Report for: Wifi Capacity Test

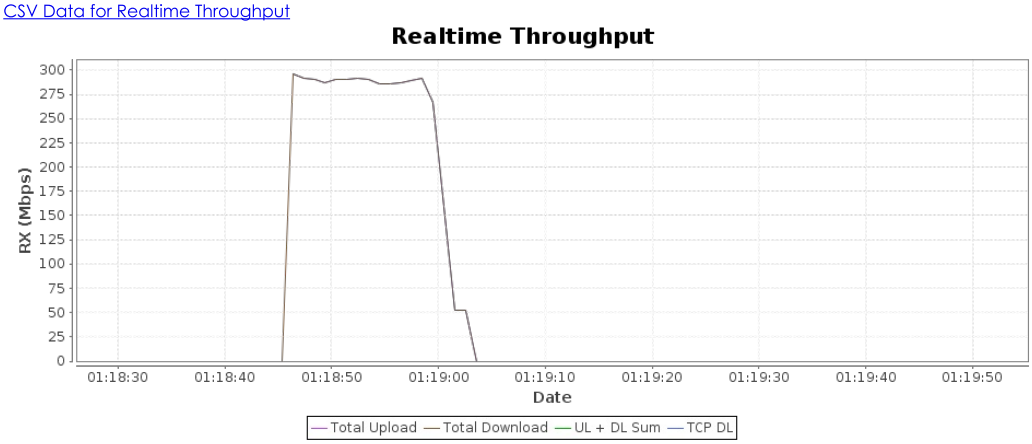
Fri Aug 05 01:19:56 PDT 2022

Objective

The Candela WiFi Capacity test is designed to measure performance of an Access Point when handling different amounts of WiFi Stations. The test allows the user to increase the number of stations in user defined steps for each test iteration and measure the per station and the overall throughput for each trial. Along with throughput other measurements made are client connection times, Fairness, % packet loss, DHCP times and more. The expected behavior is for the AP to be able to handle several stations (within the limitations of the AP specs) and make sure all stations get a fair amount of airtime both in the upstream and downstream. An AP that scales well will not show a significant over-all throughput decrease as more stations are added.

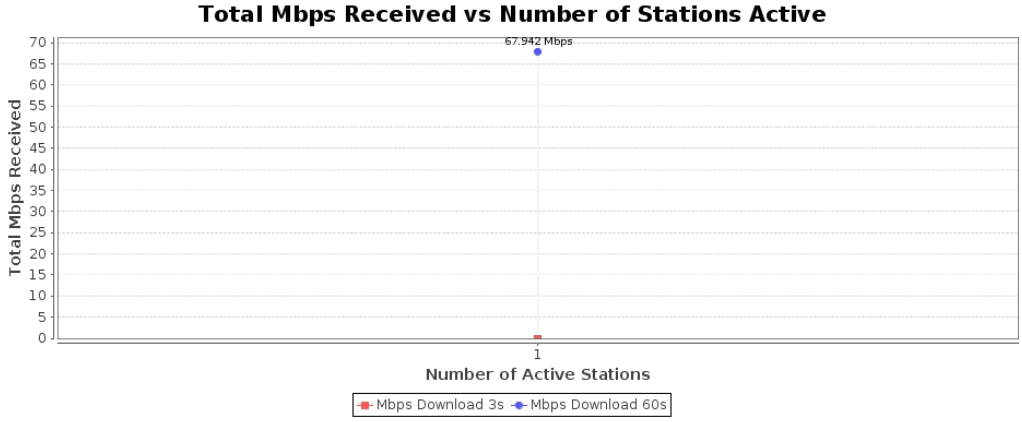
Realtime Graph shows summary download and upload RX Goodput rate of connections created by this test. Goodput does not include Ethernet, IP, UDP/TCP header overhead.

CSV Data for Realtime Throughput



Total Megabits-per-second transferred. This only counts the protocol payload, so it will not count the Ethernet, IP, UDP, TCP or other header overhead. A well behaving system will show about the same rate as stations increase. If the rate decreases significantly as stations increase, then it is not scaling we

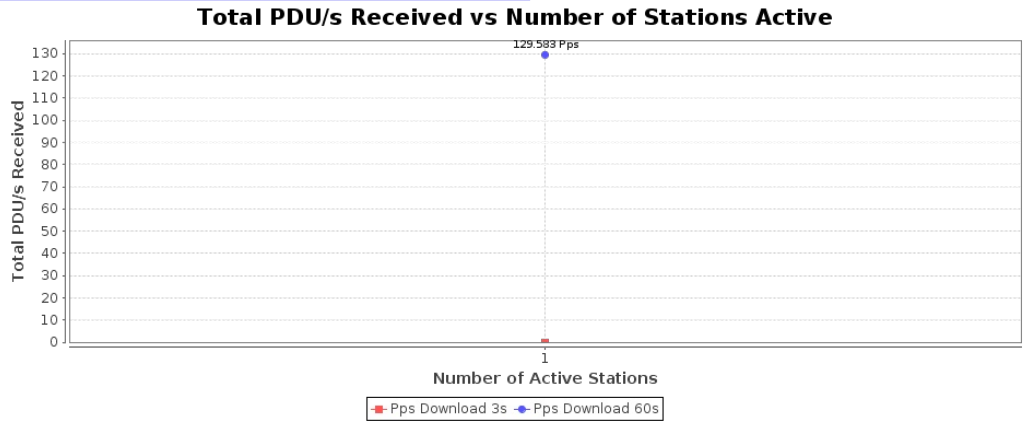
CSV Data for Total Mbps Received vs Number of Stations Active



Protocol-Data-Units received. For TCP, this does not mean much, but for UDP connections, this correlates to packet size. If the PDU size is larger than what fits into a single frame, then the network stack will

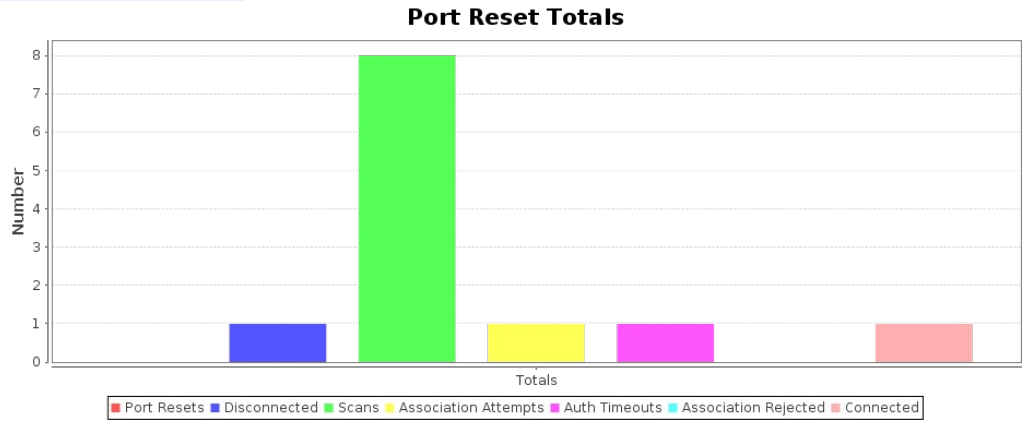
segment it accordingly. A well behaving system will show about the same rate as stations increase. If the rate decreases significantly as stations increase, then it is not scaling well.

CSV Data for Total PDU/s Received vs Number of Stations Active



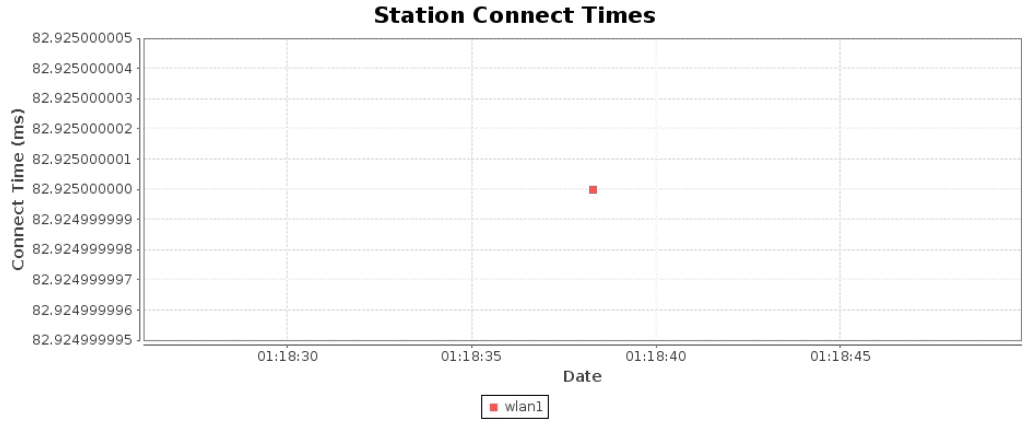
Station disconnect stats. These will be only for the last iteration. If the 'Clear Reset Counters' option is selected, the stats are cleared after the initial association. Any re-connects reported indicate a potential stability issue. Can be used for long-term stability testing in cases where you bring up all stations in one iteration and then run the test for a longer duration.

CSV Data for Port Reset Totals



Station connect time is calculated from the initial Authenticate message through the completion of Open or RSN association/authentication.

CSV Data for Station Connect Times



Wifi-Capacity Test requested values

Station Increment:	1

Loop Iterations:	Single (1)
Duration:	1 min (1 m)
Protocol:	TCP-IPv4
Layer 4-7 Endpoint:	NONE
Payload Size:	AUTO
MSS	AUTO
Total Download Rate:	1G (1 Gbps)
Total Upload Rate:	Zero (0 bps)
Percentage TCP Rate:	10% (10%)
Set Bursty Minimum Speed:	Burst Mode Disabled (-1)
Randomize Rates	true
Leave Ports Up	false
Socket buffer size:	OS Default
Settle Time:	5 sec (5 s)
Rpt Timer:	fast (1 s)
IP ToS:	Best Effort (0)
Multi-Conn:	AUTO
Show-Per-Iteration-Charts	true
Show-Per-Loop-Totals	true
Hunt-Lower-Rates	false
Show Events	true
Clear Reset Counters	false
CSV Reporting Dir	/home/lanforge/report-data/wifi-cap-csv-data-2022-08-05_01.18
Build Date	Fri 17 Jun 2022 05:02:03 PM PDT
Build Version	5.4.5
Git Version	e4afc0739ee746116945e553e48705b0b0eeb7a5
Ports	1.1.eth1 1.1.wlan1
Firmware	0. 6-1
Machines	ct523c-0b31

Requested Parameters:

Download Rate:	Per station:	1000000000 (1 Gbps)	All:	1000000000 (1 Gbps)
Upload Rate:	Per station:	0 (0 bps)	All:	0 (0 bps)
Total:				1000000000 (1 Gbps)

Station count:	1
Connections per station:	1
Payload (PDU) sizes:	AUTO (AUTO)

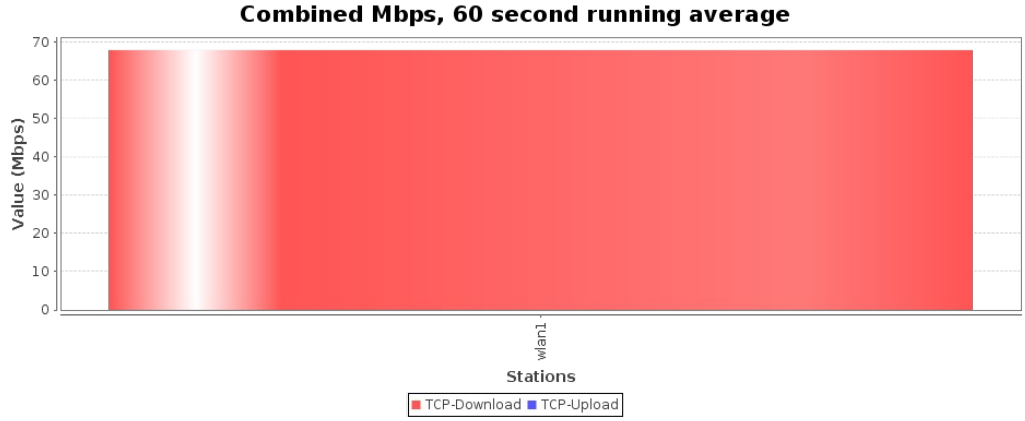
Observed Rate:

	Cx	67.942	Cx	67.942	Cx	67.942	All	67.942

Download Rate:	Min:	Mbps	Ave:	Mbps	Max:	Mbps	Cx:	Mbps
Upload Rate:	Cx Min:	0 bps	Cx Ave:	0 bps	Cx Max:	0 bps	All Cx:	0 bps
Total:								67.942 Mbps
Aggregated Rate:	Min:	67.942 Mbps	Avg:	67.942 Mbps	Max:	67.942 Mbps		

This graph shows fairness. On a fair system, each station should get about the same throughput.
In the download direction, it is mostly the device-under-test that is responsible for this behavior,
but in the upload direction, LANforge itself would be the source of most fairness issues
unless the device-under-test takes specific actions to ensure fairness.

CSV Data for Combined Mbps, 60 second running average



Requested Parameters:

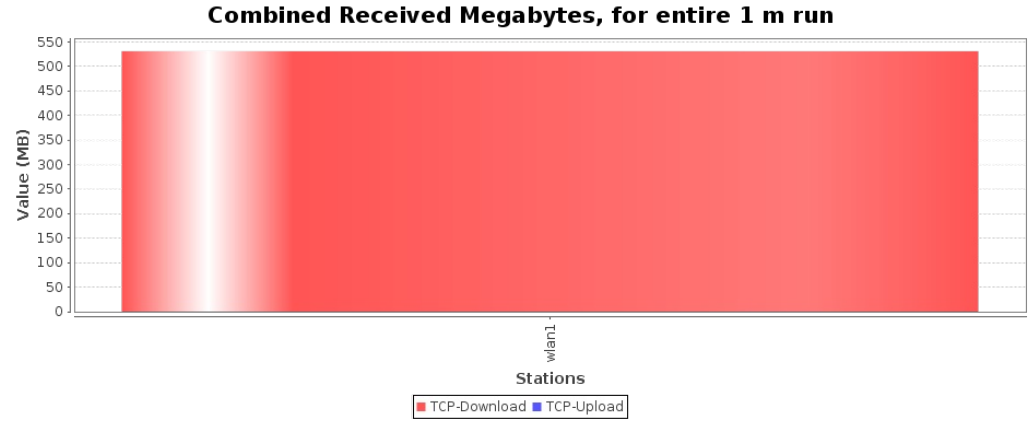
Download Rate:	Per station:	1000000000 (1 Gbps)	All:	1000000000 (1 Gbps)
Upload Rate:	Per station:	0 (0 bps)	All:	0 (0 bps)
Total:				1000000000 (1 Gbps)
Station count:				1
Connections per station:				1
Payload (PDU) sizes:				AUTO (AUTO)

Observed Amount:

Download Amount:	Cx Min:	506.465 MB	Cx Ave:	506.465 MB	Cx Max:	506.465 MB	All Cx:	506.465 MB
Upload Amount:	Cx Min:	0 B	Cx Ave:	0 B	Cx Max:	0 B	All Cx:	0 B
Total:								506.465 MB

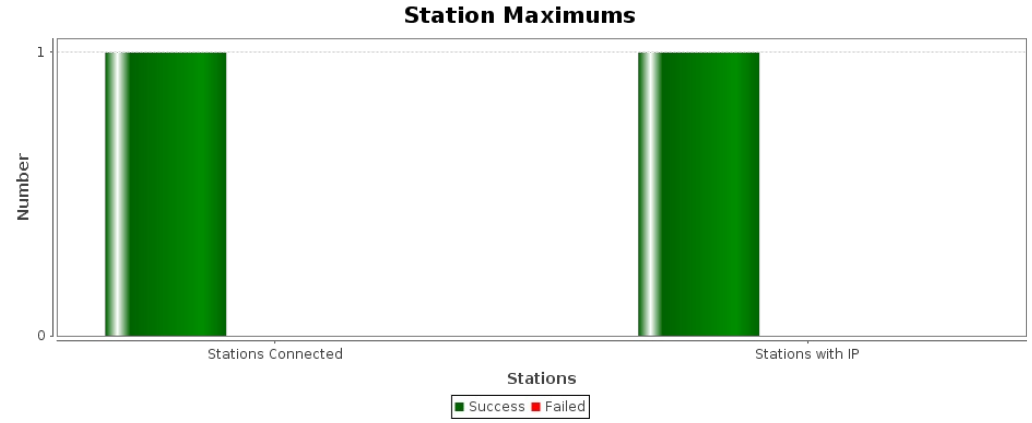
This graph shows fairness. On a fair system, each station should get about the same throughput.
In the download direction, it is mostly the device-under-test that is responsible for this behavior,
but in the upload direction, LANforge itself would be the source of most fairness issues
unless the device-under-test takes specific actions to ensure fairness.

CSV Data for Combined Received Megabytes, for entire 1 m run



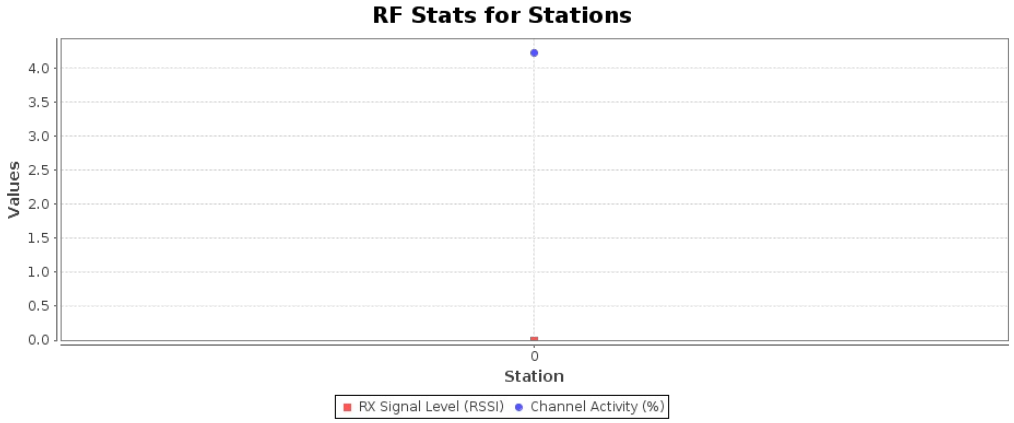

```
Maximum Stations Connected: 1
Stations NOT connected at this time: 0
Maximum Stations with IP Address: 1
Stations without IP at this time: 0
```

CSV Data for Station Maximums



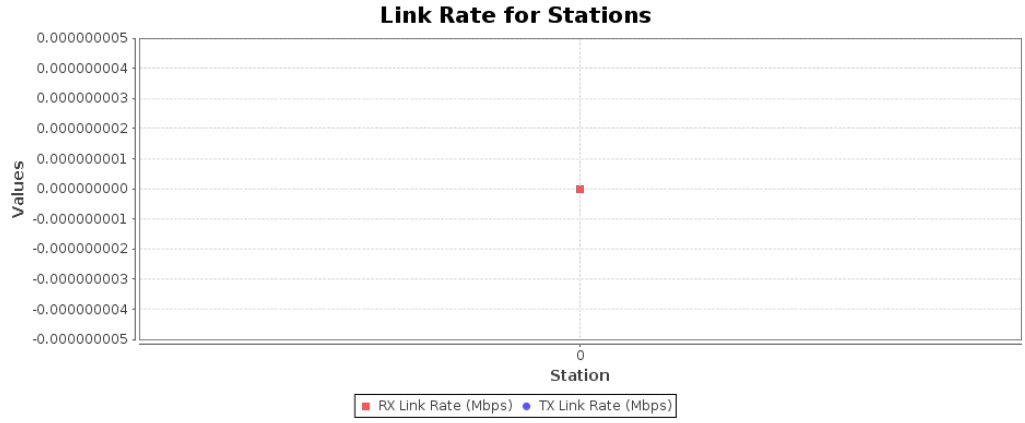
RF stats give an indication of how well how congested is the RF environment. Channel activity is what the wifi radio reports as the busy-time for the RF environment. It is expected that this be near 100% when LANforge is running at max speed, but at lower speeds, this should be a lower percentage unless the RF environment is busy with other systems.

CSV Data for RF Stats for Stations



Link rate stats give an indication of how well the rate-control is working. For rate-control, the 'RX' link rate corresponds to what the device-under-test is transmitting. If all of the stations are on the same radio, then the TX and RX encoding rates should be similar for all stations. If there is a definite pattern where some stations do not get good RX rate, then probably the device-under-test has rate-control problems. The TX rate is what LANforge is transmitting at.

CSV Data for Link Rate for Stations



Key Performance Indicators CSV

```
Scan Results for SSIDs used in this test.

BSS cc:19:a8:e6:cd:81(on wlan1)
        last seen: 409932.940s [boottime]
        TSF: 47177038 usec (0d, 00:00:47)
        freq: 5180
        beacon interval: 100 TUs
        capability: ESS Privacy RadioMeasure (0x1011)
        signal: -6.00 dBm
        last seen: 27377 ms ago
        Information elements from Probe Response frame:
        SSID: client_connectivity_al
        Supported rates: 6.0* 9.0 12.0 18.0 24.0* 36.0 48.0 54.0
        TPC report: TX power: 23 dBm
        RSN:     * Version: 1
                 * Group cipher: CCMP
                 * Pairwise ciphers: CCMP
                 * Authentication suites: PSK
                 * Capabilities: 16-PTKSA-RC 1-GTKSA-RC MFP-capable (0x008c)
        BSS Load:
                 * station count: 0
                 * channel utilisation: 2/255
                 * available admission capacity: 0 [*32us]
        RM enabled capabilities:
                Capabilities: 0x32 0x00 0x00 0x00 0x00
                        Neighbor Report
                        Beacon Passive Measurement
                        Beacon Active Measurement
                Nonoperating Channel Max Measurement Duration: 0
                Measurement Pilot Capability: 0
        HT capabilities:
                Capabilities: 0x1ad
                        RX LDPC
                        HT20
                        SM Power Save disabled
                        RX HT20 SGI
                        TX STBC
                        RX STBC 1-stream
                        Max AMSDU length: 3839 bytes
                        No DSSS/CCK HT40
                Maximum RX AMPDU length 65535 bytes (exponent: 0x003)
                Minimum RX AMPDU time spacing: 4 usec (0x05)
                HT RX MCS rate indexes supported: 0-31
                HT TX MCS rate indexes are undefined
        HT operation:
                 * primary channel: 36
                 * secondary channel offset: no secondary
                 * STA channel width: 20 MHz
                 * RIFS: 0
                 * HT protection: no
                 * non-GF present: 0
                 * OBSS non-GF present: 0
                 * dual beacon: 0
                 * dual CTS protection: 0
                 * STBC beacon: 0
                 * L-SIG TXOP Prot: 0
                 * PCO active: 0
                 * PCO phase: 0
        Extended capabilities:
                 * Extended Channel Switching
                 * BSS Transition
                 * Interworking
                 * QoS Map
                 * Operating Mode Notification
                 * Channel Schedule Management
                 * Channel Schedule Management
                 * 6
                 * Max Number Of MSDUs In A-MSDU is
        VHT capabilities:
                VHT Capabilities (0x0f8b69b1):
                        Max MPDU length: 7991
                        Supported Channel Width: neither 160 nor 80+80
                        RX LDPC
                        short GI (80 MHz)
```

```
                TX STBC
                SU Beamformer
                MU Beamformer
        VHT RX MCS set:
                1 streams: MCS 0-9
                2 streams: MCS 0-9
                3 streams: MCS 0-9
                4 streams: MCS 0-9
                5 streams: not supported
                6 streams: not supported
                7 streams: not supported
                8 streams: not supported
        VHT RX highest supported: 0 Mbps
        VHT TX MCS set:
                1 streams: MCS 0-9
                2 streams: MCS 0-9
                3 streams: MCS 0-9
                4 streams: MCS 0-9
                5 streams: not supported
                6 streams: not supported
                7 streams: not supported
                8 streams: not supported
        VHT TX highest supported: 0 Mbps
VHT operation:
         * channel width: 0 (20 or 40 MHz)
         * center freq segment 1: 36
         * center freq segment 2: 0
         * VHT basic MCS set: 0x0000
Transmit Power Envelope:
         * Local Maximum Transmit Power For 20 MHz: 25 dBm
HE capabilities:
        HE MAC Capabilities (0x000512081000):
                +HTC HE Supported
                TWT Responder
                BSR
                OM Control
                Maximum A-MPDU Length Exponent: 2
                OM Control UL MU Data Disable RX
        HE PHY Capabilities: (0x442002c00f438518000c00):
                HE40/HE80/5GHz
                242 tone RUs/5GHz
                LDPC Coding in Payload
                NDP with 4x HE-LTF and 3.2us GI
                Rx HE MU PPDU from Non-AP STA
                SU Beamformer
                SU Beamformee
                MU Beamformer
                Beamformee STS <= 80Mhz: 3
                Sounding Dimensions <= 80Mhz: 3
                Ng = 16 SU Feedback
                Codebook Size SU Feedback
                Triggered SU Beamforming Feedback
                PPE Threshold Present
                Max NC: 3
                TX 1024-QAM
                RX 1024-QAM
        HE RX MCS and NSS set <= 80 MHz
                1 streams: MCS 0-11
                2 streams: MCS 0-11
                3 streams: MCS 0-11
                4 streams: MCS 0-11
                5 streams: not supported
                6 streams: not supported
                7 streams: not supported
                8 streams: not supported
        HE TX MCS and NSS set <= 80 MHz
                1 streams: MCS 0-11
                2 streams: MCS 0-11
                3 streams: MCS 0-11
                4 streams: MCS 0-11
                5 streams: not supported
                6 streams: not supported
                7 streams: not supported
                8 streams: not supported
        PPE Threshold 0x7b 0x1c 0xc7 0x71 0x1c 0xc7 0x71 0x1c 0xc7 0x71 0x1c 0xc7 0x71
WPS:     * Version: 1.0
         * Wi-Fi Protected Setup State: 2 (Configured)
         * Response Type: 3 (AP)
         * UUID: adf4e098-1169-2efb-52cd-30431a11b6fd
         * Manufacturer: AlticeLabs
         * Model: AlticeLabs GR140DG
         * Model Number: GR140DG
         * Serial Number: 5054494EA8E6CD7F
         * Primary Device Type: 6-0050f204-1
         * Device name: FiberGateway
         * Config methods: Display
         * RF Bands: 0x3
         * Version2: 2.0
WMM:     * Parameter version 1
         * u-APSD
         * BE: CW 15-1023, AIFSN 3
         * BK: CW 15-1023, AIFSN 7
         * VI: CW 7-15, AIFSN 2, TXOP 3008 usec
         * VO: CW 3-7, AIFSN 2, TXOP 1504 usec
802.11u Advertisement:
        Query Response Info: 0x7f
                Query Response Length Limit: 127
                ANQP
```

Auxiliary files: wifi-cap-csv-data

META Information for Report for: Wifi Capacity Test