



427 West 12800 South  
Draper, UT 84020

## Test Report Certification

<b>FCC ID</b>	SWX-GBE
<b>Equipment Under Test</b>	GigaBeam
<b>Test Report Serial Number</b>	TR4003_01
<b>Date of Test(s)</b>	16 February, 7 March and 17 March 2020
<b>Report Issue Date</b>	7 April 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.



**NVLAP LAB CODE 600241-0**

## 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>	Ubiquiti
<b>Model Number</b>	GigaBeam
<b>FCC ID</b>	SWX-GBE
<b>ISED ID</b>	6545A-GBE

On this 7<sup>th</sup> day of April 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	7 April 2020

## Table of Contents

1	Client Information.....	5
1.1	Applicant.....	5
1.2	Manufacturer.....	5
2	Equipment Under Test (EUT).....	6
2.1	Identification of EUT.....	6
2.2	Description of EUT.....	6
2.3	EUT and Support Equipment.....	7
2.4	Interface Ports on EUT.....	7
2.5	Operating Environment.....	7
2.6	Operating Modes.....	7
2.7	EUT Exercise Software.....	8
2.8	Block Diagram of Test Configuration.....	8
2.9	Modification Incorporated/Special Accessories on EUT.....	8
2.10	Deviation, Opinions Additional Information or Interpretations from Test Standard.....	8
3	Test Specification, Method and Procedures.....	9
3.1	Test Specification.....	9
3.2	Methods & Procedures.....	9
3.3	FCC Part 15, Subpart E.....	9
3.4	Results.....	9
3.5	Test Location.....	9
4	Test Equipment.....	10
4.1	Conducted Emissions at Mains Ports.....	10
4.2	Direct Connect at the Antenna Port Tests.....	10
4.3	Radiated Emissions.....	11
4.4	Equipment Calibration.....	12
4.5	Measurement Uncertainty.....	12
5	Test Results.....	13
5.1	§15.203 Antenna Requirements.....	13
5.2	Conducted Emissions at Mains Ports Data.....	13
5.3	§15.403(i) 26 dB Emissions Bandwidth.....	14
5.4	§15.403(a)(1) Maximum Average Output Power.....	15
5.5	§15.407(b) Spurious Emissions.....	16
5.6	§15.407(a) Maximum Power Spectral Density.....	19
5.7	DFS Requirement.....	20

## 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>	Ubiquiti
<b>Model Number</b>	GigaBeam
<b>Serial Number</b>	N/A
<b>Dimensions (cm)</b>	14      x      14      x      4.4

### 2.2 Description of EUT

The GBE is a fixed point-to-point or point to multiple point transceiver, intended for outdoor use, operating in the UNII-1, UNII-2A, UNII-2C and UNII-3 frequency bands. The GBE also operates in the 57 GHz to 66 GHz range. A Bluetooth LE transceiver is included for device management. An Ethernet port is used for data transfer and to provide power using a POE-24V-5X-HD PoE supply.

<b>Band</b>	<b>Modulation Bandwidth</b>	<b>Frequency (MHz)</b>
UNII-2A	20 MHz	5260, 5265, 5270, 5275, 5280, 5285, 5290, 5295, 5300, 5305, 5310, 5315, 5320, 5325, 5330
	40 MHz	5270, 5275, 5280, 5285, 5290, 5295, 5300, 5305, 5310, 5315, 5320
	80 MHz	5290, 5295, 5300
UNII-2C	20 MHz	5485, 5490, 5495, 5500, 5505, 5510, 5515, 5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605, 5610, 5615, 5620, 5625, 5630, 5635, 5640, 5645, 5650, 5655, 5660, 5665, 5670, 5675, 5680, 5685, 5690, 5695, 5700, 5705, 5710
	40 MHz	5500, 5505, 5510, 5515, 5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605, 5610, 5615, 5620, 5625, 5630, 5635, 5640, 5645, 5650, 5655, 5660, 5665, 5670, 5675, 5680, 5685, 5690, 5695, 5700
	80 MHz	5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605, 5610, 5615, 5620, 5625, 5630, 5635, 5640, 5645, 5650, 5655, 5660, 5665, 5670, 5675, 5680, 5685, 5690

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: GigaBeam MN: GBE (Note 1) SN: None	Point to Point / Point-to-Multi-Point Transceiver	See section 2.4
BN: Ubiquiti MN: POE-24V-5X-HD (Note 1) SN: None	PoE Power Supply	See section 2.4
BN: Dell MN: XPS SN: None	Laptop Computer	Ethernet Non-Shielded Cat 5e to PoE PSU

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-Data	1	Shielded Cat 5e cable/8 meters
AC (PoE Injector)	1	3 conductor power cord/80 cm
Lan (PoE Injector)	1	Un-Shielded Cat 5e cable/1 meters

## 2.5 Operating Environment

<b>Power Supply</b>	24 Volt POE Powered
<b>AC Mains Frequency</b>	50/60 Hz
<b>Temperature</b>	20.8 – 22.4 °C
<b>Humidity</b>	20.5 – 26.8 %
<b>Barometric Pressure</b>	1009 mBar

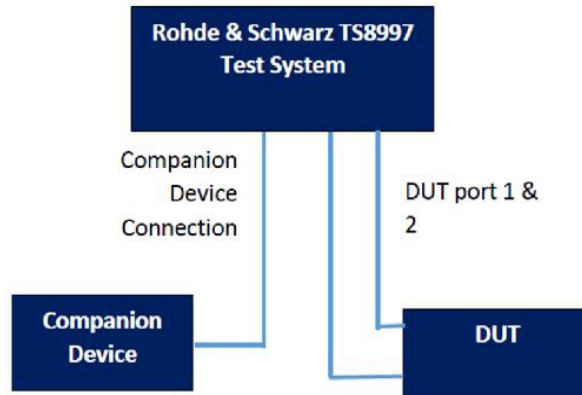
## 2.6 Operating Modes

The transmitter was tested while the UNII transceiver was in constant transmit mode at the upper, middle, and lower channels for each modulation bandwidth and frequency band. The Bluetooth LE transceiver active while testing the UNII transceiver to assess any transmitter interactions. All included tests, unless otherwise state, were perform while in PTP mode to ensure worst case results.

## 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	IC Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.407(a)	N/A	Antenna requirements	Structural Requirement	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 5875	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Peak Output Power	5150 to 5875	Compliant
15.407(b)	RSS-247 §6.2.2, §6.2.3	Antenna Conducted Spurious Emissions	0.009 to 40000	Compliant
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 5875	Compliant
15.407(h)	RSS-247 §6.3	DFS Requirements	5150 to 5875	Compliant
The testing was performed according to the procedures in ANSI C63.10-2013, KDB 789033, KDB 905462 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.

## 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
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
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

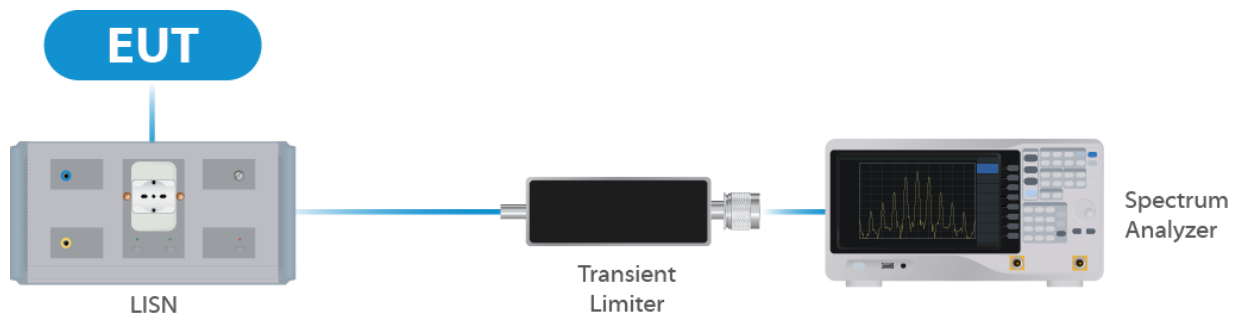


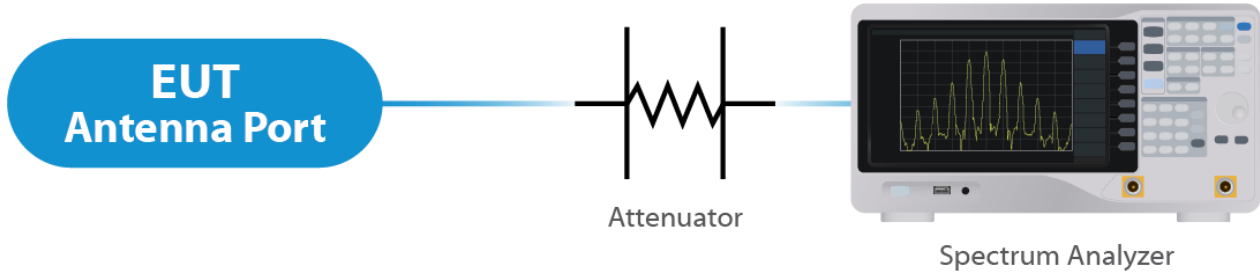
Figure 1: Conducted Emissions Test

### 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
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	Scwarzbeck	BBHA 9170	UCL-2487	2/15/2017	4/16/2020

Horn Antenna					
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

**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**

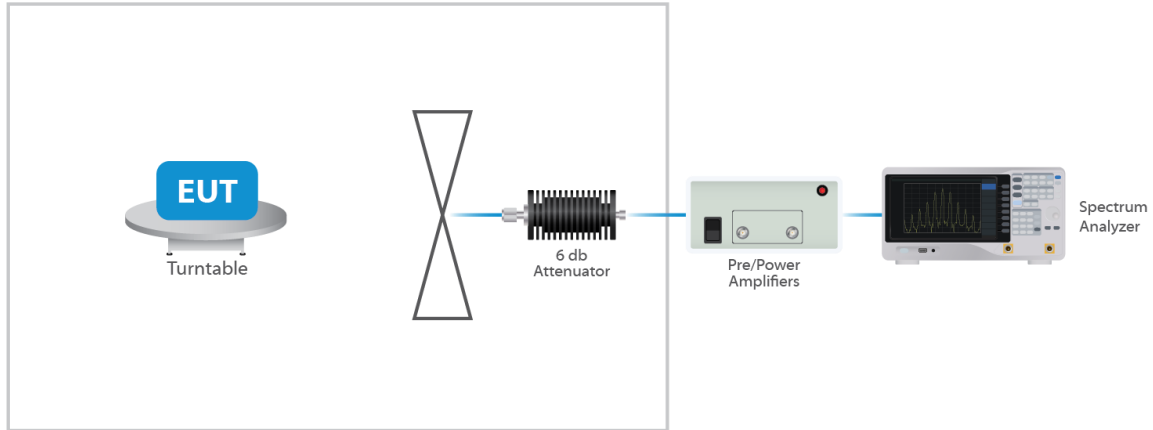


Figure 3: Radiated Emissions Test

#### 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

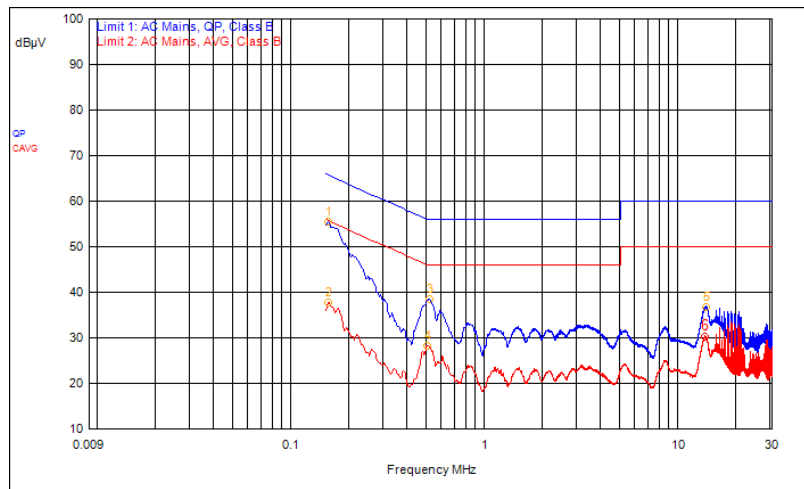
The EUT uses an internal antenna. The Maximum gain of the antenna is 10 dBi. The antenna is not user replaceable.

#### Results

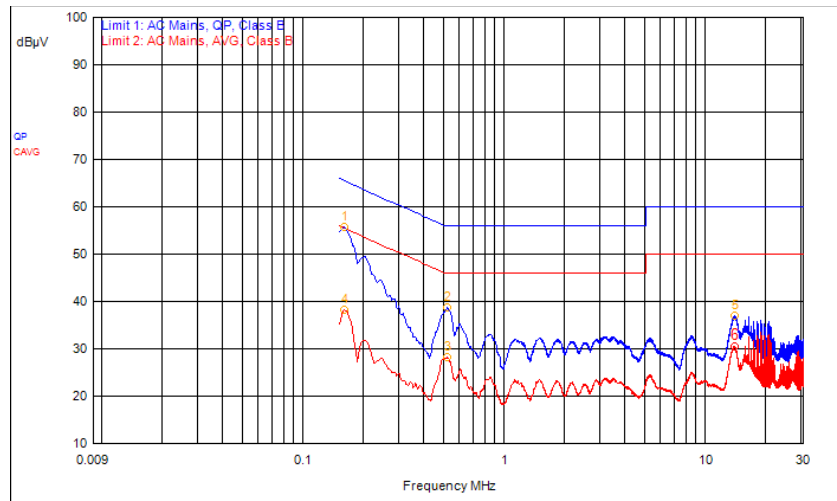
The EUT complied with the specification.

### 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 Bandwidth (MHz)	Frequency (MHz)	99% Bandwidth (MHz)	Emissions 26 dB Bandwidth (MHz)
20	5260	16.5	19.1
20	5300	16.5	19.0
20	5330	16.4	18.8
40	5270	35.25	38.12
40	5300	35.25	38.42
40	5320	35.5	38.27
80	5300	75.5	84.0
80	5300	76.0	84.0

Nominal Bandwidth (MHz)	Frequency (MHz)	99% Bandwidth (MHz)	Emissions 26 dB Bandwidth (MHz)
20	5485	16.5	18.8
20	5600	16.5	19.0
20	5710	16.5	18.9
40	5500	35.25	38.12
40	5600	35.5	38.27
40	5700	35.5	38.57
80	5520	75.5	82.0
80	5600	75.5	84.0
80	5690	76.0	82.0

#### 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 20.0 dBm or 100 mW. The limit is 24 dBm or 250 mW when using antennas with 6 dBi or less gain. The antenna has a maximum gain of 10 dBi. Therefore the conducted output power limit is 20 dBm.

### 5.4.1 UNII-2A

Nominal BW (MHz)	Frequency (MHz)	Data Rate	TP Setting	Measured EIRP	Conducted Output Power	PSD
20	5260	Mcs0	46	29.2	19.2	5.79
20	5300	Mcs0	46	28.0	18.0	4.41
20	5330	Mcs0	46	26.9	16.9	3.34
40	5270	Mcs0	52	28.3	18.3	4.08
40	5300	Mcs0	52	27.4	17.4	3.05
40	5320	Mcs0	52	26.6	16.6	2.27
80	5290	Mcs0	52	28.5	18.5	0.18
80	5300	Mcs0	52	28.1	18.1	-0.13

### 5.4.2 UNII-2C

Nominal BW (MHz)	Frequency (MHz)	Data Rate	TP Setting	Measured EIRP	Conducted Output Power	PSD
20	5485	Mcs0	52	29.5	19.5	5.933
20	5600	Mcs0	52	29.6	19.6	6.205
20	5710	Mcs0	52	30.0	20.0	6.653
40	5500	Mcs0	52	29.2	19.2	4.852
40	5600	Mcs0	52	29.2	19.2	5.052
40	5700	Mcs0	52	27.6	17.6	1.403
80	5520	Mcs0	48	27.1	17.1	-1.41
80	5600	Mcs0	54	29.9	19.9	1.77
80	5690	Mcs0	46	26.3	16.3	-1.462

### Result

In the configuration tested, the maximum average EIRP was less than 1 watt; therefore, the EUT complied with the requirements of the specification.

## 5.5 §15.407(b) Spurious Emissions

### 5.5.1 Conducted Spurious Emissions

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The graphs show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown below are plots with the EUT turned to the upper and lower channels with the antenna gain of 10 dBi accounted for. These demonstrate compliance with the provisions of this section at the band edges.

The emissions must remain below  $-27$  dBm EIRP.

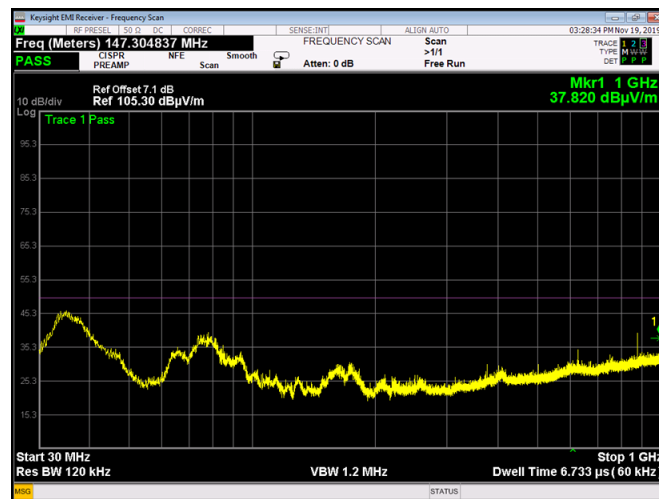
#### Result

Conducted spurious emissions were below  $-27$  dBm; therefore, the EUT complies with the specification. See Annex for results.

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

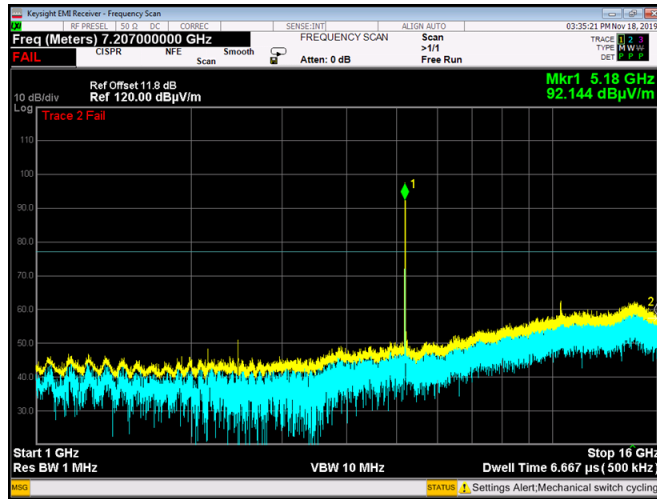
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emissions was investigated to measure any radiated emissions in the restricted bands. For frequencies above 18.0 GHz. The emissions in the restricted bands must meet the limits specified in § 15.209. Conducted measurement results are included in the Annex. Radiated data with the EUT transmitting into a load is included below. All emissions between the required frequencies were investigated, the following plots represent the worst case. The “fail” is the transmitted signal exceeding the spurious limit.

### 5.5.3 Vertical

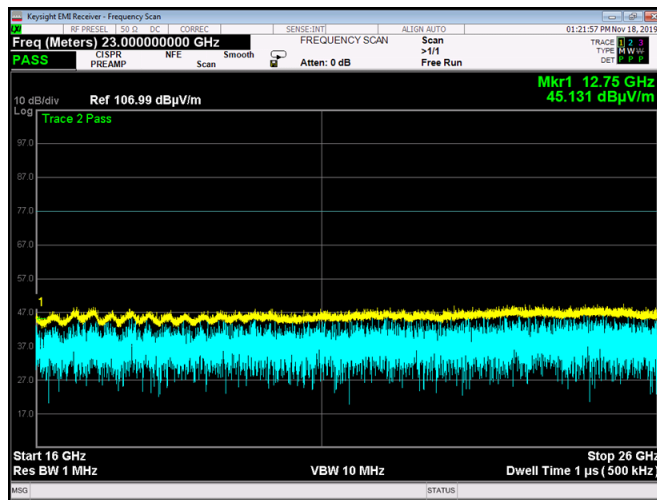


Graph 1: 30 MHz – 1 GHz



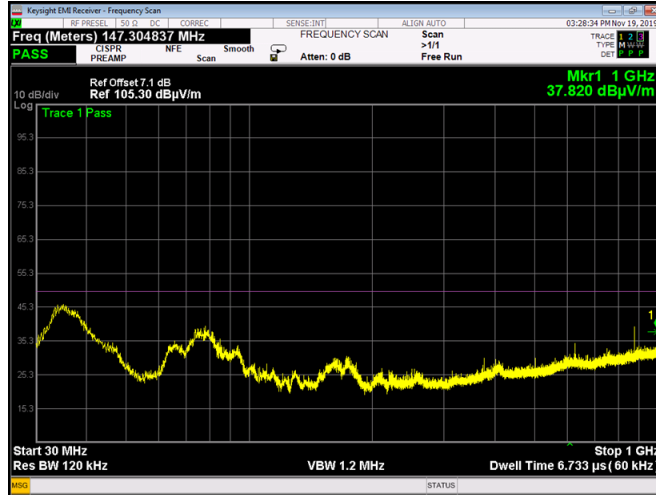


Graph 2: 1 GHz – 16 GHz

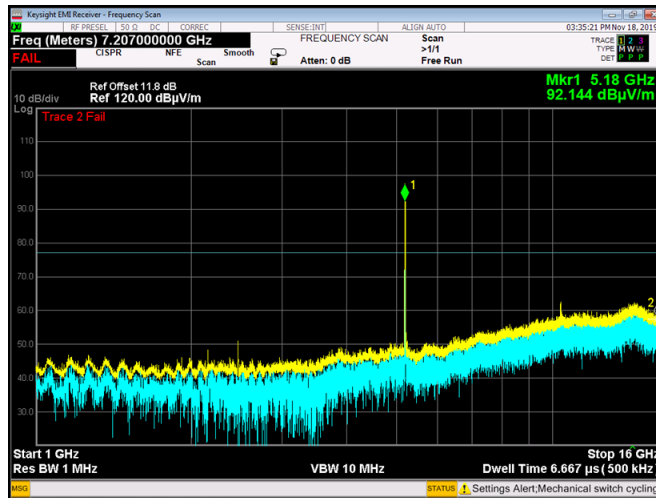


Graph 3: 16 GHz – 40 GHz

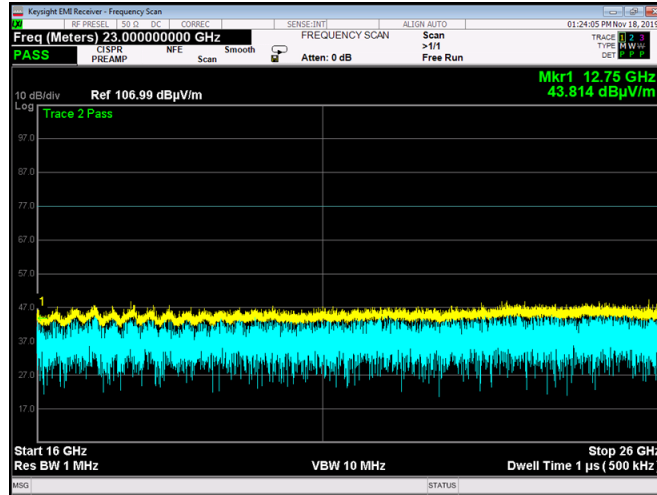
### 5.5.4 Horizontal



Graph 4: 30 MHz – 1 GHz



Graph 5: 1 GHz – 16 GHz



Graph 6: 16 GHz – 40 GHz

## 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 11 dBm in any 1 MHz band during any time interval of continuous transmission. Results of this testing are summarized. With a 10 dBi antenna, the conducted limit for power spectral density is -7 dBm.

### 5.6.1 UNII-2A

Nominal BW (MHz)	Frequency (MHz)	Data Rate	TP Setting	PSD
20	5260	Mcs0	46	5.79
20	5300	Mcs0	46	4.41
20	5330	Mcs0	46	3.34
40	5270	Mcs0	52	4.08
40	5300	Mcs0	52	3.05
40	5320	Mcs0	52	2.27
80	5290	Mcs0	52	0.18
80	5300	Mcs0	52	-0.13

### 5.6.2 UNII-2C

Nominal BW (MHz)	Frequency (MHz)	Data Rate	TP Setting	PSD
20	5485	Mcs0	52	5.933
20	5600	Mcs0	52	6.205
20	5710	Mcs0	52	6.653
40	5500	Mcs0	52	4.852
40	5600	Mcs0	52	5.052
40	5700	Mcs0	52	1.403
80	5520	Mcs0	48	-1.41
80	5600	Mcs0	54	1.77
80	5690	Mcs0	46	-1.462

#### Result

The maximum average power spectral density was less than the limit of 7 dBm; therefore, the EUT complies with the specification.

### 5.7 DFS Requirement

This product is a client without radar detection. The outcome of the required DFS tests is located in the DFS Annex. The product passes all required DFS tests for a client without radar detection.

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
<i>Non-Occupancy Period</i>	Yes	Not Required	Yes
<i>DFS Detection Threshold</i>	Yes	Not Required	Yes
<i>Channel Availability Check Time</i>	Yes	Not Required	Not Required
<i>U-NII Detection Bandwidth</i>	Yes	Not Required	Yes

Requirement	Operational Mode	
	Master Client Without Radar Detection	Client With Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not Required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not Required

-- End of Test Report --