



427 West 12800 South  
Draper, UT 84020

## Test Report Certification

<b>FCC ID</b>	SWX-U6LR
<b>Equipment Under Test</b>	U6-LR
<b>Test Report Serial Number</b>	TR4211_01
<b>Date of Test(s)</b>	28 April, 1 May and 6 May 2020
<b>Report Issue Date</b>	11 May 2020

<b>Test Specification</b>	<b>Applicant</b>
47 CFR FCC Part 15, Subpart E	Ubiquiti Inc. 685 Third Avenue New York, NY 10019 U.S.A.



## Certification of Engineering Report

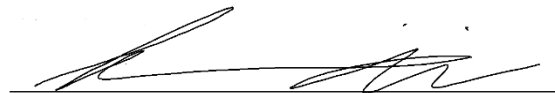
This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart E. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

<b>Applicant</b>	Ubiquiti Inc.
<b>Manufacturer</b>	Ubiquiti Inc.
<b>Brand Name</b>	UniFi
<b>Model Number</b>	U6-LR
<b>FCC ID</b>	SWX-U6LR
<b>ISED ID</b>	6545A-U6LR

On this 11<sup>th</sup> day of May 2020, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete and correct to the best of my knowledge and are made in good faith.

Although NVLAP has accredited the Unified Compliance Laboratory testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government.

Unified Compliance Laboratory



Written By: Alex Macon



Reviewed By: Joseph W. Jackson

<b>Revision History</b>		
<b>Revision</b>	<b>Description</b>	<b>Date</b>
01	Original Report Release	11 May 2020

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# 1 Client Information

## 1.1 Applicant

<b>Company</b>	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
<b>Contact Name</b>	Mark Feil
<b>Title</b>	Compliance Manager

## 1.2 Manufacturer

<b>Company</b>	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
<b>Contact Name</b>	Mark Feil
<b>Title</b>	Compliance Manager

## 2 Equipment Under Test (EUT)

### 2.1 Identification of EUT

<b>Brand Name</b>	UniFi
<b>Model Number</b>	U6-LR
<b>Serial Number</b>	NA
<b>Dimensions (cm)</b>	17.2      x    17.2      x    4.5

### 2.2 Description of EUT

U6-LR is a Wi-Fi 6 access point designed for wide-ranging wireless coverage while maintaining overall network capacity. It delivers an aggregate radio rate of up to 2.7 Gbps with 5 GHz (4x4 MU-MIMO and OFDMA) and 2.4 GHz (2x2 MIMO) radios. U6-LR uses a sophisticated antenna design with sideways amplification to offer excellent range when mounted horizontally. U6-LR combines its purpose-built antenna with powerful Wi-Fi 6 features like OFDMA, beamforming, and BSS coloring for reliable long-range wireless performance.

<b>Band</b>	<b>Modulation Bandwidth</b>	<b>Frequency (MHz)</b>
UNII-1	20 MHz	5180, 5200, 5220, 5240
	40 MHz	5190, 5230
	80 MHz	5210
UNII-3	20 MHz	5745, 5765, 5785, 5805, 5825
	40 MHz	5755, 5795,
	80 MHz	5775

This report covers the circuitry of the device subject to FCC Part 15, Subpart E. The circuitry of the device subject to FCC Part 15 Subpart B was found to be compliant and is covered under Unified Compliance Laboratory report.

## 2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

<b>Brand Name Model Number Serial Number</b>	<b>Description</b>	<b>Name of Interface Ports / Interface Cables</b>
BN: UniFi MN: U6-LR SN: NA	Long Range Access Point	See Section 2.4

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

## 2.4 Interface Ports on EUT

<b>Name of Ports</b>	<b>No. of Ports Fitted to EUT</b>	<b>Cable Description/Length</b>
POE	1	Ethernet/<3m

## 2.5 Operating Environment

<b>Power Supply</b>	120 VAC
<b>AC Mains Frequency</b>	60 Hz
<b>Temperature</b>	21.5 – 22.3 °C
<b>Humidity</b>	22.6 – 26.5 %
<b>Barometric Pressure</b>	1014 mBar

## 2.6 Operating Modes

The U6-LR was tested using test software in order to enable to constant transmission of over 98% All emission modes of 802.11 a/n/ac/ax were investigated.

## 2.7 EUT Exercise Software

Ubiquiti test software and firmware were used to control the transceivers of the EUT. (ART)

## 2.8 Block Diagram of Test Configuration

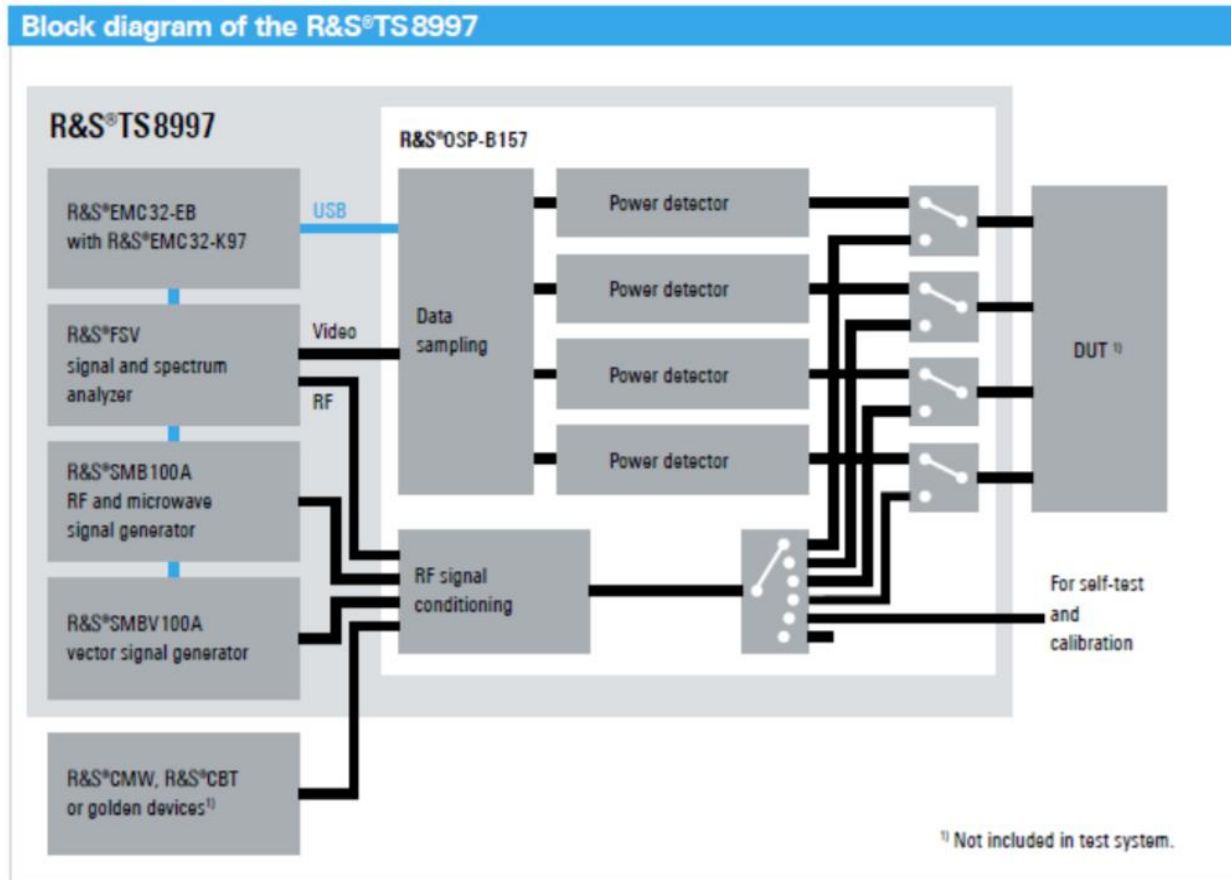


Diagram 1: Test Configuration Block Diagram

## 2.9 Modification Incorporated/Special Accessories on EUT

There were no modifications made to the EUT during testing to comply with the specification.

## 2.10 Deviation, Opinions Additional Information or Interpretations from Test Standard

There were no deviations, opinions, additional information or interpretations from the test specification.



### 3 Test Specification, Method and Procedures

#### 3.1 Test Specification

<b>Title</b>	47 CFR FCC Part 15, Subpart E, Section 15.407 Limits and methods of measurement of radio interference characteristics of Unlicensed National Information Infrastructure Devices
<b>Purpose of Test</b>	The tests were performed to demonstrate initial compliance

#### 3.2 Methods & Procedures

##### 3.2.1 47 CFR FCC Part 15 Section 15.407

See test standard for details.

#### 3.3 FCC Part 15, Subpart E

##### 3.3.1 Summary of Tests

FCC Section	ISED Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.407(a)	N/A	Antenna requirements	NA	Compliant
15.407(b)	RSS-Gen	Conducted Disturbance at Mains Port	0.15 to 30	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Bandwidth Requirement	5150 to 5250	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Peak Output Power	5150 to 5250	Compliant
15.407(b)	RSS-247 §6.2.2, §6.2.3	Antenna Conducted Spurious Emissions	0.009 to 40000	NA
15.407(b)	RSS-247 §6.2.2, §6.2.3	Radiated Spurious Emissions	0.009 to 40000	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Peak Power Spectral Density	5150 to 5250	Compliant
The testing was performed according to the procedures in ANSI C63.10-2013, KDB 789033 and 47 CFR Part 15.				

#### 3.4 Results

In the configuration tested, the EUT complied with the requirements of the specification.

#### 3.5 Test Location

Testing was performed at the Unified Compliance Laboratory 10-Meter chamber located at 427 West 12800 South, Draper, UT 84020. Unified Compliance Laboratory is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600241-0 which is effective until 30 June 2020. ISED No. 25346

## 4 Test Equipment

### 4.1 Conducted Emissions at Mains Ports

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	AFJ	FFT3010	UCL-2500	12/14/2018	4/17/2020
Transient Limiter	Com-Power	LIT-930A	UCL-2496	2/11/2019	2/11/2020
LISN	AFJ	LS16C/10	UCL-2512	12/14/2018	4/17/2020
Cat6 ISN	Teseq	ISN T8-Cat6	UCL-2971	2/11/2019	5/21/2020
ISN	Teseq	ISN T800	UCL-2974	2/19/2019	5/21/2020
LISN	Com-Power	LIN-120C	UCL-2612	2/11/2019	2/11/2020
AC Power Source	Laplace Instruments	AC1000A	UCL-2857	N/A	N/A
Monitoring Probe	Teseq	MD 4070A	UCL-2980	3/16/2019	5/21/2020
Test Software	UCL	Revision 1	UCL-3107	N/A	N/A

Table 1:List of equipment used for Conducted Emissions Testing at Mains Port

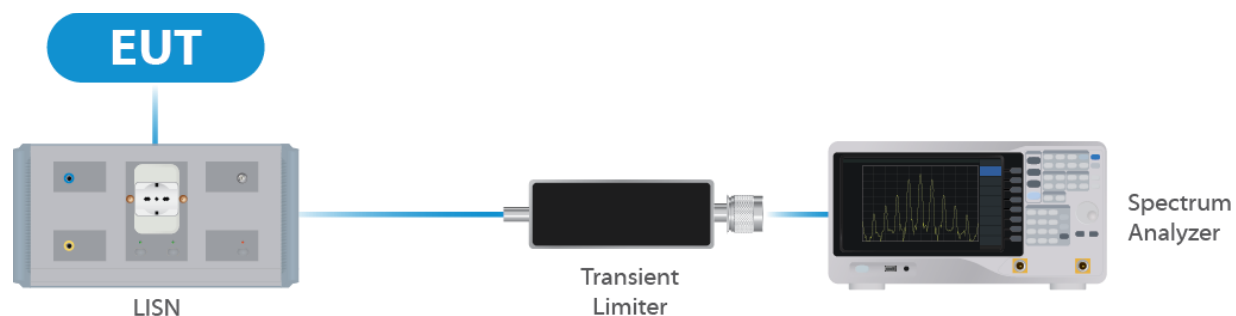


Figure 1: Conducted Emissions Test

### 4.2 Direct Connect at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	R&S	FSV40	UCL-2861	06/12/2019	06/12/2020
Signal Generator	R&S	SMB100A	UCL-2864	N/A	N/A
Vector Signal Generator	R&S	SMBV100A	UCL-2873	N/A	N/A
Switch Extension	R&S	OSP-B157WX	UCL-2867	06/13/2019	06/13/2020
Switch Extension	R&S	OSP-150W	UCL-2870	06/14/2019	06/14/2020

Table 2:List of equipment used for Direct Connect at the Antenna Port

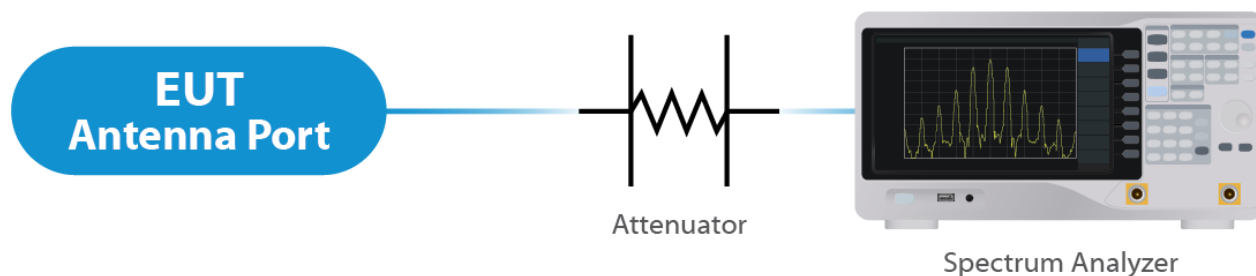
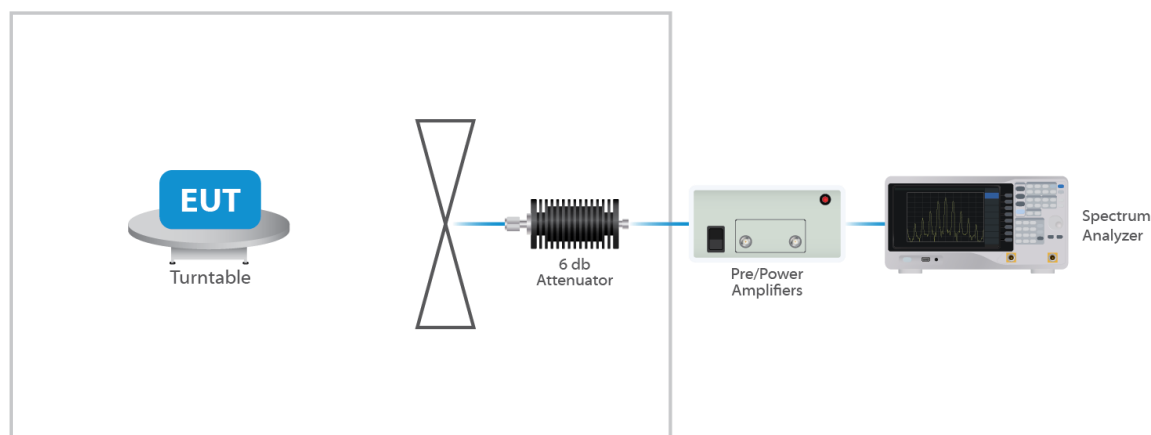


Figure 2: Direct Connect at the Antenna Port Test

### 4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	Keysight	N9038A	UCL-2778	11/26/2018	5/3/2020
Pre-Amplifier	Sonoma Instruments	310N	UCL-2889	9/13/2018	5/16/2020
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	4/11/2019	6/3/2020
Log Periodic	Scwarzbeck	STLP 9129	UCL-3068	4/11/2019	6/3/2020
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	UCL-2487	2/15/2017	4/16/2020
18 – 40 GHz Amplifier	Scwarzbeck	BBV 9721	UCL-2490	4/1/2019	4/1/2020
0.5 – 18 GHz Amplifier	Scwarzbeck	BBV 9718C	UCL-2493	4/1/2019	4/1/2020
Loop Antenna	Com-Power	AL-130R	UCL-2596	10/26/2018	4/23/2020
Test Software	UCL	Revision 1	UCL-3108	N/A	N/A

Table 3:List of equipment used for Radiated Emissions



**Figure 3: Radiated Emissions Test**

## 4.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Unified Compliance Laboratory personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request.

## 4.5 Measurement Uncertainty

Test	Uncertainty ( $\pm$ dB)	Confidence (%)
Conducted Emissions	1.44	95
Radiated Emissions (9 kHz to 30 MHz)	2.50	95
Radiated Emissions (30 MHz to 1 GHz)	3.95	95
Radiated Emissions (1 GHz to 18 GHz)	5.56	95
Radiated Emissions (18 GHz to 40 GHz)	5.16	95
<b>Direct Connect Tests</b>	<b>K Factor</b>	<b>Value</b>
Emissions Bandwidth	2	2.0%
Output Power	2	1.0 dB
Peak Power Spectral Density	2	1.3 dB
Band Edge	2	0.8 dB
Transmitter Spurious Emissions	2	1.8 dB

## 5 Test Results

### 5.1 §15.203 Antenna Requirements

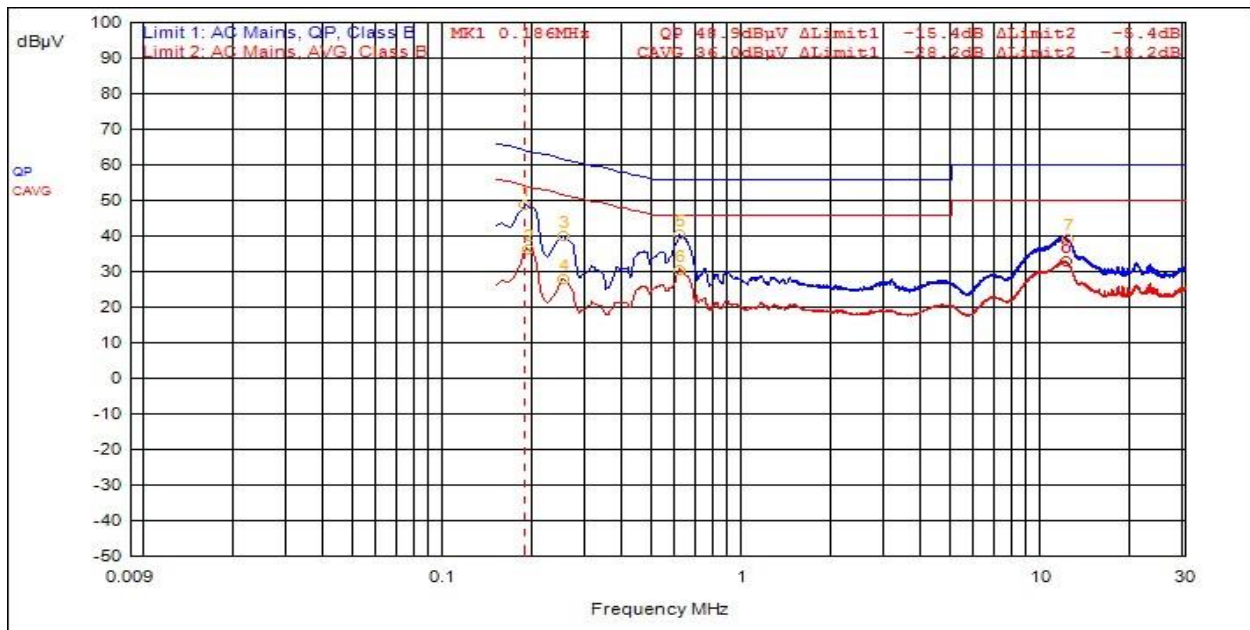
The EUT uses an integral antenna. The Maximum gain of the antenna is 7 dBi. The antenna is not user replaceable.

#### Results

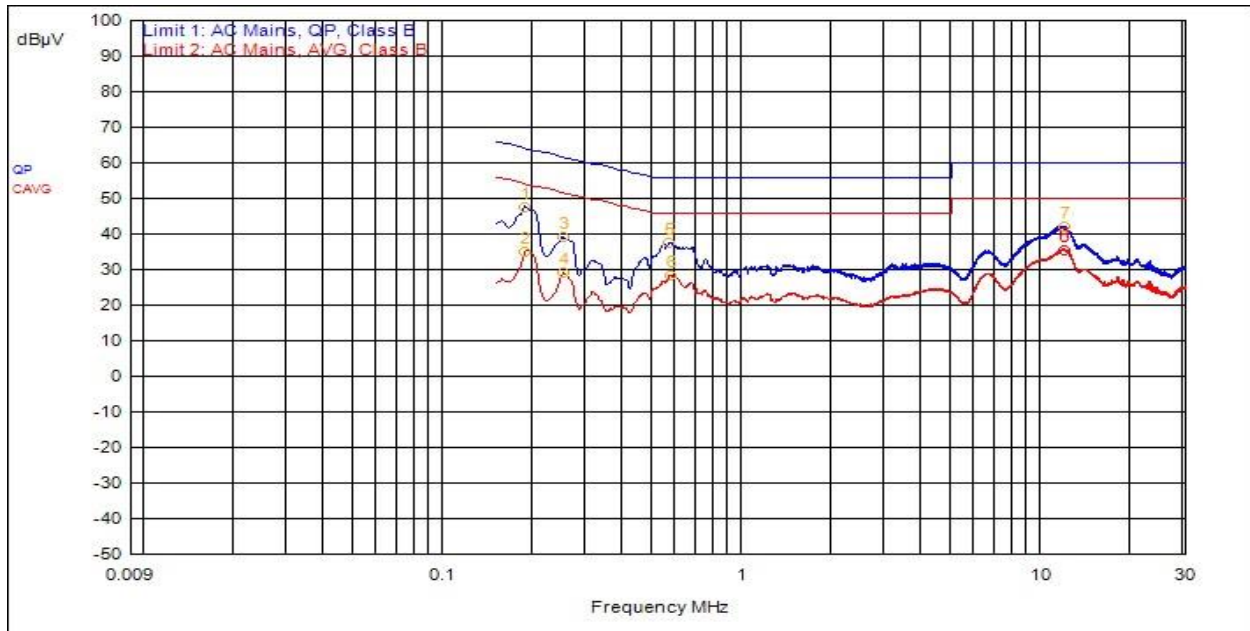
The EUT complied with the specification.

### 5.2 Conducted Emissions at Mains Ports Data

#### 5.2.1 Line



## 5.2.2 Neutral



### Result

The EUT complied with the specification limit.

## 5.3 §15.403(i) 26 dB Emissions Bandwidth

Nominal BW (MHz)	Frequency (MHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)
20	5180	19.2	19.8
20	5210	19.2	30.1
20	5240	19.1	19.8
40	5190	37.5	39.2
40	5210	37.8	39.2
80	5230	37.8	39.2

### Result

The 26 dB bandwidths are reported for information purposes. Please see Annex for all bandwidth measurements.

## 5.4 §15.403(a)(1) Maximum Average Output Power

The maximum average RF conducted output power measured for this device was 28.9 dBm or 776 mW. The limit is 30 dBm, or 1 Watt when using antennas with 23 dBi or less gain. The antenna has a gain of 7 dBi.

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power	Measured EIRP	Measured PSD
OFDM 20	5180	Mcs0	19	27.4	34.4	14.6
OFDM 20	5210	Mcs0	20	28.4	35.4	15.7
OFDM 20	5240	Mcs0	19	28.2	35.2	15.4
HT 20	5180	Mcs0	18	25.8	32.8	12.3
HT 20	5210	Mcs0	20.5	28.8	35.8	12.5
HT 20	5240	Mcs0	19.5	28.9	35.9	12.4
VHT 20	5180	Mcs0	18.5	26.7	33.7	13.6
VHT 20	5210	Mcs0	20.5	28.6	35.6	15.7
VHT 20	5240	Mcs0	19.5	28.7	35.7	15.5
HE 20	5180	Mcs0	19.5	27.1	34.1	13.7
HE 20	5210	Mcs0	21.5	28.9	35.9	15.5
HE 20	5240	Mcs0	20	28.3	35.3	14.7
HT 40	5190	Mcs0	16	24.5	31.5	11.8
HT 40	5210	Mcs0	18.5	27.1	34.1	12.2
HT 40	5230	Mcs0	18.5	28.4	35.4	11.9
VHT 40	5190	Mcs0	16.5	24.9	31.9	10.2
VHT 40	5210	Mcs0	19	27.6	34.6	13.6
VHT 40	5230	Mcs0	19	28.8	35.8	14.6
HE 40	5190	Mcs0	17	24.6	31.6	9.5
HE 40	5210	Mcs0	20	27.8	34.8	13.3
HE 40	5230	Mcs0	19.5	28.4	35.4	14.2
VHT 80	5210	Mcs0	16	24.5	31.5	7.3
HE 80	5210	Mcs0	16.5	24.3	31.3	6.6

### Result

In the configuration tested, the maximum average RF outpower was less than 29dBm therefore, the EUT complied with the requirements of the specification. See example measurement in the annex.

## 5.5 Radiated Spurious Emissions in the Restricted Bands of § 15.205

The EUT uses various power settings based on the channel in use. In order to reduce test time, the radiated spurious emissions at the lowest, middle, and highest channel were measured at the maximum power of TP 21.5, as this setting was found to be worst case for spurious emissions. Power was subsequently reduced during in-band and band edge testing. The band edge at the restricted band ending at 5150 MHz was measured using radiated measurement. All emissions modes were tested and the worse-case measurements are shown below.

### Result

All emissions in and outside of the restricted bands of § 15.205 met the limits specified in § 15.209; therefore, the EUT complies with the specification. See below for band edge plots

Frequency (MHZ)	Antenna Polarity	Detector	Correction Factor (dB)	Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
5208.44	V	A	-2.84	45.75	54.00	-8.25
11135.48	V	A	6.24	33.22	54.00	-20.78
14138.40	V	A	8.71	32.31	54.00	-21.69
15633.15	V	A	4.66	39.78	54.00	-14.22
5214.30	H	A	-2.83	42.87	54.00	-11.13
14251.22	H	A	8.58	32.44	54.00	-21.56
15636.10	H	A	4.65	38.11	54.00	-15.89
5208.44	V	P	-2.84	58.32	74.00	-15.68
11135.48	V	P	6.24	46.84	74.00	-27.16
14138.40	V	P	8.71	45.75	74.00	-28.25
15633.15	V	P	4.66	54.32	74.00	-19.68
5214.30	H	P	-2.83	53.36	74.00	-20.64
14251.22	H	P	8.58	47.99	74.00	-26.01
15636.10	H	P	4.65	53.18	74.00	-20.82

**Table 4: Transmitting on the Lowest Frequency 5180 MHz**



Frequency (MHZ)	Antenna Polarity	Detector	Correction Factor (dB)	Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
5178.37	V	A	-2.85	41.08	54.00	-12.92
10433.55	V	A	5.95	33.14	54.00	-20.86
14446.10	V	A	8.51	33.06	54.00	-20.94
15547.57	V	A	4.87	33.89	54.00	-20.11
11667.05	H	A	6.65	32.86	54.00	-21.14
14927.10	H	A	7.75	33.03	54.00	-20.97
5178.37	V	P	-2.85	52.73	74.00	-21.27
10433.55	V	P	5.95	47.95	74.00	-26.05
14446.10	V	P	8.51	47.40	74.00	-26.60
15547.57	V	P	4.87	48.20	74.00	-25.80
11667.05	H	P	6.65	46.81	74.00	-27.19
14927.10	H	P	7.75	47.55	74.00	-26.45

**Table 5: Transmitting on the Middle Frequency 5210 MHz**

Frequency (MHZ)	Antenna Polarity	Detector	Correction Factor (dB)	Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
5238.98	V	A	-2.80	47.36	54.00	-6.64
10563.42	V	A	6.04	32.58	54.00	-21.42
11682.38	V	A	6.64	33.33	54.00	-20.67
14265.33	V	A	8.56	32.88	54.00	-21.12
5238.54	H	A	-2.80	46.06	54.00	-7.94
10579.67	H	A	6.01	32.69	54.00	-21.31
14152.05	H	A	8.60	32.49	54.00	-21.51
15723.07	H	A	4.61	36.61	54.00	-17.39
5238.98	V	P	-2.80	59.54	74.00	-14.46
10563.42	V	P	6.04	46.04	74.00	-27.96
11682.38	V	P	6.64	46.56	74.00	-27.44
14265.33	V	P	8.56	47.99	74.00	-26.01
5238.54	H	P	-2.80	56.37	74.00	-17.63
10579.67	H	P	6.01	47.81	74.00	-26.19
14152.05	H	P	8.60	47.29	74.00	-26.71
15723.07	H	P	4.61	51.83	74.00	-22.17

**Table 6: Transmitting on the Highest Frequency 5240 MHz**



20MHz 5180 MHz Band Edge



40MHz 5190 MHz Band Edge



80MHz 5210 MHz Band Edge

## 5.6 §15.407(a) Maximum Power Spectral Density

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 16 dBm in any 1 MHz band during any time interval of continuous transmission.

Results of this testing are summarized.

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power	Measured EIRP	Measured PSD
OFDM 20	5180	Mcs0	19	27.4	34.4	14.6
OFDM 20	5210	Mcs0	20	28.4	35.4	15.7
OFDM 20	5240	Mcs0	19	28.2	35.2	15.4
HT 20	5180	Mcs0	18	25.8	32.8	12.3
HT 20	5210	Mcs0	20.5	28.8	35.8	12.5
HT 20	5240	Mcs0	19.5	28.9	35.9	12.4
VHT 20	5180	Mcs0	18.5	26.7	33.7	13.6
VHT 20	5210	Mcs0	20.5	28.6	35.6	15.7
VHT 20	5240	Mcs0	19.5	28.7	35.7	15.5
HE 20	5180	Mcs0	19.5	27.1	34.1	13.7
HE 20	5210	Mcs0	21.5	28.9	35.9	15.5
HE 20	5240	Mcs0	20	28.3	35.3	14.7
HT 40	5190	Mcs0	16	24.5	31.5	11.8
HT 40	5210	Mcs0	18.5	27.1	34.1	12.2
HT 40	5230	Mcs0	18.5	28.4	35.4	11.9
VHT 40	5190	Mcs0	16.5	24.9	31.9	10.2
VHT 40	5210	Mcs0	19	27.6	34.6	13.6
VHT 40	5230	Mcs0	19	28.8	35.8	14.6
HE 40	5190	Mcs0	17	24.6	31.6	9.5
HE 40	5210	Mcs0	20	27.8	34.8	13.3
HE 40	5230	Mcs0	19.5	28.4	35.4	14.2
VHT 80	5210	Mcs0	16	24.5	31.5	7.3
HE 80	5210	Mcs0	16.5	24.3	31.3	6.6

### Result

The maximum average power spectral density was less than the limit of 17dBm; therefore, the EUT complies with the specification.

-- End of Test Report --