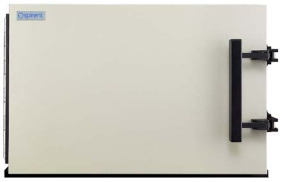
DATASHEET

Spirent

Octobox STApal-7

Spirent's Wi-Fi 7 testbeds incorporate RF chambers and instruments controlled by an integrated server with a browser-based UI and a complete API for test automation. The Octobox STApals function as Wi-Fi 7 traffic endpoints or Octobox Synchrosniffer probes for performance testing and expert analysis of Wi-Fi devices and systems. This document describes the Octobox STApal-7 subsystems shown below and the Octobox personal testbeds that incorporate them.

Wi-Fi 7 and legacy Wi-Fi Intel BE200 chipset Linux host per STApal-7 for max performance	*Octobox STApal-7*	
Octobox chamber with built-in instruments for ease of integration Built-in Pal-7 or 4 STApal-7s	*Octobox Smartbox™* *Octobox Smartbox-STA*	
Octobox chamber with 16 STApal-7s and a Pal-7 16 OFDMA endpoints; 20 sniffer probes 256 virtual stations (vSTAs)	*Octobox Palbox™*	

Features

- 802.11be up to 2x2 MIMO-OTA transmission
- 2.4, 5, and 6 GHz 802.11be radios
- STApal-7 support 6GHz Wi-Fi 7
- Palbox-7 with up to 16 OFDMA STAs and 256 vSTAs; radios configurable for sniffing
- Octobox Wireshark Synchrosniffer with sniffer probes on 4 Pal-7 and 16 STApal-7 radios
- STApal-7 housing real devices with integrated Pal instruments
- Multiperf multipoint-to-multipoint traffic with managed traffic endpoints
- Complete isolation from outside interference
- REST API for test automation benefits
- Quickly and easily verify emerging 802.11a/b/g/n/ac/ax/be and legacy Wi-Fi devices in the ideal MIMO-OTA environment that supports MU-MIMO
- Use multipoint-to-multipoint traffic while automatically recovering from dropped links during long test sequences
- Test OFDMA and MU-MIMO simultaneously using a compact Octobox personal testbed
- Use one or more STApals to scale to dozens of OFDMA stations in the testbed
- Perform root cause analysis of issues using built-in multi-probe Synchrosniffing

Benefits

- Verify 6GHz using the STApal-7
- Quickly and easily verify emerging 802.11be and legacy Wi-Fi devices in the ideal MIMO-OTA environment that supports MU-MIMO
- Use multipoint-to-multipoint traffic while automatically recovering from dropped links during long test sequences
- Test OFDMA and MU-MIMO simultaneously using a compact Octobox personal testbed
- Use one or more Palboxes to scale to dozens of OFDMA stations in the testbed
- Perform root cause analysis of issues using built-in multi-probe Octobox Synchrosniffing
- STApal-7 can both function as traffic endpoints or Synchrosniffer probes. STApal-7s come stand-alone or are built into an Octobox chamber, making that chamber a Smartbox. The STApal-7 open form factors can be used with an antenna system for testing in open air or in a walk-in test chamber.
- STApal-7 supports all the Wi-Fi protocols: IEEE 802.11a/b/g/n/ac/ax/be. Pal-7 also supports the new Wi-Fi 7 6 GHz frequency band and AP (access point) modes

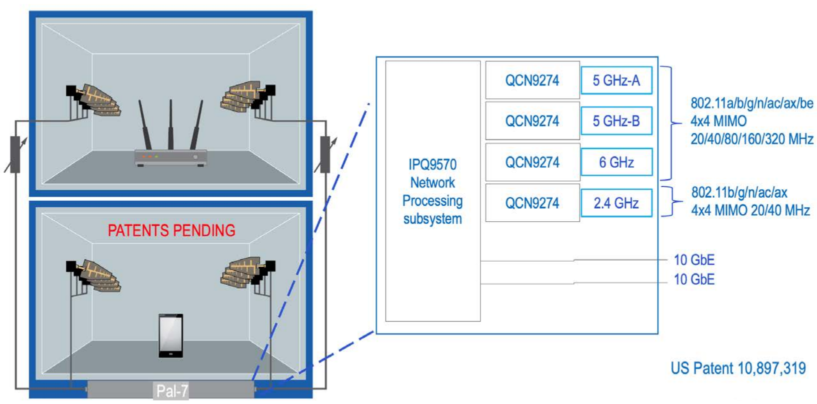
Parallel Throughput and Synchrosniffing

Based on the latest 6 GHz capable 802.11be chipset and with fine controls at the firmware and driver level, STApal-7 can function as an off-the-shelf device or as a precision test instrument.

STApal-7 features four three 802.11be radios. The two 5 GHz radios support up to 8x8 MIMO in channels of up to 80 MHz, or 4x4 MIMO in 80+80 or 160 MHz channels.

STApal-7 features two ethernet ports, one for traffic and the other for streaming plot statistics and PCAP captures.

STApal-7 open module



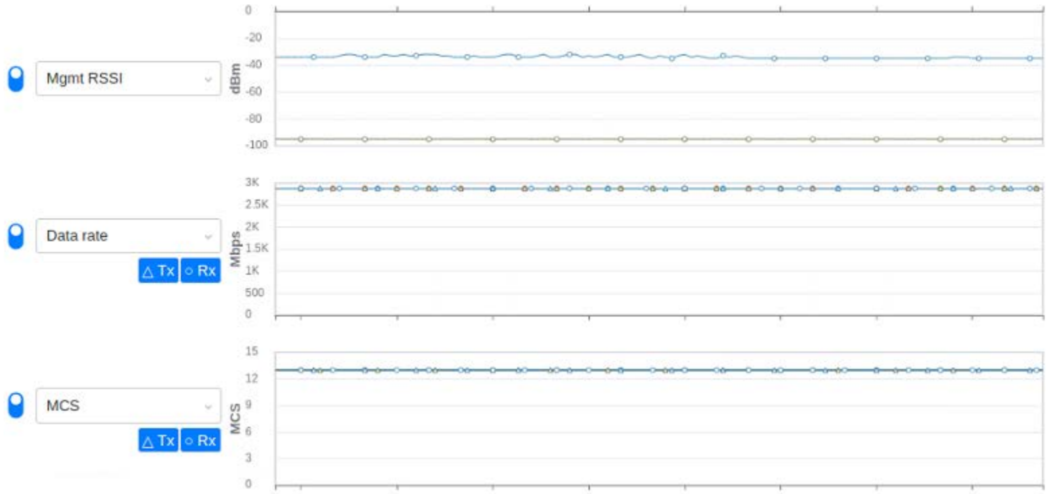
STApal-7 built into the Smartbox; block diagram

STApal-7 can function as real-time analyzers to show adaptation behavior of modern Wi-Fi systems. They can monitor and plot RSSI, data rate, number of spatial streams, channel width and other physical layer information.

Access Point Testing

STApal-7s with their own Linux host, offer maximum OFDMA performance on each radio.

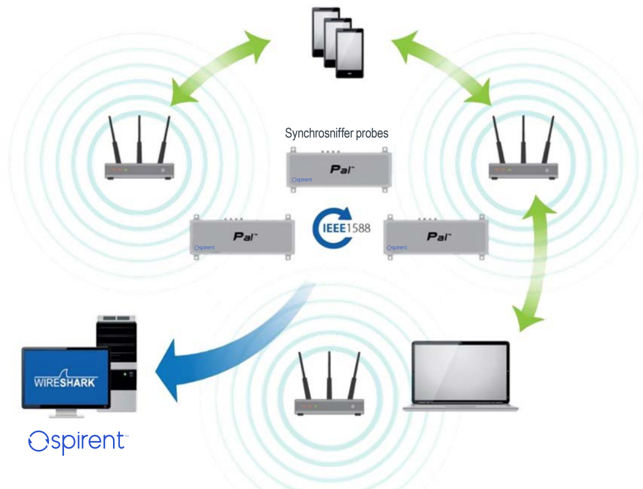
Because OFDMA testing requires multiple station devices to show the expected airlink efficiency, STApal-7 comes packaged as a set of 4 or 16. The Smartbox-STA has 4 STApal-7s while the Palbox has 16 plus a Pal-7.



STApal-7 is based on a STA chipset and supports UL and DL OFDMA. It can function as an OFDMA station or as a Synchrosniffer probe and report statistics and performance analysis metrics.

Octobox Synchrosniffer

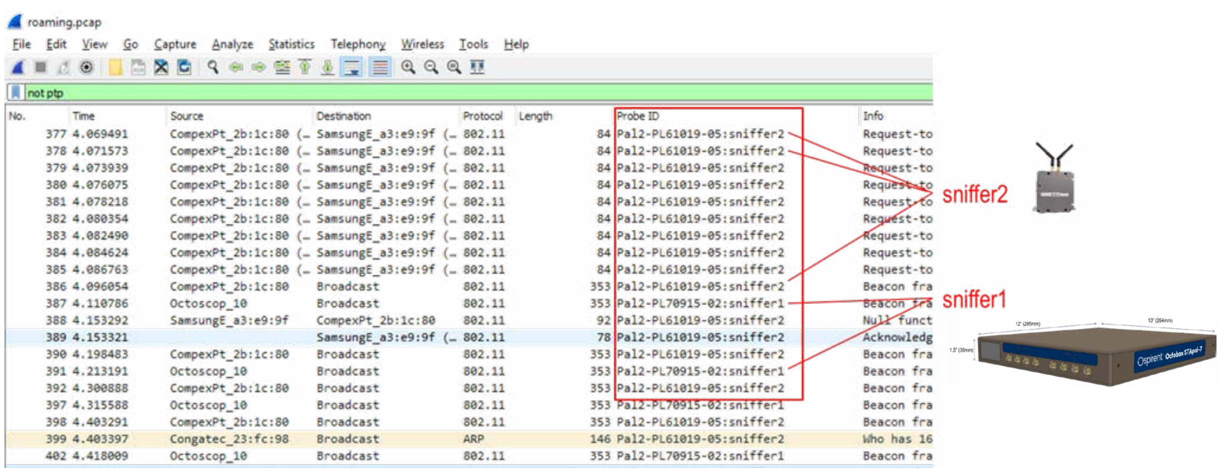
STApal-7 can capture and stream packets in PCAP format to Wireshark in real-time. All the Pal radios are synchronized via the Precision Time Protocol (PTP).

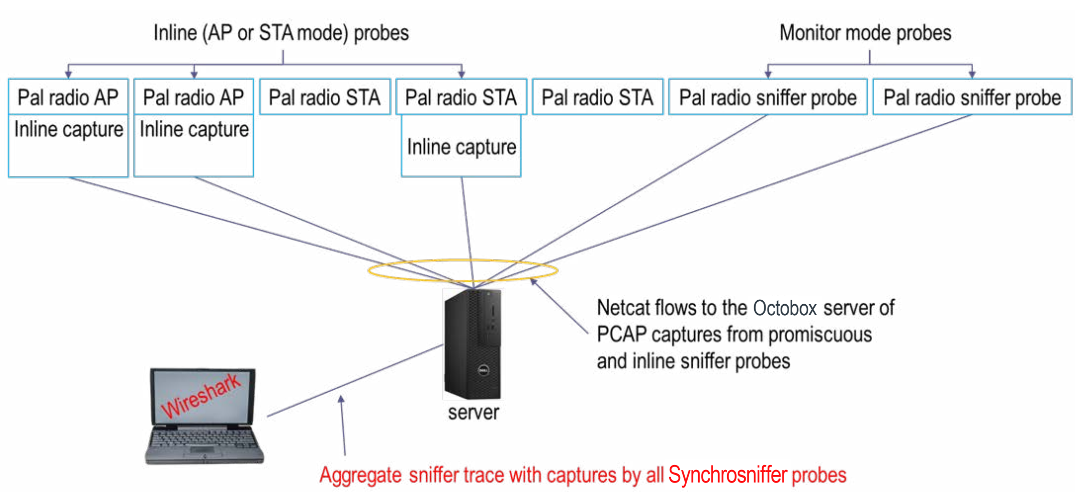


The captures from each radio in the Octobox testbed are combined by the Synchrosniffer engine running on the server into a common PCAP stream viewable in the Octobox-customized Wireshark for easy analysis. In this custom Wireshark application, you can identify captures by probe (i.e. Pal radio).

This aggregate multiprobe view helps analyze complex band steering, roaming and mesh behavior in the presence of motion, interference, path loss, multipath and device under test (DUT) orientation.

This capability is particularly helpful when testing OFDMA links with multiple stations operating on different resource units (RUs) because a single sniffer can only monitor a single AID. For an OFDMA link with 4 stations, you may need 4 sniffer probes, one on each station. The Palbox can assign a STApal-7 sniffer to each STApal-7 endpoint. The sniffer captures from each Pal are aggregated via the Synchrosniffer engine for powerful performance analysis of the entire complex OFDMA link.





Octobox Multiperf Managed Traffic Endpoints

Spirent's Multiperf traffic tool:

- Supports multipoint-to-multipoint traffic
- Automatically recovers from disconnections that are common when testing the dynamic range to a point of disassociation due to low signal level; restarts traffic after reconnection
- Supports iperf2, iperf3, and ping
- Synchronized endpoints for one-way delay measurements and for correlating sniffer captures to the performance metrics plots
- Supports bridging traffic for video, audio and other metrics

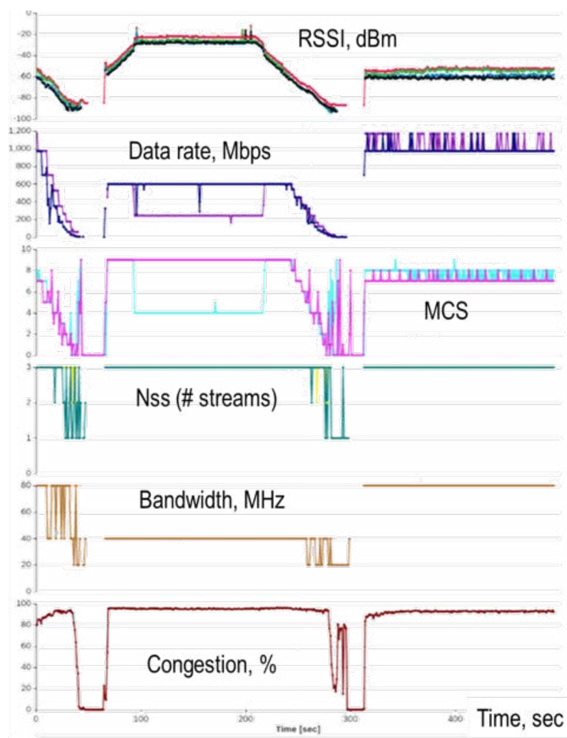
Each Multiperf traffic endpoint is controlled and monitored via an out-of-band management link. Both traffic and management Ethernet networks in the Octobox testbeds are 10 Gbps and have enough capacity to support multipoint traffic, sniffer captures and status reporting.

Multiperf is compatible with Windows, Linux, Android, iOS, and macOS devices, and all Pal test instruments can be configured as Multiperf endpoints.

Octobox Plots

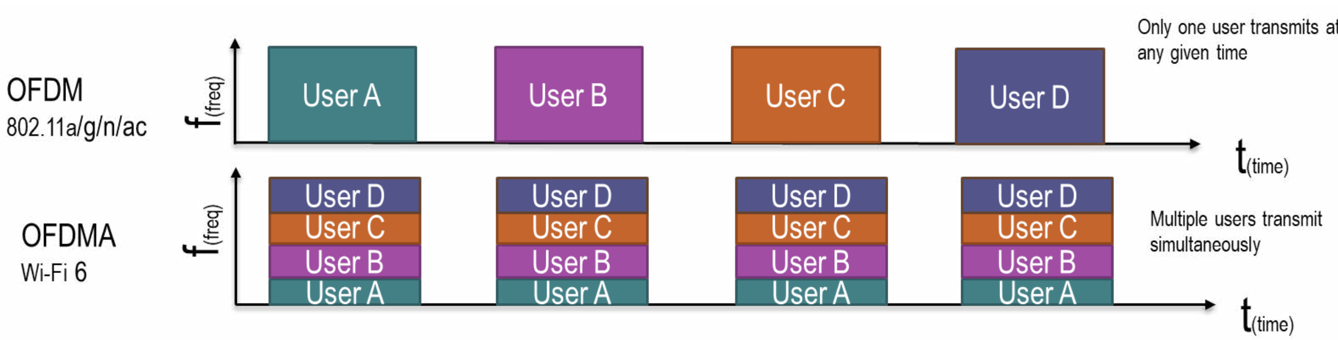
For non-OFDMA links under test, statistics are plotted as single plots for the entire channel. For example, the RSSI, data rate, MCS, Nss (number of spatial streams), bandwidth and other statistics reported by a Pal receiver are plotted as shown on the right. These legacy statistics are produced by each Pal receiver as follows:

1. Open each received packet
2. Extract each statistic from the packet header
3. Discard the packet
4. For each 1 second reporting interval compute the average or the Mode of all the packets received in that interval and plot this value as one point for the interval



Mode (the most common value) is used for discrete plots, such as data rate, Bandwidth, MCS and Nss. Average is used for averageable quantities, such as throughput, RSSI and Congestion.

For OFDMA, RUs (resource units) are assigned to each user dynamically packet by packet so that multiple users can share the frequency band, as shown below.



In the above example, 4 users, A, B, C and D, are transmitting simultaneously in the same OFDMA packet (i.e. time slot) thereby sharing the bandwidth of the channel. The maximum number of RUs per OFDMA packet is 37 in the 80 MHz band and 74 in the 160 MHz band.

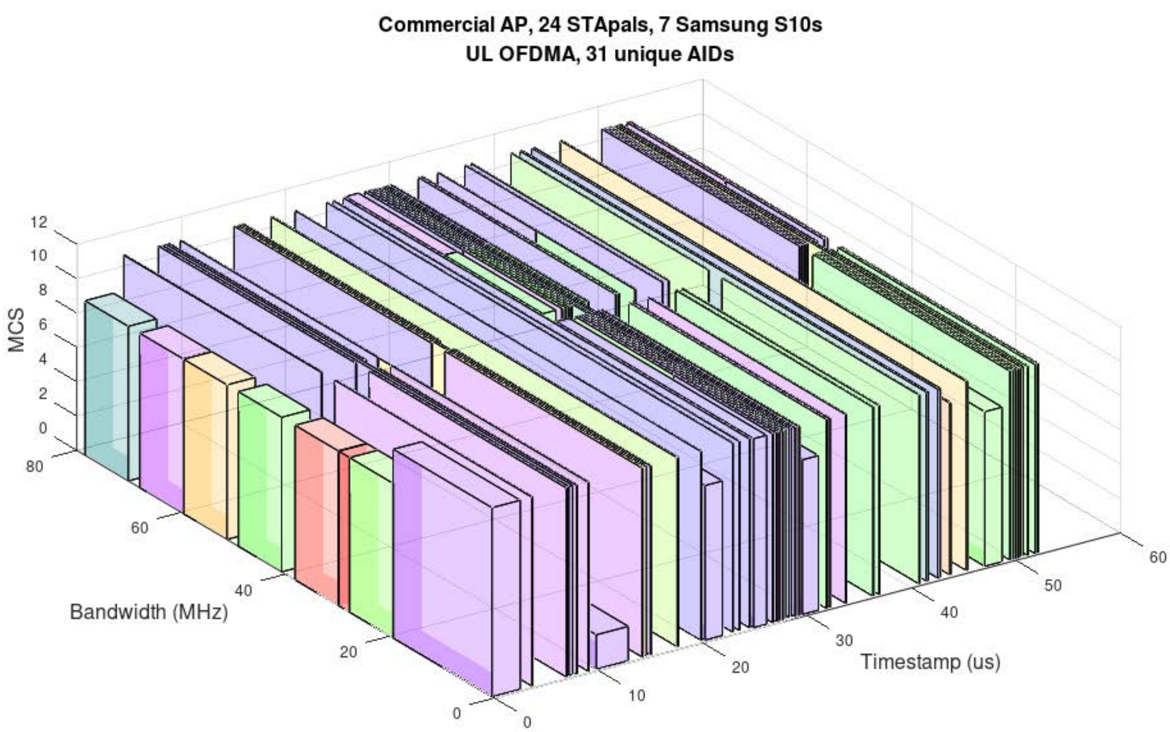
Each user is allocated an AID (association ID) and each AID is allocated an RU (aka frequency slot). The RU allocation to AIDs (users) can change dynamically packet to packet. As the AP scheduler allocates bandwidth to multiple OFDMA STAs, each STA occupies a portion of the spectrum in the operating Wi-Fi channel. For OFDMA, with simultaneous STAs sharing the band, each plot, for example RSSI, now has a 3rd dimension – RU/AID.

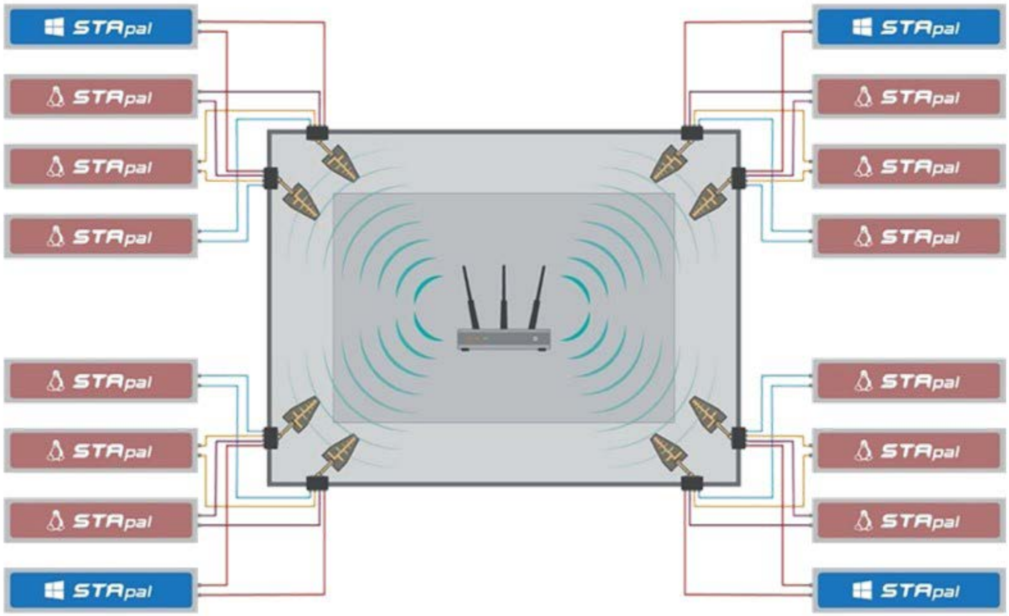
For OFDMA, since the RU/AID allocation changes from packet to packet, we need to show packet by packet plots. These packet by packet graphs are produced by dedicated Synchrosniffer probes.

Each Synchrosniffer probe can be assigned to log performance analysis metrics for a single device in the testbed. For example, if STApal2 is a sniffer, it can create plots for STApal1, STApal3 or STApal4, since all four STApal-7s are on the same pair of antennas and receive the same signal. As a sniffer probe, a STApal-7 can capture up and downlink traffic (UL/DL) for its assigned MAC address and report its PCAP captures into the Synchrosniffer trace.

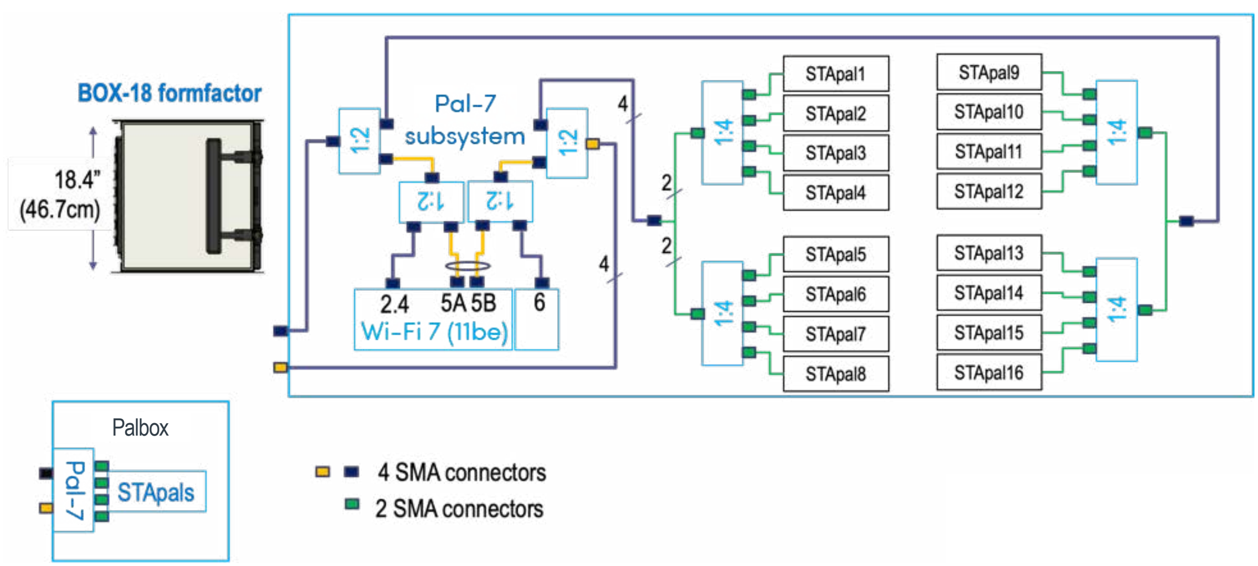
In the DUT chamber, four pairs of antennas are arranged in a spatially diverse way, i.e. mounted in the corners of the chamber in order to enable MU-MIMO beamforming plus OFDMA testing.

At each pair of antennas, you have 1 Windows and 3 Linux STApal-7s from a Palbox. You have an option to configure any of the Linux STApal-7s either as a sniffer probe or as a traffic endpoint. The Windows STApal-7s can only be traffic endpoints. Windows STApal-7s are included in the Palbox because throughput performance is driver-dependent and is different in the Windows environment vs. the Linux environment. So, testing with both drivers is desirable to determine real-world expectations.





The Palbox also incorporates a Pal-7 subsystem that connects to the same 8 antennas as the STApal-7s. The figure below shows a detailed block diagram of the Palbox and its symbol as used in the Octobox testbed diagrams.



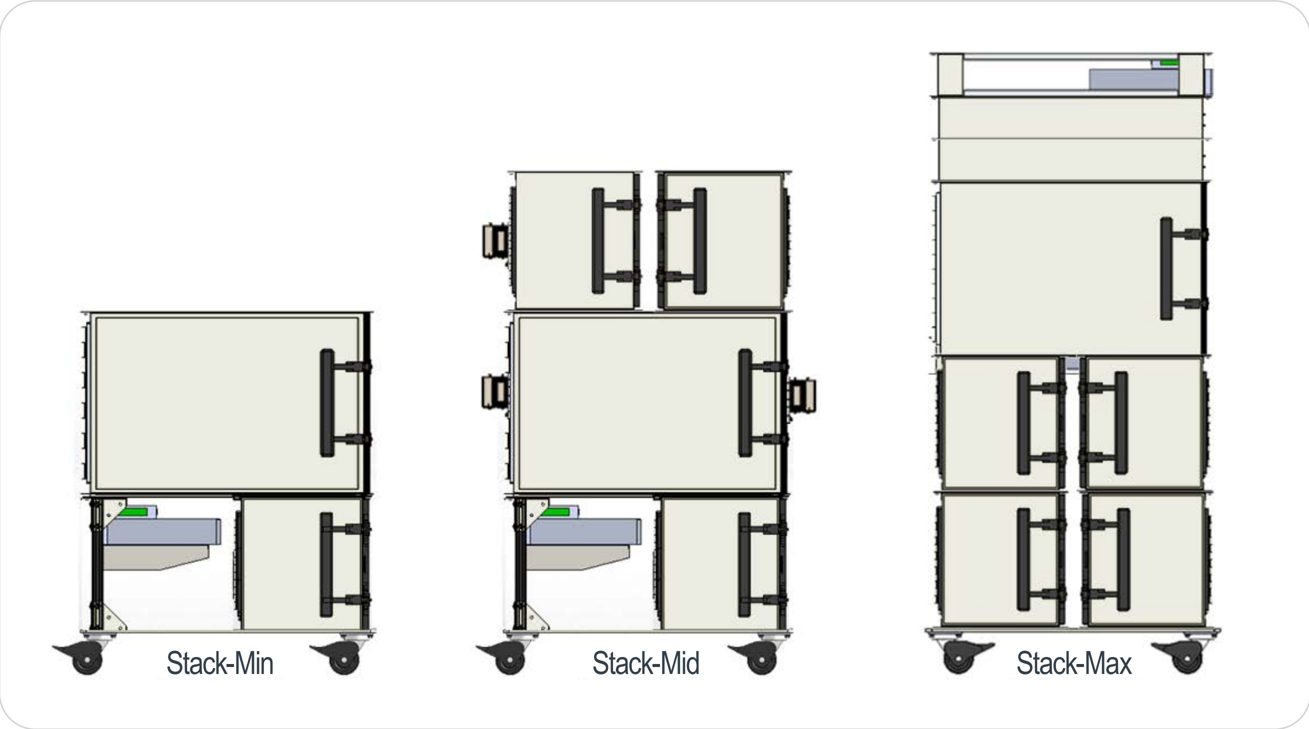
If you are testing with a reasonable number of OFDMA STAs and need dedicated Synchrosniffer probes, you can use multiple Palboxes in a testbed. The photo to the right shows a testbed with 2 Palboxes with their doors open.

In addition to 16 OFDMA STApals, each Palbox incorporates a Pal-7 subsystem that can be used to emulate up to 256 vSTAs for testing an access point under a heavy load.

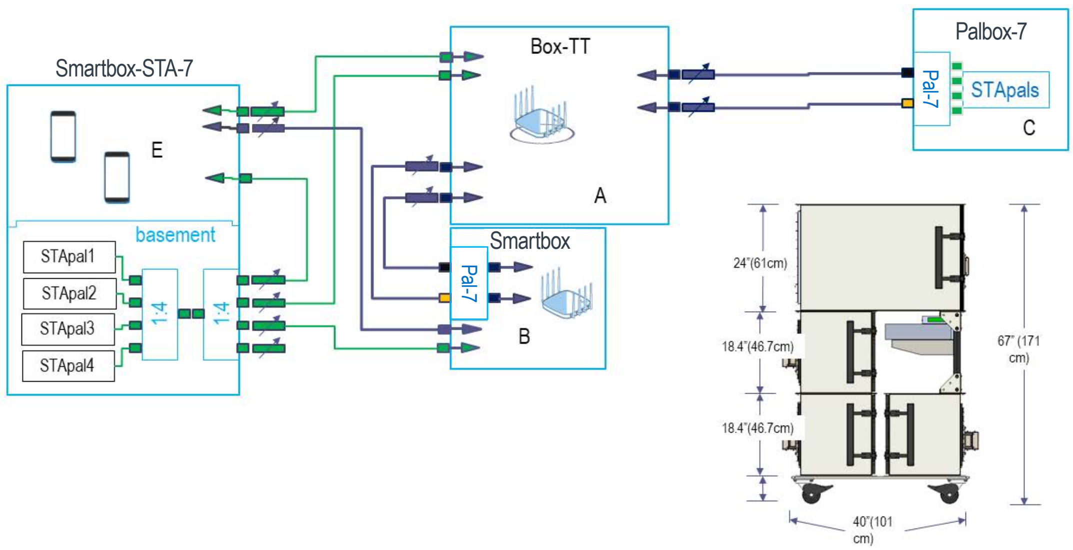
With a Palbox, you can generate OFDMA and MU-MIMO traffic simultaneously, plus traffic load from up to 96 virtual stations – a lot of parallel traffic and analysis power in a small space.

Octobox Personal Testbeds

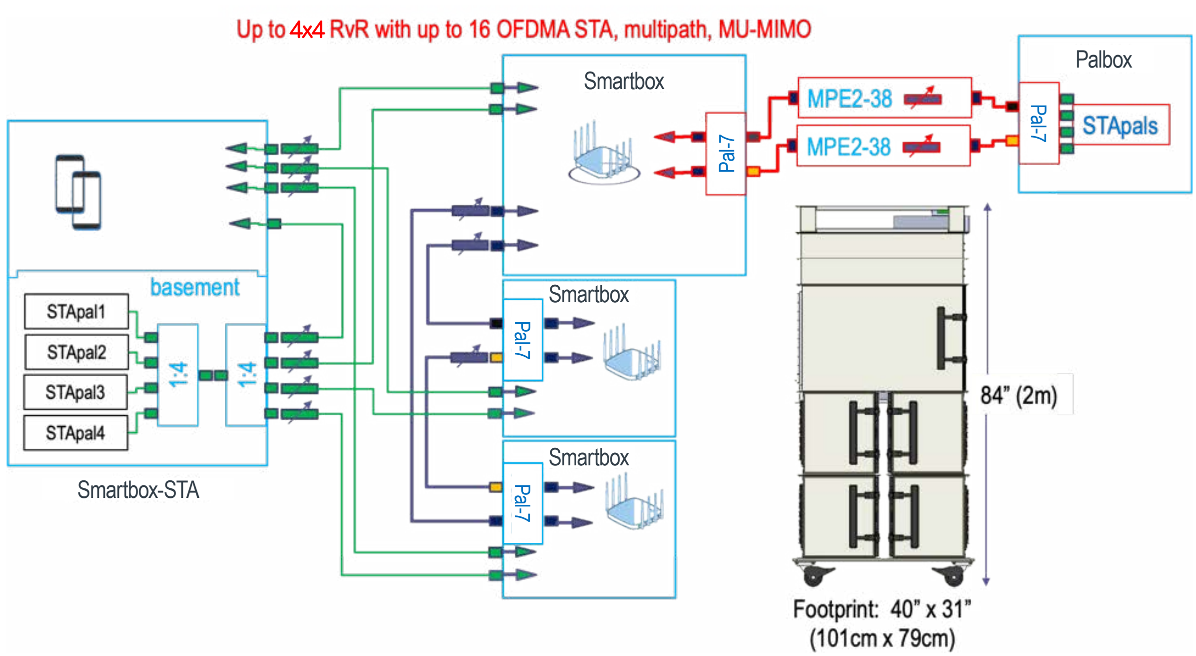
Octobox testbeds are available in three recommended configurations: Stack-Min, Stack-Mid, and Stack-Max.

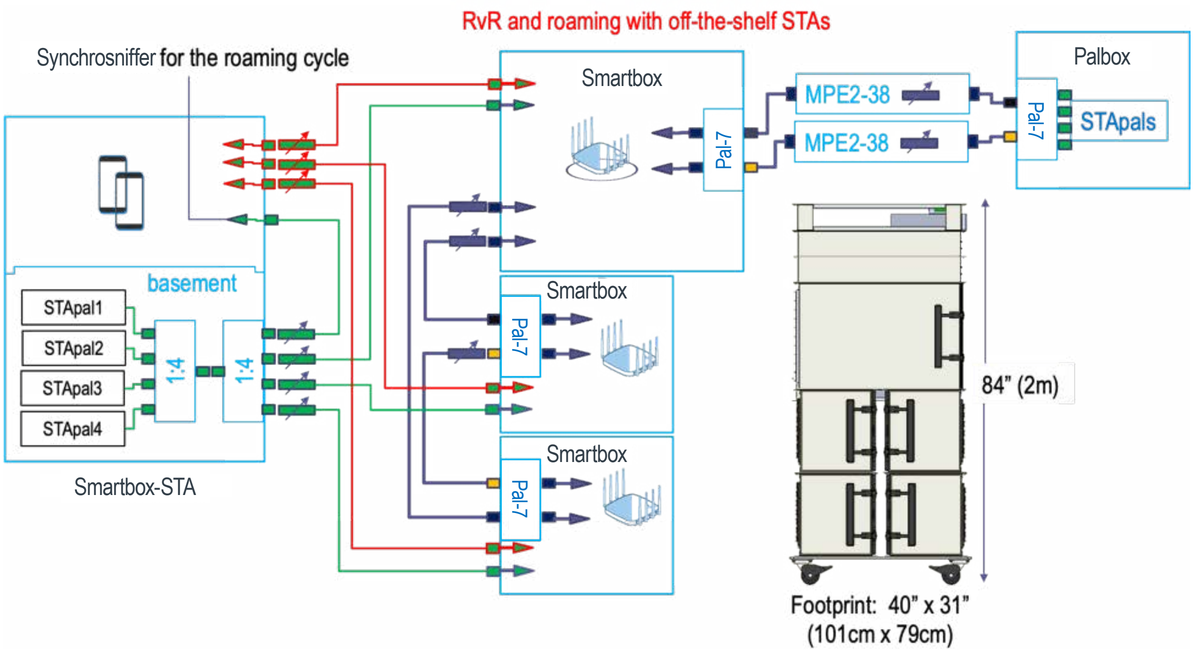


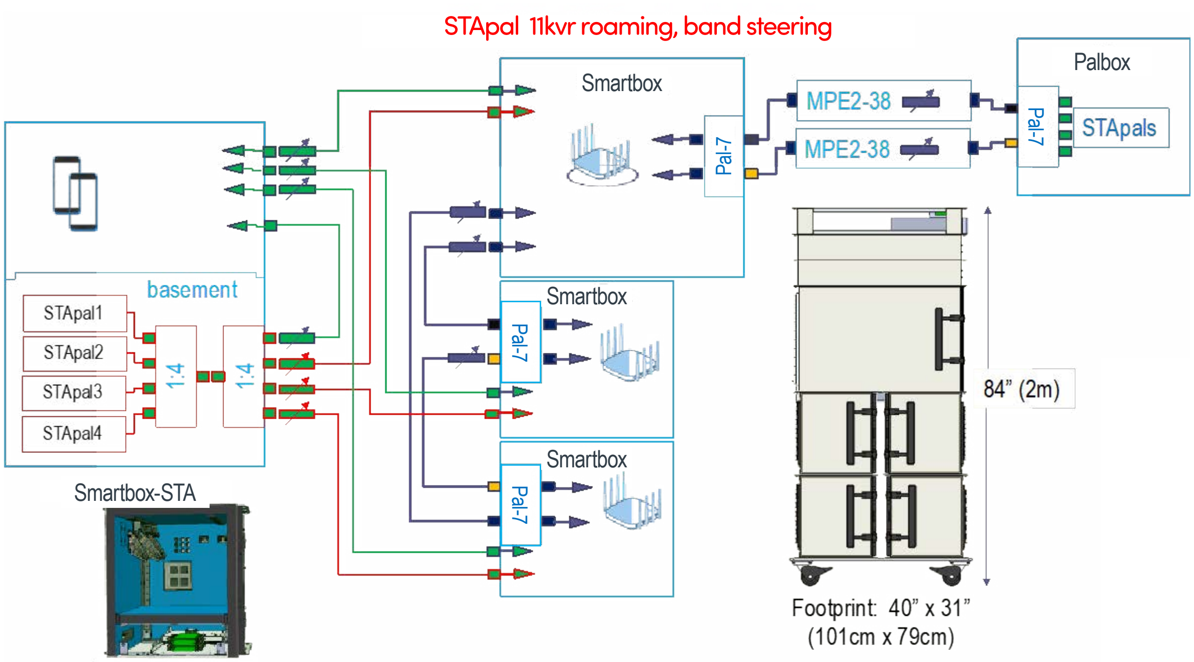
Octobox Stack-Mid is designed for communications service provider (CSP) to test and optimize home-focused Wi-Fi devices and solutions. A subset of Spirent's fully-featured Octobox Stack-Max testbed, Octobox Stack-Mid supports testing of all features and standards vital to home Wi-Fi devices, including the latest Broadband Forum TR-398 Issue 2 test cases for home router performance. It enables CSPs to test the latest Wi-Fi solutions for the home user, including the most recent technologies such as Wi-Fi 6E, Wi-Fi 7, MU-MIMO and OFDMA. When combined with the Octobox Tracker field-to-lab replay component, the testbed can also be used in the optimization of mesh networks, while features such as roaming, access point (AP) steering, band steering, and load balancing are also easy to test and optimize. Realistic deployment scenarios can be recorded in the field and replicated inside the testbed.



The following 6 block diagrams show the different RF paths in the Stack-Max and the functions they perform. The paths are highlighted in red and the functions are stated in red font.




RvR and roaming with off-the-shelf STAs
Synchrosniffer for the roaming cycle
Smartbox
MPE2-38
MPE2-38
Palbox
Pal-7
STApals
Pal-7
basement
STApal1
STApal2
STApal3
STApal4
1:4
1:4
Smartbox-STA
Smartbox
Pal-7
Smartbox
Pal-7
84" (2m)
Footprint: 40" x 31"
(101cm x 79cm)


STApal 11kvr roaming, band steering
Smartbox
MPE2-38
MPE2-38
Palbox
Pal-7
STApals
Pal-7
basement
STApal1
STApal2
STApal3
STApal4
1:4
1:4
Smartbox-STA
Smartbox
Pal-7
Smartbox
Pal-7
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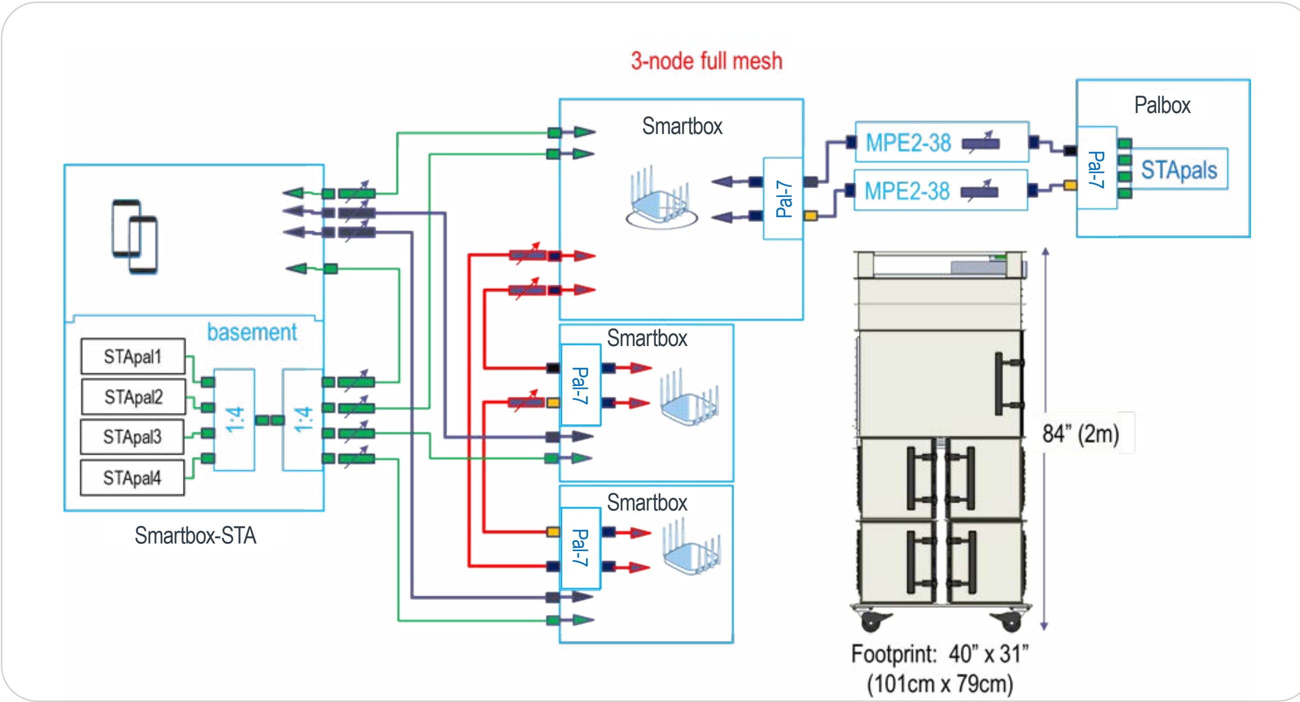
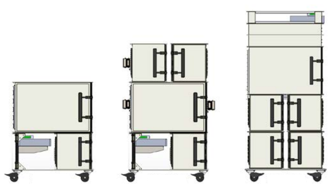
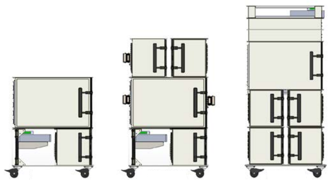


Testbed features and comparison

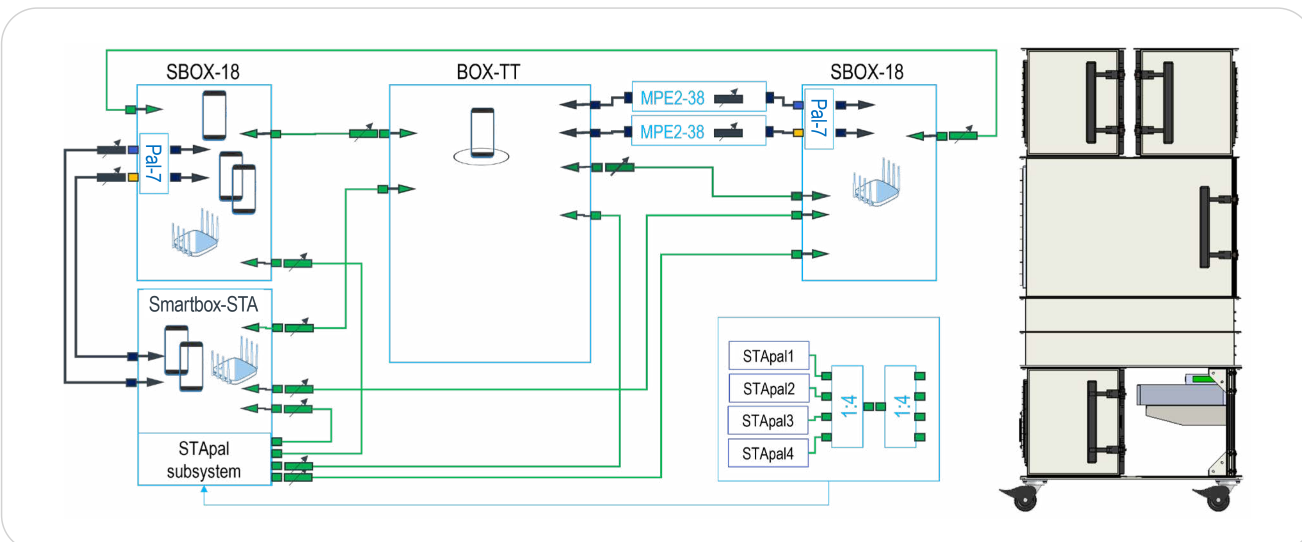


		Stack-		
	Min	Mid	Max	Notes
TR-398	•	•	•	Automated certification to the Broadband Forum TR-398 performance test standard. Full coverage on Stack-Max and Stack-Mid.
RvR	•	•	•	Rate vs range test
RvRvO, RvOvR, RvRwR	•	•	•	Orientation or rotation tests require a turntable
Quad-band throughput	•	•	•	Aggregate throughput on up to 3 channels
Band Steering	•	•	•	
Roaming		•	•	
Mesh		•	•	
4x4 MIMO OTA	•	•	•	
4x4 with multipath			•	
160 MHz MIMO OTA	•	•	•	
MU-MIMO OTA	•	•	•	Beamforming based multi-user MIMO
DFS	•	•	•	
ACS	•	•	•	
Traffic replay	•	•	•	
Inline sniffing	•	•	•	Synchrosniffer probe while in STA or AP mode, reporting packets targeted for the STA or AP
Synchrosniffer probes	16	23	31	Palbox in Stack-Max has 16 STApal-7s and a Pal-7 subsystem. Twelve out of the sixteen have a 2x2 STA radio capable of sniffing on either 2.4, 5 or 6 GHz band

Testbed features and comparison (con'td)



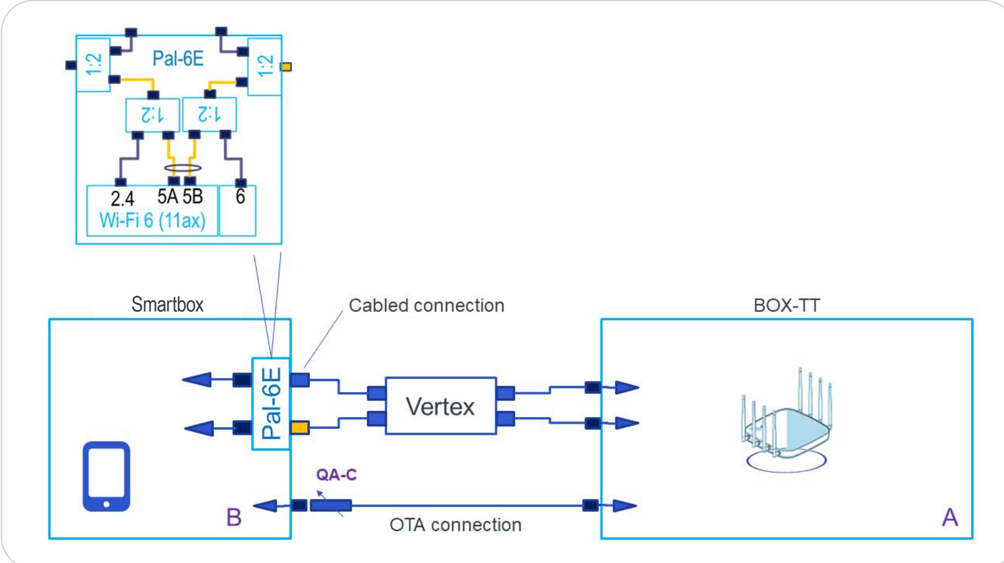
Total number of stations per band				
2.4 GHz	17	22	24	Pal-7 has one 2.4 GHz, two 5 GHz, and one 6 GHz radio. The two 5 GHz radios can be run separately or combined as a single 8x8 80MHz radio or a 4x4 160 MHz radio.
5 GHz	18	24	28	
6 GHz	17	22	24	
OFDMA-capable STAs	16	20	20	OFDMA Multiperf endpoints
vSTA				
2.4 GHz	240	480	960	Each vSTA can run its own traffic using the Octobox Multiperf mp2mp traffic; bridge via vSTAs to set up application layer traffic, e.g. voice/ video streams
5 GHz	256	512	1024	
6 GHz	80	160	320	
Total	256	1152	2304	



Stack-STA is a fully featured testbed optimized for testing Wi-Fi stations. The testbed can be used to test any device, including OFDMA and up to 8x8 capable MIMO.

Additional features include:

- Supports rate vs range testing with any off-the-shelf AP or a built in Pal-7 test instrument.
- Includes built-in instruments to test station's OFDMA capabilities. The four built-in STApals are used to load the AP thus forcing it to use OFDMA.
- Supports beamforming, allowing the built in STApal instruments and/or off-the-shelf stations to be used in a MU-MIMO test.
- Supports tests involving overlapping BSS, roaming and BSS coloring. Pal-7 instrumentation or off-the-shelf APs can be used in a test scenario.
- The built in Pal instrumentation can be used for Synchrosniffing enabling PCAP based analysis.



Stack-Vertex is an Octobox testbed that combines two Octobox chambers with an advanced, programmable channel emulator. This testbed can be used to test various wireless devices including Wi-Fi access points and stations. The Stack is useful when characterizing the behavior of a device in complicated channel environments. Additionally, a unique attribute of Stack-Vertex is that the characterization can be performed easily Over The Air (OTA). The Stack is applicable for both Wi-Fi and cellular / 5G applications.

Octobox Pal-7 Open and Octobox STApal-7 Open

Use the Octobox Pal-7 open or Octobox STApal-7 open in a walk-in isolation chamber or in an open-air test environment, such as a test house. All the RF connectors for the Wi-Fi 7 radios and interference can be directly connected to the antennas. The open antenna subsystem supports all Spirent's antenna carriers, including high-gain antennas and dipole antennas for open air testing.

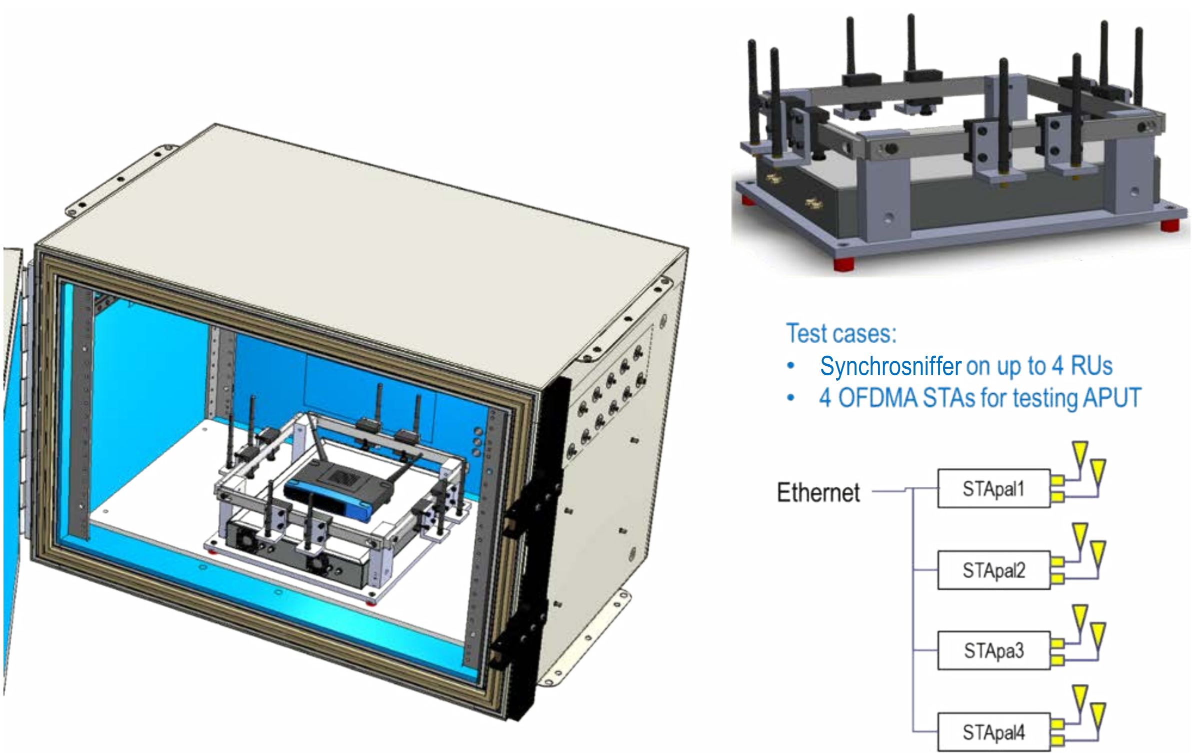
Open antenna system can be configured with any of the Octobox antennas

Both Pal-7 Open and STApal-7 Open can also be placed inside an Octobox chamber as a portable Synchrosniffer or as traffic endpoints.

Octobox STApal-7

Pal-7 open photo showing all the RF ports

STApal-7 open contains 4 STApal-7s as shown.



STApal-7 open with the antenna system shown inside and outside of the Octobox chamber

Pal-7 and STApal-7 Specifications

Wi-Fi	Pal-7	STApal, and STApal-7
Channels	2.4 GHz, 5 GHz and 6 GHz (Pal-7 only); quad-band	2.4 GHz, 5 GHz and 6 GHz (STApal-7 only)
Bandwidth	20, 40, 80, 80+80, 160 MHz	20, 40, 80, 160 MHz and subchannel RUs
Standards	801.11a, 802.11b, 802.11g, 802.11n, 802.11ac (wave 2), 802.11be	801.11a, 802.11b, 802.11g, 802.11n, 802.11ac (wave 2), 802.11be
Virtual stations	64 per-radio	
Traffic replay	From PCAP file	
Monitor	Detailed statistics from the Wi-Fi chipset	RSSI, MCS, Nss, bandwidth plus per packet deep performance metrics plots from the Synchrosniffer
Sniffer	Synchrosniffer Wireshark captures	Synchrosniffer Wireshark captures
802.11ax PHY	DL/UP OFDMA in AP mode DL MU-MIMO in AP mode and beamforming	DL/UL OFDMA in STA mode DL MU-MIMO
802.11ax MAC	• Trigger frame support • Non-trigger based and trigger-based sounding for beamforming • Multi-user RTS and CTS • Buffer status report • UL-OFDMA Random Access • Multiple BSSID • Bandwidth query report	• Trigger frame support • Non-trigger based and trigger-based sounding for beamforming • UL-OFDMA Random Access
General	**Pal-7**	
Traffic endpoints	Multiperf, iperf3, iperf2, ping	
	Trigger out connector for triggering external RF instruments	
Management	10 Gbps Ethernet	
Power	Power adapter	
Dimensions	23” x 10.4” x 1.4” (58 √ 26 √ 3.5cm)	
TX power	MCS, # streams, frequency and channel width dependent (see below)	
Processor subsystem	quad-core, ARM Cortex 64-bit, 2 GHz	

Pal-7, STApal, STApal-7 Real-Time Radio Status

STA	AP	MON	Pal-7	STApal and STApal-7
√	√	√	Offline	Offline
√	√	√	Monitor	Monitor
√			Scanning <CH #>	Scanning <CH #>
√	√		PHY mode <HT20, OFDMA, HE40, etc.>	PHY mode <HT20, OFDMA, HE40, etc.>
√	√	√	Channel primary and secondary	Channel primary and secondary channels
√			Bandwidth	Bandwidth
	√		Associated STAs <#> hover over to show list of STAs	
√			MAC address	MAC address
√	√		BSSIDs <list>	BSSIDs <list>
	√		SSID	

STApal-7 Tx Power and Rx Sensitivity for 2.4GHz

RF Performance for 2.4 GHz

	Data Rate	Tx Power (Per Chain)	Tx Power (4 Chains)	Tolerance
2.4GHz 802.11be EHT20	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	22dBm	28dBm	±2dB
	MCS 3	22dBm	28dBm	±2dB
	MCS 4	22dBm	28dBm	±2dB
	MCS 5	22dBm	28dBm	±2dB
	MCS 6	22dBm	28dBm	±2dB
	MCS 7	22dBm	28dBm	±2dB
	MCS 8	22dBm	28dBm	±2dB
	MCS 9	22dBm	28dBm	±2dB
	MCS 10	21dBm	27dBm	±2dB
	MCS 11	21dBm	27dBm	±2dB
	MCS 12	21dBm	27dBm	±2dB
	MCS 13	21dBm	27dBm	±2dB
2.4GHz 802.11 be EHT40	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	22dBm	28dBm	±2dB
	MCS 3	22dBm	28dBm	±2dB
	MCS 4	22dBm	28dBm	±2dB
	MCS 5	22dBm	28dBm	±2dB
	MCS 6	22dBm	28dBm	±2dB
	MCS 7	22dBm	28dBm	±2dB
	MCS 8	22dBm	28dBm	±2dB
	MCS 9	22dBm	28dBm	±2dB
	MCS 10	21dBm	27dBm	±2dB
	MCS 11	21dBm	27dBm	±2dB
	MCS 12	21dBm	27dBm	±2dB
	MCS 13	21dBm	27dBm	±2dB

	Data Rate	Rx Specifications Sensitivity	Tolerance
2.4GHz 802.11be EHT20	MCS 0	-97dBm	±2dB
	MCS 1	-95dBm	±2dB
	MCS 2	-93dBm	±2dB
	MCS 3	-90dBm	±2dB
	MCS 4	-88dBm	±2dB
	MCS 5	-84dBm	±2dB
	MCS 6	-81dBm	±2dB
	MCS 7	-79dBm	±2dB
	MCS 8	-75dBm	±2dB
	MCS 9	-73dBm	±2dB
	MCS 10	-69dBm	±2dB
	MCS 11	-67dBm	±2dB
	MCS 12	-64dBm	±2dB
	MCS 13	-61dBm	±2dB
2.4GHz 802.11 be EHT40	MCS 0	-95dBm	±2dB
	MCS 1	-93dBm	±2dB
	MCS 2	-91dBm	±2dB
	MCS 3	-88dBm	±2dB
	MCS 4	-85dBm	±2dB
	MCS 5	-81dBm	±2dB
	MCS 6	-78dBm	±2dB
	MCS 7	-76dBm	±2dB
	MCS 8	-73dBm	±2dB
	MCS 9	-70dBm	±2dB
	MCS 10	-67dBm	±2dB
	MCS 11	-65dBm	±2dB
	MCS 12	-61dBm	±2dB
	MCS 13	-58dBm	±2dB

STApal-7 Tx Power and Rx Sensitivity for 5GHz

RF Performance for 2.4 GHz

	Data Rate	Tx Power (Per Chain)	Tx Power (4 Chains)	Tolerance
5GHz 802.11be EHT20	MCS0	22dBm	28dBm	±2dB
	MCS1	22dBm	28dBm	±2dB
	MCS2	22dBm	28dBm	±2dB
	MCS3	22dBm	28dBm	±2dB
	MCS4	22dBm	28dBm	±2dB
	MCS5	22dBm	28dBm	±2dB
	MCS6	21dBm	27dBm	±2dB
	MCS7	21dBm	27dBm	±2dB
	MCS8	20dBm	26dBm	±2dB
	MCS9	20dBm	26dBm	±2dB
	MCS10	19dBm	25dBm	±2dB
	MCS11	19dBm	25dBm	±2dB
	MCS12	18dBm	24dBm	±2dB
	MCS13	18dBm	24dBm	±2dB
5GHz 802.11 be EHT40	MCS0	22dBm	28dBm	±2dB
	MCS1	22dBm	28dBm	±2dB
	MCS2	22dBm	28dBm	±2dB
	MCS3	22dBm	28dBm	±2dB
	MCS4	22dBm	28dBm	±2dB
	MCS5	22dBm	28dBm	±2dB
	MCS6	21dBm	27dBm	±2dB
	MCS7	21dBm	27dBm	±2dB
	MCS8	20dBm	26dBm	±2dB
	MCS9	20dBm	26dBm	±2dB
	MCS10	19dBm	25dBm	±2dB
	MCS11	19dBm	25dBm	±2dB
	MCS12	18dBm	24dBm	±2dB
	MCS13	18dBm	24dBm	±2dB

	Data Rate	Rx Specifications Sensitivity	Tolerance
5GHz 802.11be EHT20	MCS0	-96dBm	±2dB
	MCS1	-93dBm	±2dB
	MCS2	-91dBm	±2dB
	MCS3	-87dBm	±2dB
	MCS4	-84dBm	±2dB
	MCS5	-80dBm	±2dB
	MCS6	-78dBm	±2dB
	MCS7	-77dBm	±2dB
	MCS8	-73dBm	±2dB
	MCS9	-70dBm	±2dB
	MCS10	-67dBm	±2dB
	MCS11	-64dBm	±2dB
	MCS12	-61dBm	±2dB
	MCS13	-58dBm	±2dB
5GHz 802.11 be EHT40	MCS 0	-93dBm	±2dB
	MCS 1	-91dBm	±2dB
	MCS 2	-88dBm	±2dB
	MCS 3	-84dBm	±2dB
	MCS 4	-82dBm	±2dB
	MCS 5	-78dBm	±2dB
	MCS 6	-76dBm	±2dB
	MCS 7	-75dBm	±2dB
	MCS 8	-71dBm	±2dB
	MCS 9	-68dBm	±2dB
	MCS 10	-64dBm	±2dB
	MCS 11	-61dBm	±2dB
	MCS 12	-59dBm	±2dB
	MCS 13	-56dBm	±2dB

STApal-7 Tx Power and Rx Sensitivity for 5GHz (cont'd)

RF Performance for 2.4 GHz

	Data Rate	Tx Power (Per Chain)	Tx Power (4 Chains)	Tolerance
5GHz 802.11be EHT80	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	22dBm	28dBm	±2dB
	MCS 3	22dBm	28dBm	±2dB
	MCS 4	22dBm	28dBm	±2dB
	MCS 5	22dBm	28dBm	±2dB
	MCS 6	21dBm	27dBm	±2dB
	MCS 7	21dBm	27dBm	±2dB
	MCS 8	20dBm	26dBm	±2dB
	MCS 9	20dBm	26dBm	±2dB
	MCS 10	19dBm	25dBm	±2dB
	MCS 11	19dBm	25dBm	±2dB
	MCS 12	18dBm	24dBm	±2dB
	MCS 13	18dBm	24dBm	±2dB
5GHz 802.11 be EHT160	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	22dBm	28dBm	±2dB
	MCS 3	22dBm	28dBm	±2dB
	MCS 4	22dBm	28dBm	±2dB
	MCS 5	22dBm	28dBm	±2dB
	MCS 6	21dBm	27dBm	±2dB
	MCS 7	21dBm	27dBm	±2dB
	MCS 8	20dBm	26dBm	±2dB
	MCS 9	19dBm	25dBm	±2dB
	MCS 10	19dBm	25dBm	±2dB
	MCS 11	18dBm	24dBm	±2dB
	MCS 12	18dBm	24dBm	±2dB
	MCS 13	18dBm	24dBm	±2dB

	Data Rate	Rx Specifications Sensitivity	Tolerance
5GHz 802.11be EHT80	MCS 0	-90dBm	±2dB
	MCS 1	-88dBm	±2dB
	MCS 2	-85dBm	±2dB
	MCS 3	-82dBm	±2dB
	MCS 4	-79dBm	±2dB
	MCS 5	-75dBm	±2dB
	MCS 6	-73dBm	±2dB
	MCS 7	-71dBm	±2dB
	MCS 8	-67dBm	±2dB
	MCS 9	-65dBm	±2dB
	MCS 10	-61dBm	±2dB
	MCS 11	-59dBm	±2dB
	MCS 12	-55dBm	±2dB
	MCS 13	-52dBm	±2dB
5GHz 802.11 be EHT160	MCS 0	-88dBm	±2dB
	MCS 1	-84dBm	±2dB
	MCS 2	-82dBm	±2dB
	MCS 3	-79dBm	±2dB
	MCS 4	-76dBm	±2dB
	MCS 5	-72dBm	±2dB
	MCS 6	-70dBm	±2dB
	MCS 7	-68dBm	±2dB
	MCS 8	-64dBm	±2dB
	MCS 9	-62dBm	±2dB
	MCS 10	-58dBm	±2dB
	MCS 11	-55dBm	±2dB
	MCS 12	-53dBm	±2dB
	MCS 13	-50dBm	±2dB

STApal-7 Tx Power and Rx Sensitivity for 6GHz

RF Performance for 2.4 GHz

	Data Rate	Tx Power (Per Chain)	Tx Power (4 Chains)	Tolerance
6GHz 802.11be EHT20	MCS0	22dBm	28dBm	±2dB
	MCS1	22dBm	28dBm	±2dB
	MCS2	21dBm	27dBm	±2dB
	MCS3	21dBm	27dBm	±2dB
	MCS4	20dBm	26dBm	±2dB
	MCS5	20dBm	26dBm	±2dB
	MCS6	19dBm	25dBm	±2dB
	MCS7	18dBm	24dBm	±2dB
	MCS8	18dBm	24dBm	±2dB
	MCS9	17dBm	23dBm	±2dB
	MCS10	17dBm	23dBm	±2dB
	MCS11	17dBm	23dBm	±2dB
	MCS12	16dBm	22dBm	±2dB
	MCS13	16dBm	22dBm	±2dB
6GHz 802.11 be EHT40	MCS0	22dBm	28dBm	±2dB
	MCS1	22dBm	28dBm	±2dB
	MCS2	21dBm	27dBm	±2dB
	MCS3	21dBm	27dBm	±2dB
	MCS4	20dBm	26dBm	±2dB
	MCS5	20dBm	26dBm	±2dB
	MCS6	19dBm	25dBm	±2dB
	MCS7	18dBm	24dBm	±2dB
	MCS8	18dBm	24dBm	±2dB
	MCS9	17dBm	23dBm	±2dB
	MCS10	17dBm	23dBm	±2dB
	MCS11	17dBm	23dBm	±2dB
	MCS12	16dBm	22dBm	±2dB
	MCS13	16dBm	22dBm	±2dB
6GHz 802.11 be EHT80	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	21dBm	27dBm	±2dB
	MCS 3	21dBm	27dBm	±2dB
	MCS 4	20dBm	26dBm	±2dB
	MCS 5	20dBm	26dBm	±2dB
	MCS 6	19dBm	25dBm	±2dB
	MCS 7	18dBm	24dBm	±2dB
	MCS 8	18dBm	24dBm	±2dB
	MCS 9	17dBm	23dBm	±2dB
	MCS 10	17dBm	23dBm	±2dB
	MCS 11	17dBm	23dBm	±2dB
	MCS 12	16dBm	22dBm	±2dB
	MCS 13	16dBm	22dBm	±2dB

	Data Rate	Rx Specifications Sensitivity	Tolerance
6GHz 802.11be EHT20	MCS0	-92dBm	±2dB
	MCS1	90dBm	±2dB
	MCS2	-88dBm	±2dB
	MCS3	84dBm	±2dB
	MCS4	-81dBm	±2dB
	MCS5	-78dBm	±2dB
	MCS6	-76dBm	±2dB
	MCS7	-74dBm	±2dB
	MCS8	-71dBm	±2dB
	MCS9	-68dBm	±2dB
	MCS10	-65dBm	±2dB
	MCS11	-62dBm	±2dB
	MCS12	-59dBm	±2dB
	MCS13	-57dBm	±2dB
6GHz 802.11 be EHT40	MCS0	-90dBm	±2dB
	MCS1	-87dBm	±2dB
	MCS2	-85dBm	±2dB
	MCS3	-82dBm	±2dB
	MCS4	-79dBm	±2dB
	MCS5	-75dBm	±2dB
	MCS6	-73dBm	±2dB
	MCS7	-71dBm	±2dB
	MCS8	-68dBm	±2dB
	MCS9	-66dBm	±2dB
	MCS10	-62dBm	±2dB
	MCS11	-60dBm	±2dB
	MCS12	-57dBm	±2dB
	MCS13	-55dBm	±2dB
6GHz 802.11 be EHT80	MCS 0	-88dBm	±2dB
	MCS 1	-85dBm	±2dB
	MCS 2	-82dBm	±2dB
	MCS 3	-79dBm	±2dB
	MCS 4	-76dBm	±2dB
	MCS 5	-71dBm	±2dB
	MCS 6	-70dBm	±2dB
	MCS 7	-67dBm	±2dB
	MCS 8	-65dBm	±2dB
	MCS 9	-62dBm	±2dB
	MCS 10	-59dBm	±2dB
	MCS 11	-56dBm	±2dB
	MCS 12	-54dBm	±2dB
	MCS 13	-52dBm	±2dB

STApal-7 Tx Power and Rx Sensitivity for 6GHz (cont'd)

RF Performance for 2.4 GHz

	Data Rate	Tx Power (Per Chain)	Tx Power (4 Chains)	Tolerance
6GHz 802.11be EHT160	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	21dBm	27dBm	±2dB
	MCS 3	21dBm	27dBm	±2dB
	MCS 4	20dBm	26dBm	±2dB
	MCS 5	19dBm	25dBm	±2dB
	MCS 6	19dBm	25dBm	±2dB
	MCS 7	18dBm	24dBm	±2dB
	MCS 8	18dBm	24dBm	±2dB
	MCS 9	17dBm	23dBm	±2dB
	MCS 10	17dBm	23dBm	±2dB
	MCS 11	16dBm	22dBm	±2dB
	MCS 12	16dBm	22dBm	±2dB
	MCS 13	16dBm	22dBm	±2dB
6GHz 802.11 be EHT320	MCS 0	22dBm	28dBm	±2dB
	MCS 1	22dBm	28dBm	±2dB
	MCS 2	21dBm	27dBm	±2dB
	MCS 3	21dBm	27dBm	±2dB
	MCS 4	20dBm	26dBm	±2dB
	MCS 5	19dBm	25dBm	±2dB
	MCS 6	19dBm	25dBm	±2dB
	MCS 7	18dBm	24dBm	±2dB
	MCS 8	18dBm	24dBm	±2dB
	MCS 9	17dBm	23dBm	±2dB
	MCS 10	17dBm	23dBm	±2dB
	MCS 11	16dBm	22dBm	±2dB
	MCS 12	16dBm	22dBm	±2dB
	MCS 13	16dBm	22dBm	±2dB

	Data Rate	Rx Specifications Sensitivity	Tolerance
6GHz 802.11be EHT160	MCS 0	-84dBm	±2dB
	MCS 1	-82dBm	±2dB
	MCS 2	-79dBm	±2dB
	MCS 3	-77dBm	±2dB
	MCS 4	-73dBm	±2dB
	MCS 5	-68dBm	±2dB
	MCS 6	-66dBm	±2dB
	MCS 7	-65dBm	±2dB
	MCS 8	-61dBm	±2dB
	MCS 9	-59dBm	±2dB
	MCS 10	-56dBm	±2dB
	MCS 11	-53dBm	±2dB
	MCS 12	-51dBm	±2dB
	MCS 13	-48dBm	±2dB
6GHz 802.11 be EHT320	MCS 0	-82dBm	±2dB
	MCS 1	-79dBm	±2dB
	MCS 2	-76dBm	±2dB
	MCS 3	-73dBm	±2dB
	MCS 4	-70dBm	±2dB
	MCS 5	-65dBm	±2dB
	MCS 6	-63dBm	±2dB
	MCS 7	-61dBm	±2dB
	MCS 8	-58dBm	±2dB
	MCS 9	-55dBm	±2dB
	MCS 10	-52dBm	±2dB
	MCS 11	-50dBm	±2dB
	MCS 12	-47dBm	±2dB
	MCS 13	-45dBm	±2dB

About Spirent

Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks. We help bring clarity to increasingly complex technological and business challenges. Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled.

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Glossary

A2DP	advanced audio distribution profile
ACS	automated channel selection
AFH	adaptive frequency hopping
AID	association ID
AP	access point
BE	best effort (priority)
BK	background (priority)
BLE	Bluetooth low energy
BT	Bluetooth
DFS	dynamic frequency selection
DL	downlink
HE	high efficiency
HFP	hands free profile
HID	human interface device profile
KPI	key performance indicator
MCS	modulation coding scheme
MIMO	multiple input multiple output
MP2MP	multi-point to multi-point (traffic generator)
MU	multi-user
Nss	number of spatial streams
OFDMA	orthogonal frequency domain multiple access
OPP	object push profile
OTA	over the air
RSSI	receive signal strength indicator
RU	resource unit
RvR	rate vs. range
RvRvO	rate vs. range vs. orientation
RvOvR	rate vs. orientation vs. range
RX	receive
STA	station (aka client)
TX	transmit
UL	uplink
VI	video (priority)
VO	voice (priority)
vSTA	virtual STA

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