FCC Testing of the
DAQRI International Ltd
Model: DAQRI Smart Helmet
In accordance with FCC 47 CFR Part 15C

Prepared for: DAQRI LLC
1201 W. 5th St. Suite T-800333
Los Angeles
California
90017
United States

FCC ID: 2AEWMDQR001001

Product Service

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COMMERCIAL-IN-CONFIDENCE

Date: March 2017
Document Number: 75937080-02 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Steven White	24 March 2017	
Authorised Signatory	Matthew Russell	24 March 2017	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Neil Russell	24 March 2017	
Testing	Graeme Lawler	24 March 2017	
Testing	Dan Ralley	24 March 2017	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be in compliance with FCC 47 CFR Part 15C: (2015)

TÜV SÜD Product Service
is a trading name of TUV SUD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TUV SUD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

TÜV SÜD Product Service
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

Product Service

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	24 March 2017

Table 1

1.2 Introduction

Applicant	DAQRI LLC
Manufacturer	DAQRI International Ltd
Model Number(s)	DAQRI Smart Helmet
Serial Number(s)	1) 106 2) 1829C-DC8-6UPN9XJWJW
Hardware Version(s)	DAQRI Thor DE
Software Version(s)	V16
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: (2015)
Order Number Date	107133 25-November-2016
Date of Receipt of EUT	28-November-2016
Start of Test	29-November-2016
Finish of Test	15-March-2017
Name of Engineer(s)	Neil Rousell, Graeme Lawler, Dan Ralley and Mehadi Choudhury
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r01

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration: Bluetooth Low Energy				
2.1	15.247 (b)(3)	Maximum Conducted Output Power	Pass	ANSI C63.10
2.2	15.247 (a)(2)	Emission Bandwidth	Pass	ANSI C63.10
2.3	15.247 (e)	Power Spectral Density	Pass	ANSI C63.10
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	ANSI C63.10
2.5	15.205	Restricted Band Edges	Pass	ANSI C63.10
2.6	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10
Configuration: 802.11b				
2.1	15.247 (b)(3) and 5.4	Maximum Conducted Output Power	Pass	ANSI C63.10
2.2	15.247 (a)(2) and 5.2	Emission Bandwidth	Pass	ANSI C63.10
2.3	15.247 (e) and 5.4	Power Spectral Density	Pass	ANSI C63.10
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	ANSI C63.10
2.5	15.205	Restricted Band Edges	Pass	ANSI C63.10
2.6	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration: 802.11g				
2.1	15.247 (b)(3) and 5.4	Maximum Conducted Output Power	Pass	ANSI C63.10
2.2	15.247 (a)(2) and 5.2	Emission Bandwidth	Pass	ANSI C63.10
2.3	15.247 (e) and 5.4	Power Spectral Density	Pass	ANSI C63.10
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	ANSI C63.10
2.5	15.205	Restricted Band Edges	Pass	ANSI C63.10
2.6	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10
Configuration: 802.11n (20 MHz Bandwidth)				
2.1	15.247 (b)(3) and 5.4	Maximum Conducted Output Power	Pass	ANSI C63.10
2.2	15.247 (a)(2) and 5.2	Emission Bandwidth	Pass	ANSI C63.10
2.3	15.247 (e) and 5.4	Power Spectral Density	Pass	ANSI C63.10
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	ANSI C63.10
2.5	15.205	Restricted Band Edges	Pass	ANSI C63.10
2.6	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10
Configuration: 802.11n (40 MHz Bandwidth)				
2.1	15.247 (b)(3) and 5.4	Maximum Conducted Output Power	Pass	ANSI C63.10
2.2	15.247 (a)(2) and 5.2	Emission Bandwidth	Pass	ANSI C63.10
2.3	15.247 (e) and 5.4	Power Spectral Density	Pass	ANSI C63.10
2.5	15.205	Restricted Band Edges	Pass	ANSI C63.10
2.6	15.247 (d)	Authorised Band Edges	Pass	ANSI C63.10

Table 2

Product Service

1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	DAQRI Smart Helmet
Part Number	THR5002101
Hardware Version	DAQRI Thor DE
Software Version	V16
FCC ID (if applicable)	2AEWMDQR001001
Industry Canada ID (if applicable)	N/A
Technical Description (Please provide a brief description of the intended use of the equipment)	DAQRI Smart Helmet is a wearable human-machine interface that connects workers in a variety of industries and environments to real time information and augmented work instructions.

Types of Modulations used by the Equipment	
☒	FHSS
☒	Other forms of modulation
In case of FHSS Modulation	
In case of non-Adaptive Frequency Hopping equipment:	
	Number of Hopping Frequencies:
In case of Adaptive Frequency Hopping Equipment:	
	Maximum number of Hopping Frequencies: 79
	Minimum number of Hopping Frequencies: 20
Dwell Time: Up to 3.2 ms for Bluetooth	
Adaptive / non-adaptive equipment:	
☐	non-adaptive Equipment
☒	adaptive Equipment without the possibility to switch to a non-adaptive mode
☐	adaptive Equipment which can also operate in a non-adaptive mode
In case of adaptive equipment:	
The maximum Channel Occupancy Time implemented by the equipment: 13 ms	
☐	The equipment has implemented an LBT based DAA mechanism
In case of equipment using modulation different from FHSS:	
☐	The equipment is Frame Based equipment
☒	The equipment is Load Based equipment
☐	The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: 18 µs	
☒	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

In case of non-adaptive Equipment:
The maximum RF Output Power (e.i.r.p.): 19 dBm
The maximum (corresponding) Duty Cycle: 100 %
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

The worst case operational mode for each of the following tests:
RF Output Power: Determined by test lab
Power Spectral Density: Determined by test lab
Duty cycle, Tx-Sequence, Tx-gap: Determined by test lab
Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment): Determined by test lab
Hopping Frequency Separation (only for FHSS equipment): Determined by test lab
Medium Utilisation: N/A
Adaptivity & Receiver Blocking: Determined by test lab
Nominal Channel Bandwidth: Determined by test lab
Transmitter unwanted emissions in the OOB domain: Determined by test lab
Transmitter unwanted emissions in the spurious domain: Determined by test lab
Receiver spurious emissions: Determined by test lab

The different transmit operating modes (tick all that apply):		
☒	Operating mode 1: Single Antenna Equipment	
	☒	Equipment with only 1 antenna
	☒	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
	☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
☒	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	
	☒	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
	☒	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☒	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	
	☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		

In case of Smart Antenna Systems:
The number of Receive chains: 2
The number of Transmit chains: 2
☒ symmetrical power distribution
☐ asymmetrical power distribution
In case of beam forming, the maximum (additional) beam forming gain: dB
NOTE: The additional beam forming gain does not include the basic gain of a single antenna.
Operating Frequency Range(s) of the equipment:
Operating Frequency Range 1: 2400 MHz to 2483.5 MHz
Operating Frequency Range 2: MHz to MHz
Operating Frequency Range 3: MHz to MHz
NOTE: Add more lines if more Frequency Ranges are supported.
Nominal Channel Bandwidth(s):
Nominal Channel Bandwidth1: 20 MHz
Nominal Channel Bandwidth2: 40 MHz
Nominal Channel Bandwidth3: 1 MHz (Bluetooth)
Nominal Channel Bandwidth4: 2 MHz MHz (BLE)
Nominal Channel Bandwidth5: MHz
NOTE: Add more lines if more channel bandwidths are supported.
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):
☒ Stand-alone
☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐ Plug-in radio device (Equipment intended for a variety of host systems)
☐ Other
The normal and extreme operating conditions that apply to the equipment:
Normal operating conditions (if applicable):
Operating temperature: °C
Other (please specify if applicable):
Extreme operating conditions:
Operating temperature range: Minimum 0 °C to Maximum 37 °C
Other (please specify if applicable): Minimum °C to Maximum °C
Details provided are for the:
☒ stand-alone equipment
☐ combined (or host) equipment
☐ test jig

Product Service

The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☒ Integral Antenna (information to be provided in case of conducted measurements)			
Antenna Gain: 2 dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☒ Temporary RF connector provided			
☐ No temporary RF connector provided			
☐ Dedicated Antennas (equipment with antenna connector)			
☐ Single power level with corresponding antenna(s)			
☐ Multiple power settings and corresponding antenna(s)			
Number of different Power Levels:			
Power Level 1: dBm			
Power Level 2: dBm			
Power Level 3: dBm			
NOTE 1: Add more lines in case the equipment has more power levels.			
NOTE 2: These power levels are conducted power levels (at antenna connector).			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: 19 dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1	2.0	19.0	Taoglas FXP840
2	2.0	19.0	Taoglas FXP840
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			

The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:	
Details provided are for the:	
☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	
Supply Voltage ☐ AC mains State AC voltage V	
☐ DC State DC voltage V	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☐ External Power Supply or AC/DC adapter	
☐ Battery	
☒ Other: Li-ion	
Describe the test modes available which can facilitate testing:	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3] IEEE 802.15.4™ [i.4], proprietary, etc.):	
If applicable, the statistical analysis referred in clause 5.4.1 q)	
To be provided as separate attachment	
If applicable, the statistical analysis referred in clause 5.4.1 r)	
To be provided as separate attachment	
Geo-location capability supported by the equipment:	
☒ Yes	
☒ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.	
☐ No	
Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or 4.3.2.11.3)	
Get this from 328 blocking test section.	
Combination for testing (see clause 5.3.2.3 of EN 300 328 V21.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 5.4.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment. Unless otherwise specified in ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also ETS EN 300 328, clause 5.3.2.3	
Highest overall e.i.r.p. value: 19 dBm	
Corresponding Antenna assembly gain: 2.0 dBi	Antenna Assembly #:
Corresponding conducted power setting: dBm (also the power level to be used for testing)	Listed as Power Setting #:
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission: 20M0 G1D, 40M0 G1D, 2M00 G1D, 1M00 G1D	
Can the transmitter operate unmodulated? ☐ Yes ☒ No	

Duty Cycle	
The transmitter is intended for:	
☒	Continuous duty
☐	Intermittent duty
☐	Continuous operation possible for testing purposes

About the UUT	
☐	The equipment submitted are representative production models
☐	If not, the equipment submitted are pre-production models?
☒	If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested
☐	If not, supply full details
☐	The equipment submitted is CE marked

Additional items and/or supporting equipment provided	
☒	Spare batteries (e.g. for portable equipment)
☒	Battery charging device
☒	External Power Supply or AC/DC adapter
☐	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☐	Combined equipment
	Manufacturer
	Model
	Model Name
☒	User Manual
☐	Technical documentation (Handbook and circuit diagrams)

I hereby declare that that the information supplied is correct and complete.

Name: Dave Williams Position held: Certification Test Manager
Date: 1st March 2017

1.5 Product Information

1.5.1 Technical Description

DAQRI Smart Helmet is a wearable human-machine interface that connects workers in a variety of industries and environments to real time information and augmented work instructions.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: 106			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: 1829C-DC8-6UPN9XJWJW			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration: Bluetooth Low Energy		
Maximum Conducted Output Power	Neil Rousell	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Power Spectral Density	Neil Rousell	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Configuration: 802.11b		
Maximum Conducted Output Power	Neil Rousell	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Power Spectral Density	Dan Ralley	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS

Test Name	Name of Engineer(s)	Accreditation
Configuration: 802.11g		
Maximum Conducted Output Power	Neil Rousell	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Power Spectral Density	Dan Ralley	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Configuration: 802.11n (20 MHz Bandwidth)		
Maximum Conducted Output Power	Neil Rousell	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Power Spectral Density	Dan Ralley	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Configuration: 802.11n (40 MHz Bandwidth)		
Maximum Conducted Output Power	Neil Rousell	UKAS
Emission Bandwidth	Mehadi Choudhury	UKAS
Power Spectral Density	Dan Ralley	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)(3)

2.1.2 Equipment Under Test and Modification State

DAQRI Smart Helmet, S/N: 106 - Modification State 0

2.1.3 Date of Test

29-November-2016 to 01-December-2016

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, Clause 11.9.1.1.

For configurations supporting MiMo, the measured output across the antenna ports were summed in accordance with KDB 662911, clause 2.a.

2.1.5 Environmental Conditions

Ambient Temperature	21.3 - 22.1 °C
Relative Humidity	23.7 - 25.9 %

2.1.6 Test Results

Bluetooth Low Energy

Frequency (MHz)	Output Power	
	dBm	mW
2402	5.8	3.8
2440	6.1	4.1
2480	5.7	3.7

Table 5

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

802.11b

Testing was performed on the data rate with the highest conducted output power. This data rate was 11 Mbps.

Frequency (MHz)	Output Power	
	dBm	mW
2412	15.2	33.113
2437	15.3	33.884
2462	15.3	33.884

Table 6

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

802.11g

Testing was performed on the data rate with the highest conducted output power. This data rate was 9 Mbps.

Frequency (MHz)	Output Power	
	dBm	mW
2412	15.5	35.481
2437	15.7	37.154
2462	15.8	38.019

Table 7

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

802.11n (20 MHz Bandwidth)

Testing was performed on the modulation coding scheme with the highest conducted output power. This modulation coding scheme was MCS8.

Frequency (MHz)	Output Power	
	dBm	mW
2412	15.3	33.884
2437	15.5	35.481
2462	15.6	36.308

Table 8

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

802.11n (40 MHz Bandwidth)

Testing was performed on the modulation coding scheme with the highest conducted output power. This modulation coding scheme was MCS4.

Frequency (MHz)	Output Power	
	dBm	mW
2422	15.1	32.360
2437	15.2	33.113
2452	15.1	32.360

Table 9

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017

Table 10

2.2 Emission Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)

2.2.2 Equipment Under Test and Modification State

DAQRI Smart Helmet, S/N: 106 - Modification State 0

2.2.3 Date of Test

15-March-2017

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, Clause 11.8.2.

2.2.5 Environmental Conditions

Ambient Temperature	23.8 °C
Relative Humidity	40.8 %

2.2.6 Test Results

Bluetooth Low Energy

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	6 dB Bandwidth (MHz)
2402	0.659
2440	0.664
2480	0.670

Table 11

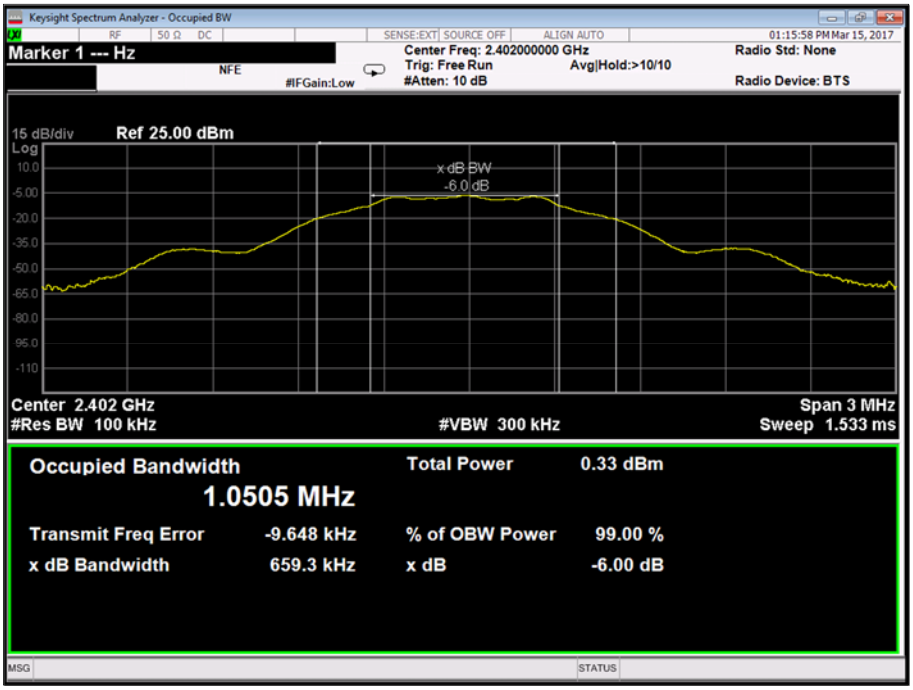

Figure 1 - 2402 MHz

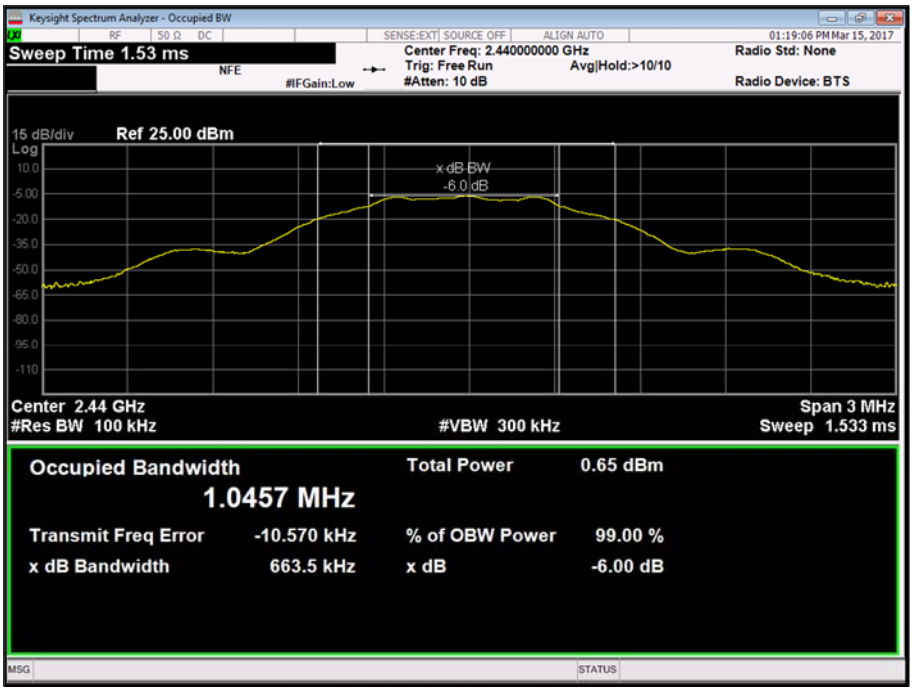

Figure 2 - 2440 MHz

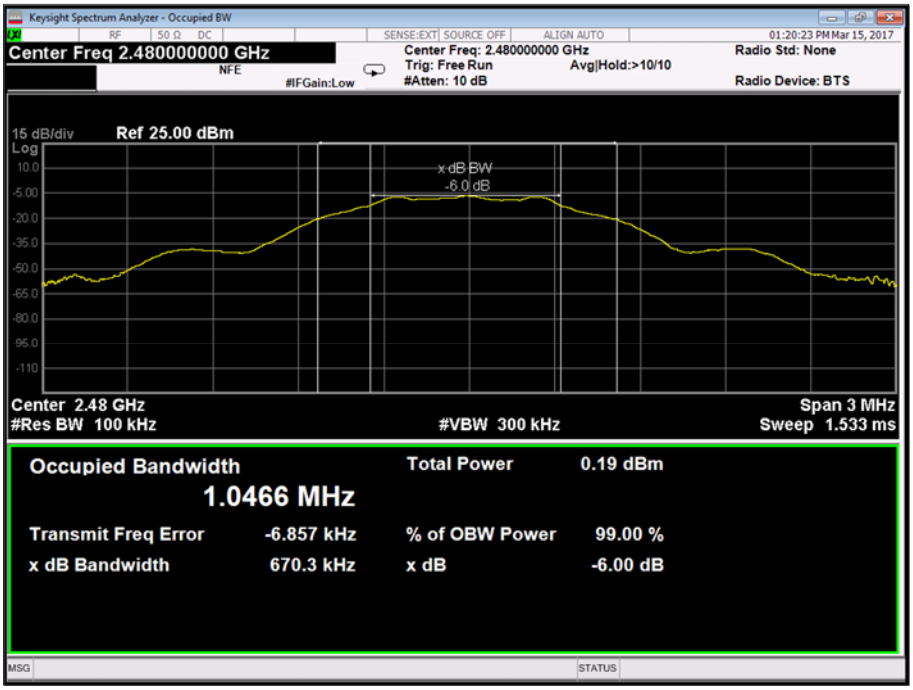

Figure 3 - 2480 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(2)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

802.11b

Data Rate: 11 Mbps

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	11.05
2437	10.90
2462	10.54

Table 12

Figure 4 - 2412 MHz

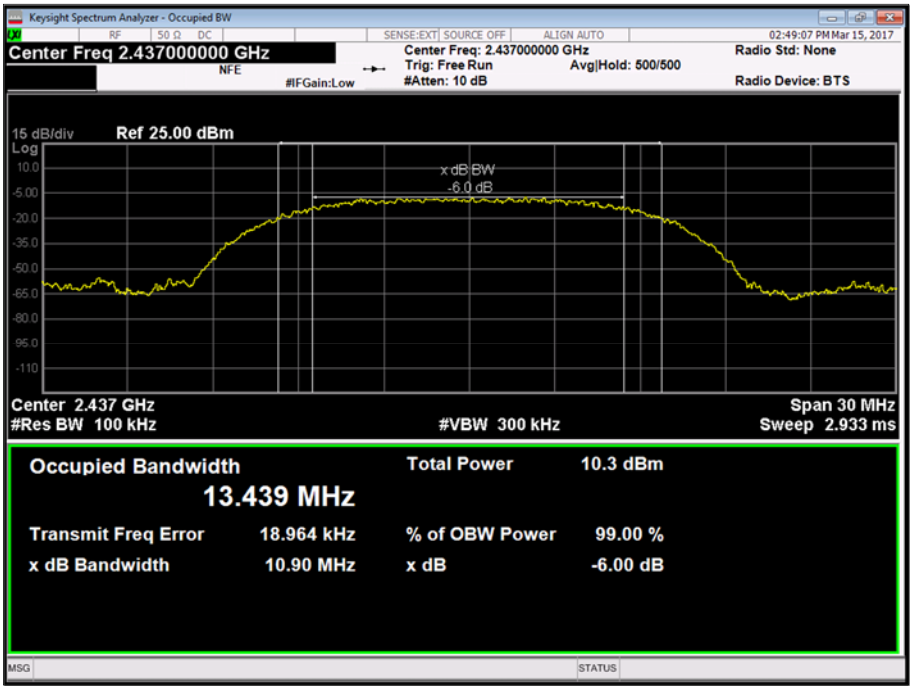

Figure 5 - 2437 MHz

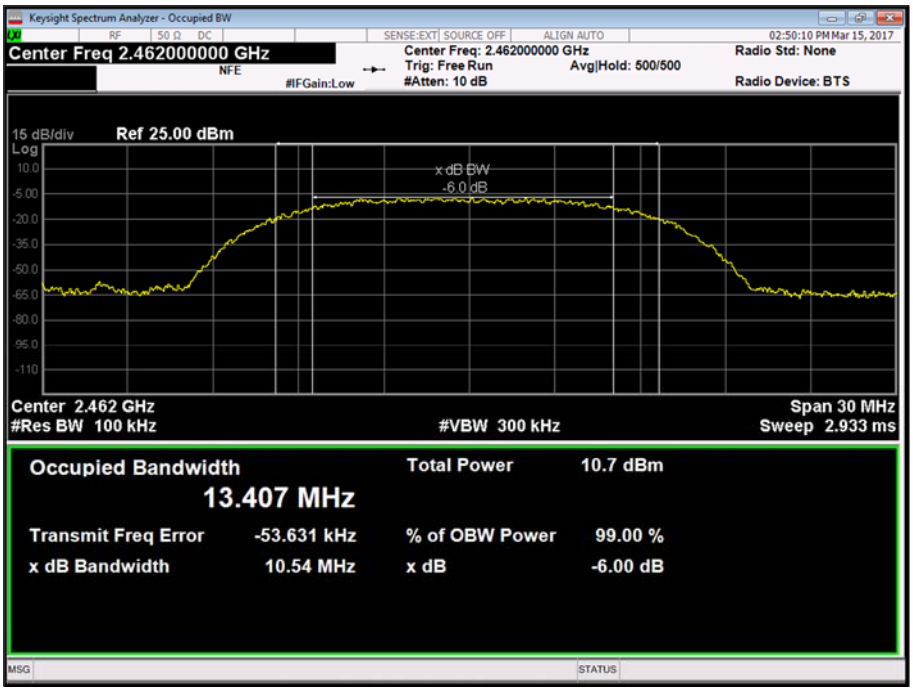

Figure 6 - 2462 MHz

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

802.11g

Data Rate: 9 Mbps

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	15.14
2437	15.09
2462	15.12

Table 13

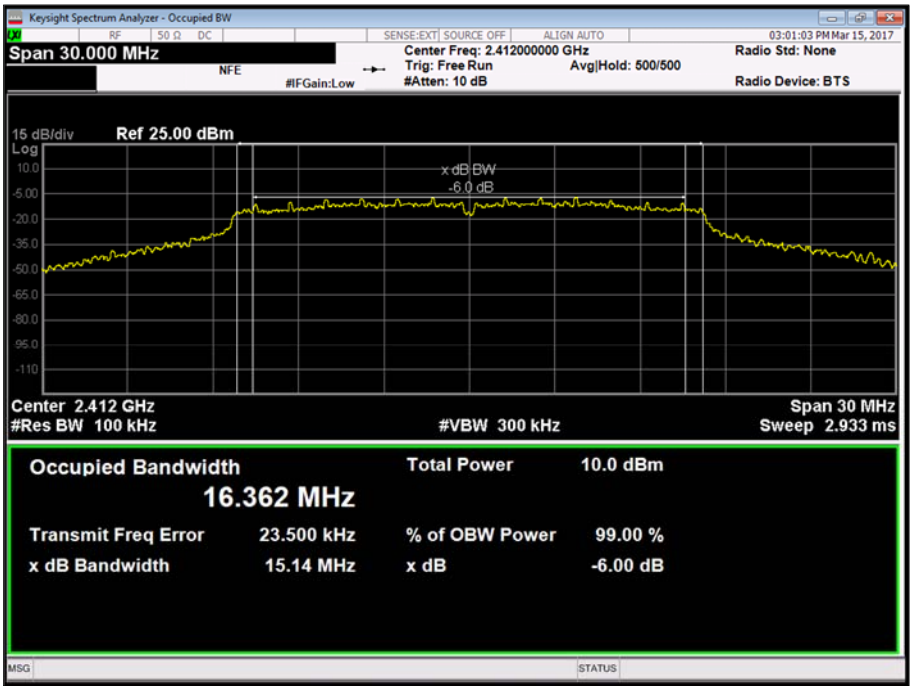

Figure 7 - 2412 MHz

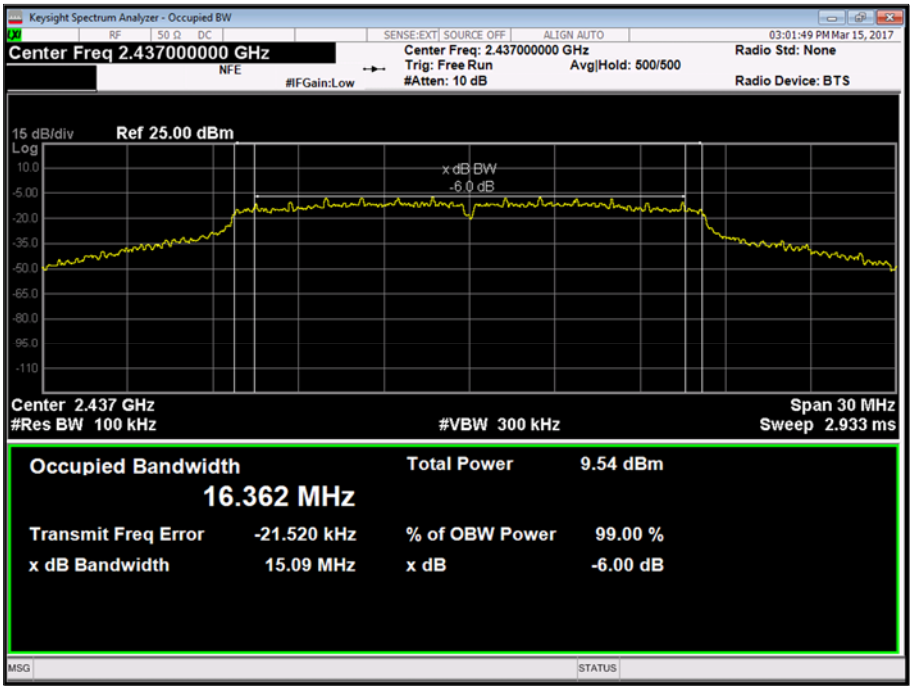

Figure 8 - 2437 MHz

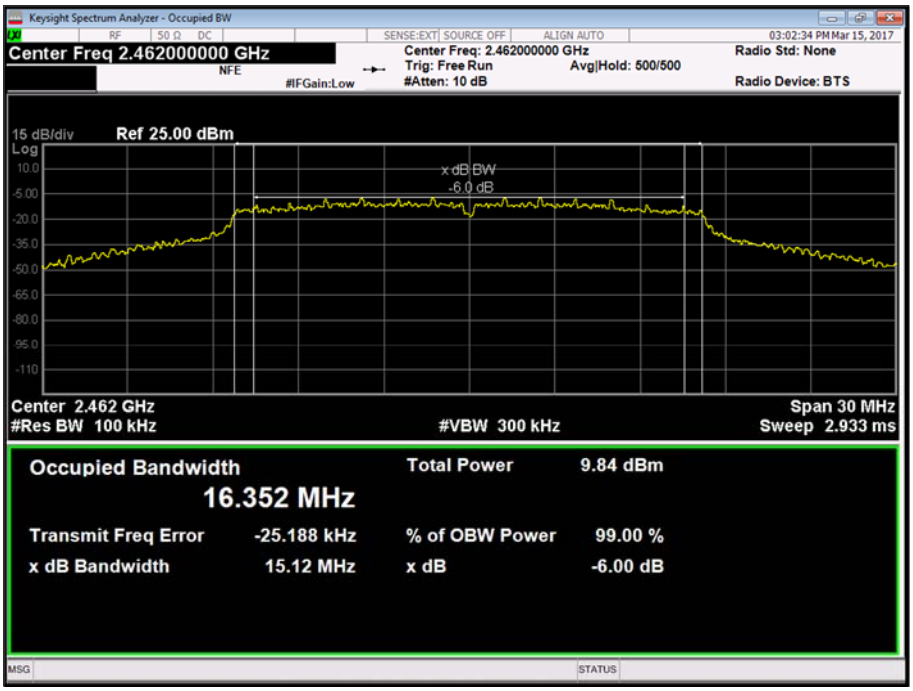

Figure 9 - 2462 MHz

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

802.11n (20 MHz Bandwidth)

Modulation Coding Scheme: MCS8

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	15.29
2437	15.14
2462	15.14

Table 14

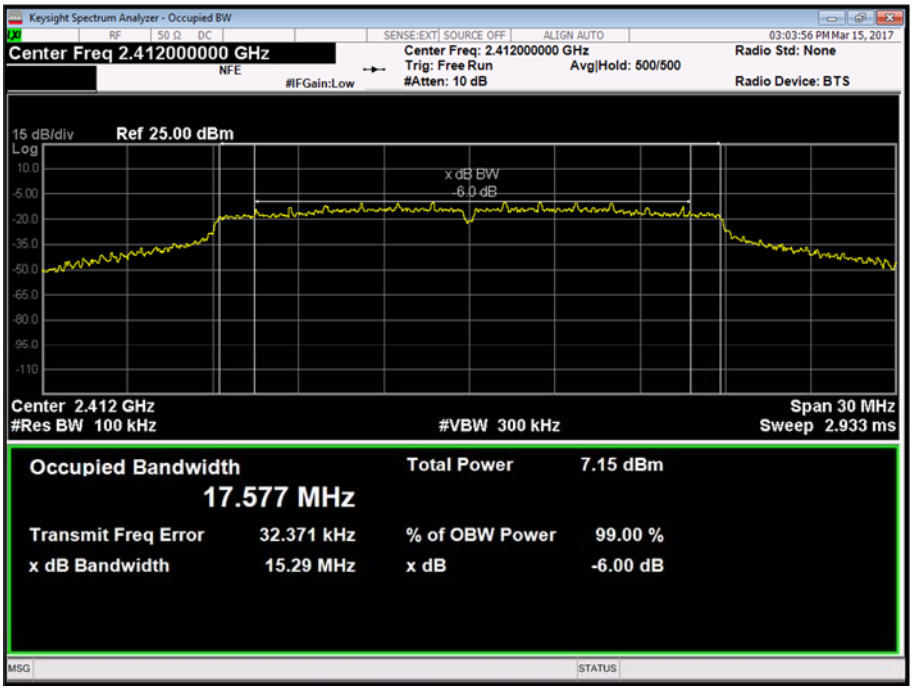

Figure 10 - 2412 MHz

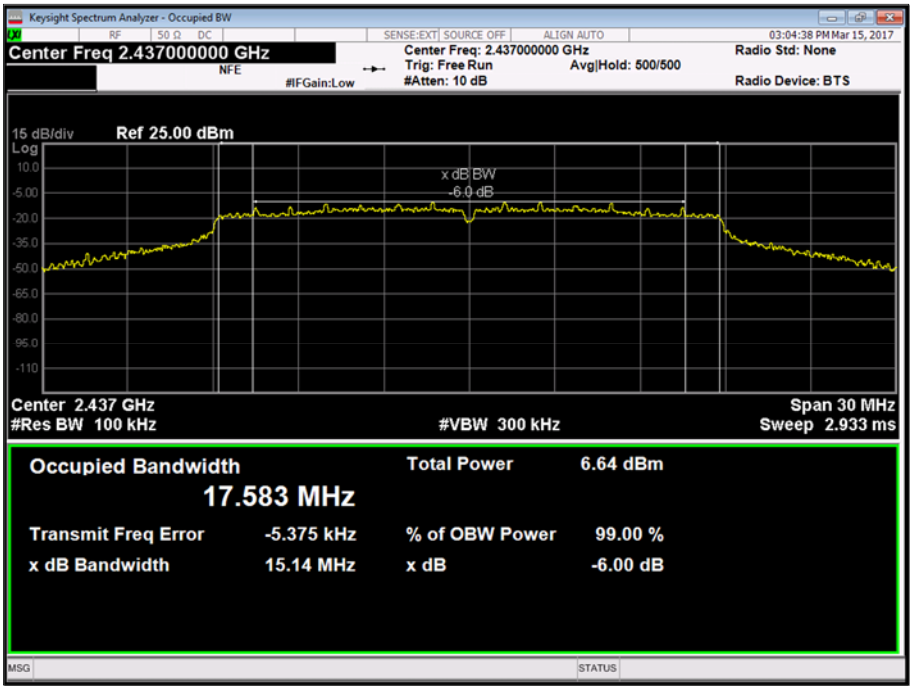

Figure 11 - 2437 MHz

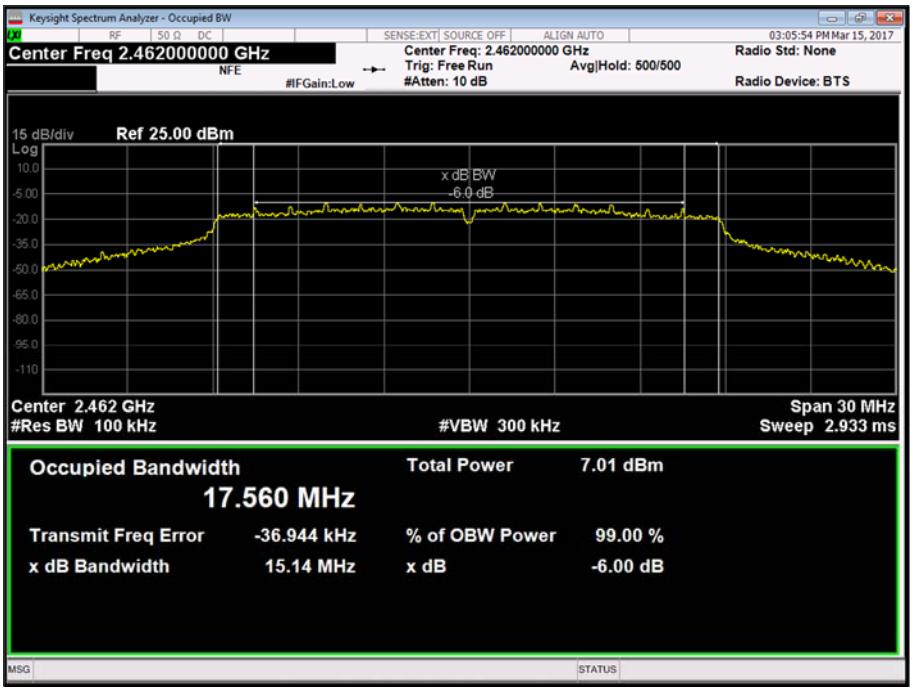

Figure 12 - 2462 MHz

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

802.11n (40 MHz Bandwidth)

Modulation Coding Scheme: MCS4

Frequency (MHz)	6 dB Bandwidth (MHz)
2422	35.38
2437	35.12
2452	35.44

Table 15

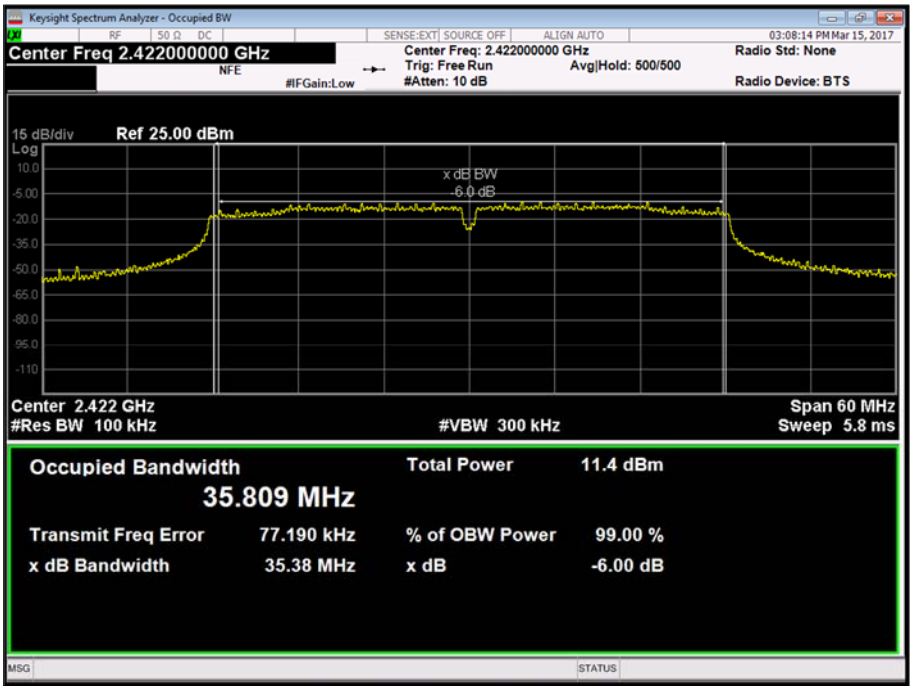

Figure 13 - 2422 MHz

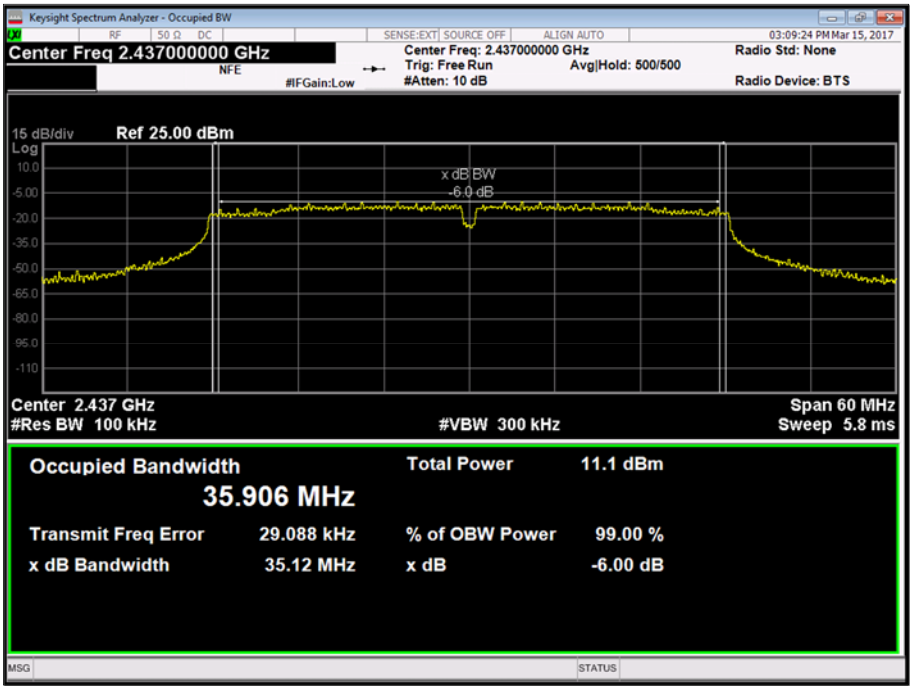

Figure 14 - 2437 MHz

Figure 15 - 2452 MHz

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2)

The minimum 6 dB Bandwidth shall be at least 500 kHz.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Attenuator (10dB, 1W)	Sealectro	60-674-1010-89	1224	12	30-Jun-2017
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017
1 metre K type Cable	IW Microwave	KPS-1501LC-394-KPS-R	4830	12	24-Jan-2018

Table 16

2.3 Power Spectral Density

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (e)

2.3.2 Equipment Under Test and Modification State

DAQRI Smart Helmet, S/N: 106 - Modification State 0

2.3.3 Date of Test

30-November-2016 to 06-December-2016

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, Clause 11.10.2.

For configurations supporting MiMo, 3 dB was added to the antenna port with the highest PSD to give the total power figure obtained as described in KDB 662911 D01.

2.3.5 Environmental Conditions

Ambient Temperature	21.0 - 22.7 °C
Relative Humidity	19.2 - 44.6 %

2.3.6 Test Results

Bluetooth Low Energy

Modulation/Packet Type: GFSK/DH1

Frequency (MHz)	Power Spectral Density (dBm)
2402	-4.561
2440	-4.204
2480	-4.549

Table 17

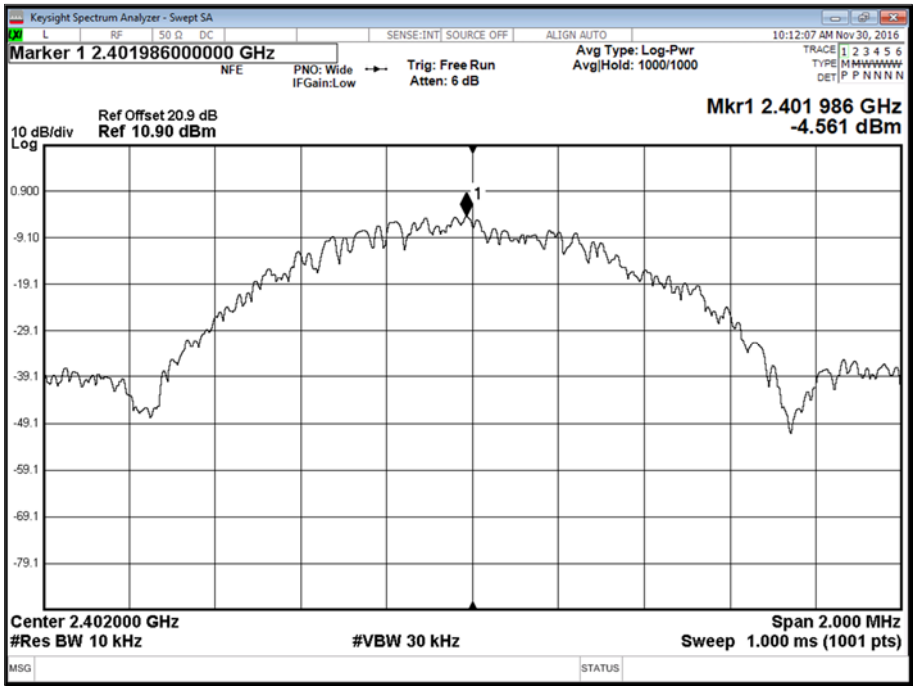

Figure 16 - 2402 MHz

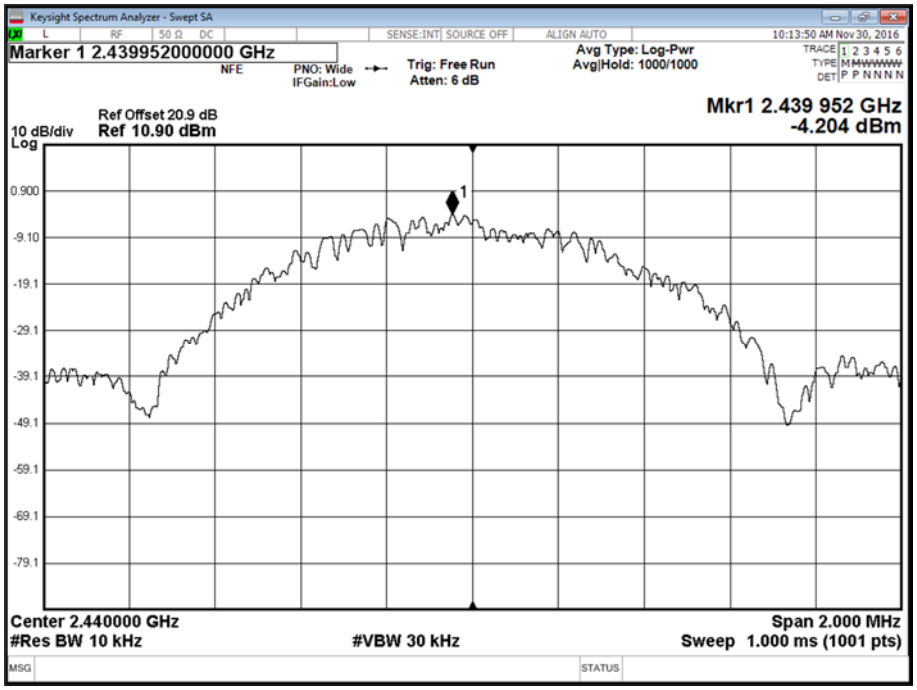

Figure 17 - 2440 MHz

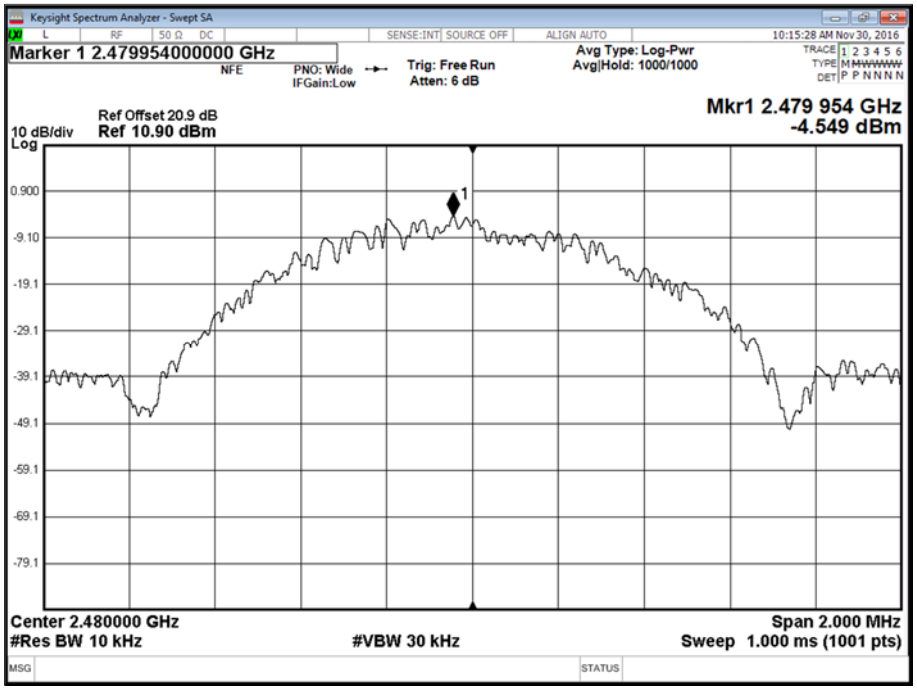

Figure 18 - 2480 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

802.11b

Data Rate: 5.5 Mbps

Frequency (MHz)	Port A (dBm)	Port B (dBm)	Total Power (dBm)
2412	-7.574	-9.149	N/A
2437	-7.287	-8.767	N/A
2462	-7.282	-8.715	N/A

Table 18

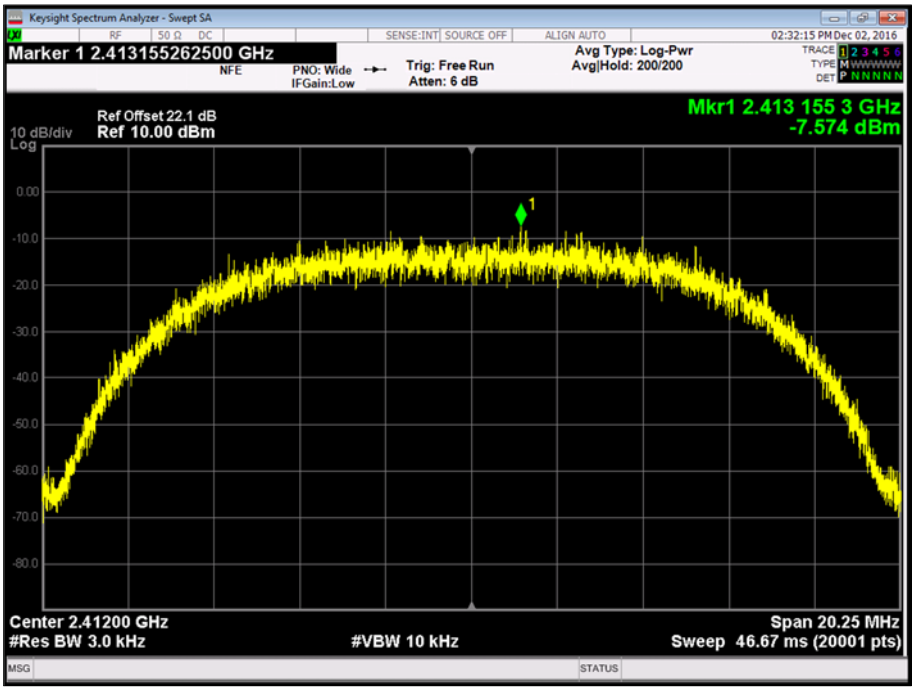

Figure 19 - 2412 MHz - Port A

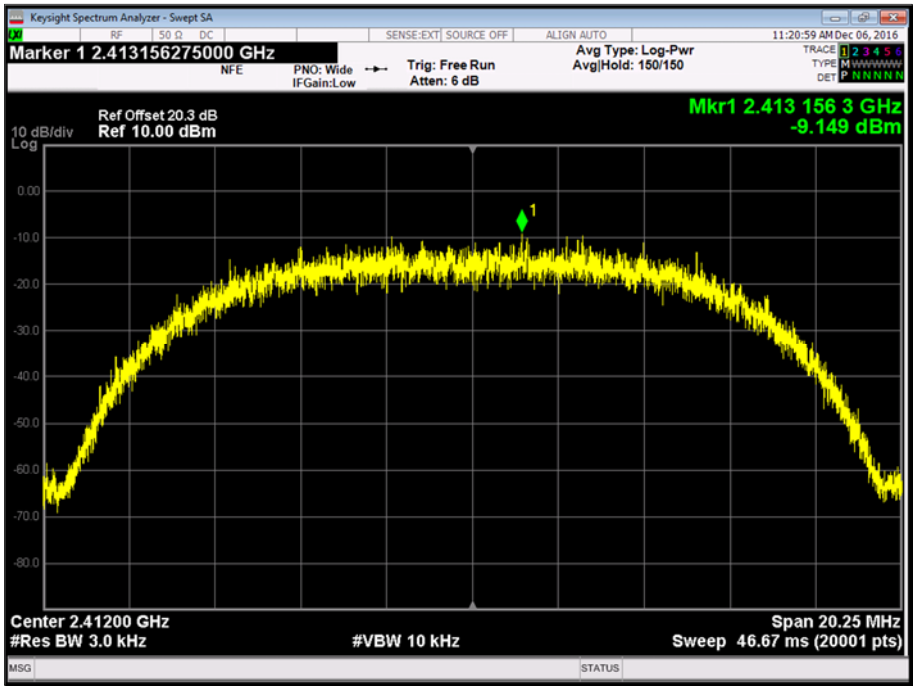

Figure 20 - 2412 MHz - Port B

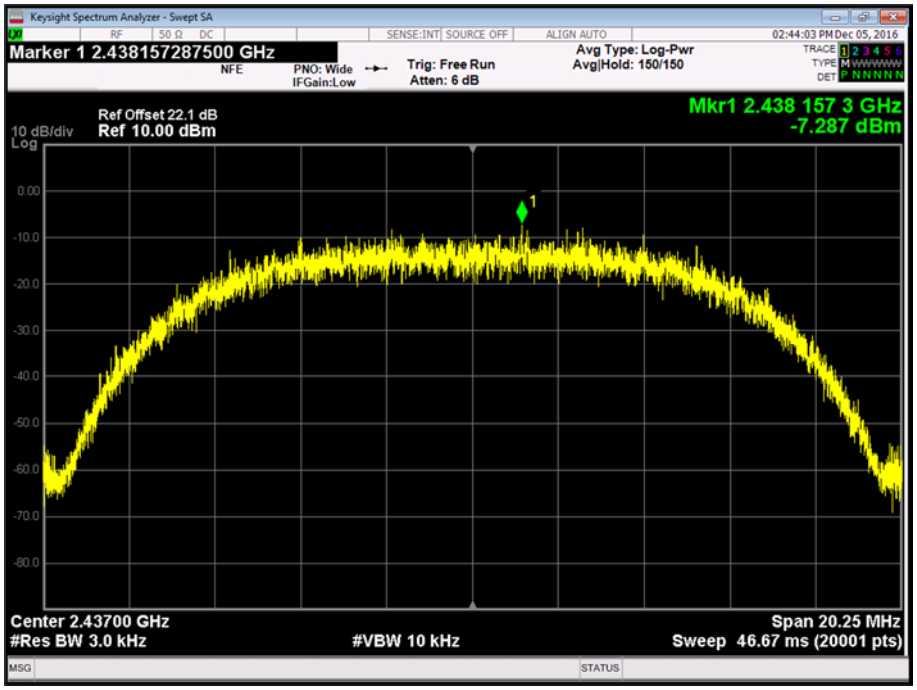

Figure 21 - 2437 MHz - Port A

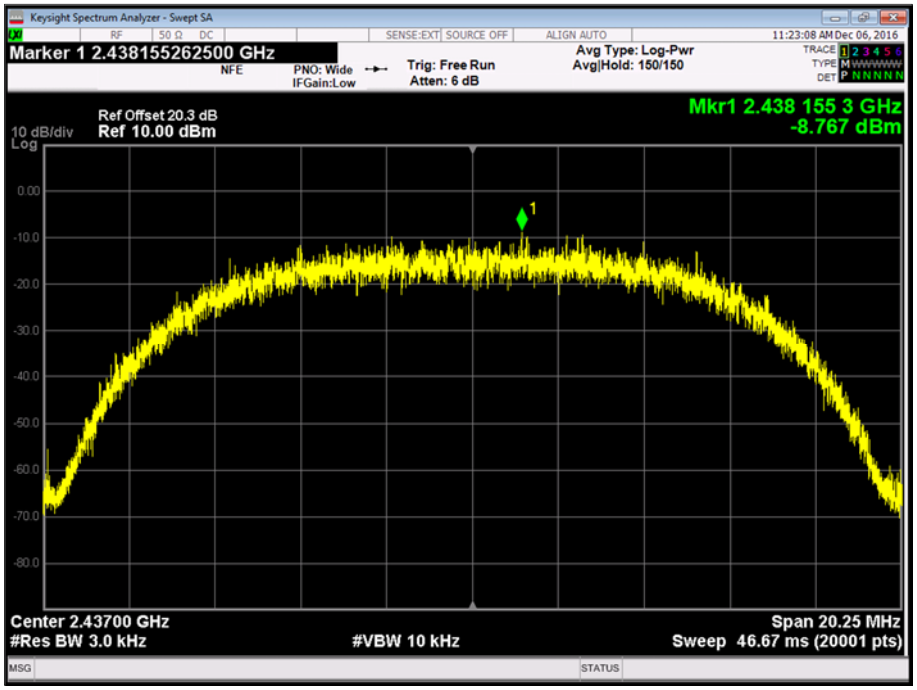

Figure 22 - 2437 MHz - Port B

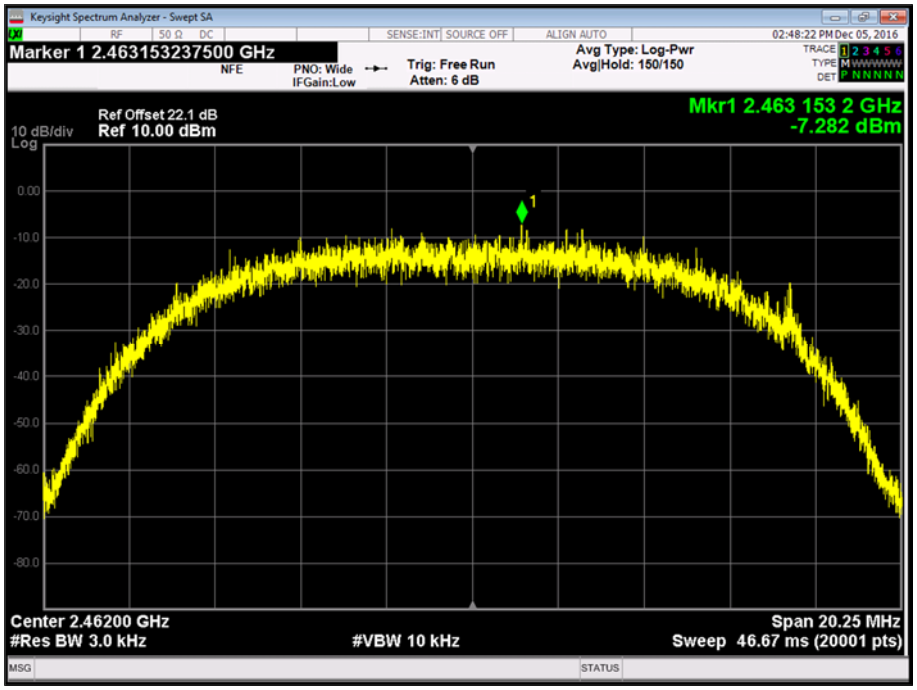

Figure 23 - 2462 MHz - Port A

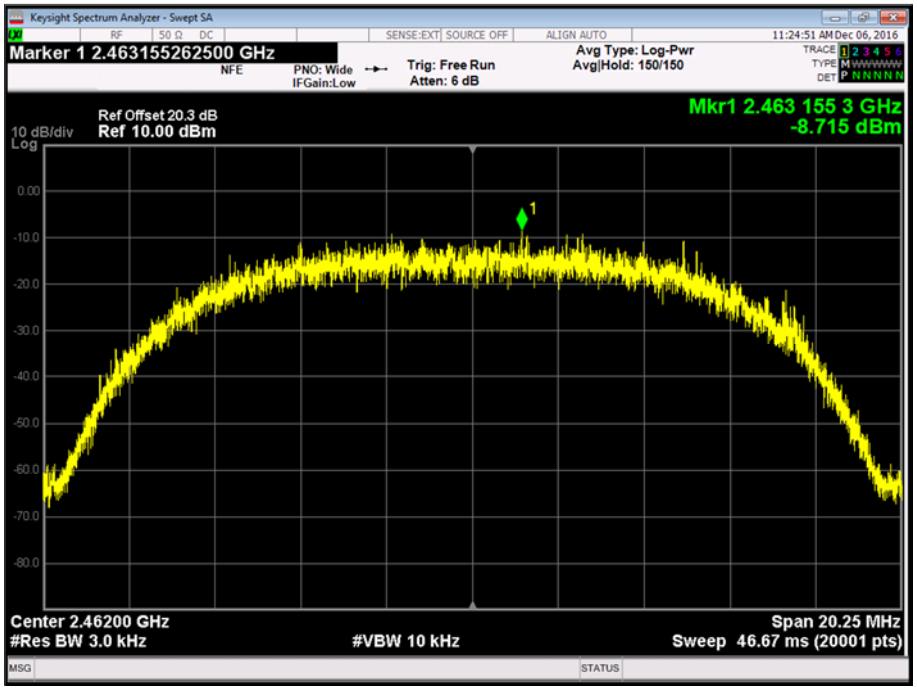

Figure 24 - 2462 MHz - Port B

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

802.11g

Data Rate: 54 Mbps

Frequency (MHz)	Port A (dBm)	Port B (dBm)	Total Power (dBm)
2412	-7.281	-10.010	N/A
2437	-8.309	-10.197	N/A
2462	-7.111	-9.597	N/A

Table 19

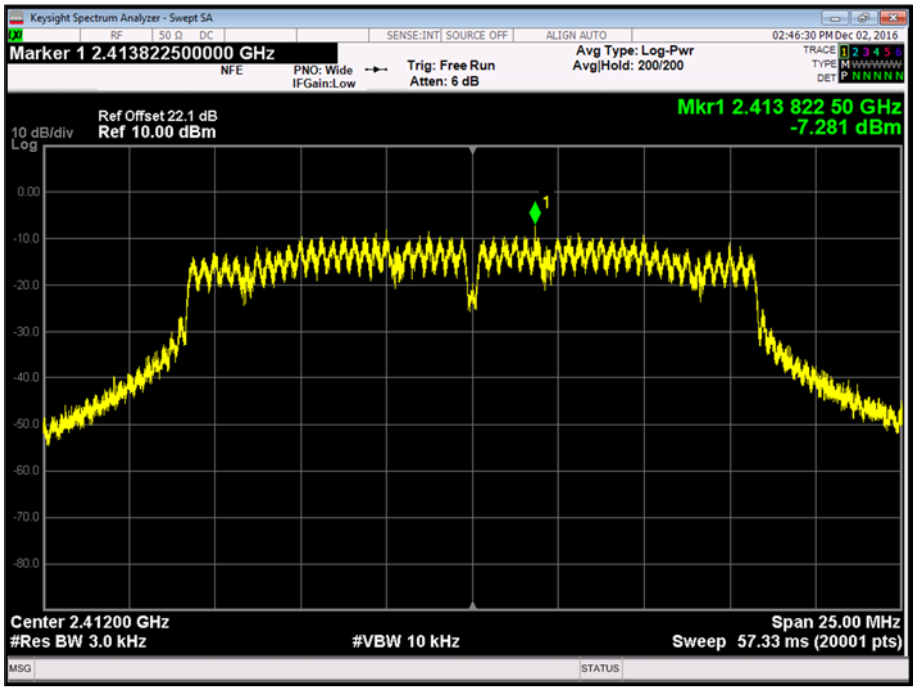

Figure 25 - 2412 MHz - Port A

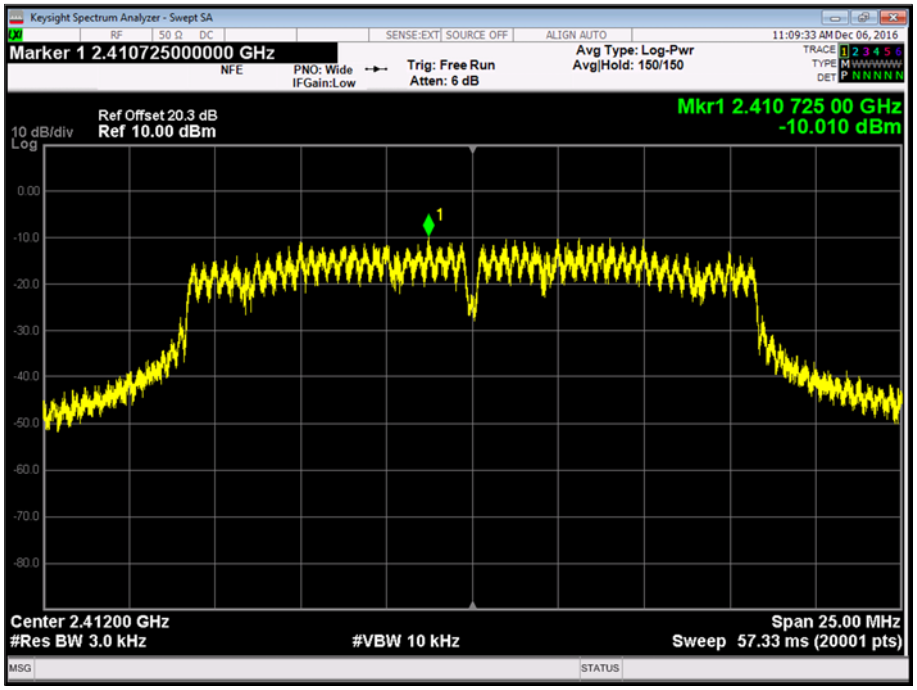

Figure 26 - 2412 MHz - Port B

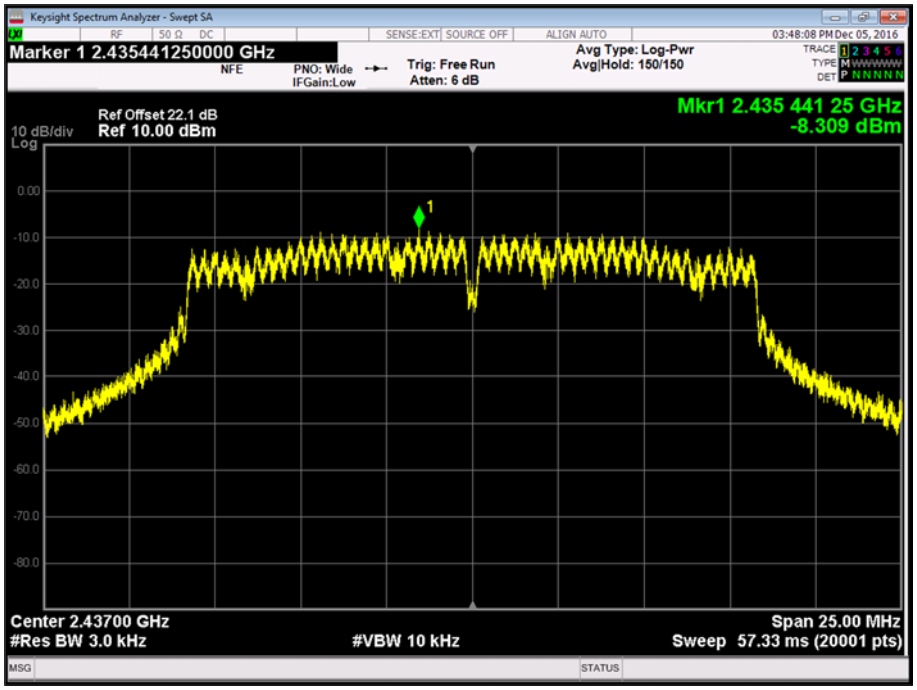

Figure 27 - 2437 MHz - Port A

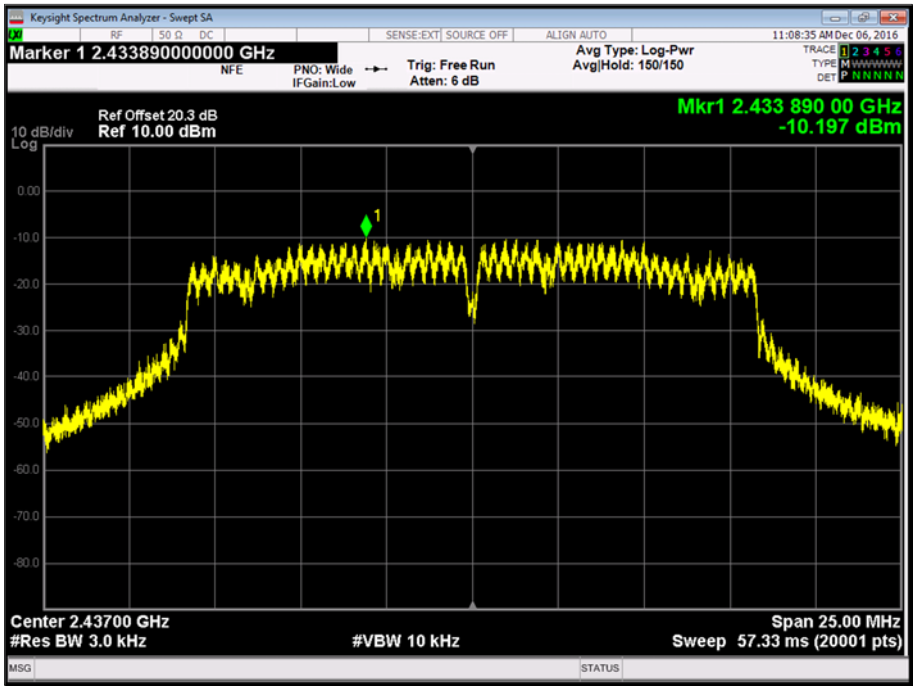

Figure 28 - 2437 MHz - Port B

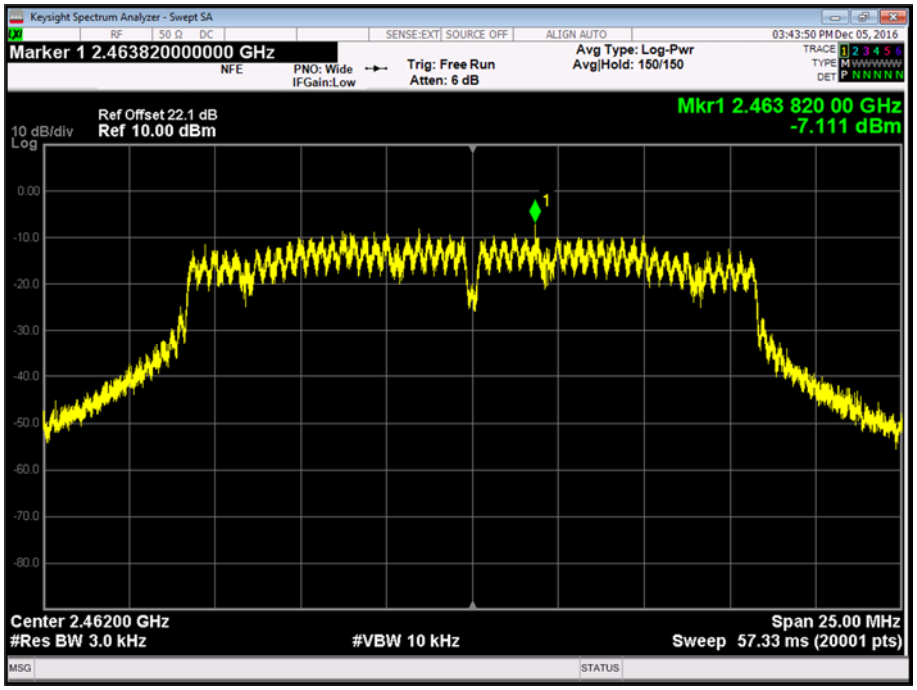

Figure 29 - 2462 MHz - Port A

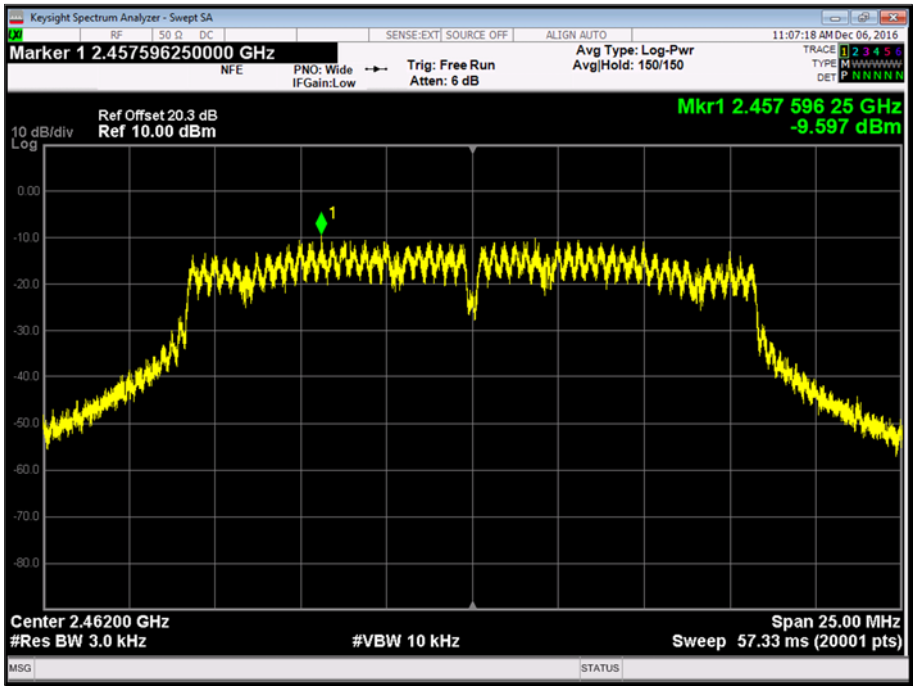

Figure 30 - 2462 MHz - Port B

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

802.11n (20 MHz Bandwidth)

Modulation Coding Scheme: MCS5

Frequency (MHz)	Port A (dBm)	Port B (dBm)	Total Power (dBm)
2412	-7.869	-9.818	-4.869
2437	-8.495	-9.559	-5.495
2462	-7.764	-9.662	-4.764

Table 20

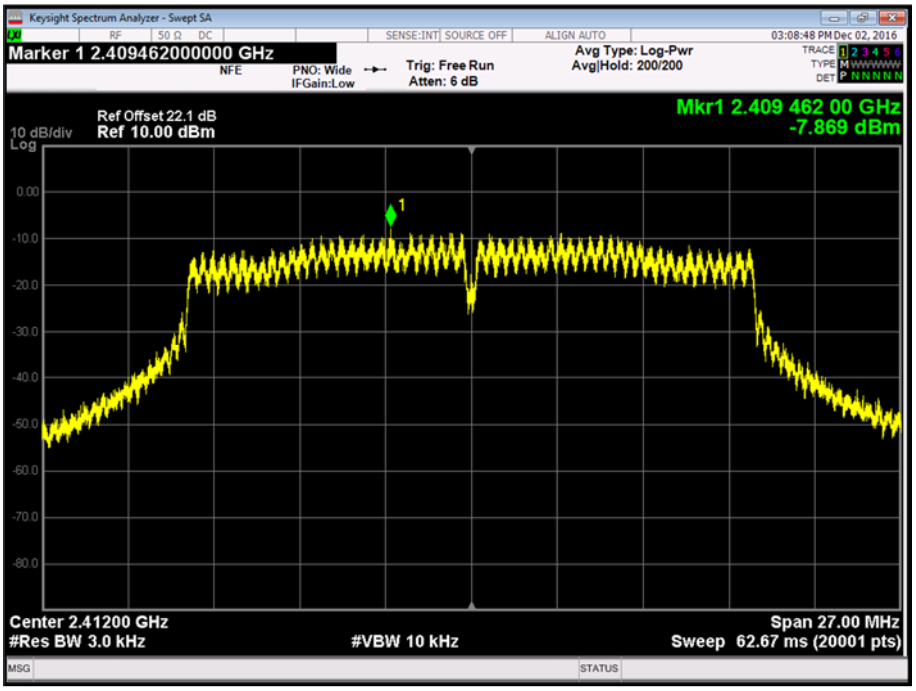

Figure 31 - 2412 MHz - Port A

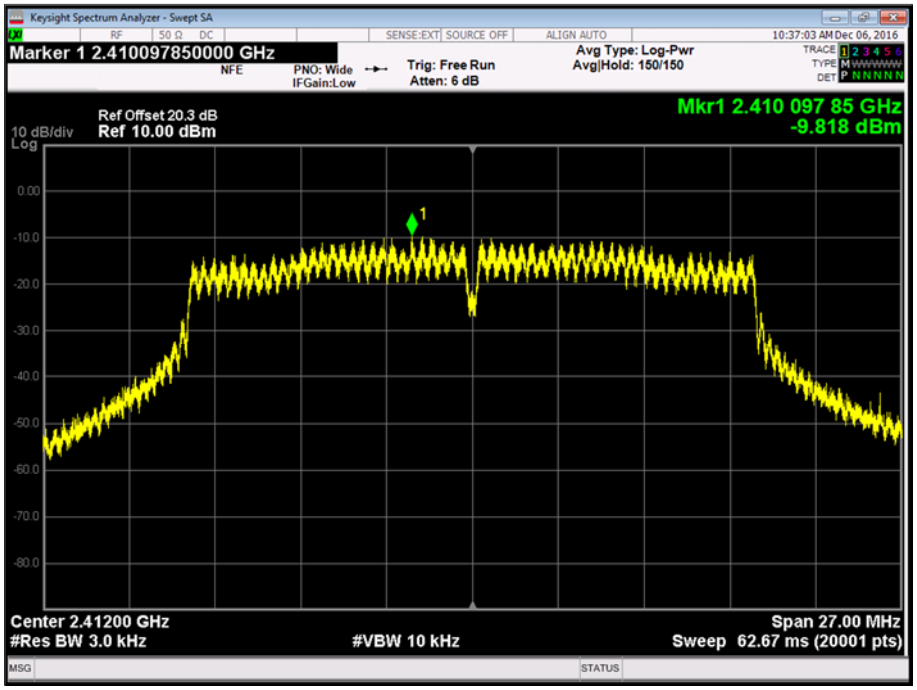

Figure 32 - 2412 MHz - Port B

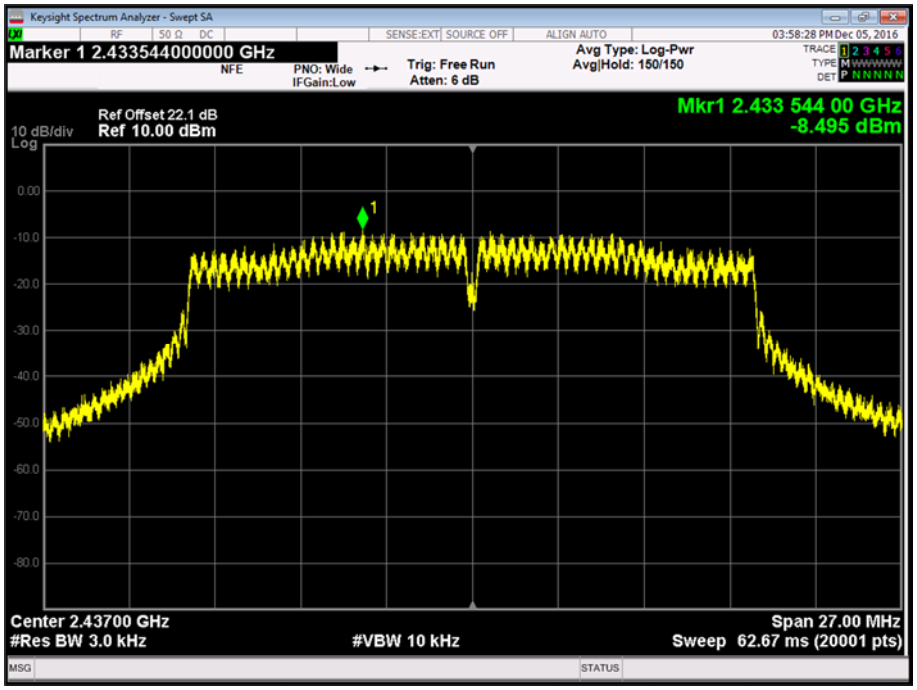

Figure 33 - 2437 MHz - Port A

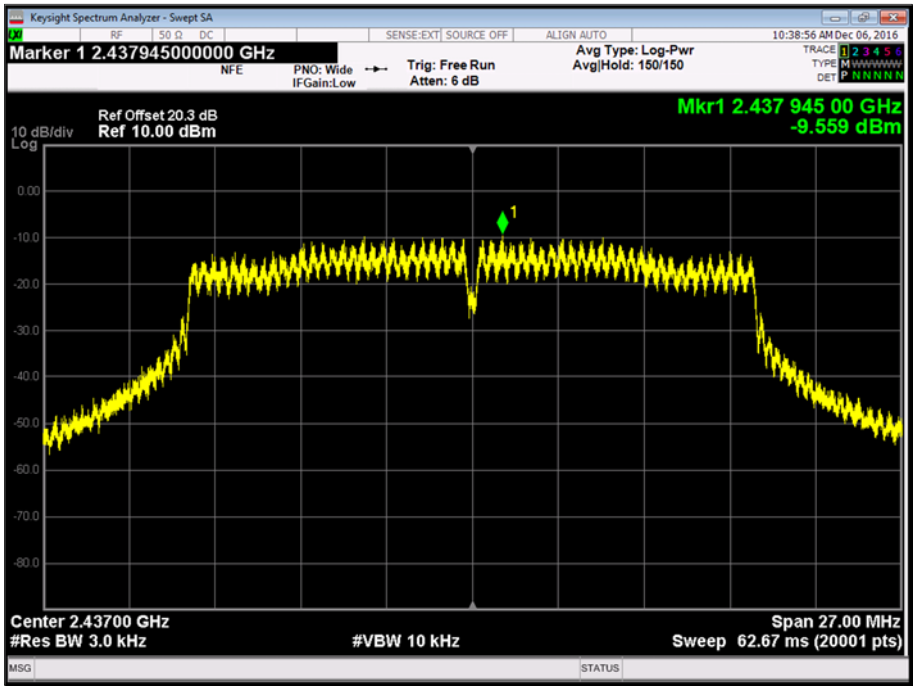

Figure 34 - 2437 MHz - Port B

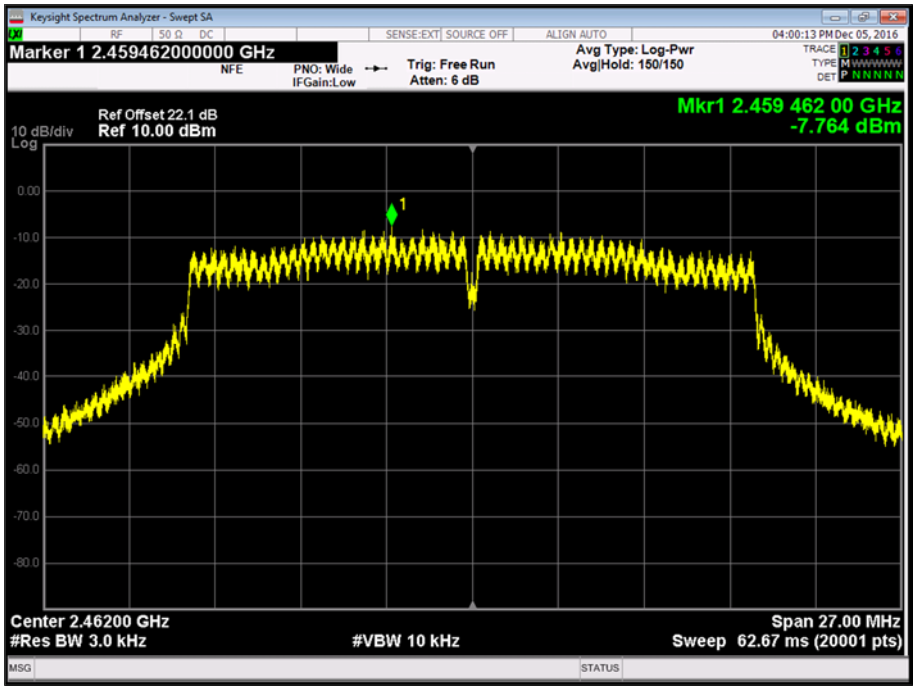

Figure 35 - 2462 MHz - Port A

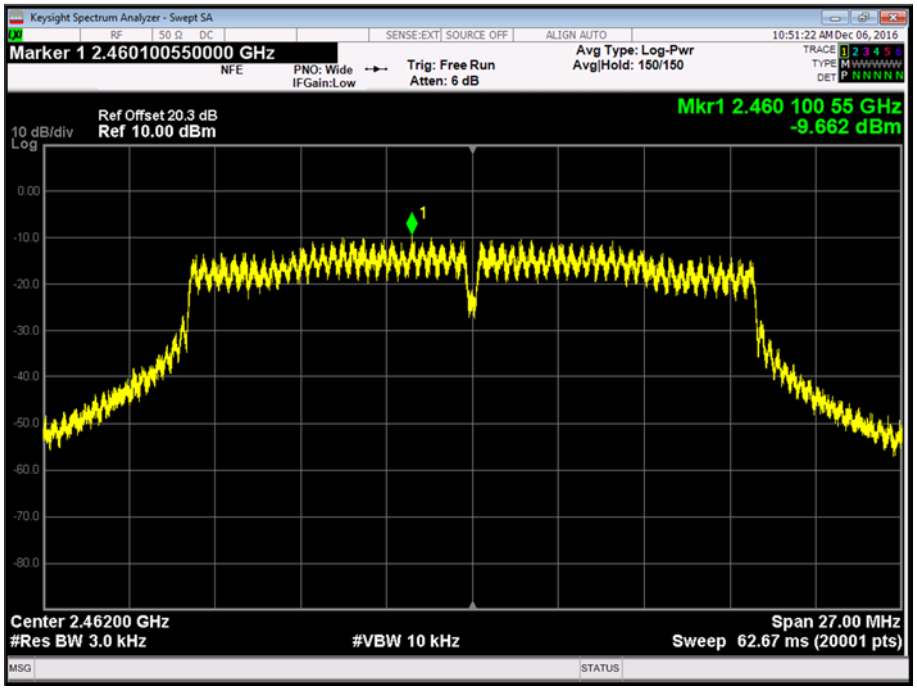

Figure 36 - 2462 MHz - Port B

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

802.11n (40 MHz Bandwidth)

Modulation Coding Scheme: MCS1

Frequency (MHz)	Port A (dBm)	Port B (dBm)	Total Power (dBm)
2422	-13.344	-16.095	-10.344
2437	-15.049	-16.614	-12.049
2452	-13.526	-16.650	-10.526

Table 21

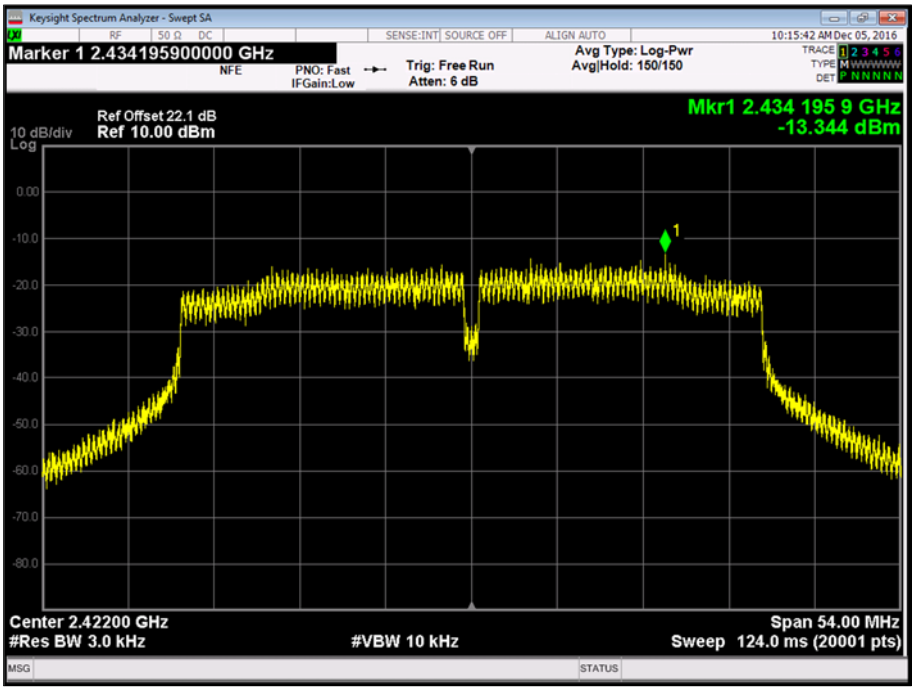

Figure 37 - 2422 MHz - Port A

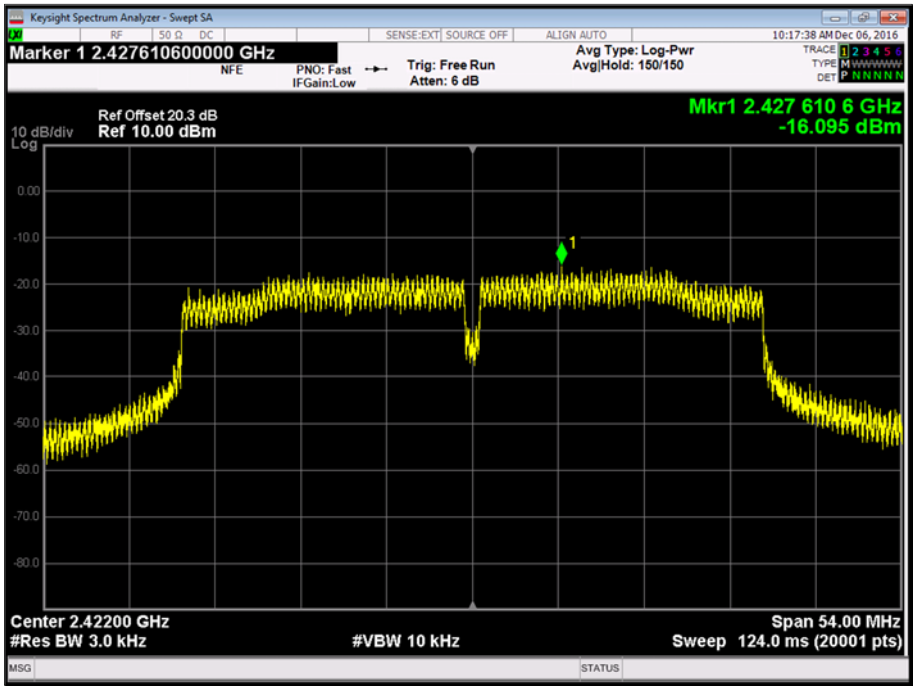

Figure 38 - 2422 MHz - Port B

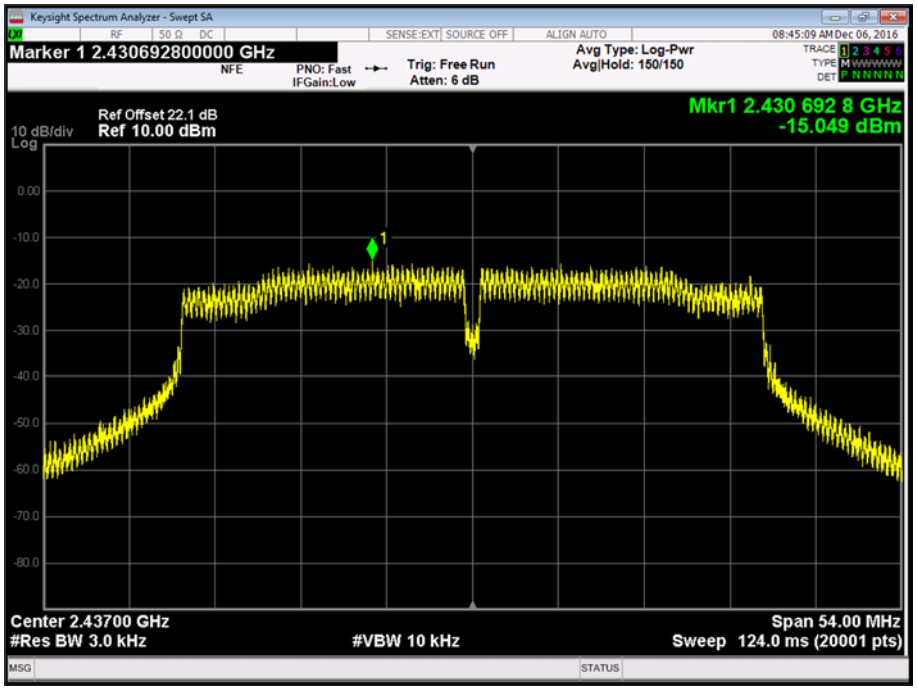

Figure 39 - 2437 MHz - Port A

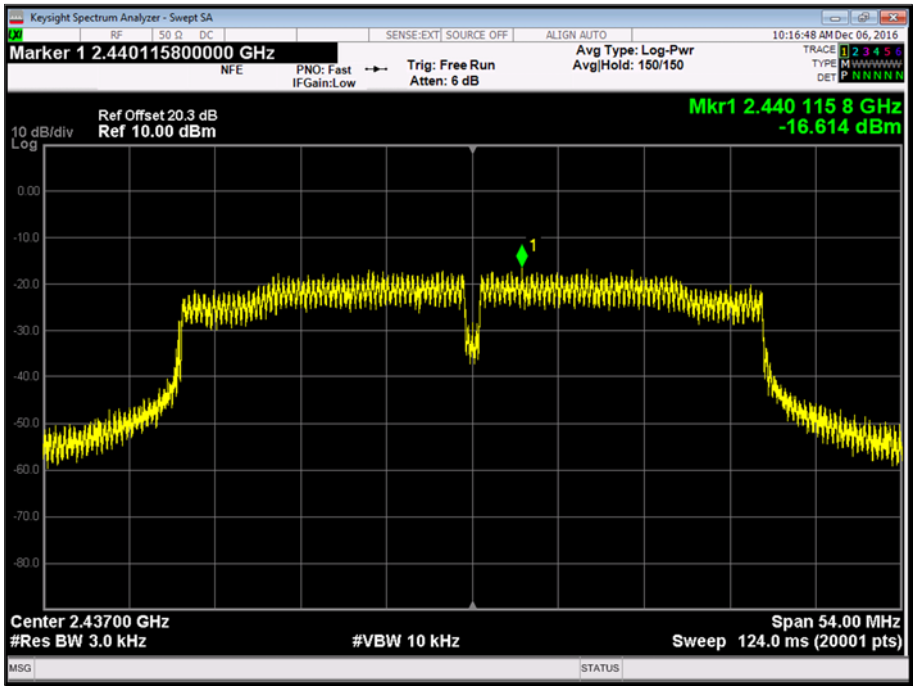

Figure 40 - 2437 MHz - Port B

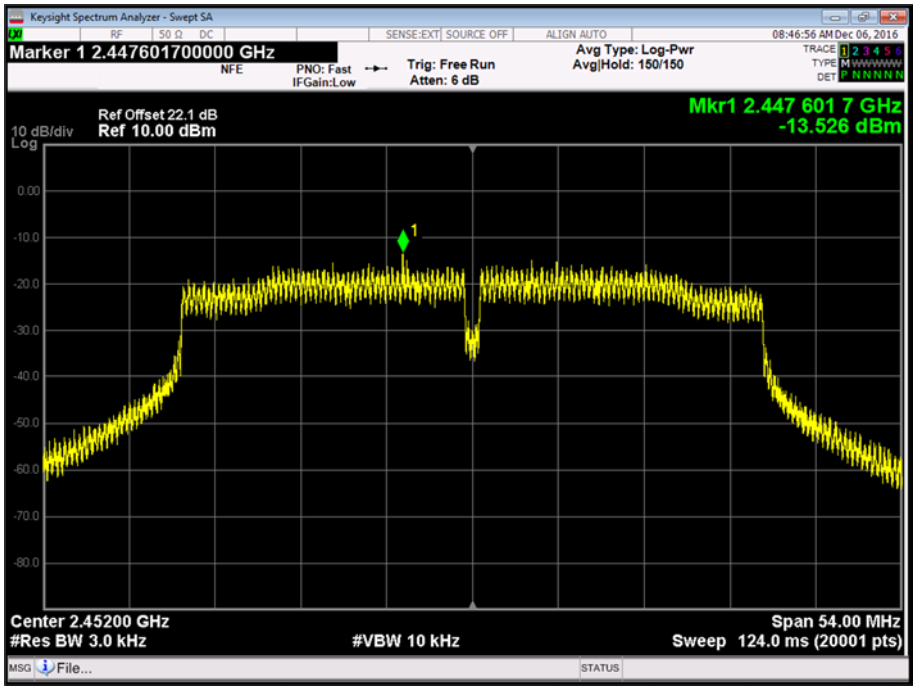

Figure 41 - 2452 MHz - Port A

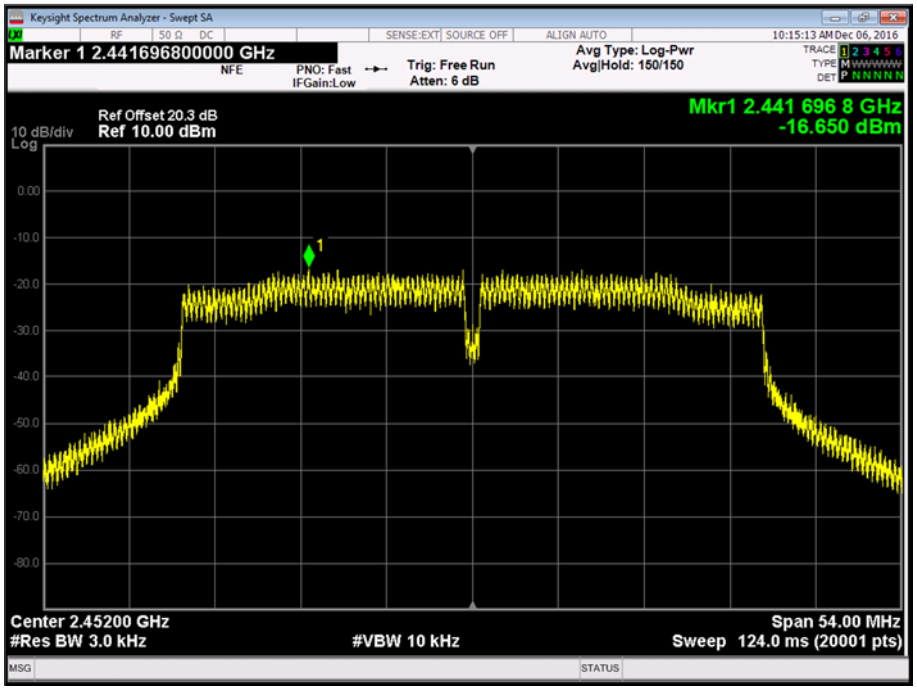

Figure 42 - 2452 MHz - Port B

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
20dB SMA Attenuator dc - 18GHz	Sealectro	60-674-1020-89	345	12	30-Jun-2017
20dB/2W Attenuator	Narda	4772-20	462	12	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Attenuator (20dB, 1W)	Sealectro	60-674-1020-89	1506	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	08-Sep-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Oct-2017
1 metre K type Cable	IW Microwave	KPS-1501LC-394-KPS-R	4727	12	03-Aug-2017

Table 22

TU - Traceability Unscheduled
O/P Mon – Output Monitored

2.4 Spurious Radiated Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205

2.4.2 Equipment Under Test and Modification State

DAQRI Smart Helmet, S/N: 1829C-DC8-6UPN9XJWJW - Modification State 0

2.4.3 Date of Test

28-February-2017 to 07-March-2017

2.4.4 Test Method

Testing was performed in accordance with ANSI C63.10, Clause 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10, Clause 4.1.4.2.3.

Final average measurements were taken in accordance with ANSI C63.10, Clause 4.1.4.2.2.

The limit lines on the plots show the field strength requirements as stated in FCC Part 15.209. These limits only apply inside the restricted frequency bands as specified in FCC Part 15.205.

2.4.5 Environmental Conditions

Ambient Temperature	17.9 - 19.3 °C
Relative Humidity	31.0 - 34.0 %

2.4.6 Test Results

Bluetooth Low Energy

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
38.086	30.6	40.0	-9.4	50	1.00	Vertical
41.596	31.9	40.0	-8.1	315	1.26	Vertical
53.135	37.3	40.0	-2.7	259	1.00	Vertical
55.819	35.5	40.0	-4.5	250	1.00	Vertical
226.847	30.1	46.0	-15.9	151	1.37	Vertical
226.927	39.0	46.0	-7.0	208	1.00	Horizontal

Table 23 - 2402 MHz - 30 MHz to 1 GHz Emissions Results

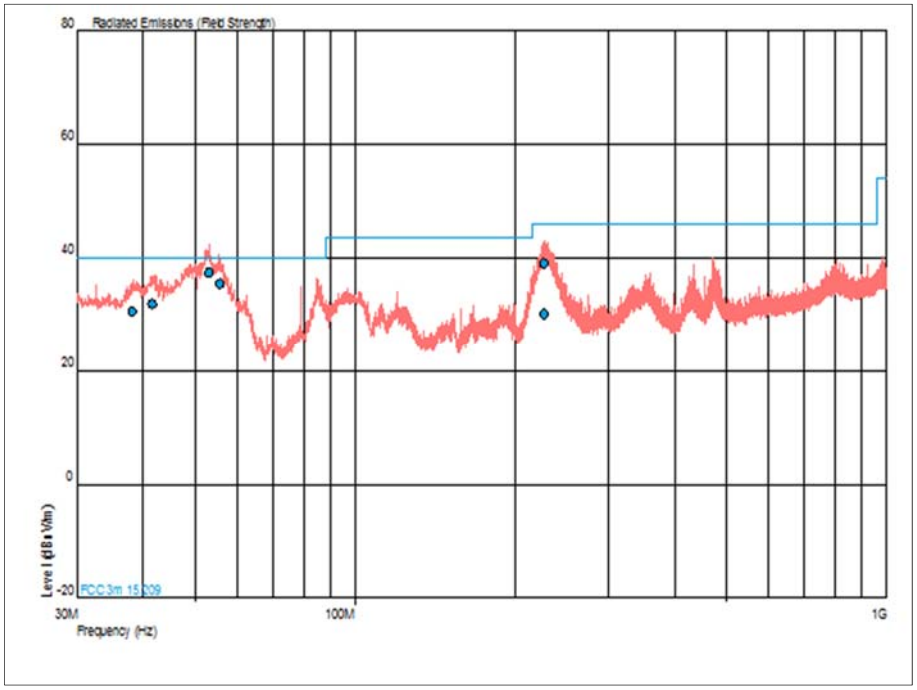

Figure 43 - 2402 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 24 - 2402 MHz - 1 GHz to 25 GHz Emissions Results

*No emissions were detected within 10 dB of the limit.

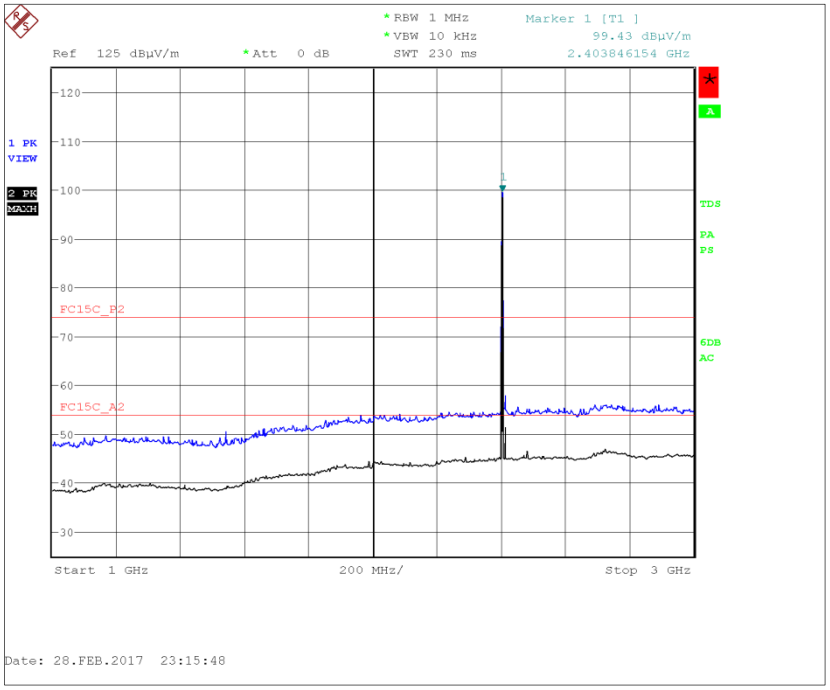

Figure 44 - 2402 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

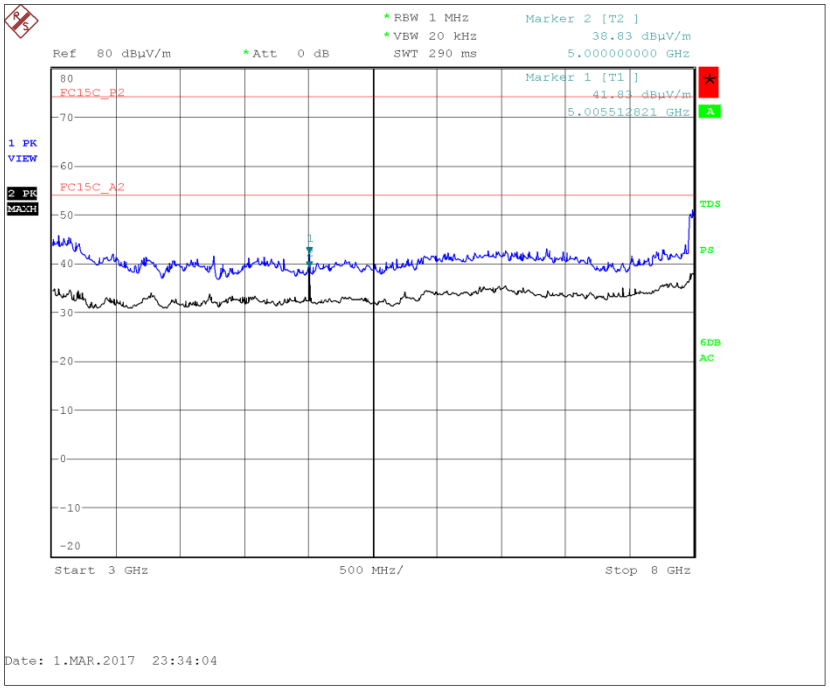

Figure 45 - 2402 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

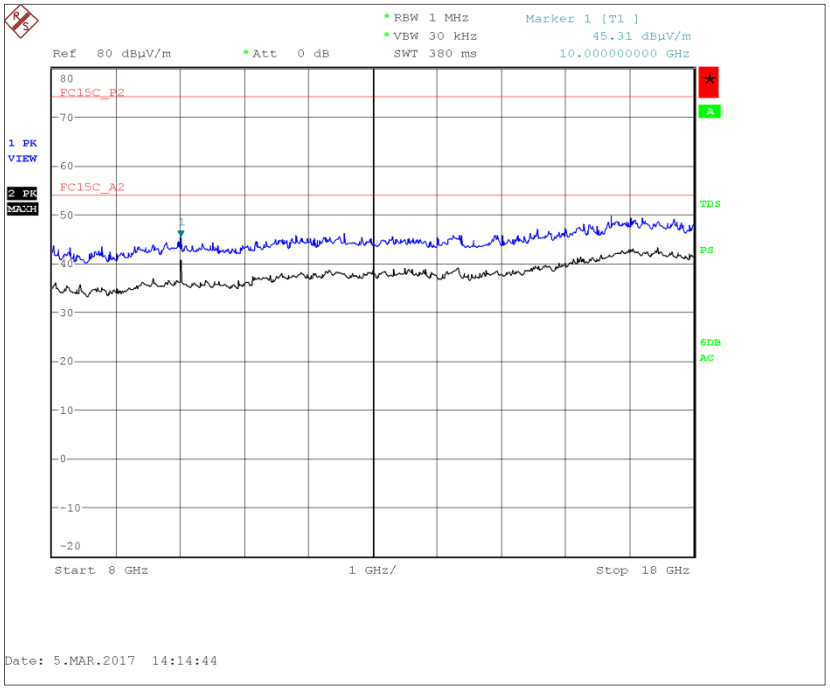

Figure 46 - 2402 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

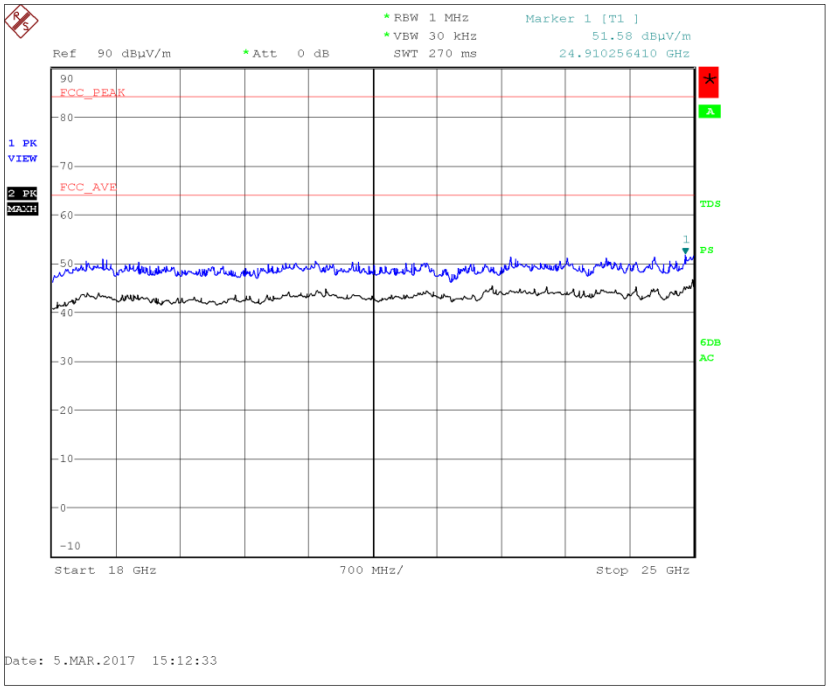

Figure 47 - 2402 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
38.000	30.4	40.0	-9.6	68	1.00	Vertical
43.029	30.6	40.0	-9.4	284	1.00	Vertical
50.746	35.7	40.0	-4.3	241	1.00	Vertical
53.260	37.2	40.0	-2.8	251	1.00	Vertical
226.957	39.3	46.0	-6.7	217	1.00	Horizontal
227.975	29.8	46.0	-16.2	0	1.00	Vertical

Table 25 - 2440 MHz - 30 MHz to 1 GHz Emissions Results

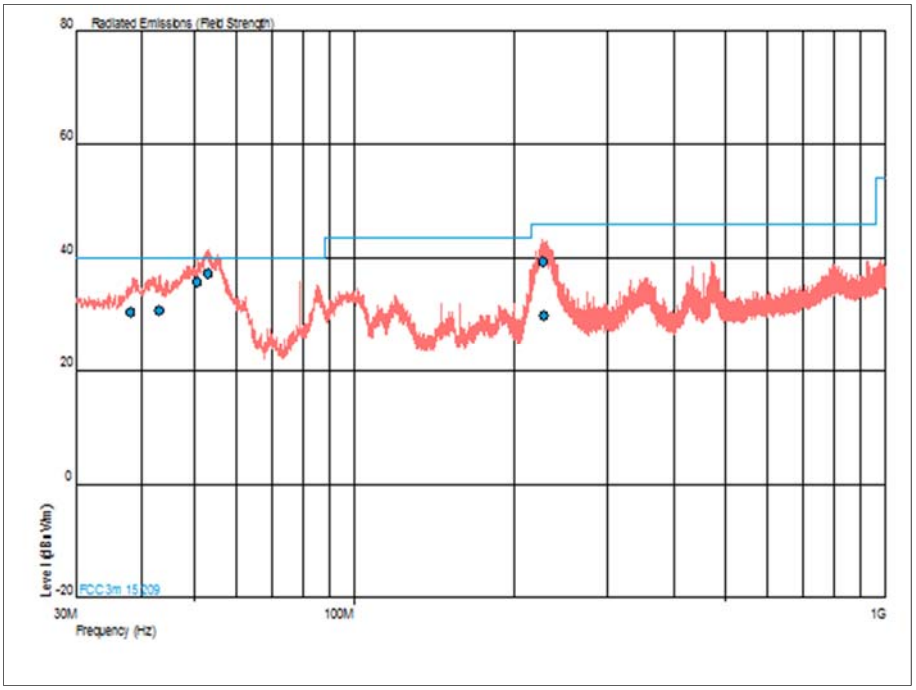

Figure 48 - 2440 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 26 - 2440 MHz - 1 GHz to 25 GHz Emissions Results

*No emissions were detected within 10 dB of the limit.

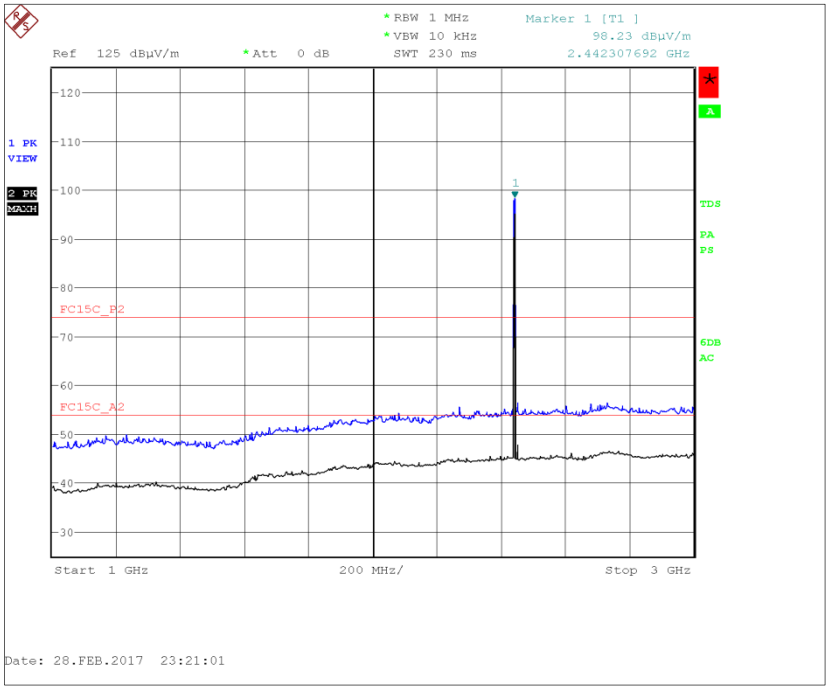

Figure 49 - 2440 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

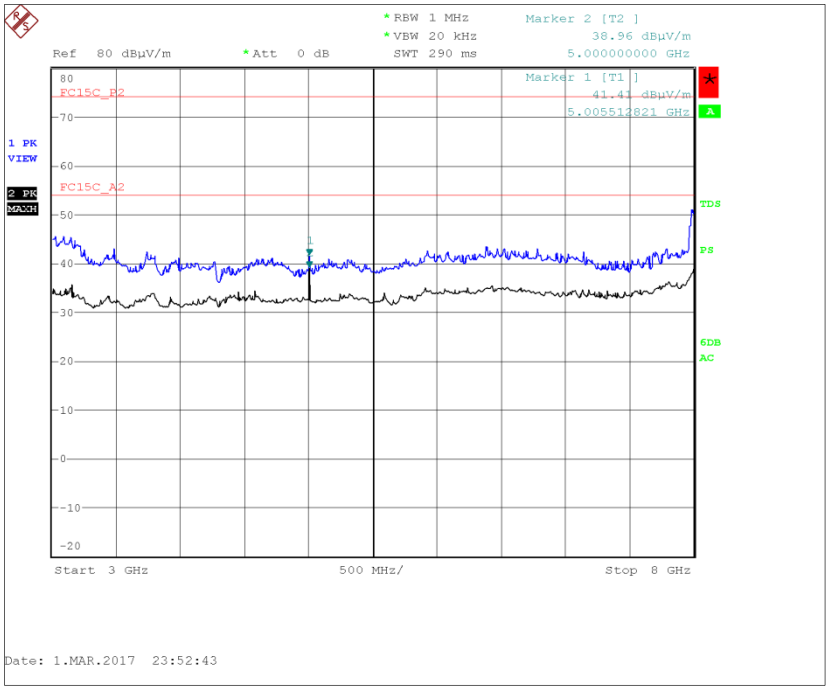

Figure 50 - 2440 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

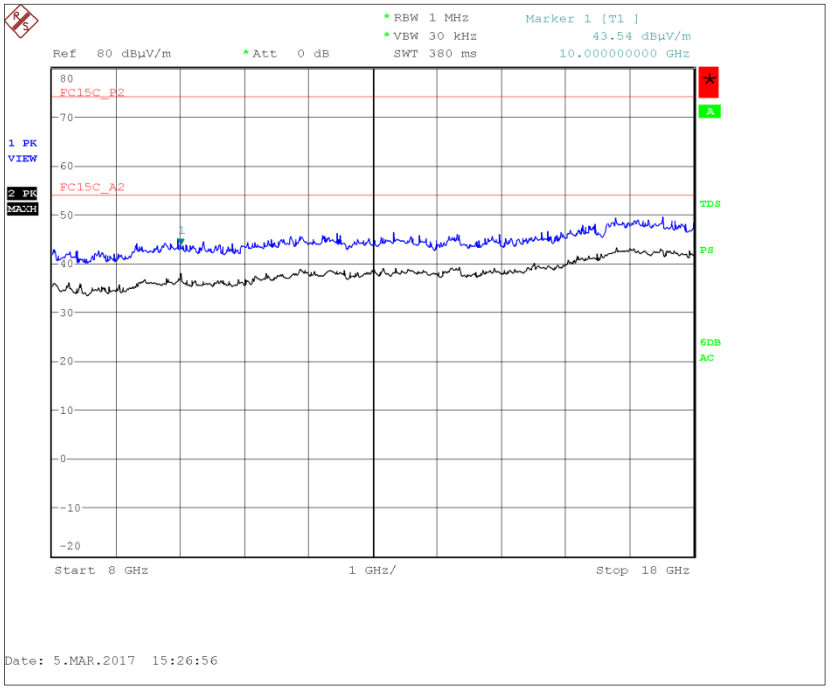

Figure 51 - 2440 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

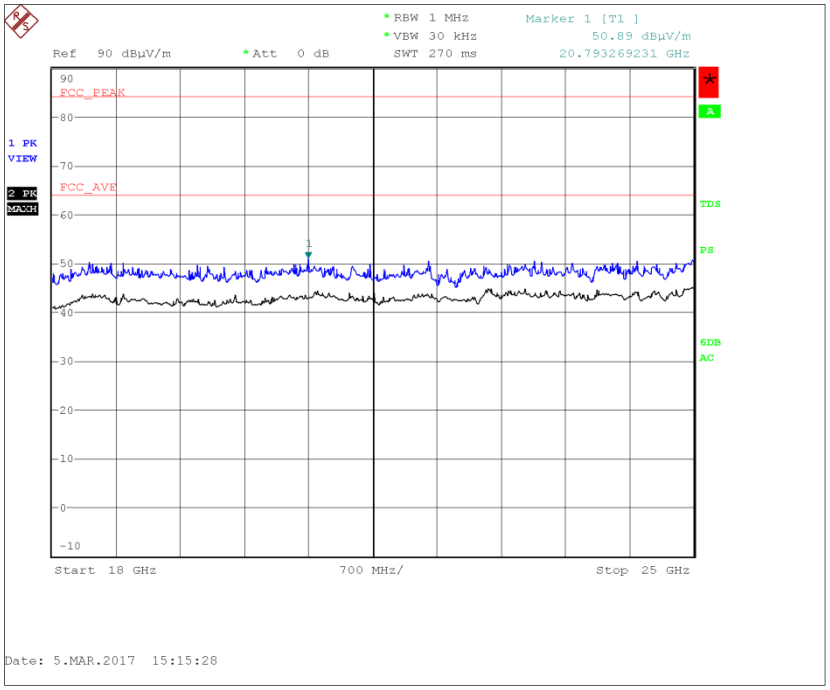

Figure 52 - 2440 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
38.165	30.2	40.0	-9.8	195	1.00	Vertical
41.336	31.8	40.0	-8.2	215	1.00	Vertical
53.246	36.9	40.0	-3.1	238	1.00	Vertical
56.193	33.6	40.0	-6.4	275	1.00	Vertical
227.309	30.6	46.0	-15.4	336	1.00	Vertical
227.950	39.4	46.0	-6.6	210	1.00	Horizontal

Table 27 - 2480 MHz - 30 MHz to 1 GHz Emissions Results

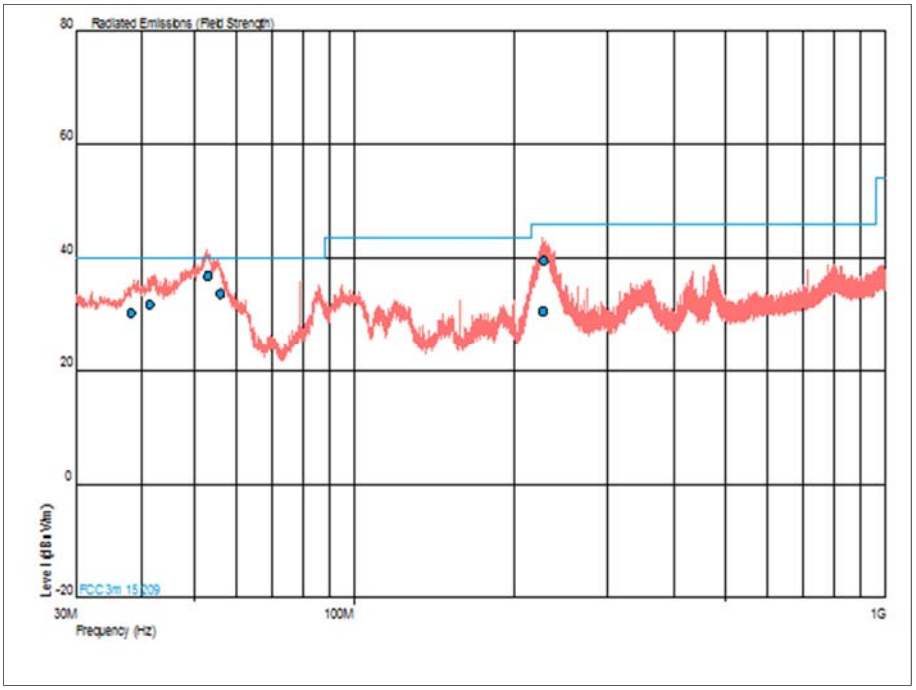

Figure 53 - 2480 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 28 - 2480 MHz - 1 GHz to 25 GHz Emissions Results

*No emissions were detected within 10 dB of the limit.

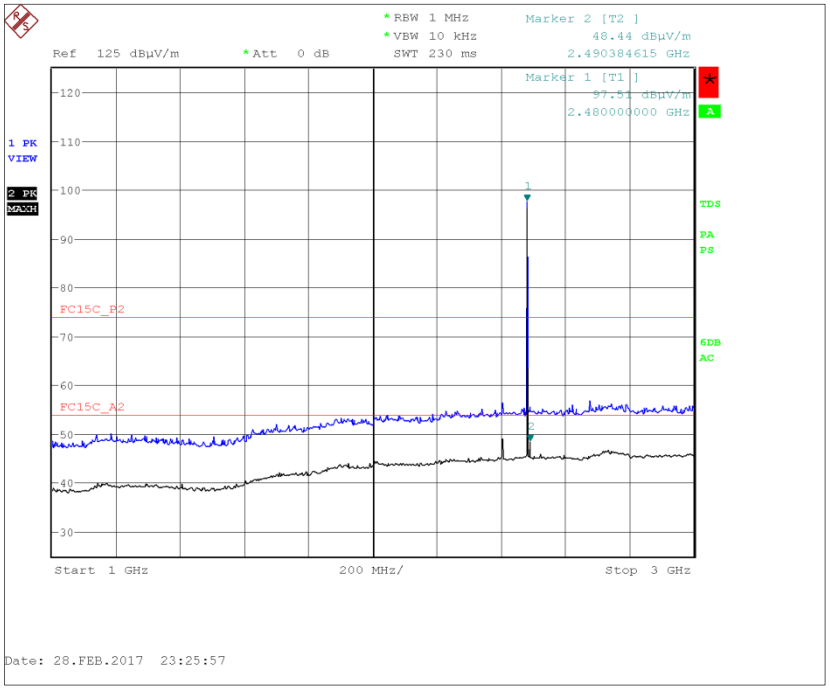

Figure 54 - 2480 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

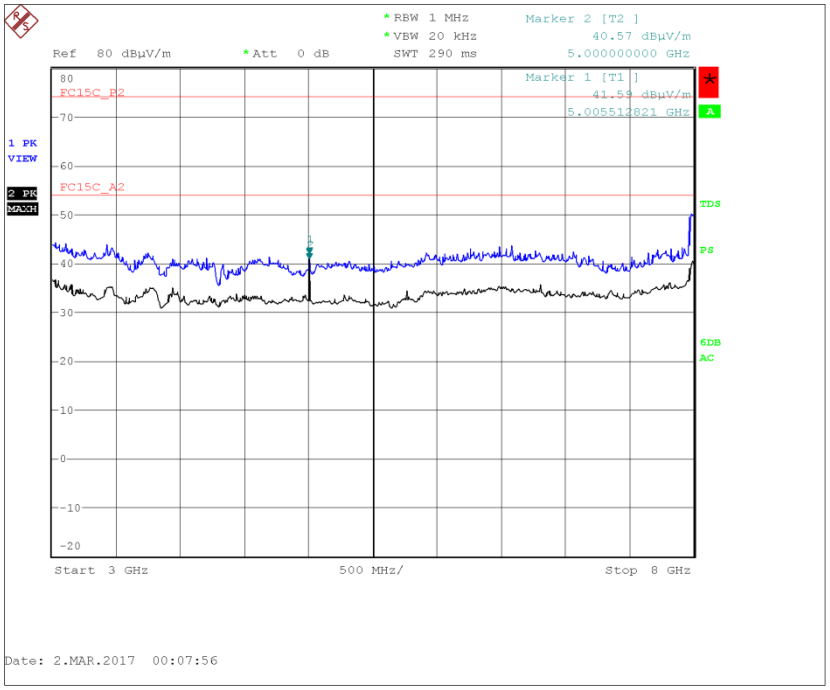

Figure 55 - 2480 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

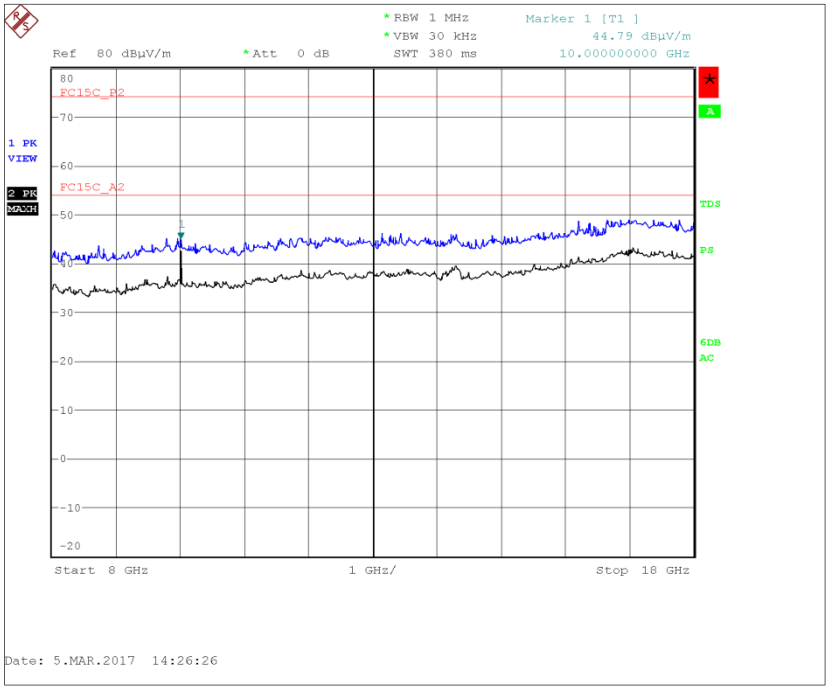

Figure 56 - 2480 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

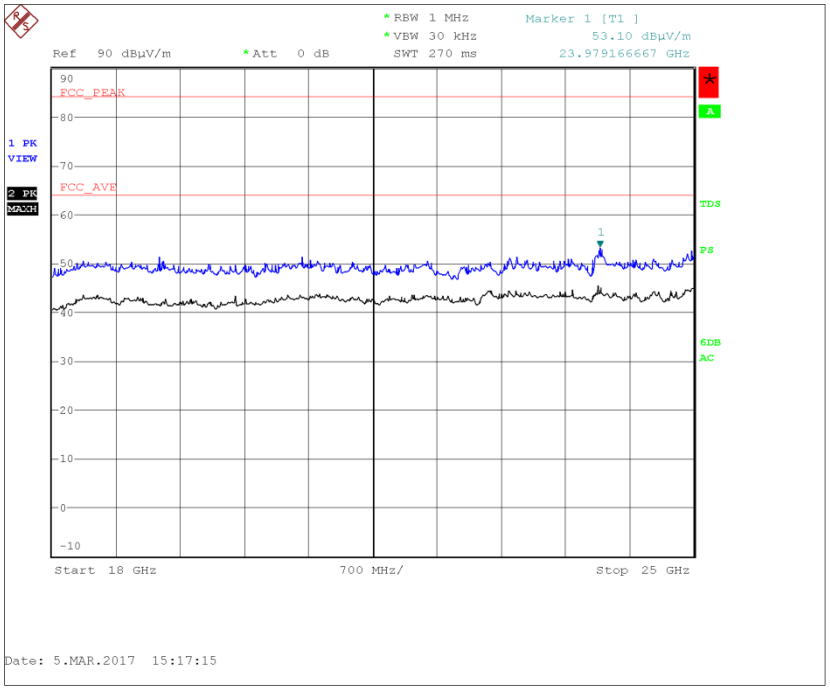

Figure 57 - 2480 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

802.11b

Testing was performed on the data rate which resulted in the highest conducted output power. The data rate used during testing was 11 Mbps. For configurations supporting multiple bandwidths, emission measurements were only made in the bandwidth with the highest conducted output power.

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
38.250	30.3	40.0	-9.7	233	1.00	Vertical
51.750	36.2	81.9	-45.7	53	1.00	Vertical
57.461	40.9	81.9	-41.0	20	1.16	Vertical
58.623	37.4	81.9	-44.5	24	1.00	Vertical
224.803	30.0	81.9	-51.9	360	1.16	Vertical
226.630	39.6	81.9	-42.3	31	1.00	Horizontal

Table 29 - 2412 MHz - 30 MHz to 1 GHz Emissions Results

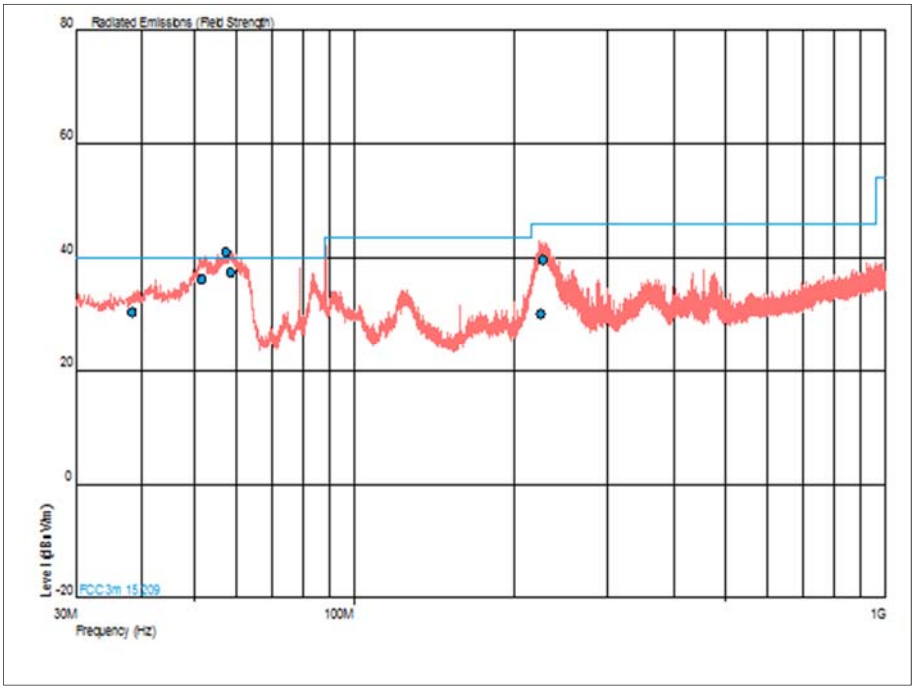

Figure 58 - 2412 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 30 - 2412 MHz - 1 GHz to 25 GHz Emissions Results

*No emissions were detected within 10 dB of the limit.

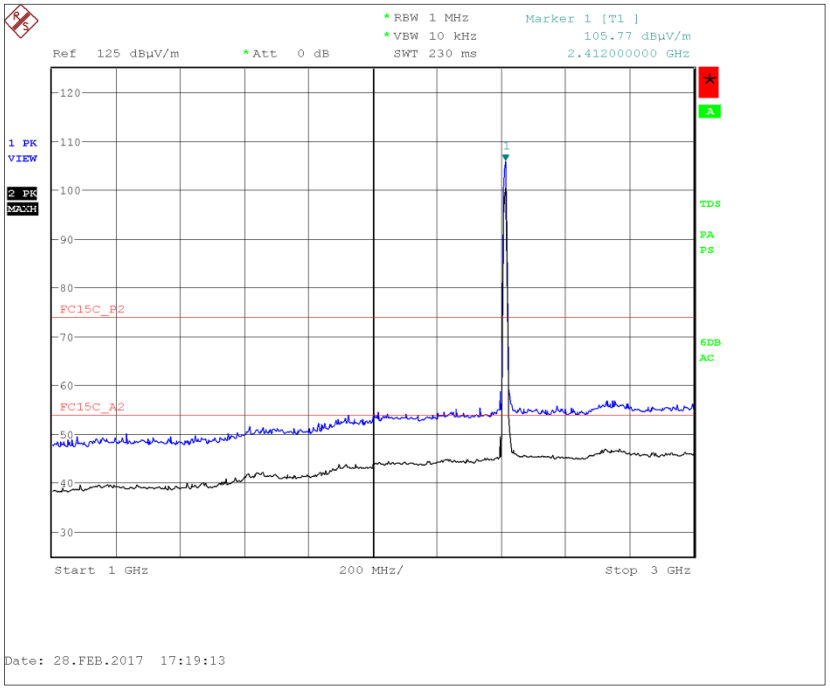

Figure 59 - 2412 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

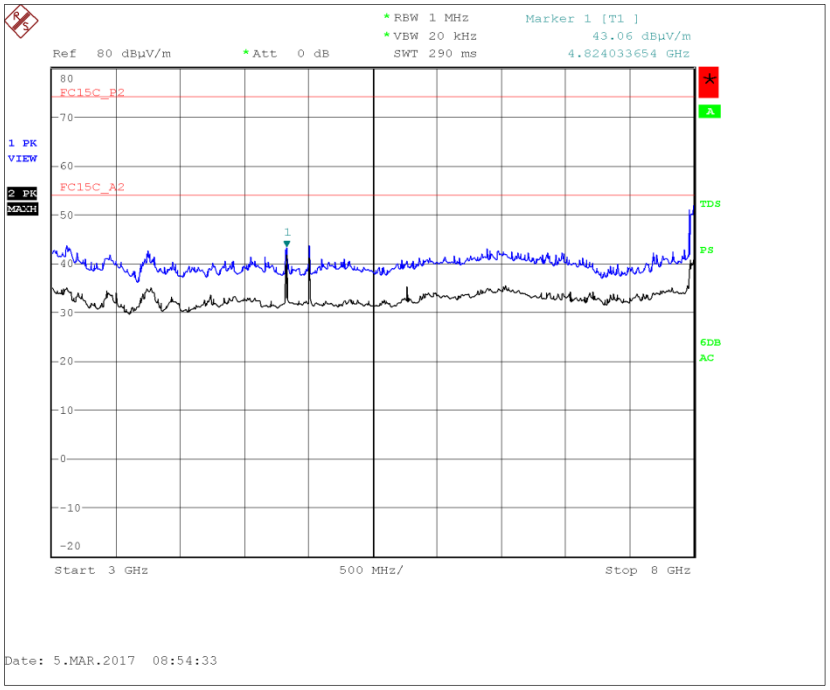

Figure 60 - 2412 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

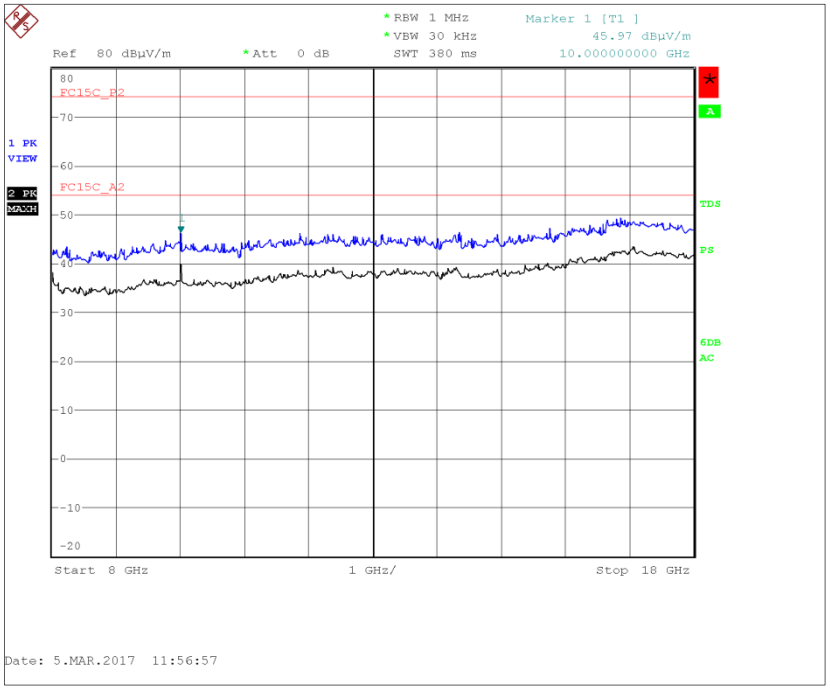

Figure 61 - 2412 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

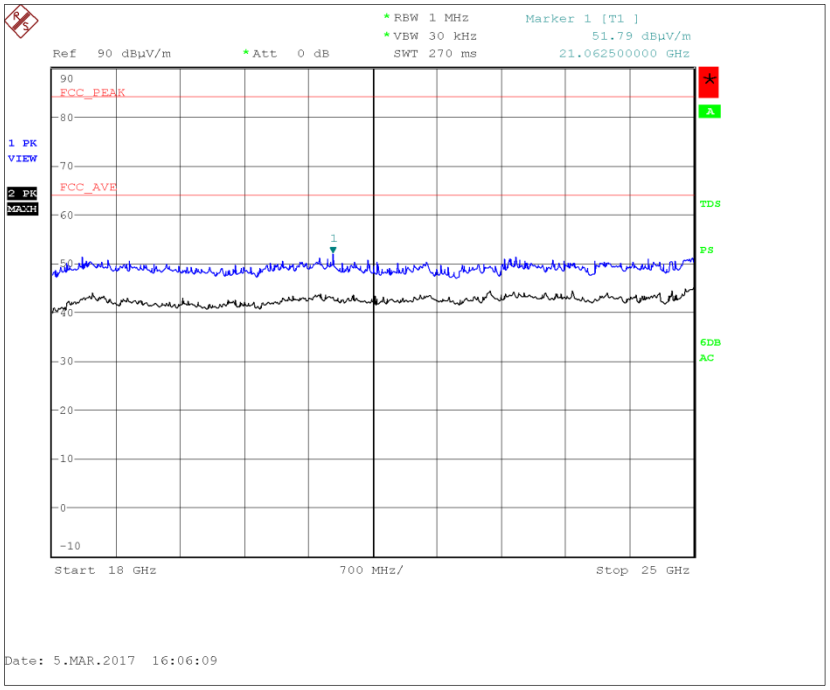

Figure 62 - 2412 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
37.858	29.6	40.0	-10.4	220	1.00	Vertical
56.939	37.5	81.3	-43.8	25	1.00	Vertical
57.270	40.8	81.3	-40.5	8	1.00	Vertical
118.650	31.8	43.5	-11.7	348	1.00	Vertical
218.923	29.1	81.3	-52.2	8	1.00	Vertical
226.775	39.3	81.3	-42.0	24	1.00	Horizontal

***Table 31* - 2437 MHz - 30 MHz to 1 GHz Emissions Results**

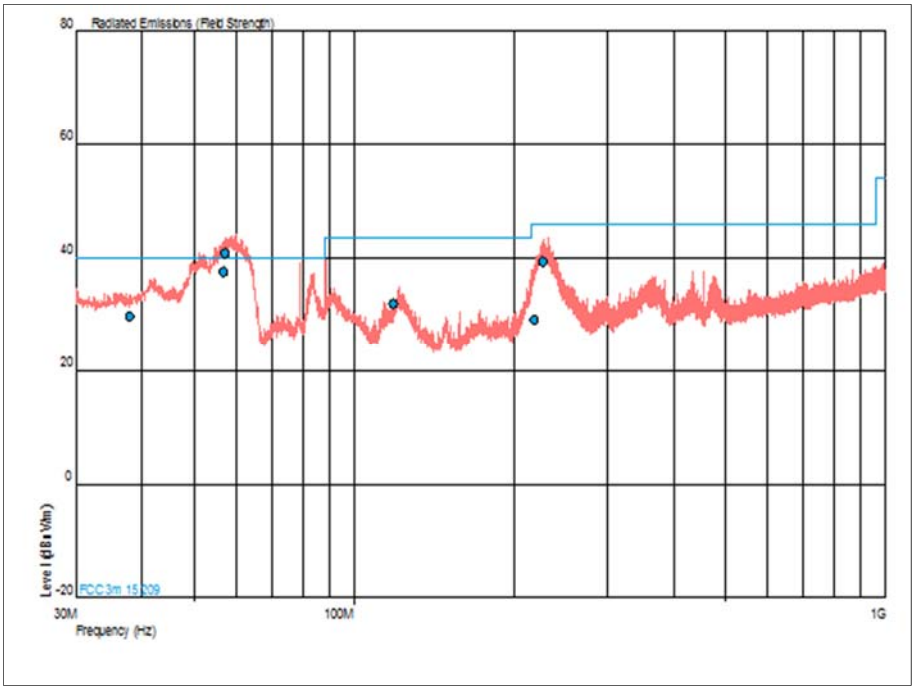

Figure 63 - 2437 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 32 - 2437 MHz - 1 GHz to 25 GHz Emissions Results

*No emissions were detected within 10 dB of the limit.

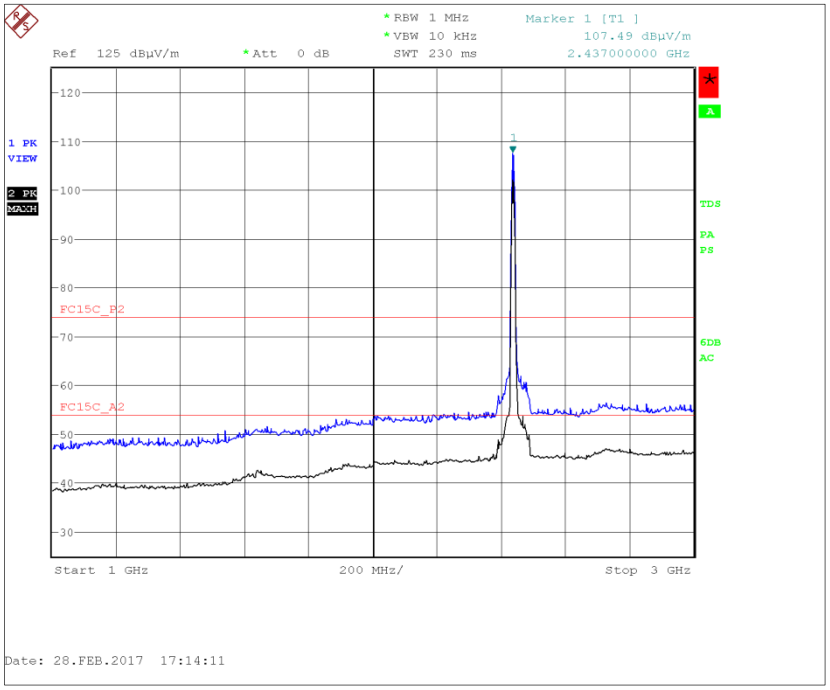

Figure 64 - 2437 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

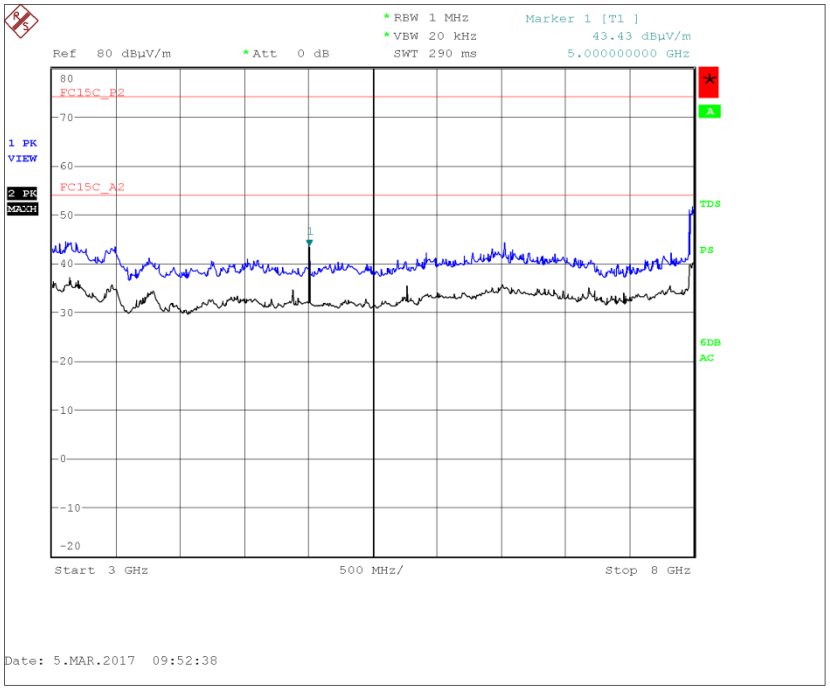

Figure 65 - 2437 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

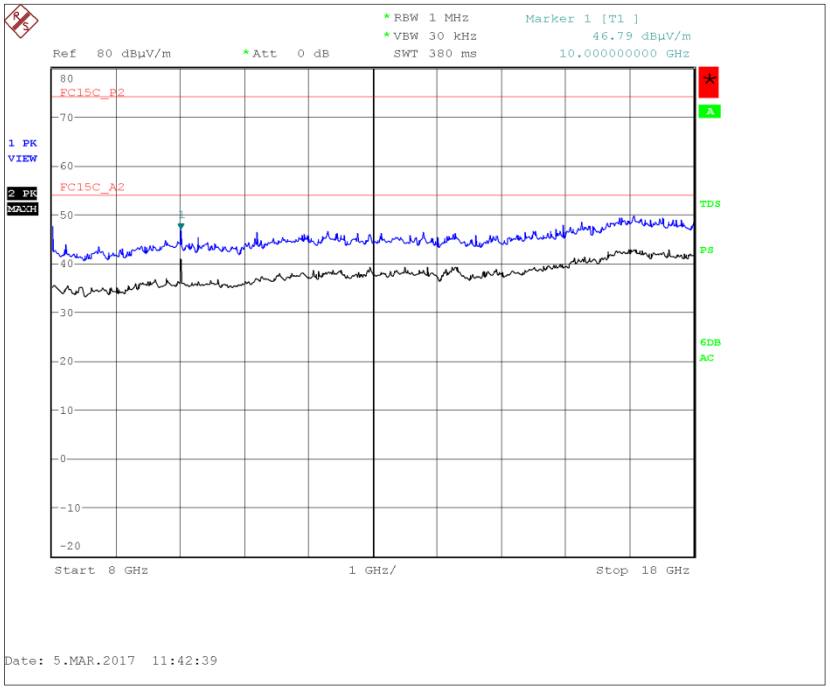

Figure 66 - 2437 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

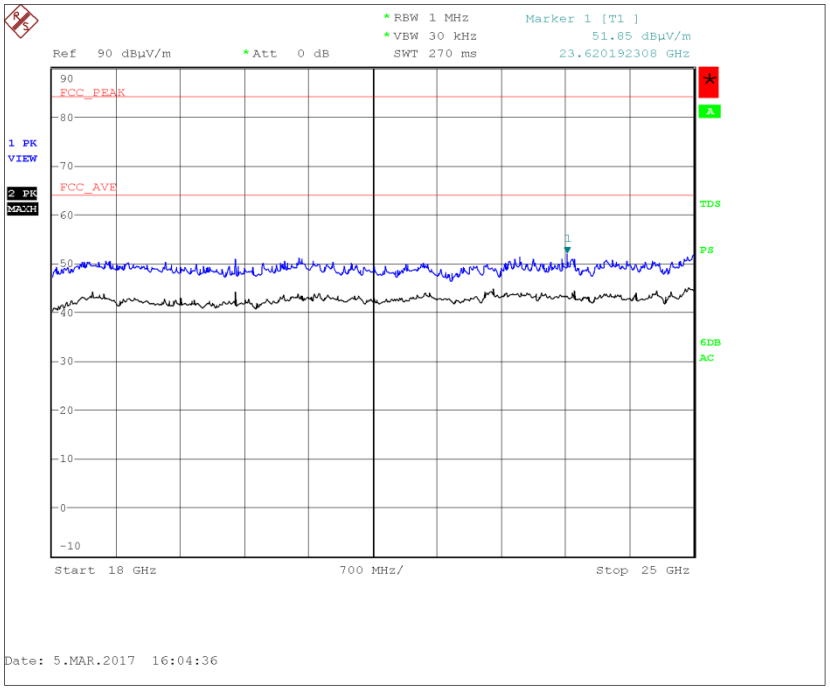

Figure 67 - 2437 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
38.041	29.6	40.0	-10.4	263	1.00	Vertical
56.659	41.3	79.6	-38.3	0	1.00	Vertical
57.641	40.0	79.6	-39.6	107	1.00	Vertical
117.931	30.0	43.5	-13.5	325	1.00	Vertical
225.202	30.0	79.6	-49.6	357	1.00	Vertical
226.644	37.7	79.6	-41.9	0	1.36	Horizontal
960.000	35.8	54.0	-18.2	61	2.77	Horizontal

Table 33 - 2462 MHz - 30 MHz to 1 GHz Emissions Results

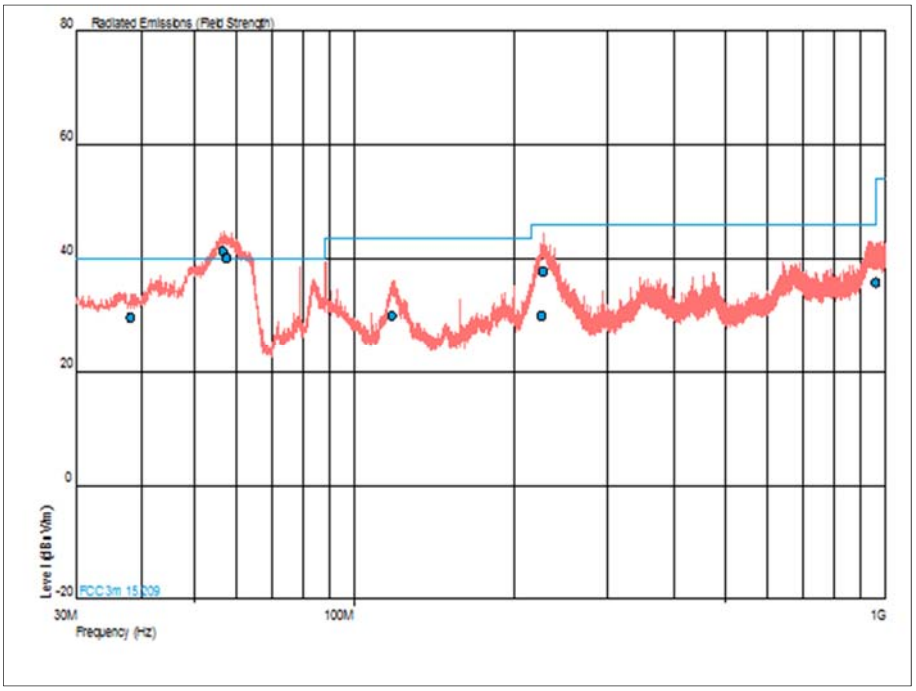

Figure 68 - 2462 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (µV/m)		Limit (µV/m)		Margin (µV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 34 - 2462 MHz - 1 GHz to 25 GHz Emissions Results

*No emissions were detected within 10 dB of the limit.

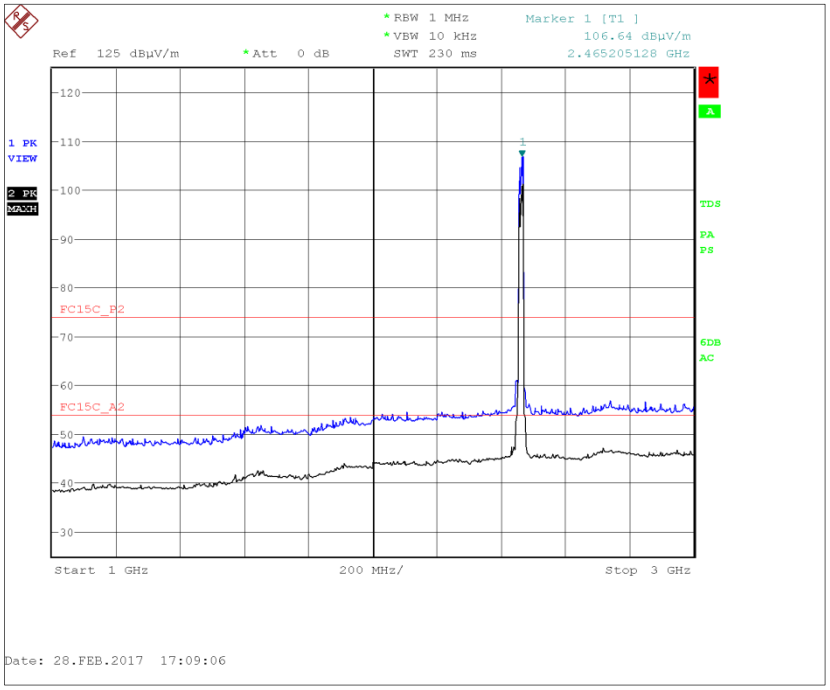

Figure 69 - 2462 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

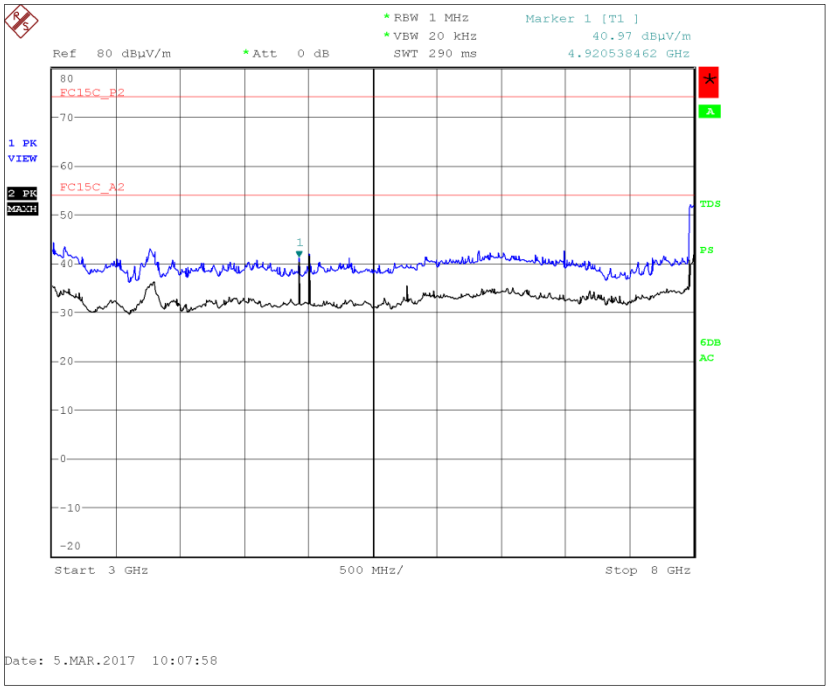

Figure 70 - 2462 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

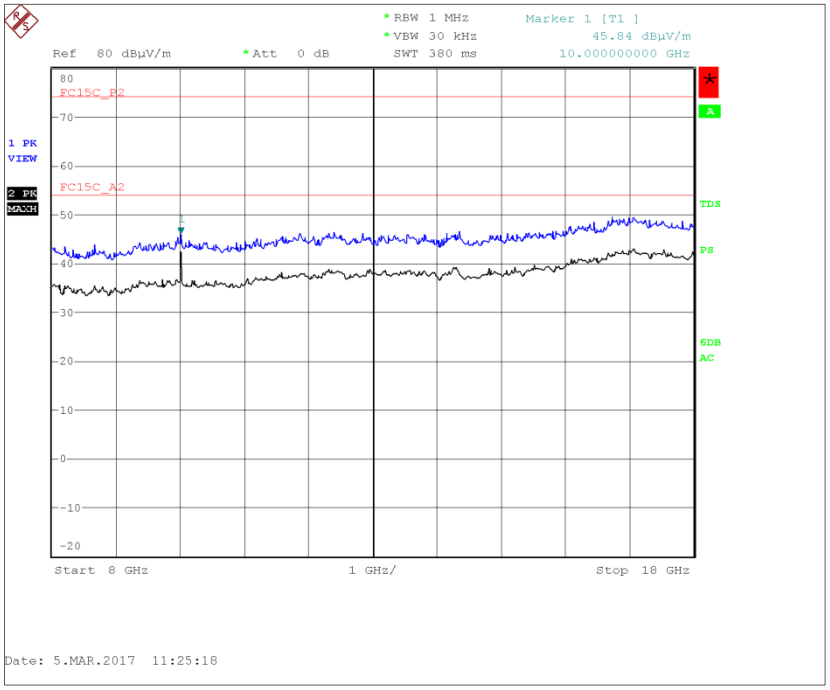

Figure 71 - 2462 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

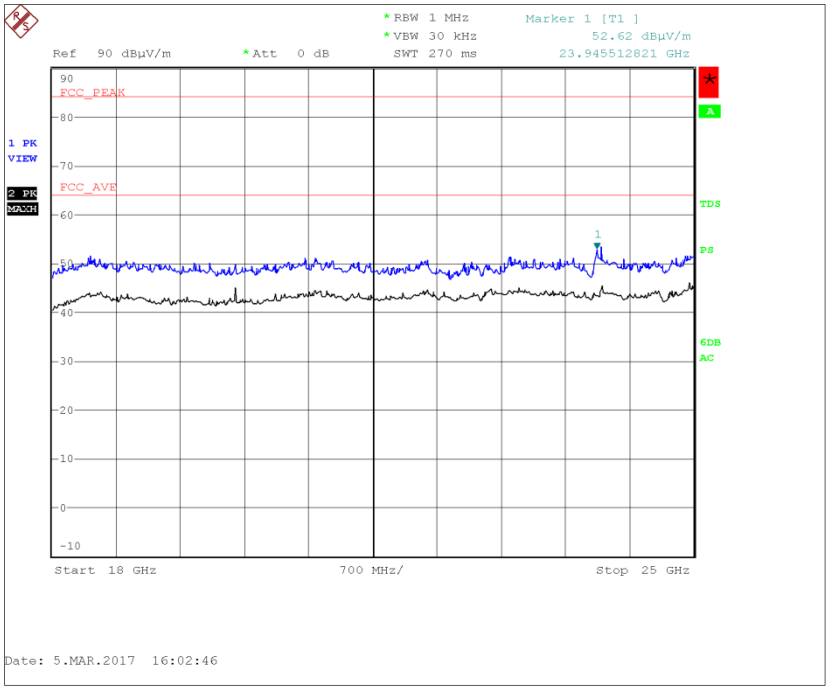

Figure 72 - 2462 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)