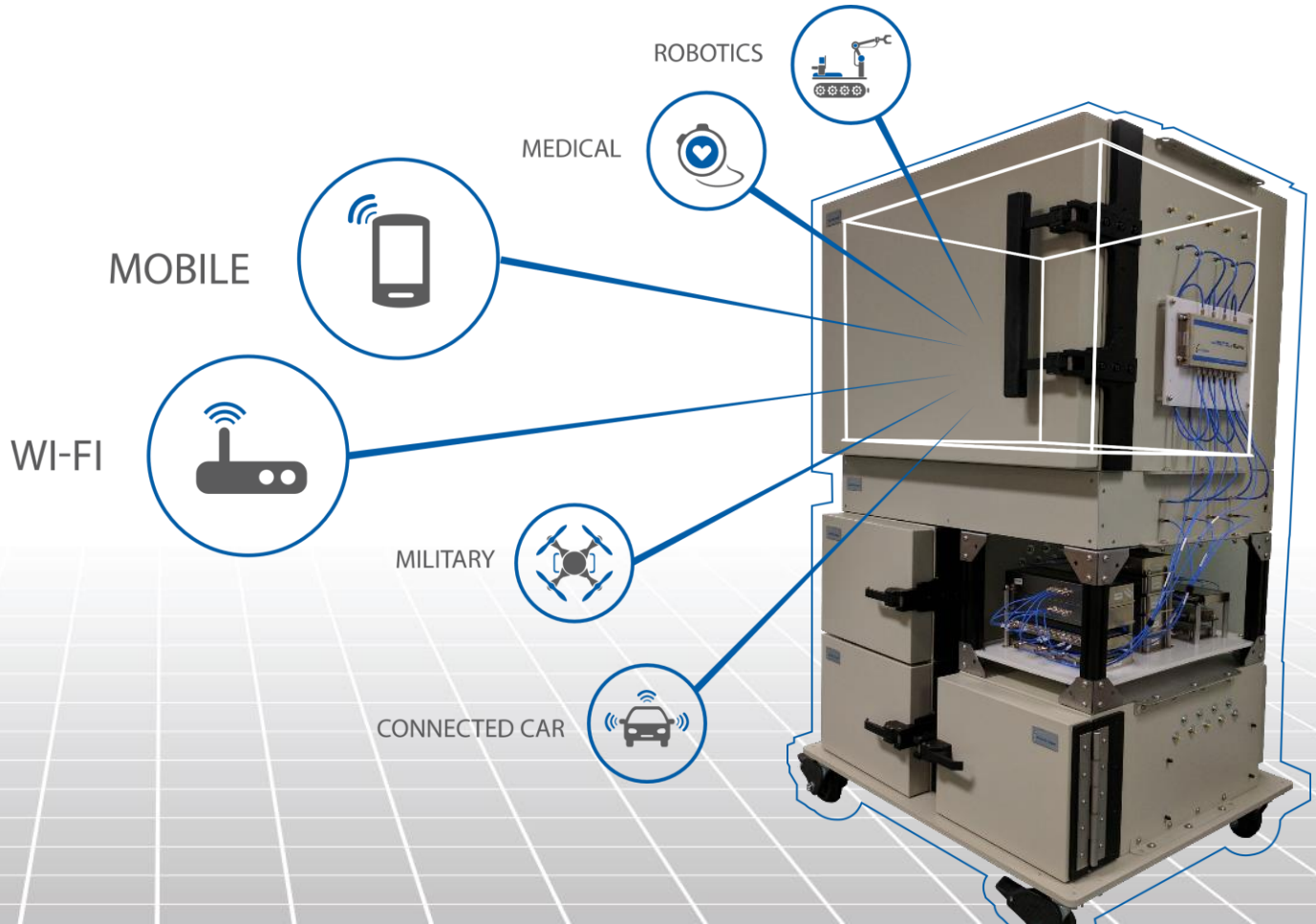
octoBox
Wireless personal testbeds

# octoScope Introduction

December 2017



# octoScope Company Summary

**Company**

**Manufacturer of *personal testbeds* for Wi-Fi, LTE, IoT and other wireless markets**

- → Shipping the octoBox testbeds since 2013
- → Serving wireless operators and their supply chain, including device and chipset vendors
- → Solutions for Wi-Fi, LTE, 5G, IoT, wireless broadband, connected car, medical devices, robotics, public safety, military

**Product**

**Compact, modular, completely isolated and controllable wireless testbed**

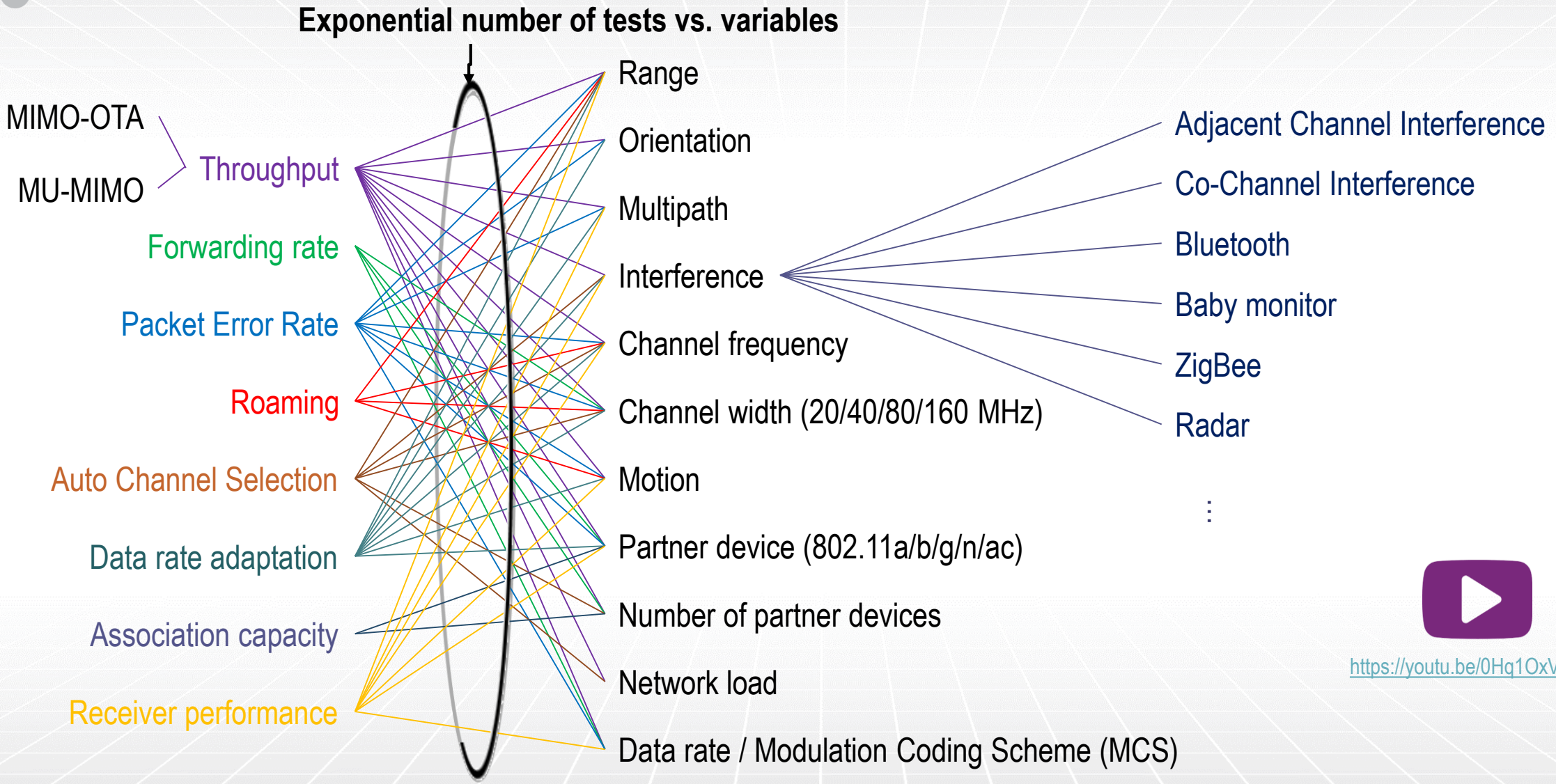
- → Automated, repeatable and accurate metrics of wireless performance & behavior
- → Patented novel technology for emulating real-life RF environment
- → Wireless performance, coexistence, behavior testing in controlled RF environment

**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, Azimuth/Anritsu and Spirent

# Tests Supported by the octoBox Testbed

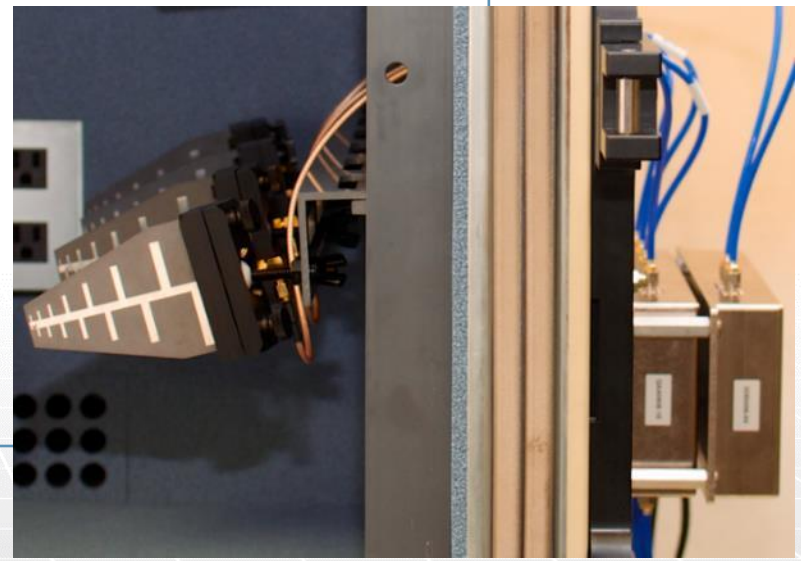



https://youtu.be/0Hq1OxVaAwk

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

# Market Segments and Technologies

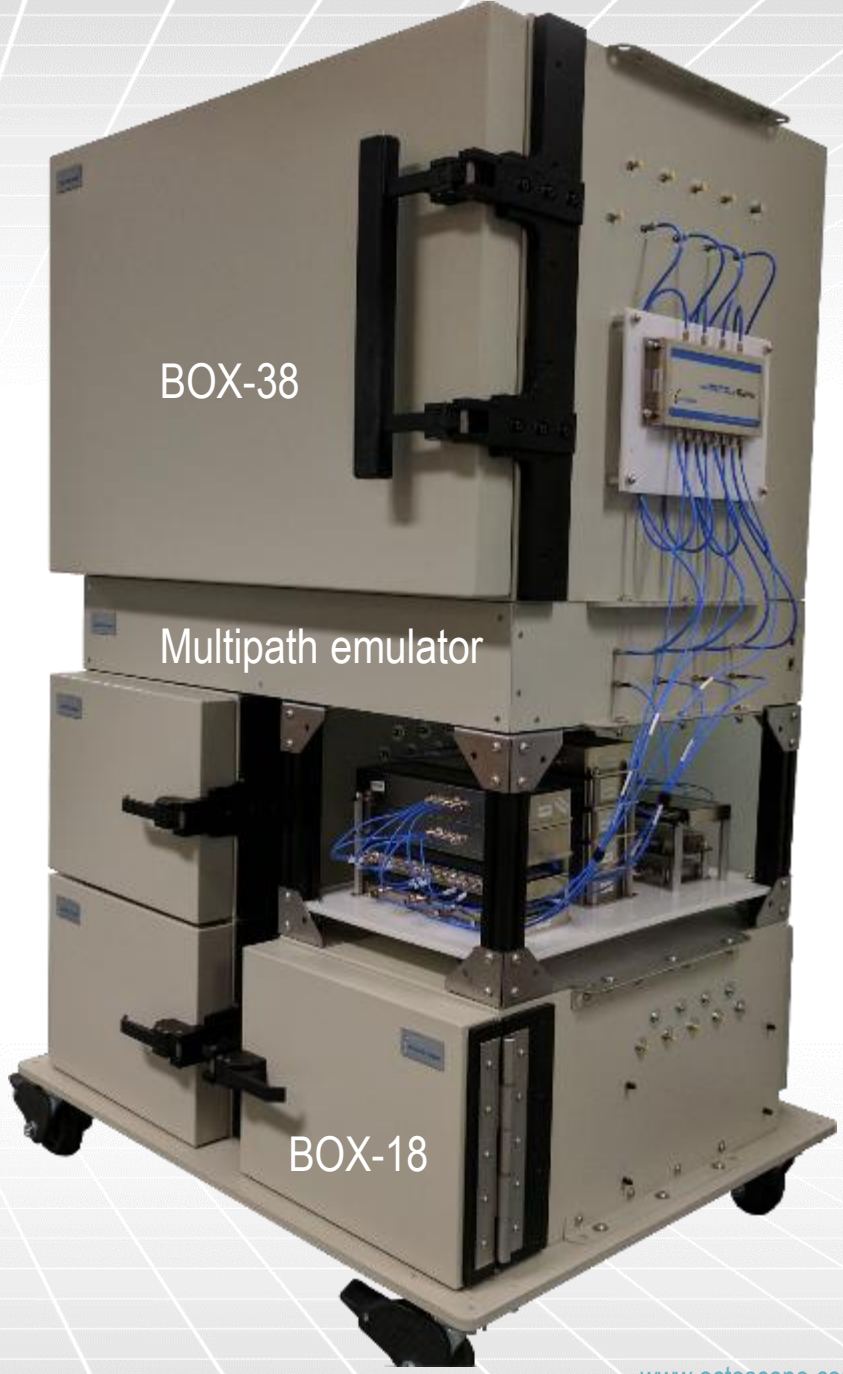
| Market segments | Technologies | Test applications |
|---|---|---|
| | | |
| Consumer<br>Service providers (Comcast)<br>IoT<br>Wireless mobility (cellular, LTE)<br>Enterprise IT (Cisco)<br>Medical (Philips)<br>ITS/DSRC<br>Public Safety<br>Military | Wi-Fi<br>LTE-U, LTE-LAA<br>LTE<br>2G/3G<br>5G<br>GPS<br>Bluetooth<br>Google Nest (ZigBee)<br>LMR<br>Proprietary | Performance<br>Certification test<br>Coexistence<br>Low volume production |



ITS = intelligent transportation systems
DSRC = direct short range communications
LTE = long term evolution
LMR = land mobile radio
IoT = internet of things

# octoScope *octoBox Personal Testbed*

- 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 Customers

## Operators

vodafone
TELECOM ITALIA
Charter COMMUNICATIONS
COMCAST
orange
airtel
Telstra
Chunghwa Telecom
belgacom
CenturyLink
TELUS
at&t
upc
Google
中国电信 CHINA TELECOM
altice
swisscom
verizon wireless
اتصالات etisalat
Sprint
Telefonica
T-Mobile
SPREADTRUM

## Labs

SmallNetBuilder Real Help For Your Small Network
Wi Fi ALLIANCE
CETECOM
UL
TÜV
iol
AT4 Wireless a DEKRA company
KYRIO
CableLabs
esa European Space Agency

## Chipset vendors

QUALCOMM ATHEROS
BROADCOM
MARVELL
Ralink
REALTEK
Quantenna Communications

## Equipment vendors

Nokia Siemens Networks
intel
CISCO
softathome
SONY
D-Link
ARUBA networks
Google
ASUS
ASKEY
belkin
NETGEAR
BROCADE
Ruckus Simply Better Wireless.
AVAYA
Airgain
Calix
HUAWEI
SONOS
SPACEX
oppo
AVM
SECURIFI
technicolor
ALPHA Alpha Networks Inc.
DELL
FORTINET
iRobot
COMPAL
Stoneridge
PHILIPS
symbotic
EDIMAX NETWORKING PEOPLE TOGETHER
HARRIS

# 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)

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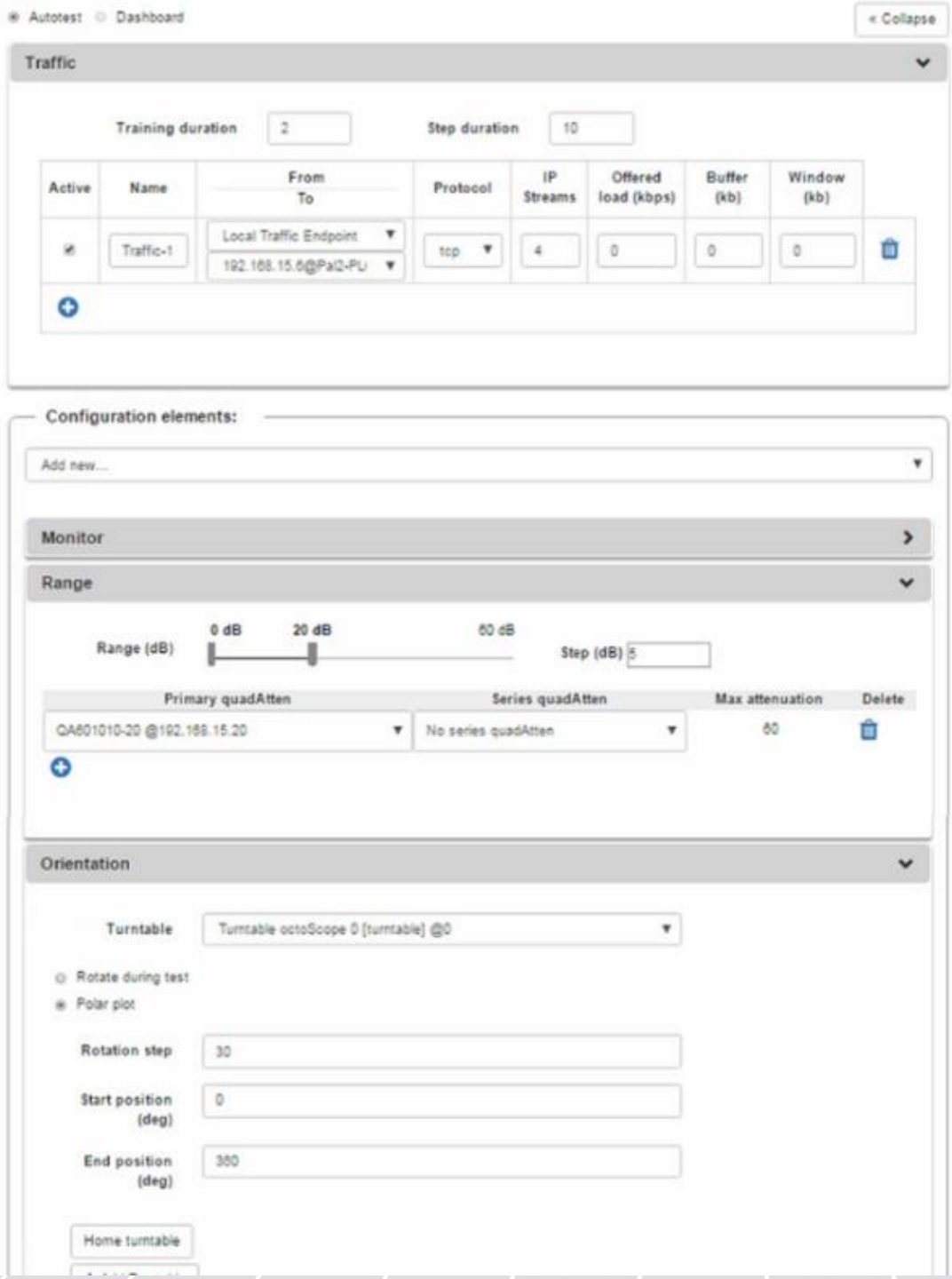
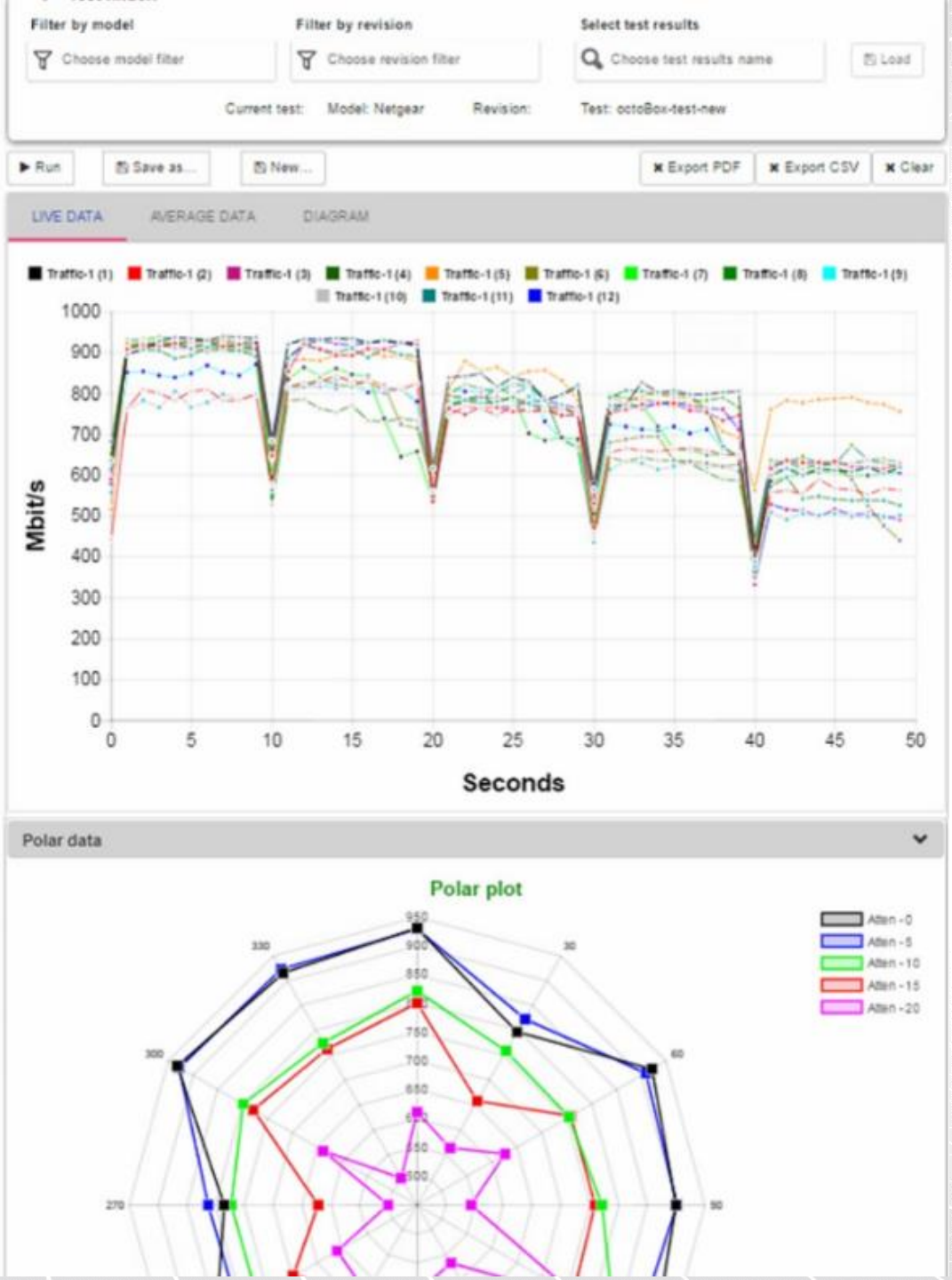
*octoBox software suite*

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

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



# The Pal Partner Device

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

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


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

*Qualcomm*
*QCA9984 4x4 160 MHz*
*Wave 2 radio*

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



Flexible network topology configurations are possible with octoScope's completely isolated RF MIMO splitters, attenuators an switches.

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