

## **Intentional Radiator Test Report**

### **Application for Grant of Equipment Authorization**

**FCC Part 15 Subpart C (15.247)**

**FCC ID: 2ANJI-1SRV0C8**

**Product Name:** Unikey Smart Reader 2  
**Model:** SR2

**APPLICANT:** Unikey Technologies  
111 W. Jefferson St.  
Orlando, FL 32801

**TEST SITE(S):** National Technical Systems - Plano  
1701 E Plano Pkwy #150  
Plano, TX 75074

**REPORT DATE:** August 27<sup>th</sup> 2017


**FINAL TEST DATES:** July 17<sup>th</sup> – July 19<sup>th</sup>, 2017

**TOTAL NUMBER OF PAGES:** 23


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## REVISION HISTORY

Rev#	Date	Comments	Modified By
0	August 16 <sup>th</sup> 2017	Draft	Armando Del Angel
1	September 18 <sup>th</sup> 2017	Finalized report removing the Canada requirements and adding signatures.	Armando Del Angel

**TABLE OF CONTENTS**

<b>REVISION HISTORY .....</b>	<b>2</b>
<b>TABLE OF CONTENTS .....</b>	<b>3</b>
<b>SCOPE.....</b>	<b>4</b>
<b>OBJECTIVE .....</b>	<b>4</b>
<b>STATEMENT OF COMPLIANCE .....</b>	<b>4</b>
<b>DEVIATIONS FROM THE STANDARDS .....</b>	<b>4</b>
<b>MODIFICATIONS.....</b>	<b>4</b>
<b>MEASUREMENT UNCERTAINTIES .....</b>	<b>4</b>
<b>TEST RESULTS SUMMARY .....</b>	<b>5</b>
<b>EQUIPMENT UNDER TEST (EUT) DETAILS .....</b>	<b>6</b>
<b>EUT OPERATION .....</b>	<b>6</b>
<b>TEST SITE .....</b>	<b>7</b>
<b>TEST EQUIPMENT.....</b>	<b>7</b>
<b>TEST RESULTS SECTION .....</b>	<b>8</b>
6DB BANDWIDTH.....	9
PEAK OUTPUT POWER.....	12
BANDEDGE .....	15
PEAK POWER SPECTRAL DENSITY.....	17
RADIATED SPURIOUS EMISSIONS .....	20
<b>END OF REPORT.....</b>	<b>22</b>

## **SCOPE**

Tests have been performed on Unikey Technologies product Unikey Smart Reader 2 Model SR2 to demonstrate compliance with:

FCC Part 15 Subpart C (15.247)

All testing have been performed in accordance with:

ANSI C63.4-2003

FCC KDB 558074 D01 v03r01

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

## **OBJECTIVE**

The primary objective of the manufacturer is to demonstrate compliance with the regulations outlined in the previous section.

## **STATEMENT OF COMPLIANCE**

Unikey Smart Reader 2 Model SR2 complied with the applicable requirements listed under the following FCC and IC rules as a 2.4GHz DTS transmitter:

FCC Part 15 Subpart C (15.247)

No additional model variations or configurations were specified by the manufacturer.

Maintenance of compliance is the responsibility of the manufacturer. Any modification to the product should be assessed to ensure compliance has been maintained.

Tommy Bennett was present during all testing to represent the manufacturer.

## **DEVIATIONS FROM THE STANDARDS**

During testing there were no deviations from the regulatory rules and test procedures listed above.

## **MODIFICATIONS**

None

## **MEASUREMENT UNCERTAINTIES**

The measurement of uncertainty is not included with the data in this test report.

**TEST RESULTS SUMMARY**

FCC Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.203	Antenna connector	MCX 50ohm Coaxial Connection	Unique antenna connector, permanently attached antenna, or professionally installed	Complies
15.207	AC Line conducted emissions	N/A	As specified in 15.207(a)	Note 1
15.215(c)	Frequency band of operation	2402MHz - 2480MHz	Within 2400MHz – 2483.5MHz	Complies
15.247 (a) (1)	6dB Bandwidth	754.713kHz	>500kHz	Complies
15.247(e)	Power Spectral Density	-13.737dBm	8dBm	Complies
15.247(d)	Bandedge	> -30dBc	-30dBc	Complies
15.247 (b) (3)	Conducted Output Power	582.1uW (conducted) 1.303mW EIRP	Conducted < 1.0W EIRP < 4.0W	Complies
15.247(d) 15.209	Radiated Spurious Emissions 30MHz – 25 GHz	43.272dBuV/m	15.209(a) in restricted bands, all others < -20dBc	Complies

## Notes:

1. EUT is powered by DC Voltage
2. Antenna gain is declared as maximum 3.5dBi by the manufacturer.
3. A separate test report has been issued to demonstrate compliance with FCC 15B unintentional emissions and receiver spurious emissions requirements.

**EQUIPMENT UNDER TEST (EUT) DETAILS**

The Unikey Smart Reader 2 (SR2) is a combination of legacy proximity-card reader and advanced Bluetooth Low Energy enabled reader in one. This reader is intended for use in conjunction with a physical access control system to manage physical access to a protected building or area. This reader allows for an access request to be transmitted to a control panel using the industry standard Wiegand protocol. End users can present any combination of proximity-cards, proximity fobs, or Bluetooth Low Energy credentials via a supported smart device such as Android and Apple phones to attempt access using the Unikey SR2.

One sample was supplied for testing. For antenna port conducted tests the EUT was fitted with a suitable antenna connector for direct measurements.

**EUT OPERATION**

During testing, EUT was transmitting continuously at its highest power level at full data rate. Three different channels (low, middle and top) could be selected for continuous transmission as needed.

**TEST SITE**

Final test measurements were taken at the test sites listed below.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 1	A2LA Accredited Designation Number US1077	IC 4319A	1701 E Plano Pkwy #150 Plano, TX 75074.

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

**TEST EQUIPMENT**

NTS Equipment #	Description	Manufacturer	Model	Calibration Duration	Calibration Due Date
E1529P	PSA	Agilent	E4446A	24 Months	5/4/2019
E1009P	PreAmp (1GHz-26.5GHz)	HP	JS32-00104000-62-5P	12 Months	2/14/2018
E1524P	Biconilog Antenna (30MHz-1GHz)	ETS Lindgren	3142D	12 Months	12/22/2017
E1149P	Horn Antenna (1GHz-18GHz)	EMCO	3115	12 Months	1/30/2018
E1068P	Horn Antenna (18GHz-40GHz)	EMCO	3116	12 Months	9/27/2017

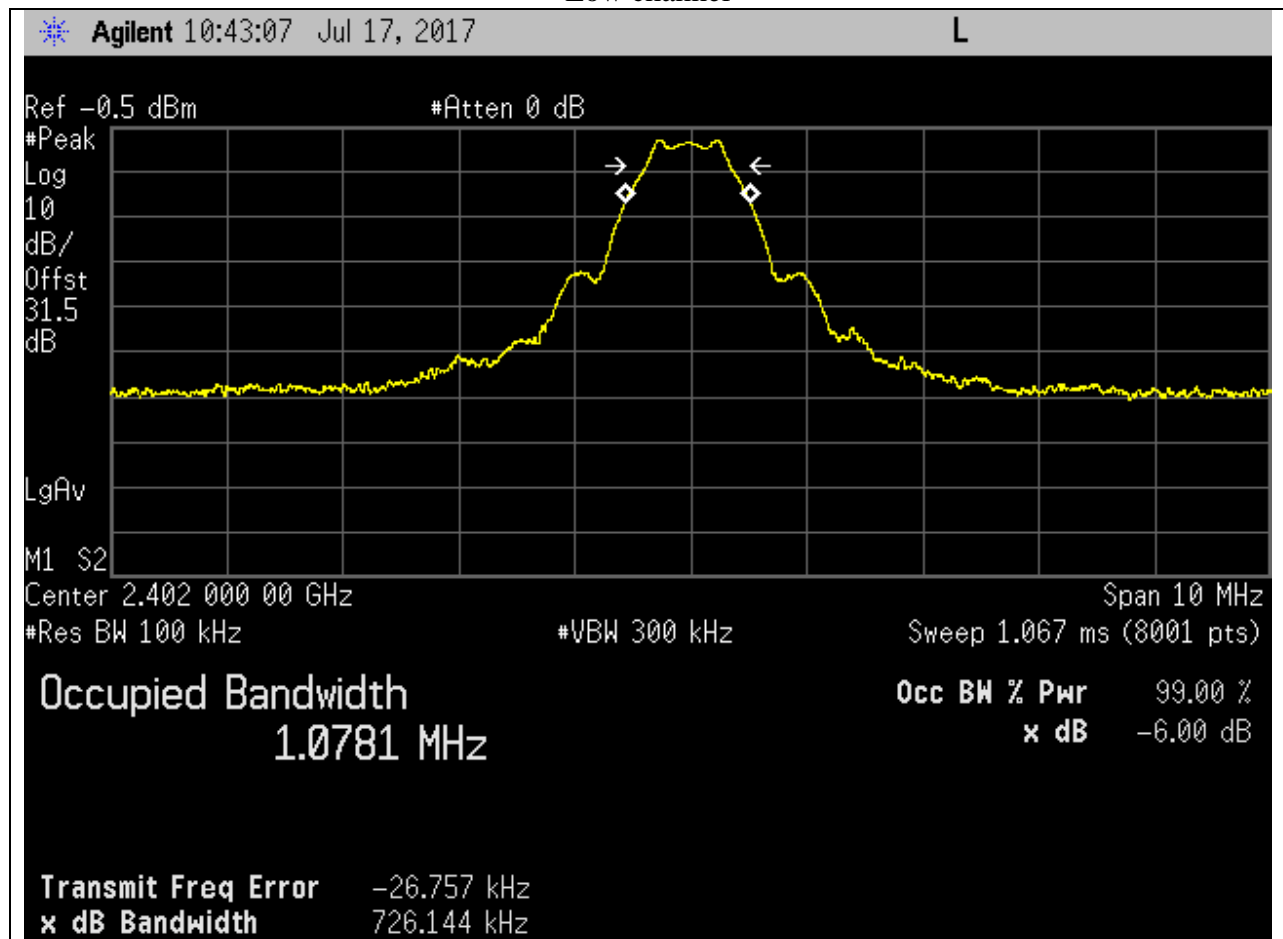
## ***Test Results Section***



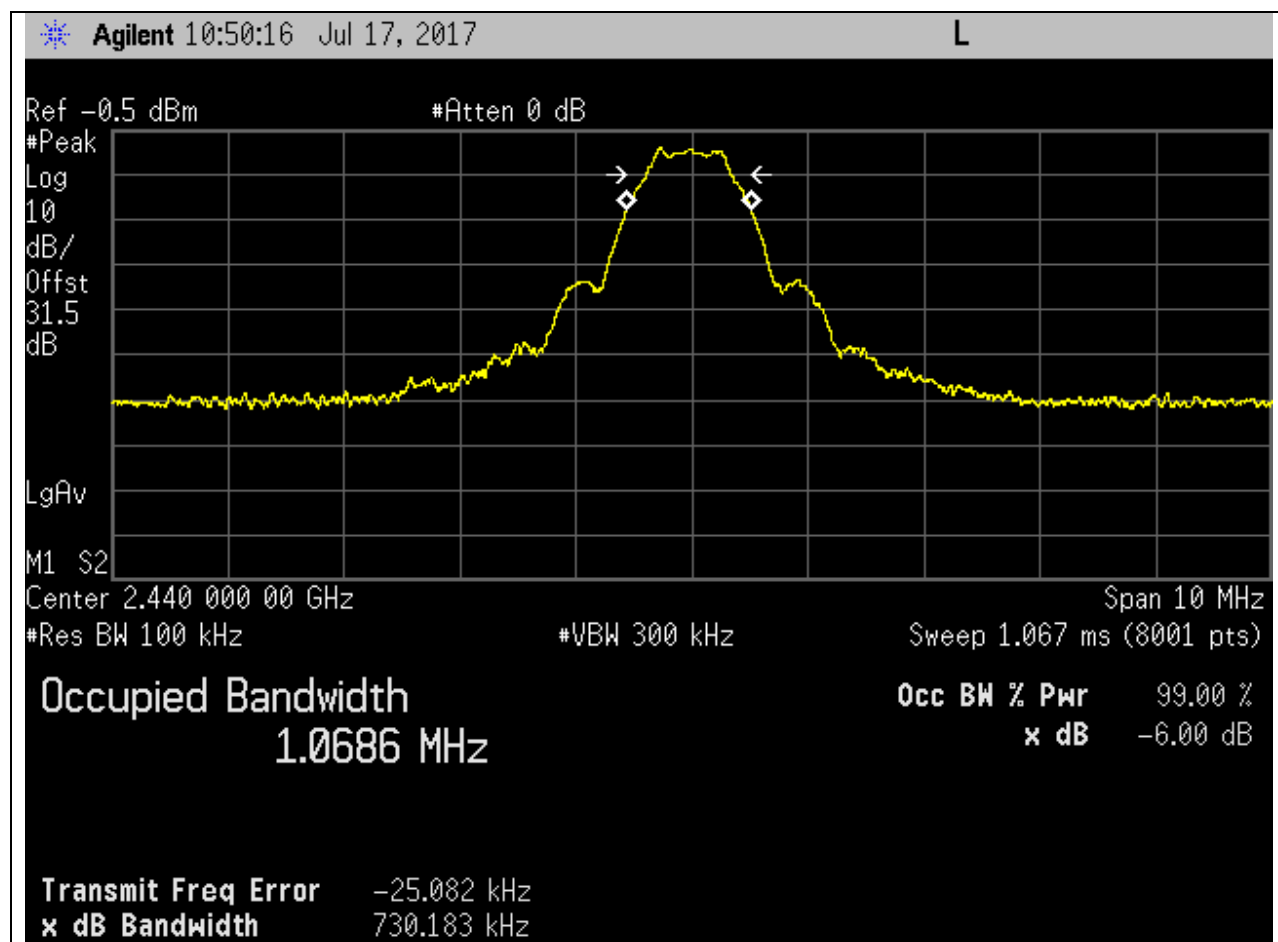
**6dB Bandwidth**

<b>Regulatory Rule / Standard</b>	CFR Title 47 §15.247(a)(2)				
<b>Standard / Method of Measurement</b>	FCC KDB 558074 D01 v03r01				
<b>Specifications</b>	Minimum 6dB bandwidth shall be at least 500kHz				
<b>Deviations From Method of Measurement</b>	None – Testing performed through Radiated Measurements				
<b>Tested By</b>	Armando Del Angel				
<b>Date</b>	July 17 <sup>th</sup> 2017				
<b>Test Result</b>	Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Verdict
	Low	2402	726.144kHz	> 500kHz	Complies
	Middle	2440	730.183kHz	> 500kHz	Complies
	High	2480	754.713kHz	> 500kHz	Complies
	6dB bandwidth plots included below.				

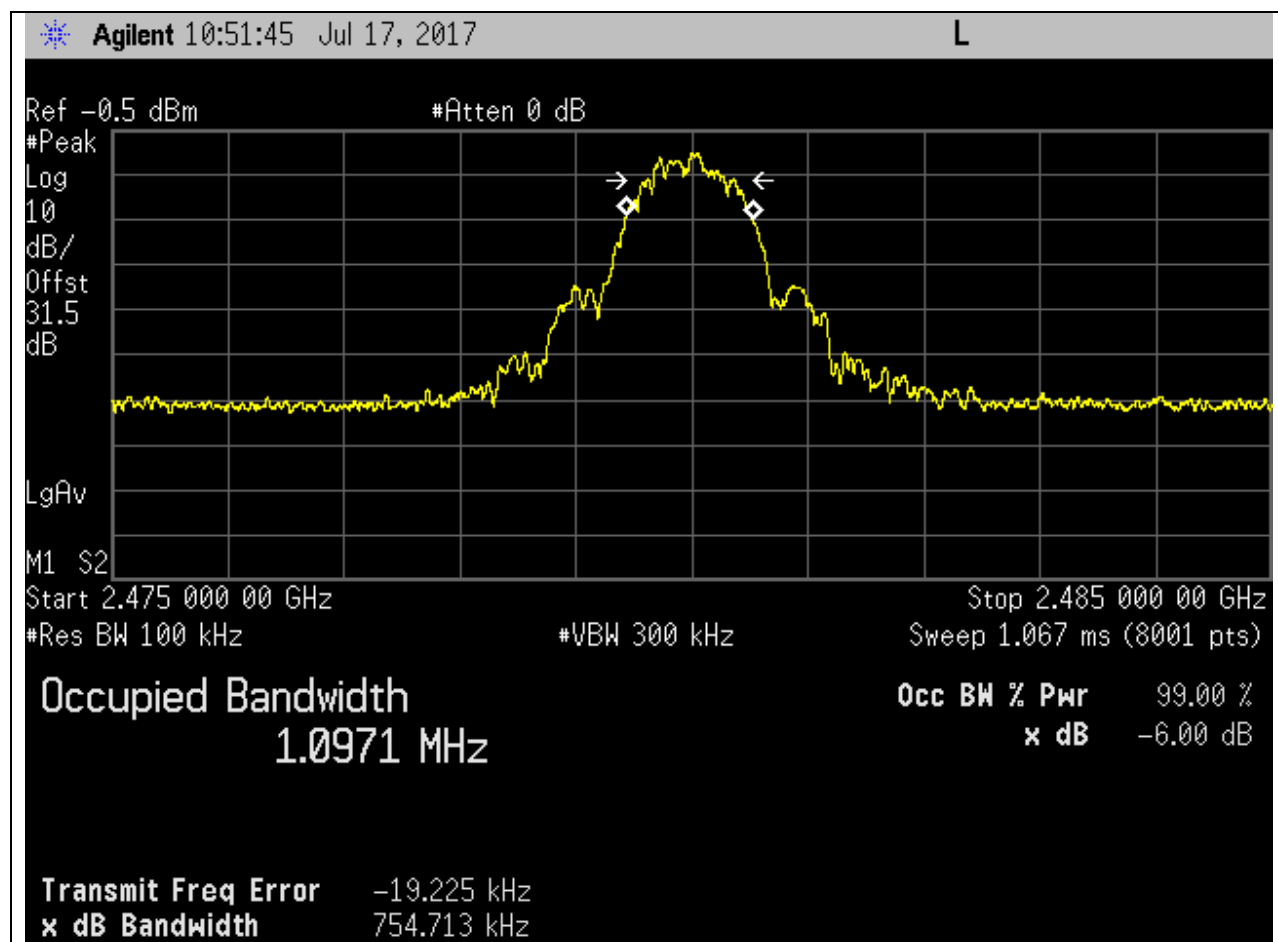
Low channel



## Middle channel



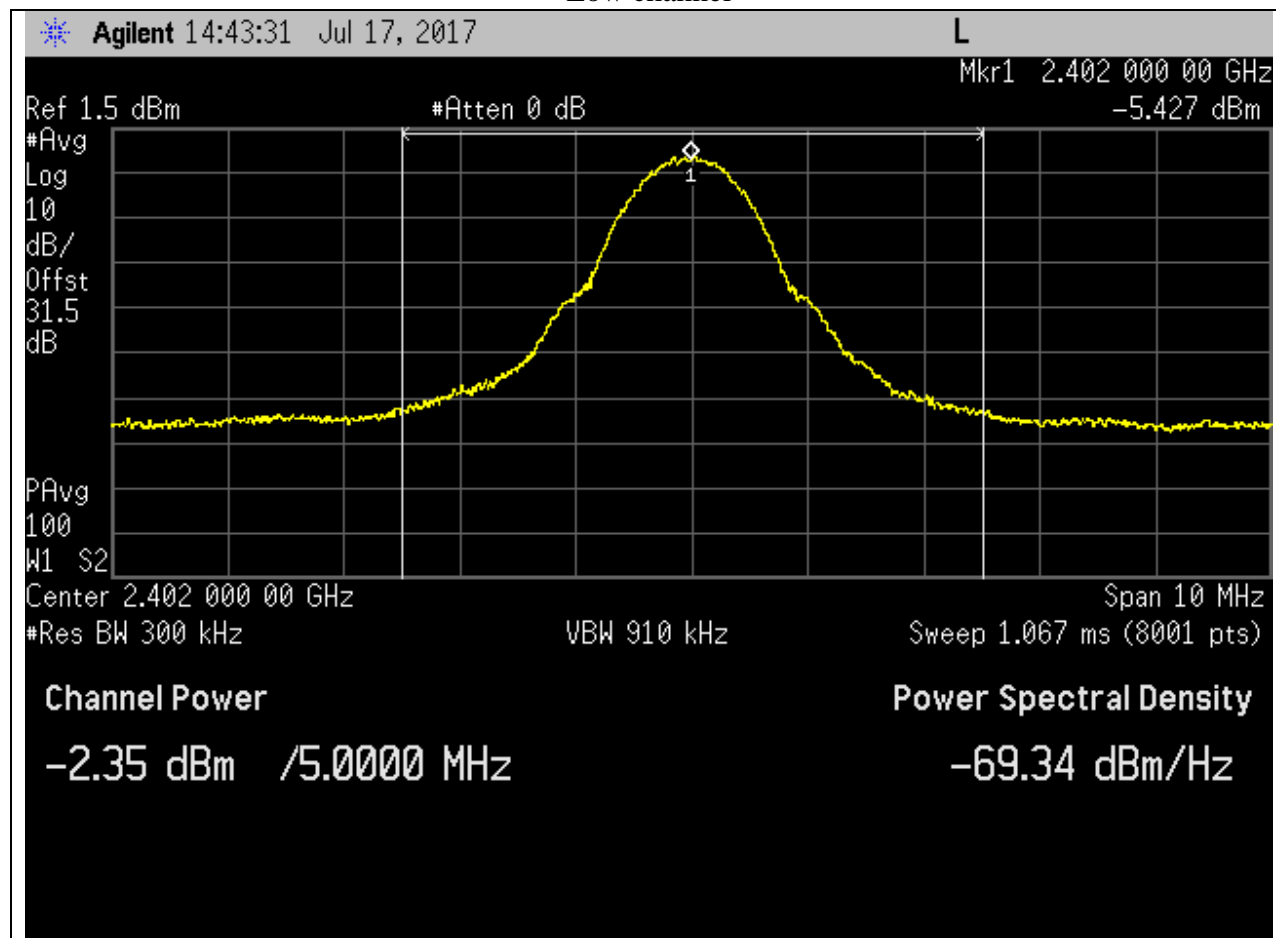
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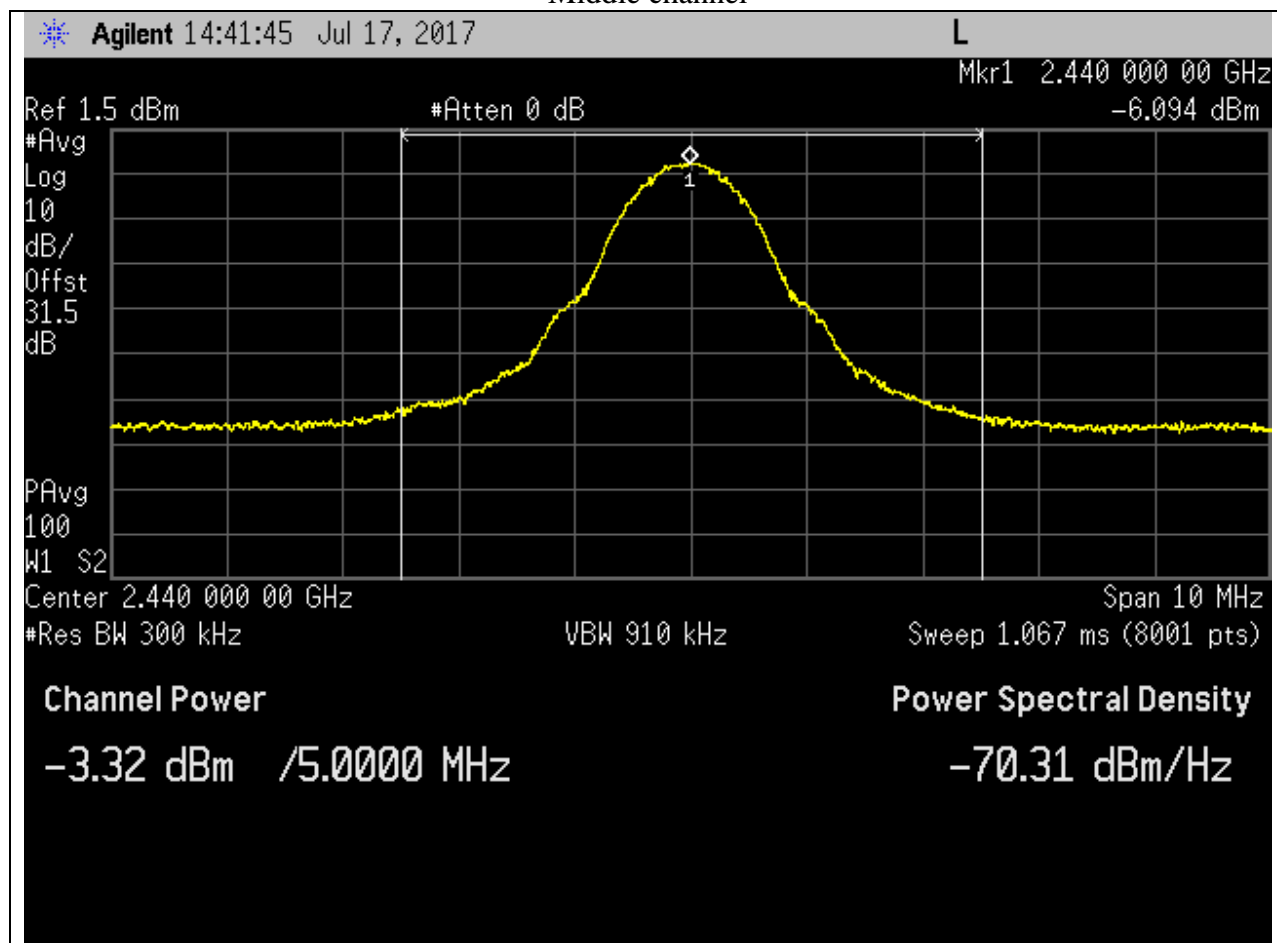
**Peak Output Power**

<b>Regulatory Rule / Standard</b>	CFR Title 47 §15.247(b)(3)				
<b>Standard / Method of Measurement</b>	FCC KDB 558074 D01 v03r01				
<b>Specifications</b>	1.0W (30dBm) Peak Conducted and 4.0W (36dBm) EIRP				
<b>Deviations From Method of Measurement</b>	None – Testing performed through Radiated Measurements				
<b>Tested By</b>	Armando Del Angel				
<b>Date</b>	July 17 <sup>th</sup> 2017				
<b>Test Result</b>	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Verdict
	Low	2402	-2.35dBm	30dBm	Complies
	Middle	2440	-3.32dBm	30dBm	Complies
	High	2480	-4.11dBm	30dBm	Complies

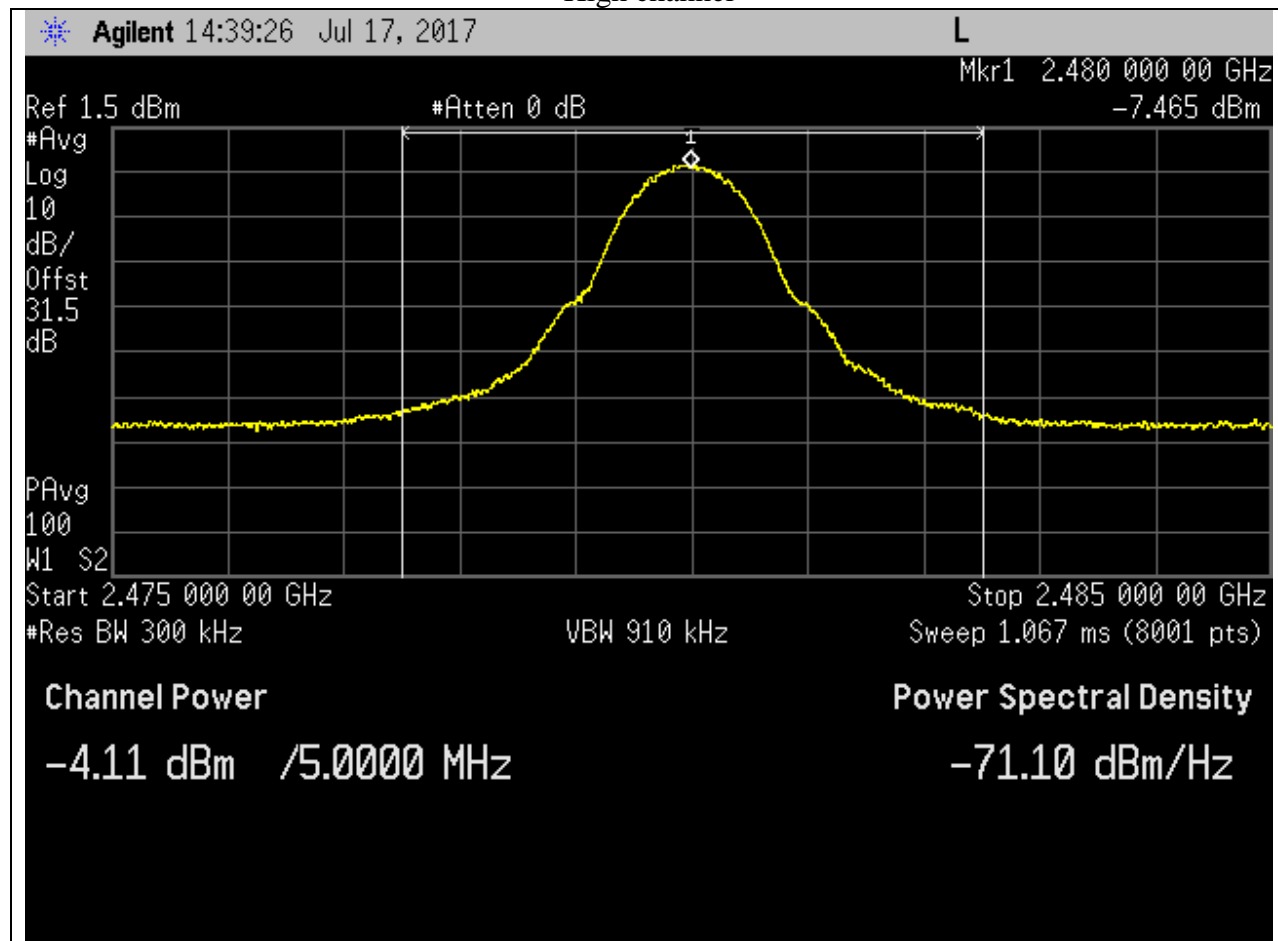
Low channel



Middle channel



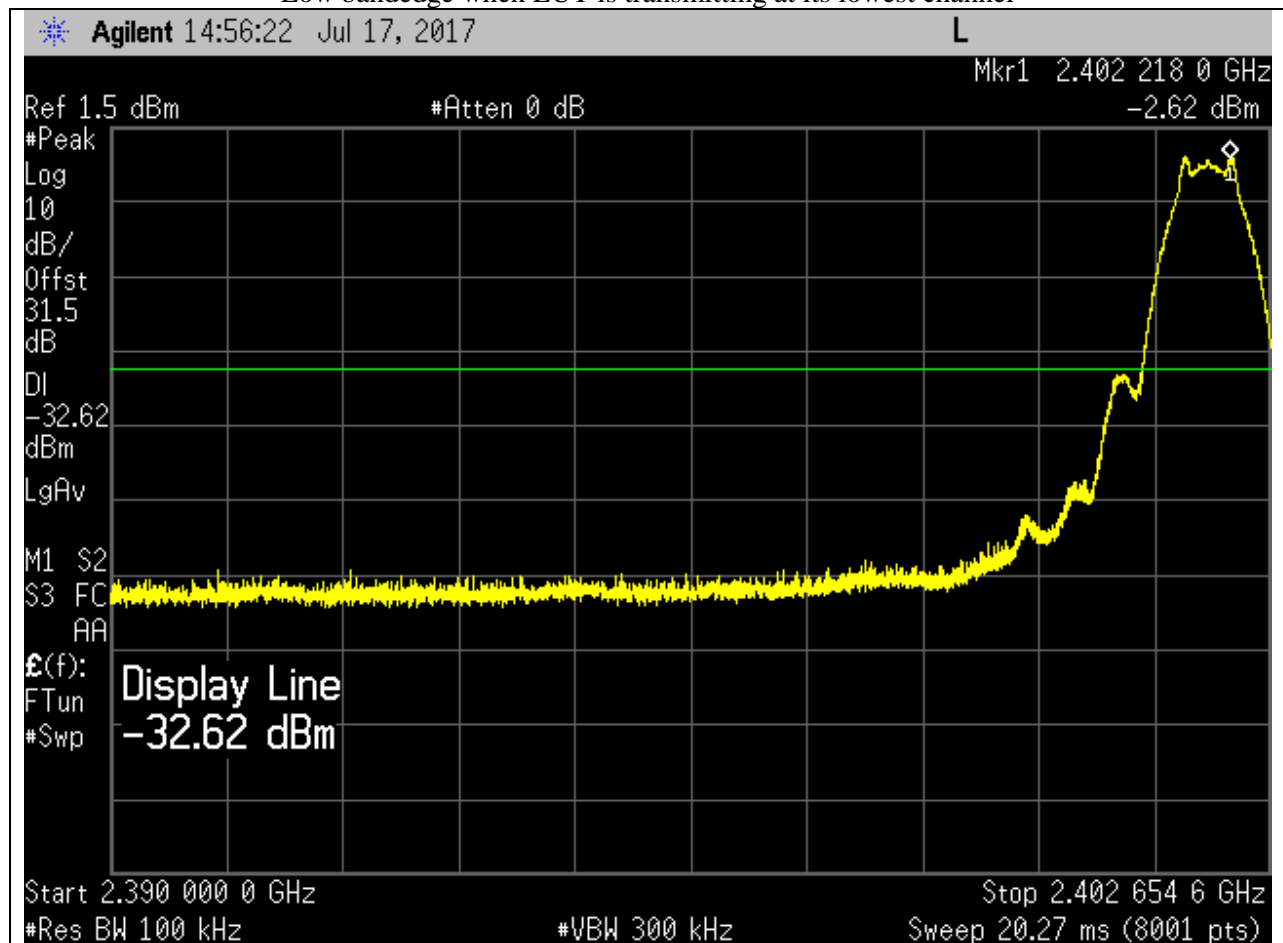
# High channel



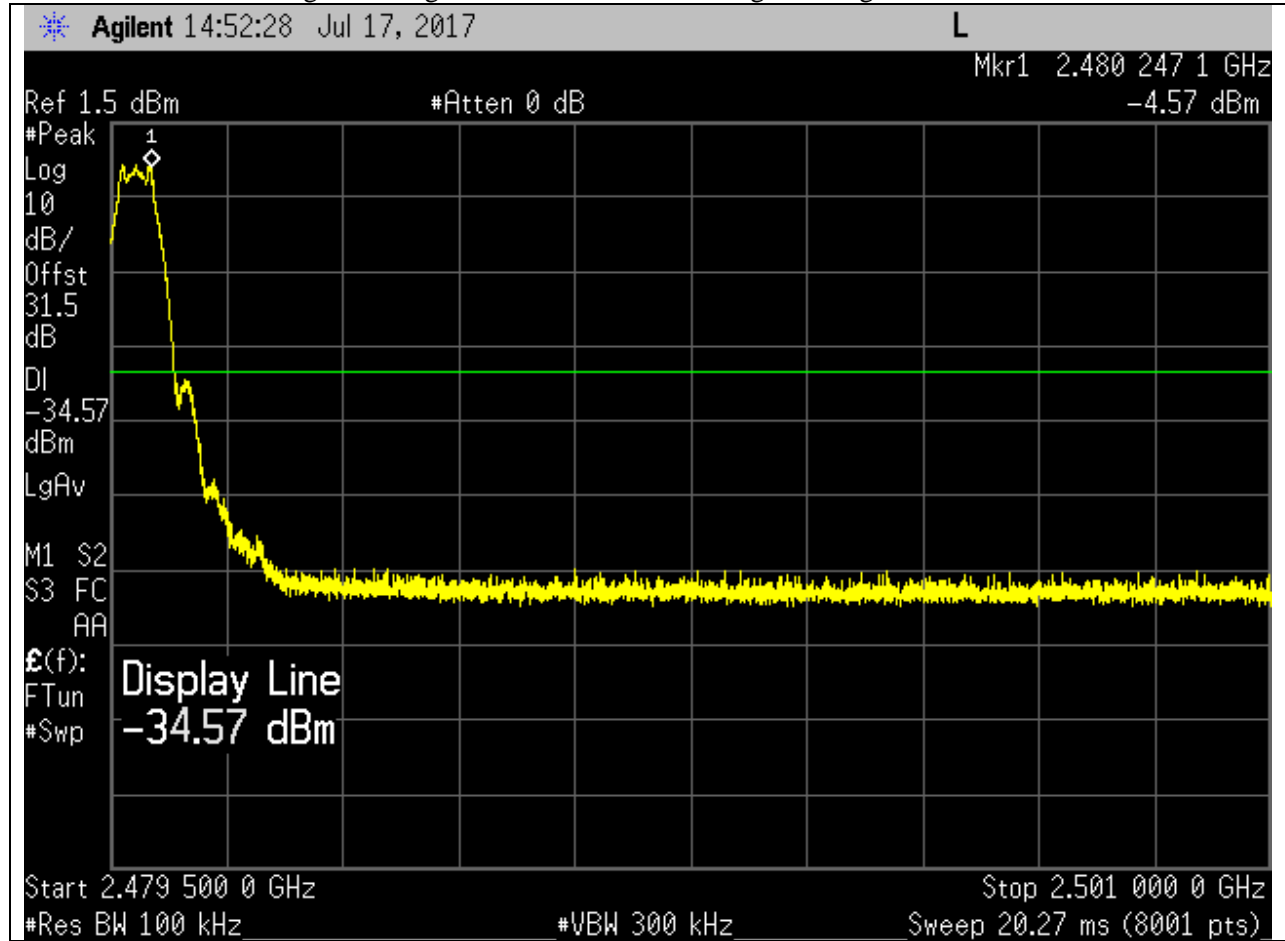
**Bandedge**

<b>Regulatory Rule / Standard</b>	CFR Title 47 §15.247(d)				
<b>Standard / Method of Measurement</b>	FCC KDB 558074 D01 v03r01				
<b>Specifications</b>	20dB below the fundamental in any 100kHz bandwidth				
<b>Deviations From Method of Measurement</b>	None – Testing performed through Radiated Measurements				
<b>Tested By</b>	Armando Del Angel				
<b>Date</b>	July 17 <sup>th</sup> 2017				
<b>Test Result</b>	Channel	Bandedge Frequency (MHz)	Delta at Bandedge (dBc)	Limit	Verdict
	Lowest	2400	>30dBc	-30dBc	Complies
	Highest	2483.5	>30dBc	-30dBc	Complies
	Corresponding plots shown below for bandedge frequencies at 2400MHz and 2483.5MHz.				

Low bandedge when EUT is transmitting at its lowest channel



High bandedge when EUT is transmitting at its highest channel

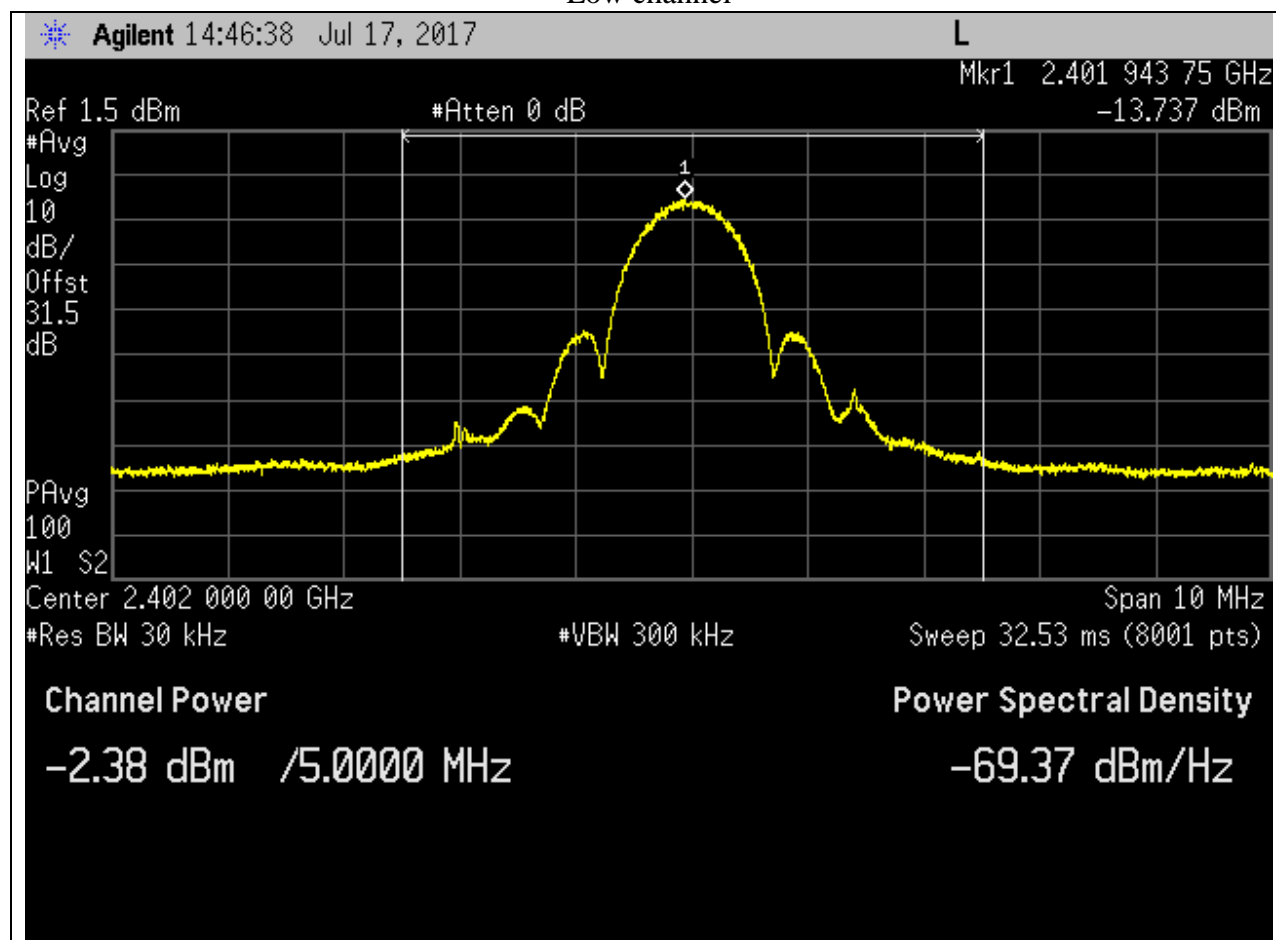




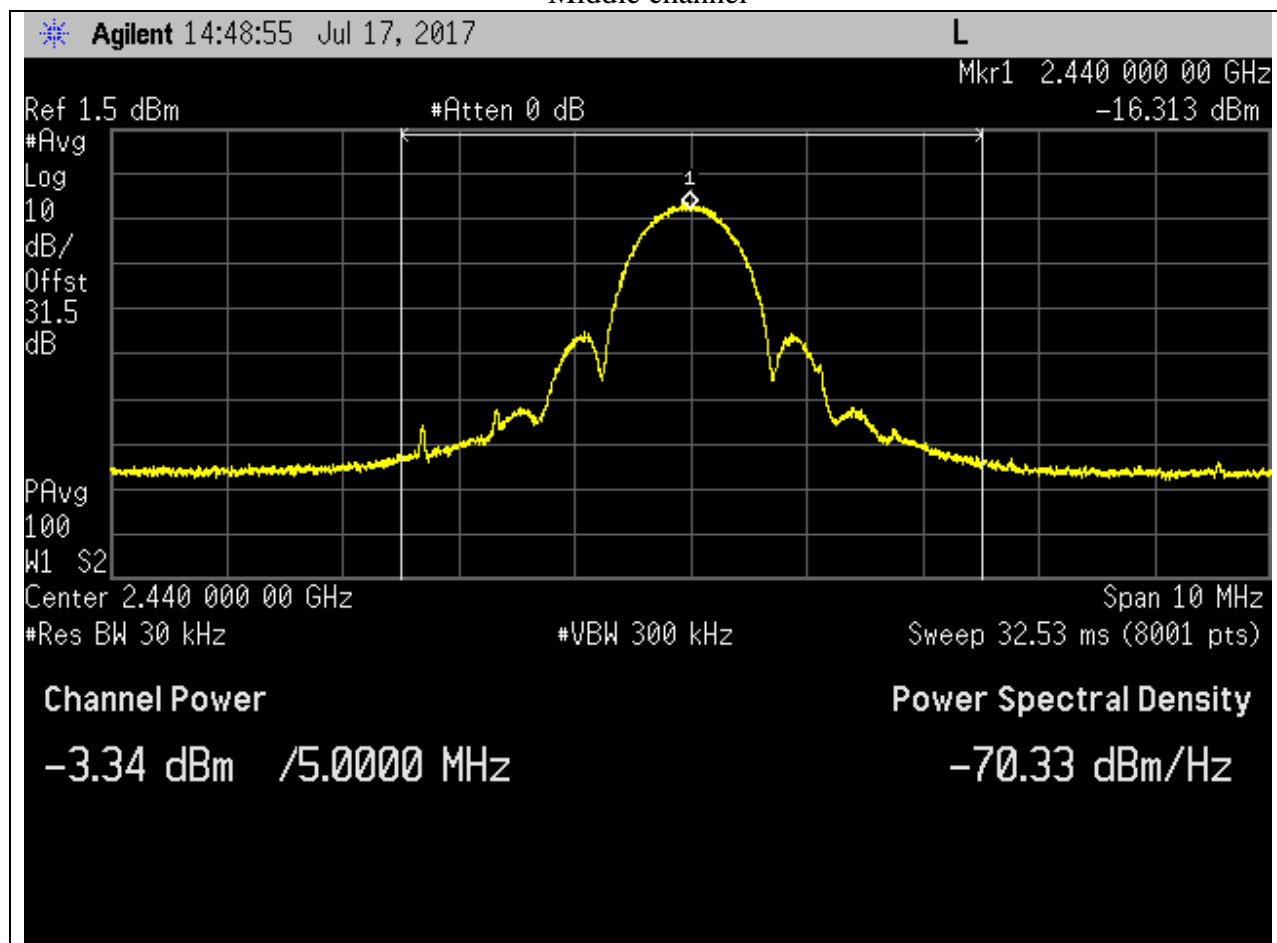
**Peak Power Spectral Density**

<b>Regulatory Rule / Standard</b>	CFR Title 47 §15.247(e)				
<b>Standard / Method of Measurement</b>	FCC KDB 558074 D01 v03r01				
<b>Specifications</b>	Maximum 8dBm in any 3kHz band				
<b>Deviations From Method of Measurement</b>	None – Testing performed through Radiated Measurements				
<b>Tested By</b>	Armando Del Angel				
<b>Date</b>	July 17 <sup>th</sup> 2017				
<b>Test Result</b>	Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Verdict
	Low	2402	-13.737dBm	8dBm	Complies
	Middle	2440	-16.313dBm	8dBm	Complies
	High	2480	-16.872dBm	8dBm	Complies

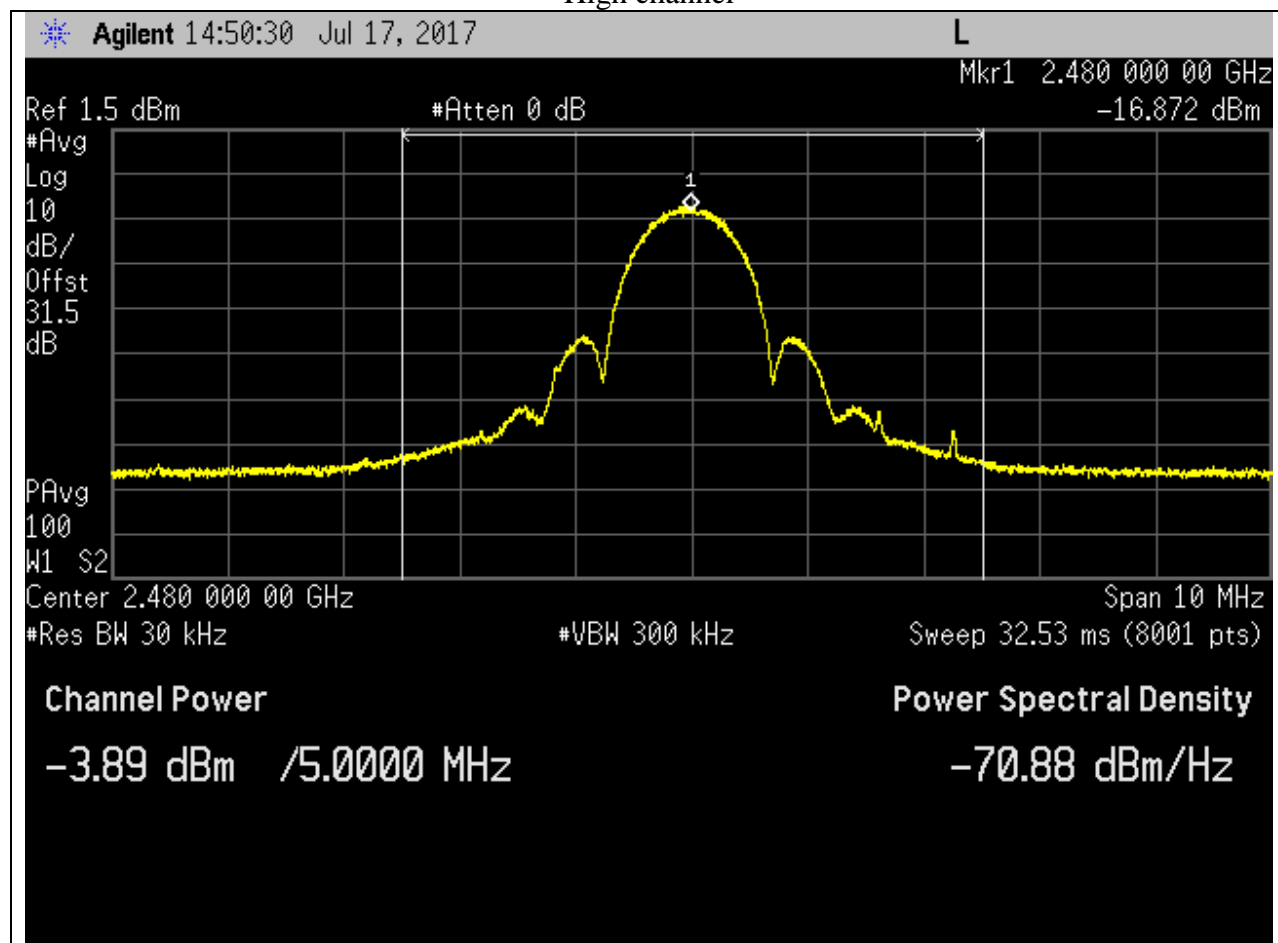
Low channel



Middle channel



# High channel



**Radiated Spurious Emissions**

<b>Regulatory Rule / Standard</b>	CFR Title 47 §15.247(d)
<b>Standard / Method of Measurement</b>	FCC KDB 558074 D01 v03r01
<b>Specifications</b>	15.209(a) limits in all restricted bands as specified in 15.205(a) and > -20dBc outside the restricted bands.
<b>Deviations From Method of Measurement</b>	None – Testing performed through Radiated Measurements
<b>Tested By</b>	Armando Del Angel
<b>Date</b>	July 18 <sup>th</sup> – 19 <sup>th</sup> 2017
<b>Test Result</b>	Complies - Tabular data shown below

**30MHz-1GHz range:**

In 30MHz-1GHz range, transmit channel did not impact emission characteristics based on pre-scan results. Mid channel at 2442MHz was selected for final testing.

Measurement System Settings: Quasi Peak, RBW = 120kHz

Frequency	Polarity	Raw Peaks	QP Raw	Cableloss	Antenna Loss	PreAmp Gain	Corrected Peaks	Corrected QP	Limit	QP Margin	Tower	Turntable
MHz	V/H	dBuV/m	dBuV/m	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV	cm	Degrees
472.007	H	61.808	61.609	1.124	18.281	-37.741	43.471	43.271	46.03	-2.759	112	359
487.991	H	58.973	59.207	1.15	18.96	-37.718	41.366	41.599	46.03	-4.431	100	1
455.999	H	60.587	60.407	1.109	17.84	-37.801	41.732	41.553	46.03	-4.477	112	1
519.99	H	57.856	58.295	1.22	19.1	-37.728	40.448	40.887	46.03	-5.143	104	359
503.995	H	57.223	57.528	1.185	19.1	-37.723	39.786	40.09	46.03	-5.94	100	352
440.003	H	58.615	58.285	1.093	18.3	-37.863	40.145	39.814	46.03	-6.216	100	1
471.99	V	55.253	53.096	1.124	18.28	-37.741	36.915	34.757	46.03	-11.273	287	273
111.10	V	59.44	57.067	0.498	8.933	-38.159	30.713	28.34	43.522	-15.182	300	275
87.71	V	61.794	49.858	0.439	7.529	-38.16	31.599	19.663	40	-20.337	288	359
84.57	V	60.482	49.243	0.422	7.183	-38.143	29.945	18.706	40	-21.294	300	276
90.26	V	62.93	50.349	0.453	7.843	-38.173	33.053	20.472	43.522	-23.05	288	101
91.82	V	59.534	44.34	0.459	8.095	-38.179	29.908	14.714	43.522	-28.808	300	1

Corrected Reading (dBuV/m) = Raw Reading (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) + Preamp Gain (dB)

Margin (dB) = Corrected Reading (dBuV/m) – Limit (dBuV/m)

Negative margin indicates a passing result

**1GHz-25GHz range:**

In 1GHz-25GHz range only harmonics of the fundamental as listed below were detected. All other emissions were at the noise floor level and the highest noise floor for both Peak and Average were more than 6dB below their corresponding 15.209 limits.

**Measurement System Settings:**

Peak: RBW = 1MHz, VBW = 3MHz, max-hold

Average: 10Hz video averaging on Peak trace

Frequency	Polarity	Raw Peaks	AVE Raw	Cableloss	Antenna Loss	PreAmp Gain	Corrected Peaks	Corrected AVE	Limit	AVE Margin	Tower	Turntable
GHz	V/H	dBuV/m	dBuV/m	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV	cm	Degrees
9.95946	V	28.92	26.843	6.021	38.177	-31.051	42.065	39.989	53.98	-13.991	296	142
9.94	H	28.57	26.448	6.006	38.153	-31.169	41.554	39.437	53.98	-14.543	100	359
5.55875	V	28.92	25.726	4.28	34.094	-31.713	35.584	32.387	53.98	-21.593	296	359
5.56	H	29.04	25.645	4.279	34.095	-31.711	35.7	32.307	53.98	-21.673	100	239
4.69373	V	30.31	26.897	3.797	32.766	-32.509	34.359	30.95	53.98	-23.03	296	359
3.96	H	29.50	2.68E+01	3.499	32.678	-32.168	33.504	30.771	53.98	-23.209	126	273
3.77	H	30.13	2.69E+01	3.427	32.495	-32.377	33.673	30.438	53.98	-23.542	296	141
3.84453	V	29.54	2.61E+01	3.437	32.799	-32.296	33.479	30.049	53.98	-23.931	296	202
1.89639	V	32.14	2.89E+01	2.286	27.376	-34.54	27.262	23.986	53.98	-29.994	296	359
1.90	H	32.01	2.88E+01	2.287	27.378	-34.539	27.132	23.923	53.98	-30.057	296	1
1.24068	V	33.68	3.07E+01	1.998	25.633	-35.796	25.512	22.556	53.98	-31.424	300	359
1.24	H	32.42	3.02E+01	1.998	25.625	-35.8	24.237	21.987	53.98	-31.993	296	106

Corrected Reading (dBuV/m) = Raw Reading (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) + Preamp Gain (dB) + Filter Loss (dB)

Margin (dB) = Corrected Reading (dBuV/m) – Limit (dBuV/m)

Average measurements were not performed when peak readings met the average limits

Negative margin indicates a passing result

***End of Report***

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