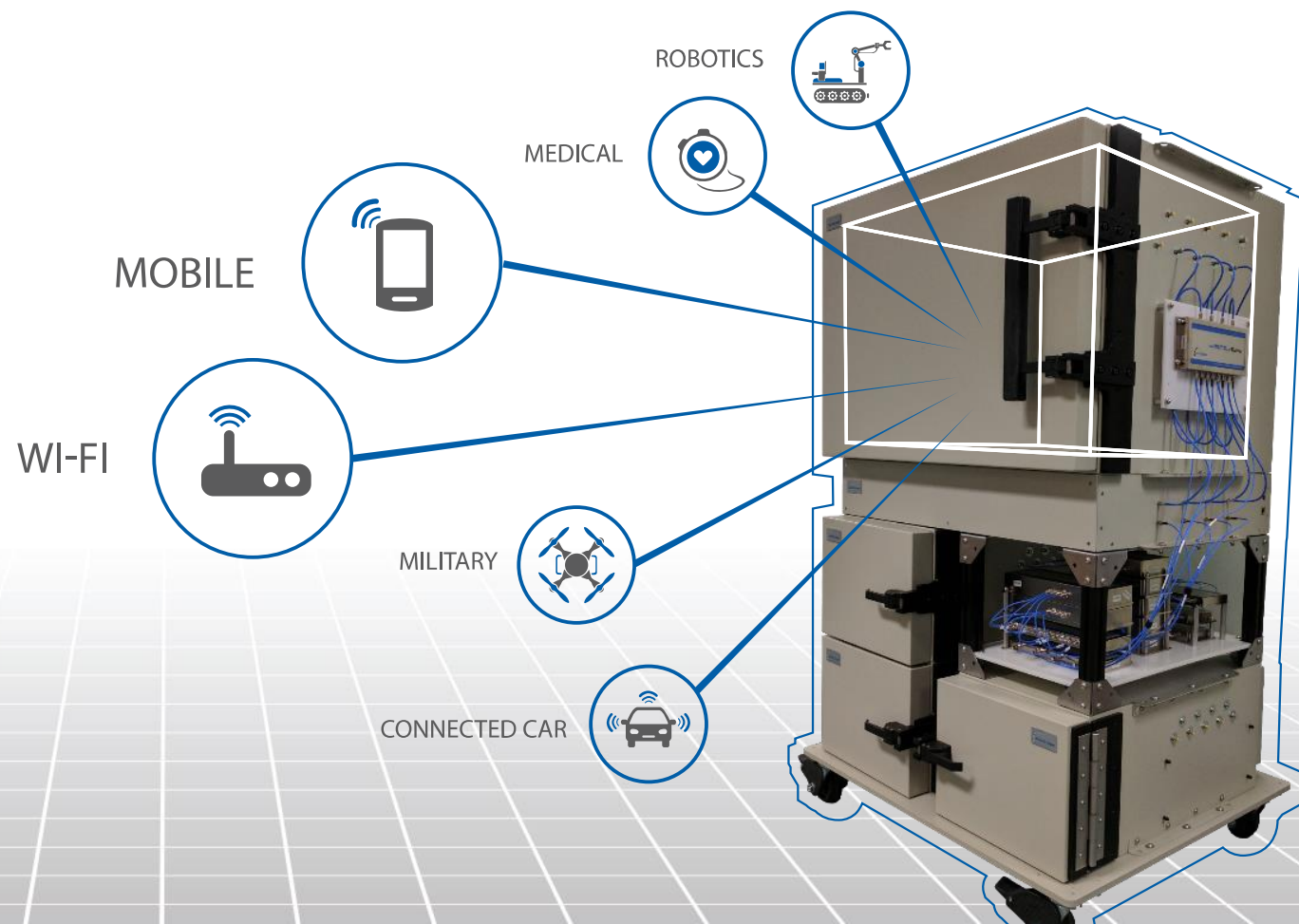




octoScope Introduction

April 2018



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

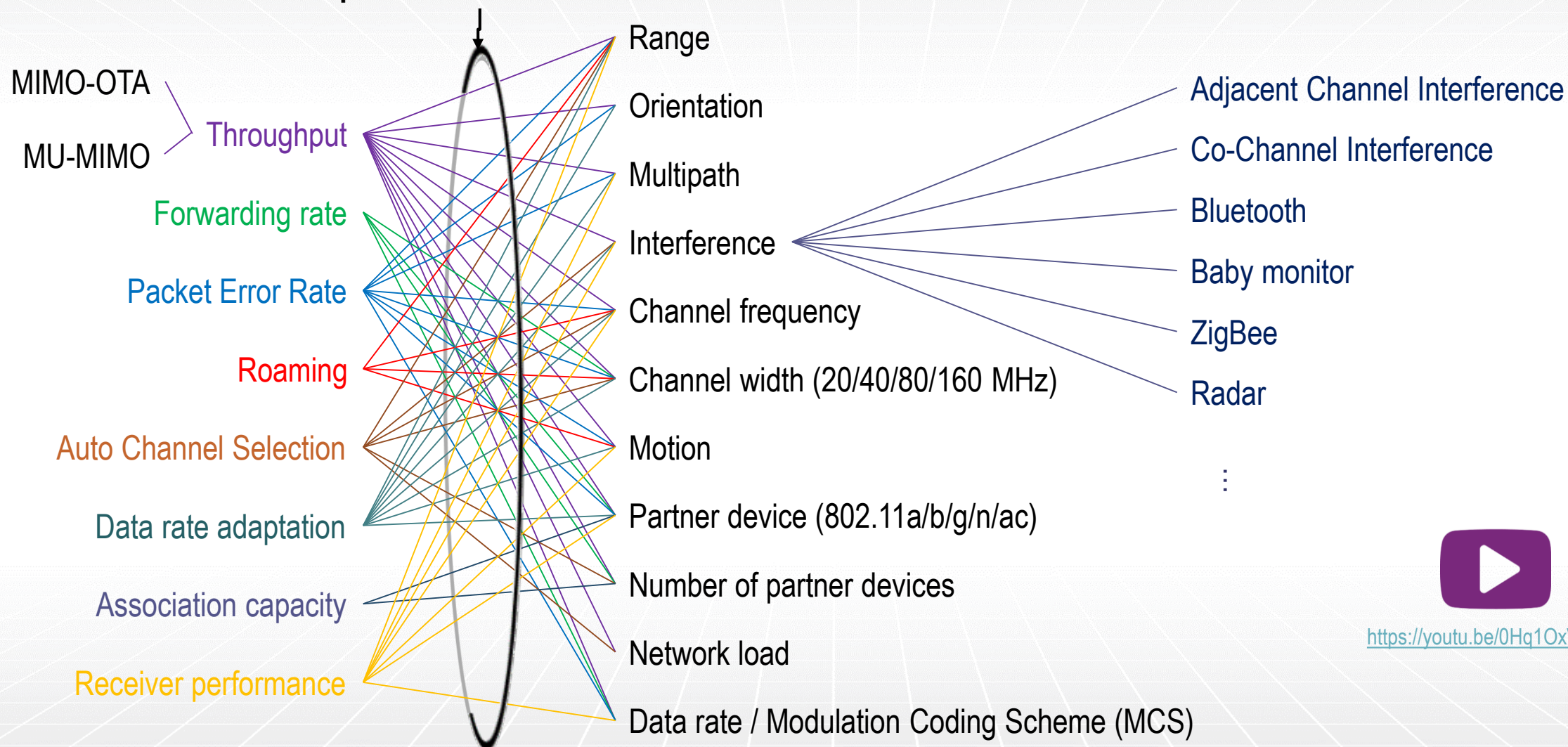
- Track record of delivering successful communications and wireless test products
- Key team members worked together going back to mid-1980s at prominent test equipment companies including Teradyne, HP/Agilent, Azimuth/Anritsu and Spirent





Tests supported by the octoBox personal testbed

Exponential number of tests vs. variables



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

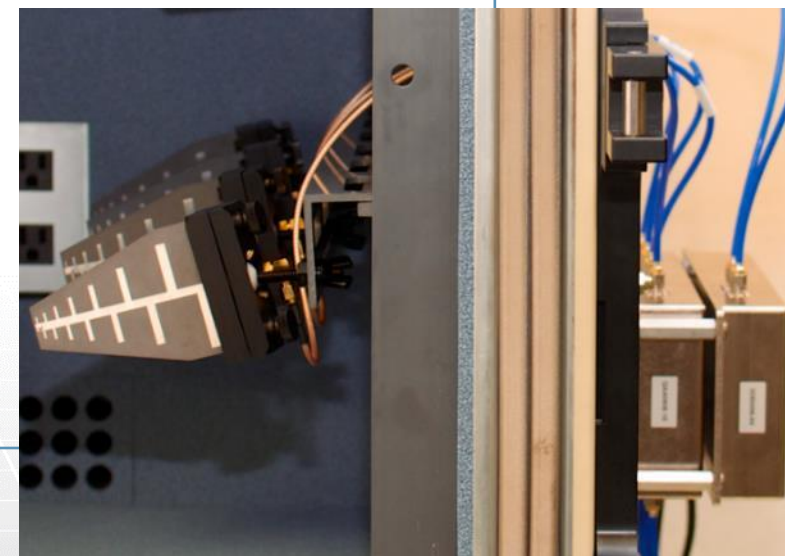


<https://youtu.be/0Hq1OxVaAwk>



Market segments and technologies

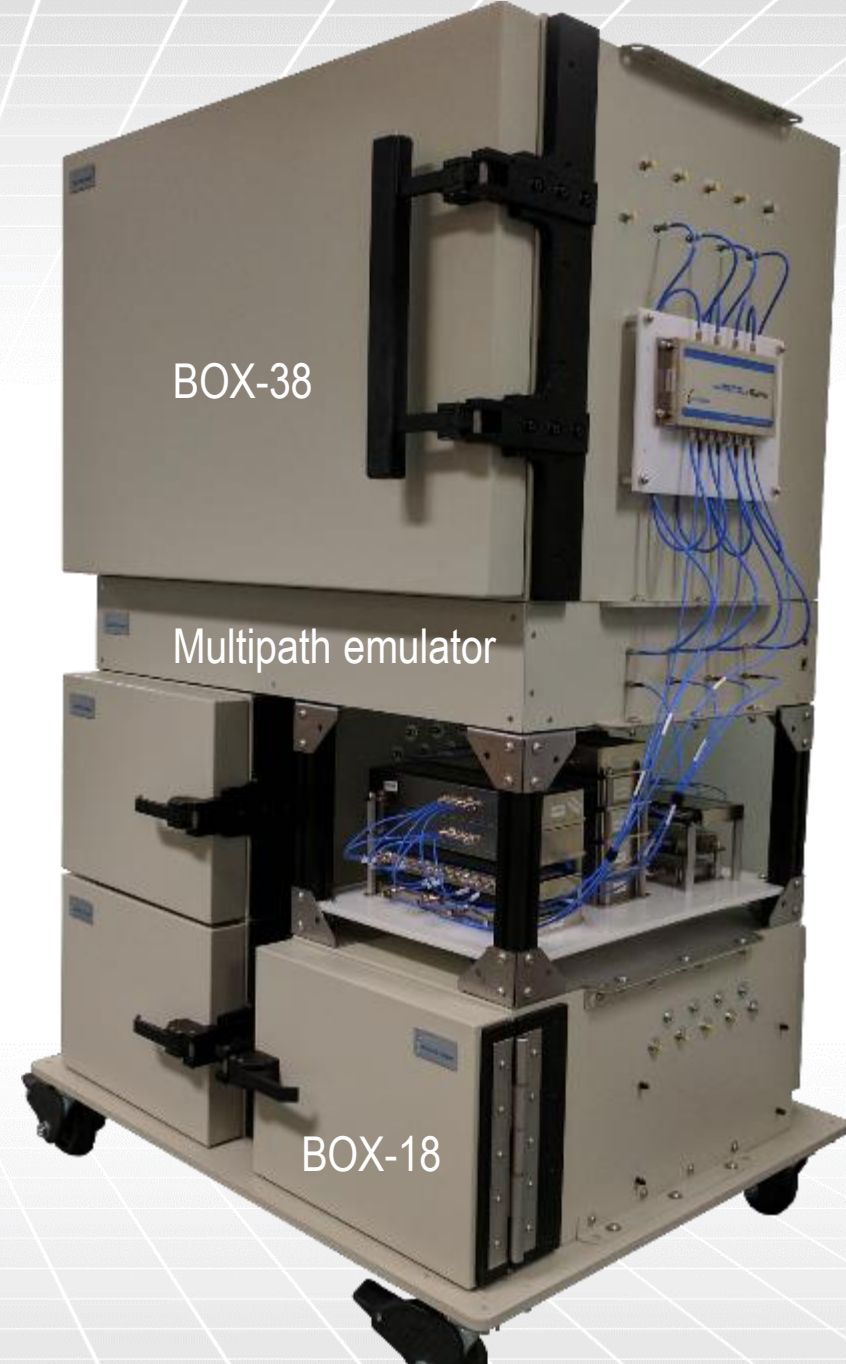
Market segments	Technologies	Test applications
Consumer Service providers (Comcast) IoT Wireless mobility (cellular, LTE) Enterprise IT (Cisco) Medical (Philips) ITS/DSRC Public Safety Military	Wi-Fi LTE-U, LTE-LAA LTE mmWave 2G/3G GPS Bluetooth Google Nest (ZigBee) LMR Proprietary	Performance Certification 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 octoScope customers

Operators



Labs



Chipset vendors



Equipment vendors



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)



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 Collapse

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	

Orientation

Turntable Turntable octoScope 0 [turntable] @0

☐ Rotate during test
☒ Polar plot

Rotation step 30

Start position (deg) 0

End position (deg) 360

Home turntable

Filter by model Filter by revision Select test results

Choose model filter Choose revision filter 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

Traffic-1 (1) Traffic-1 (2) Traffic-1 (3) Traffic-1 (4) Traffic-1 (5) Traffic-1 (6) Traffic-1 (7) Traffic-1 (8) Traffic-1 (9)
Traffic-1 (10) Traffic-1 (11) Traffic-1 (12)

Polar data

Polar plot

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

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

octoScope 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

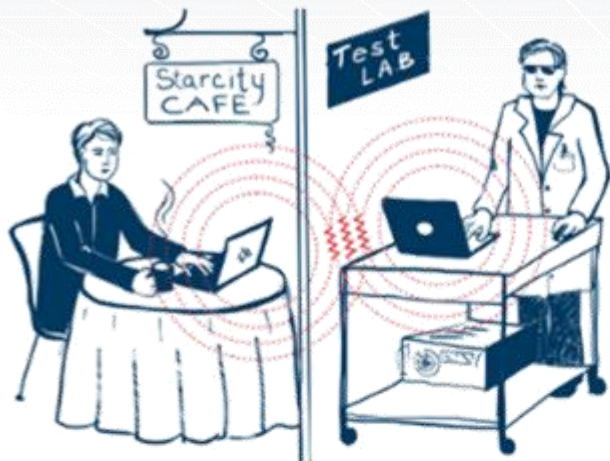
mmWave 24 – 86 GHz

octoScope Wireless personal testbed usable out-of-the-box



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

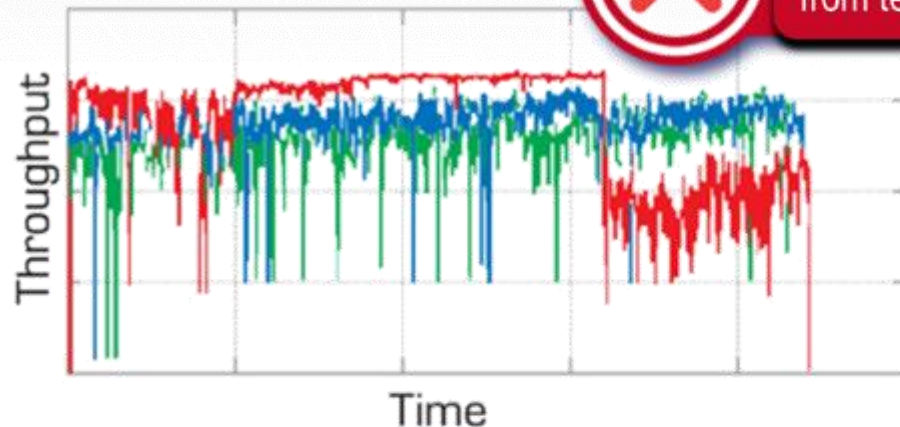
octoScope octoBox controlled test environment



Open air



Results vary
from test to test



Technologies Applications

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

Capabilities

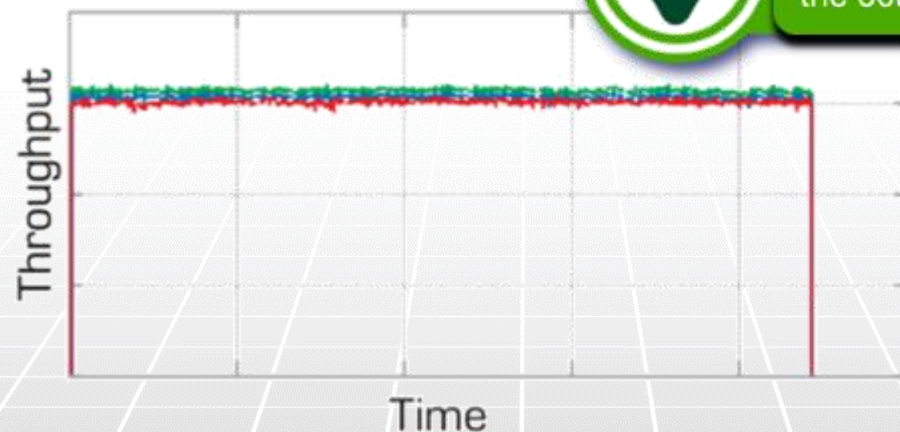
MIMO (up to 8x8)
 Multipath + path loss
 Multi-channel interference
 Turn table for realistic results
 Completely isolated
 Stackable, configurable, compact
 Powerful test automation



octoBox



Same results in
the octoBox





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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