Testing Tomorrow's Technology

Application

For

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.247

For the

Sanitag Technologies Corporation
Sanitag Active RFID Coordinator
Model: AC-001-LAN

FCC ID: 2AMOW-AC001LAN

UST Project: 17-0278
Issue Date: October 2, 2017

Total Pages in This Report: 54

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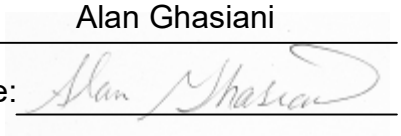
Testing Tomorrow's Technology

I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date October 2, 2017

TESTING
NVLAP LAB CODE 200162-0

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MEASUREMENT TECHNICAL REPORT

COMPANYS NAME: Sanitag Technologies Corp

MODEL: AC-001-LAN

FCC ID: 2AMOW-AC001LAN

DATE: October 2, 2017

This report concerns (check one): Original grant [X]
Class II change

Equipment type: DTS Transmitter Module

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes_____ No X

If Yes, defer until: _____N/A_____
date

agrees to notify the Commission by N/A
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

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1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 247.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on July 20, 2017 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Sanitag Technologies Corporation Sanitag Coordinator, Model AC-001-LAN. The EUT provides Real-Time Location for the Healthcare Industry to track infants, patients, assets and staff. The intended user is hospitals, senior living centers and rehab centers. The EUT collected data received from reader and bridges it to the server via TCP port. It EUT utilizes 802.15.4 wireless technology which is evaluated in this test report.

Modulation: O-QPSK
Data rate: 250 kbps
Operating frequency band: 2400-2483.5 MHz
Antenna: Monopole wire antenna, 2.0 dBi Gain

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* for the intentional radiator aspect of the device and *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)* for the unintentional radiator aspect of the device as well as FCC subpart B and C of Part 15 and per FCC KDB Publication number 558074 v04 for Digital Transmission Systems Operating Under section 15.247.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices.

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

1.6 Related Submittals

1.6.1 The EUT is subject to the following FCC authorizations:

a) Certification under section 15.247 as a transmitter.
b) Verification under 15.101 as a digital device and receiver.

1.6.2 Verification of the Digital apparatus

The Verification requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the Verification authorization report (part 15.107 and 15.109) for the EUT is included herein.

Table 1. EUT and Peripherals

EUT/PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC ID (Pending)	CABLES P/D
Router Sanitag Technologies Corp (EUT)	AC-001-LAN	20000619 & 20000620	2AMOW-AC001LAN	1.5 m U P 1.5 m U D
Power Supply adapter Mervesan	MS-0505 USB	None	None	1.5 m U P
Antenna See antenna details	--	--	--	--

U= Unshielded S= Shielded
P= Power D= Data

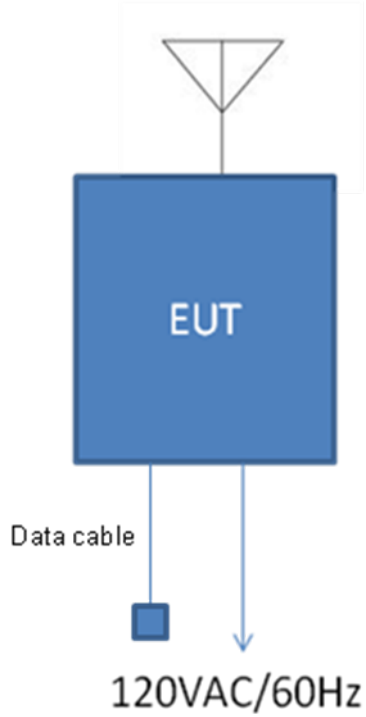


Figure 1. Block Diagram of Test Configuration

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	DSA815	RIGOL	DSA8A18030 0138	9/30/2017 Extended
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	11/23/2017 Extended
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	6/22/2018
LOOP ANTENNA	SAS-200/562	A.H. Systems	142	9/28/2017
BICONICAL ANTENNA	3110B	EMCO	9307-1431	11/25/2017
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	9/21/2018
HORN ANTENNA	3115	EMCO	9107-3723	9/22/2018
PRE-AMPLIFIER	8449B	HEWLETT-PACKARD	3008A00480	10/26/2017
PRE-AMPLIFIER	8447D	HEWLETT-PACKARD	1937A02980	3/07/2018
LISN x 2	9247-50-TS-50-N	SOLAR ELECTRONICS	955824 and 955825	2/28/2017

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates at 2400 MHz to 2483.5 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10^{th} harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be 30 MHz to 1000 MHz, or to 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG) the duty cycle factor calculated will be applied.

2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
Antenna	Sanitag Technologies Corp	Monopole, Wire antenna	Wire antenna	2.0	u.fl

2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other spurious are examined for this requirement see paragraph 2.1

2.8 Transmitter Duty Cycle (CFR 35 (c))

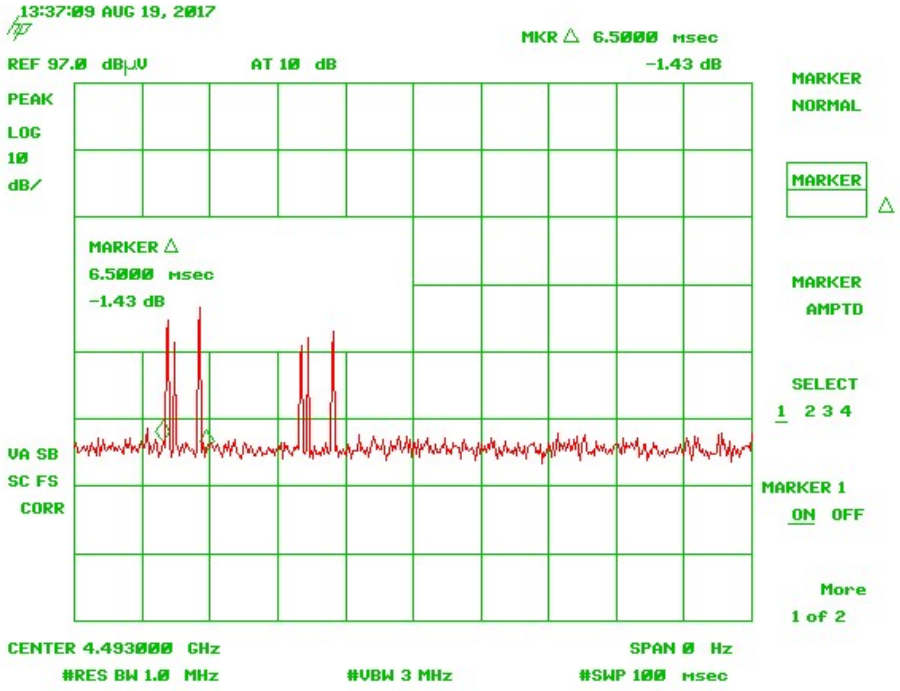


Figure 2. Duty Cycle 100ms Sweep

Total Time On from Figure 2 = 6.5 mS x 2 = 13 mS

(13 ms Total Time On)/(100 ms Total Pulse Train) = 0.13 Numeric Duty Cycle
Duty Cycle = 20 Log (0.13) = **-17.7 dB**

2.9 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

Power line conducted emissions testing was performed to ensure that with the EUT in operation (exercising all transmitter functions), the complete system continues to meet the applicable requirements for CFR 15.207. These measurements were completed and are displayed along with the 15.107 power line test data in the sections below.

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d))

Radiated Spurious measurements: The EUT was placed into a continuous transmit mode of operation (>98%) duty cycle) and tested per FCC Public Notice DA 00-705 and ANSI C63.10:2013. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the device. A preliminary scan was performed on the EUT to find the worse case results the EUT was tested in X, Y, and Z axes or in the orientation of normal operation if the device is designed to operate in a fixed position.

Radiated measurements were then conducted between the frequency range of 9 kHz (or lowest frequency used/generated by the device) up to the tenth harmonic of the device (no greater than 40 GHz). In the band below 30 MHz a resolution bandwidth (RBW) of 9 kHz was used, emissions below 1 GHz were tested with a RBW of 120 kHz and emissions above 1 GHz were tested with a RBW of 1 MHz. All video bandwidth settings were at least three times the RBW value.

The EUT was investigated to CFR 15.209, General requirements for unwanted spurious emissions. The conducted spurious method as described below was used to investigate all other emissions emanating from the antenna port.

Conducted Spurious measurements: The EUT was put into a continuous-transmit mode of operation and tested per ANSI C63.10:2013 for conducted out of band emissions emanating from the antenna port over the frequency range of 30 MHz to 25 GHz. A conducted scan was performed on the EUT to identify and record the spurious signals that were related to the transmitter to show that all spurious emissions were at least 20 dB below the fundamental frequency.

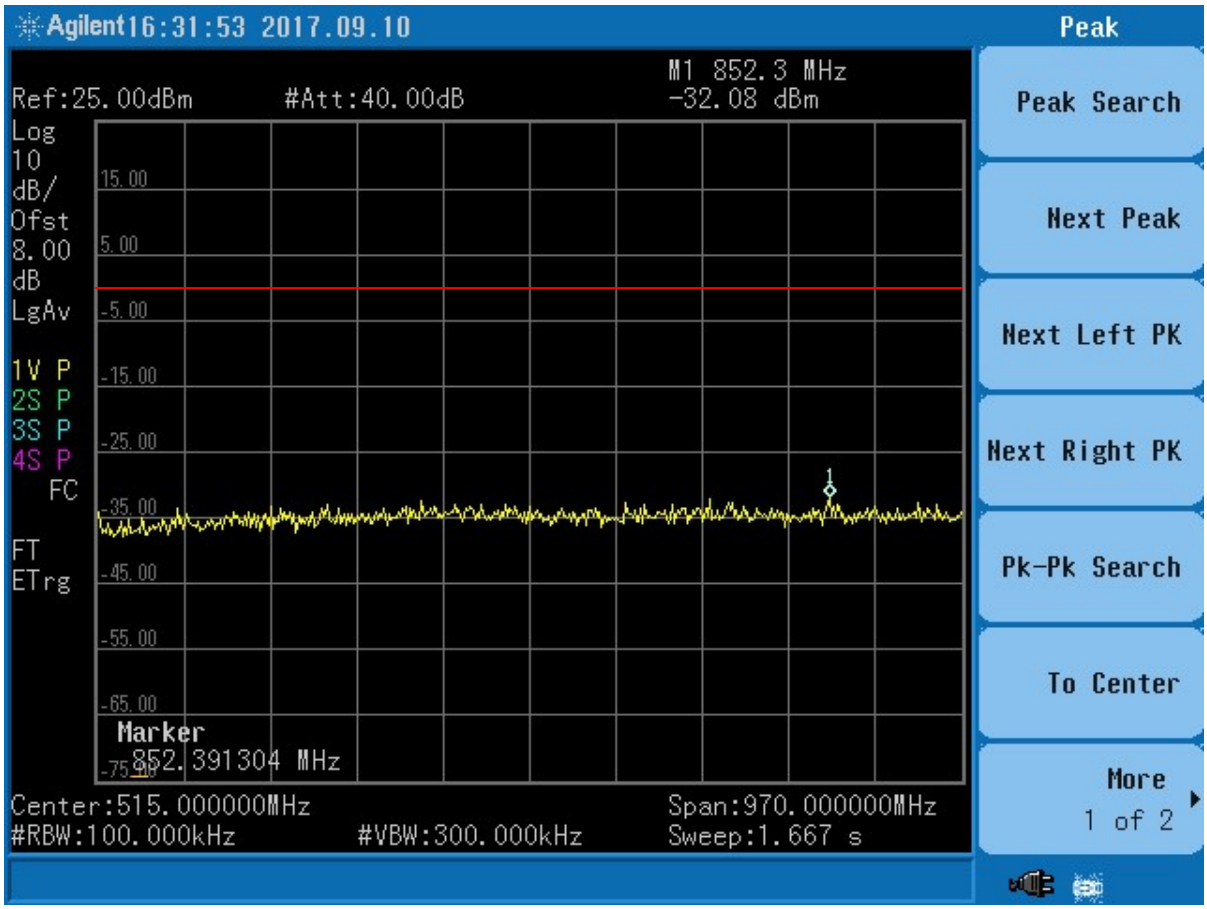


Figure 3. Antenna Conducted Emissions Low, Part 1

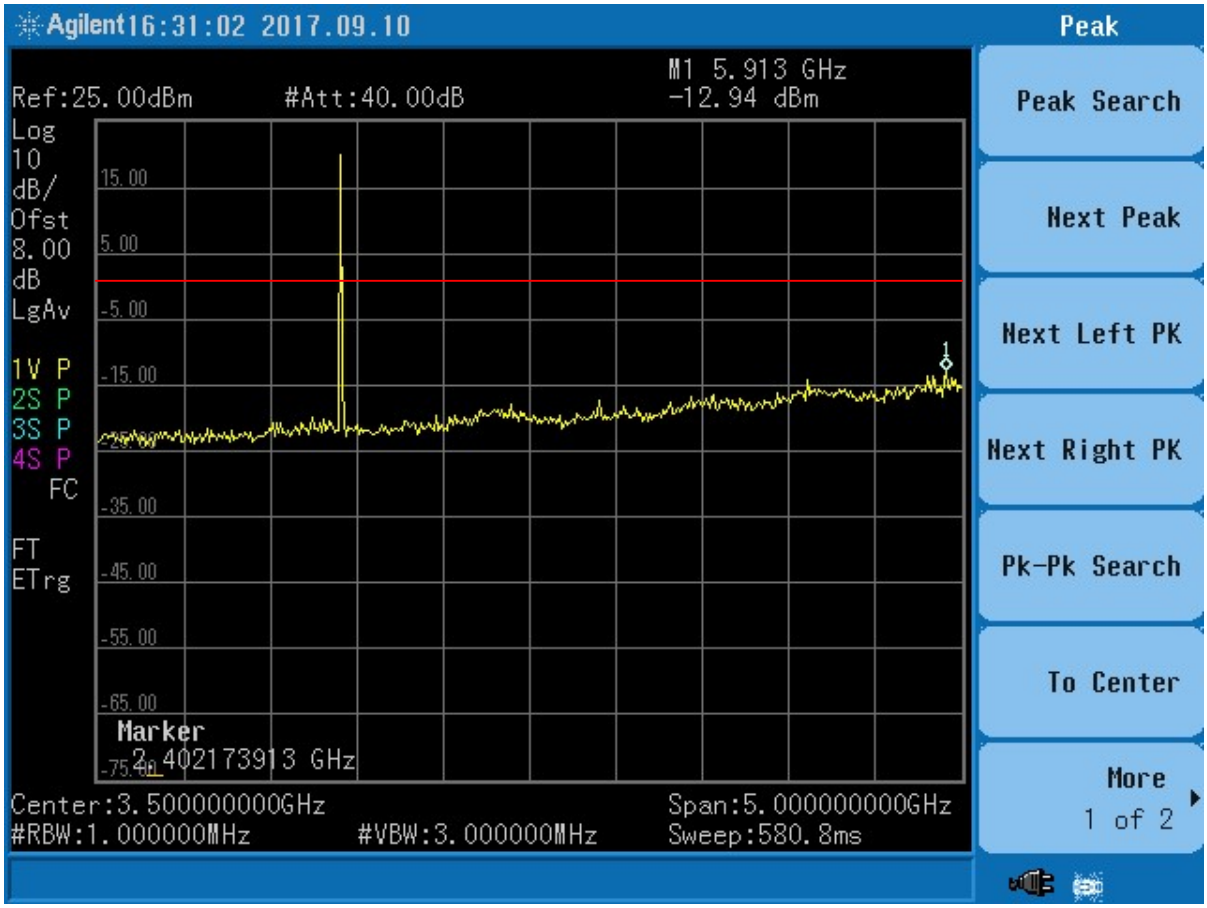


Figure 4. Antenna Conducted Emissions Low, Part 2

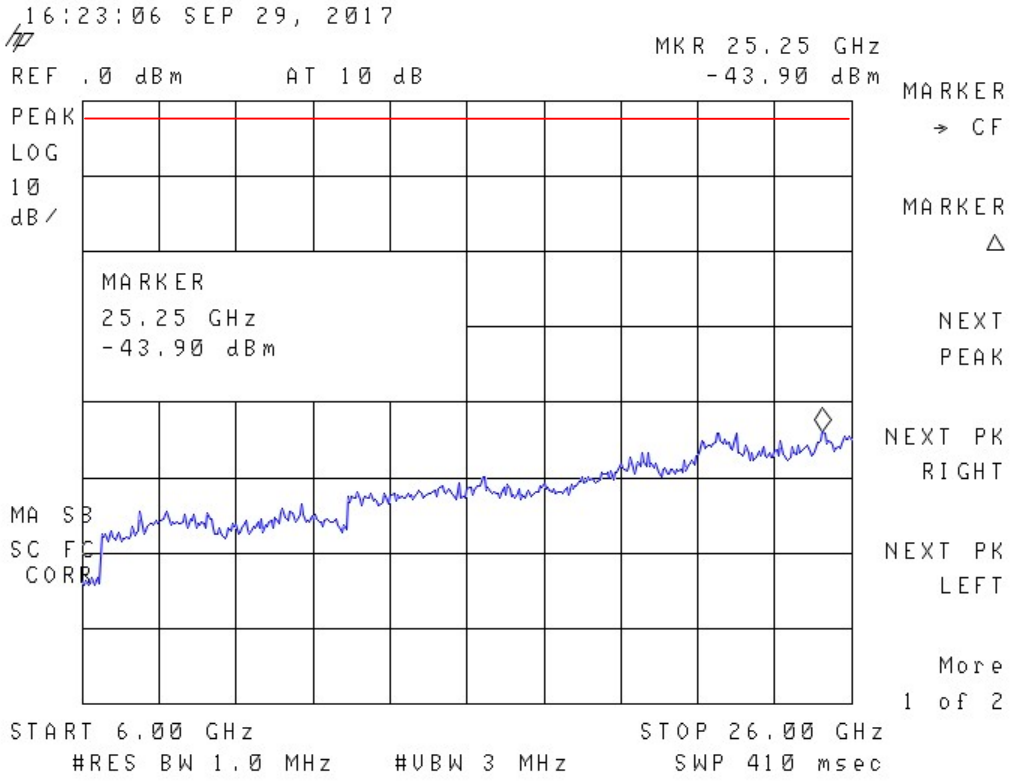


Figure 5. Antenna Conducted Emissions Low, Part 3

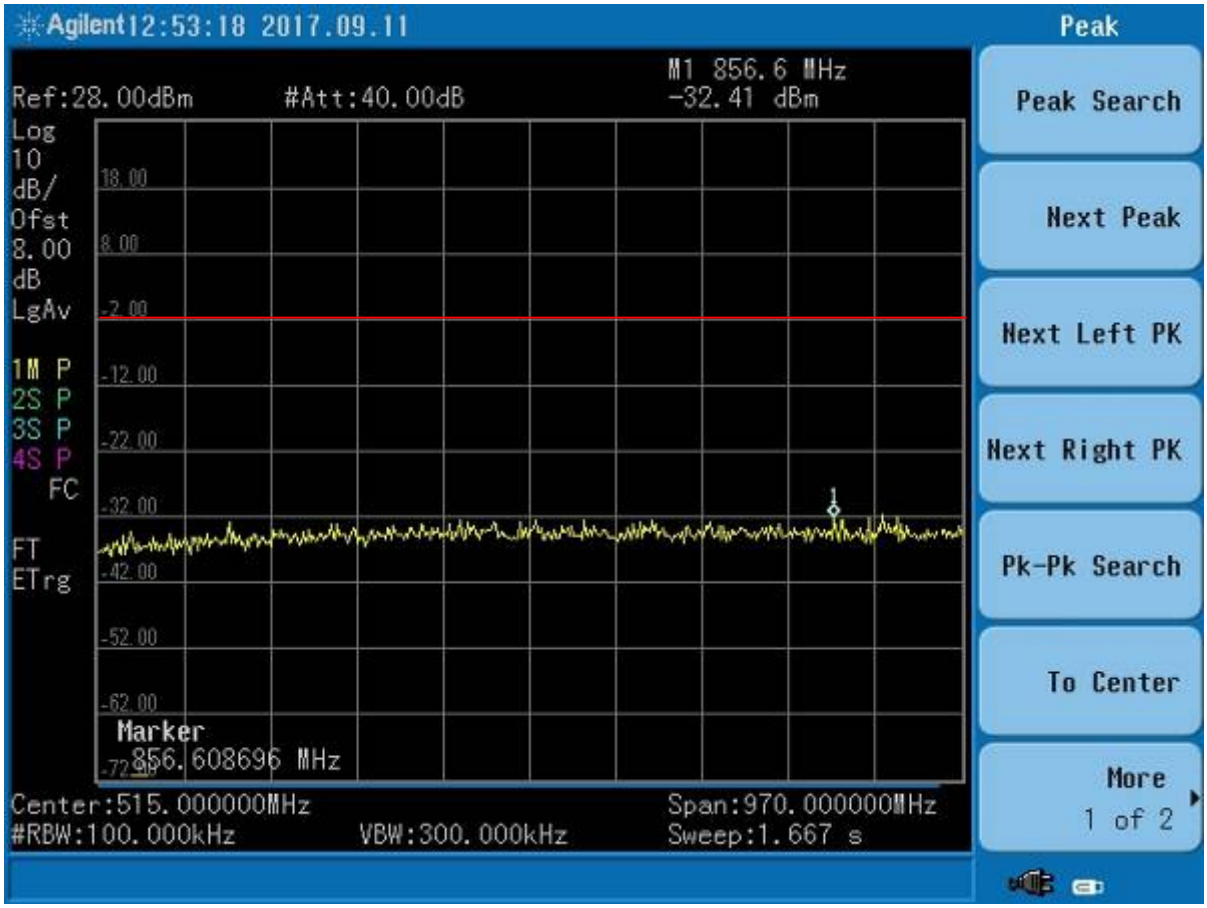


Figure 6. Antenna Conducted Emissions Mid, Part 1

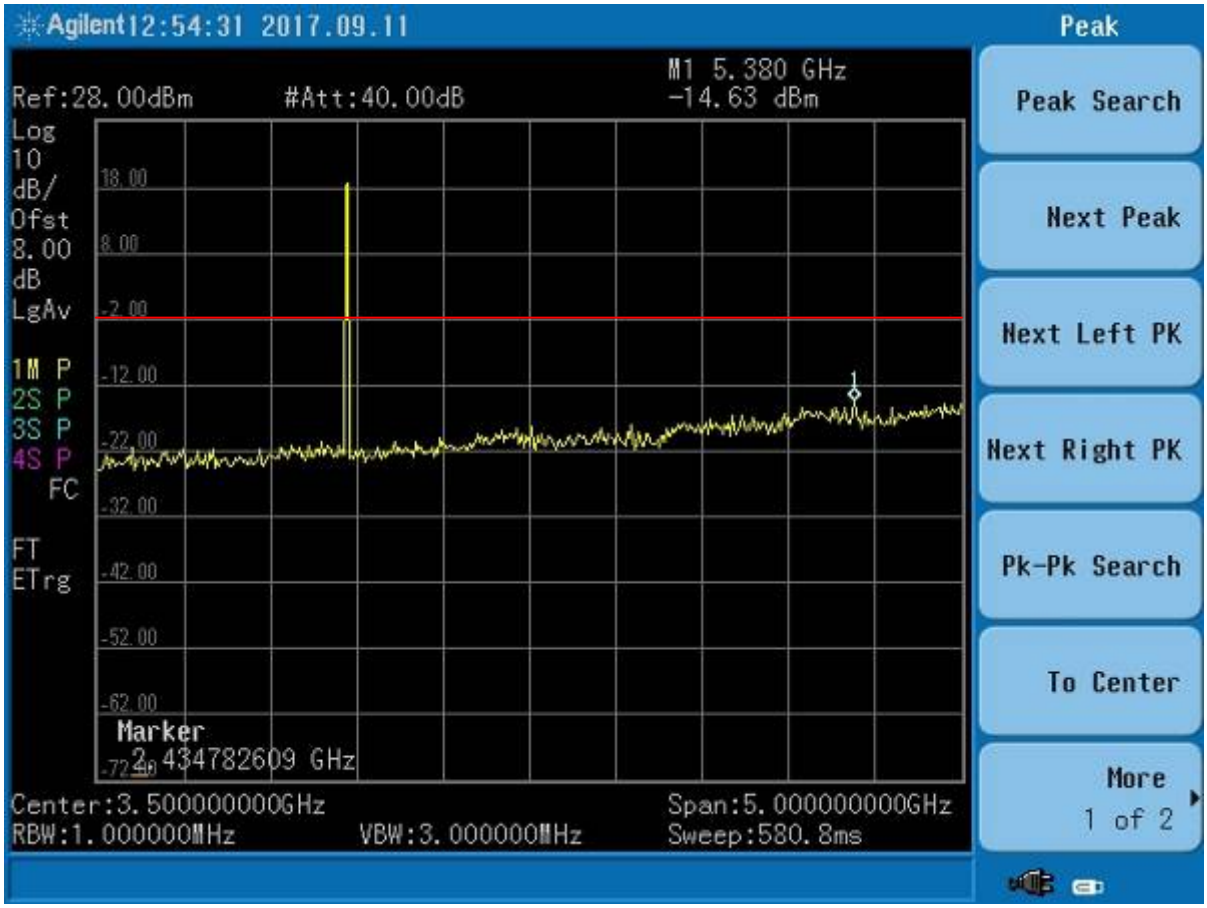


Figure 7. Antenna Conducted Emissions Mid, Part 2

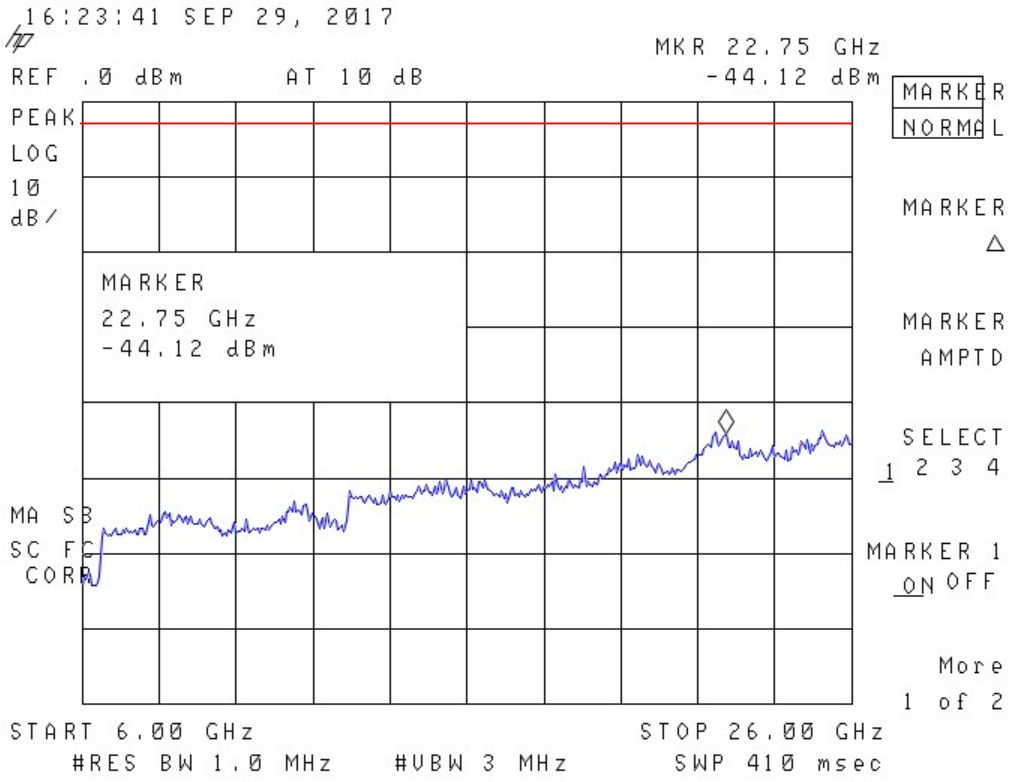


Figure 8. Antenna Conducted Emissions Mid, Part 3

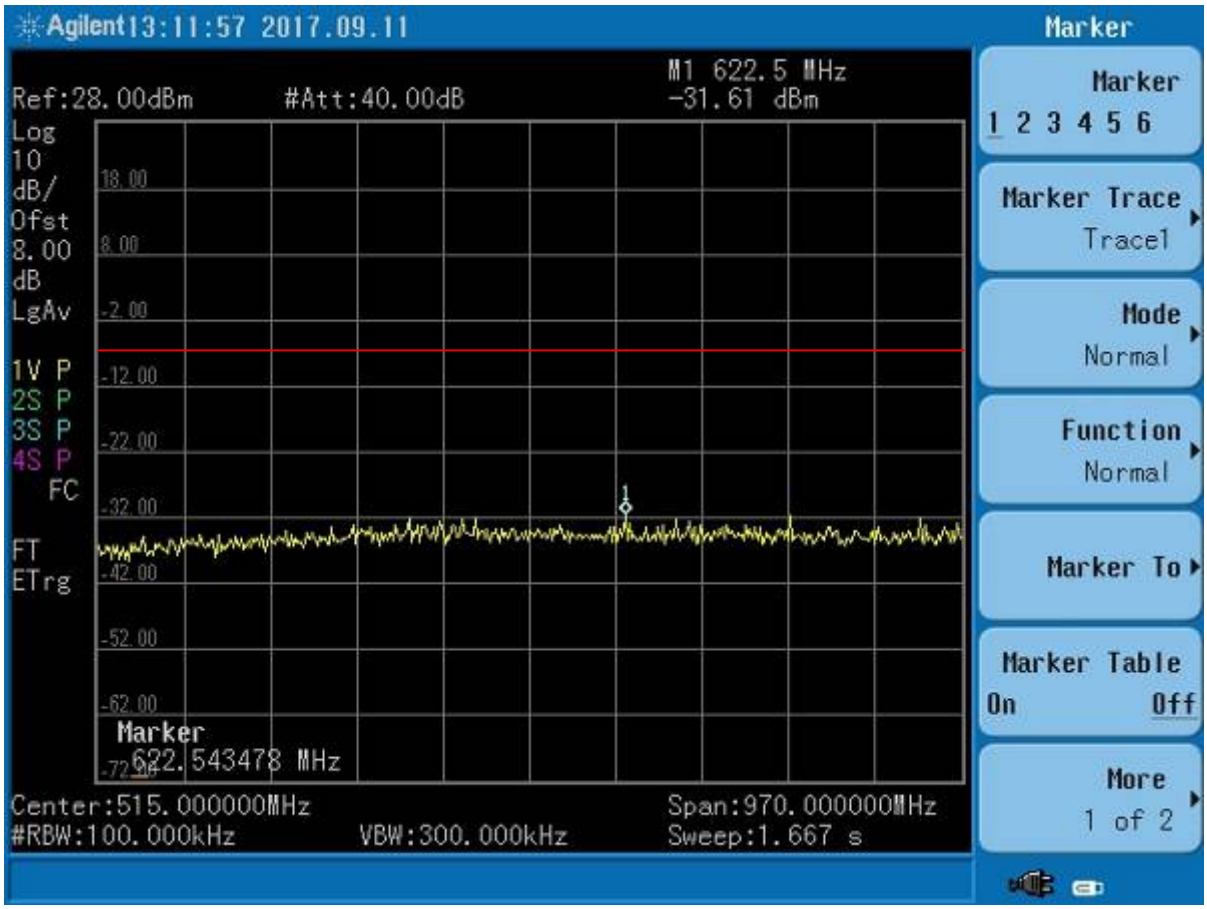


Figure 9. Antenna Conducted Emissions High, Part 1

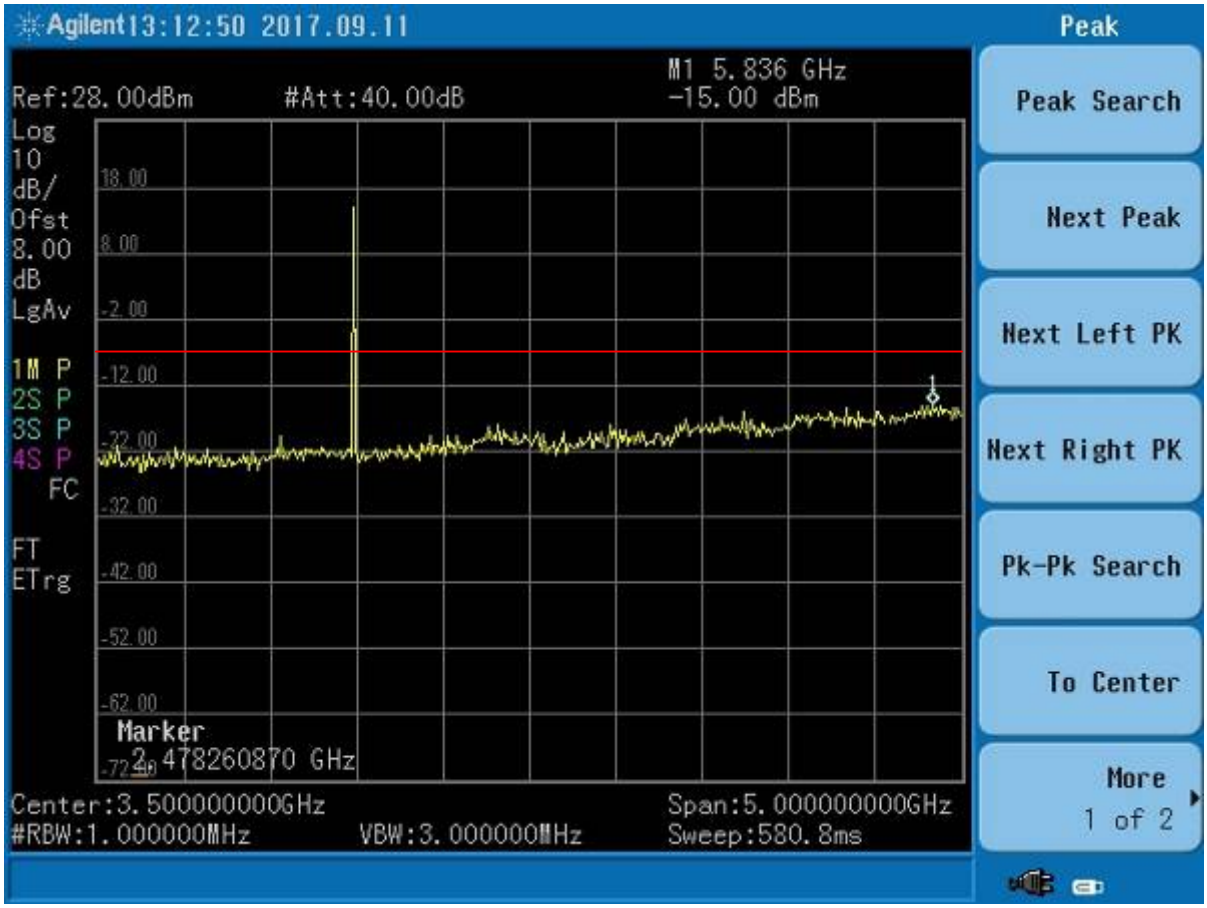


Figure 10. Antenna Conducted Emissions High, Part 2

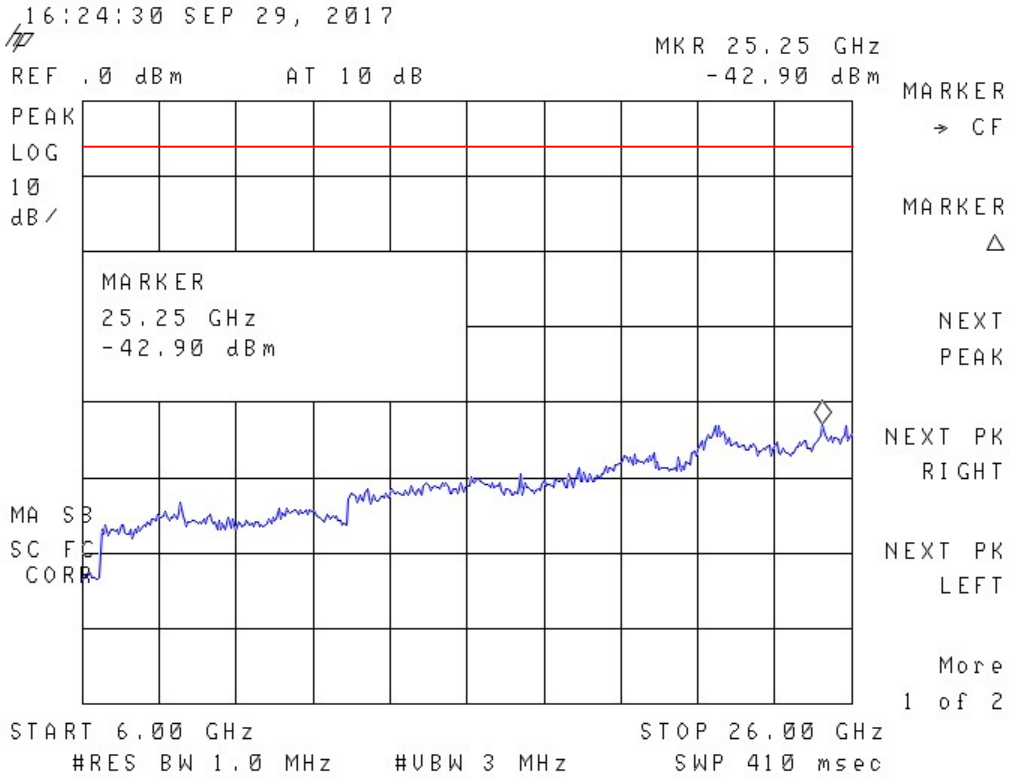


Figure 11. Antenna Conducted Emissions High, Part 3

Table 5. Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Sanitag Technologies Corp			
Project: 17-0278					**Model:** AC-001-LAN			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
2405.48	86.56	0.0	32.00	118.56	--	3.0m./HORZ	--	**PK**
2405.48	25.70	0.0	32.00	57.70	--	3.0m./HORZ	--	**AVG**
4811.08*	48.97	0.0	7.68	56.65	74.0	3.0m./HORZ	17.3	**PK**
4811.08*	28.78	0.0	7.68	36.46	54.0	3.0m./HORZ	17.5	**AVG**
7216.25	55.80	0.0	18.34	74.14	98.6	3.0m./HORZ	24.4	**PK**
7216.25	28.77	0.0	18.34	47.11	79.0	3.0m./HORZ	31.8	**AVG**
9621.55	53.37	0.0	19.28	72.65	98.6	3.0m./HORZ	25.9	**PK**
9621.55	29.24	0.0	19.28	48.52	78.6	3.0m./HORZ	30.0	**AVG**
2439.40	86.82	0.0	31.94	118.76	--	3.0m./HORZ	--	**PK**
2439.40	26.50	0.0	31.94	58.44	--	3.0m./HORZ	--	**AVG**
4878.65*	53.01	0.0	7.64	60.65	74.0	3.0m./HORZ	13.4	**PK**
4878.65*	29.78	0.0	7.64	37.42	54.0	3.0m./HORZ	16.6	**AVG**
7318.38*	61.12	-9.50	18.94	70.56	74.0	3.0m./HORZ	3.4	**PK**
7318.38*	29.62	-9.50	18.94	39.06	54.0	3.0m./HORZ	14.9	**AVG**
9761.95	49.28	0.0	20.32	69.60	98.8	3.0m./HORZ	29.2	**PK**
9761.95	29.17	0.0	20.32	49.49	78.8	3.0m./HORZ	29.3	**AVG**
2479.45	81.44	0.0	31.96	113.40	--	3.0m./HORZ	--	**PK**
2479.45	23.44	0.0	31.96	55.40	--	3.0m./HORZ	--	**AVG**
4958.73*	52.86	0.0	8.71	61.57	74.0	3.0m./HORZ	12.4	**PK**
4958.73*	29.02	0.0	8.71	37.73	54.0	3.0m./HORZ	16.3	**AVG**
7438.58*	52.80	0.0	19.01	71.81	74.0	3.0m./HORZ	2.2	**PK**
7438.58*	28.73	0.0	19.01	47.74	54.0	3.0m./HORZ	6.3	**AVG**
9917.40	46.73	0.0	20.32	67.05	93.4	3.0m./HORZ	26.3	**PK**
9917.40	28.81	0.0	20.32	49.13	73.4	3.0m./HORZ	24.3	**AVG**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB added for peak limits per CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10^{th} harmonic
3. (~)Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).
4. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4811.08 MHz:

Magnitude of Measured Frequency	48.97	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	7.68	dB/m
1 meter to 3 meter extrapolation	0.0	dB
Corrected Result	56.65	dBuV/m

Test Date: August 3, 2017
Tested By
Signature:  Name: Robert K Mills

2.11 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made following the guidelines in ANSI C63.10:2013 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Antenna port conducted measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge set the Spectrum Analyzer frequency span large enough (usually around 3 MHz) to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. Conducted measurements are performed with RBW ≥1% of the frequency span. In all cases, the VBW is set ≥ RBW. See figure and calculations below for more detail. This measurement was performed with the EUT continuously transmitting on the low and high channels as well as in normal use mode.

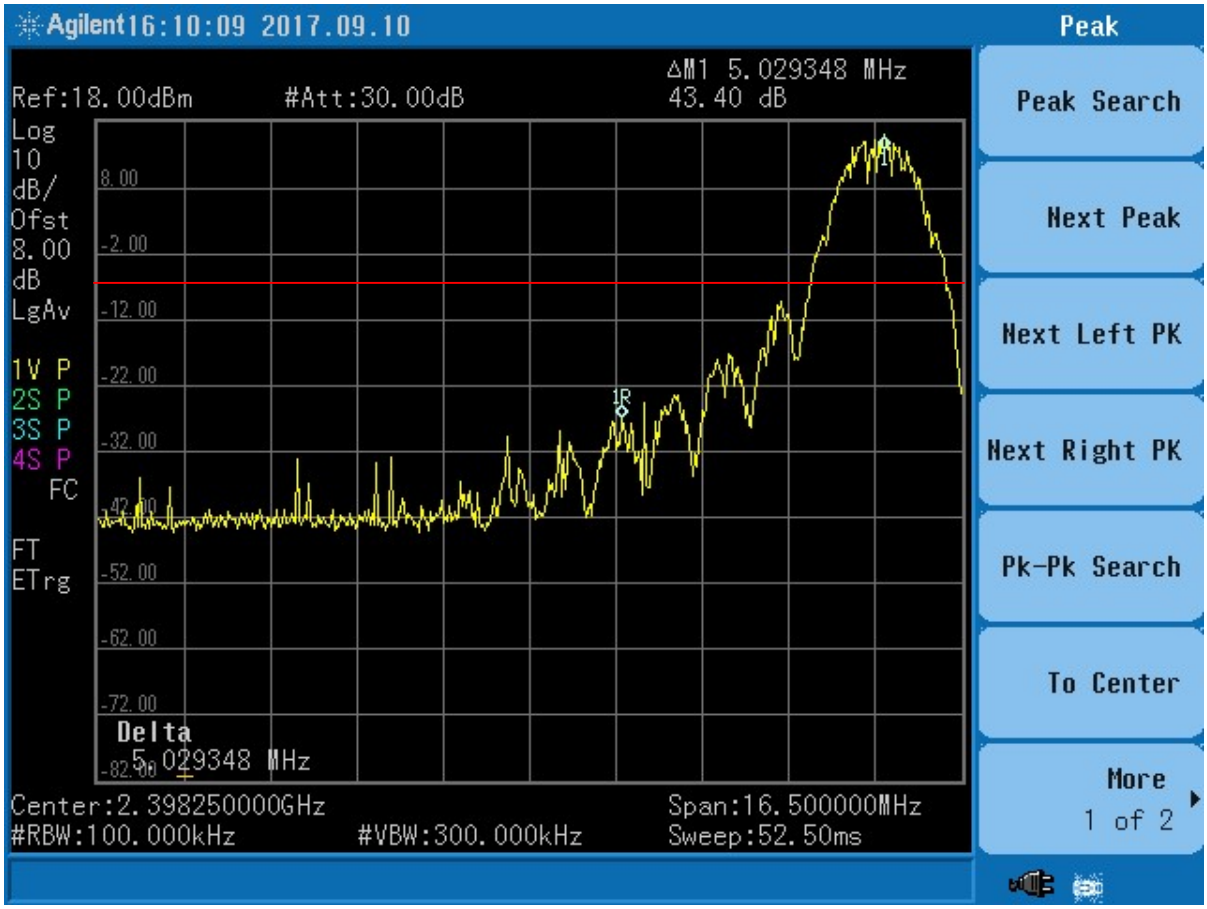


Figure 12. Band Edge Compliance, Low Channel Delta - Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

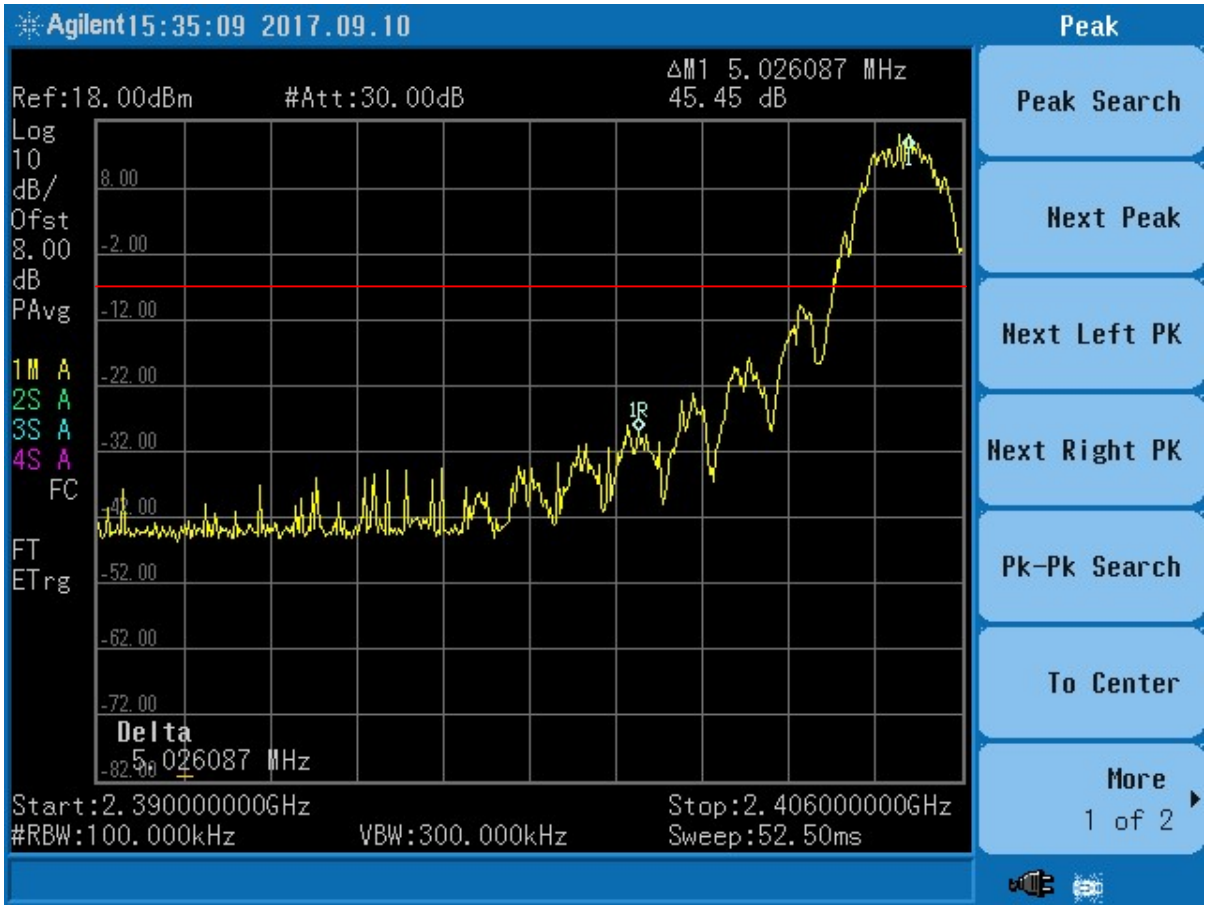


Figure 13. Band Edge Compliance, Low Channel Delta - Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

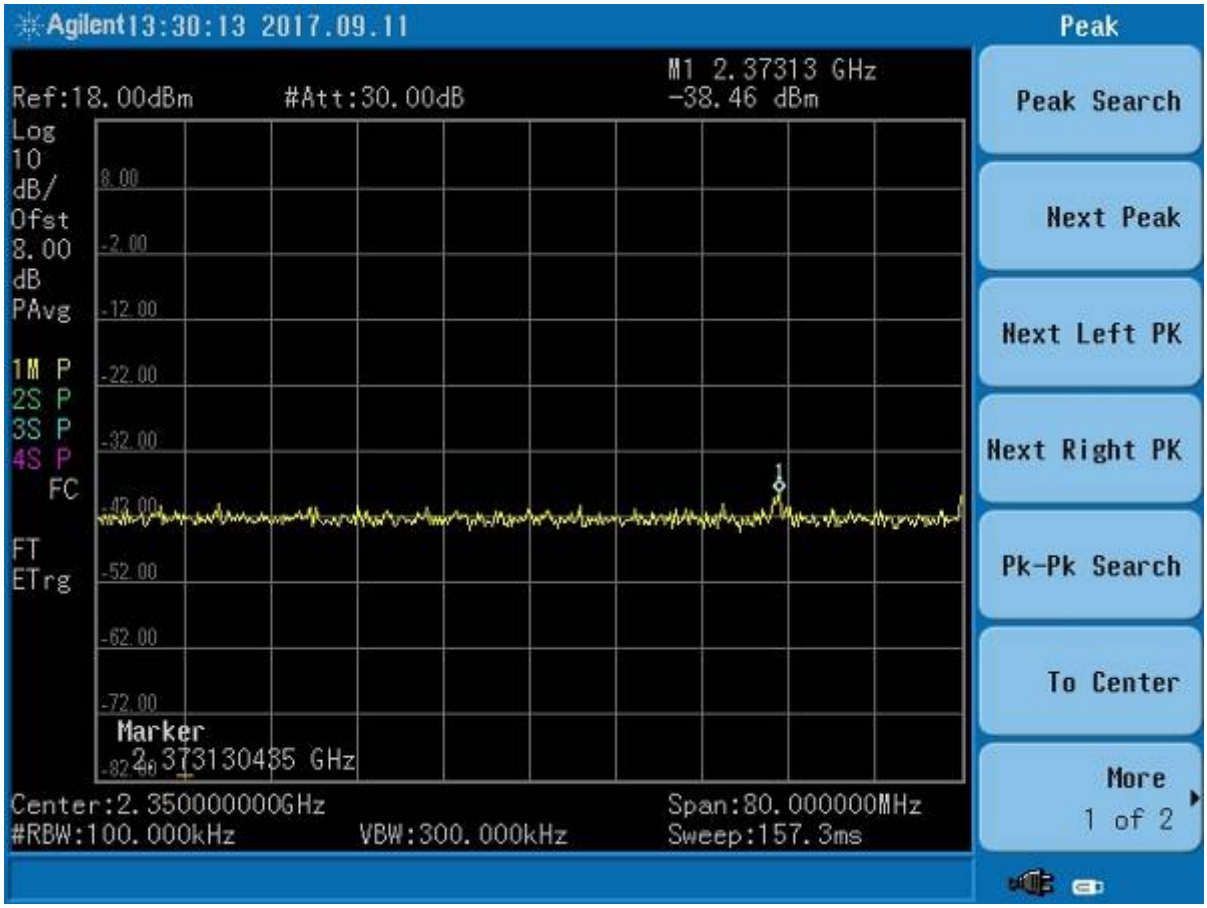


Figure 14. Conducted Restricted Band Measurements 2.31 GHz to 2.39 GHz

Calculation:

E= EIRP – 20 log (d) +104.8, where d is 3 meters

E= -38.46 – (20 log (3)) + 104.8 = 56.79 dBuV

Limit PK = 74.0 dBuV/m

Margin= 74.0- 56.79 = 17.21, PASS

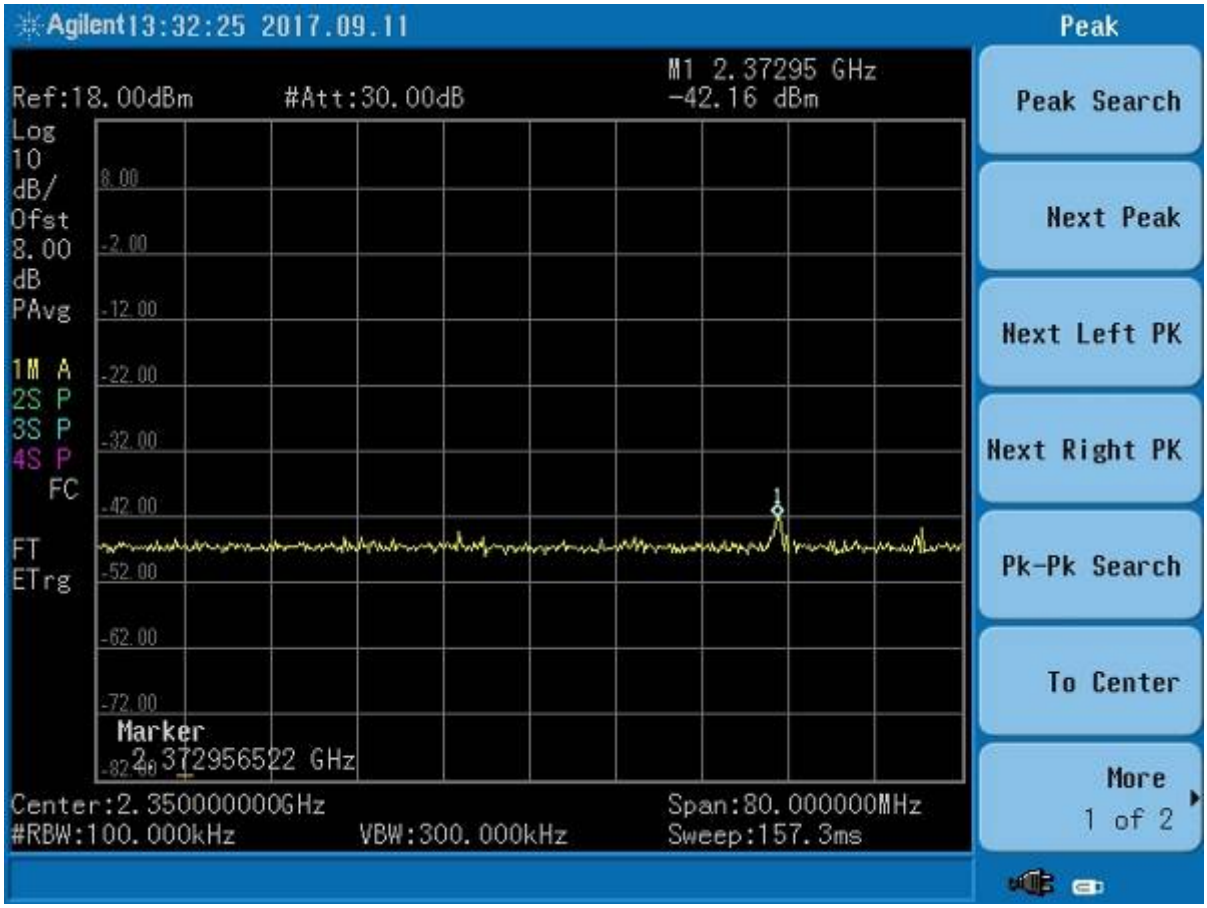


Figure 15. Radiated Restricted Band Measurements AVG, 2.31 GHz to 2.39 GHz

Calculation:

E= EIRP – 20 log (d) +104.8, where d is 3 meters

E= -42.16 – (20 log (3)) + 104.8 = 53.09 dBuV

Limit PK = 54.0 dBuV/m

Margin= 54.0- 53.09 = 0.91, PASS

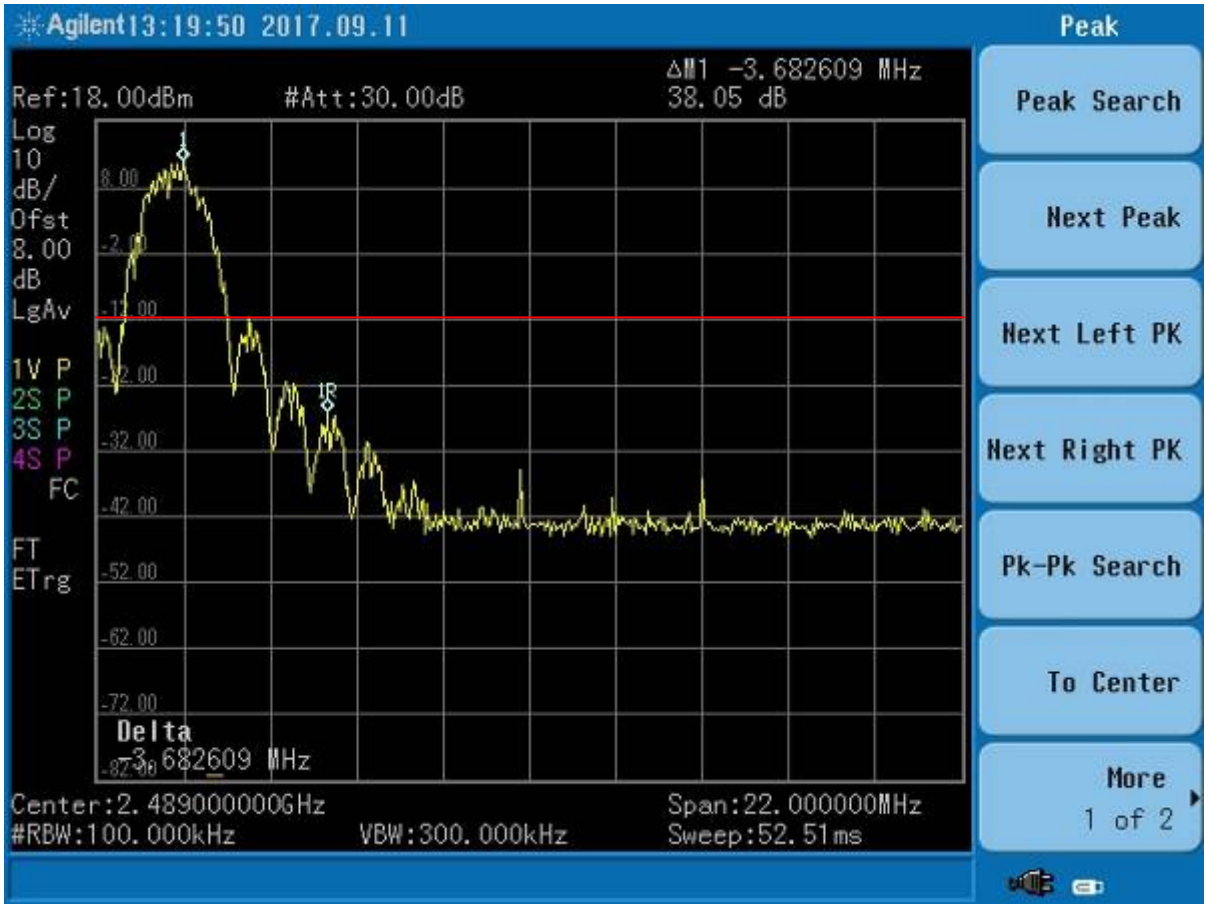


Figure 16. Band Edge Compliance, High Channel Delta – Peak

Upper band edge must be 20 dB below the fundamental. This requirement is met.

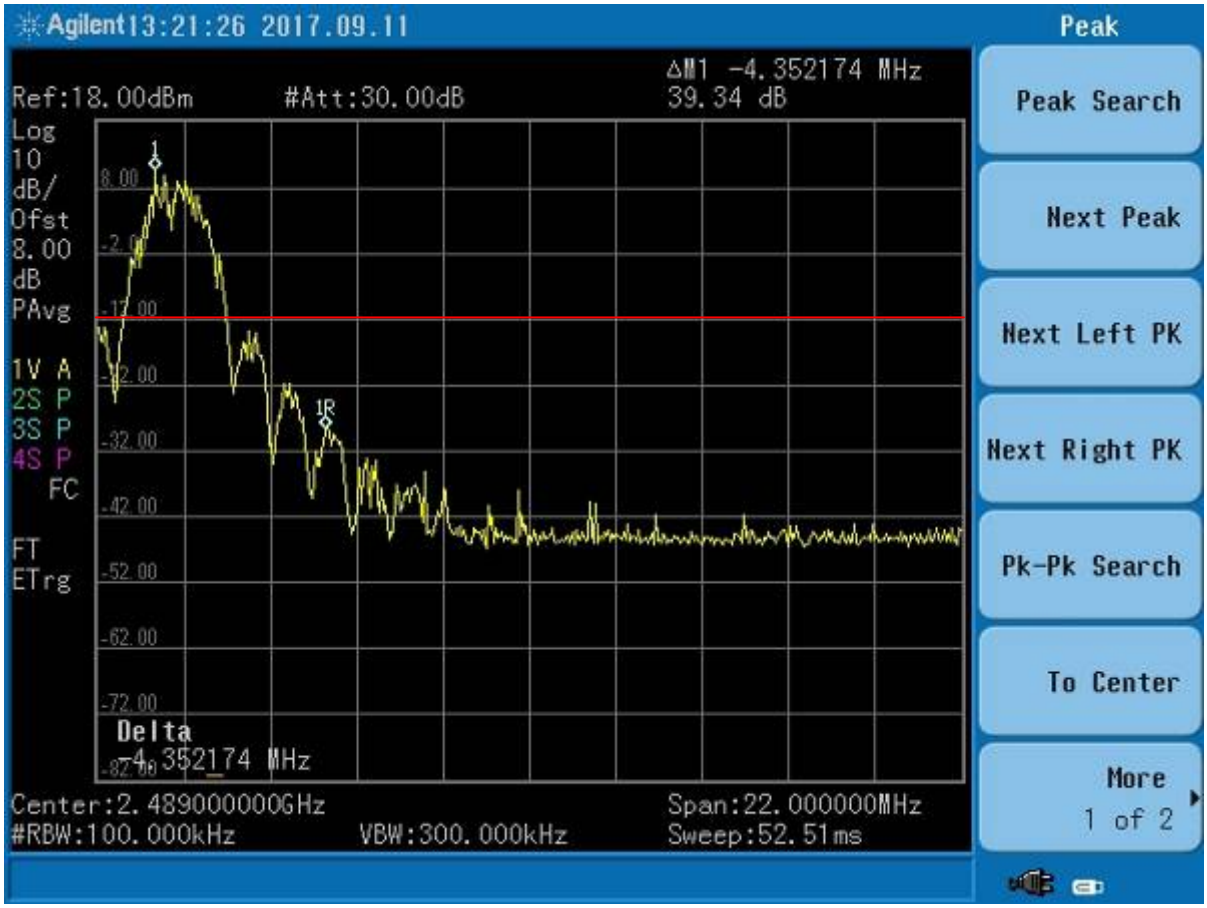


Figure 17. Band Edge Compliance, High Channel Delta – Average

Upper band edge must be 20 dB below the fundamental. This requirement is met.

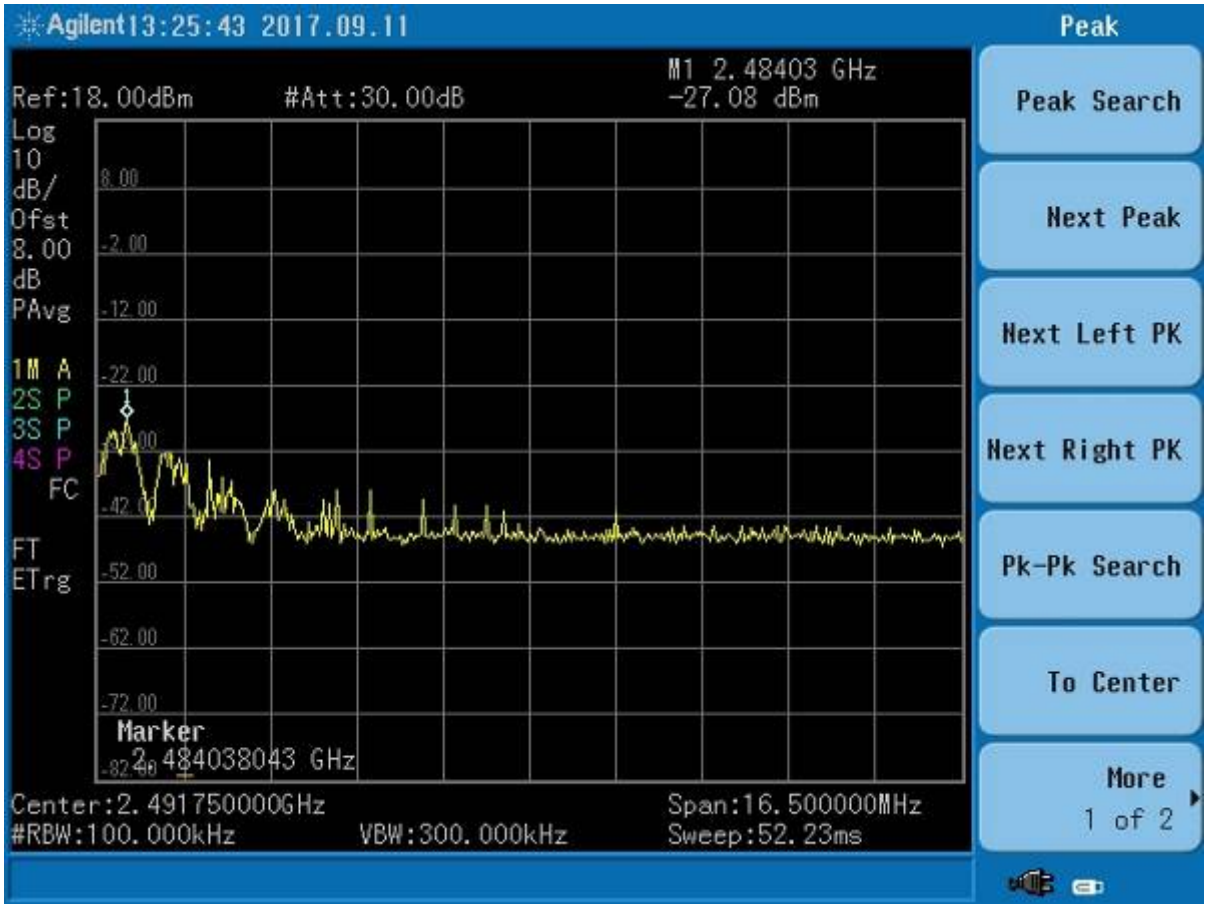


Figure 18. Conducted Restricted Band Measurements PK, 2.4835 GHz to 2.5 GHz

Calculation:

E= EIRP – 20 log (d) +104.8, where d is 3 meters

E= -27.08 – (20 log (3)) + 104.8 = 68.18 dBuV

Limit PK = 74.0 dBuV/m

Margin= 74.0- 68.18 = 5.82, PASS

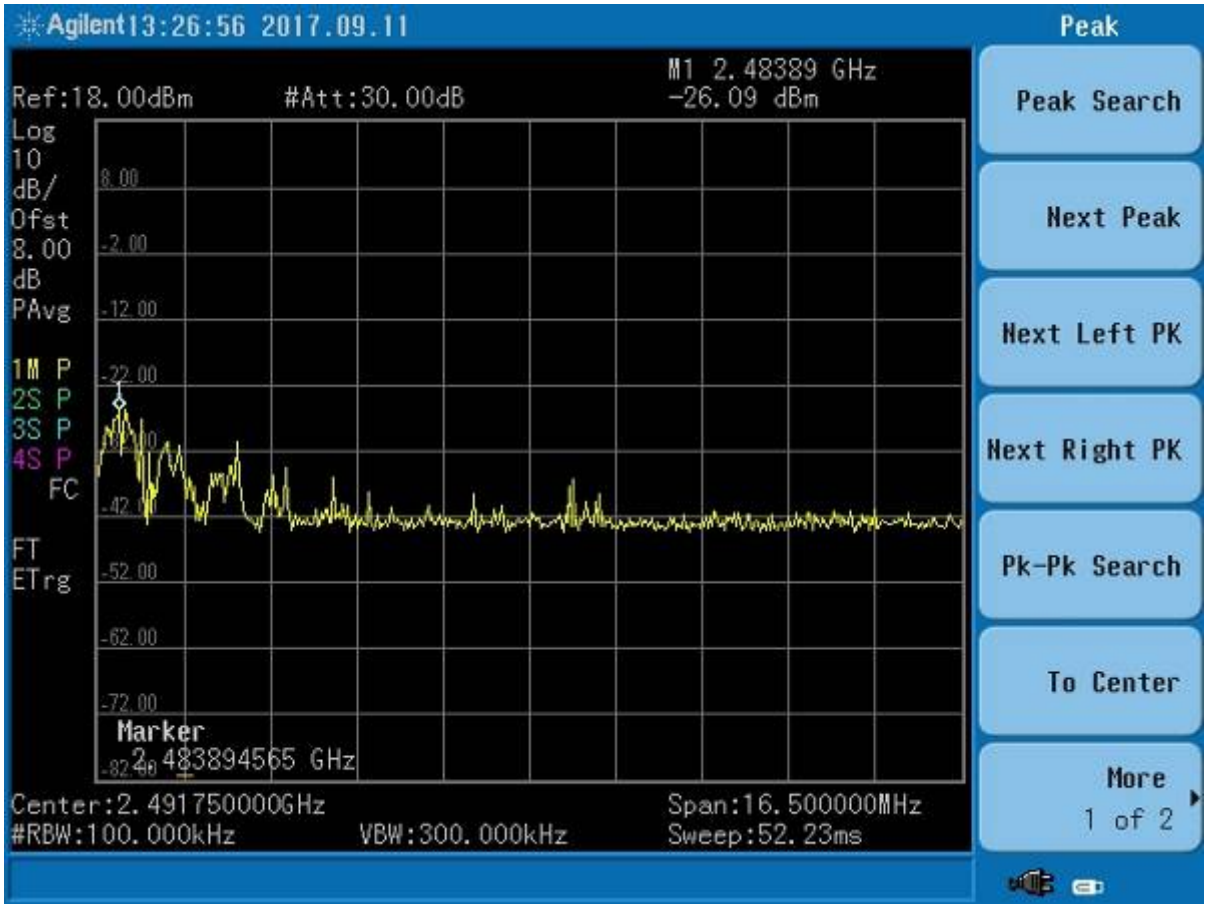


Figure 19. Conducted Restricted Measurements AVG, 2.4835 GHz to 2.5 GHz

Calculation:

E= EIRP – 20 log (d) +104.8, where d is 3 meters

E= -26.09 – (20 log (3)) + 104.8 = 69.17 dBuV
69.17 dBuV + -17.7 dB (duty cycle) = 51.47 dBuV/m (corrected)

Limit PK = 54.0 dBuV/m

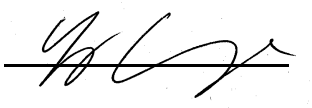
Margin= 54.0- 51.47 = 2.53, PASS

2.12 Six (6) dB Bandwidth per CFR 15.247(a)(2)

The EUT antenna port was connected to a spectrum analyzer having a 50Ω input impedance. Measurements were performed following the guidelines of ANSI C63.10:2013.

Table 6. 6 dB Bandwidth and 99% Occupied Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2405.00	1.32	0.5
2440.00	1.50	0.5
2480.00	1.50	0.5

Test Date: September 10 & 11, 2017
Tested By
Signature:  Name: George Yang

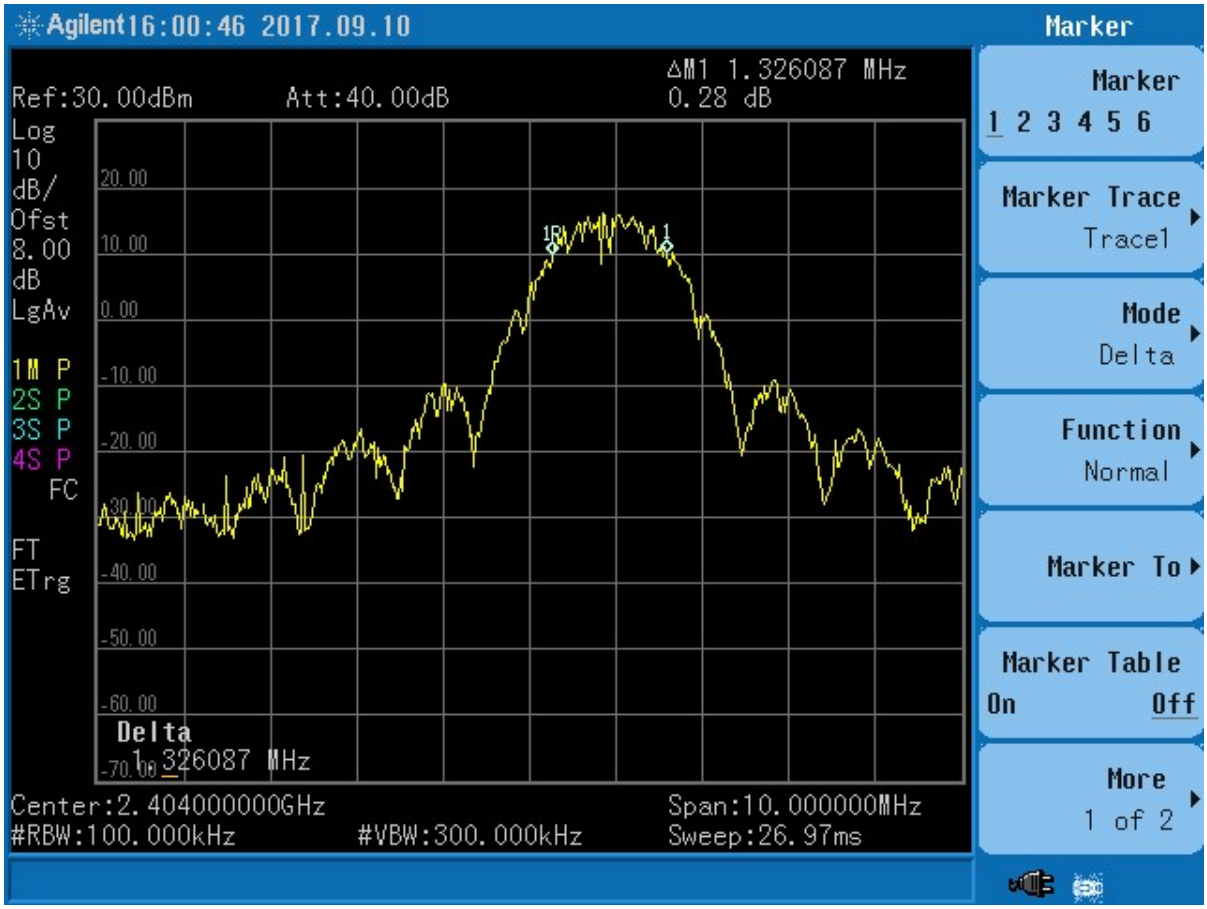


Figure 20. Six (6) dB Bandwidth– Low Channel

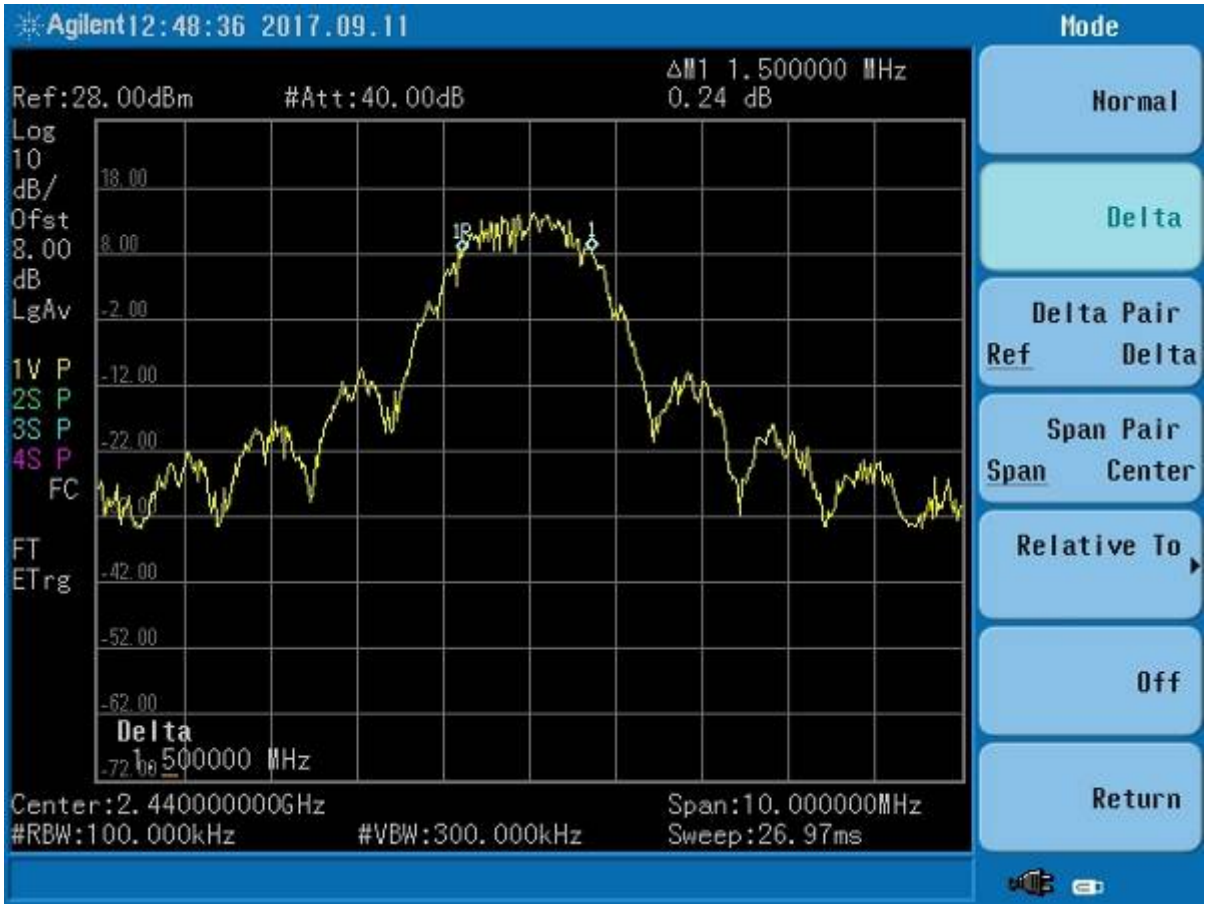


Figure 21. Six (6) dB Bandwidth – Mid Channel

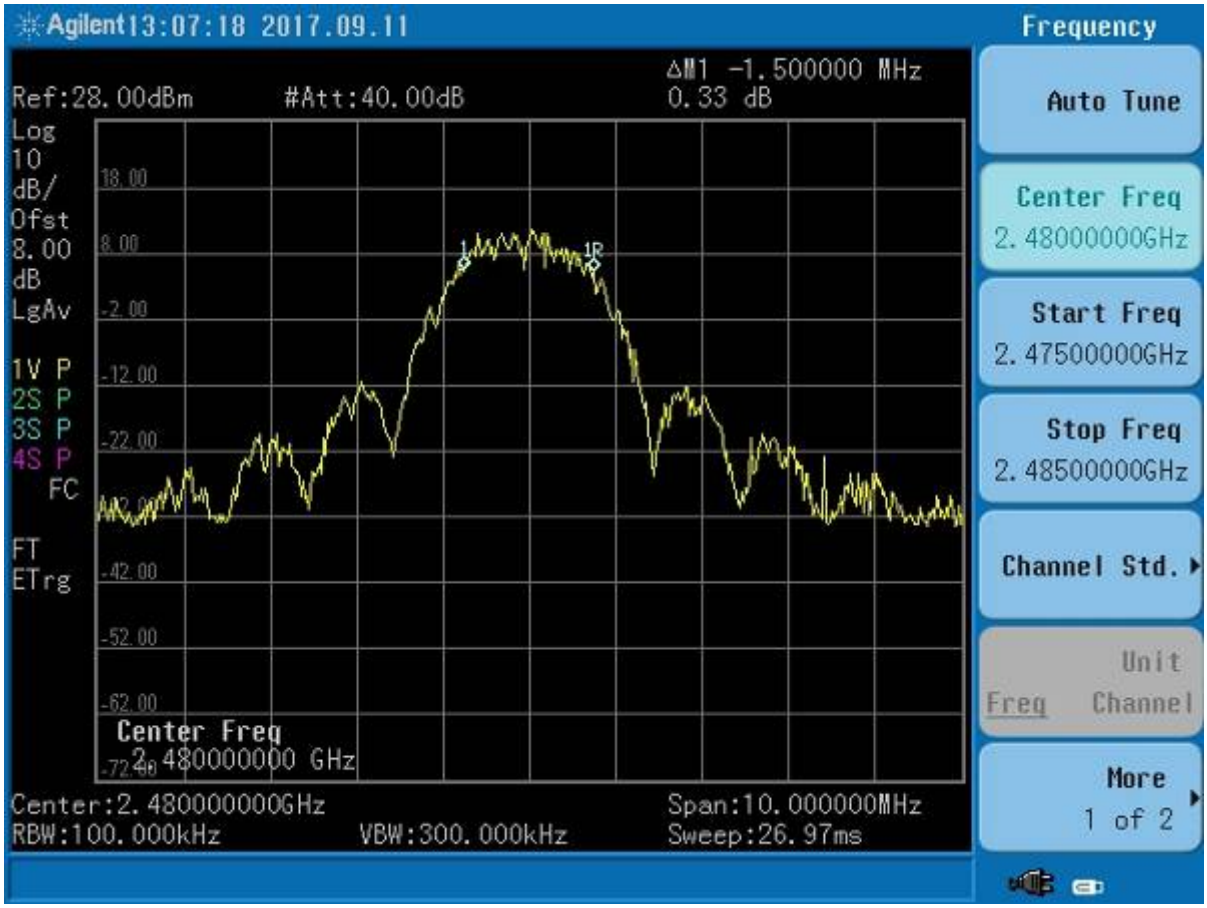


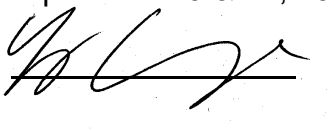
Figure 22. Six (6) dB Bandwidth – High Channel

2.13 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

Peak power within the band 2400 MHz to 2483.5 MHz was measured per FCC KDB Publication 558074 v04 and ANSI C63.10:2013 as an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, and attenuators to the antenna output terminals on the EUT. The spectrum analyzer was set for an impedance of 50 Ω with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. Peak antenna conducted output power is tabulated in the table below.

Table 7. Peak Antenna Conducted Output Power per Part 15.247 (b) (3)

Frequency of Fundamental (MHz)	Measured Data dBm	Converted Data (mW)	FCC Limit (mW Maximum)
2405.00	20.32	107.64	1000
2440.00	19.18	82.79	1000
2480.00	16.64	46.13	1000

Test Date: September 10 & 11, 2017
Tested By
Signature:  Name: George Yang

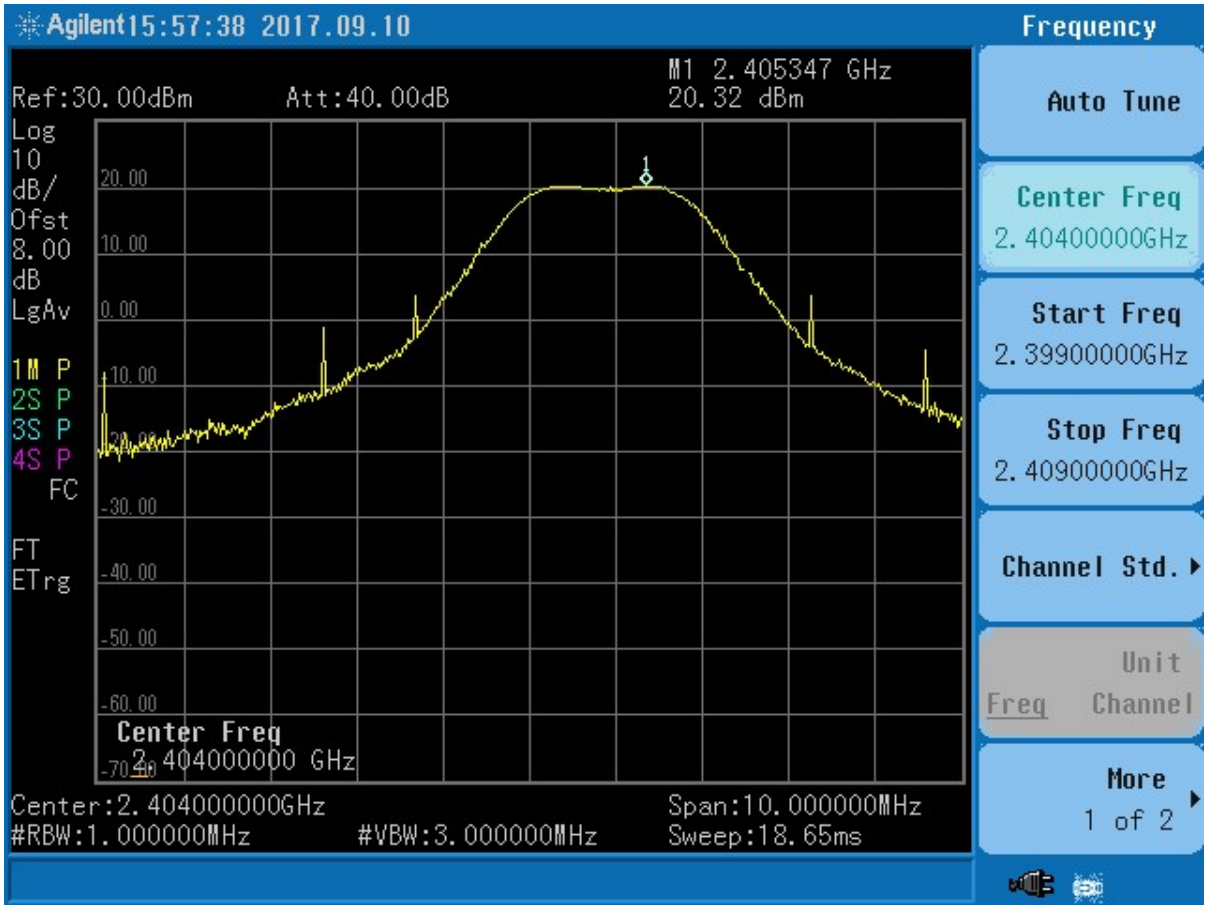


Figure 23. Peak Antenna Conducted Output Power, Low Channel

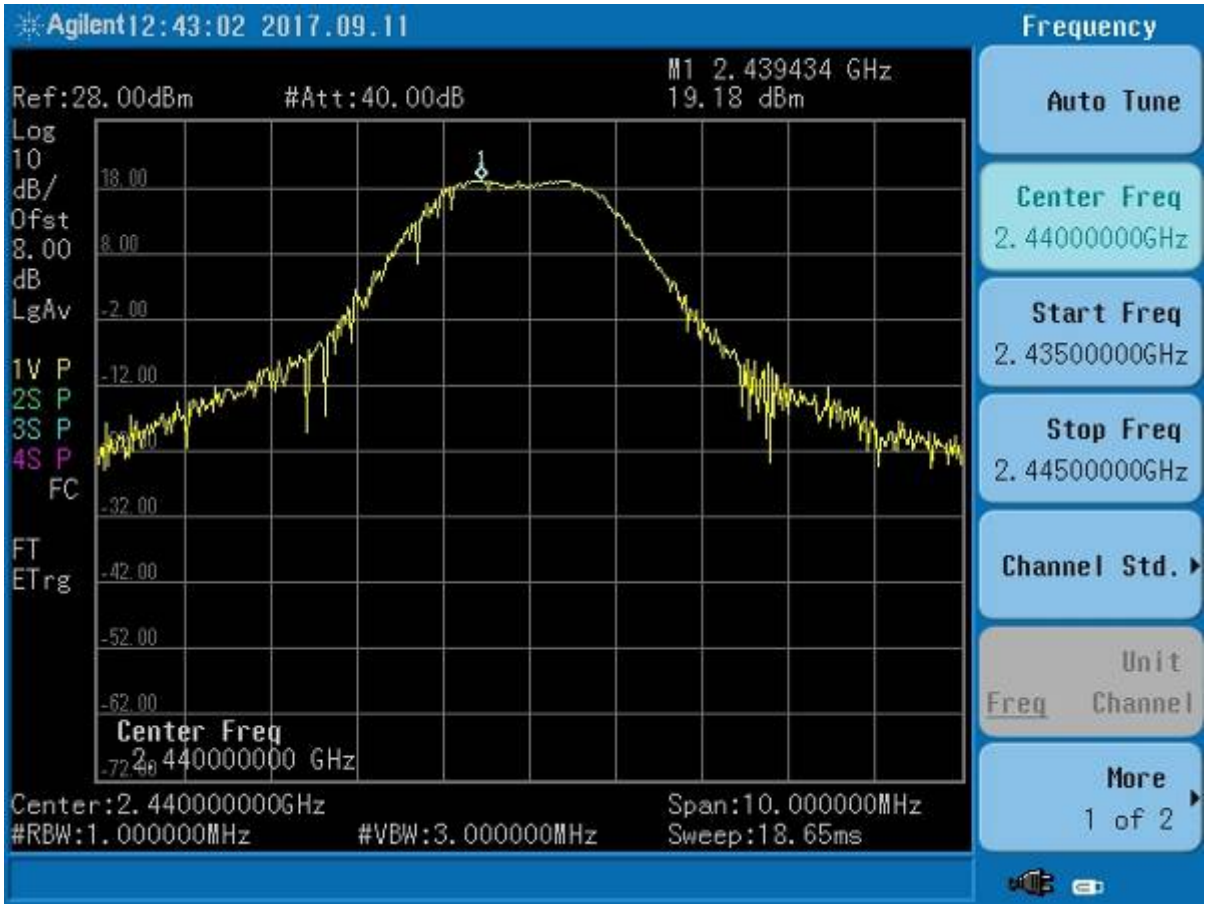


Figure 24. Peak Antenna Conducted Output Power, Mid Channel

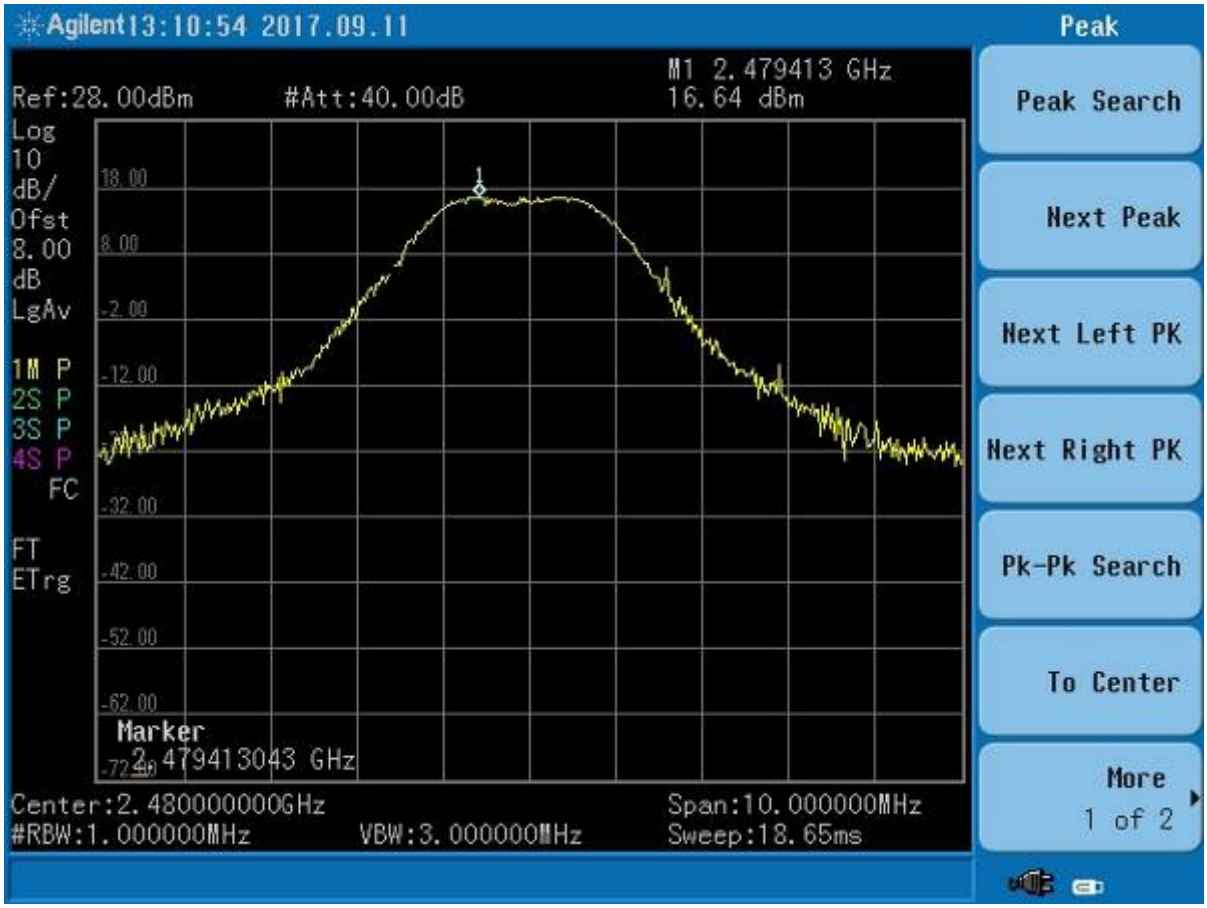


Figure 25. Peak Antenna Conducted Output Power, High Channel

2.14 Power Spectral Density (CFR 15.247(e))

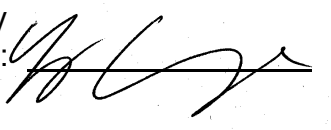
The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of FCC KDB Procedure 558074 v04 and ANSI C63.10:2013. The RBW was set to 3 kHz and the Video Bandwidth was set to ≥ RBW. The trace capture time was set to (Span/3 kHz).

In accordance with 15.247 (e), the power spectral density shall be no greater than +8 dBm per any 3 kHz band.

Results are shown in the table below and figures below. All are less than +8 dBm per 3 kHz band.

Table 8. Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Results (dBm/3 kHz)	FCC Limit (dBm/3 kHz)
2405.00	7.68	8.0
2440.00	5.33	8.0
2480.00	4.39	8.0

Test Date: September 10 & 11, 2017
Tested By
Signature:  Name: George Yang

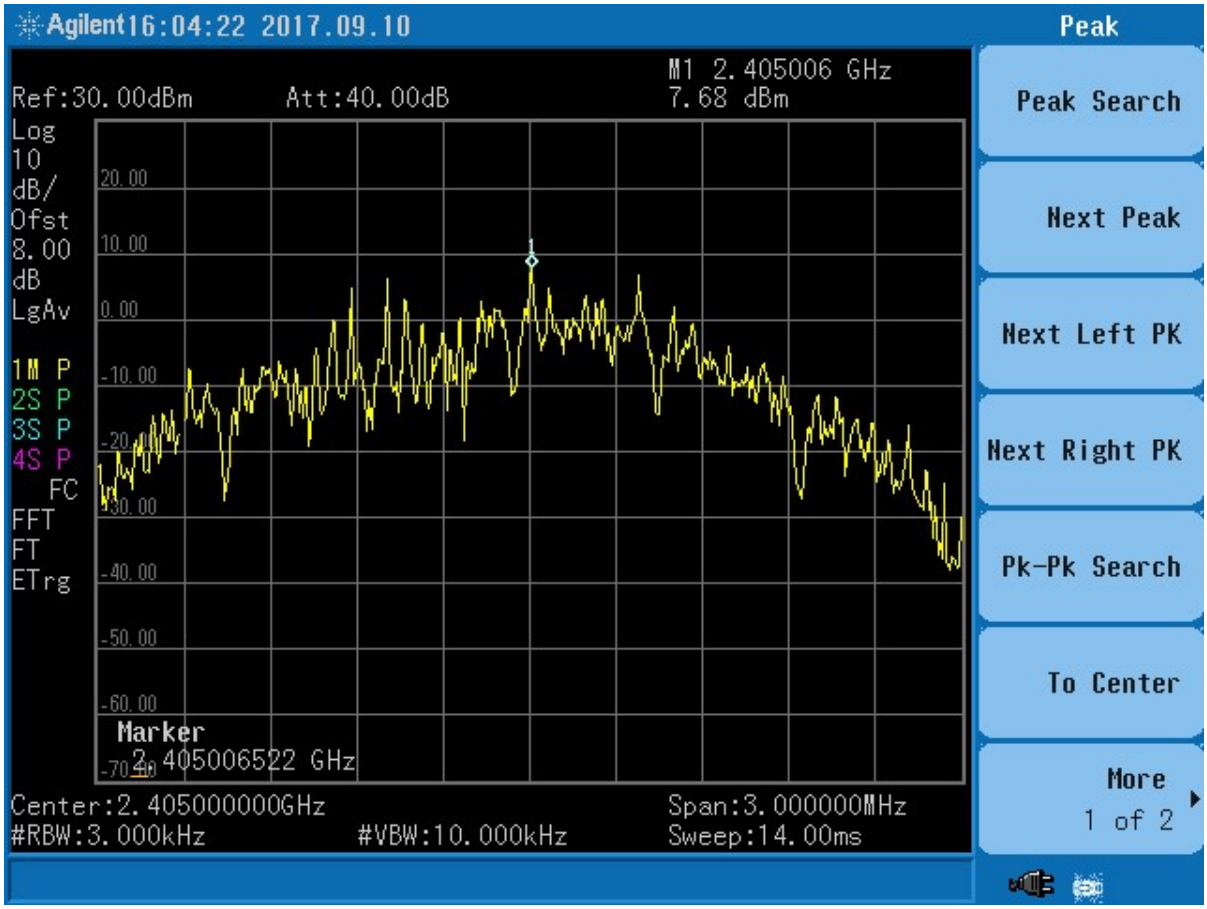


Figure 26. Peak Power Spectral Density - Part 15.247 (e) - Low Channel

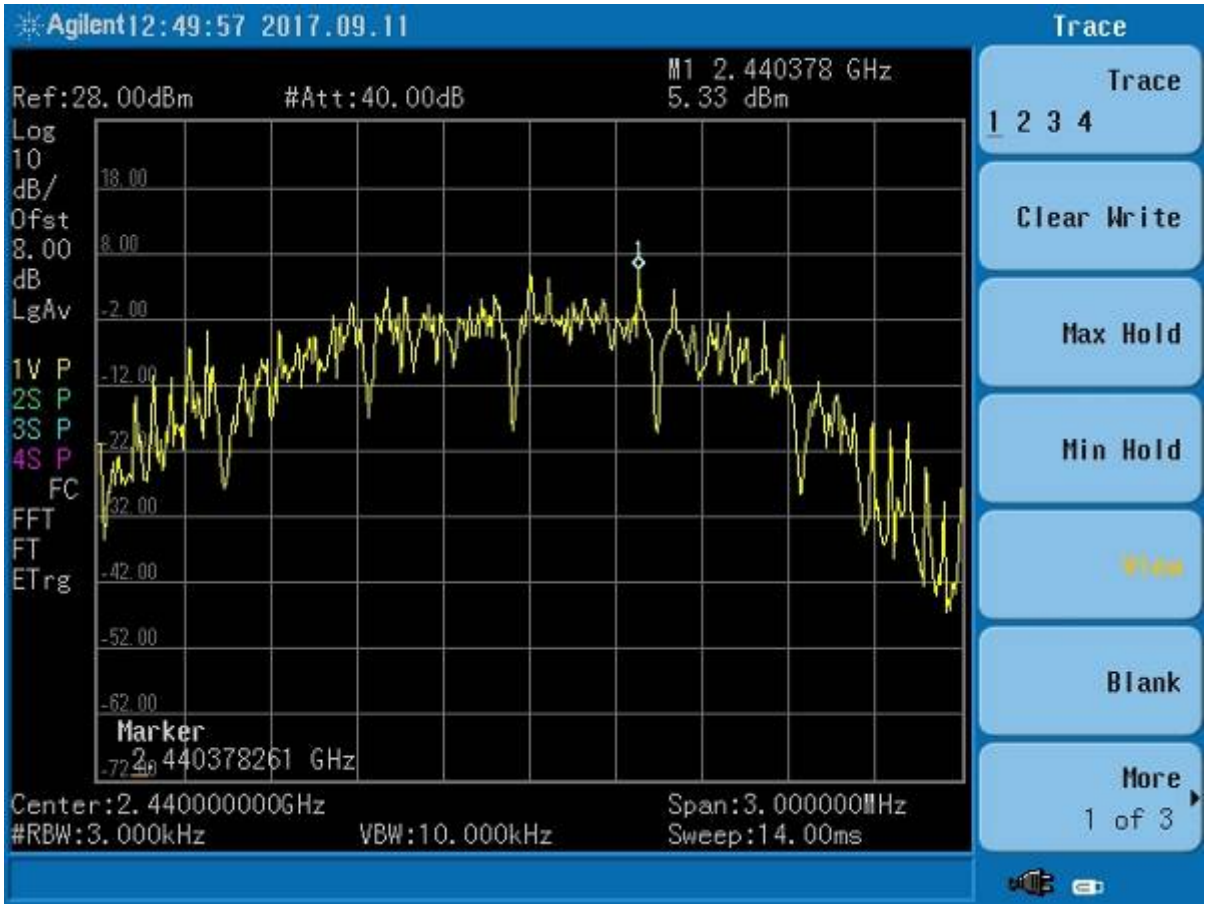


Figure 27. Power Spectral Density - Part 15.247 (e) - Mid Channel

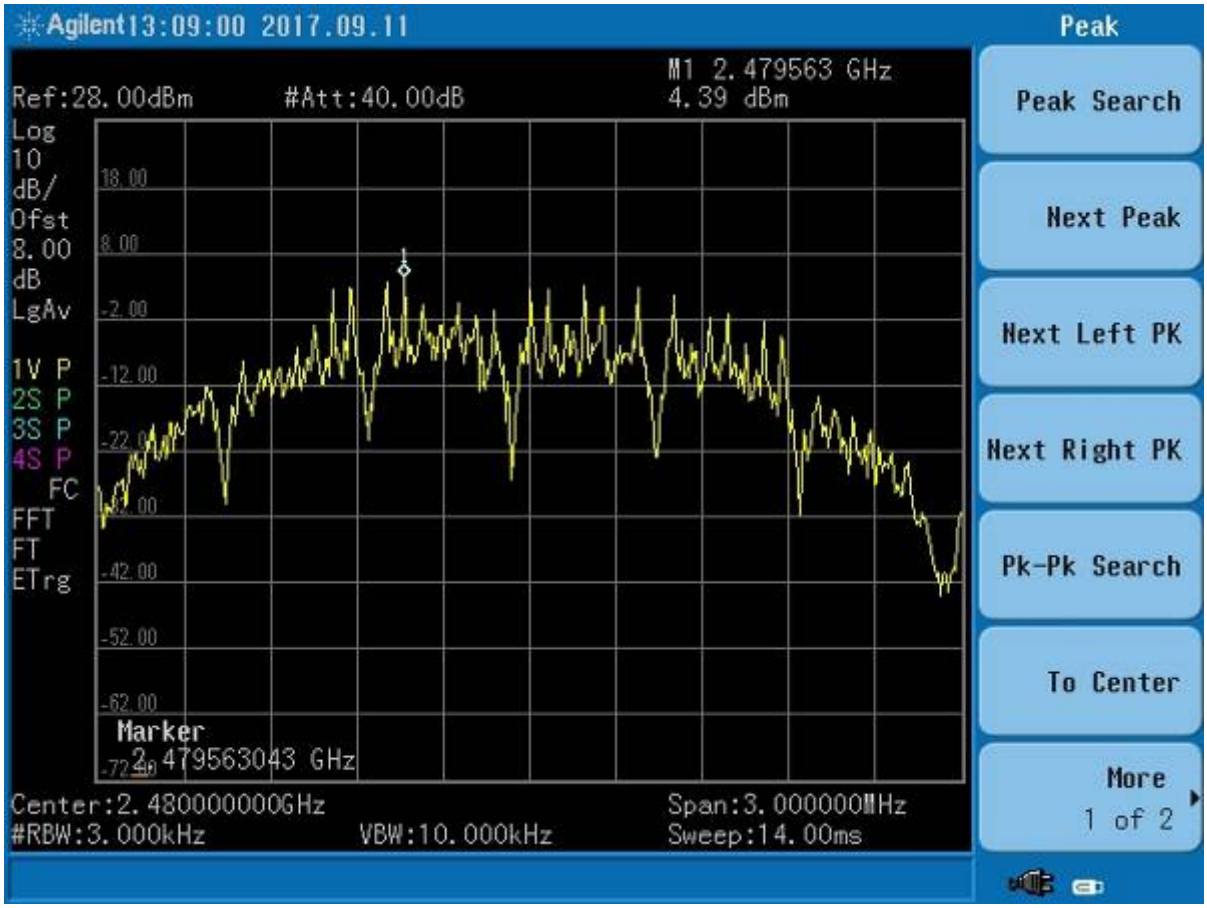


Figure 28. Peak Power Spectral Density - Part 15.247 (e) - High Channel

2.15 Unintentional Radiator and Intentional Radiator Power Lines Conducted Emissions (CFR 15.107, 15.207)

The test data provided in this section is to support the Verification requirement for the digital apparatus. The power line conducted voltage measurements for Receiver and Digital Devices have been carried out in accordance with CFR 15.107 and ANSI C63.4:2014, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into an idle condition or a continuous mode of receive (non-transmitting).

Additionally the power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.10:2013, Clause 6.2, with a spectrum analyzer connected to an LISN and the EUT placed into a continuous mode of transmission.

The transmitter evaluated in this report is considered a co-located radio because it is located less than 20 cm from all other radios on this product. The end product was therefore tested with all radios simultaneously transmitting as this was considered the worst case operation. The powerline emissions data is collected and presented below. This data is meant to show that this product has been evaluated as a product with co-located radios. Reports showing the evaluation of each of the other radios in this end product will be submitted separately.

The worst-case results for conducted emissions were determined to be produced when the EUT was operating under continuous transmission. The worst case measurement was 8.3 dB from the applicable limit at 2.0667 MHz on the Phase line. All other emissions were at least 8.6 dB from the limit. Those results are given in the table below.

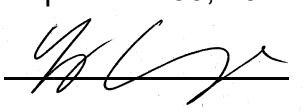
NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

Table 9. Transmitter Power Line Conducted Emissions Test Data, Part 15.107

150KHz to 30 MHz with Class A Limits						
Test: Power Line Conducted Emissions				**Client:** Sanitag Technologies Corp		
Project: 17-0278				**Model:** AC-001-LAN		
Frequency (MHz)	**Test Data (dBuv)**	**LISN+CL-PA (dB)**	**Results (dBuV)**	**AVG Limits (dBuV)**	**Margin (dB)**	**Detector PK, QP, or AVG**
120 VAC, 60 Hz Phase						
0.4930	37.25	0.20	37.45	56.1	18.7	**QP**
0.4930	25.04	0.20	25.24	46.1	20.9	**AVG**
0.5000	36.16	0.28	36.44	56.0	19.6	**QP**
0.5000	23.52	0.28	23.80	46.0	22.2	**AVG**
2.0667	37.41	0.31	37.72	46.0	8.3	**PK**
6.4000	31.67	0.47	32.14	50.0	17.9	**PK**
10.0830	27.01	1.24	28.25	50.0	21.7	**PK**
23.5830	25.70	0.86	26.56	50.0	23.4	**PK**
120VAC, 60 Hz Neutral						
0.4840	39.83	0.06	39.89	56.3	16.4	**QP**
0.4840	26.35	0.06	26.41	46.3	19.9	**AVG**
0.5000	38.28	0.14	38.42	56.0	17.6	**QP**
0.5000	24.91	0.14	25.05	46.0	21.0	**AVG**
1.8400	37.22	0.16	37.38	46.0	8.6	**PK**
5.0250	32.89	0.30	33.19	50.0	16.8	**PK**
10.3167	29.27	1.12	30.39	50.0	19.6	**PK**
21.8330	25.39	0.76	26.15	50.0	23.8	**PK**

SAMPLE CALCULATION at 0.4930 MHz:

Magnitude of Measured Frequency	37.25	dBuV
+ Cable Loss+ LISN Loss	0.20	dB
=Corrected Result	37.45	dBuV
Limit	56.10	dBuV
-Corrected Result	37.45	dBuV
Margin	18.70	dB

Test Date: September 30, 2017
Tested By
Signature:  Name: George Yang

2.16 Unintentional Radiator and Intentional Radiator, Radiated Emissions (CFR 15.109 and 15.209)

The test data provided herein is to support the verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmit state per 15.109 were evaluated from 30 MHz to 12.5 GHz as well as radiated emissions coming for the EUT in a transmitting state per 15.209 and were investigated from 9 kHz or the lowest operating clock frequency to 25 GHz and tested as detailed in ANSI C63.10:2013, Clause 6.4-6.6. Data is presented in the table below. The data presented is with the EUT and all transmitters ON and transmitting. This is intended to satisfy the requirements for co-location transmitter testing.

Radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated Loop Antenna and per the requirements of ANSI C63.10:2013.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth; 1 MHz RBW and 3 MHz VBW. The test data were maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure.

The transmitter evaluated in this report is considered a co-located radio because it is located less than 20 cm from all other radios on this product. The end product was therefore tested with all radios simultaneously transmitting as this was considered the worst case operation. The radiated emissions data is collected and presented below. This data is meant to show that this product has been evaluated as a product with co-located radios. Reports showing the evaluation of each of the other radios in this end product will be submitted separately.

The worst-case radiated emission was 5.8 dB below the specification limit at 106.68 Mhz. All other measured signals were at least 6.1 dB below the specification limit. The results are shown in the table below. These results are meant to show that this EUT’s digital device portion has met the verification requirements for an unintentional radiator under CFR Part 15.109 as well as the intentional transmitter requirements of CFR Part 15.209.

NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

Table 10. Spurious Radiated Emissions (150 KHz-30MHz)

Test By: GY	Test: FCC Part 15.209			Client: Sanitag			
	Project: 17-0278			Model: AC-001-LAN			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK / QP/AVG**
All emissions were at least 20 dB from the applicable limit.							

No other emissions detected other than those presented in this table and the tables in section 2.10 above.
AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION: N/A

Test Date: August 20, 2017

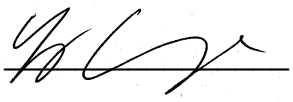
Tested By
Signature:  Name: George Yang

Table 11. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109), 30 MHz to 1000 MHz

30 MHz to 1000 MHz, 15.109/15.209 Limits							
Test: Radiated Emissions				**Client:** Sanitag Technologies Corp			
Project: 17-0278				**Model:** AC-001-LAN			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or QP**
51.80	50.57	-17.05	33.52	40.0	3m./VERT	6.5	**QP**
71.18	39.92	-17.49	22.43	40.0	3m./HORZ	17.6	**PK**
106.63	50.67	-16.60	34.07	43.5	3m./HORZ	9.4	**PK**
106.68	53.49	-15.80	37.69	43.5	3m./VERT	5.8	**QP**
204.82	46.93	-14.17	32.76	54.0	3m./VERT	21.2	**PK**
210.98	47.00	-13.98	33.02	43.5	3m./HORZ	10.5	**PK**
249.95	52.84	-12.97	39.87	46.0	3m./VERT	6.1	**PK**
377.80	49.44	-10.06	39.38	46.0	3m./HORZ	6.6	**PK**

SAMPLE CALCULATION at 71.18 MHz:

Magnitude of Measured Frequency	39.92	dBuV
+ Cable Loss+ LISN Loss	-17.49	dB
=Corrected Result	22.43	dBuV
Limit	40.00	dBuV
-Corrected Result	22.43	dBuV
Margin	17.60	dB

Test Date: July 27, 2017
Tested By
Signature:  Name: Robert K. Mills

Table 12. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109/15.209) 1 GHz to 25 GHz

1 GHz to 25 GHz, Part 15.109/15.209 Limits							
Test: Radiated Emissions				**Client:** Sanitag Technologies Corp			
Project: 17-0278				**Model:** AC-001-LAN			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
1652.00	44.23	-4.87	39.36	54.0	3.0m./VERT	14.6	**AVG**
1647.40	46.00	-4.72	41.28	54.0	3.0m./HORZ	12.7	**AVG**

SAMPLE CALCULATION at 1652.00 MHz:

Magnitude of Measured Frequency	44.23	dBuV
+ Cable Loss+ LISN Loss	-4.87	dB
=Corrected Result	39.36	dBuV
Limit	54.00	dBuV
-Corrected Result	39.36	dBuV
Margin	14.60	dB

Test Date: July 27, 2017
Tested By
Signature:  Name: Robert K. Mills

2.17 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4-2:2011. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.17.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.78 dB.

2.17.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.39 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.18 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.21dB.

3 Conclusions

The EUT meets the requirements of the applicable standard when tested as presented in this test report.