UNIFIED COMPLIANCE LABORATORY

427 West 12800 South
Draper, UT 84020

Test Report

Certification

FCC ID	SWX-U6EXT
IC ID	6545A-U6EXT
Equipment Under Test	U6-Extender
Test Report Serial Number	TR4930_03
Date of Test(s)	3, 7, 8 and 13 July 2020
Report Issue Date	14 July 2020

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C	Ubiquiti Inc. 685 Third Avenue New York, NY 10019 U.S.A.

NVLAP TESTING ilac-MRA

NVLAP LAB CODE 600241-0

Certification of Engineering Report

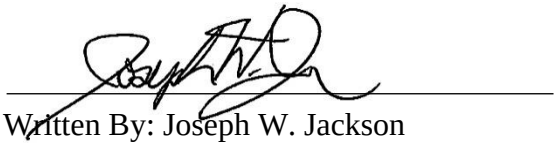
This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with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

Applicant	Ubiquiti Inc.
Manufacturer	Ubiquiti Inc.
Brand Name	UniFi
Model Number	U6-Extender
FCC ID	SWX-U6EXT
IC ID	6545A-U6EXT

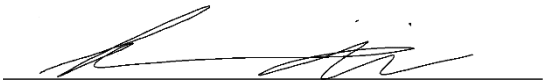
On this 14th day of July 2020, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete and correct to the best of my knowledge and are made in good faith.

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: Joseph W. Jackson



Reviewed By: Alex Macon

Revision History		
Revision	**Description**	**Date**
01	Original Report Release	14 July 2020
02	Amended Section 2.2, Added Conducted Disturbance at Main Port Data and Radiated Plots	21 July 2020
03	Added KDB 662911 Reference in Table 3.3.1	27 July 2020

Table of Contents

1 Client Information

1.1 Applicant

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

1.2 Manufacturer

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

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	UniFi
Model Number	U6-Extender
Serial Number	7483C29FF507
Dimensions (cm)	16.97 x 11.22 x 3.22

2.2 Description of EUT

The U6-Extender is to extend WiFi 6 coverage and to increase throughput in a home or office. The U6-Externder has 4x4 MIMO for the WiFi 6 technology. The U6-Extender is designed to be installed into any environment and plugs directly in a standard US wall outlet. The U6-Extender operates in the 2.4 MHz band and the 5 GHz band. The U6-Extender is for indoor use and is powered from mains power at 120 – 240 Volts, 50/60 Hz. The current version of firmware used in the U6-Extender is 1.0.

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

2.3 EUT and Support Equipment

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

Brand Name **Model Number** **Serial Number**	**Description**	**Name of Interface Ports / Interface Cables**
BN: UniFi MN: U6-Extender (Note 1) SN: 7483C29FF507	WiFi Access Point	See Section 2.4
BN: Dell MN: XPS 13 SN: N/A	Laptop PC	Shielded or Un-Shielded Cat 5e cable (Note 2)

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

Name of Ports	No. of Ports Fitted to EUT	Cable Description/Length
AC Power	1	N/A

2.5 Operating Environment

Power Supply	120/240 VAC
AC Mains Frequency	50/60 Hz
Temperature	23.7 °C
Humidity	27.3 %
Barometric Pressure	1007 mBar

2.6 Operating Modes

The U6-Extender was tested using test software in order to enable to constant transmission of over 98% All emission modes of 802.11 b/g/n 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

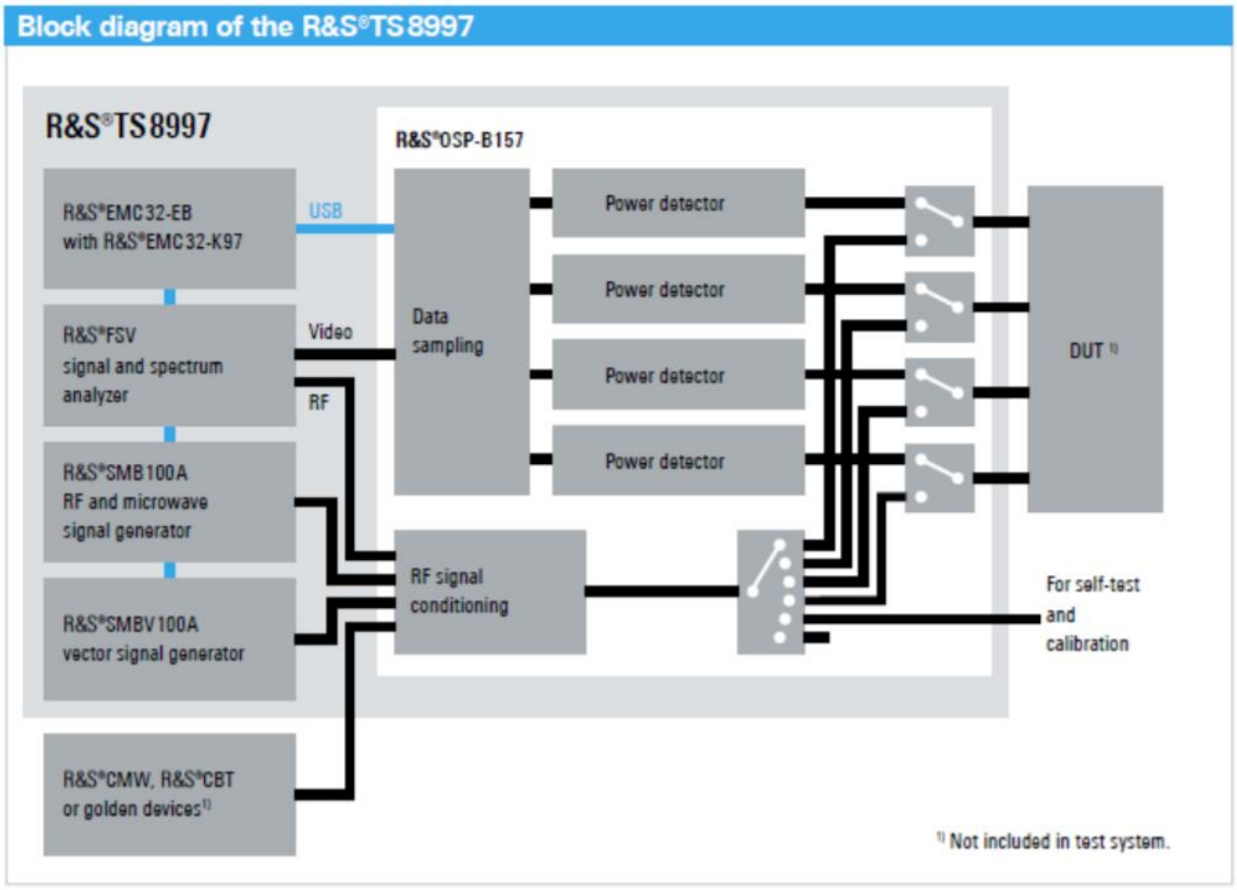


Diagram 1: Test Configuration Block Diagram

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

Title	47 CFR FCC Part 15, Subpart C 15.203, 15.207 and 15.247 Limits and methods of measurement of radio interference characteristics of radio frequency devices.
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 47 CFR FCC Part 15 Section 15.203

See test standard for details.

3.2.2 47 CFR FCC Part 15 Section 15.207

See test standard for details.

3.2.3 47 CFR FCC Part 15 Section 15.247

See test standard for details.

3.3 FCC Part 15, Subpart C

3.3.1 Summary of Tests

FCC Section	ISED Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.203	N/A	Antenna requirements	Structural Requirement	Compliant
15.207	RSS-Gen	Conducted Disturbance at Mains Port	0.15 to 30	Compliant
15.247(a)	RSS-247 § 5.2	Bandwidth Requirement	2400 to 2483.5	Compliant
15.247(b)	RSS-247 § 5.4	Peak Output Power	2400 to 2483.5	Compliant
N/A15.247(d)	RSS-247 § 5.4	Antenna Conducted Spurious Emissions	0.009 to 25000	Compliant
15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 25000	Compliant
15.247(e)	RSS-247 § 5.2	Peak Power Spectral Density	2400 to 2483.5	Compliant
The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074 and 47 CFR Part 15. The conducted power was summed per FCC KDB 662911 in sections 5.4 and 5.6.				

3.4 Results

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

3.5 Test Location

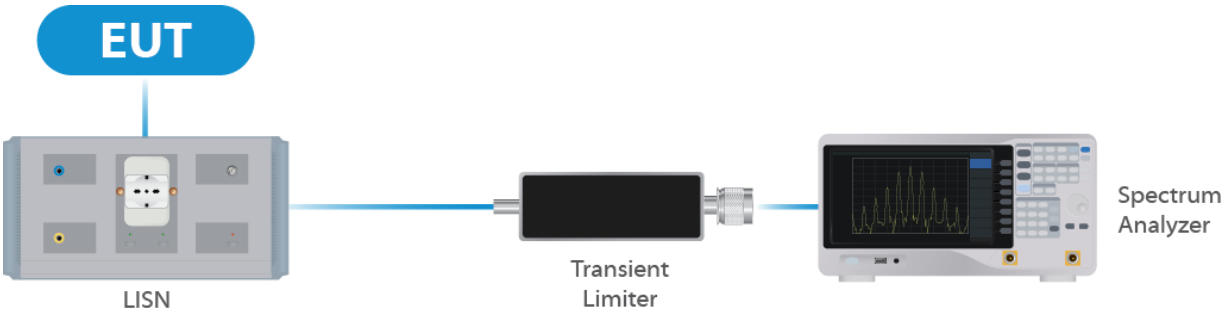
Testing was performed at the Unified Compliance Laboratory #10-Meter# chamber located at 427 West 12800 South, Draper, UT 84020. Unified Compliance Laboratory is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600241-0 which is effective until 30 June 2021. This site has also been registered with Innovations, Science and Economic Development (ISED) department and was accepted under Appendix B, Phase 1 procedures of the APEC Tel MRA for Canadian recognition. ISED No.: 25346, effective until July 31, 2020. Unified Compliance Laboratory has been assigned Conformity Assessment Number US0223 by ISED.

4 Test Equipment

4.1 Conducted Emissions at Main 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	8/17/2020
LISN	AFJ	LS16C/10	UCL-2512	5/26/2020	5/26/2021
AC Power Source	Laplace Instruments	AC1000A	UCL-2857	N/A	N/A
Monitoring Probe	Teseq	MD 4070A	UCL-2980	3/16/2019	7/21/2020
Test Software	UCL	Revision 1	UCL-3107	N/A	N/A

Table 1: List of equipment used for Direct Connect at the Antenna Port



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	08/12/2020
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	08/13/2020
Switch Extension	R&S	OSP-150W	UCL-2870	06/14/2019	08/14/2020

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

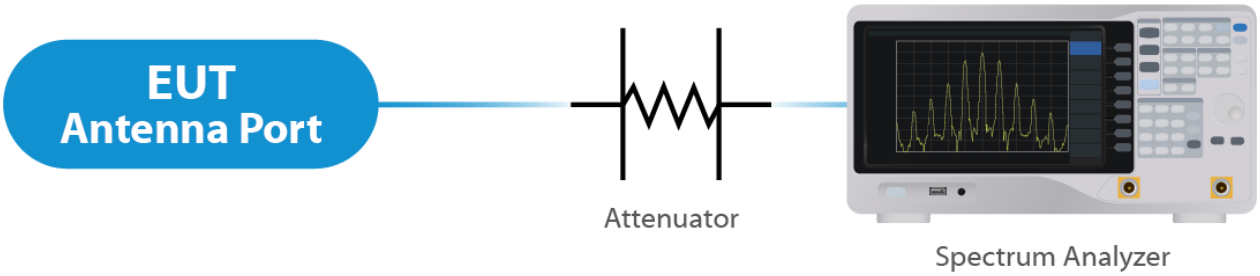


Figure 1: Direct Connect at the Antenna Port Test

4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	R&S	FSV40	UCL-2861	06/12/2019	08/12/2020
Pre-Amplifier	Sonoma Instruments	310N	UCL-2889	9/13/2018	9/16/2020
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	4/11/2019	8/3/2020
Log Periodic	Scwarzbeck	STLP 9129	UCL-3068	4/11/2019	8/3/2020
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	UCL-2487	2/15/2017	8/16/2020
18 – 40 GHz Amplifier	Scwarzbeck	BBV 9721	UCL-2490	4/1/2019	8/1/2020
0.5 – 18 GHz Amplifier	Scwarzbeck	BBV 9718C	UCL-2493	4/1/2019	8/1/2020
Loop Antenna	Com-Power	AL-130R	UCL-2596	10/26/2018	8/23/2020
Test Software	UCL	Revision 1	UCL-3108	N/A	N/A

Table 3: List of equipment used for Radiated Emissions

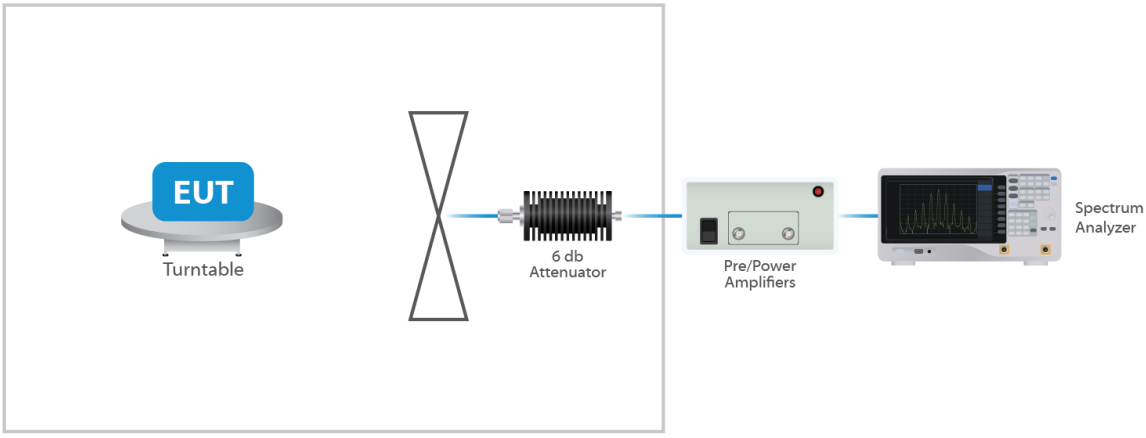


Figure 2: Radiated Emissions Test

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 (± 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
Direct Connect Tests	**K Factor**	**Value**
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 5.8 dBi. The antenna is not user replaceable.

Results

The EUT complied with the specification

5.2 §15.207 Conducted Emissions at Mains Ports Data

5.2.1 Hot Lead

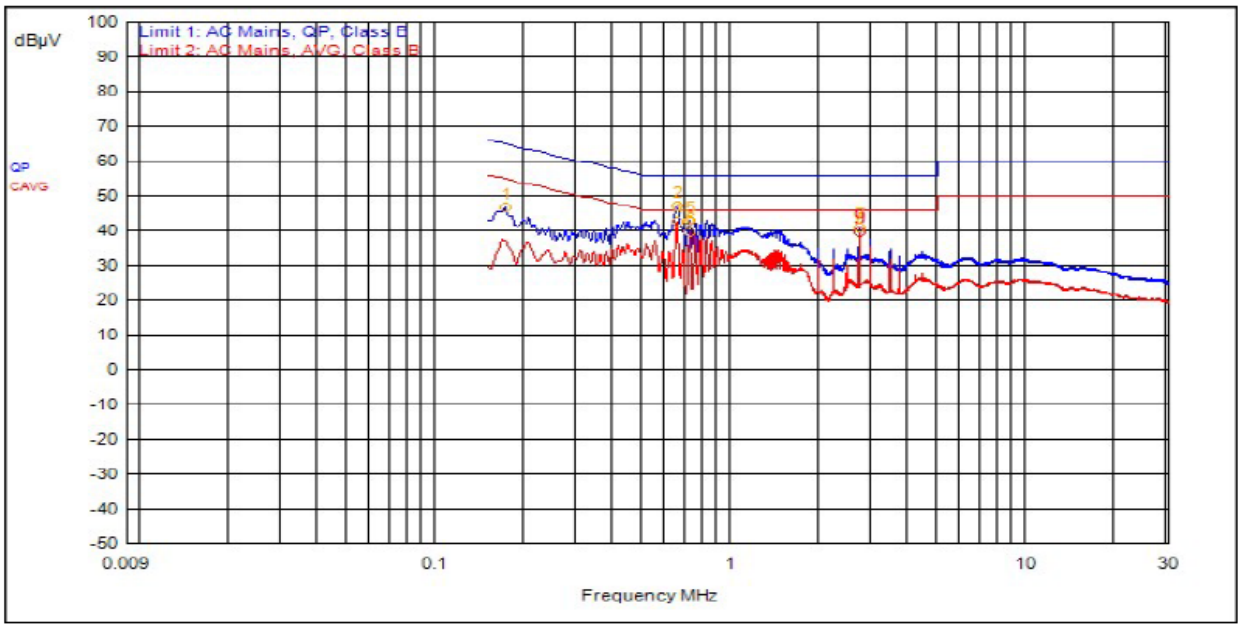
Frequency (MHZ)	Detector	Receiver Measured Level (dBµV)	Correction Factor (dB/m)	Corrected Receiver Level (dBµV)	Limit Class B Limit (dBµV)	Margin (dB)
0.651	Average (Note 1)	30.3	12.3	42.60	46.0	- 3.40
2.69	Average (Note 1)	27.3	12.3	39.60	46.0	- 6.40
0.717	Average (Note 1)	27.2	12.3	39.50	46.0	- 6.50
0.651	Quasi-Peak (Note 1)	34.7	12.3	47.00	56.0	- 9.00
0.717	Quasi-Peak (Note 1)	30.8	12.3	43.10	56.0	- 12.90
2.69	Quasi-Peak (Note 1)	28.6	12.3	40.90	56.0	- 15.10
0.171	Quasi-Peak (Note 1)	34.2	12.3	46.50	64.9	- 18.40

Note 1: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.
Note 2: The limits of CISPR 32/22 were applied

Sample Field Strength Calculation

Correction Factor = LISN Insertion Loss + Cable Insertion Loss + Transient Limiter Insertion Loss

Conducted Emissions Amplitude = Receiver Reading + Correction Factor



5.2.2 Neutral Lead

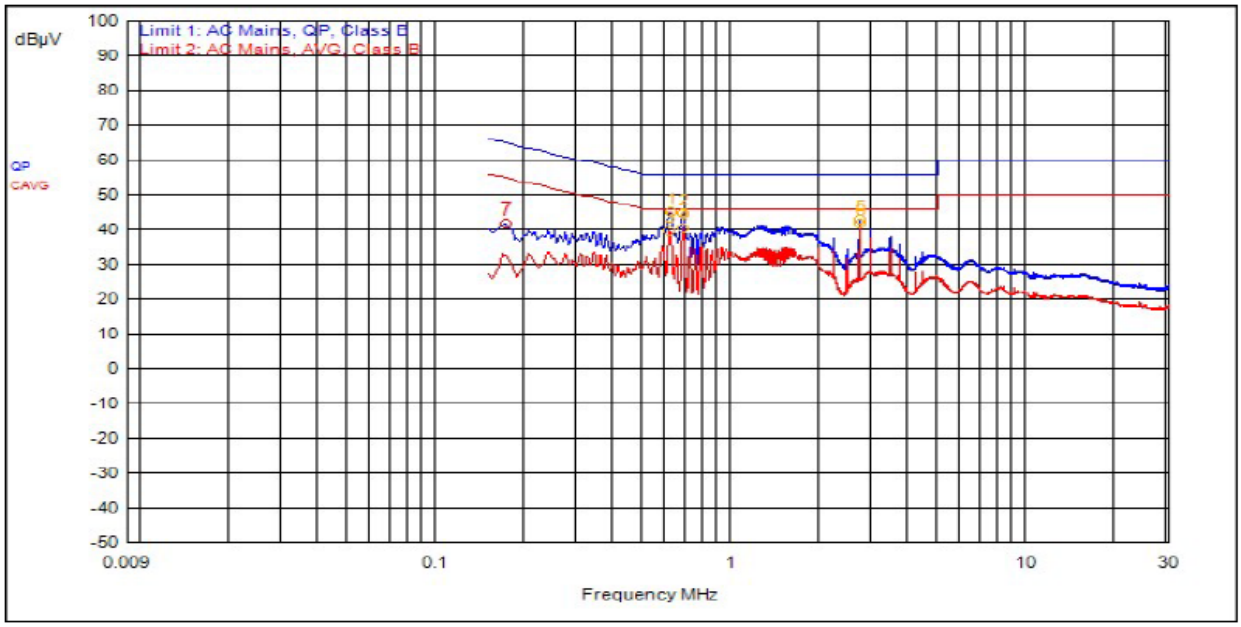
Frequency (MHZ)	Detector	Receiver Measured Level (dBµV)	Correction Factor (dB/m)	Corrected Receiver Level (dBµV)	Limit Class B Limit (dBµV)	Margin (dB)
2.69	Average (Note 1)	29.5	12.3	41.80	46.0	- 4.20
0.681	Average (Note 1)	28.3	12.3	40.60	46.0	- 5.40
0.615	Average (Note 1)	27.4	12.3	39.70	46.0	- 6.30
0.618	Quasi-Peak (Note 1)	32.5	12.3	44.80	56.0	- 11.20
0.681	Quasi-Peak (Note 1)	32.1	12.3	44.40	56.0	- 11.60
2.69	Quasi-Peak (Note 1)	30.5	12.3	42.80	56.0	- 13.20
0.171	Quasi-Peak (Note 1)	29.6	12.2	41.80	64.9	- 23.10

Note 1: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.
Note 2: The limits of CISPR 32/22 were applied

Sample Field Strength Calculation

Correction Factor = LISN Insertion Loss + Cable Insertion Loss + Transient Limiter Insertion Loss

Conducted Emissions Amplitude = Receiver Reading + Correction Factor



5.3 §15.247(a)(2) Emissions Bandwidth

Mode	Frequency (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth (MHz)
b	2412	14.4	10.15
	2437	14.7	9.75
	2462	14.5	10.15
g	2412	16.4	16.40
	2437	19.3	16.35
	2462	16.4	16.35
n 20	2412	17.6	17.40
	2437	18.9	17.65
	2462	17.6	17.00
n 40	2422	35.75	35.15
	2437	37.25	35.75
	2452	36.25	34.55

Result

In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots in the associated annex report).

5.4 §15.247(b)(3) Maximum Average Output Power

The maximum average RF conducted output power measured for this device was 23.5 dBm or 223.87 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antenna has a gain of 5.8 dBi.

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power	Measured EIRP
CCK 20	2412	Mcs0	14.5	19.6	25.4
	2417	Mcs0	15.5	20.6	26.4
	2422	Mcs0	16	21.2	27.0
	2437	Mcs0	16	21.1	26.9
	2452	Mcs0	16	21.1	26.9
	2457	Mcs0	15.5	20.6	26.4
	2462	Mcs0	15	20.0	25.8
OFDM 20	2412	Mcs0	10	15.3	21.1
	2417	Mcs0	13	18.2	24.0
	2422	Mcs0	16	21.0	26.8
	2427	Mcs0	21.5	23.5	29.3
	2437	Mcs0	21.5	23.3	29.1
	2447	Mcs0	21.5	23.1	28.9
	2452	Mcs0	16	21.0	26.8
	2457	Mcs0	14.5	19.6	25.4
	2462	Mcs0	12	17.2	23.0
HT 20	2412	Mcs0	9.5	14.7	20.5
	2417	Mcs0	13	18.0	23.8
	2422	Mcs0	15.5	20.6	26.4
	2427	Mcs0	21.5	23.5	29.3
	2437	Mcs0	21.5	23.2	29.0
	2447	Mcs0	21.5	22.9	28.7
	2452	Mcs0	15	20.0	25.8
	2457	Mcs0	13.5	18.5	24.3
	2462	Mcs0	10	15.2	21.0
HT 40	2422	Mcs0	6.5	11.8	17.6
	2437	Mcs0	11.5	17.0	22.8
	2452	Mcs0	8	13.4	19.2

Result

In the configuration tested, the maximum average RF output power was less than 1 watt; therefore, the EUT complied with the requirements of the specification. See example measurement within annex.

5.5 §15.247(d) 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 table 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 tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges.

The emissions must be attenuated 30 dB below the highest power spectral density level measured within the authorized band as measured with a 100 kHz RBW.

Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification. All results are within the associated annex.

5.5.2 Radiated Spurious Emissions in the Restricted Bands of §15.205

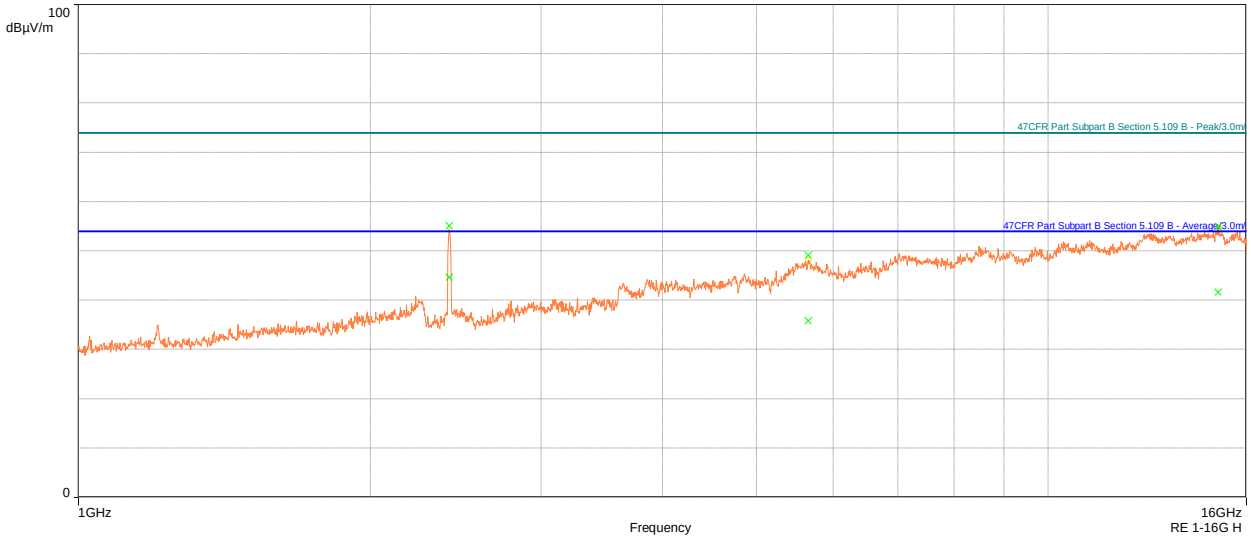
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emissions was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emissions that fell into the restricted bands of §15.205. The tables show the worst-case emissions measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limits. The emissions in the restricted bans must meet the limits specified in §15.209. Tabular data for each of the spurious emissions is shown below for each of the units. Plots of the band edges are also shown.

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

Frequency (MHZ)	Detector	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
31.76	QuasiPeak	Vertical	32.19	-11.21	20.98	30.0	- 9.02
228.30	QuasiPeak	Vertical	30.56	-12.58	17.98	30.0	- 12.02
31.86	QuasiPeak	Horizontal	33.97	-11.19	22.78	30.0	- 7.22
219.72	QuasiPeak	Horizontal	26.72	-13.23	13.49	30.0	- 16.51
226.83	QuasiPeak	Horizontal	29.72	-12.68	17.04	30.0	- 12.96
229.26	QuasiPeak	Horizontal	31.17	-12.53	18.64	30.0	- 11.36
778.70	QuasiPeak	Horizontal	26.73	-1.48	25.25	37.0	- 11.75
10934	Average	Vertical	27.21	12.22	39.43	54.0	- 14.57
14922	Average	Vertical	26.47	15.12	41.59	54.0	- 12.41
5657.3	Average	Horizontal	29.14	6.69	35.83	74.0	- 38.17
14960	Average	Horizontal	26.53	15.11	41.64	74.0	- 74.00
10934	Peak	Vertical	40.95	12.22	53.17	74.0	- 20.83
14922	Peak	Vertical	40.92	15.12	56.04	74.0	- 17.96
5657.3	Peak	Horizontal	42.45	6.69	49.14	74.0	- 24.86
14960	Peak	Horizontal	39.84	15.11	54.95	74.0	- 19.05
Note 1: No significant emissions were noted from 16 – 40 GHz							

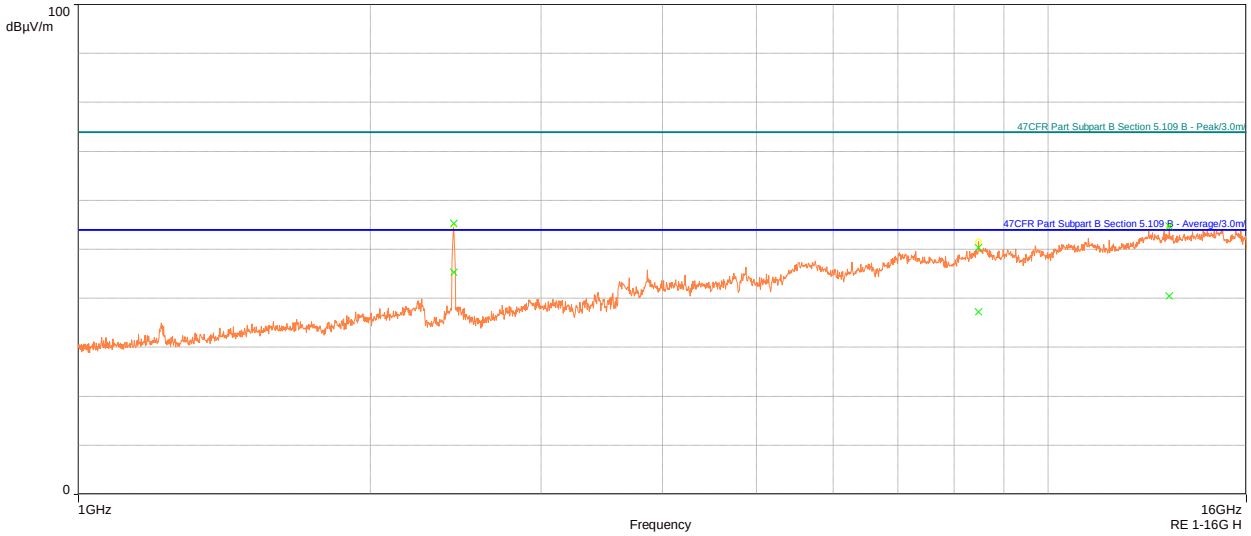
Table 4: Transmitting at the Lowest Frequency



Frequency (MHZ)	Detector	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
14526	Average	Vertical	25.99	15.67	41.66	54.0	- 12.34
8470.4	Average	Horizontal	26.78	10.50	37.28	54.0	- 16.72
13318	Average	Horizontal	26.10	14.43	40.53	54.0	- 13.47

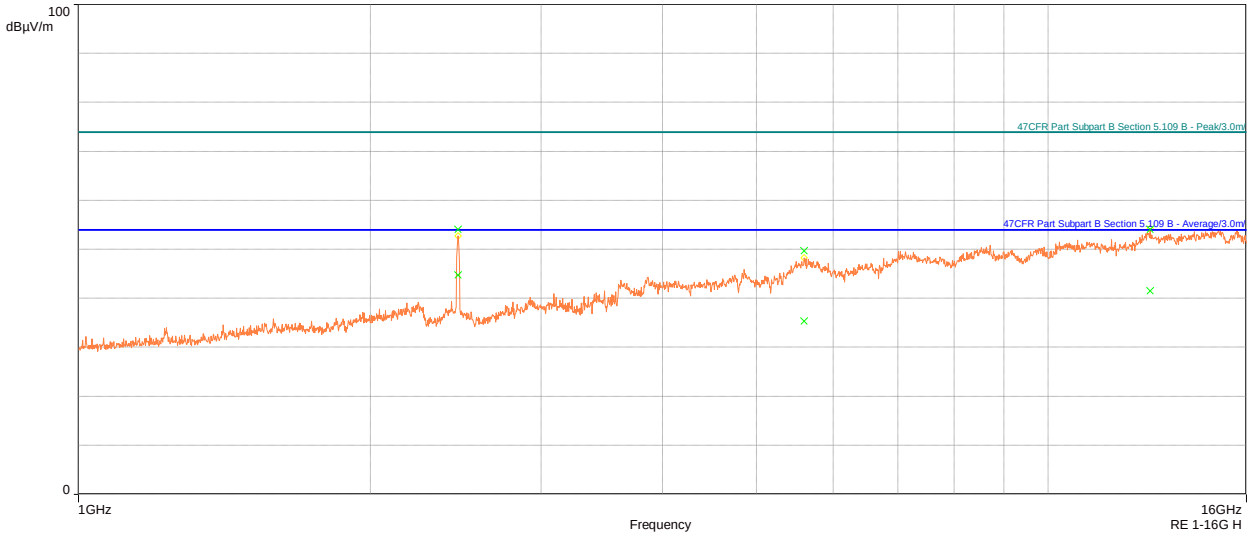
14526	Peak	Vertical	39.25	15.67	54.92	74.0	- 19.08
8470.4	Peak	Horizontal	39.88	10.50	50.38	74.0	- 23.62
13318	Peak	Horizontal	40.35	14.43	54.78	74.0	- 19.22
Note 1: Change in Channel did not affect the measurements in the 30 – 1000 MHz range Note 2: No significant emissions were noted from 16 – 40 GHz							

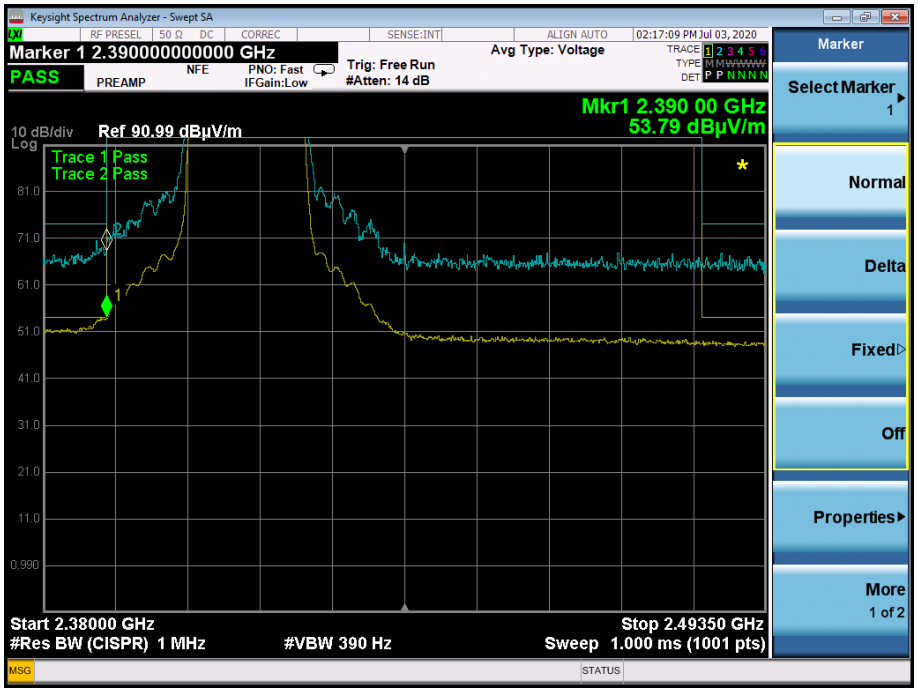
Table 5:Transmitting at the Middle Frequency



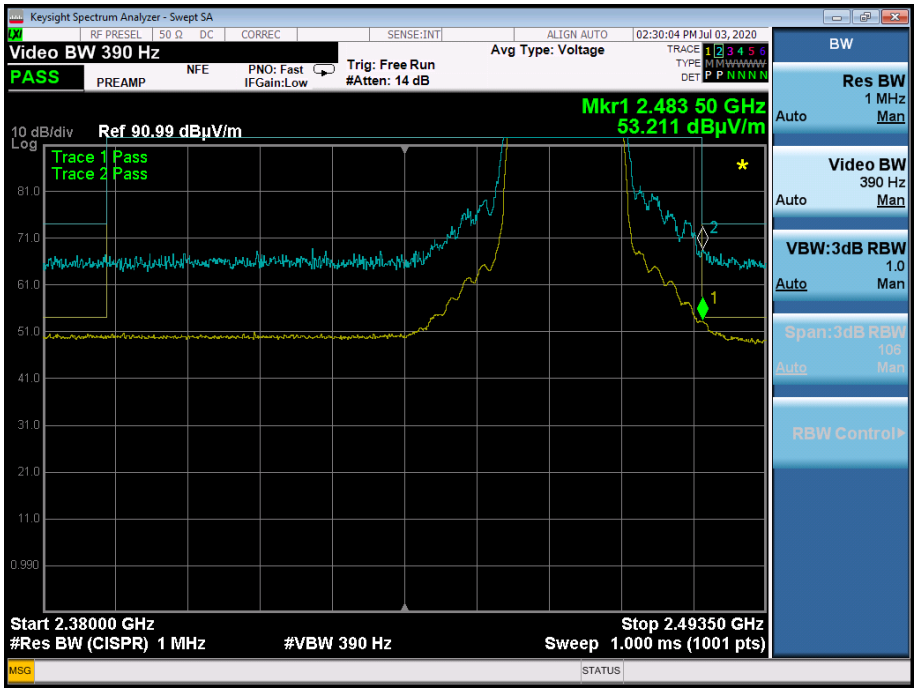
Frequency (MHZ)	Detector	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5651.8	Average	Vertical	28.95	6.77	35.72	54.0	- 18.28
15068	Average	Vertical	27.03	15.10	42.13	54.0	- 11.87
5598.2	Average	Horizontal	28.81	6.56	35.37	54.0	- 18.63
12735	Average	Horizontal	26.58	14.93	41.51	54.0	- 12.49
5651.8	Peak	Vertical	42.47	6.77	49.24	74.0	- 24.76
15068	Peak	Vertical	39.84	15.10	54.94	74.0	- 19.06
5598.2	Peak	Horizontal	43.20	6.56	49.76	74.0	- 24.24
12735	Peak	Horizontal	39.15	14.93	54.08	74.0	- 19.92
Note 1: Change in Channel did not affect the measurements in the 30 – 1000 MHz range Note 2: No significant emissions were noted from 16 – 40 GHz							

Table 6: Transmitting at the Highest Frequency

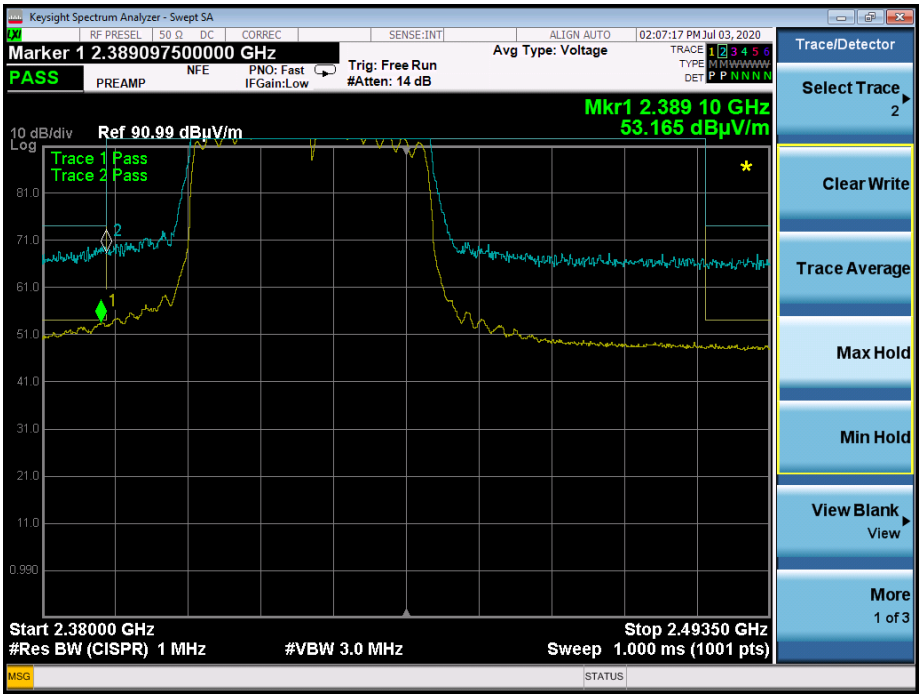




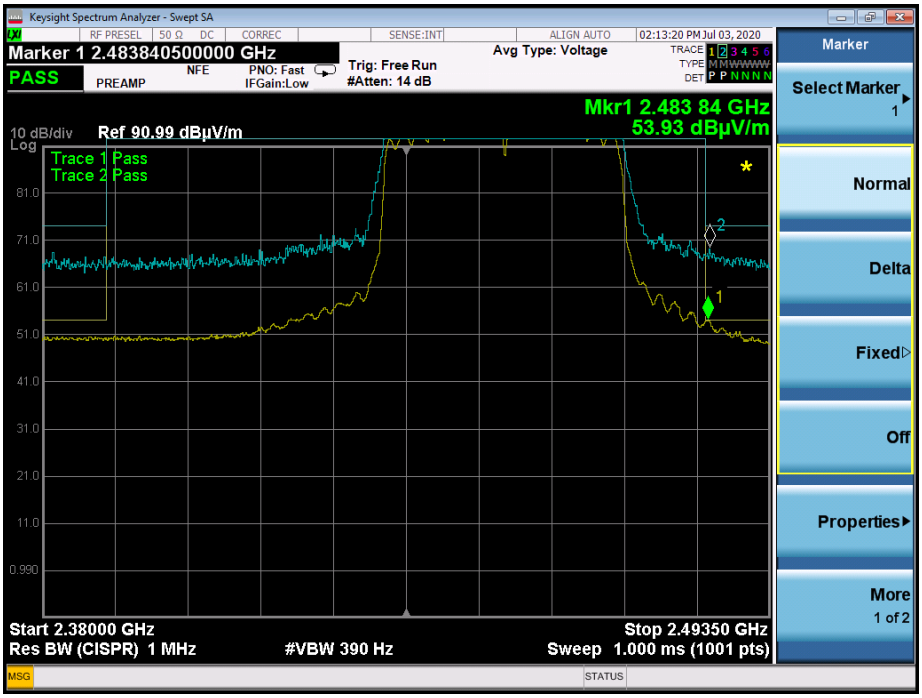
Graph 1: 20 MHz Radiated Lower Band Edge Plot



Graph 2: 20 MHz Radiated Upper Band Edge Plot



Graph 3: 40 MHz Radiated Upper Band Edge Plot



Graph 4: 40 MHz Radiated Upper Band Edge Plot

5.6 §15.247(e) Maximum Average Power Spectral Density

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. Results of this testing are summarized.

Mode	Frequency (MHz)	Measurement (dBm)	Criteria (dBm)
b	2412	7.8	8.0
	2437	7.0	8.0
	2462	7.7	8.0
g	2412	0.8	8.0
	2437	-4.2	8.0
	2462	4.5	8.0
n 20	2412	2.5	8.0
	2437	-4.5	8.0
	2462	3.2	8.0
n 40	2422	-4.3	8.0
	2437	0.9	8.0
	2452	0.0	8.0

Result

The maximum average power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.

-- End of Test Report --