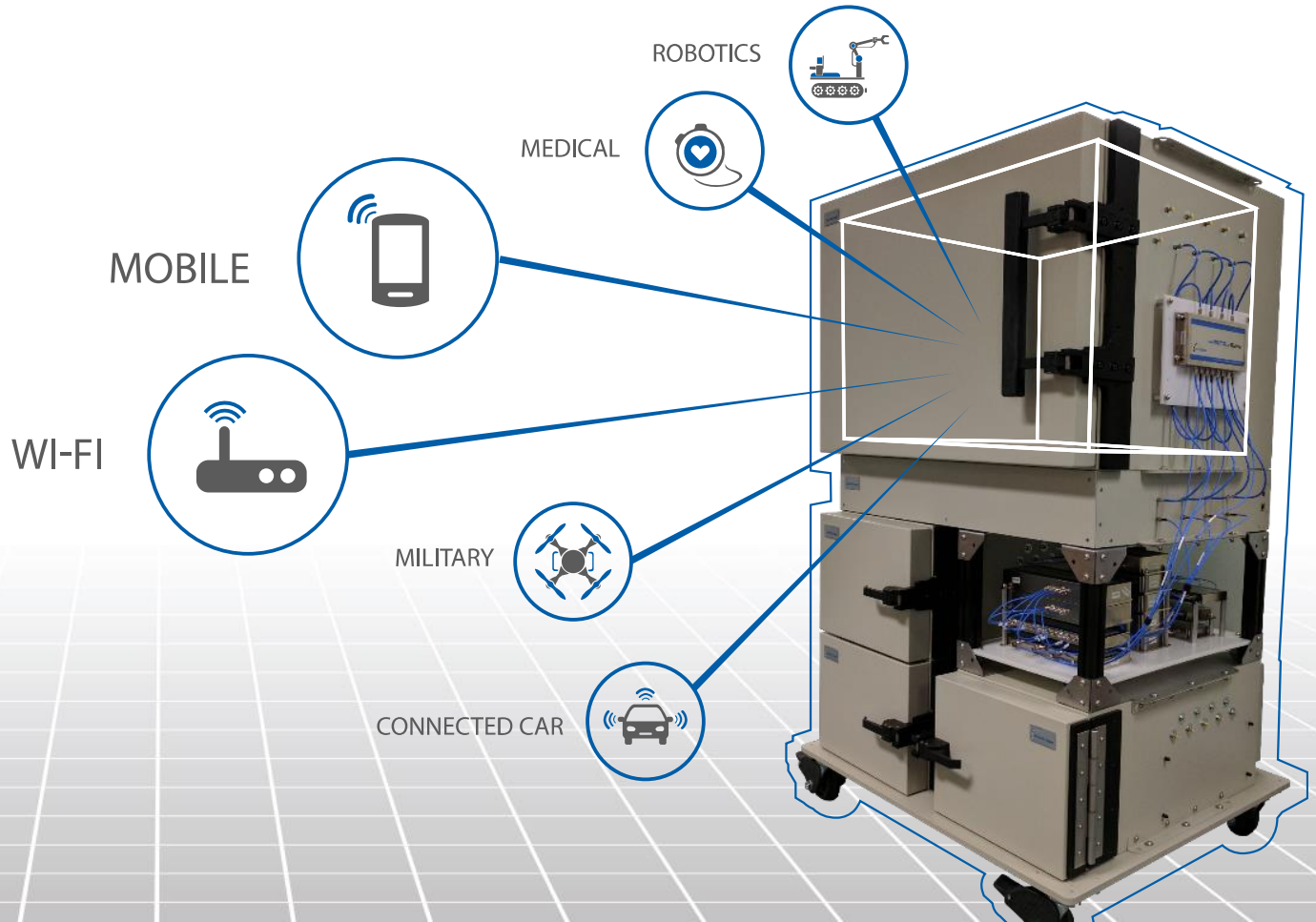
octoBox
Wireless personal testbeds

octoScope Introduction

January 2018



Company overview

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

Wi Fi™ LTE Bluetooth™ ZigBee® THREAD GROUP

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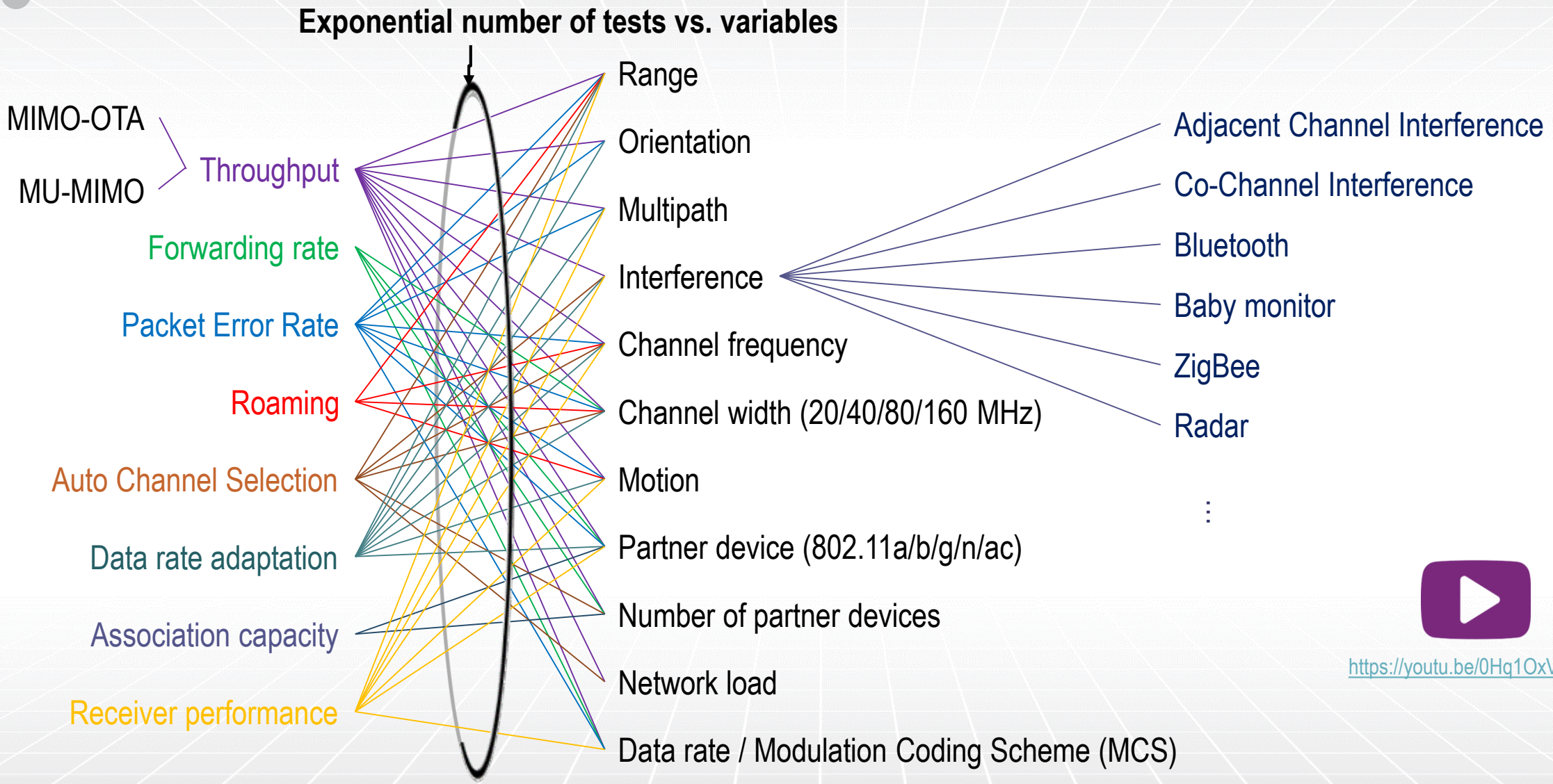
Tests supported by the octoBox personal testbed

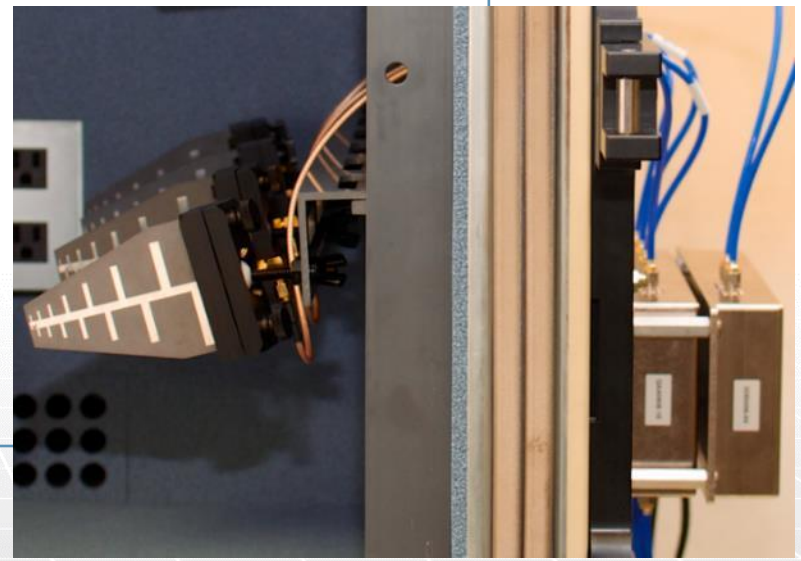


https://youtu.be/0Hq1OxVaAwk

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

Market segments and technologies

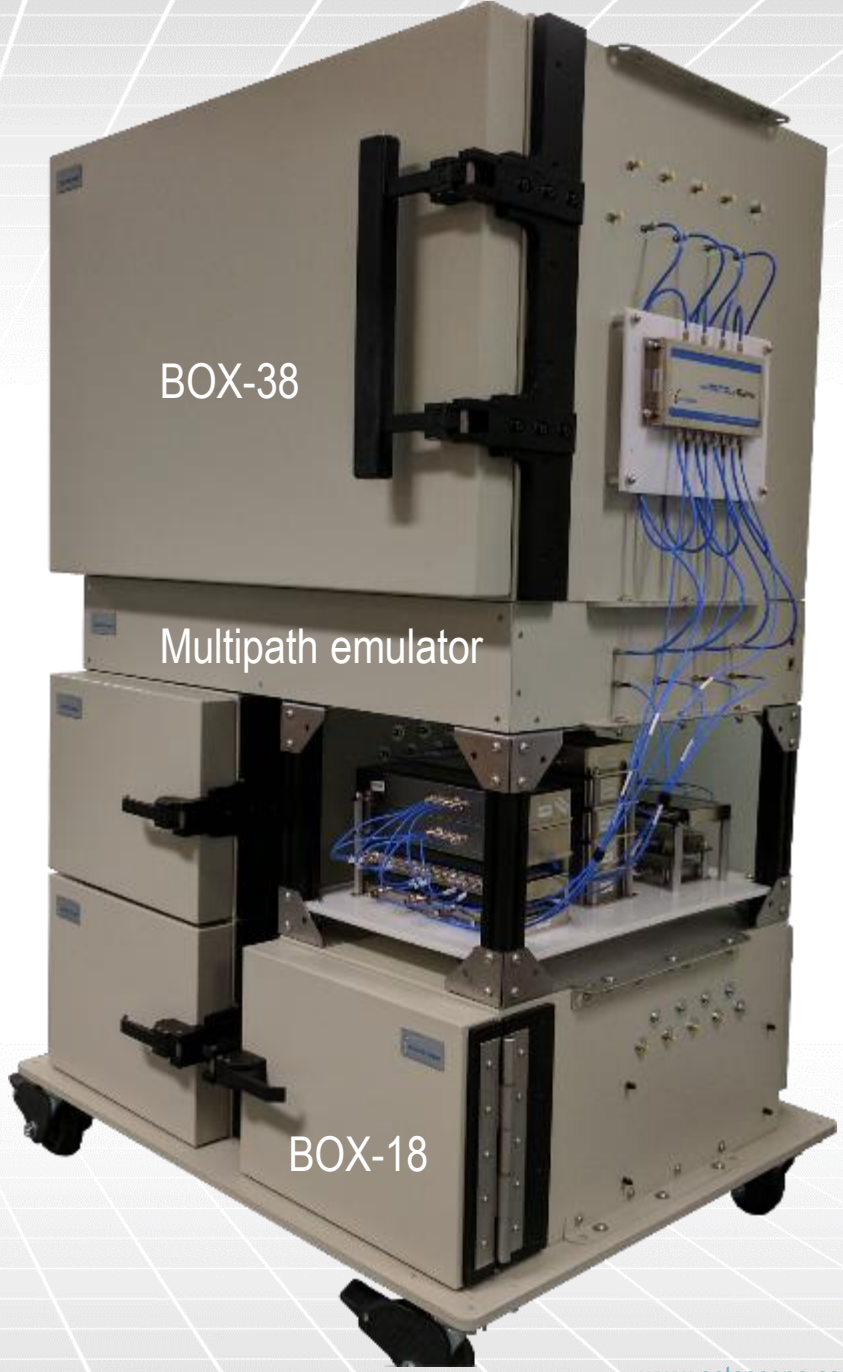
Market segments	Technologies	Test applications
Consumer Service providers (Comcast) IoT Wireless mobility (cellular, LTE) Enterprise IT (Cisco) Medical (Philips) ITS/DSRC Public Safety Military	Wi-Fi LTE-U, LTE-LAA LTE 2G/3G 5G GPS Bluetooth Google Nest (ZigBee) LMR Proprietary	Performance Certification test Coexistence 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 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 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
intel
MARVELL
Ralink
REALTEK
Quantenna Communications

Equipment vendors

Nokia Siemens Networks
intel
CISCO
SONY
softathome
D-Link
ARUBA networks
Google
ASUS
ASKEY
belkin
NETGEAR
AVAYA
BROCADE Ruckus Simply Better Wireless.
Calix
ARRIS
Airgain
HUAWEI
SONOS
SPACEX
oppo
AVM
SECURIFI
technicolor
ALPHA Alpha Networks Inc.
DELL
FORTINET
iRobot
COMPAL
Stoneridge
symbotic
H3C The Leader in New IT
PHILIPS
EDIMAX NETWORKING PEOPLE TOGETHER
HARRIS

Wireless test applications

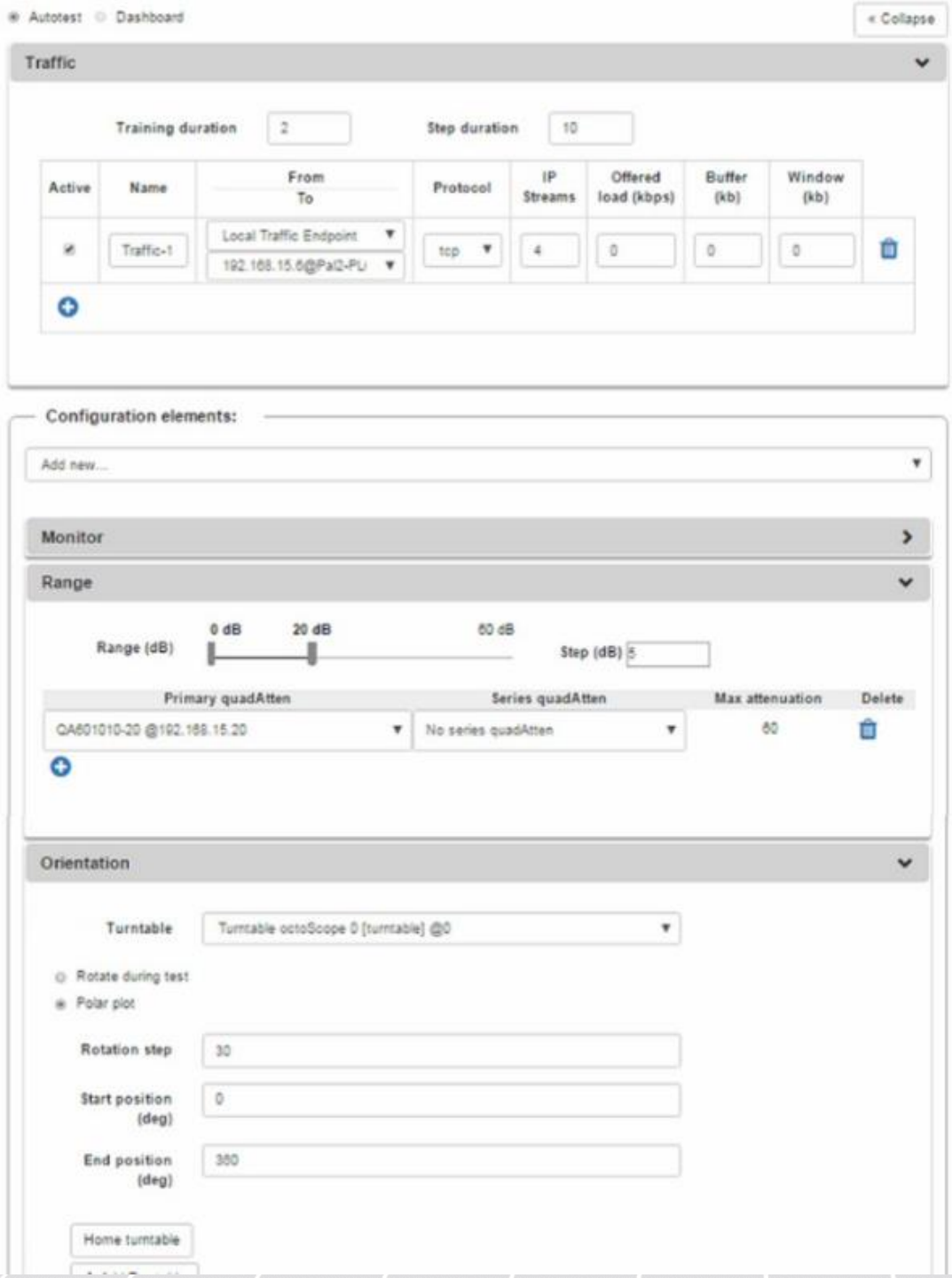
- Performance
  - MIMO OTA throughput
  - MU-MIMO gains
  - Load testing
  - Roaming
  - RX sensitivity
- User Experience
  - Adaptation to impairments, such as path loss, interference, multipath, load
  - Roaming behavior – find sticky clients
  - DFS (dynamic frequency selection)

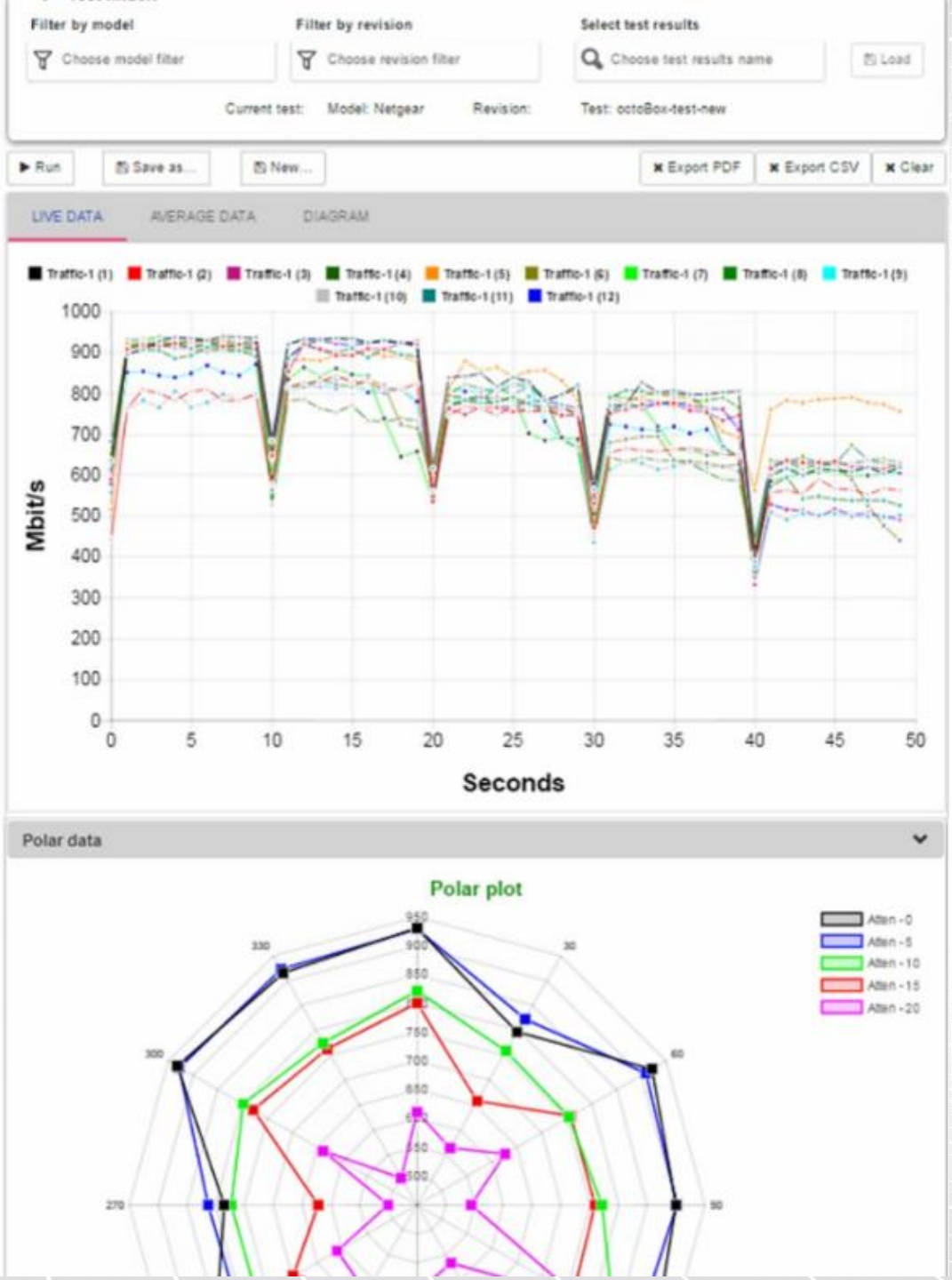
octoBox software suite

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)





The Pal

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

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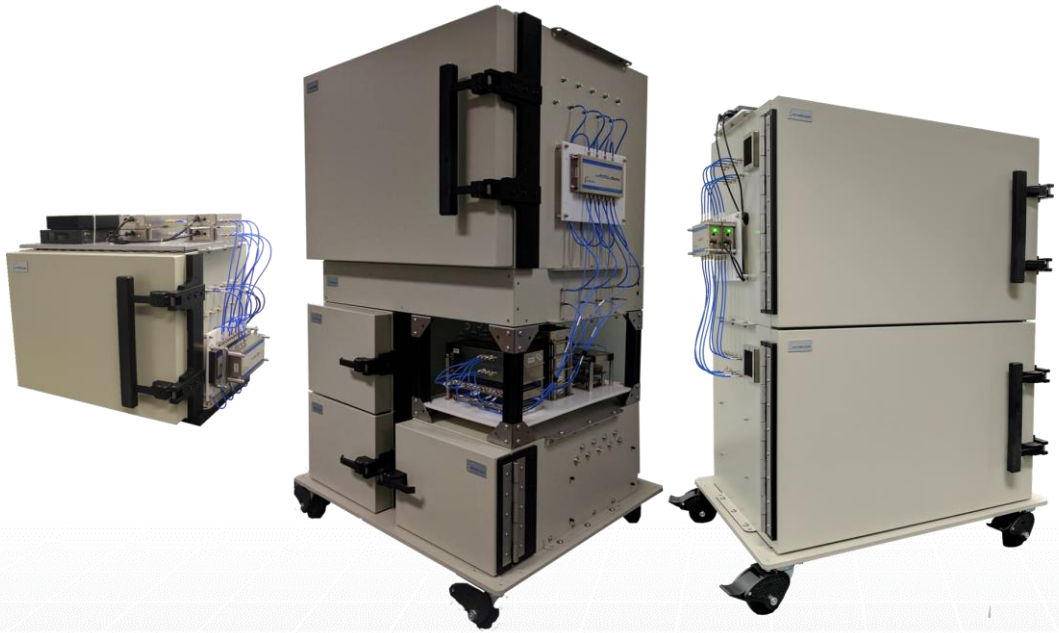
octoBox test applications

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

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Wireless personal testbed usable out-of-the-box

Ships preconfigured and rolls out of its crate ready to use.

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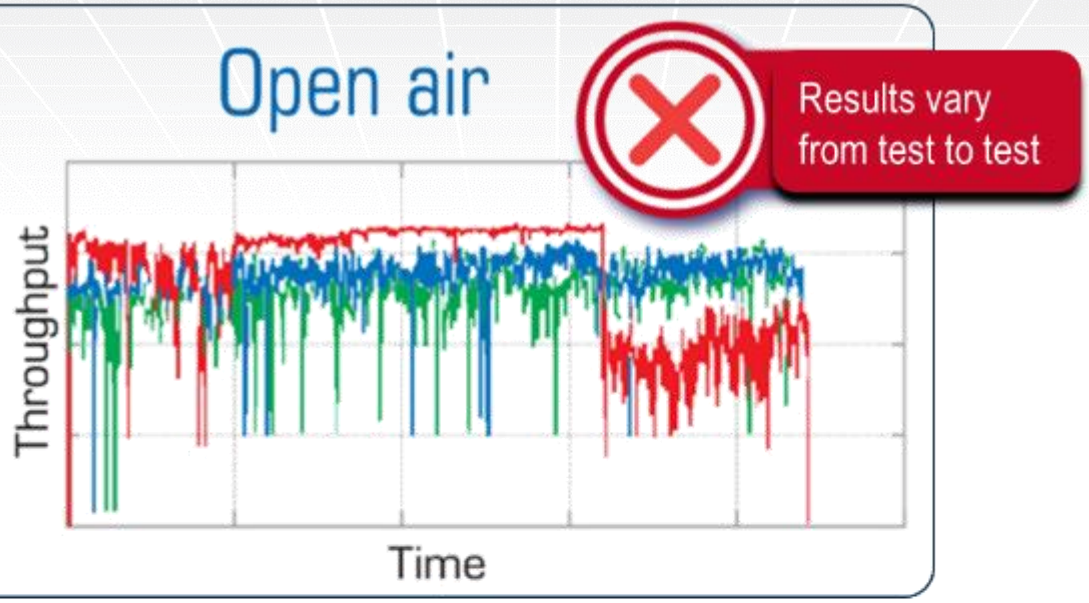
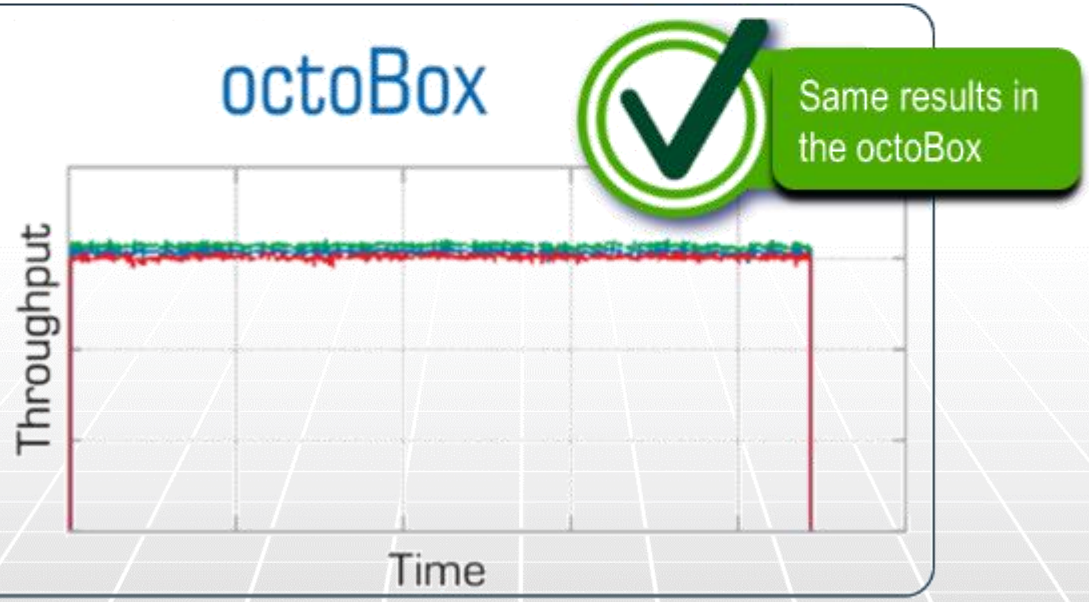
octoBox controlled test environment





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 personal testbed delivers cost-effective high performance repeatable MIMO OTA environment

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