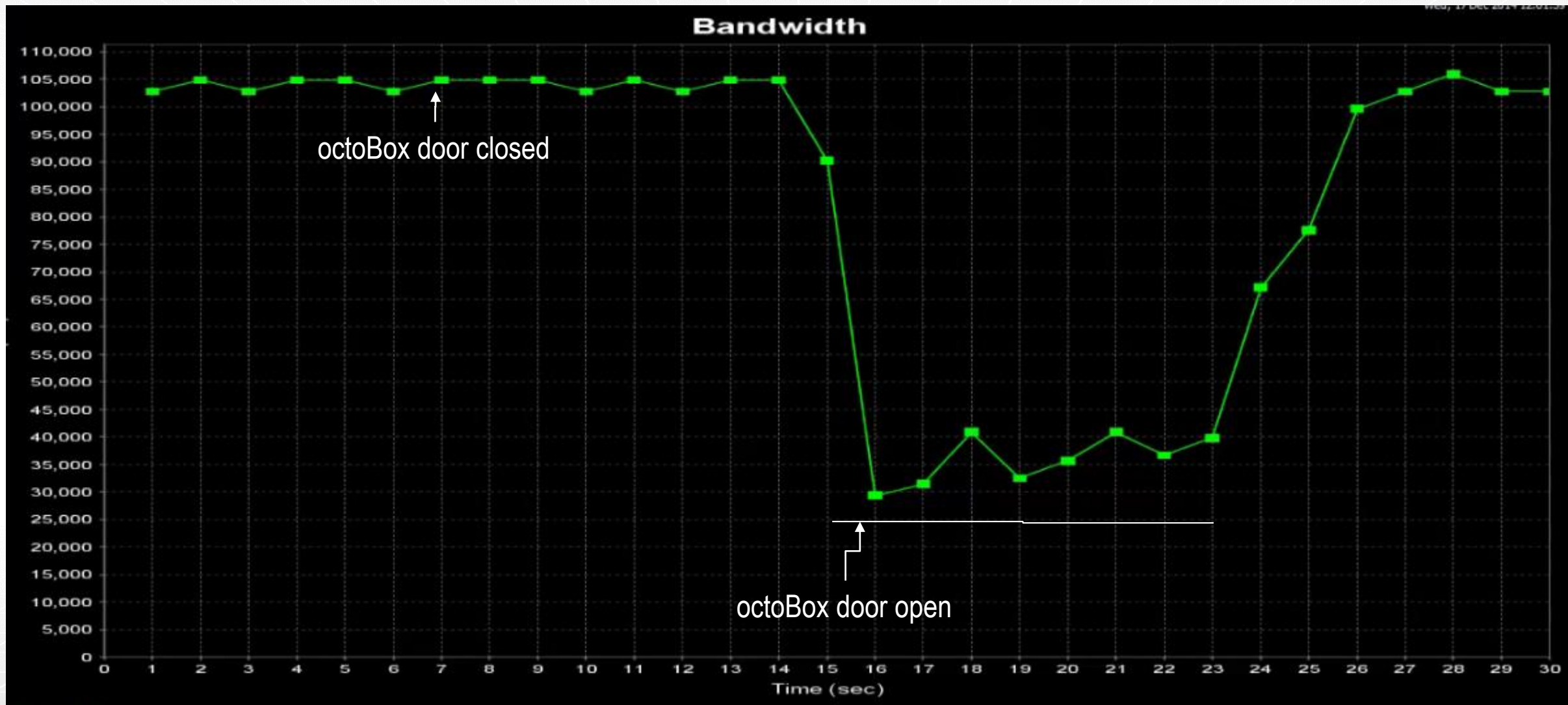


<https://www.youtube.com/watch?v=SK1857UkO04>

octoScope Jperf run in the 5 GHz band, 80 MHz channel

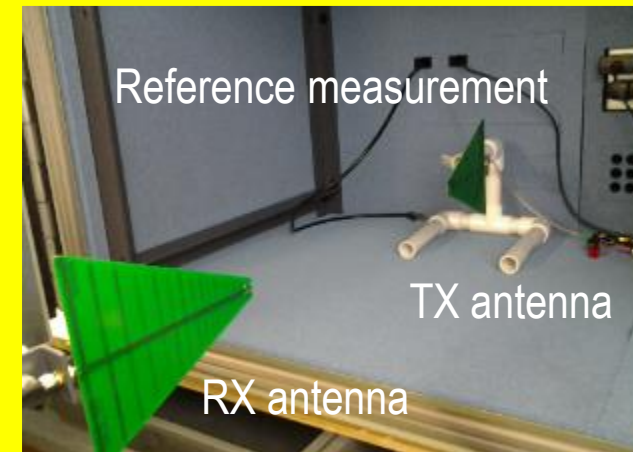
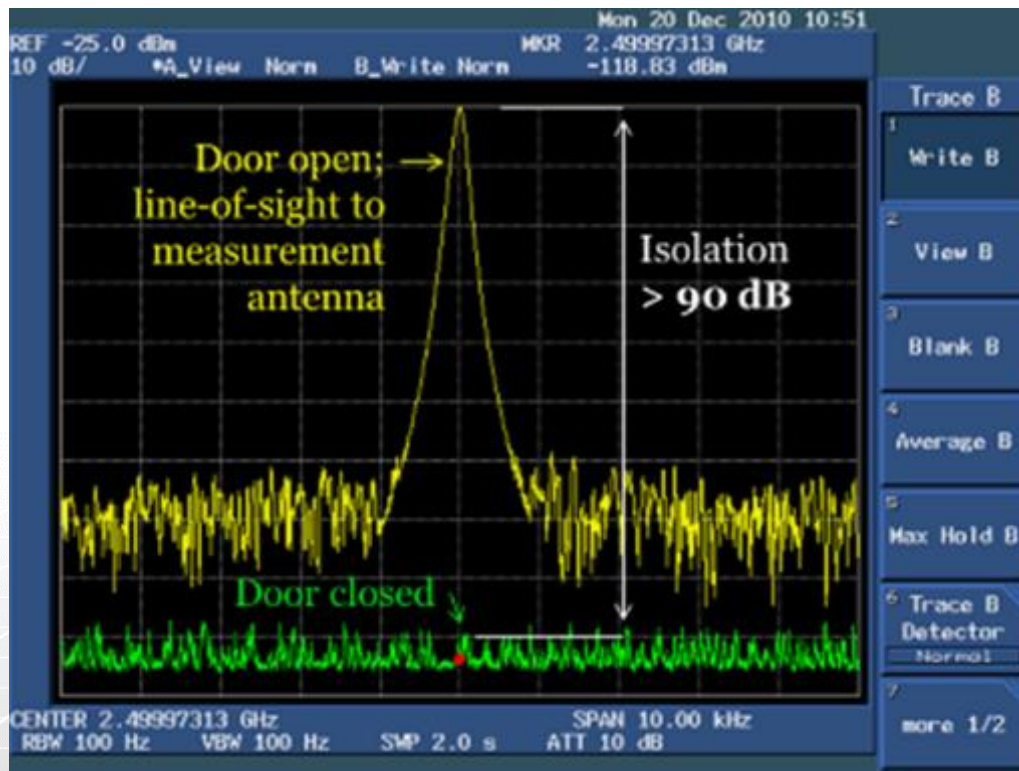


octoScope Jperf run in the 2.4 GHz band, 20 MHz channel

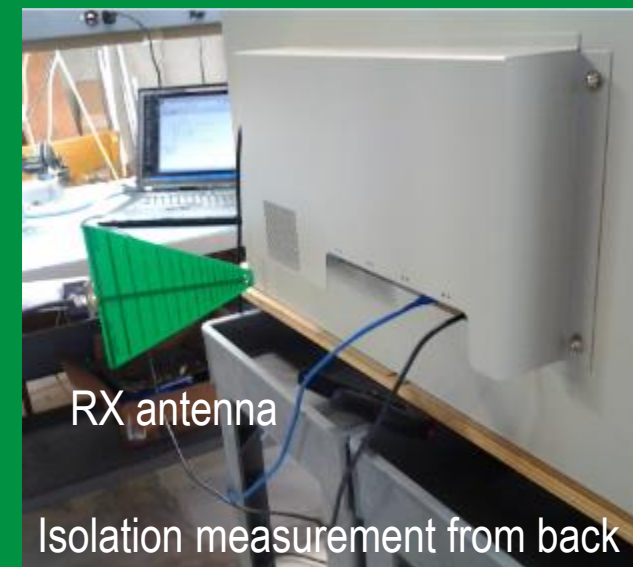


octoScope Achieving repeatability

- Complete isolation
 - octoBox testbed design with filtered data and power connections provides complete isolation



Door open



Door closed

octoScope Under the shroud - filters



Filters

Internal side



OBS-05-X2
Ethernet filter



OBS-06-X2
USB filter



OBS-09
Eth+USB filter



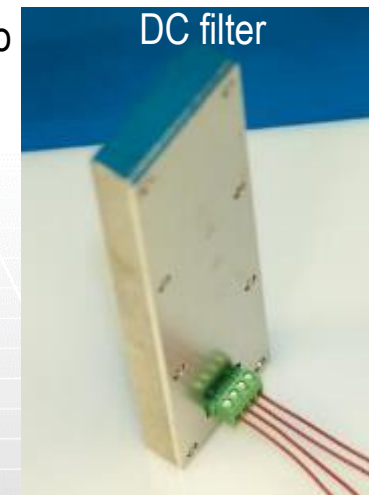
OBS-08
HDMI filter



OBS-10
3.5 mm phono
jack filter



OBS-07
DC filter



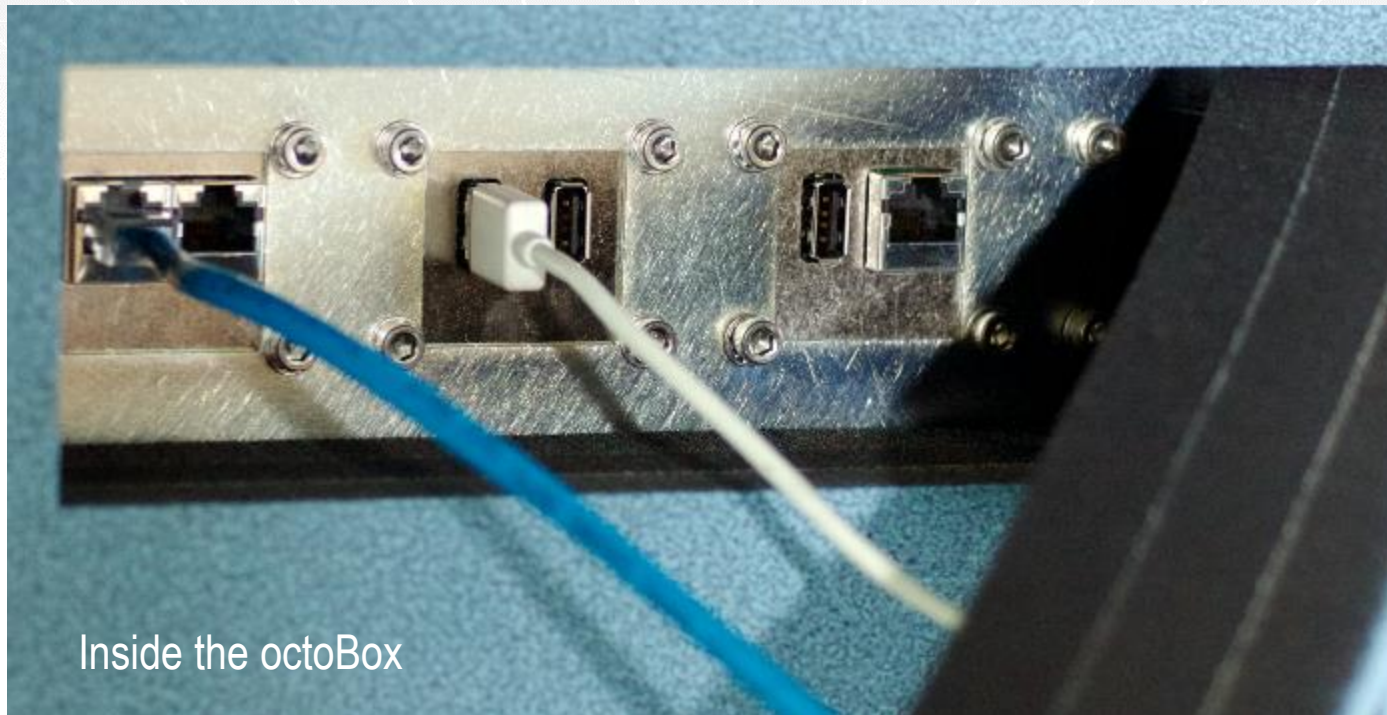
DC current handling:

10A 50V on any of the DC filter (OBS-07) lines

6A 50V on any of the Ethernet filter (OBS-05) lines

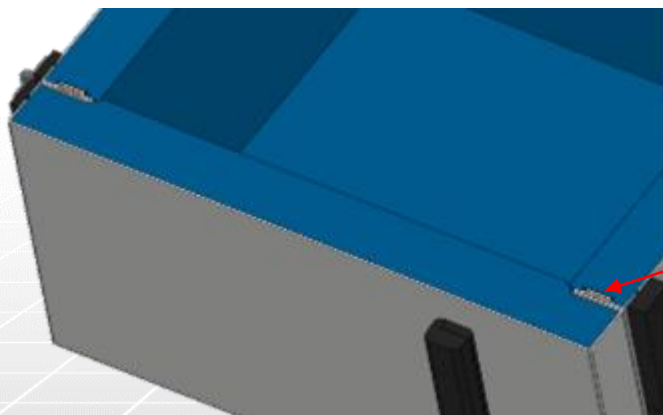
1.5A 5V over the USB filter (OBS-06) power pair

Data filters – internal and external views



octoScope Achieving repeatability

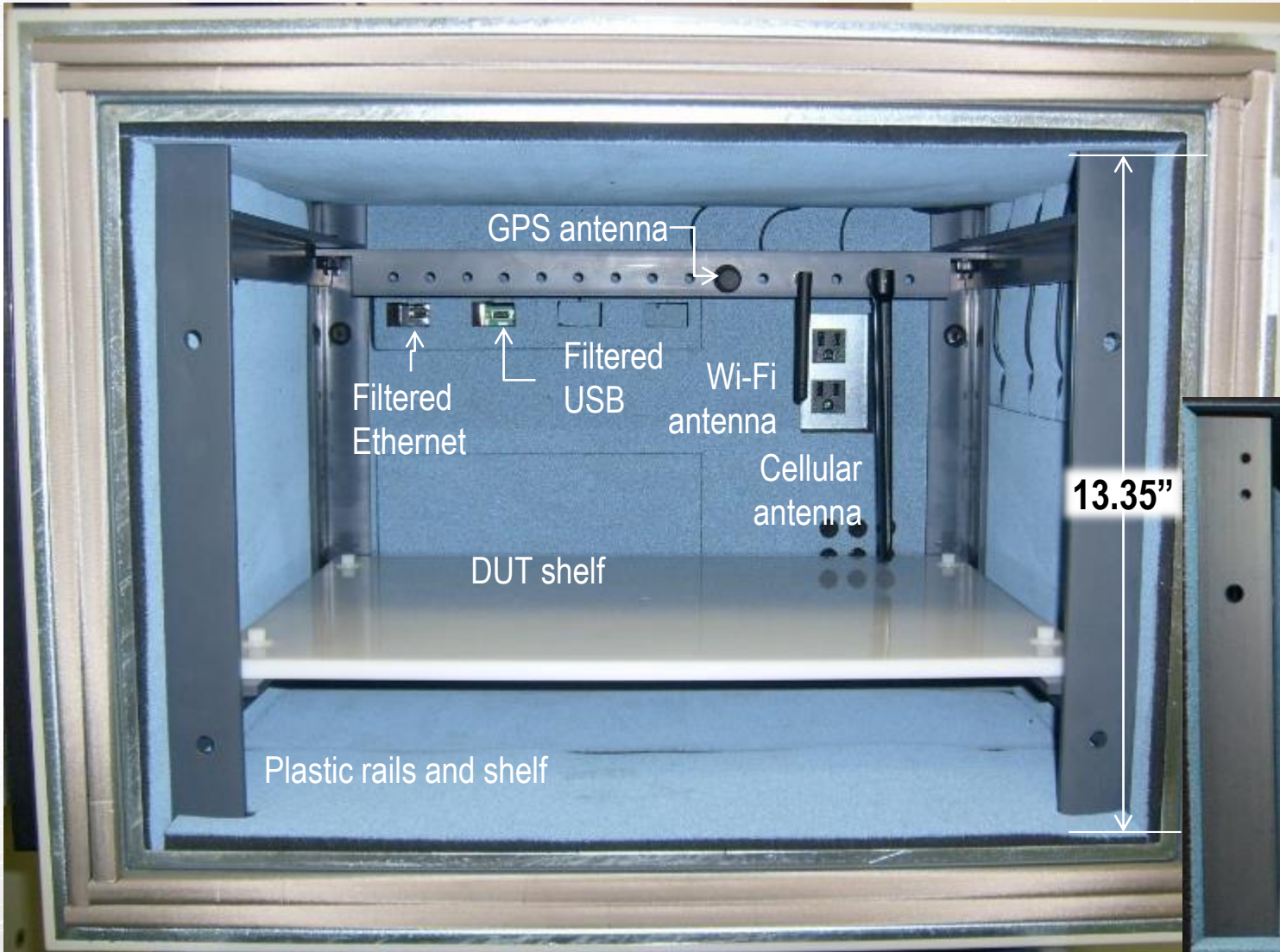
- Semi-anechoic (non-echoing)
 - 20dB of absorption allows for OTA (over the air) testing which is essential when working with devices with embedded antennas (laptops, cellphones etc.)
 - Makes a small box behave like a large room in terms of reflection magnitude and creates excellent surround-sound MIMO-OTA environment (delay profile of a room is emulated by the MPE module)



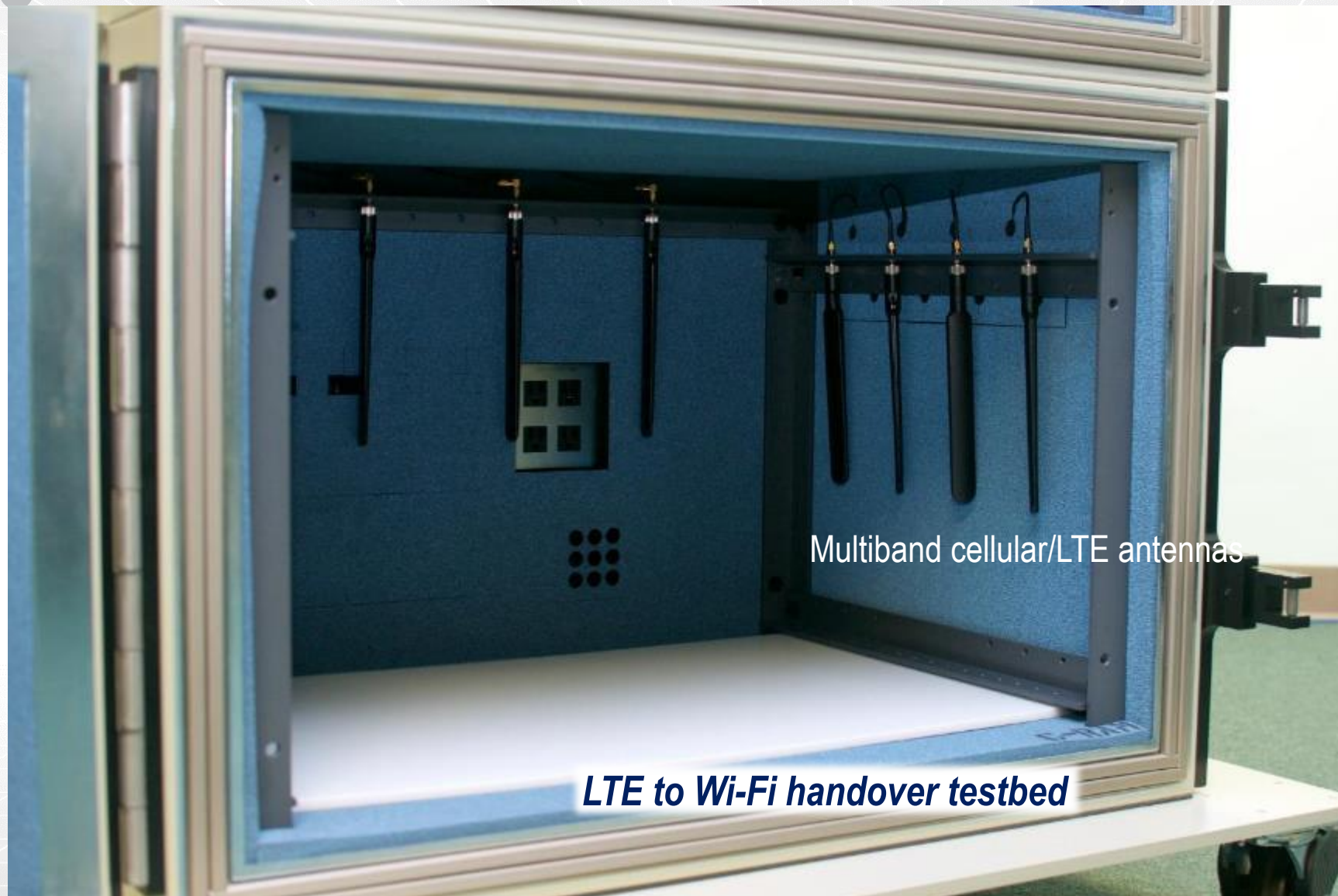
Dual gasketing and right angle door seals



octoScope BOX-26 internal view



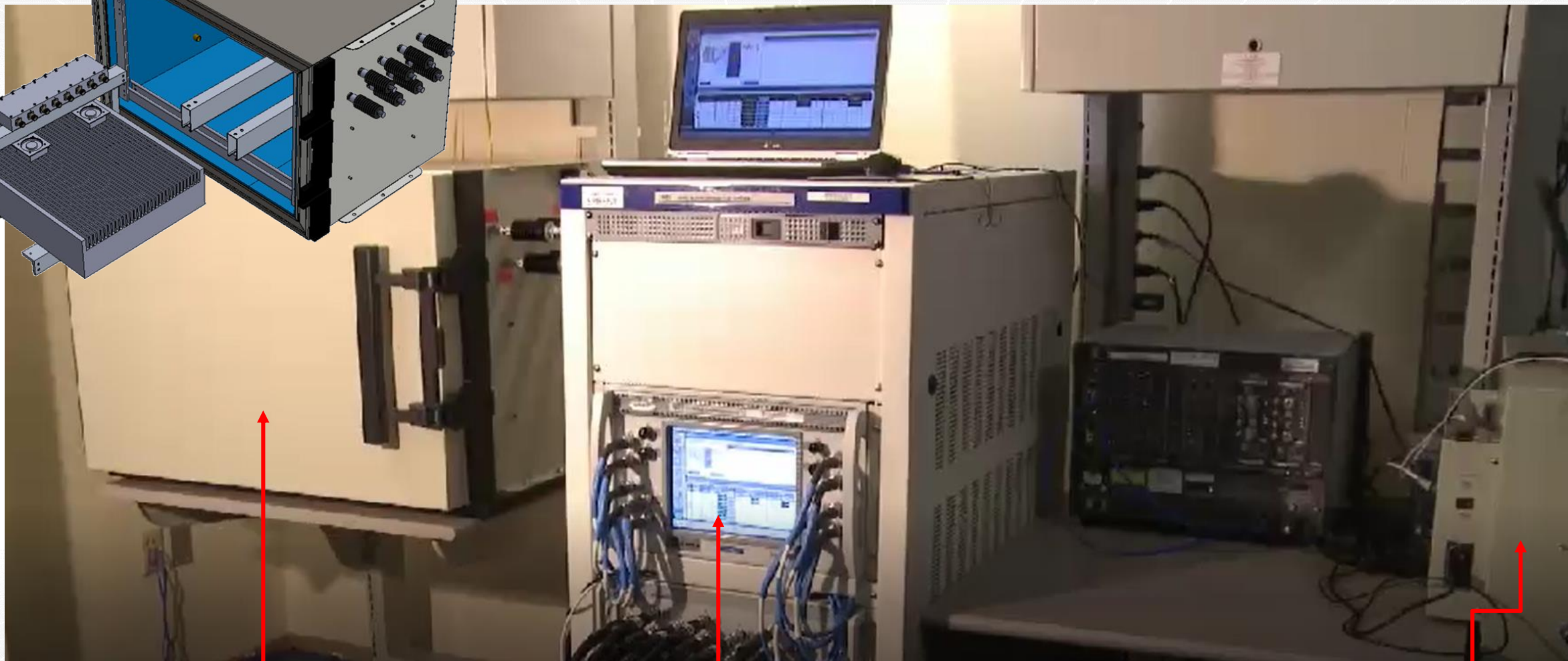
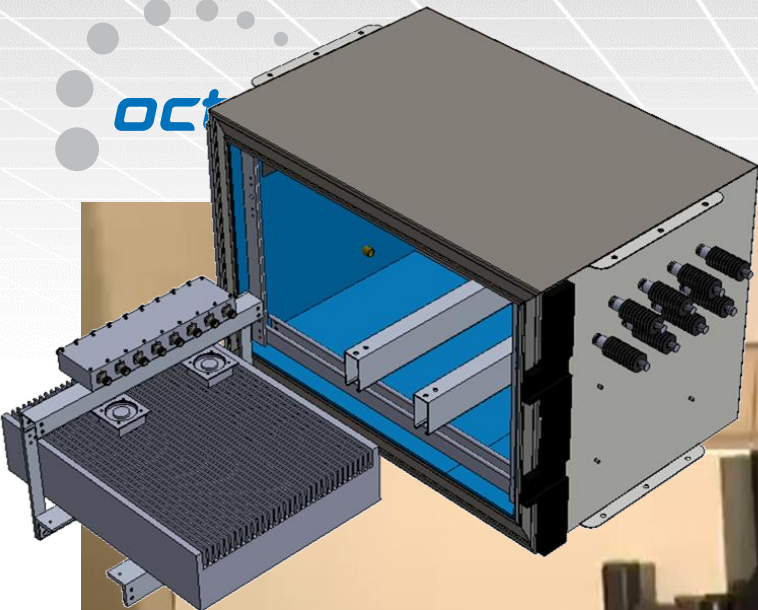
octoScope Example of multiband cellular/LTE antenna mounting



Multiband cellular antenna such as Pulse-Larsen SPDA24700/2700* (shown) enables cellular or LTE testing including Wi-Fi to LTE offloading.

* Frequency bands: 698-960 MHz, 1710-2170 MHz, 2500-2700 MHz; 2 dBi

RRH – UE testbed for beamforming testing



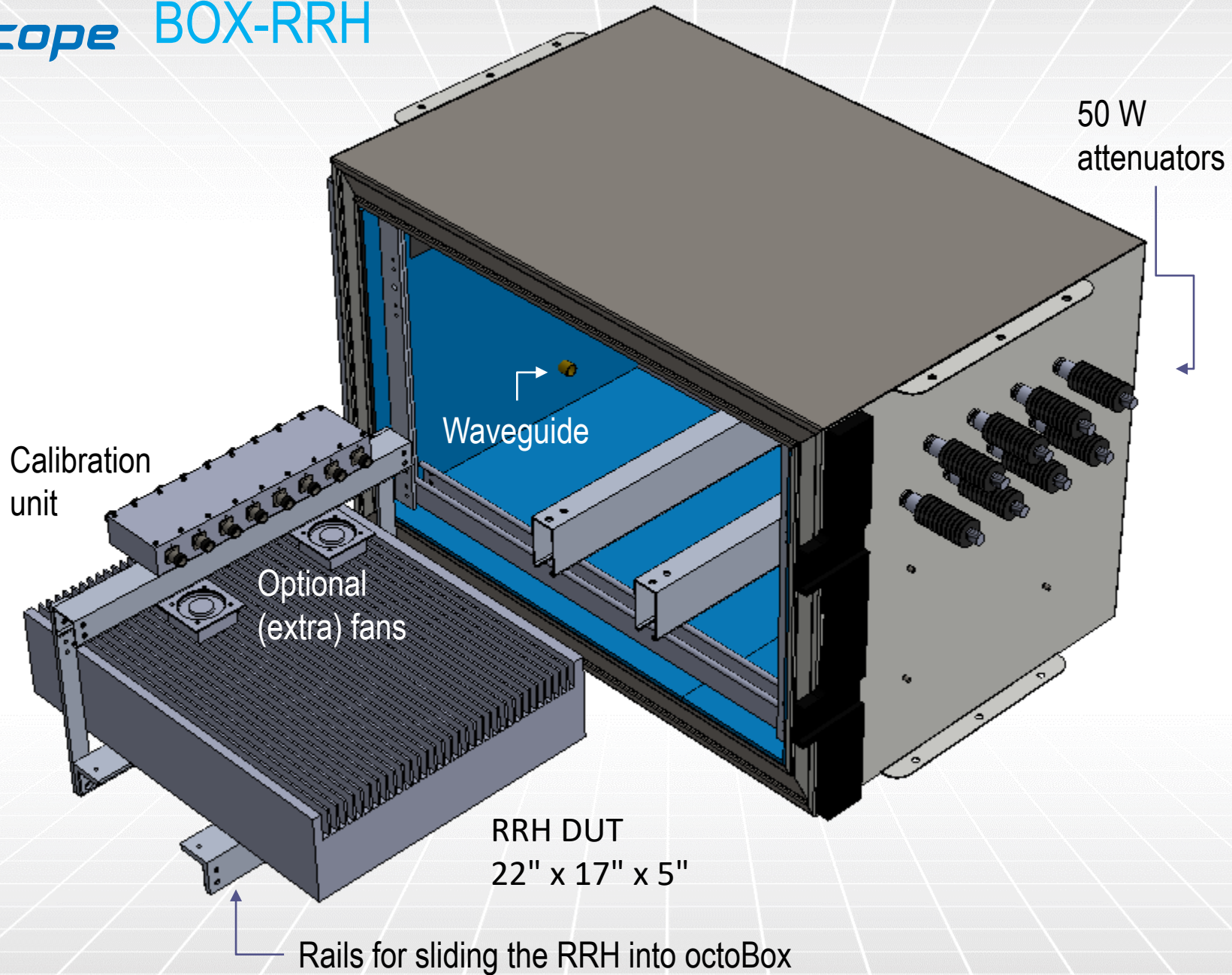
RRH

Fader

UE

RRH = remote radio head
UE = user equipment

octoScope BOX-RRH



50 W attenuators

Waveguide

Calibration unit

Optional (extra) fans

RRH DUT
22" x 17" x 5"

Rails for sliding the RRH into octoBox

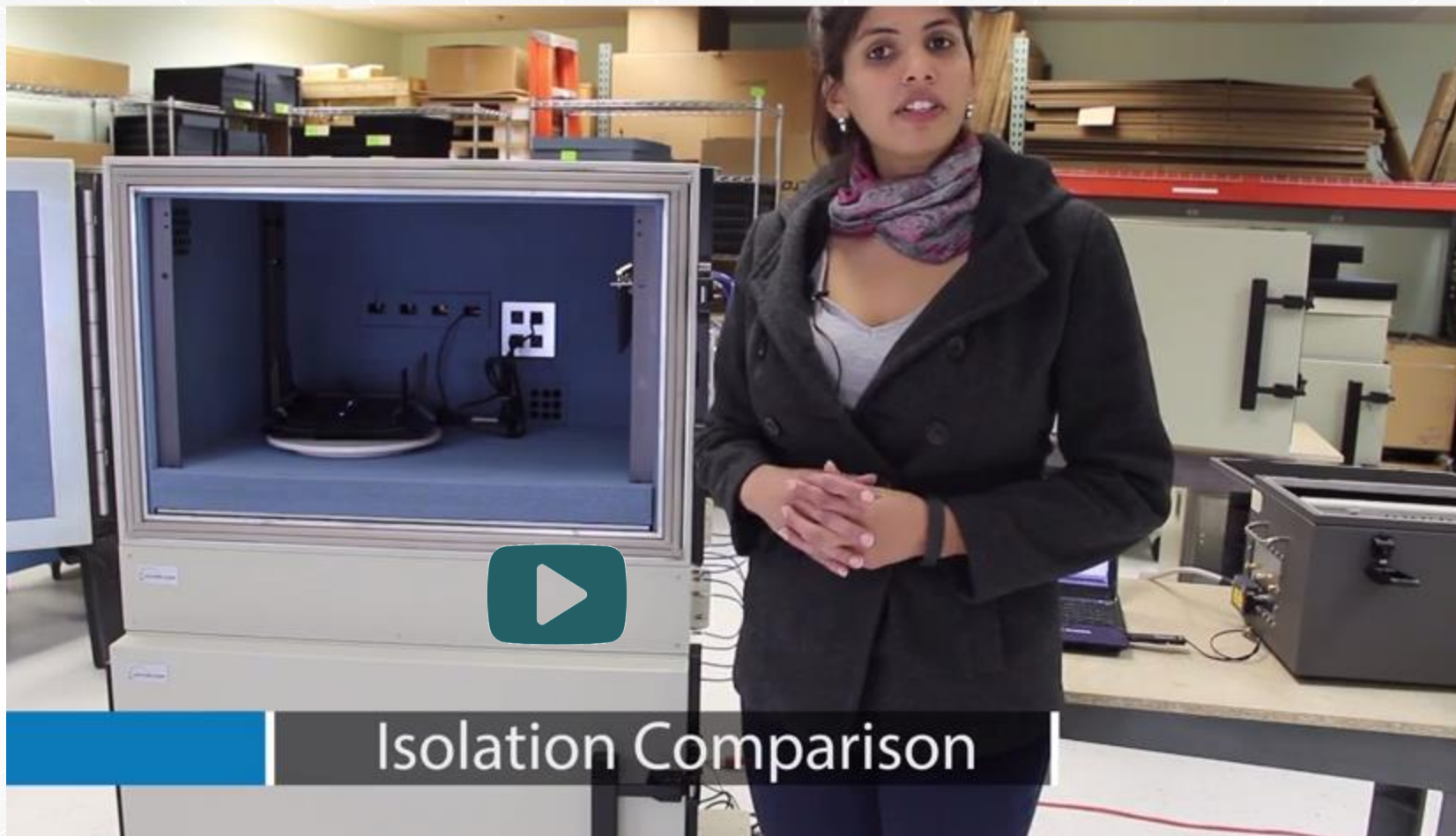
RRH = remote radio head

octoScope Antenna arrangement suitable for a PC DUT

4 sets of 4x4 MIMO links
feeding into the octoBox
that's part of a 4x4 full
mesh system



octoScope octoBox vs. common shield box



<https://www.youtube.com/watch?v=Q6xlcTSVKeo>

octoScope Key wireless test capabilities

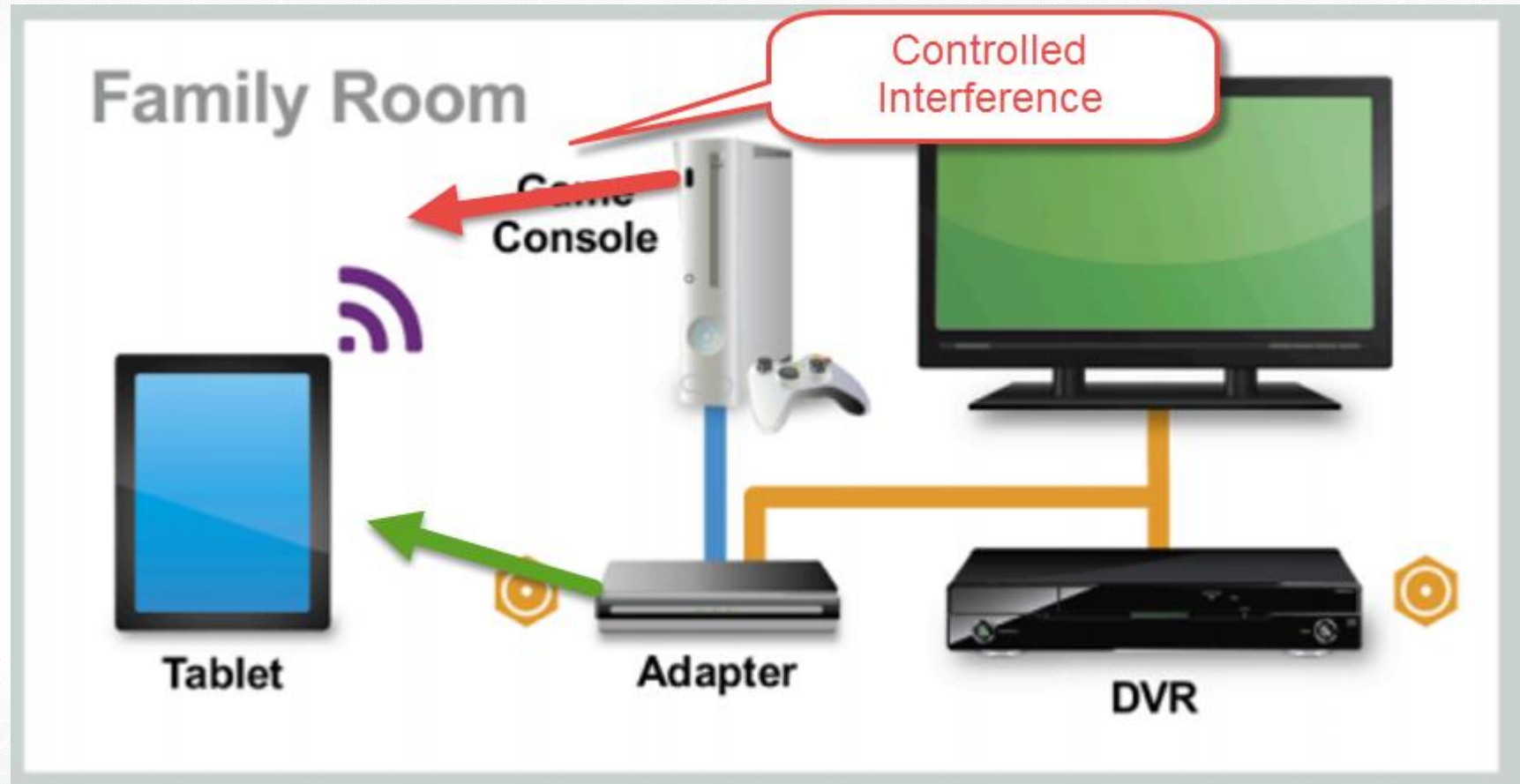
- ✓ Throughput performance
- ✓ Complete isolation
- ✓ Controlled interference
- ✓ Roaming behavior (sticky clients)
- ✓ Interoperability (vendor to vendor)
- ✓ Emulate a multi-room house



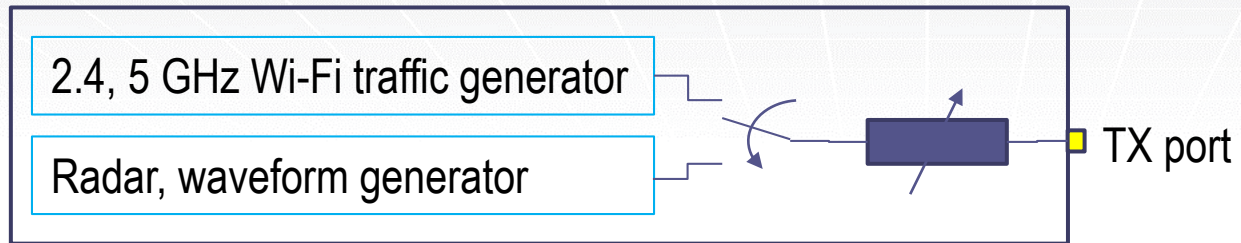
<https://youtu.be/pZ9bsQAPvII>

octoScope Generate interference

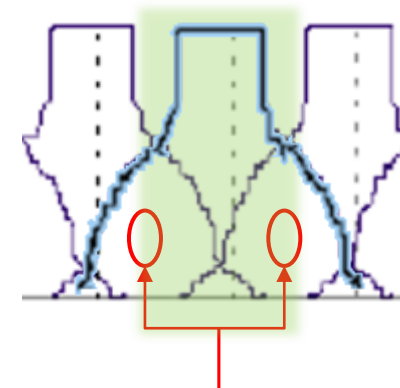
octoBox iGen interference generator generates realistic traffic and waveform interference.



octoScope octoBox iGen interference generator



- Generates Wi-Fi traffic or an interference waveform
- Test cases
 - Automated channel selection algorithm
 - DFS (Dynamic Frequency Selection)
 - Fairness of access (CSMA/CA and WMM)
 - CCI with WMM priorities; no other generator can set priorities
 - ACI
 - Performance in the presence of IoT, BT, microwave, baby monitor
 - Rate adaptation



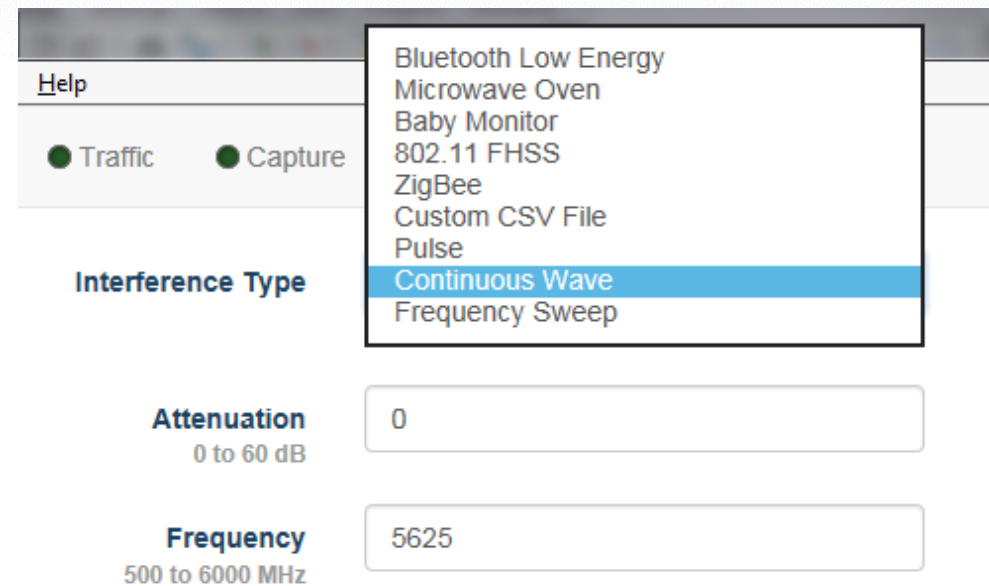
802.11 ACI significantly impacts performance

ACI = adjacent channel interference
 CCI = co channel interference
 WMM = wireless multi media
 CSMA/CA = carrier sense multiple access / collision avoidance
 OOK = on off keying
 BT = Bluetooth
 IoT = internet of things



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_TCIPacket_3128B.pcap
Play Mode	Loop until <stop>
Priority (WMM)	Best Effort
Inter-Packet Gap 300µsec minimum	300 <input type="text"/> µsec
Attenuation 0dB to 60dB	0 <input type="text"/>

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

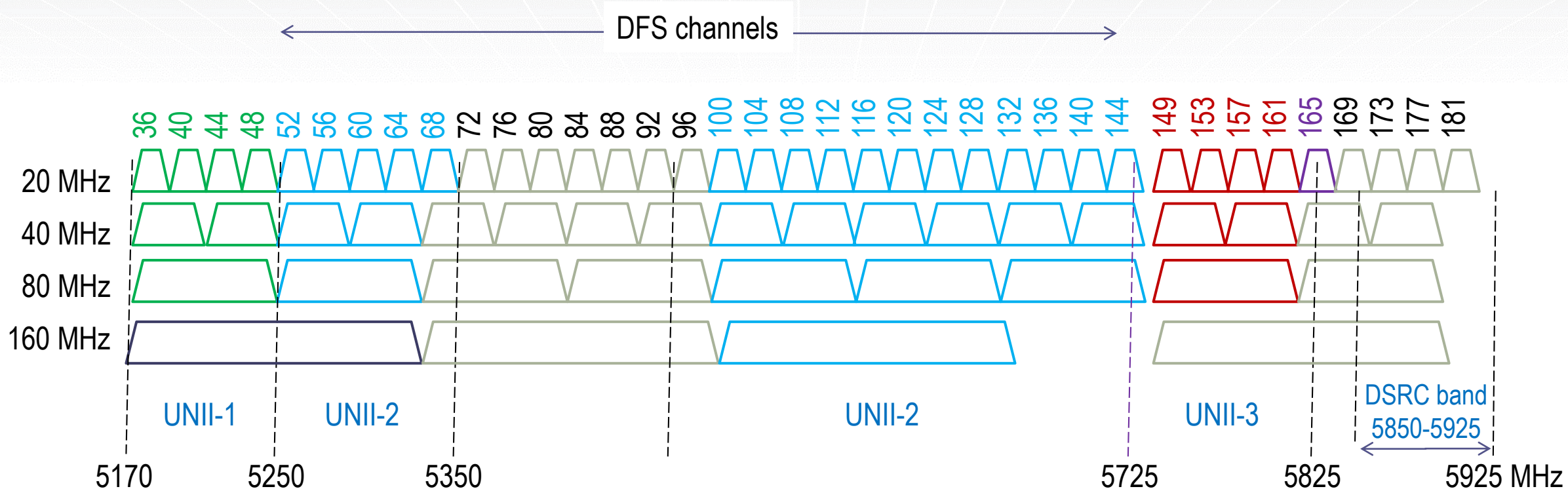
0

Frequency
500 to 6000 MHz

5625



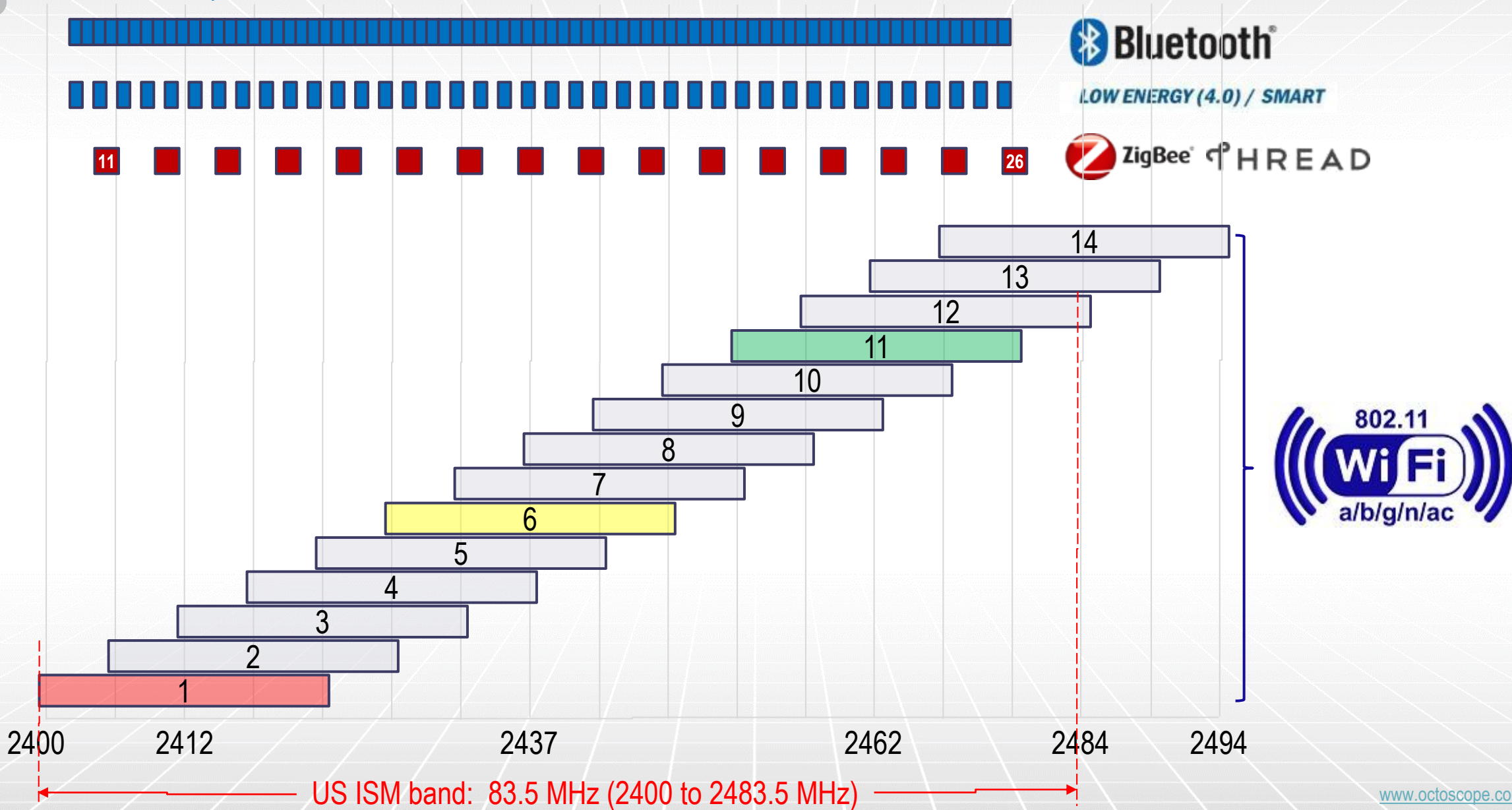
octoScope 5 GHz band channel allocation



UNII = unlicensed national information infrastructure
 DSRC = direct short range communications



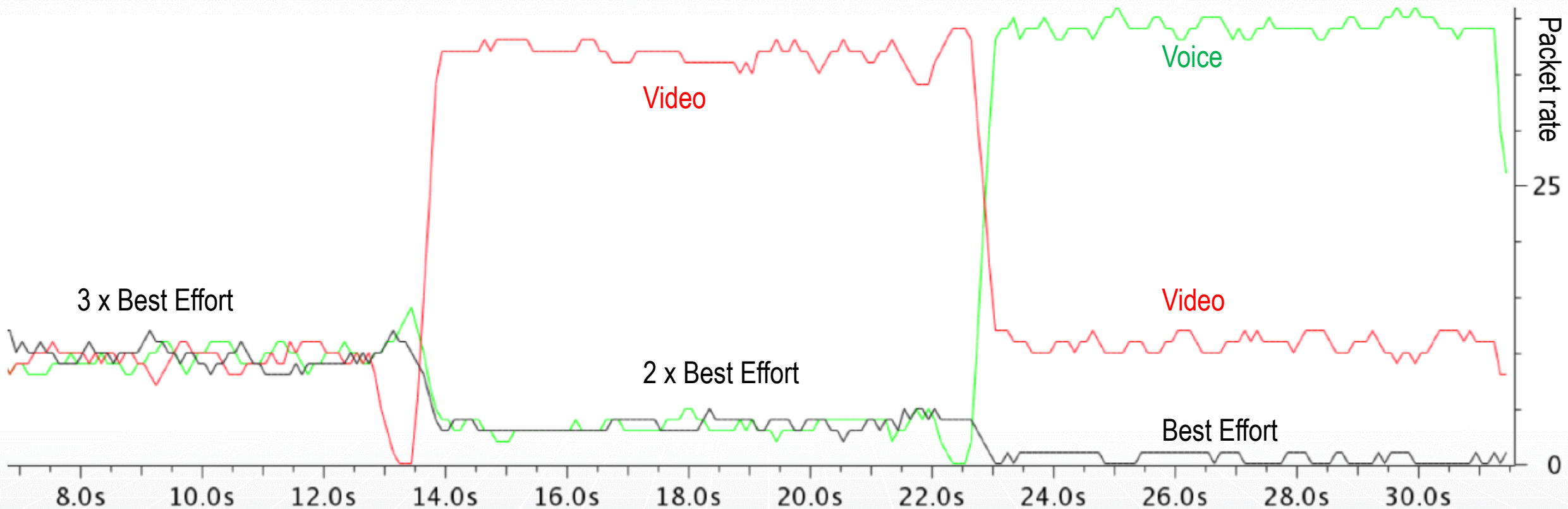
octoScope 2.4 GHz band channel allocation





WMM (wireless multi media) – streams of different priorities

3 iGen modules transmitting inside an octoBox and sharing the airlink at different priorities



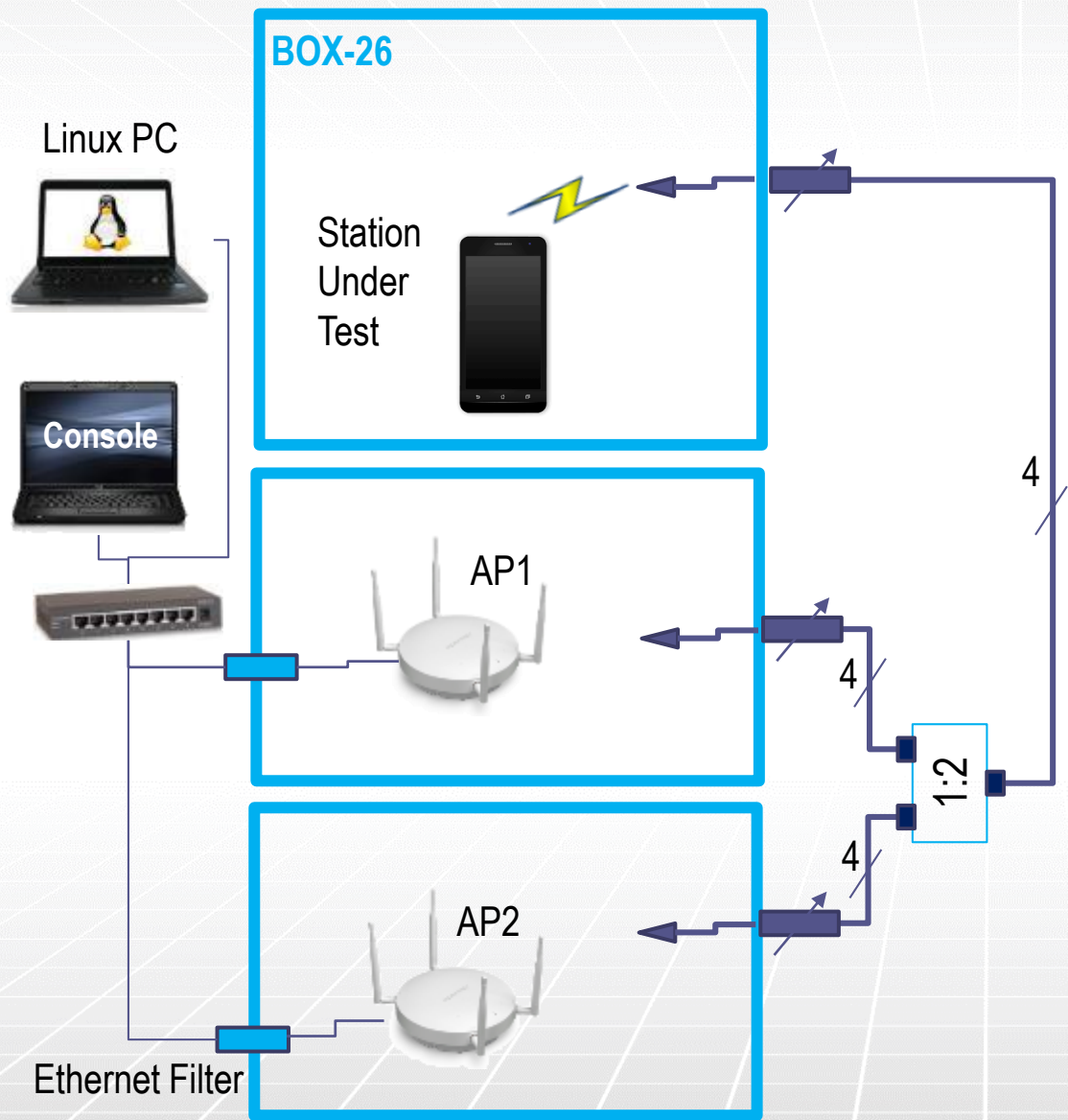
octoScope Key wireless test capabilities

- ✓ Throughput performance
- ✓ Complete isolation
- ✓ Controlled interference
- ✓ Roaming behavior (sticky clients)
- ✓ Interoperability (vendor to vendor)
- ✓ Emulate a multi-room house

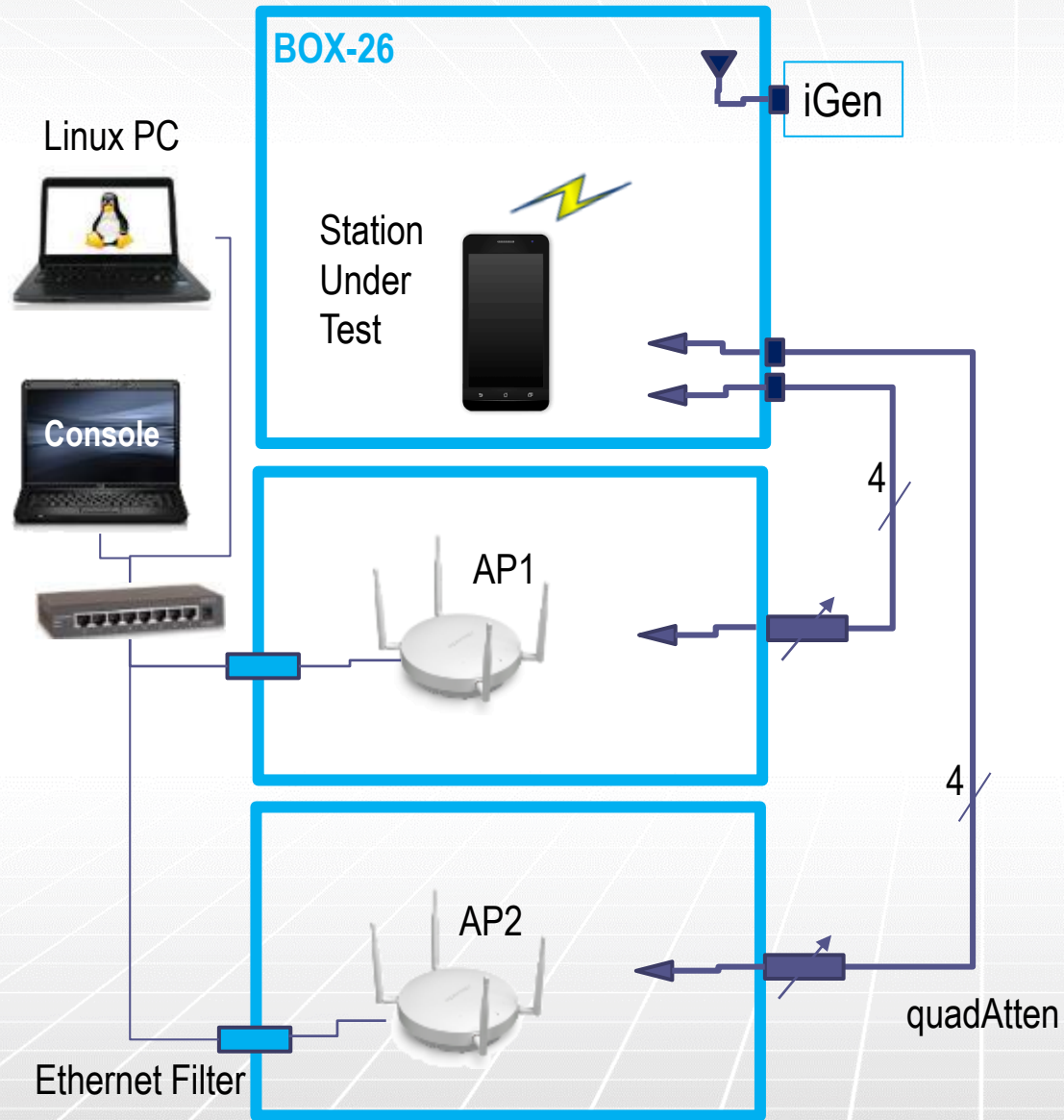


<https://www.youtube.com/watch?v=GAIfugKSQ1A>

octoScope Roaming testbed diagram

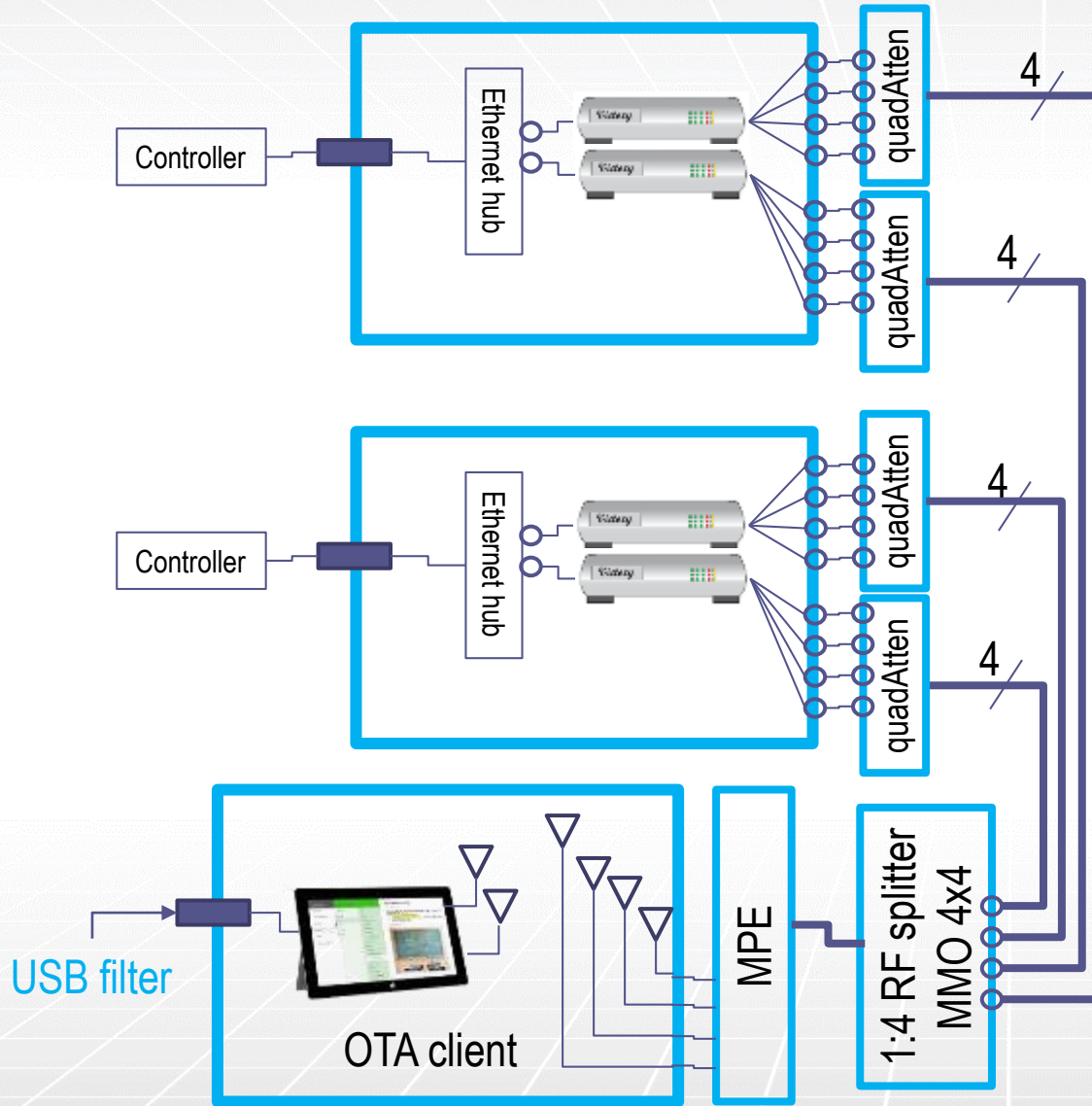


octoScope Roaming testbed diagram alternative

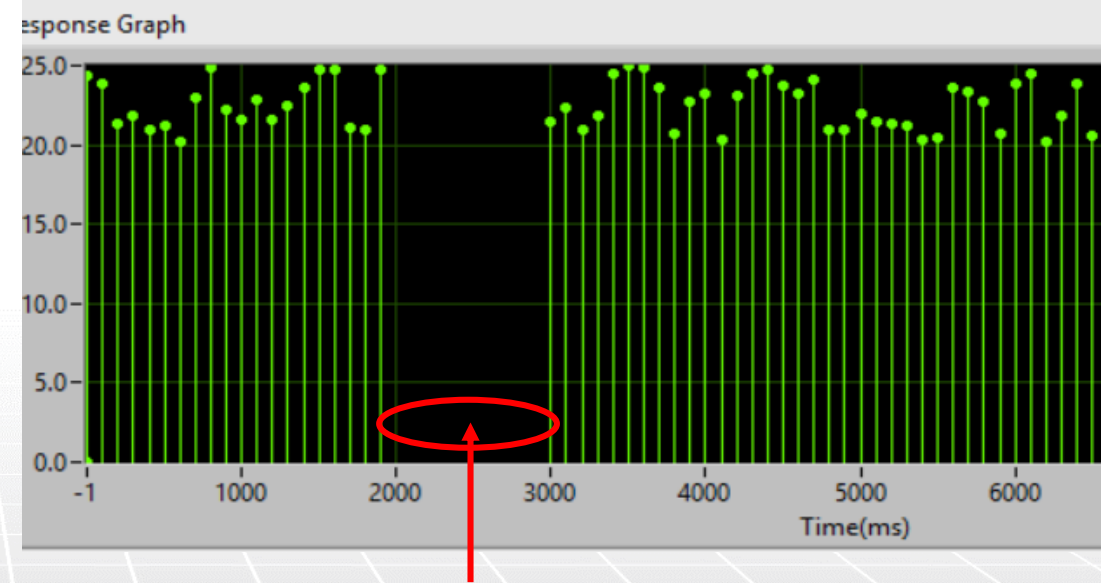
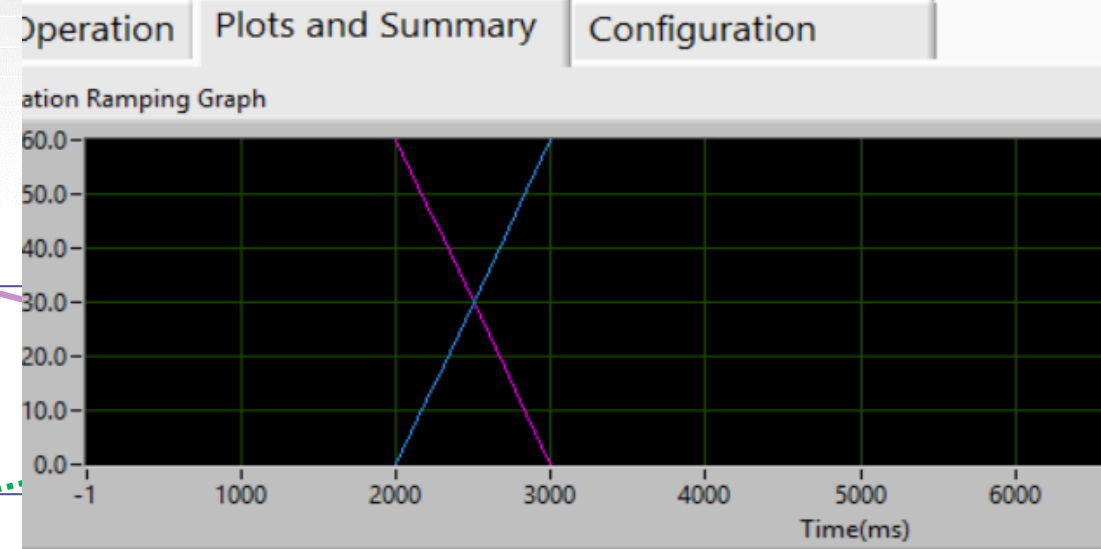
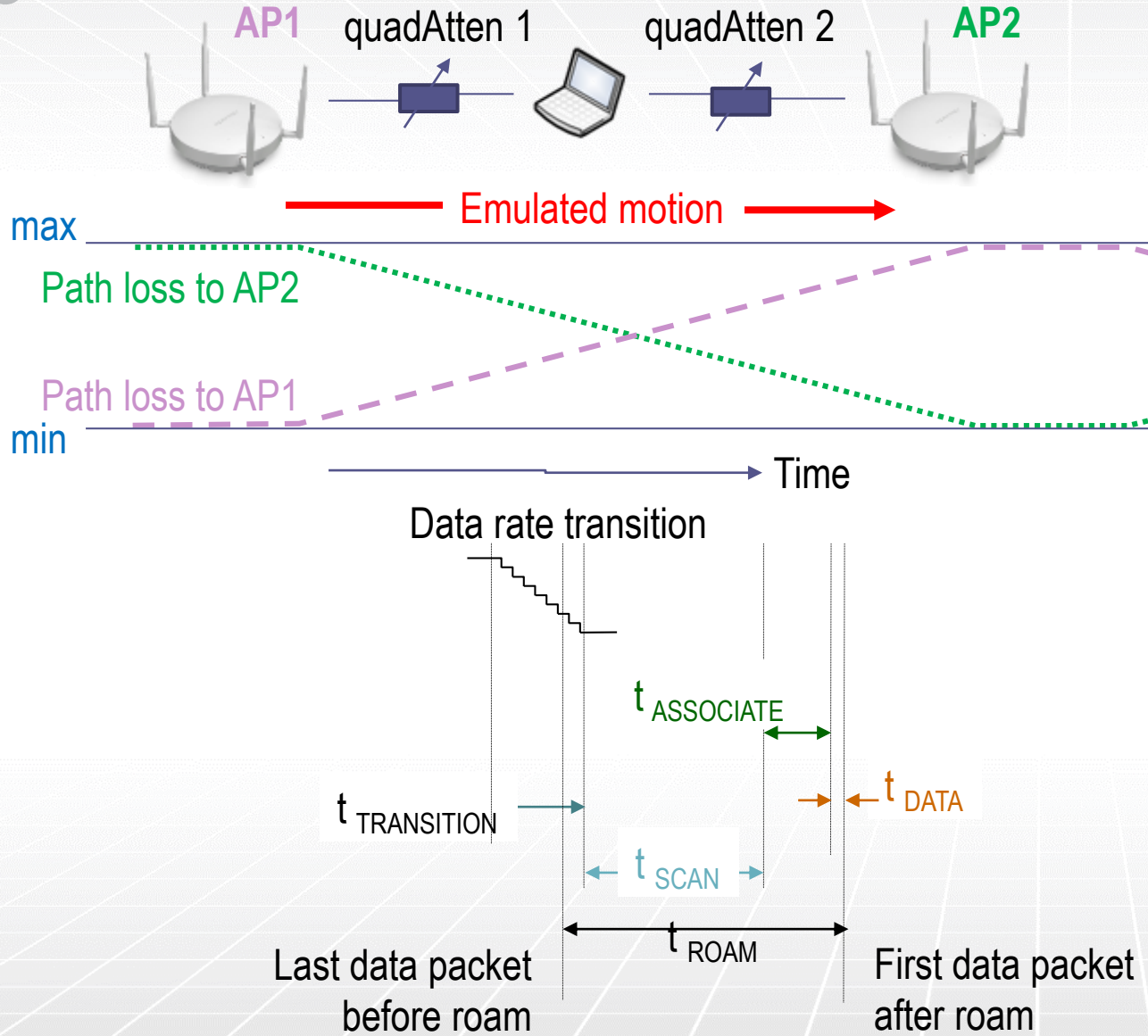


Alternative cabling with no splitter and with the iGen interference generator/monitor

octoScope Multi-AP roaming



octoScope Roaming test conceptual diagram



Outage due to roaming

octoScope Roaming software, OB-ROAMING

roaming-gui-11.vi

octoScope **Roaming Test** Version 2.0

Roaming Operation | Plots and Summary | Configuration

Exit

Attenuation

Atten 1 (dB) 0 20 40 60

Atten 2 (dB) 0 20 40 60

AP 1 AP 2

Roam

Total Ping Duration (sec) 10

Ramp Delay (sec) 2

Expected Ping Progress (sec)

0 2 4 6 8 10

Ramp Time (msec) 1000

Ramp Range (dB) 60

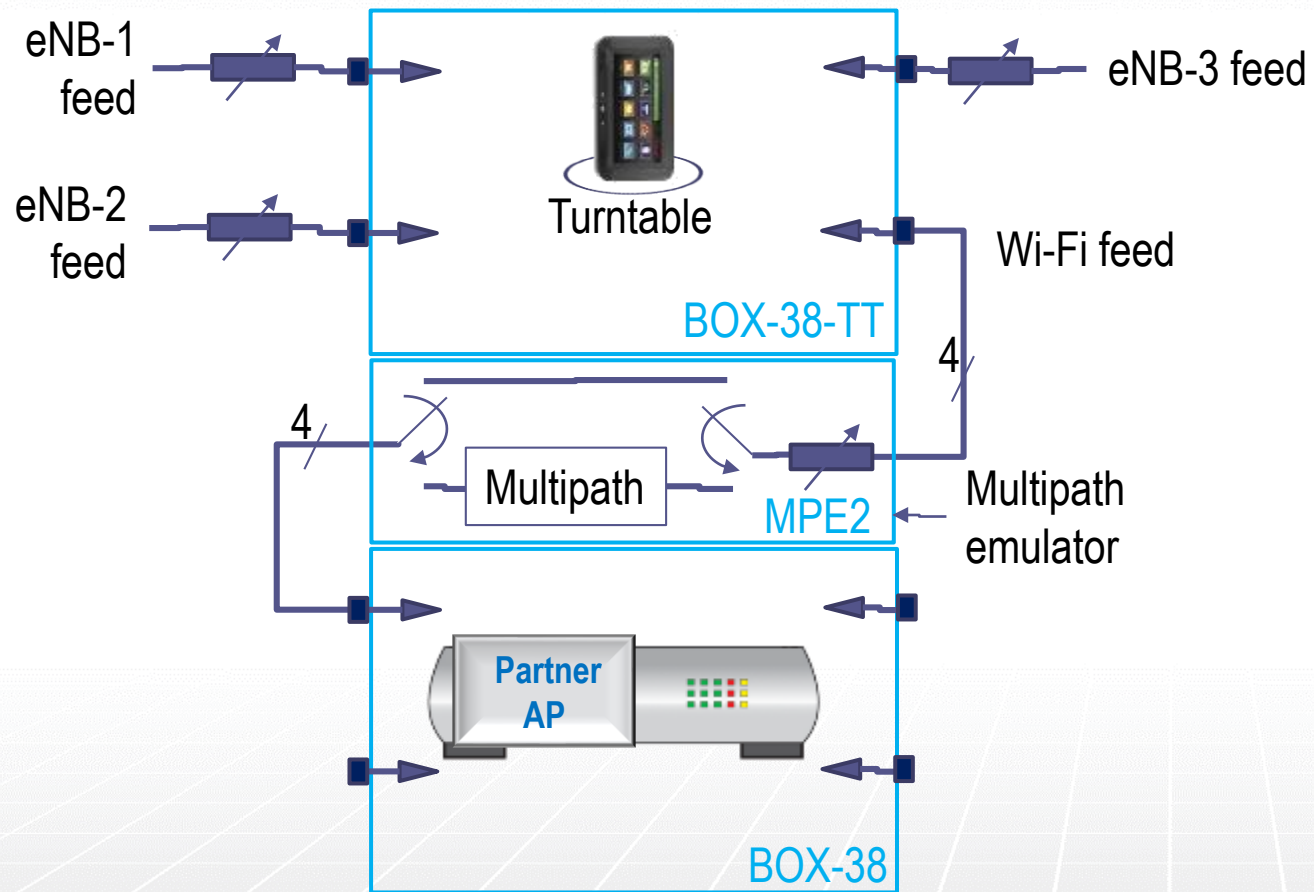
Ramp Rate (dB/sec) 60

Status

Demo Mode? ●

Controls motion,
velocity, pinging,
graphical reporting

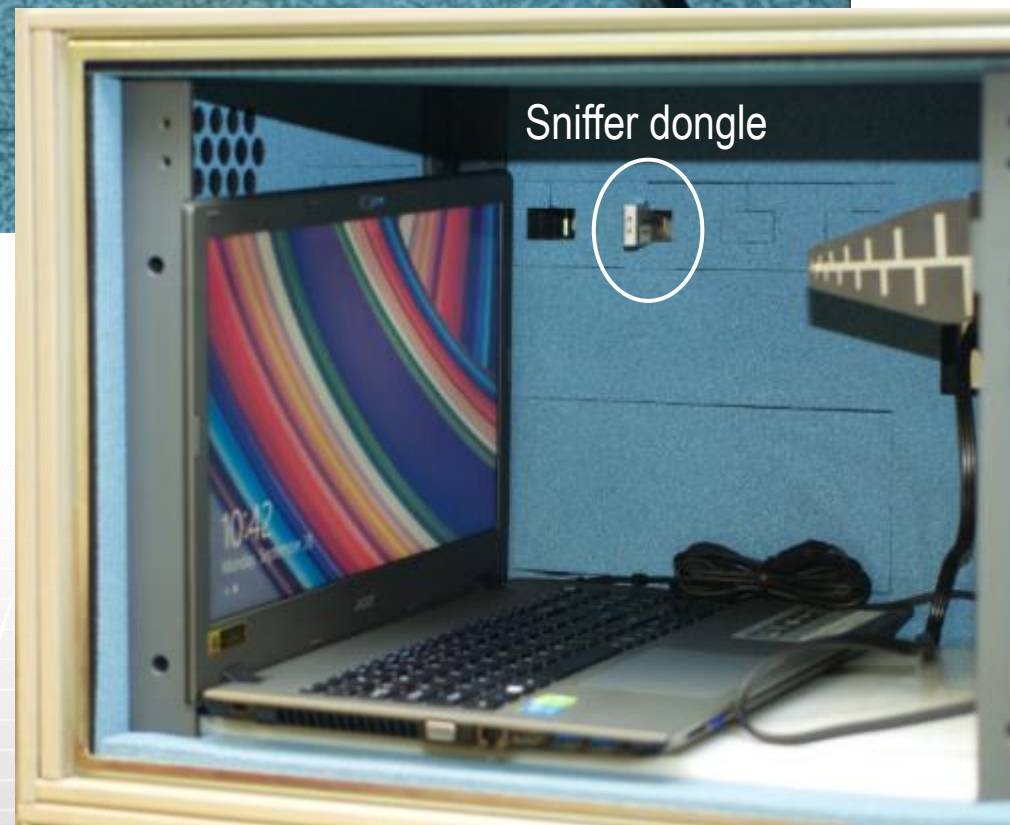
octoScope Wi-Fi offloading test configuration example



octoScope Connecting a sniffer dongle



Connect the sniffer USB dongle to the inside port of the octoBox USB filter (shown) and sniffer PC to the outside port of the USB filter.



octoScope Key wireless test capabilities

- ✓ Throughput performance
- ✓ Complete isolation
- ✓ Controlled interference
- ✓ Roaming behavior (sticky clients)
- ✓ Interoperability (vendor to vendor)
- ✓ Emulate a multi-room house



<https://www.youtube.com/watch?v=CaNxaTxCWWc>



Wi-Fi Alliance testbed

Ethernet filters
BOX-38

Sigma UCC

Sigma AP Control Agent

Sigma PC End Point

RADIUS Server

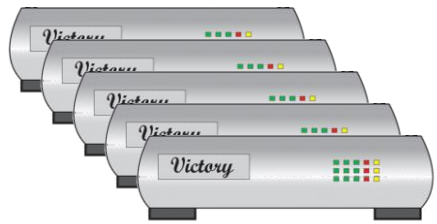
Control Ethernet
Test Ethernet

Wireless Sniffer

WFA EMT

DUT

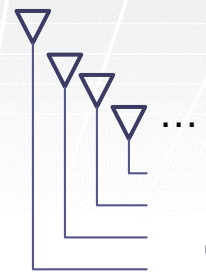
Ethernet Switch



Ethernet Switch



Ethernet Switch



RF combiner

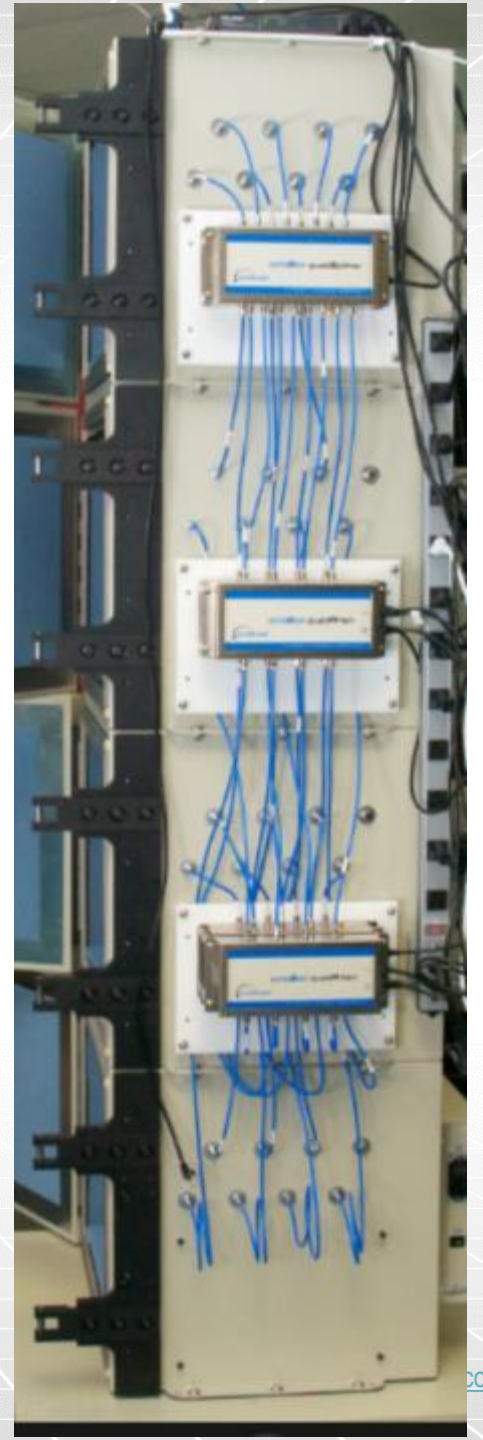
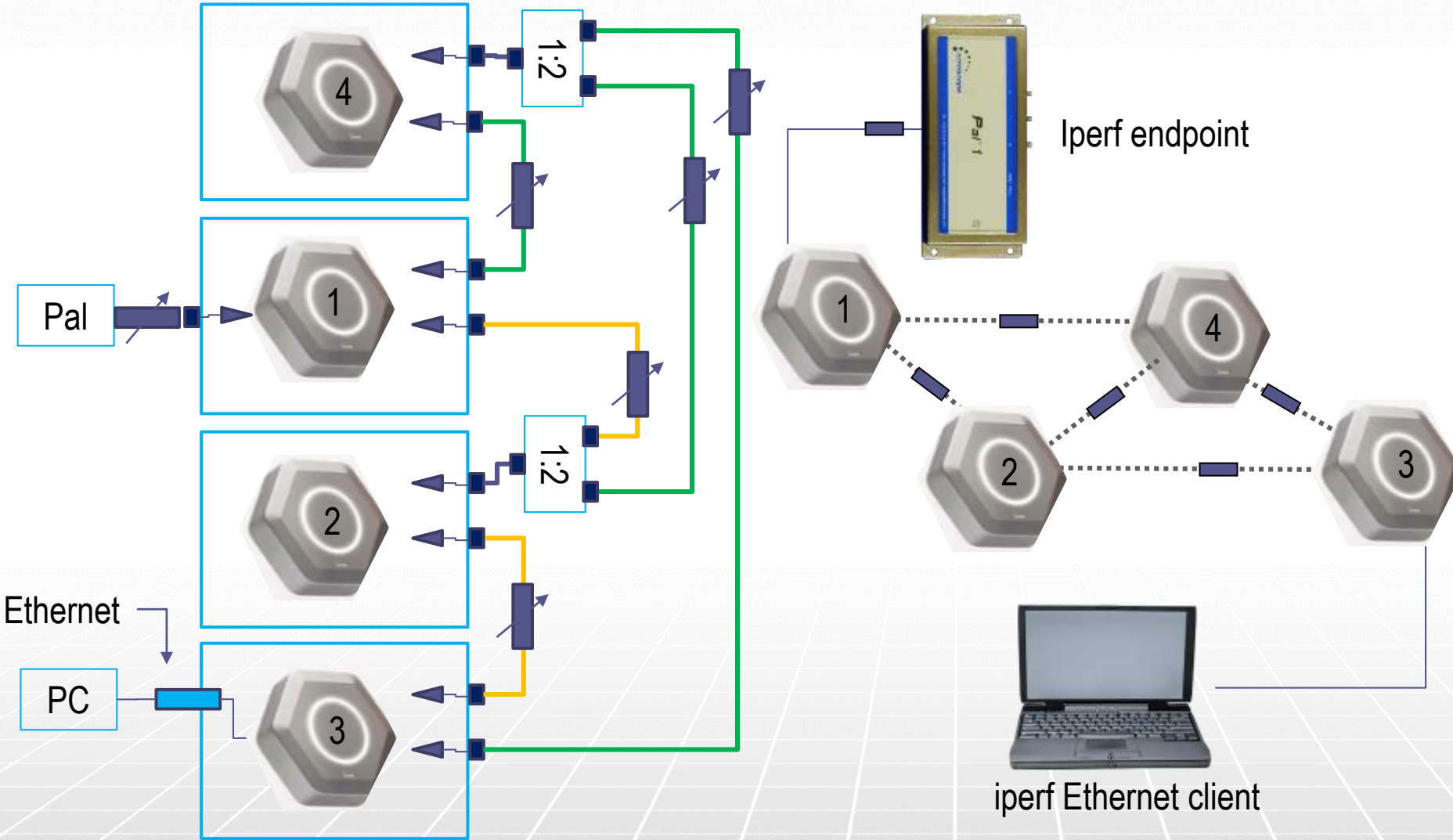


UCC = universal CAPI control

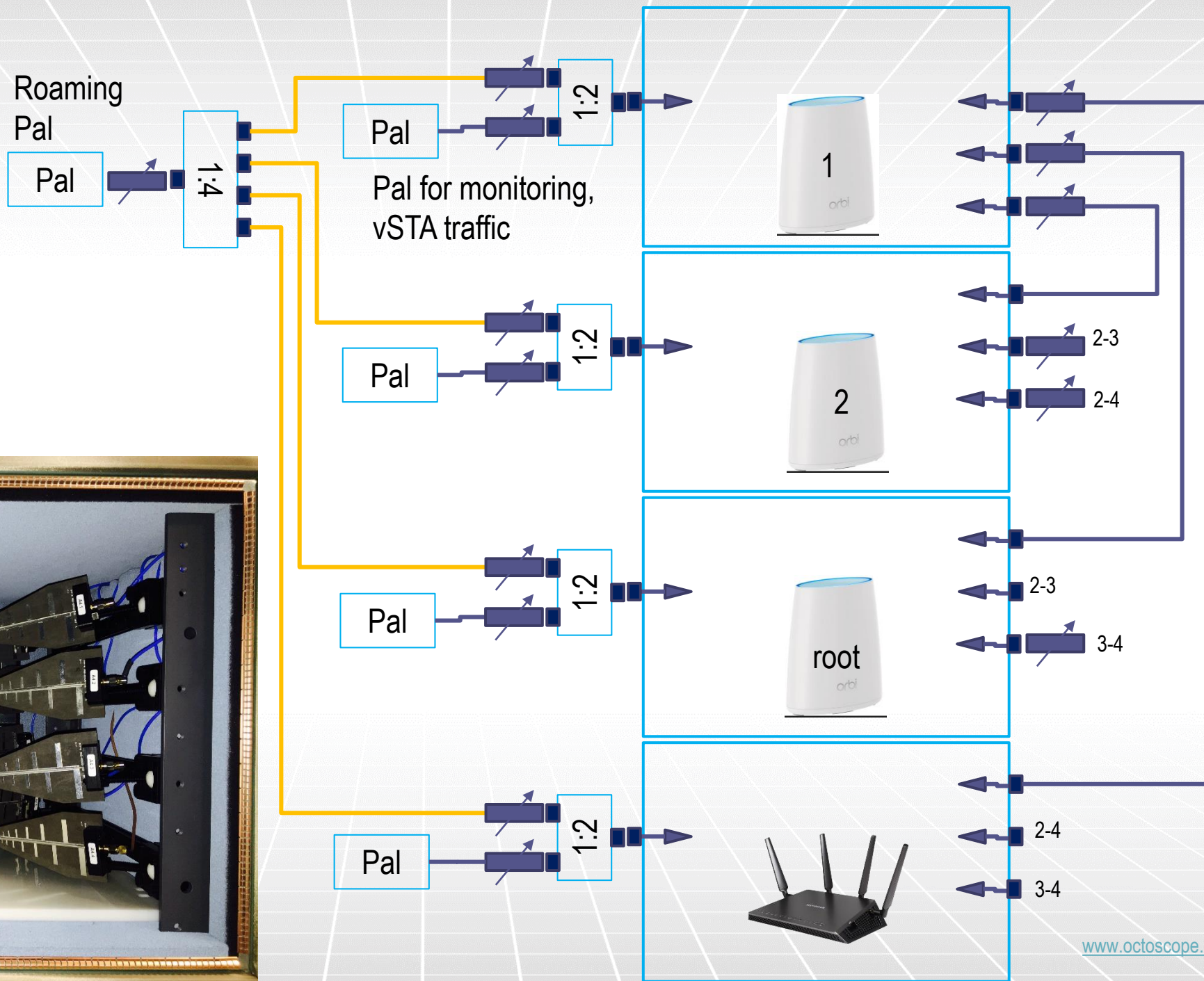
CAPI = common application programming interface

octoScope Mesh testbed example

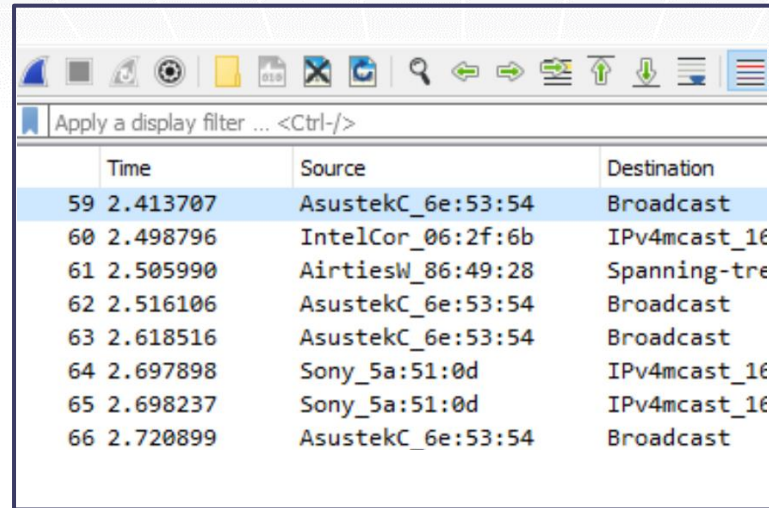
Mesh self-forming, self-healing test cases



4-node full mesh with a roaming Pal

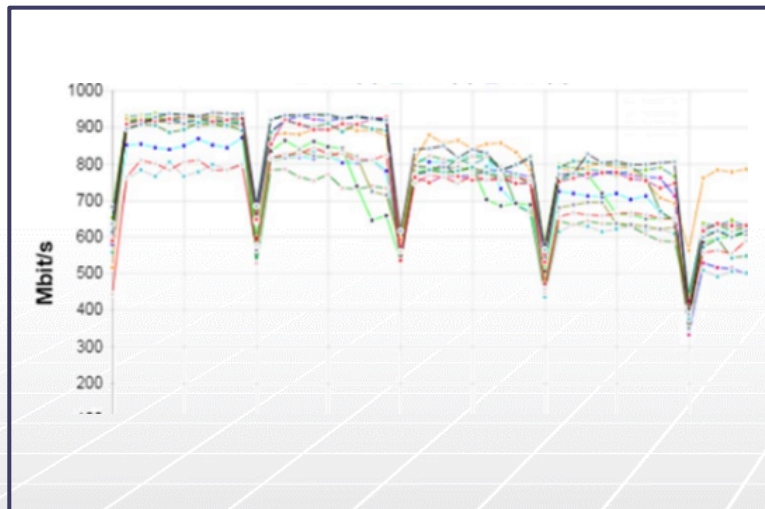


Wireshark captures

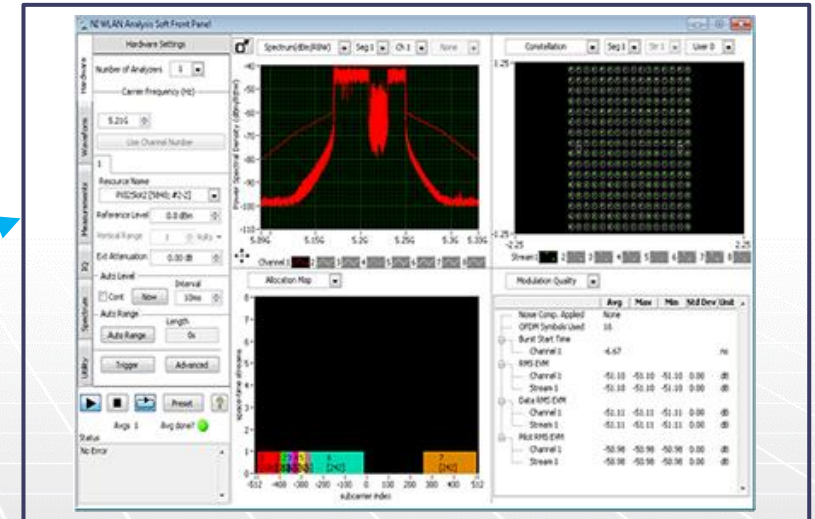


	Time	Source	Destination
	59 2.413707	AsustekC_6e:53:54	Broadcast
	60 2.498796	IntelCor_06:2f:6b	IPv4mcast_16
	61 2.505990	AirtiesW_86:49:28	Spanning-tre
	62 2.516106	AsustekC_6e:53:54	Broadcast
	63 2.618516	AsustekC_6e:53:54	Broadcast
	64 2.697898	Sony_5a:51:0d	IPv4mcast_16
	65 2.698237	Sony_5a:51:0d	IPv4mcast_16
	66 2.720899	AsustekC_6e:53:54	Broadcast

Throughput and monitor plots

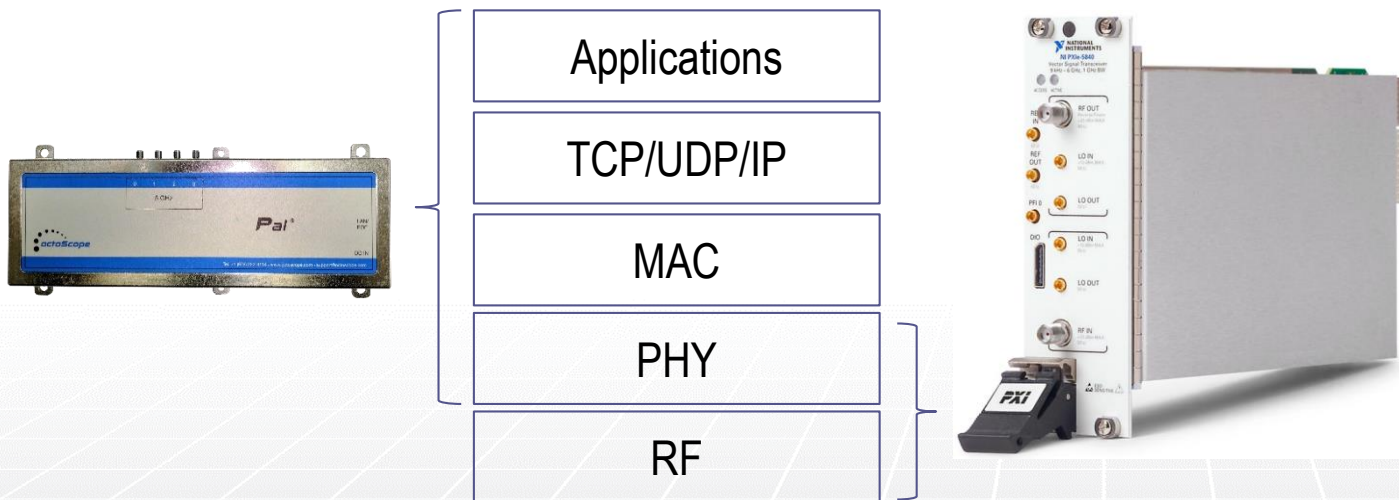


RF Measurements



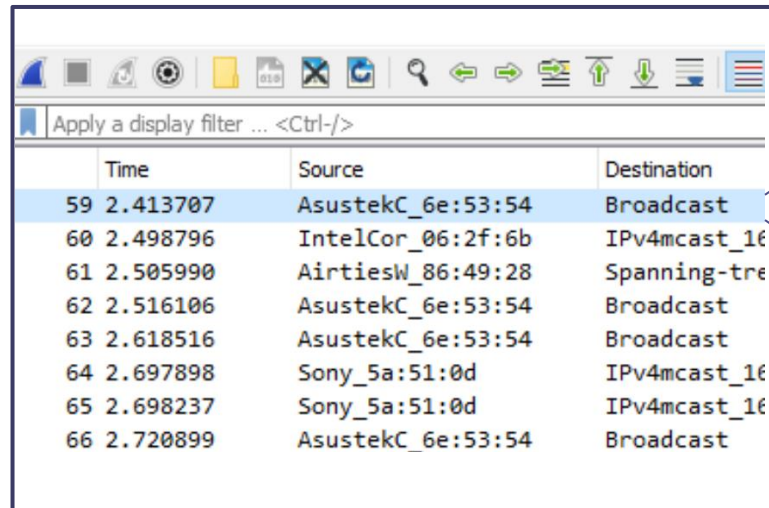
octoScope Integrating RF instruments - example

- Combine an RF instrument, such as a VSA/VSG with octoScope's [Pal](#) to deliver synchronized RF, PHY and MAC captures with editable replay capability.
- The RF instrument supports the PHY and RF layers. The Pal supports the PHY and higher layers.



octoScope Packet captures to IQ synchronization

Wireshark captures

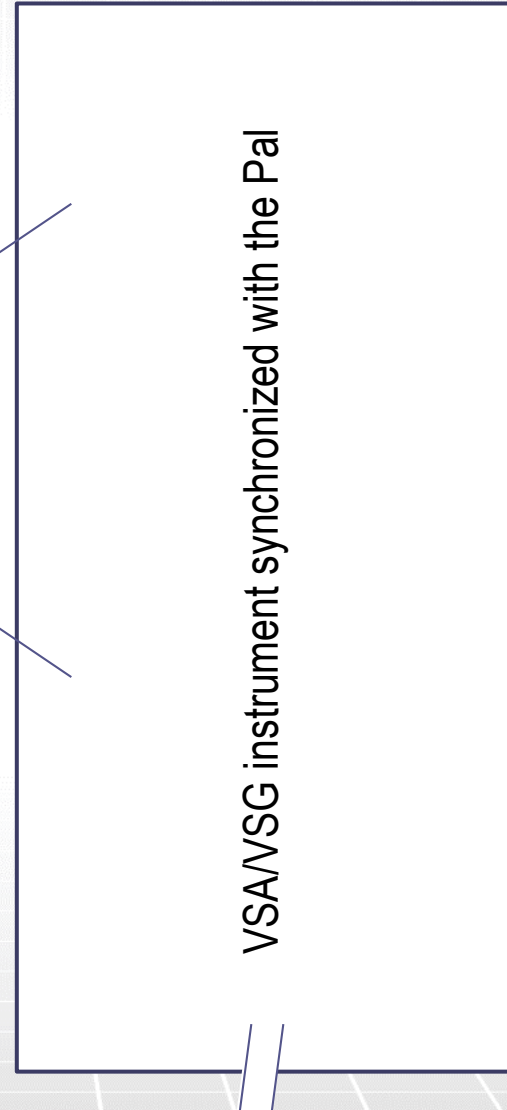


The screenshot shows a Wireshark packet capture table with the following data:

	Time	Source	Destination
59	2.413707	AsustekC_6e:53:54	Broadcast
60	2.498796	IntelCor_06:2f:6b	IPv4mcast_16
61	2.505990	AirtiesW_86:49:28	Spanning-tre
62	2.516106	AsustekC_6e:53:54	Broadcast
63	2.618516	AsustekC_6e:53:54	Broadcast
64	2.697898	Sony_5a:51:0d	IPv4mcast_16
65	2.698237	Sony_5a:51:0d	IPv4mcast_16
66	2.720899	AsustekC_6e:53:54	Broadcast

The Pal provides triggering to the RF instrument based on real-time analysis of the captures

IQ samples



octoScope Ready to use out of the box



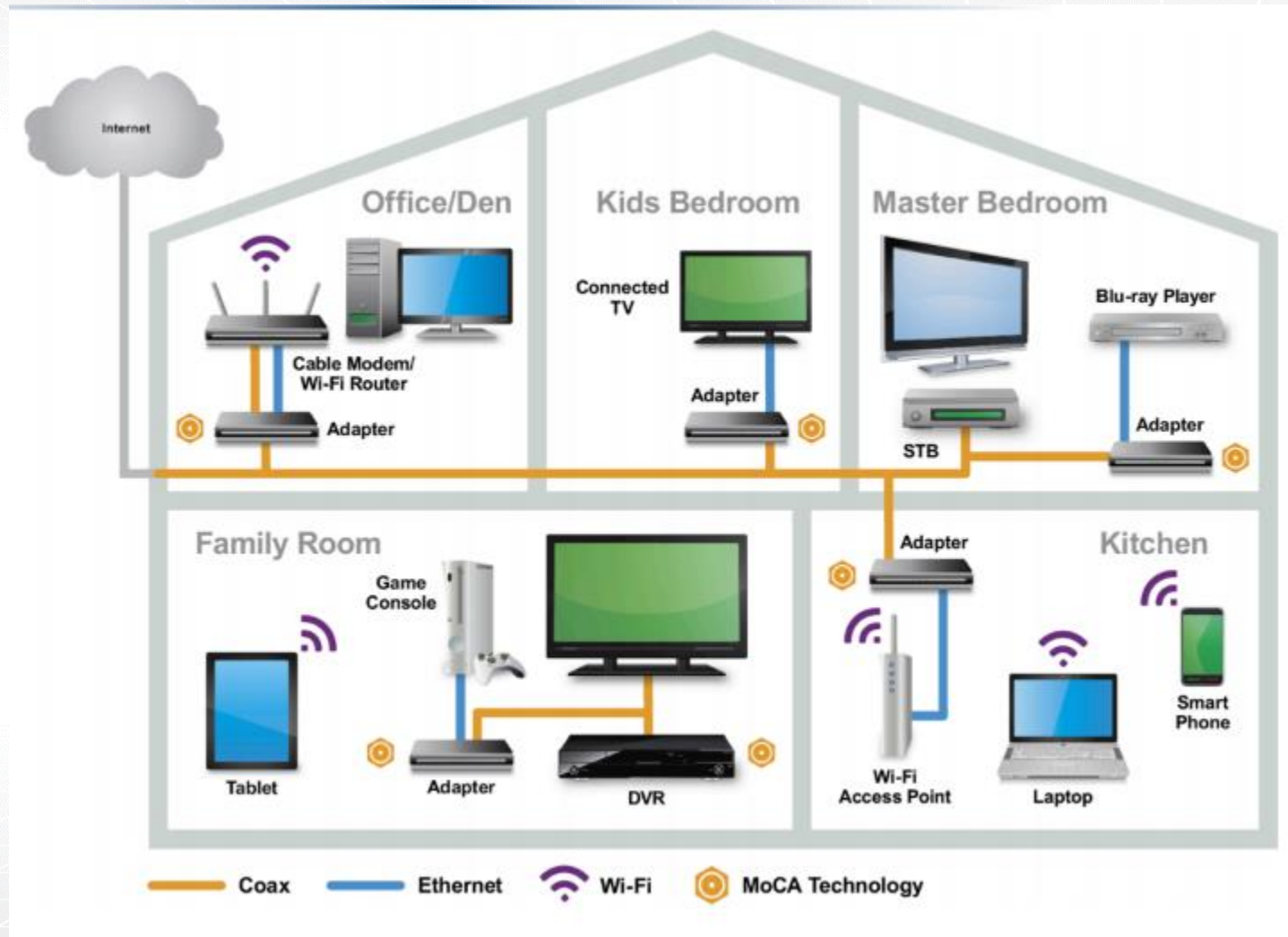
octoScope Key wireless test capabilities

- ✓ Throughput performance
- ✓ Complete isolation
- ✓ Controlled interference
- ✓ Roaming behavior (sticky clients)
- ✓ Interoperability (vendor to vendor)
- ✓ Emulate a multi-room house



<https://www.youtube.com/watch?v=UTXtebyORQA>

octoScope Multiple boxes to emulate multi-room connected house



Controlled environment octoBox testbed emulating a multi-room house



Three OB-38 triStacks

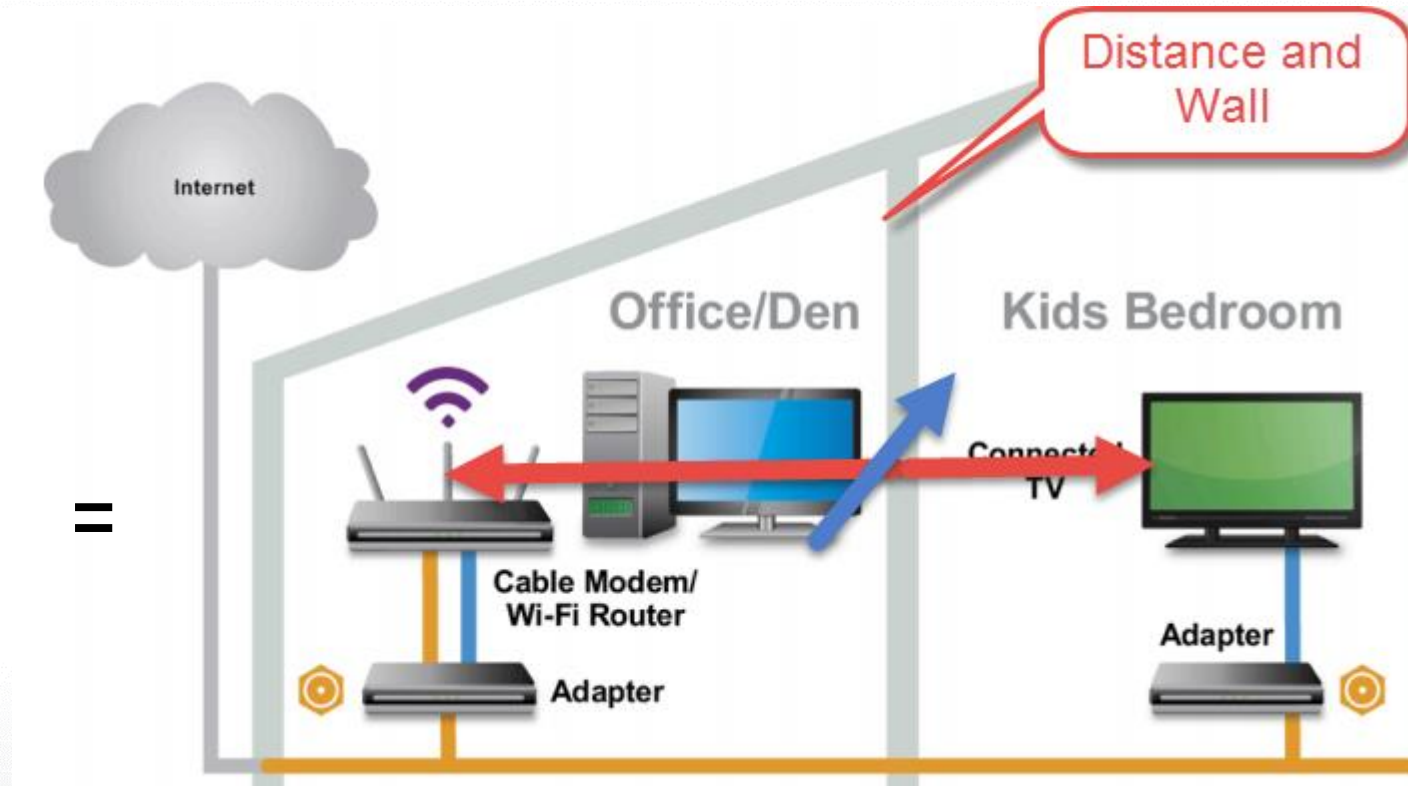
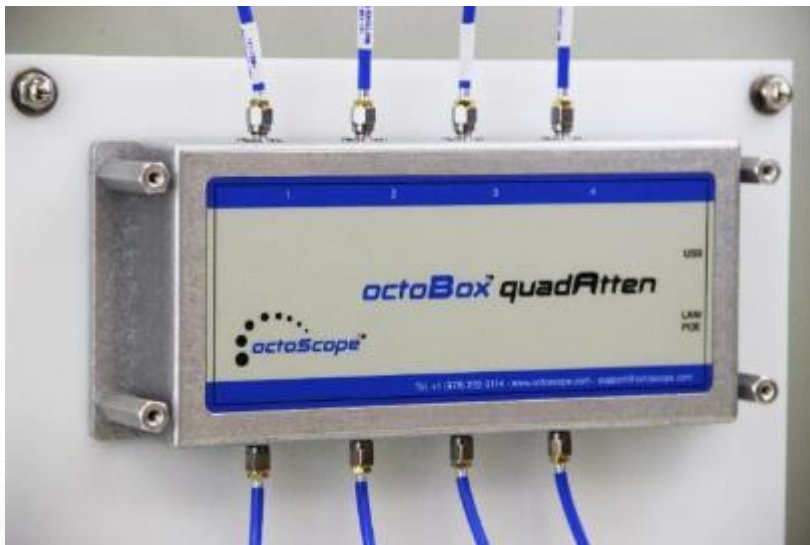




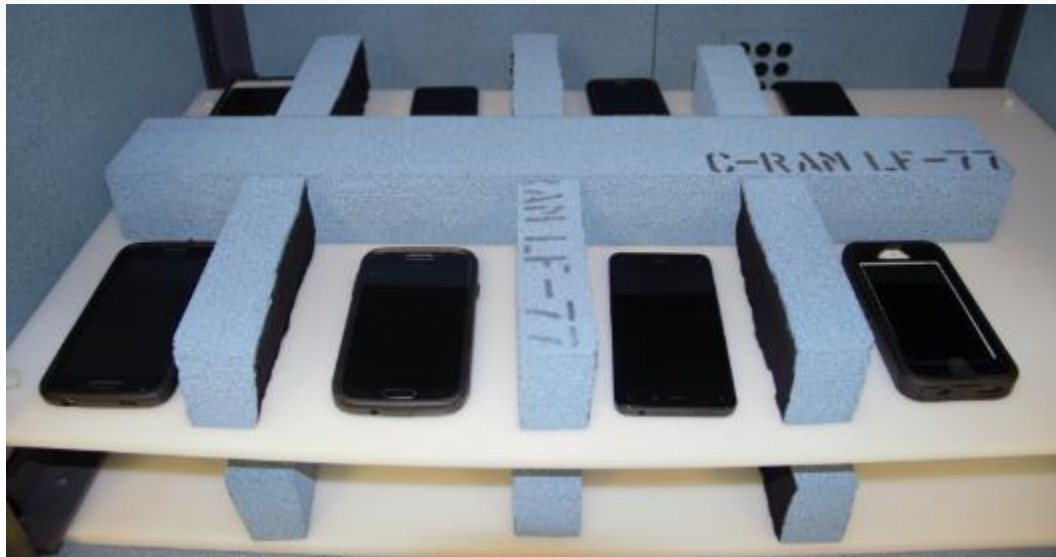
Video, data over Wi-Fi testbed

octoScope Emulate walls and distance

octoBox quadAtten emulates walls, floors/ceilings, space and motion of devices.



octoScope Multi-DUT arrangement examples



Plastic shelves, rails
and corner brackets

Perforated corner
brackets support
multiple shelves



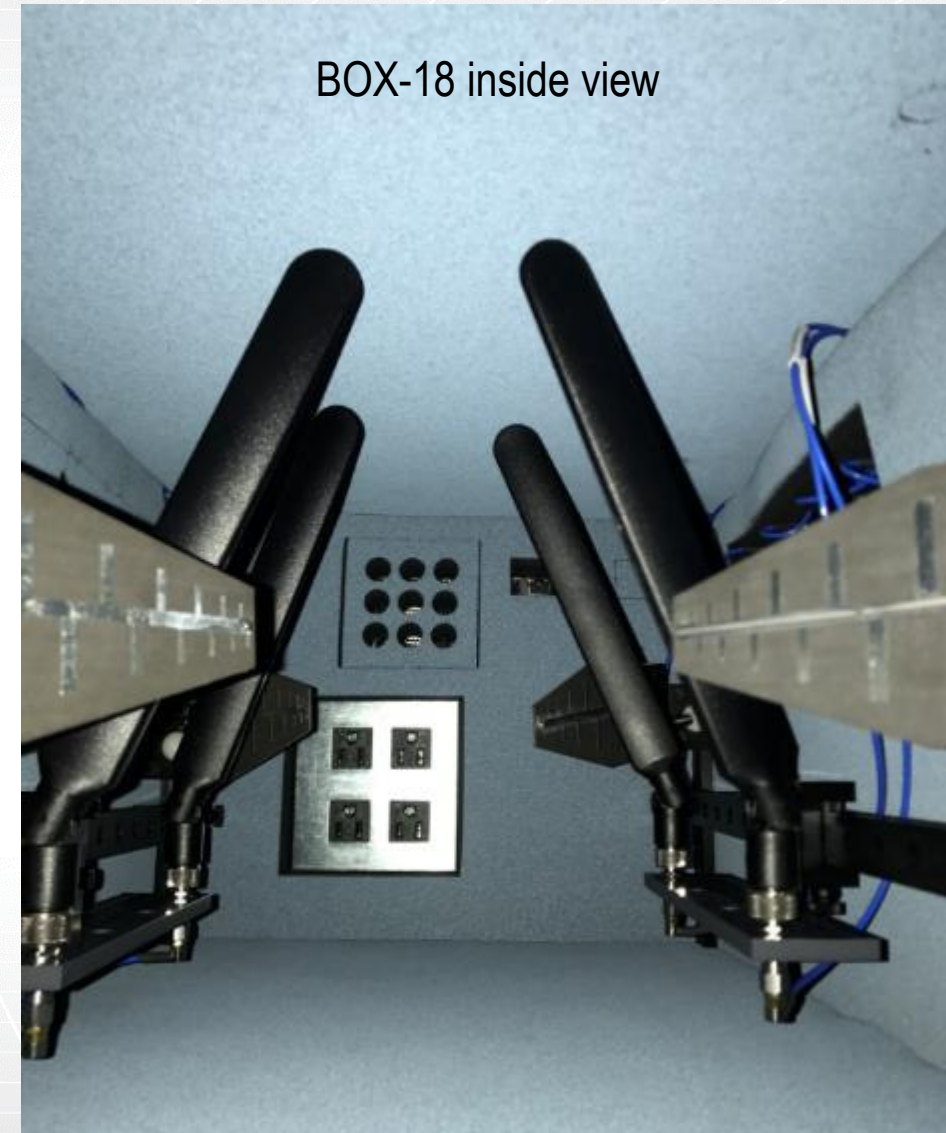
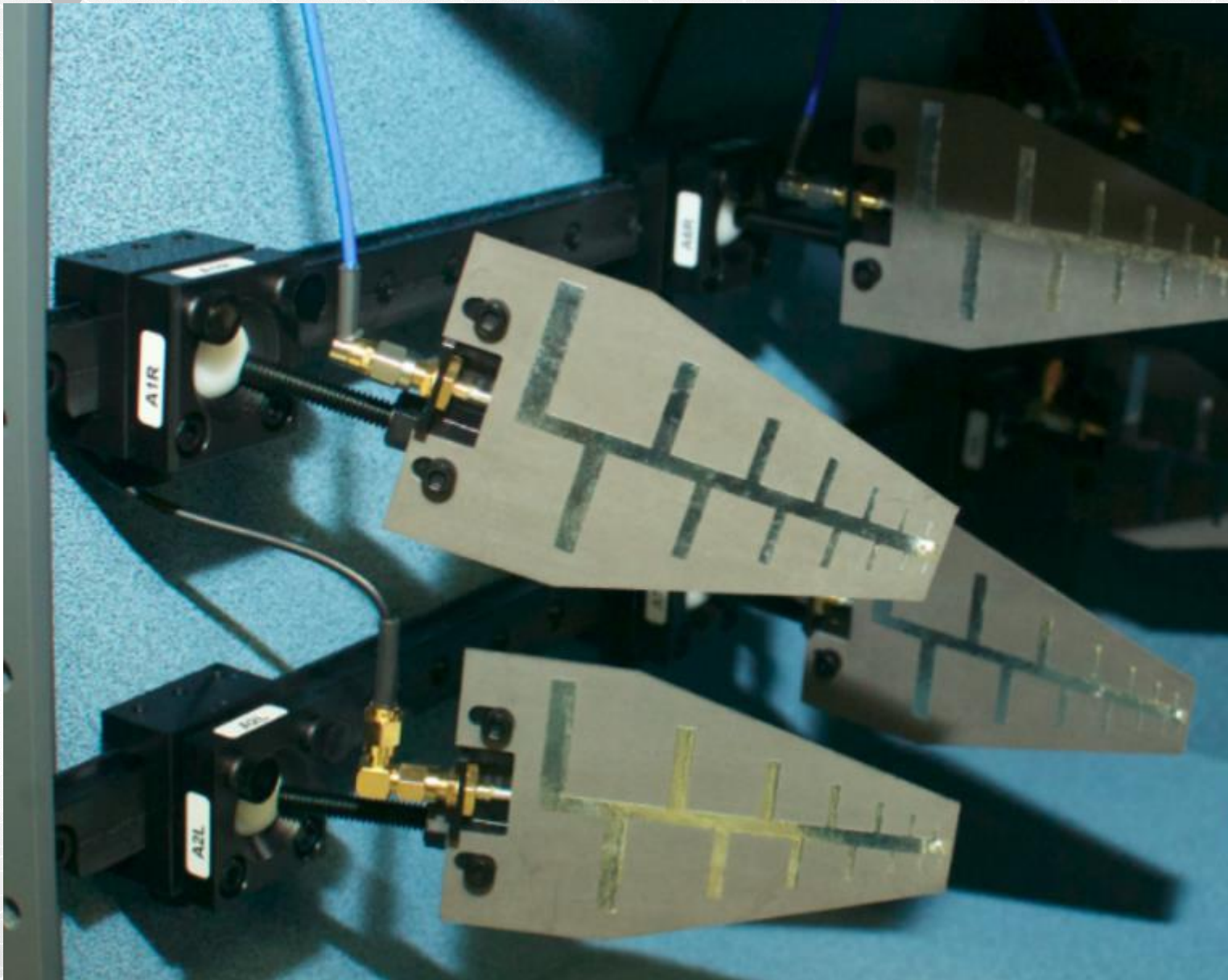
octoScope

Mountable shelves to keep the entire testbed, including the console and endpoint PCs, neatly connected and mobile

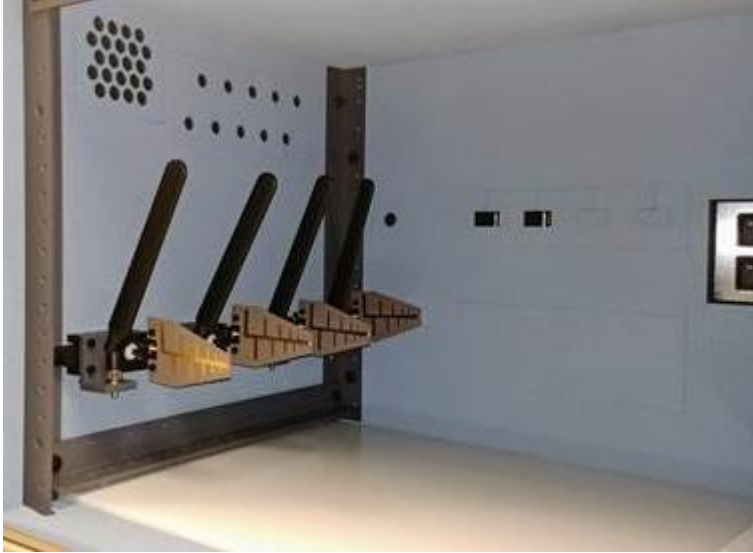
octoShelves



octoScope Examples of antenna mounting



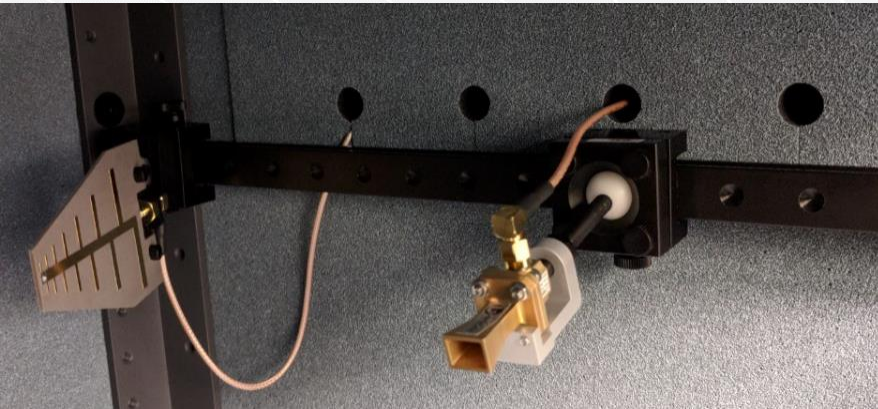
octoScope Antenna mounting



A combination of multiband cellular and high gain antennas



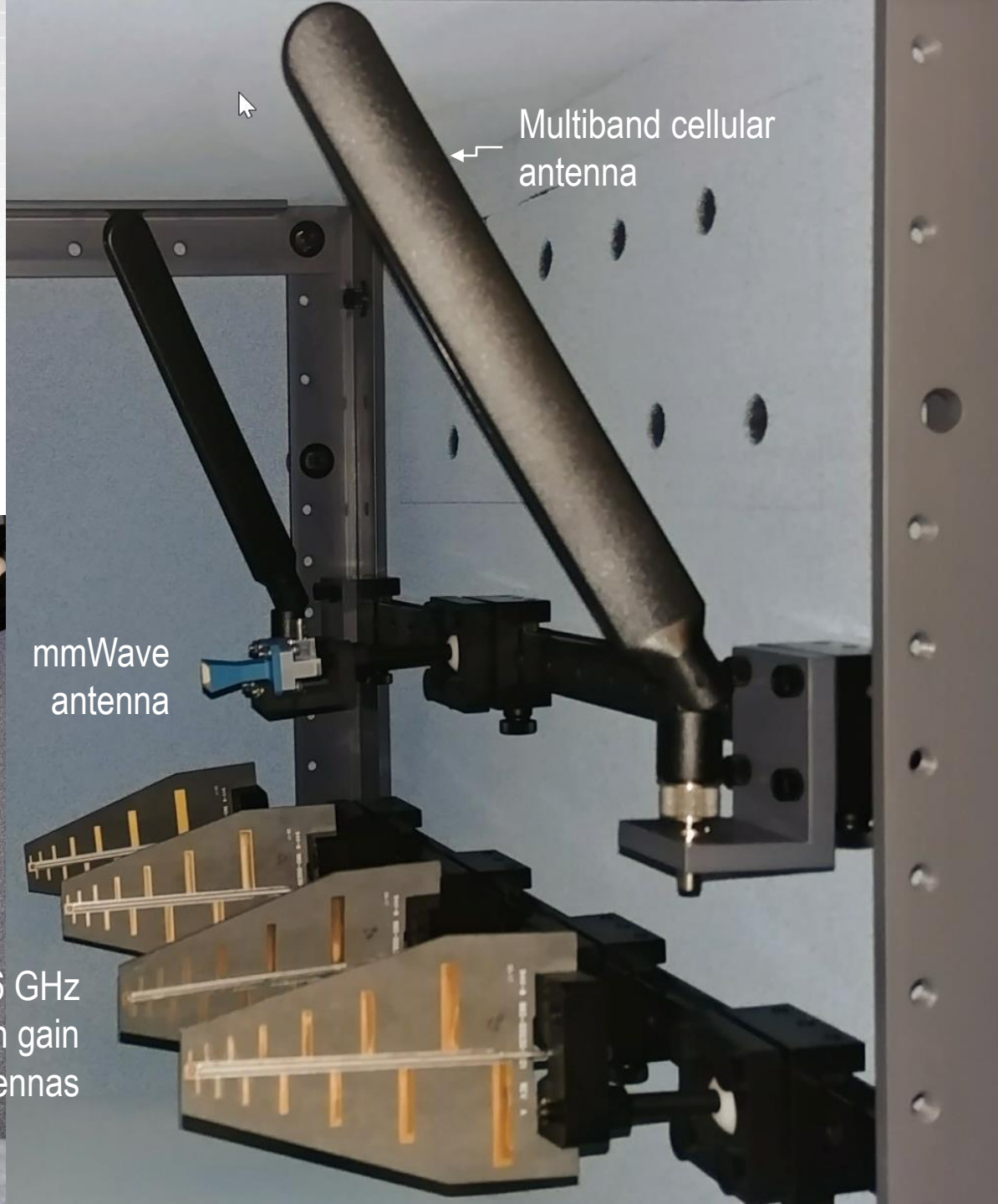
octoScope BOX-MMW



Configurable antenna arrangement for Wi-Fi, LTE and mmWave



2-6 GHz high gain antennas



Multiband cellular antenna

mmWave antenna

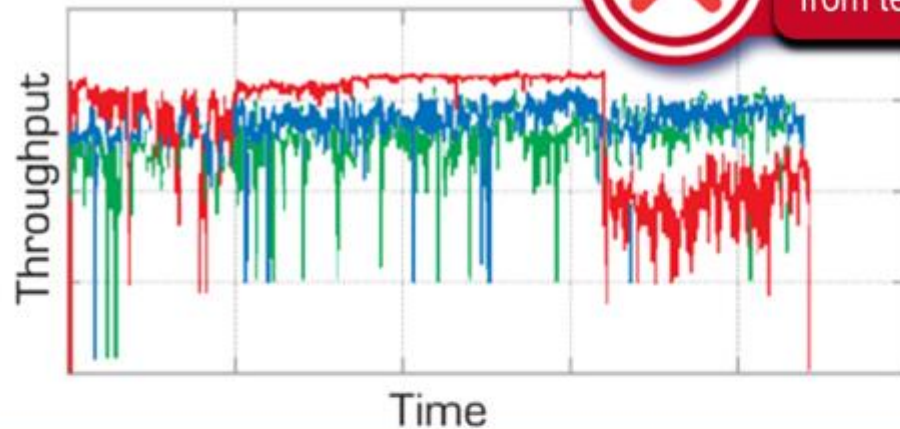
octoScope octoBox controlled test environment



Open air



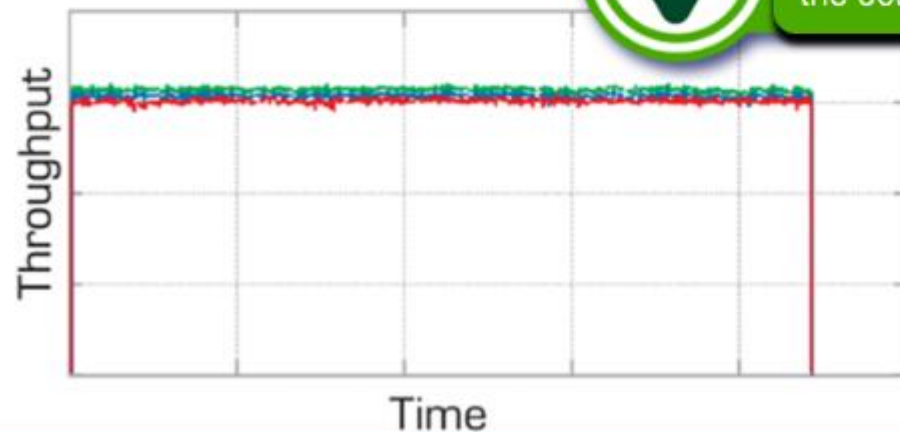
Results vary
from test to test



octoBox



Same results in
the octoBox



Technologies Applications

Wi-Fi	Throughput
LTE	Roaming
2G/3G	Wi-Fi Alliance
Bluetooth	Wireless video
ZigBee	Coexistence
Proprietary	Multi-node/mesh

Capabilities

- MIMO (up to 8x8)
- Multipath + path loss
- Multi-channel interference
- Turn table for realistic results
- Completely isolated
- Stackable, configurable, compact
- Powerful test automation



Customer value proposition

- Repeatable RF environment makes wireless measurements easy to manage
- Automation accelerates data collection and time to market; improves quality
- Graphical reporting helps visualize device performance or behavior issues

Compact wireless test platform delivers cost-effective high performance repeatable MIMO OTA environment



Info@octoScope.com

Boston area headquarters

305 Foster Street

Littleton, MA 01460 USA

Tel: +1.978.222.3114

California office

780 Montague Expressway, Building 1

San José, CA 95131 USA

Tel: +1.978.339.9431