



## COMPLIANCE WORLDWIDE INC. TEST REPORT 470-17

In Accordance with the Requirements of  
**FCC PART 15.247, SUBPART C**  
**Innovation, Science and Economic Development Canada**  
**RSS-247, ISSUE 2**

**Low Power License-Exempt Radio Communication Devices**  
**Intentional Radiators**

Issued to

**IsoLynx, LLC.**  
**179 Ward Hill Avenue**  
**Haverhill, MA 01835**  
**978-556-9780**

for the

**IsoLynx II UWB Tracking Tag**  
**Model: IL0302**

**FCC ID: 2AHCQ-IL0302**

**Report Issued on September 10, 2018**

Tested by

\_\_\_\_\_  
Brian F. Breault

Reviewed by

\_\_\_\_\_  
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## 1. Scope

This test report certifies that the IsoLynx II UWB Tracking Tag, as tested, meets the FCC Part 15, Subpart C requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

## 2. Product Details

<b>2.1. Manufacturer:</b>	IsoLynx, LLC
<b>2.2. Model Number:</b>	IL0302
<b>2.3. Serial Number:</b>	02:04:13B8
<b>2.4. Description:</b>	The IsoLynx Tracking Tag (IL0302) is a small, battery-powered RFID device that produces ultrawideband pulses that are used to generate real-time location and movement data.
<b>2.5. Power Source:</b>	DC 3.7 Volts
<b>2.6. Hardware Revision:</b>	2.1.1
<b>2.7. Software Version:</b>	N/A
<b>2.8. Modulation Type:</b>	GFSK
<b>2.9. Operating Frequency:</b>	2.4 GHz to 2.4835 Nominal
<b>2.10. EMC Modifications:</b>	None

## 3. Product Configuration

### 3.1. Operational Characteristics & Software

#### Hardware Setup:

The tag was pre-configured with firmware that allowed it to transmit on the low, middle and high BLE channels by giving the unit a hard shake. Operation is confirmed by the number of blinks of the red led. One blink, channel 37, two blinks, channel 38, three blinks, channel 39, four blinks, receive only.

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### 3. Product Configuration (continued)

#### 3.1. Operational Characteristics & Software (continued)

During all radiated emissions measurement testing, the product was mounted on a polystyrene form to facilitate rotating the device through three orthogonal axes, as required by ANSI C63.10, section 5.10.1, for a hand held or body worn device. The three axes were defined as follows:

X Axis	Horizontal on edge	Arrow on the unit is facing the antenna at 0°
Y Axis	Upright on edge	Arrow on the unit is facing the antenna at 90°
Z Axis	Flat on table	Arrow on the unit is facing the antenna at 0°

X-Axis

Y-Axis

Z-Axis

#### 3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
IsoLynx, LLC	IL0302	02:04:13B8	3.7	DC	UWB / BLE Tag

#### 3.3. EUT Cables/Transducers

Cable Type	Length	Shield	From	To
USB	2M	Yes	EUT	USB Charger

#### 3.4. Support Equipment

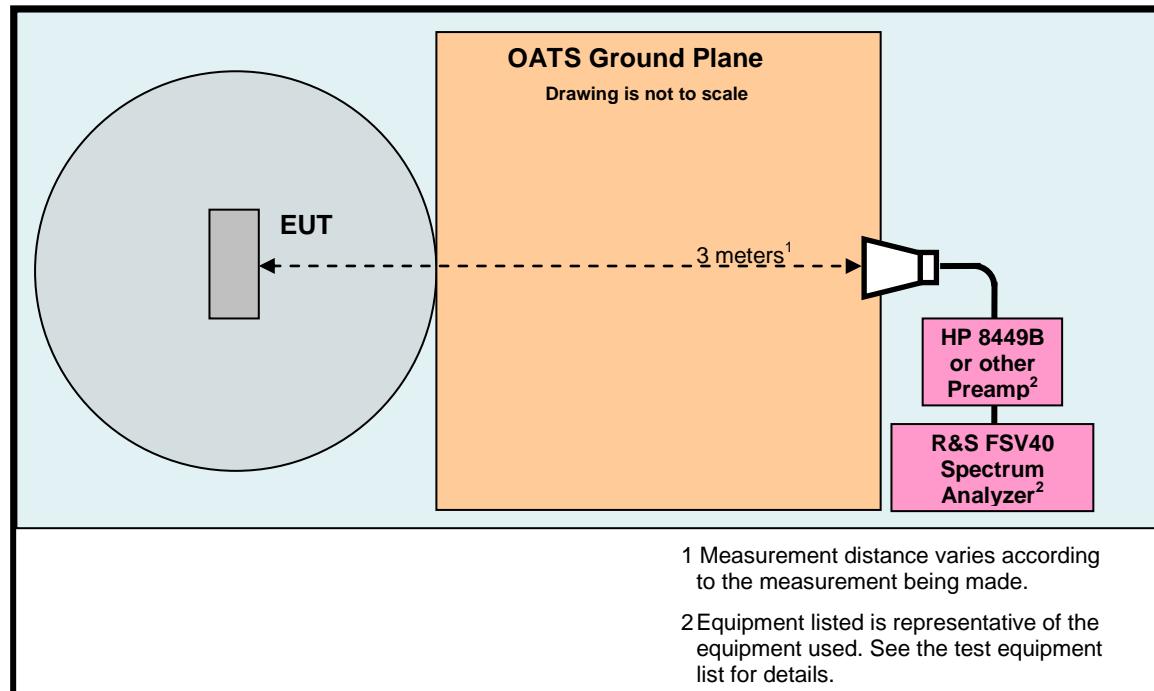
Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
None					

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### 3. Product Configuration

#### 3.5. Block Diagram





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#### 4. Measurements Parameters

##### 4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz <sup>1</sup>	Rohde & Schwarz	ESR7	101156	7/23/2018	3 Years
Spectrum Analyzer 20 Hz – 40 GHz <sup>2</sup>	Rohde & Schwarz	FSV40	100899	7/23/2018	3 Years
Spectrum Analyzer, 9 kHz - 40 GHz <sup>3</sup>	Rohde & Schwarz	FSVR40	100909	5/3/2019	2 Years
Spectrum Analyzer, 2 Hz - 26 GHz <sup>4</sup>	Rohde & Schwarz	FSW26	102057	12/7/2018	2 Years
EMI Receiver	Hewlett Packard	8546A	3650A00360	12/6/2018	3 Years
Passive Loop Antenna, 9 kHz to 30 MHz	EMCO	6512	9309-1139	10/26/2018	2 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences	JB1	A050913	6/3/2019	2 Years
Horn Antenna, 960 MHz to 18 GHz	Electro-Metrics	EM-6961	6337	5/2/2018	2 Years
Horn Antenna, 18 GHz to 40 GHz	Com-Power	AH-840	101032	2/24/2018	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A00329	7/22/2018	3 Years
LISN 50 ohm 50 µH, 9 kHz to 30 MHz	EMCO	3825/2	9109-1860	11/17/2018	1 Year
2.4 GHz Band Reject Filter	Micro-Tronics	BRM50702	150	6/12/2018	1 Year
EMI Receiver, 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3330A00115	12/4/2018	2 Years
Digital Barometer	Control Company	4195	ID236	10/8/2017	2 Years

<sup>1</sup> ESR7 Firmware revision: V3.36, SP2 Date installed: 11/02/2017

Previous V3.36, installed 05/16/2017.

<sup>2</sup> FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016

Previous V2.30 SP1, installed 10/22/2014.

<sup>3</sup> FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016

Previous V2.23, installed 10/20/2014.

<sup>4</sup> FSW26 Firmware revision: V2.80, Date installed: 10/28/2017

Previous V2.61, installed 04/04/2017.

##### 4.2. Measurement Software

Manufacturer	Software Description	Title or Model #	Rev.	Report Sections
Compliance Worldwide	Test Report Generation Software	Test Report Generator	1.0	7.9. Conducted Emissions



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#### 4. Measurements Parameters

##### 4.3. Measurement & Equipment Setup

Test Dates:	12/14/2017, 12/22/2017, 12/26/2017, 12/27/2017, 4/13/2018
Test Engineer:	Larry Stillings
Normal Site Temperature (15 - 35°C):	19.0
Relative Humidity (20 -75%RH):	31
Frequency Range:	30 kHz to 40 GHz
Measurement Distance:	3, 1.5, 1 and 0.3 Meters 200 Hz - 10 kHz to 150 kHz 9 kHz - 150 kHz to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz 1 kHz - 10 kHz to 150 kHz 30 kHz - 150 kHz to 30 MHz 300 kHz - 30 MHz to 1 GHz 3 MHz - Above 1 GHz
EMI Receiver IF Bandwidth:	Peak, QP - 10 kHz to 1 GHz Peak, Avg - Above 1 GHz Unless otherwise specified.
EMI Receiver Average Bandwidth:	
Detector Function:	

##### 4.4. Measurement Procedures

Test measurements were made in accordance FCC Part 15.247: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5850 MHz, and 24.0 - 24.25 GHz.

The measurement procedures in this report are in accordance with ANSI C63.10-2013: *American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*. FCC OET Publication Number KDB 558074 D01 v04, *Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247*, dated April 5, 2017, was also referenced for the test procedures used to generate the data in this report. All references to FCC OET publication number 558074 refer to this version of the publication.

All radiated emissions measurements include correction factors for antenna, cables, preamp and attenuators, if used.

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#### 4. Measurements Parameters

##### 4.5. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency	$\pm 1 \times 10^{-8}$
Radiated Emission of Transmitter	$\pm 4.55$ dB
Radiated Emission of Receiver	$\pm 4.55$ dB
Temperature	$\pm 0.91^\circ C$
Humidity	$\pm 5\%$

#### 5. Choice of Equipment for Test Suits

##### 5.1 Choice of Model

This test report is based on the one test sample supplied by the manufacturer. These units are reported by the manufacturer to be equivalent to the production units.

##### 5.2 Presentation

The test samples were tested complete with all required ancillary equipment. Refer to Section 3 of this report for product equipment configuration.

##### 5.3 Choice of Operating Frequencies

The IsoLynx II UWB Tracking Tag, as tested, operates on 40 channels, from channels 0 to 39 in the 2.4 GHz band.

In accordance with ANSI C63.10-2013, section 5.6, and FCC Part 15.31 (m), the choice of operating frequencies selected for the testing detailed in this report are as follows:

Channel	Frequency (MHz)						
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

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## 5. Choice of Equipment for Test Suits (continued)

### 5.4 Mode of Operation

Modulation type : GFSK

Payload pattern : PRB29

Payload Length : 37 bytes

For band edge measurements (section 7.6), the DTS bandwidth measurements were taken into consideration for the worst case examples.

## 6. Measurement Summary

Test Requirement	FCC Rule Reference	Test Report Section	Result
Antenna Requirement	15.203	7.1	Compliant
Minimum DTS Bandwidth	15.247 (a) (2)	7.2	Compliant
Maximum Peak Conducted Output Power	15.247 (b) (1)	7.3	Compliant
Operation with directional antenna gains greater than 6 dBi	15.247 (b) (4)	7.4	Compliant
Spurious Radiated Emissions	15.247 (d)	7.5	Compliant
Spurious Radiated Emissions (> GHz) - Harmonic Measurements	15.247 (d)		Compliant
Lower and Upper Band Edges	15.247 (d)	7.6	Compliant
Emissions in Non-restricted Frequency Bands	15.247(e)	7.7	Compliant
Peak Power Spectral Density	15.247(e)	7.8	Compliant
Conducted Emissions	15.207	7.9	Compliant
Duty Cycle	15.207	7.10	Compliant
Public Exposure to Radio Frequency Energy Levels	1.1307 (b) (1)	7.11	Compliant



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## 7. Measurement Data

### 7.1. Antenna Requirement (15.203)

Requirement: 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.

Results: The IsoLynx II utilizes a pcb etch antenna which is not user replaceable.

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## 7. Measurement Data

### 7.2. Minimum DTS Bandwidth

Requirement: (15.247 (a) (2))

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 8.1 Option 1, DTS (6 dB) Channel Bandwidth.

Results: The device under test meets the minimum 500 kHz DTS (6 dB) bandwidth requirement.

Channel	Frequency (MHz)	-6 dB Bandwidth (kHz)	Minimum -6 dB Bandwidth (kHz)	Result
37	2402	724.30	>500	Compliant
38	2426	739.30	>500	Compliant
39	2480	724.30	>500	Compliant

#### 7.2.1. Low Channel – 37, 2402 MHz



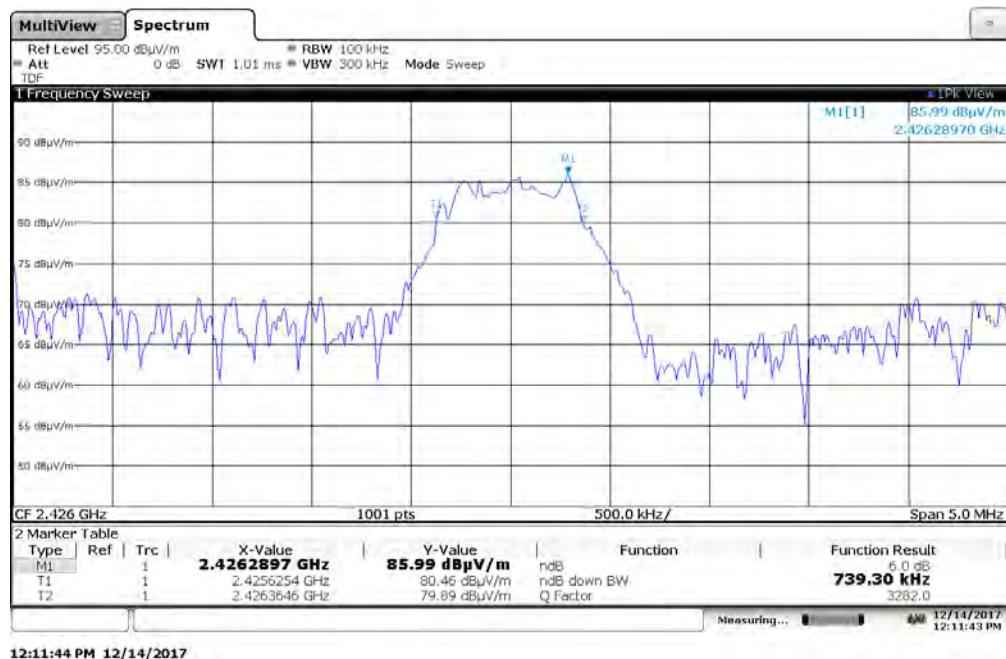
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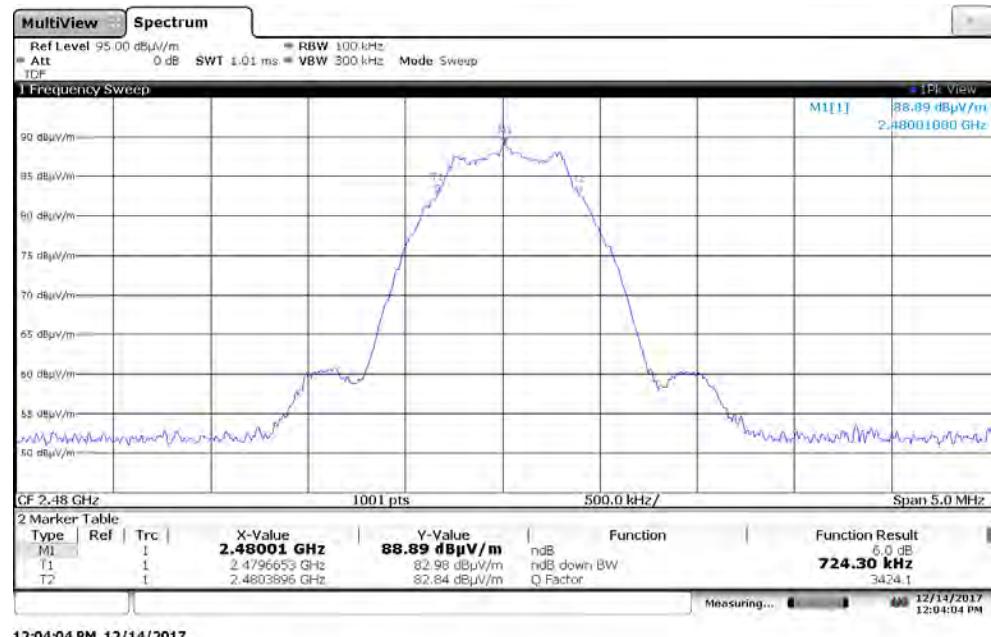
## 7. Measurement Data

### 7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

#### 7.2.2. Middle Channel – 38, 2426 MHz



#### 7.2.3. High Channel – 39, 2480 MHz



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## 7. Measurement Data (continued)

### 7.3. Maximum Peak Conducted Output Power

Requirement: (15.247 (b) (3))

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt (+30 dBm).

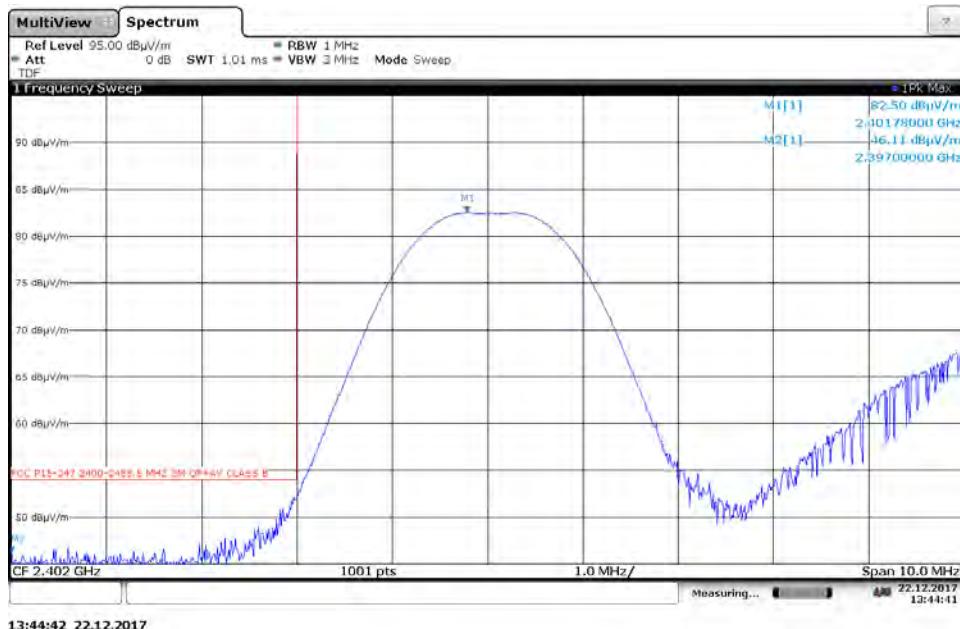
Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number KDB 558074, Section 9.1.1.

Test Note: A spectrum analyzer resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz were used to meet the requirements of FCC OET publication number 558074, Section 9.1.1 and the measured product DTS bandwidth.

Results: The device under test meets the required maximum peak conducted output power level of 1 Watt (125.2 dB $\mu$ V/m at 3 Meters).

Channel	Frequency (MHz)	Maximum Peak Radiated Output Power	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
		(dB $\mu$ V/m)			
37	2402	82.50	125.20	-42.70	Compliant
38	2426	84.80	125.20	-40.40	Compliant
39	2480	84.22	125.20	-40.98	Compliant

#### 7.3.1. Low Channel – 37, 2402 MHz



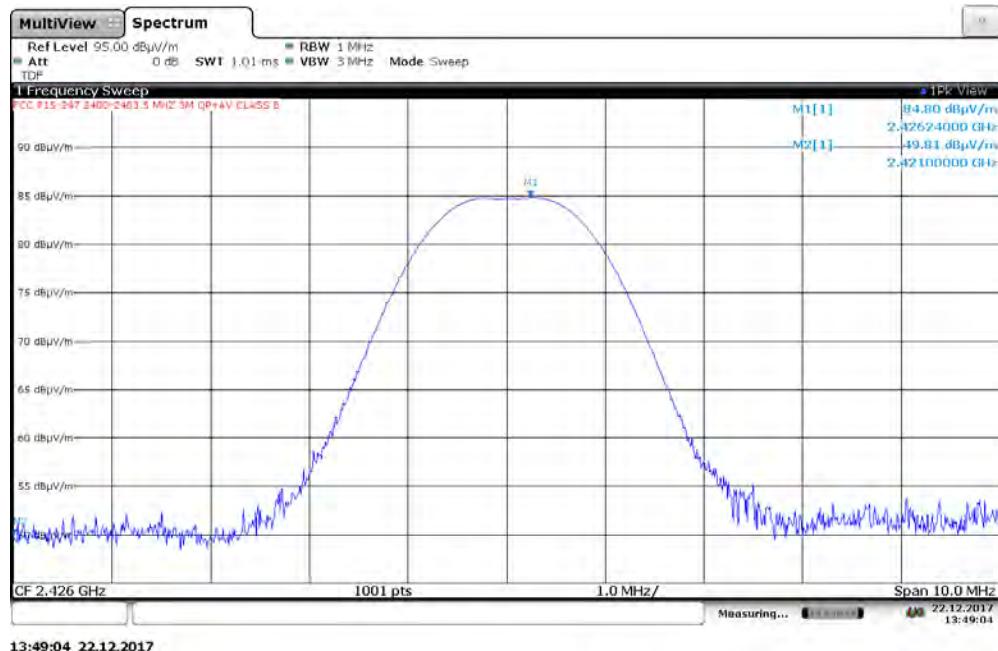
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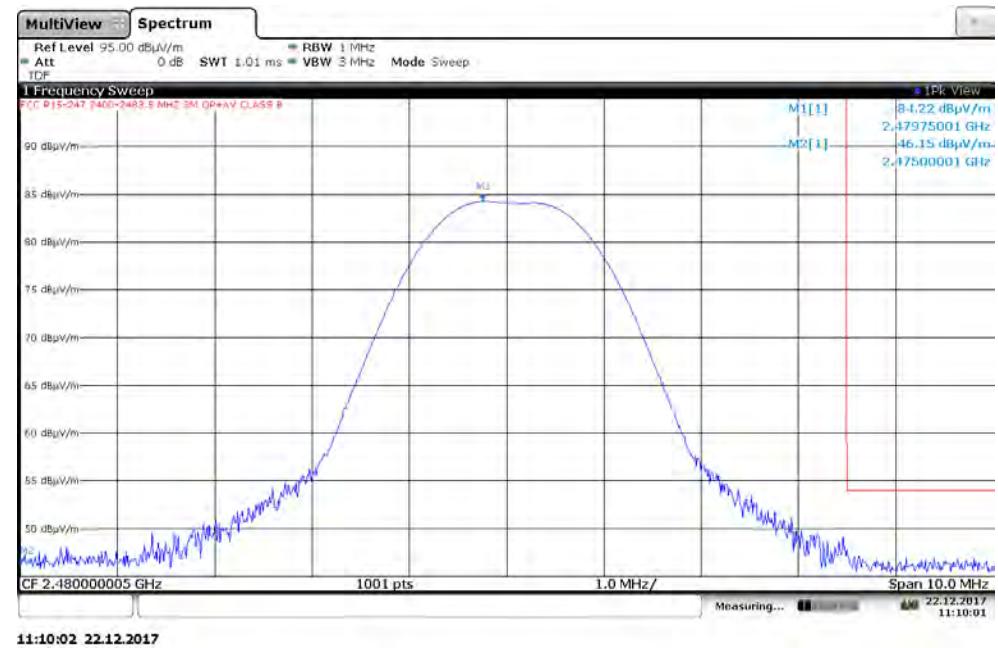
## 7. Measurement Data

### 7.3. Maximum Peak Conducted Output Power (continued)

#### 7.3.2. Middle Channel – 38, 2426 MHz



#### 7.3.3. High Channel – 39, 2480 MHz



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## 7. Measurement Data

### 7.4. Operation with directional antenna gains greater than 6 dBi (15.247 (b)(4))

Requirement: If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of FCC Part 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Procedure: Not applicable for the device under test.

DUT Status: The DUT utilizes an antenna with a 0.9 dBi gain and therefore is exempt from this requirement.

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## 7. Measurement Data (continued)

### 7.5. Transmitter Spurious Radiated Emissions (30 kHz to 40 GHz)

#### 7.5.1 Transmitter Spurious Radiated Emissions

Requirement: (15.209) The Emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency Range (MHz)	Distance (Meters)	Limit (dB $\mu$ V/m) <sup>1</sup>
0.009 to 0.490	3	128.5 to 93.8
0.490 to 1.705	3	73.8 to 63.0
1.705 to 30	3	69.5
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
>960	3	54.0

<sup>1</sup> Measurements in the 9 to 90 kHz, 110 to 490 kHz and above 1000 MHz ranges employ an average detector. Otherwise a quasi-peak detector is used.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 12.0: Emissions in restricted frequency bands and FCC 47CFRPart 15.209: Radiated Emission Limits; General Requirements.

The test methods used to generate the data in this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

Test Notes: Measurements were made from the lowest oscillator frequency as stated by the manufacturer (32.768 kHz) to the 10<sup>th</sup> harmonic of the highest transmitter frequency or 40 GHz, whichever is lower.

Reference FCC Part 15.33(a) and FCC Part 15.33(a)(1).

Each of the test modes documented within the test report were evaluated and the worst case of each of the test modes is detailed in this section. A full set of measurement scans are presented in Appendix A of this test report.

Results: The Emissions from the DUT did not exceed the field strength levels specified in the above table.

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	Appendix A	(H/V)
30 kHz - 150 kHz	0.03010	70.94	117.90	-46.96	A1.3.1	Parallel
150 kHz - 30 MHz	0.15225	71.71	83.92	-12.21	A2.3	Gnd Parallel
30 MHz - 1000 MHz	30.15000	32.38	40.00	-7.62	A3.1.3	H
1000 MHz - 10000 MHz	4959.575	53.97	74.00	-20.03	A4.3.3	H
10000 MHz - 18000 MHz	16579.700	54.42	74.00	-19.58	A5.3.6	V
18000 MHz - 40000 MHz	39981.500	46.11	74.00	-27.89	A6.3.6	V

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## 7. Measurement Data (continued)

### 7.5. Transmitter Spurious Radiated Emissions (30 kHz to 40 GHz)

#### 7.5.2. Transmitter Spurious Radiated Emissions (Harmonic Meas.) Test Results

Worst case measurements of Harmonics that fall into the restricted bands.

##### 7.5.2.1. 2.4 GHz, BLE

Freq. (MHz)	Field Strength (dB $\mu$ V/m) <sup>1</sup>		Limit (dB $\mu$ V/m)		Margin (dB $\mu$ V/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
4804	51.50	39.99	74.00	54.00	-22.50	-14.01	V	Compliant
4852	50.41	38.45	74.00	54.00	-23.59	-15.55	H	Compliant
4960	51.33	39.22	74.00	54.00	-22.67	-14.78	H	Compliant
7278	58.06	47.89	74.00	54.00	-15.94	-6.11	V	Compliant
7440	55.10	43.51	74.00	54.00	-18.90	-10.49	H	Compliant
12010	59.81	46.28	74.00	54.00	-14.19	-7.72	H	Compliant
12130	59.69	46.34	74.00	54.00	-14.31	-7.66	V	Compliant
12400	60.15	46.06	74.00	54.00	-13.85	-7.94	V	Compliant
19216	61.19	48.01	74.00	54.00	-12.81	-5.99	H	Compliant
19520	60.92	47.37	74.00	54.00	-13.08	-6.63	H	Compliant
19840	60.75	47.12	74.00	54.00	-13.25	-6.88	H	Compliant
22320	63.53	50.00	74.00	54.00	-10.47	-4.00	H	Compliant

<sup>1</sup> All correction factors are stored in the spectrum analyzer and applied to this column entry.

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## 7. Measurement Data (continued)

### 7.6. Band Edge and Out of Band Measurements

Requirement: 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Procedure: For the lower band edge, this measurement was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 11: Emissions in non-restricted frequency bands.

For the upper band edge, this measurement was performed as a typical restricted band radiated emissions measurement above 1 GHz. Peak and CISPR average detectors and a 1 MHz resolution and 3 MHz video bandwidth were utilized.

Test Note: The radiated band edge and worst case out of band measurements in this report represent the measurements made with the worst case receive antenna polarity and product orthogonal position. In addition, the DTS bandwidth measurements were taken into consideration for the worst case examples.

Results: The DUT met the 20 dB requirement at the lower band edge and the Part 15.209 requirements at the upper band edge.

#### 7.6.1. Lower Band Edge

Band Edge Frequency	Lowest Transmitter Frequency	Maximum PSD (100 kHz)	Band Edge Delta to Max PSD (100 kHz)	Minimum Required Delta	Result
(MHz)	(MHz)	(dB $\mu$ V/m)	(dB)	(dB)	
2400	2402	83.81	-32.13	-20	Compliant

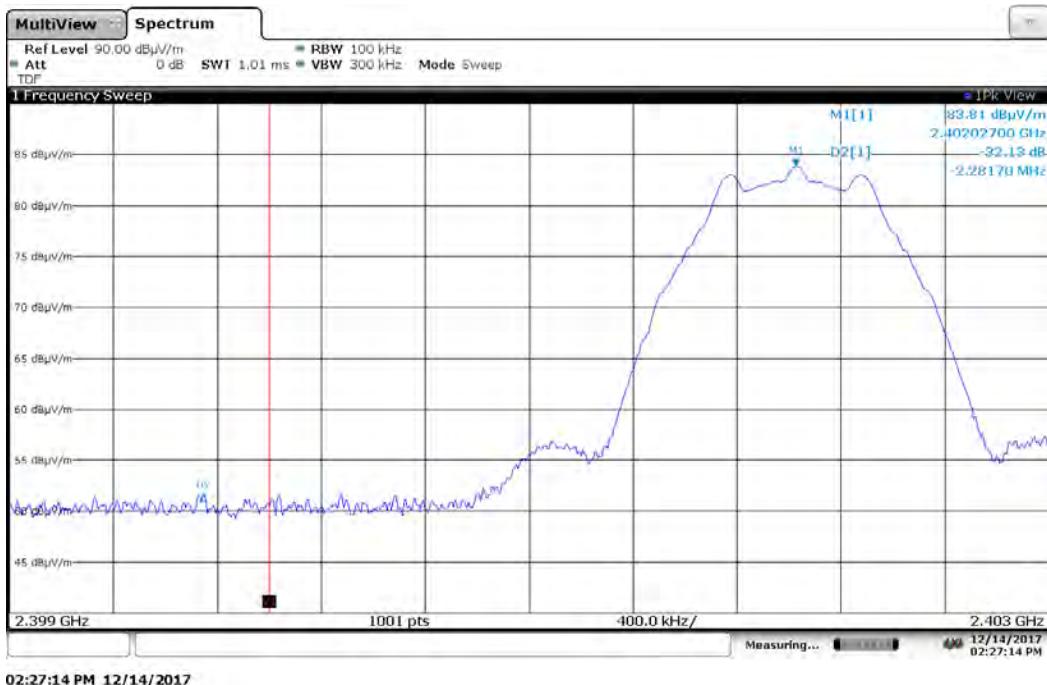
**Note:** See plot on following page

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## 7. Measurement Data (continued)

### 7.6. Band Edge and Out of Band Measurements (continued)

#### Lower Band Edge



#### 7.6.2. Upper Band Edge and Worst Case Out of Band

##### Upper Band Edge

Band Edge Frequency (MHz)	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)		Result
	Peak	Average	Peak	Average	Peak	Average	
2483.5	61.51	47.74	74	54	-12.49	-6.26	Compliant

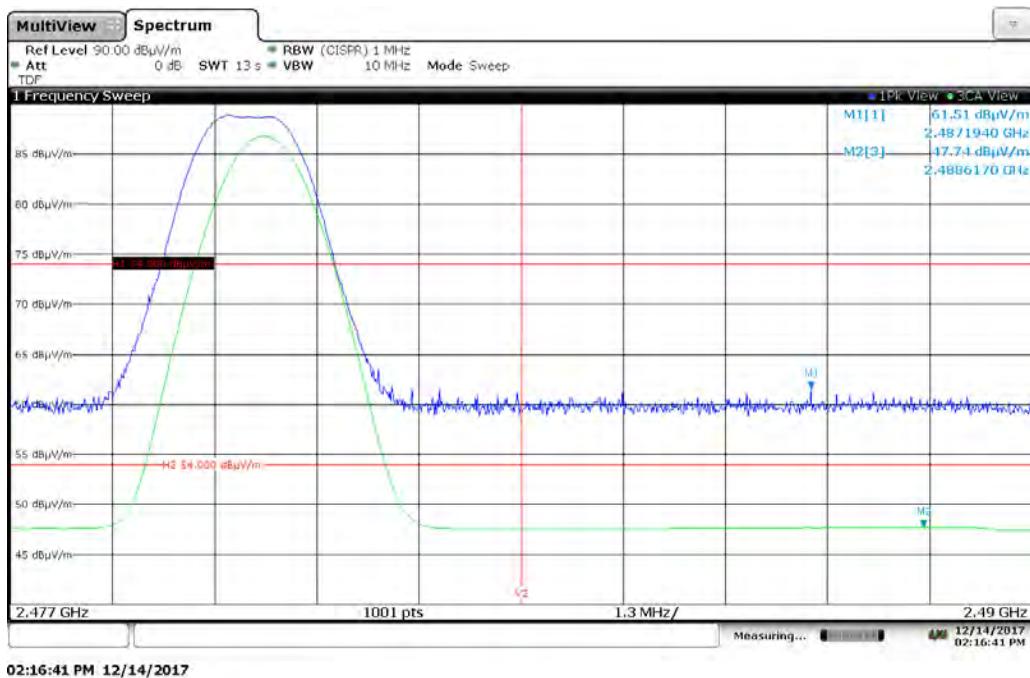
**Note:** See plot on following page

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## 7. Measurement Data (continued)

### 7.6. Band Edge and Out of Band Measurements (continued)

Upper Band Edge and Worst Case Out of Band



#### 7.6.3. Lower Restricted Band, 2.310 MHz to 2390 MHz

Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)		Result
Peak	Average	Peak	Average	Peak	Average	
60.66	47.06	74	54	-13.34	-6.94	Compliant

**Note:** See plot on following page

#### 7.6.4. Upper Restricted Band, 2483.5 MHz, to 2500 MHz

Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)		Result
Peak	Average	Peak	Average	Peak	Average	
61.44	47.80	74	54	-12.56	-6.20	Compliant

**Note:** See plot on following page

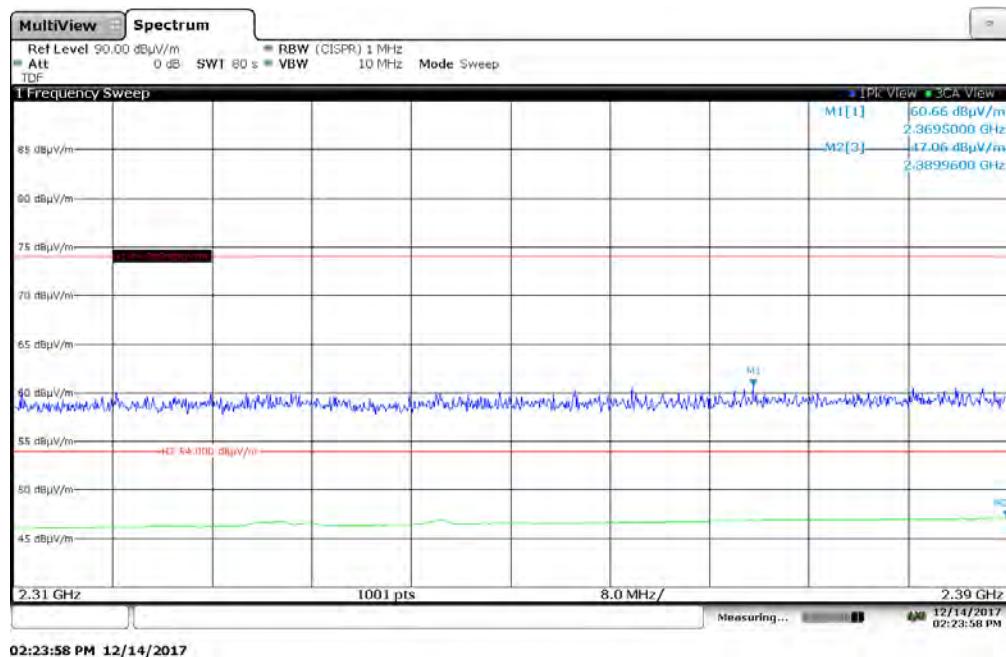
Test Number: 470-17

Issue Date: 9/10/2018

## 7. Measurement Data (continued)

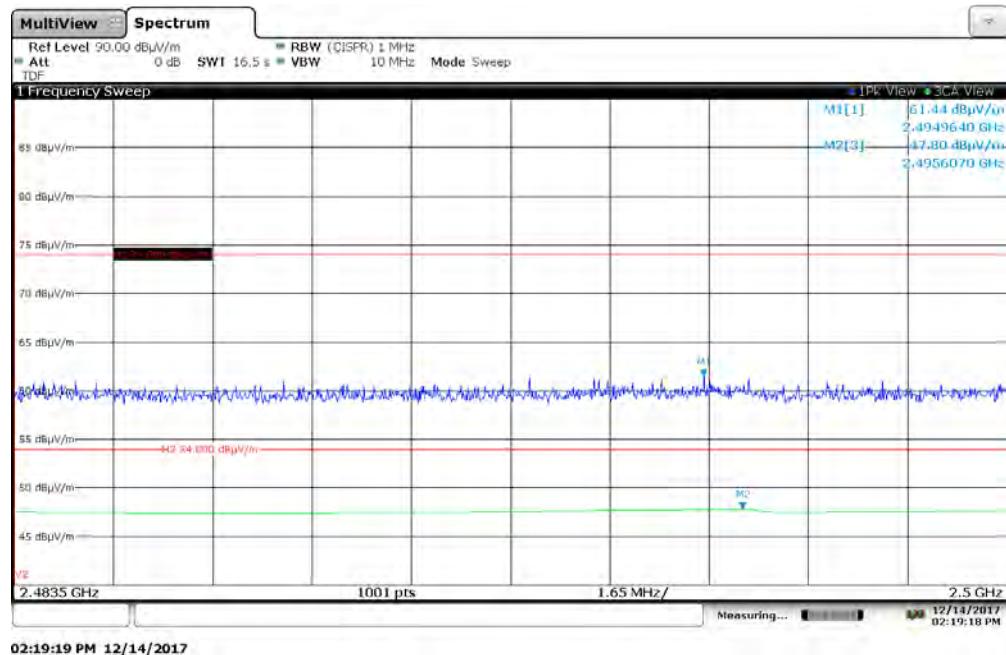
### 7.6. Band Edge and Out of Band Measurements (continued)

Lower Restricted Band, 2310 MHz, to 2390 MHz



02:23:58 PM 12/14/2017

Upper Restricted Band, 2483.5 MHz, to 2500 MHz



02:19:19 PM 12/14/2017

Test Number: 470-17

Issue Date: 9/10/2018

## 7. Measurement Data (continued)

### 7.7. Emissions in Non-restricted Frequency Bands

Requirement: 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.

Test Notes: Peak in-band measurements were taken at the time the DTS (-6 dB) bandwidth measurements were made. These values were used as the reference levels for the following measurements. Refer to section 7.2 of this report for these values.

Results: The DUT met the 20 dB requirement emission level delta requirement in the non restricted frequency bands.

#### Emissions in Non-restricted Frequency Bands

Maximum PSD (100 kHz) In-Band <sup>1</sup> (dB $\mu$ V/m)	Worst Case Out-of-Band Frequency (MHz)	Maximum PSD (100 kHz) Out-of-Band <sup>1</sup> (dB $\mu$ V/m)	Delta to Maximum PSD (dB)	Minimum Required Delta	Result
83.81	2400.0	61.51	22.30	-20 dB	Compliant

<sup>1</sup>Taken from Section 7.6 – Lower Bandedge

Test Number: 470-17

Issue Date: 9/10/2018

## 7. Measurement Data (continued)

### 7.8. Peak Power Spectral Density (15.247(e))

Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm (103.2 dB $\mu$ V/m) in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of FCC Part 15.247. The same method of determining the conducted output power shall be used to determine the power spectral density.

Procedure: FCC OET publication number 558074, Section 10.2: Method PKPSD (peak PSD). FCC OET 662911 was referenced to determine the procedure for measuring in-band power spectral density of transmitters with multiple outputs in the same band.

Results: The DUT met the required power spectral density limit at the tested frequencies.

#### Measurement Results in 2400 MHz to 2483.5 MHz Band

Channel	Frequency	Maximum PSD Frequency	Maximum Power Spectral Density	Limit	Margin	Result
37	2402	2402.1441	69.61	103.2	-33.59	Compliant
38	2426	2426.0084	72.72	103.2	-30.48	Compliant
39	2480	2480.0979	75.76	103.2	-27.44	Compliant

**Note:** 8 dBm limit was converted to dB $\mu$ V/m at 3 meters by adding 95.2

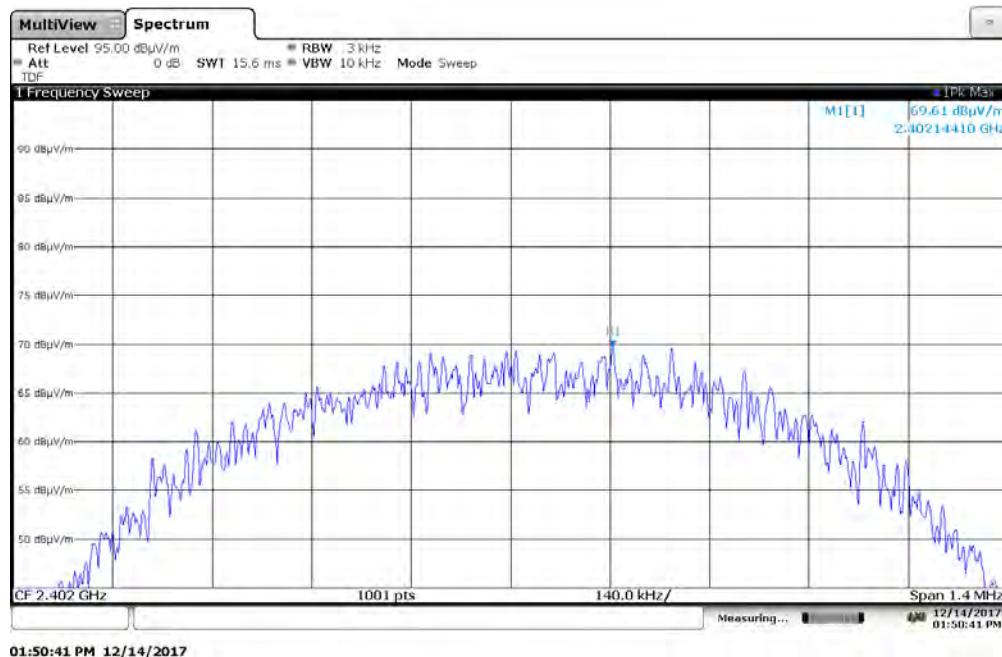
Test Number: 470-17

Issue Date: 9/10/2018

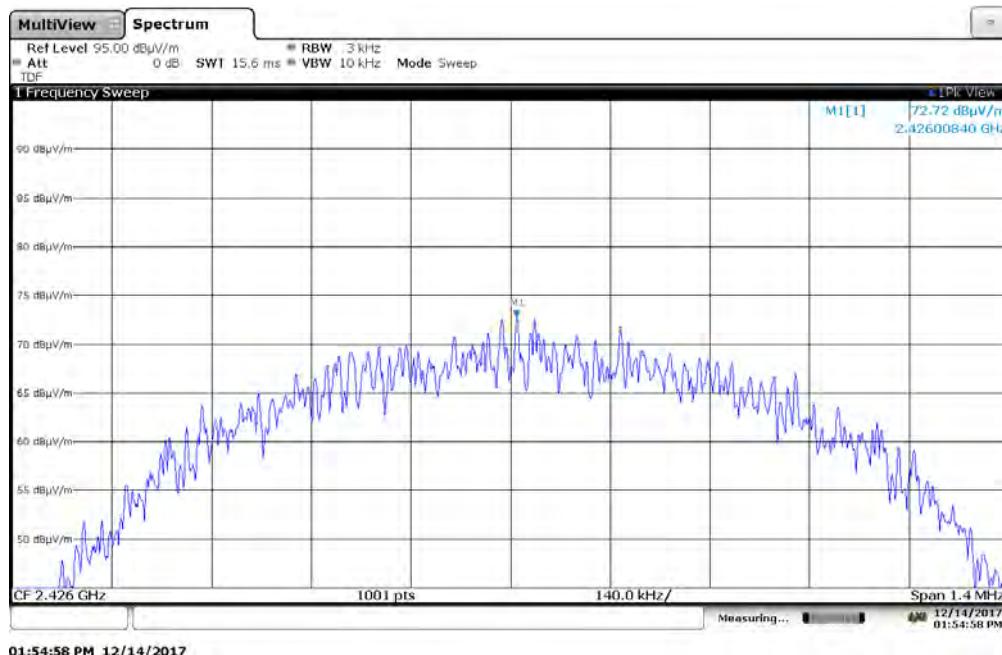
## 7. Measurement Data (continued)

### 7.8. Peak Power Spectral Density (15.247(e)) (continued)

#### 7.8.1. Low Channel – 37, 2402 MHz



#### 7.8.2. Middle Channel – 38, 2426 MHz



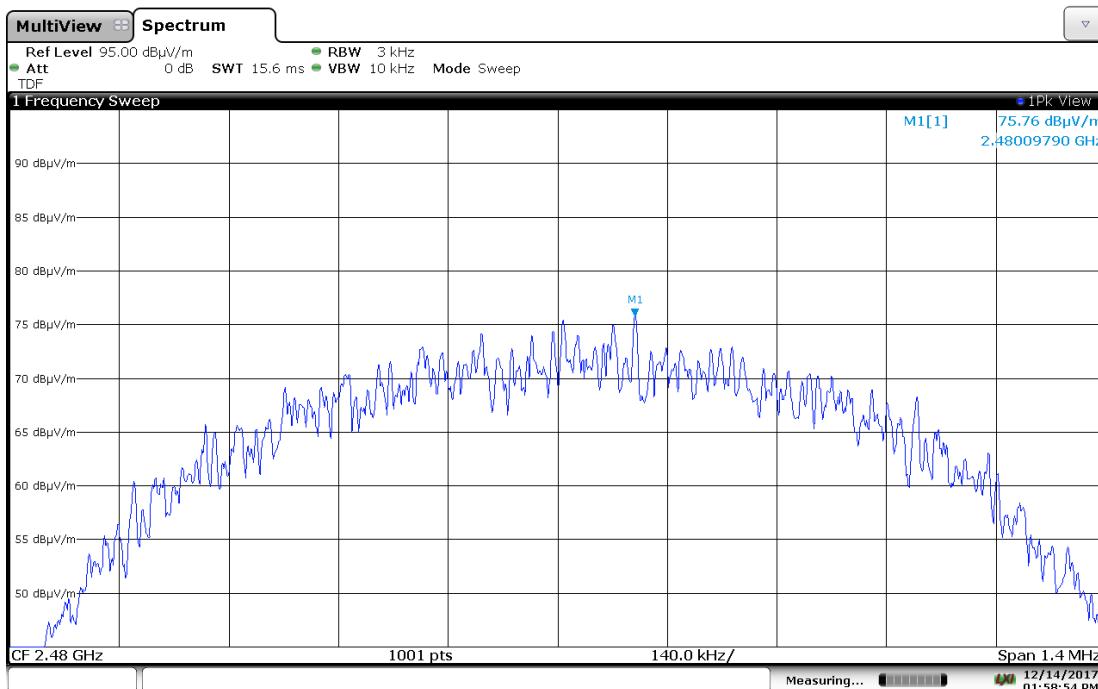
Test Number: 470-17

Issue Date: 9/10/2018

## 7. Measurement Data

### 7.8. Peak Power Spectral Density (15.247(e)) (continued)

#### 7.8.3. High Channel – 39, 2480 MHz



01:58:54 PM 12/14/2017

Test Number: 470-17

Issue Date: 9/10/2018

## 7. Measurement Data (continued)

### 7.9. Conducted Emissions

Requirement: 15.207 With certain exceptions, an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50

\* Decreases with the logarithm of the frequency.

Procedure: This test was performed in accordance with the procedure detailed in ANSI C63.10-2013, Section 6.2: Standard test method for ac power-line conducted emissions from unlicensed wireless devices.

Test Notes: The device was tested using the support equipment laptop.

Results: The device under test meets the FCC Part 15.207 test requirements.

### Measurement & Equipment Setup

Test Date:	4/13/2018
Test Engineer:	Mark R. McSweeney
Site Temperature (°C):	22.8
Relative Humidity (%RH):	48.3
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	30 kHz
Detector Functions:	Peak, Quasi-Peak & Average

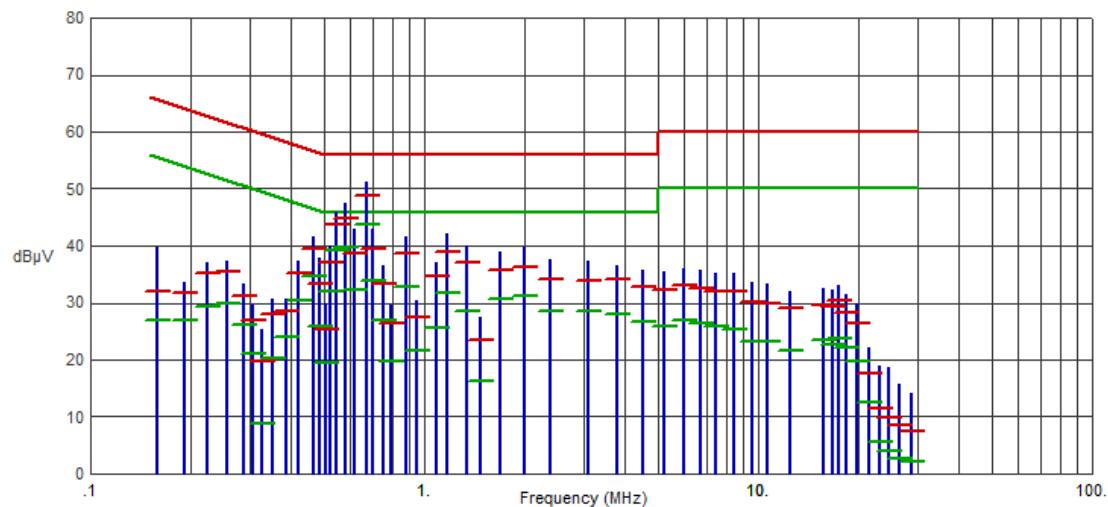
Test Number: 470-17

Issue Date: 9/10/2018

**7. Measurement Data (continued)****7.9. Conducted Emissions (FCC Part 15.207)****7.9.1. 120 Volts, 60 Hz Phase**

Test No.: 470-17, 120 Volts, 60 Hz Phase

FCC, Class B



**Test Number: 470-17**
**Issue Date: 9/10/2018**

## 7. Measurement Data (continued)

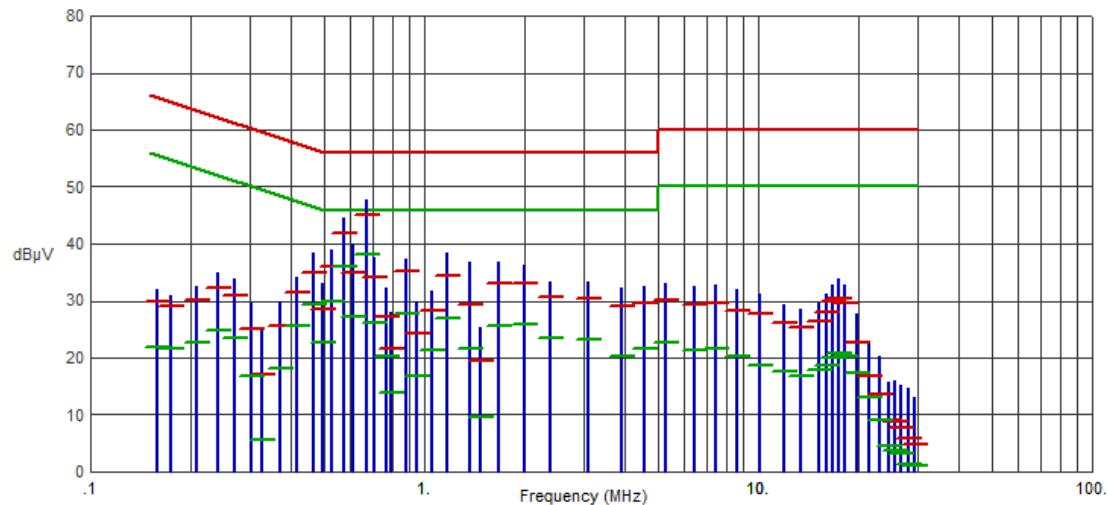
### 7.9. Conducted Emissions (FCC Part 15.207)

#### 7.9.1. 120 Volts, 60 Hz Phase (Continued)

Frequency (MHz)	Pk Amp (dB $\mu$ V)	QP Amp (dB $\mu$ V)	QP Limit (dB $\mu$ V)	QP Margin (dB)	Avg Amp (dB $\mu$ V)	Avg Limit (dB $\mu$ V)	Avg Margin (dB)	Comments
.1590	39.81	32.02	65.52	-33.50	26.95	55.52	-28.57	
.1905	33.57	31.78	64.01	-32.23	26.92	54.01	-27.09	
.2243	36.95	35.07	62.66	-27.59	29.26	52.66	-23.40	
.2558	37.44	35.52	61.57	-26.05	29.76	51.57	-21.81	
.2873	33.26	31.31	60.60	-29.29	26.25	50.60	-24.35	
.3053	29.64	26.87	60.10	-33.23	21.06	50.10	-29.04	
.3278	25.25	19.71	59.51	-39.80	8.89	49.51	-40.62	
.3525	30.55	28.00	58.90	-30.90	20.28	48.90	-28.62	
.3840	30.63	28.42	58.19	-29.77	24.09	48.19	-24.10	
.4178	37.34	35.12	57.49	-22.37	30.40	47.49	-17.09	
.4650	41.55	39.51	56.60	-17.09	34.61	46.60	-11.99	
.4875	37.91	33.37	56.21	-22.84	25.98	46.21	-20.23	
.5055	29.97	25.25	56.00	-30.75	19.56	46.00	-26.44	
.5235	39.93	37.10	56.00	-18.90	31.93	46.00	-14.07	
.5438	45.88	43.79	56.00	-12.21	39.19	46.00	-6.81	
.5775	47.53	44.86	56.00	-11.14	39.86	46.00	-6.14	
.6158	42.83	38.78	56.00	-17.22	32.19	46.00	-13.81	
.6720	51.23	48.83	56.00	-7.17	43.64	46.00	-2.36	
.6990	42.91	39.55	56.00	-16.45	33.92	46.00	-12.08	
.7553	36.50	33.26	56.00	-22.74	26.93	46.00	-19.07	
.7958	29.54	26.31	56.00	-29.69	19.75	46.00	-26.25	
.8835	41.57	38.66	56.00	-17.34	32.68	46.00	-13.32	
.9488	30.51	27.53	56.00	-28.47	21.64	46.00	-24.36	
1.0883	37.18	34.63	56.00	-21.37	25.73	46.00	-20.27	
1.1738	42.22	39.04	56.00	-16.96	31.82	46.00	-14.18	
1.3380	39.99	37.07	56.00	-18.93	28.57	46.00	-17.43	
1.4663	27.42	23.44	56.00	-32.56	16.35	46.00	-29.65	
1.6845	38.91	35.71	56.00	-20.29	30.55	46.00	-15.45	
1.9950	39.64	36.37	56.00	-19.63	31.09	46.00	-14.91	
2.3865	37.53	34.11	56.00	-21.89	28.63	46.00	-17.37	
3.1043	37.27	33.75	56.00	-22.25	28.41	46.00	-17.59	
3.7793	36.57	34.05	56.00	-21.95	27.96	46.00	-18.04	
4.5105	35.77	32.92	56.00	-23.08	26.71	46.00	-19.29	
5.2283	35.51	32.39	60.00	-27.61	25.96	50.00	-24.04	
5.9685	35.89	33.13	60.00	-26.87	26.87	50.00	-23.13	
6.7065	35.72	32.49	60.00	-27.51	26.53	50.00	-23.47	
7.4333	35.26	31.99	60.00	-28.01	25.82	50.00	-24.18	
8.4818	35.08	31.94	60.00	-28.06	25.29	50.00	-24.71	
9.5910	33.50	30.10	60.00	-29.90	23.22	50.00	-26.78	
10.6845	33.31	29.81	60.00	-30.19	23.09	50.00	-26.91	
12.4530	32.12	29.00	60.00	-31.00	21.67	50.00	-28.33	
15.6818	32.53	29.47	60.00	-30.53	23.36	50.00	-26.64	
16.7033	32.38	29.31	60.00	-30.69	22.72	50.00	-27.28	
17.3985	33.19	30.51	60.00	-29.49	23.66	50.00	-26.34	
18.3323	31.44	28.20	60.00	-31.80	22.24	50.00	-27.76	
19.7678	29.98	26.27	60.00	-33.73	19.80	50.00	-30.20	
21.4800	22.09	17.72	60.00	-42.28	12.59	50.00	-37.41	
23.0865	19.06	11.37	60.00	-48.63	5.59	50.00	-44.41	
24.7178	18.60	9.92	60.00	-50.08	3.99	50.00	-46.01	
26.4615	15.75	8.65	60.00	-51.35	2.66	50.00	-47.34	
28.7048	14.20	7.37	60.00	-52.63	2.09	50.00	-47.91	

Test Number: 470-17

Issue Date: 9/10/2018

**7. Measurement Data (continued)****7.9. Conducted Emissions (FCC Part 15.207) (continued)****7.9.2. 120 Volts, 60 Hz Neutral**Test No.: 470-17, 120 Volts, 60 Hz Neutral FCC, Class B

**Test Number: 470-17**
**Issue Date: 9/10/2018**

## 7. Measurement Data (continued)

### 7.9. Conducted Emissions (FCC Part 15.207) (continued)

#### 7.9.2. 120 Volts, 60 Hz Neutral (continued)

Frequency (MHz)	Pk Amp (dB $\mu$ V)	QP Amp (dB $\mu$ V)	QP Limit (dB $\mu$ V)	QP Margin (dB)	Avg Amp (dB $\mu$ V)	Avg Limit (dB $\mu$ V)	Avg Margin (dB)	Comments
.1590	32.00	29.78	65.52	-35.74	21.91	55.52	-33.61	
.1748	31.04	29.00	64.73	-35.73	21.62	54.73	-33.11	
.2085	32.57	30.10	63.26	-33.16	22.76	53.26	-30.50	
.2400	35.04	32.15	62.10	-29.95	24.72	52.10	-27.38	
.2715	33.76	30.92	61.07	-30.15	23.52	51.07	-27.55	
.3030	29.57	25.03	60.16	-35.13	16.83	50.16	-33.33	
.3255	25.06	17.03	59.57	-42.54	5.57	49.57	-44.00	
.3683	29.90	25.72	58.54	-32.82	18.24	48.54	-30.30	
.4155	34.20	31.58	57.54	-25.96	25.61	47.54	-21.93	
.4650	38.35	35.05	56.60	-21.55	29.26	46.60	-17.34	
.4943	33.09	28.42	56.10	-27.68	22.54	46.10	-23.56	
.5280	38.90	36.13	56.00	-19.87	29.95	46.00	-16.05	
.5753	44.60	41.86	56.00	-14.14	36.01	46.00	-9.99	
.6135	39.94	34.93	56.00	-21.07	27.25	46.00	-18.75	
.6720	47.68	45.08	56.00	-10.92	38.17	46.00	-7.83	
.7103	37.56	34.21	56.00	-21.79	26.10	46.00	-19.90	
.7665	32.31	27.07	56.00	-28.93	20.31	46.00	-25.69	
.7980	28.01	21.60	56.00	-34.40	13.92	46.00	-32.08	
.8790	37.44	35.17	56.00	-20.83	27.77	46.00	-18.23	
.9465	29.79	24.23	56.00	-31.77	16.85	46.00	-29.15	
1.0523	31.78	28.35	56.00	-27.65	21.35	46.00	-24.65	
1.1715	38.41	34.36	56.00	-21.64	26.92	46.00	-19.08	
1.3650	36.83	29.31	56.00	-26.69	21.58	46.00	-24.42	
1.4775	25.23	19.51	56.00	-36.49	9.64	46.00	-36.36	
1.6688	36.73	33.07	56.00	-22.93	25.70	46.00	-20.30	
1.9950	36.20	32.99	56.00	-23.01	25.99	46.00	-20.01	
2.3843	33.40	30.73	56.00	-25.27	23.58	46.00	-22.42	
3.1043	33.25	30.47	56.00	-25.53	23.25	46.00	-22.75	
3.9098	32.28	28.95	56.00	-27.05	20.26	46.00	-25.74	
4.5758	32.50	29.71	56.00	-26.29	21.71	46.00	-24.29	
5.2958	33.09	30.24	60.00	-29.76	22.58	50.00	-27.42	
6.4118	32.44	29.40	60.00	-30.60	21.25	50.00	-28.75	
7.4985	32.84	29.56	60.00	-30.44	21.64	50.00	-28.36	
8.5988	31.88	28.37	60.00	-31.63	20.15	50.00	-29.85	
10.1040	31.14	27.85	60.00	-32.15	18.78	50.00	-31.22	
11.8905	29.38	26.11	60.00	-33.89	17.72	50.00	-32.28	
13.3823	28.52	25.28	60.00	-34.72	16.80	50.00	-33.20	
15.1553	29.72	26.30	60.00	-33.70	17.77	50.00	-32.23	
15.9383	31.28	28.07	60.00	-31.93	18.76	50.00	-31.24	
16.6650	32.70	29.76	60.00	-30.24	19.94	50.00	-30.06	
17.3940	33.80	30.43	60.00	-29.57	20.71	50.00	-29.29	
18.1838	32.67	29.50	60.00	-30.50	20.38	50.00	-29.62	
19.7453	27.73	22.69	60.00	-37.31	17.40	50.00	-32.60	
21.4935	22.39	16.83	60.00	-43.17	12.95	50.00	-37.05	
23.1315	20.34	13.61	60.00	-46.39	9.14	50.00	-40.86	
24.6863	15.74	9.18	60.00	-50.82	4.51	50.00	-45.49	
25.5998	15.98	8.71	60.00	-51.29	3.81	50.00	-46.19	
26.6078	15.16	7.71	60.00	-52.29	3.15	50.00	-46.85	
28.1715	14.79	5.87	60.00	-54.13	1.39	50.00	-48.61	
29.5373	13.11	4.73	60.00	-55.27	1.11	50.00	-48.89	

**Test Number: 470-17**
**Issue Date: 9/10/2018**

## 7. Measurement Data (continued)

### 7.10. Duty Cycle

Requirement: (FCC OET publication number 558074)

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

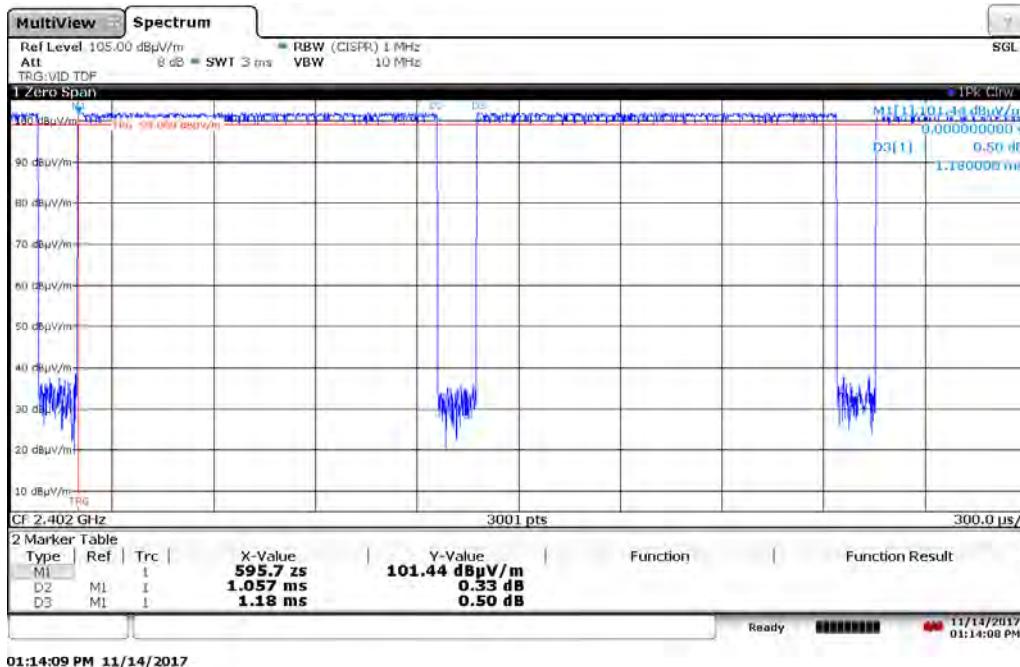
Procedure: Duty cycle measurements were made according to the procedure detailed ANSI C63.10-2013, Section 11.6(b)

Results: Duty cycle measurements are listed in the following table.

All power and power spectral density measurements for this report are peak mode measurements. Ample peak hold time was provided to ensure maximum peak measurements.

Channel	Frequency	Time High	Time per Period	Duty Cycle	
	(MHz)	(μS)	(μS)	(Numeric)	(%)
37	2402	1.057	1.180	0.89576	89.58
38	2426	1.057	1.180	0.89576	89.58
39	2480	1.057	1.180	0.89576	89.58

#### 7.10.1. Low Channel – 37, 2402 MHz

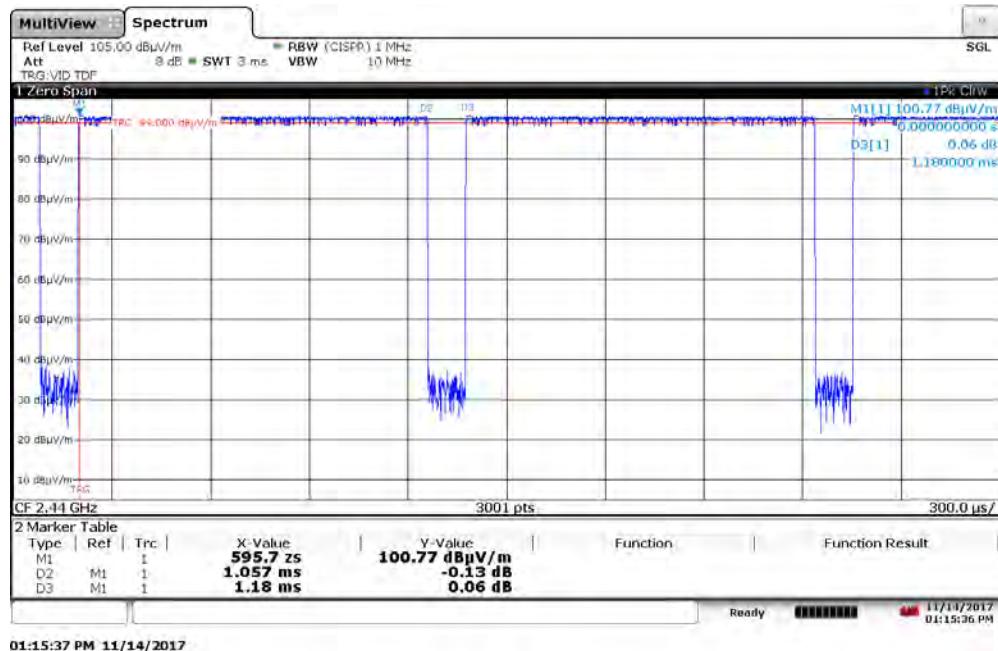


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**Issue Date: 9/10/2018**

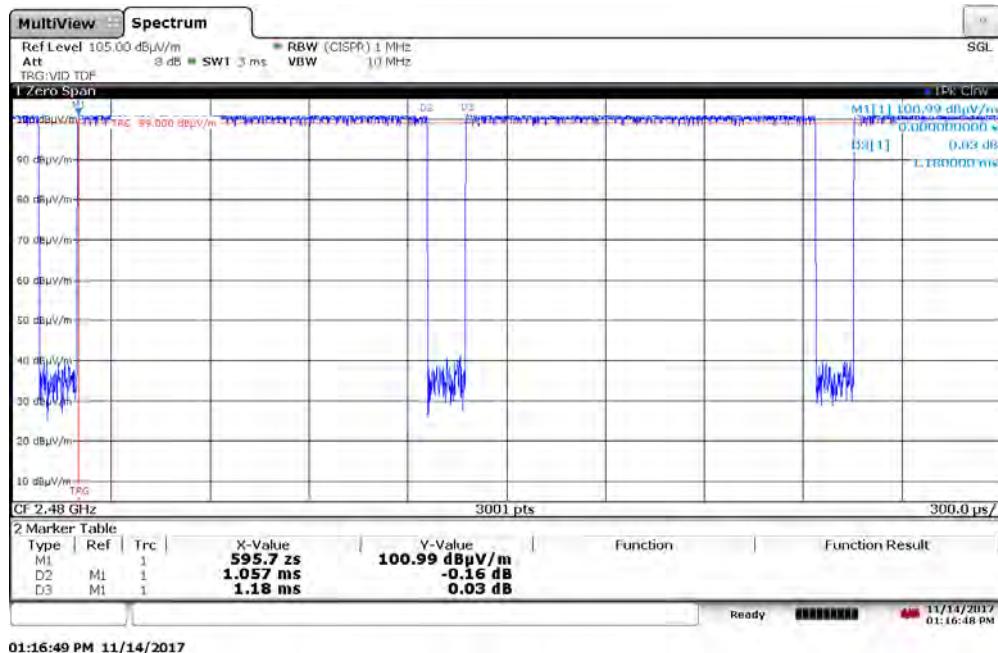
## 7. Measurement Data (continued)

### 7.10. Duty Cycle (continued)

#### 7.10.2. Middle Channel – 38, 2426 MHz



#### 7.10.3. High Channel – 39, 2480 MHz



Test Number: 470-17

Issue Date: 9/10/2018

## 7. Measurement Data (continued)

### 7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN, ISSUE 4 5.5, RSS 102)

#### 7.11.1. 15.247(i) (1.1307 (b)(1) Requirements

Requirement: Portable devices are subject to radio frequency radiation exposure requirements.

For a 1-g head or body SAR, the test exclusion result must be  $\leq 3.0$ .

For a 10-g extremity SAR, the test exclusion result must be  $\leq 7.5$ .

Test Notes: The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by the following formula:

$$\text{SAR Test Exclusion} = \frac{P_{\text{MAX}}}{d_{\text{MIN}}} \times \sqrt{f_{(\text{GHz})}} \quad (1)$$

$P_{\text{MAX}}$  mW Maximum power of channel, including tune-up tolerance

$d_{\text{MIN}}$  mm Minimum test separation distance, mm ( $\leq 50$  mm)

$f_{(\text{GHz})}$  GHz  $f_{(\text{GHz})}$  is the RF channel transmit frequency in GHz ( $>100$  MHz and  $<6$  GHz)

(1) FCC OET 447498 - Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

Results: Passed - The device under test meets the exclusion requirement detailed in FCC OET 447498.

Channel:	37	38	39	
<b>Input<sup>1</sup>:</b>	$P_{\text{MAX}}$	0.054	0.091	0.080
	$d_{\text{MIN}}^2$	5.00	5.00	5.00
	$f_{(\text{GHz})}$	2.402	2.626	2.480
<b>Test Exclusion:</b>	0.02	0.03	0.03	
<b>Limit Exemption:</b>	3.0	3.0	3.0	
<b>Measurement Result:</b>	Compliant	Compliant	Compliant	

<sup>1</sup> Taken from column 3 of the table in Section 7.3 of this test report.

<sup>2</sup> When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to KDB 447498, 4.1 f) is applied to determine SAR test exclusion.

**Note:** BLE and UWB Radios do not transmit simultaneously.

Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.1. Spurious Radiated Emissions, 10 kHz to 1 GHz – Front



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.2. Spurious Radiated Emissions, 10 kHz to 30 MHz – Rear



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.3. Spurious Radiated Emissions, 30 MHz to 1 GHz – Rear



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.4. Radiated Emissions above 1 to 18 GHz – Front



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.5. Radiated Emissions 1 to 18 GHz – Rear



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.6. Radiated Emissions 18 to 40 GHz– Side View



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.7. Power Line Conducted Emissions – Front



Test Number: 470-17

Issue Date: 9/10/2018

## 8. Test Setup Photographs

### 8.8. Power Line Conducted Emissions – Rear





Test Number: 470-17

Issue Date: 9/10/2018

## 9. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025:2005 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1**) and VCCI (Member number 3168) under registration number A-0274.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

Both sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

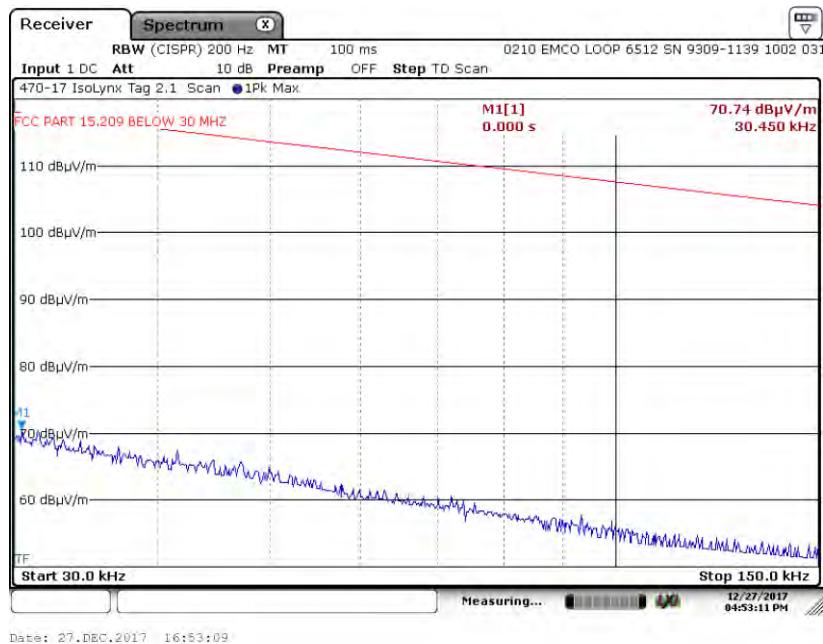
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

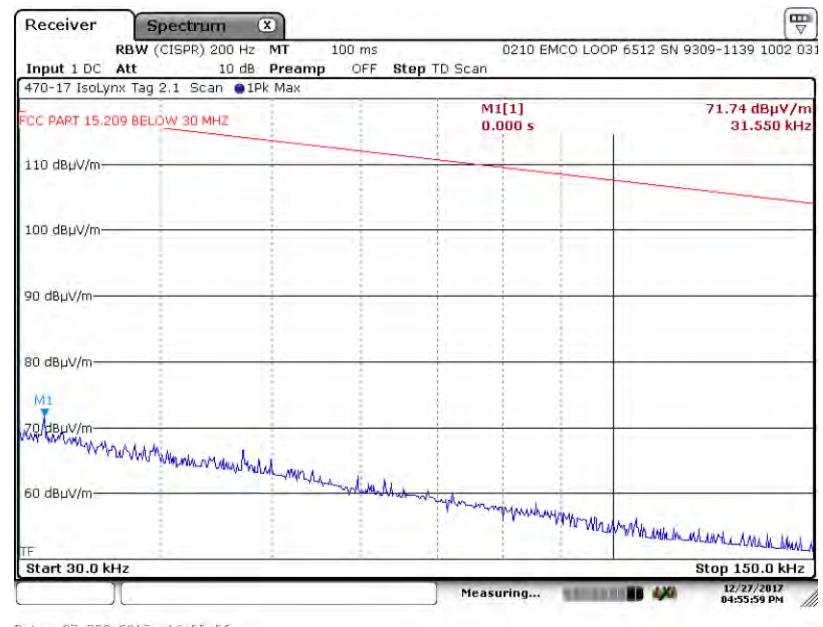
### A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

#### A1.1. Channel 37, 2402 MHz

##### A1.1.1. Measurement Results: X-Axis, Parallel Antenna



##### A1.1.2. Measurement Results: X-Axis, Perpendicular Antenna



Test Number: 470-17

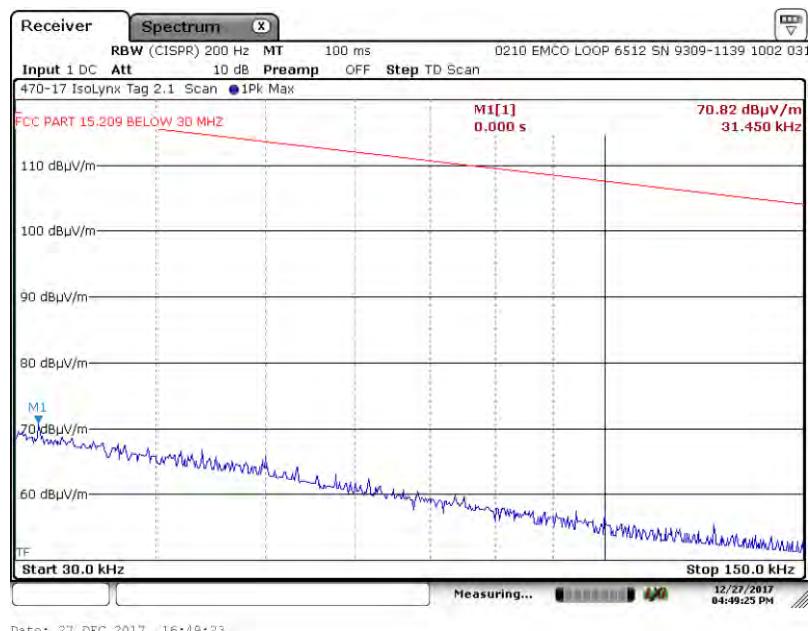
Issue Date: 9/10/2018

### Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

#### A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

##### A1.1. Channel 37, 2402 MHz

###### A1.1.3. Measurement Results: X-Axis, Ground-Parallel Antenna



**Note:** Y-Axis and Z-Axis EUT Orientations was also noise floor.

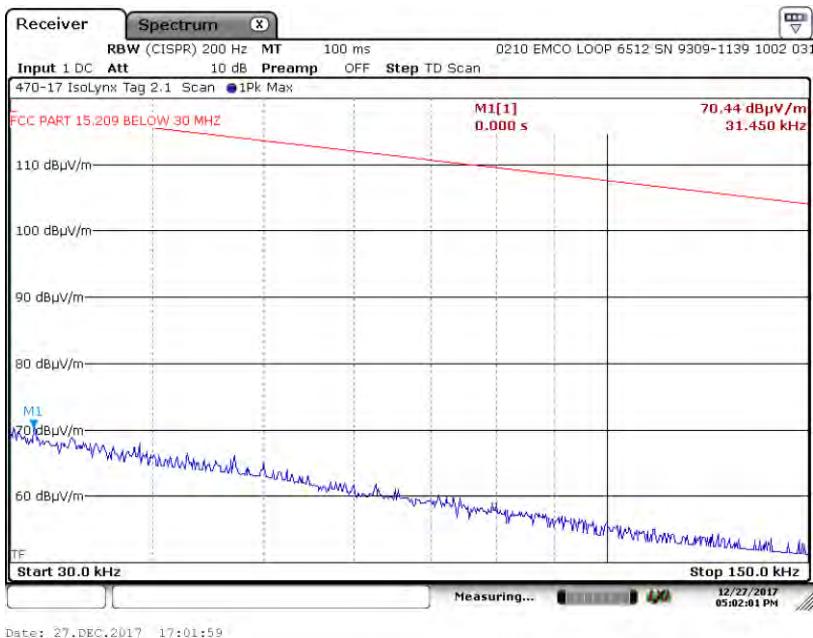
**Test Number: 470-17**
**Issue Date: 9/10/2018**

### **Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)**

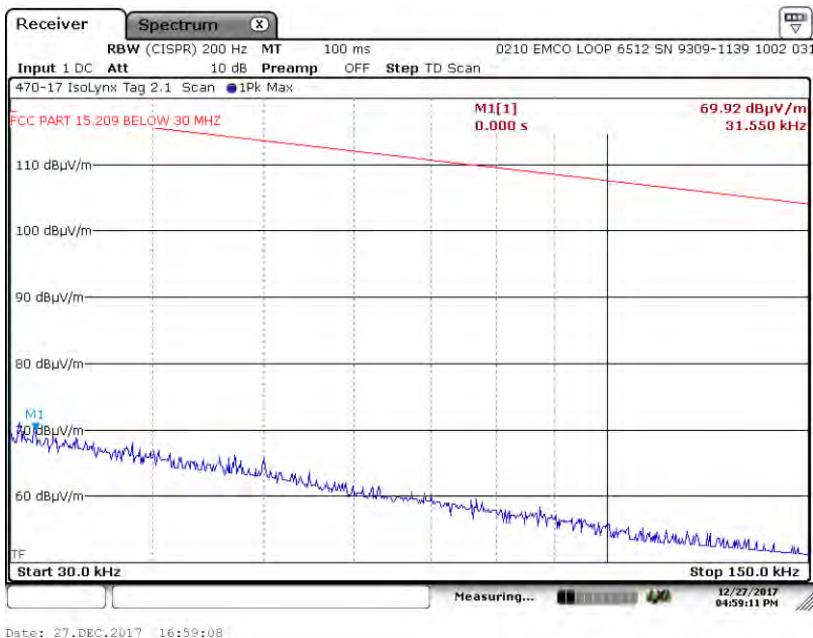
#### A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

##### A1.2. Channel 38, 2426 MHz

###### A1.2.1. Measurement Results: X-Axis, Parallel Antenna



###### A1.2.2. Measurement Results: X-Axis, Perpendicular Antenna



Test Number: 470-17

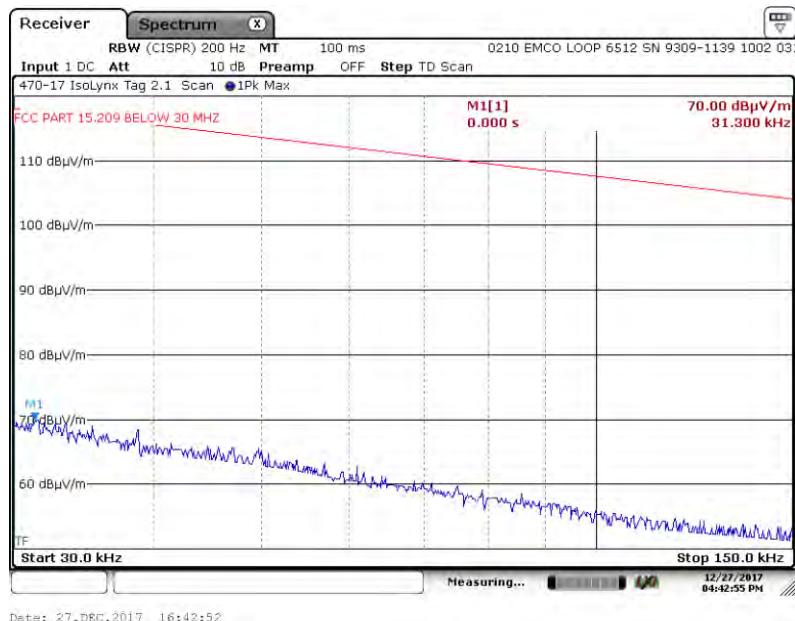
Issue Date: 9/10/2018

### Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

#### A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

##### A1.2. Channel 38, 2426 MHz

###### A1.2.3. Measurement Results: X-Axis, Ground-Parallel Antenna



**Note:** Y-Axis and Z-Axis EUT Orientations was also noise floor.

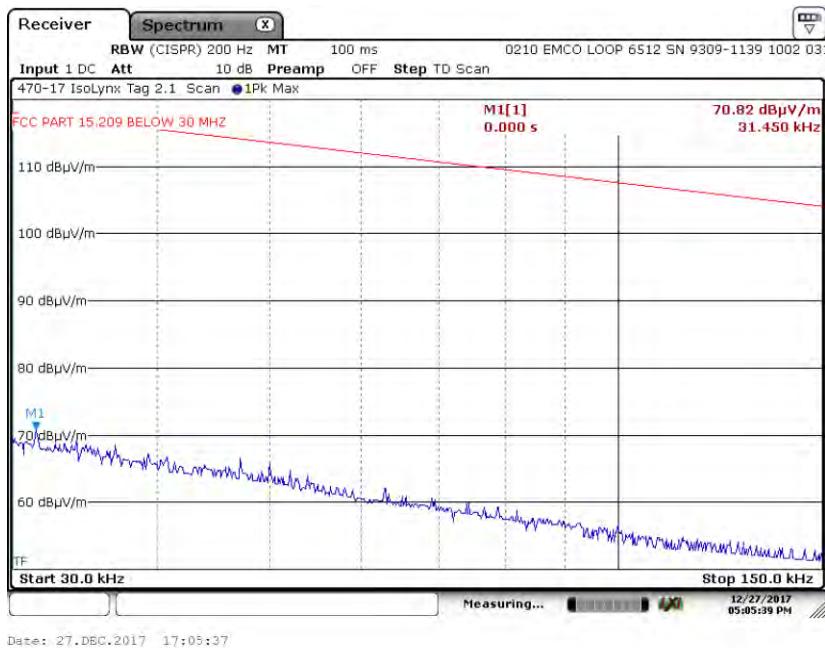
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

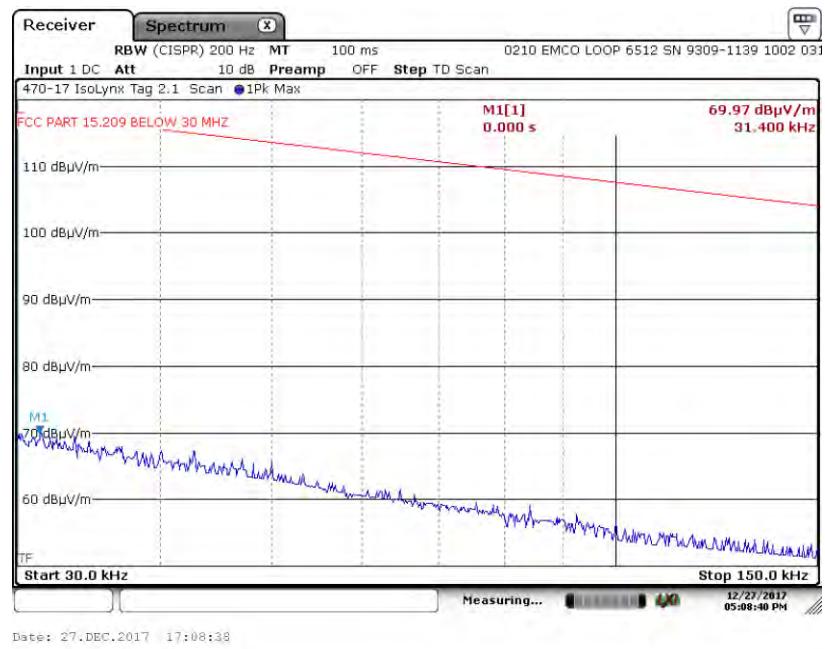
### A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

#### A1.3. Channel 39, 2480 MHz

##### A1.3.1. Measurement Results: X-Axis, Parallel Antenna



##### A1.3.2. Measurement Results: X-Axis, Perpendicular Antenna



Test Number: 470-17

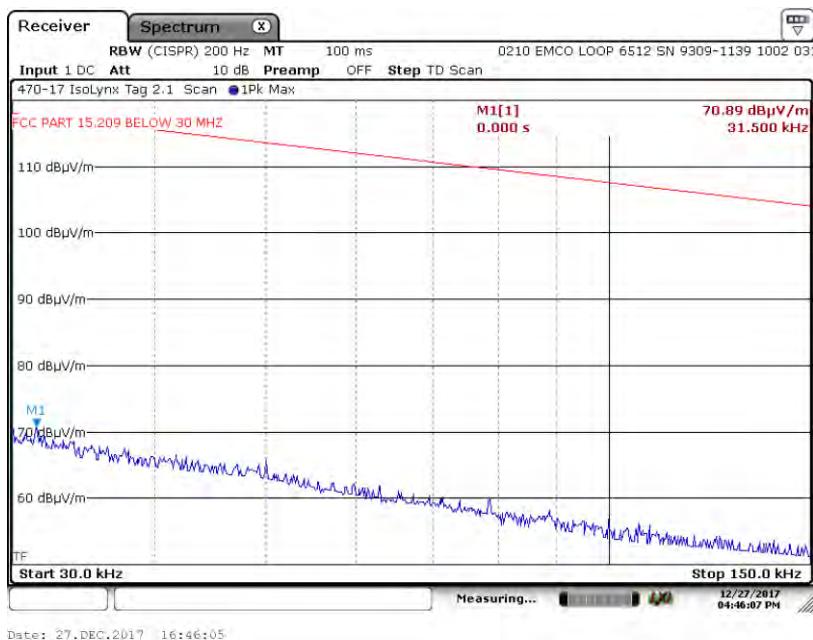
Issue Date: 9/10/2018

### Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

#### A1. Spurious Radiated Emissions (30 kHz – 150 kHz) Test Results

##### A1.3. Channel 39, 2480 MHz

###### A1.3.3. Measurement Results: X-Axis, Ground-Parallel Antenna



**Note:** Y-Axis and Z-Axis EUT Orientations was also noise floor.

**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

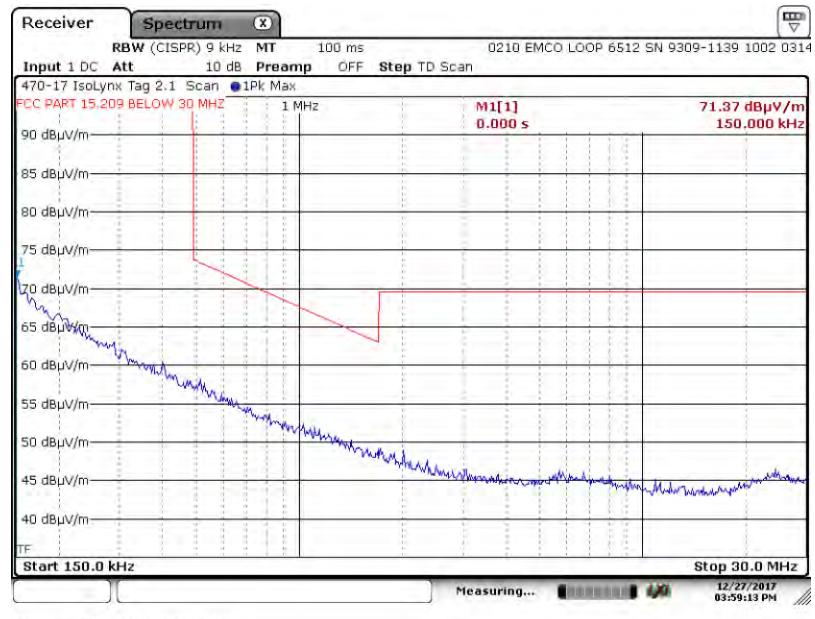
### A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

#### A2.1. Channel 37, 2402 MHz

##### A2.1.1. Measurement Results: X-Axis, Parallel Antenna



##### A2.1.2. Measurement Results: X-Axis, Perpendicular Antenna



Test Number: 470-17

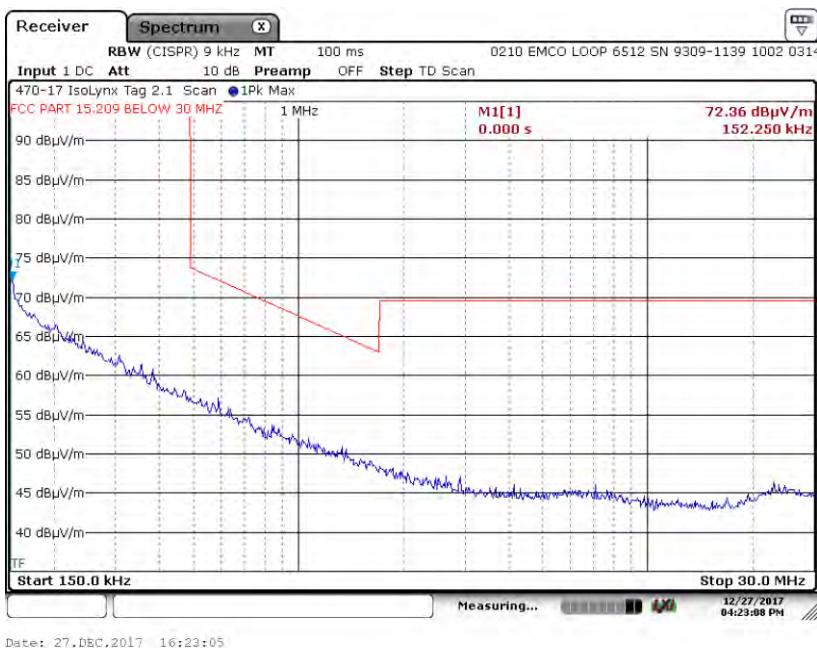
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

#### A2.1. Channel 37, 2402 MHz

##### A2.1.3. Measurement Results: X-Axis, Ground-Parallel Antenna



**Note:** Y-Axis and Z-Axis EUT Orientations was also noise floor.

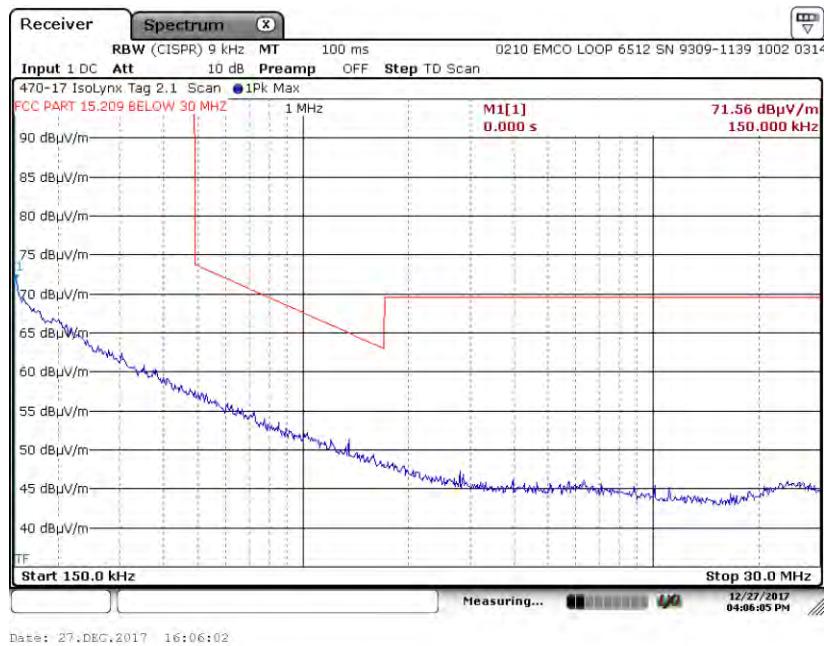
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

#### A2.2. Channel 38, 2426 MHz

##### A2.2.1. Measurement Results: X-Axis, Parallel Antenna



##### A2.2.2. Measurement Results: X-Axis, Perpendicular Antenna



Test Number: 470-17

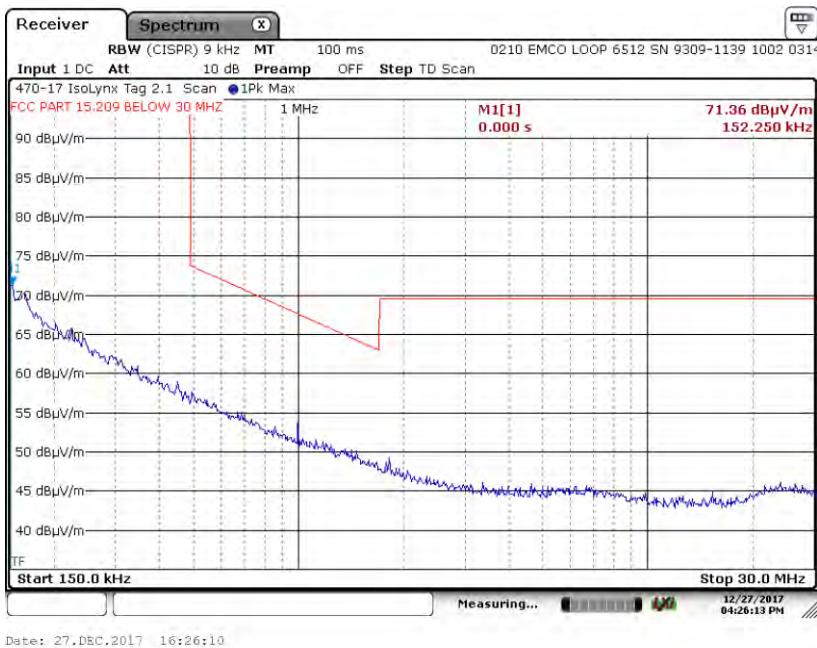
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

#### A2.2. Channel 38, 2426 MHz

##### A2.2.3. Measurement Results: X-Axis, Ground-Parallel Antenna



**Note:** Y-Axis and Z-Axis EUT Orientations was also noise floor.

**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

#### A2.3. Channel 39, 2480 MHz

##### A2.3.1. Measurement Results: X-Axis, Parallel Antenna



##### A2.3.2. Measurement Results: X-Axis, Perpendicular Antenna



Test Number: 470-17

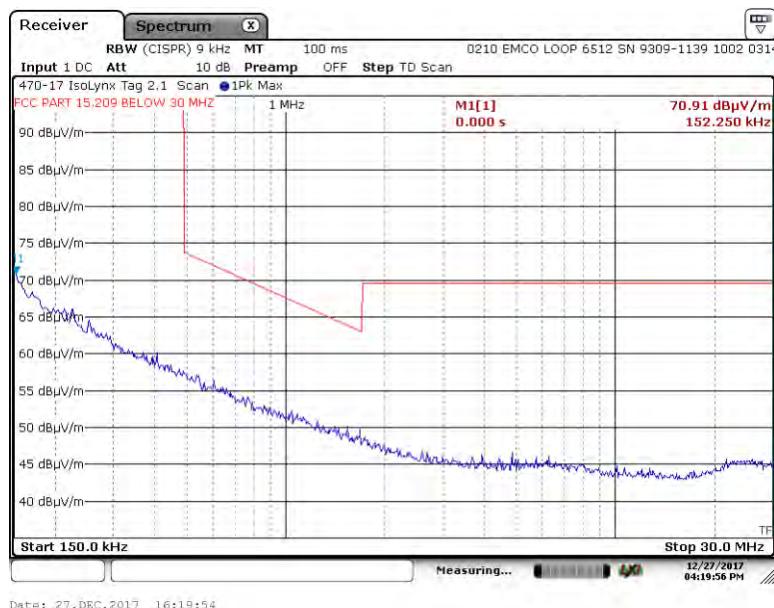
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A2. Spurious Radiated Emissions (150 kHz – 30 MHz) Test Results

#### A2.3. Channel 39, 2480 MHz

##### A2.3.3. Measurement Results: X-Axis, Ground-Parallel Antenna



**Note:** Y-Axis and Z-Axis EUT Orientations was also noise floor.

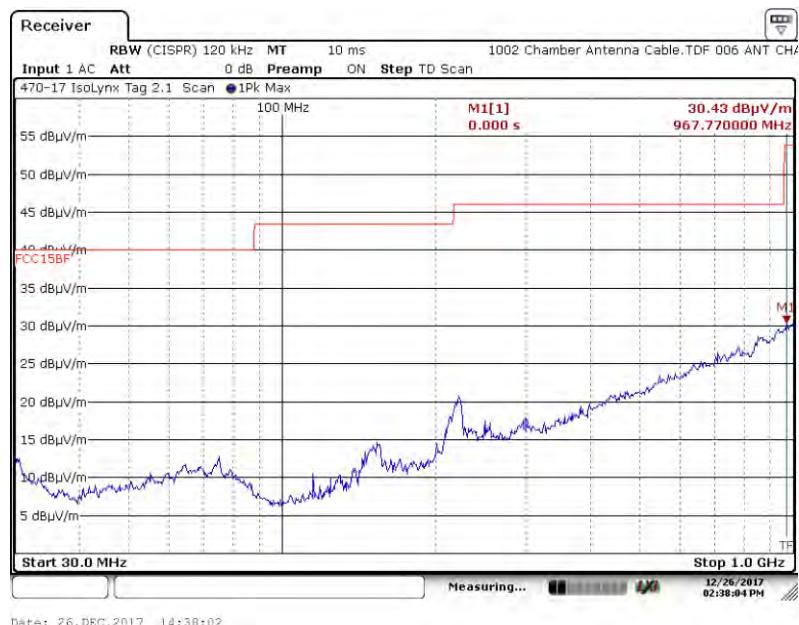
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

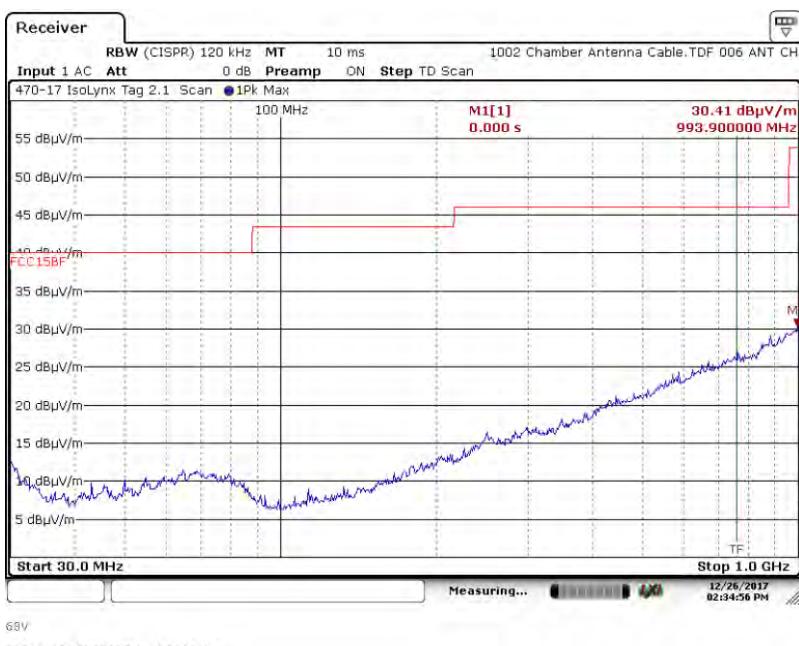
### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

#### A3.1. Channel 37, 2402 MHz

##### A3.1.1. Measurement Results: X-Axis, Horizontal Antenna



##### A3.1.2. Measurement Results: X-Axis, Vertical Antenna



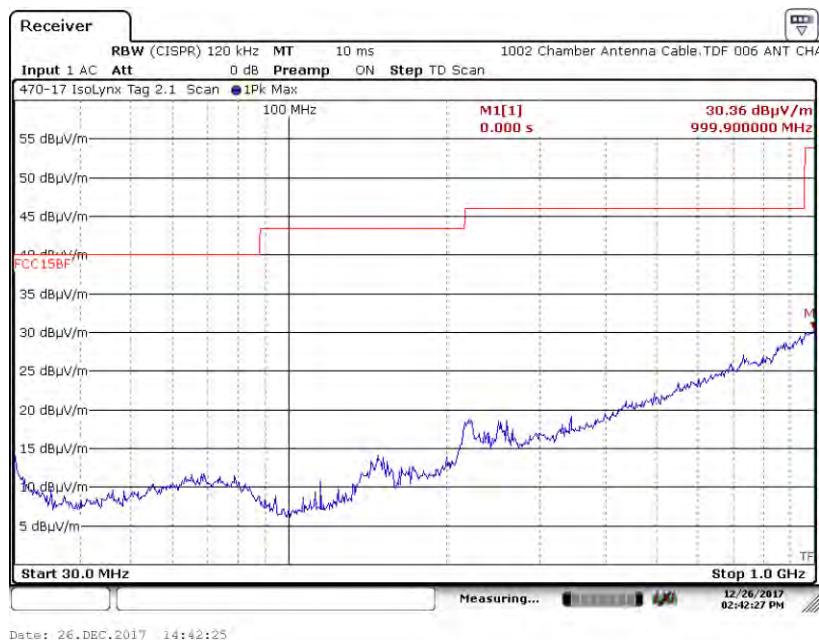
**Test Number: 470-17**
**Issue Date: 9/10/2018**

### Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

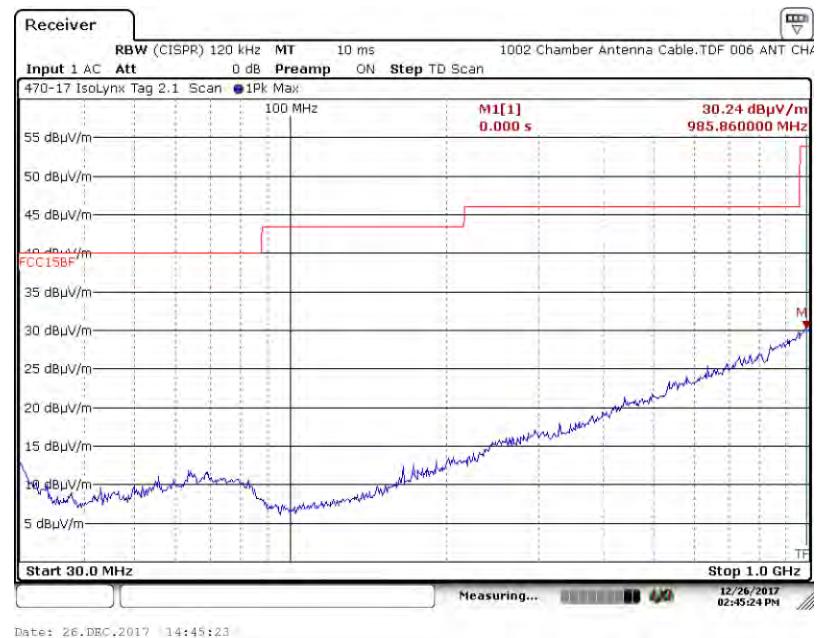
#### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

##### A3.1. Channel 37, 2402 MHz

###### A3.1.3. Measurement Results: Y-Axis, Horizontal Antenna



###### A3.1.4. Measurement Results: Y-Axis, Vertical Antenna



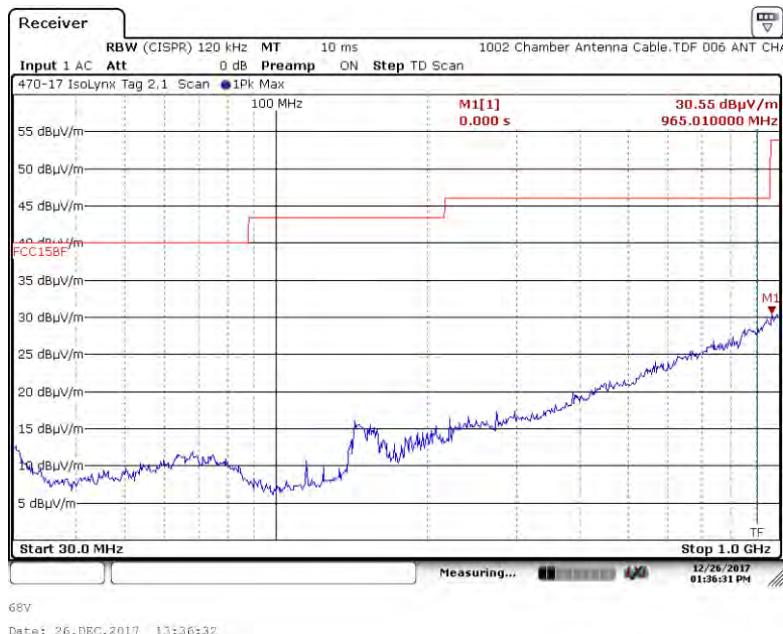
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

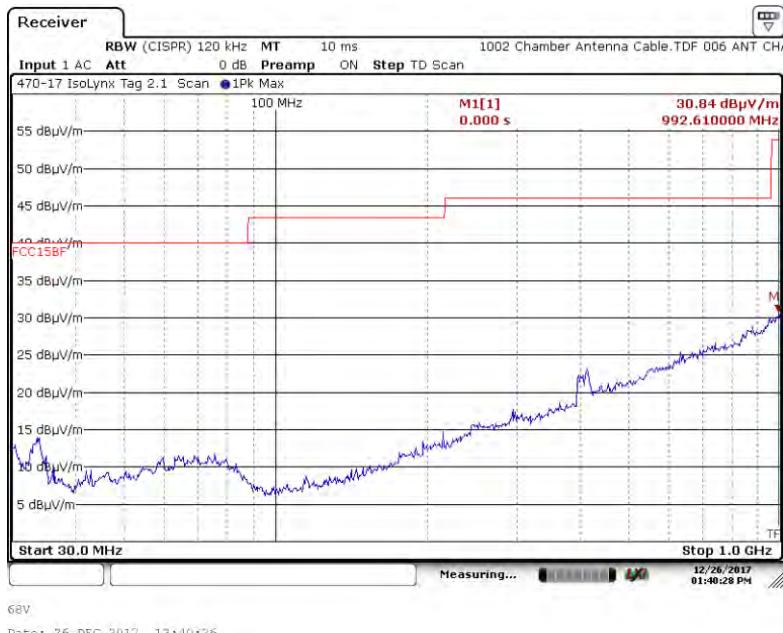
### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

#### A3.1. Channel 37, 2402 MHz

##### A3.1.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A3.1.6. Measurement Results: Z-Axis, Vertical Antenna



**Test Number: 470-17**
**Issue Date: 9/10/2018**

### **Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)**

#### **A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results**

##### **A3.2. Channel 38, 2426 MHz**

###### **A3.2.1. Measurement Results: X-Axis, Horizontal Antenna**



Date: 26.DEC.2017 14:54:56

###### **A3.2.2. Measurement Results: X-Axis, Vertical Antenna**



Date: 26.DEC.2017 14:58:17

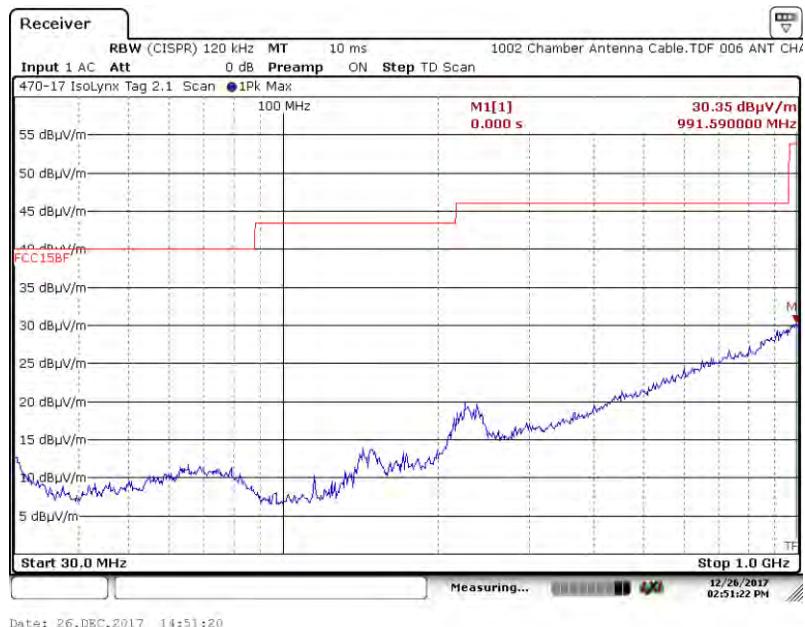
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

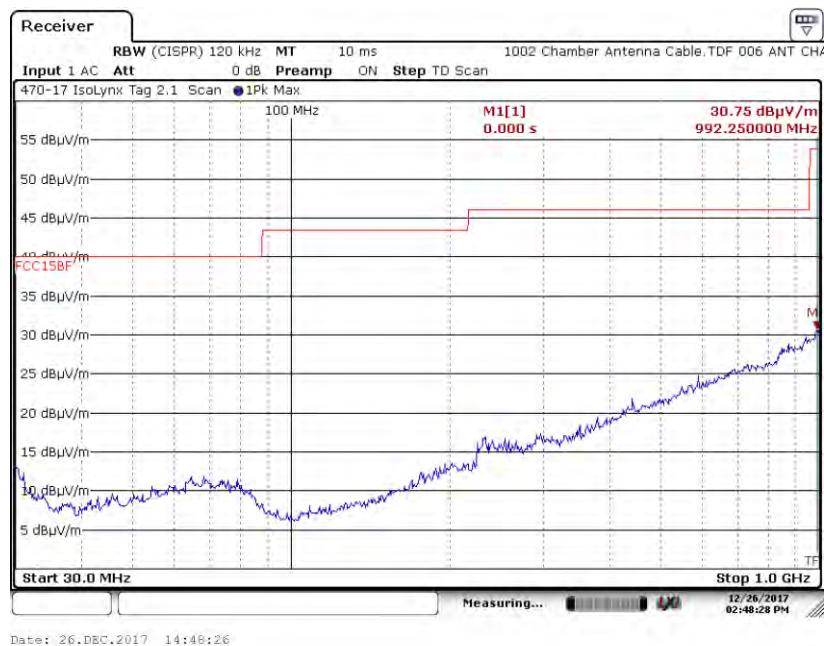
### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

#### A3.2. Channel 38, 2426 MHz

##### A3.2.3. Measurement Results: Y-Axis, Horizontal Antenna



##### A3.2.4. Measurement Results: Y-Axis, Vertical Antenna



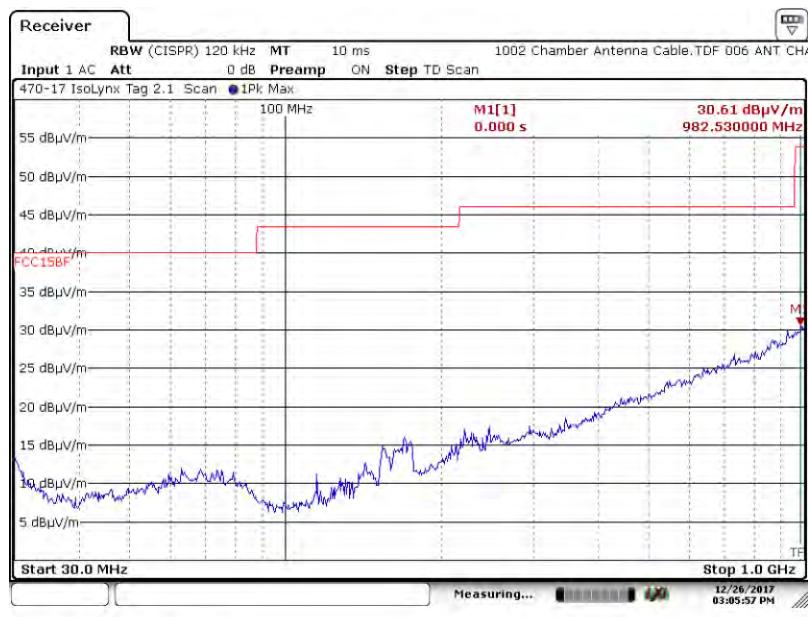
**Test Number: 470-17**
**Issue Date: 9/10/2018**

### Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

#### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

##### A3.2. Channel 38, 2426 MHz

###### A3.2.5. Measurement Results: Z-Axis, Horizontal Antenna



###### A3.2.6. Measurement Results: Z-Axis, Vertical Antenna



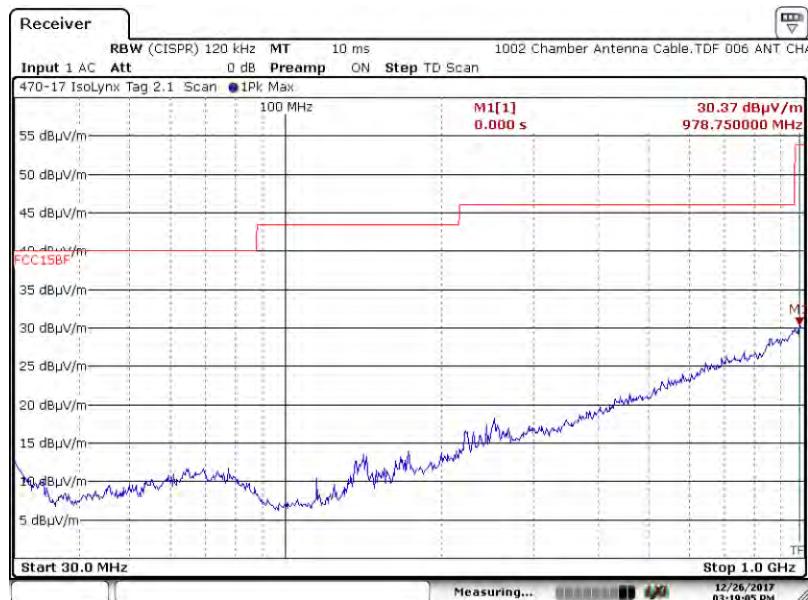
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

#### A3.3. Channel 39, 2480 MHz

##### A3.3.1. Measurement Results: X-Axis, Horizontal Antenna



##### A3.3.2. Measurement Results: X-Axis, Vertical Antenna



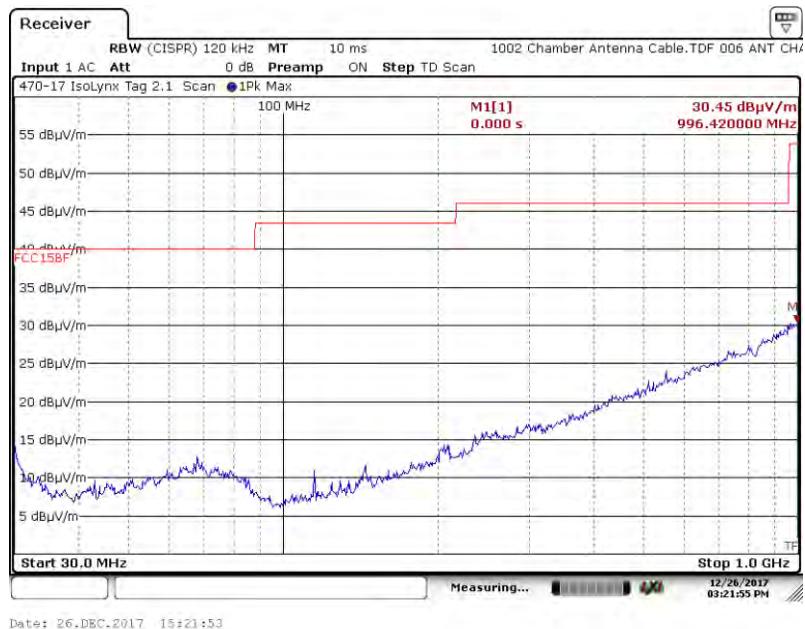
**Test Number: 470-17**
**Issue Date: 9/10/2018**

### Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

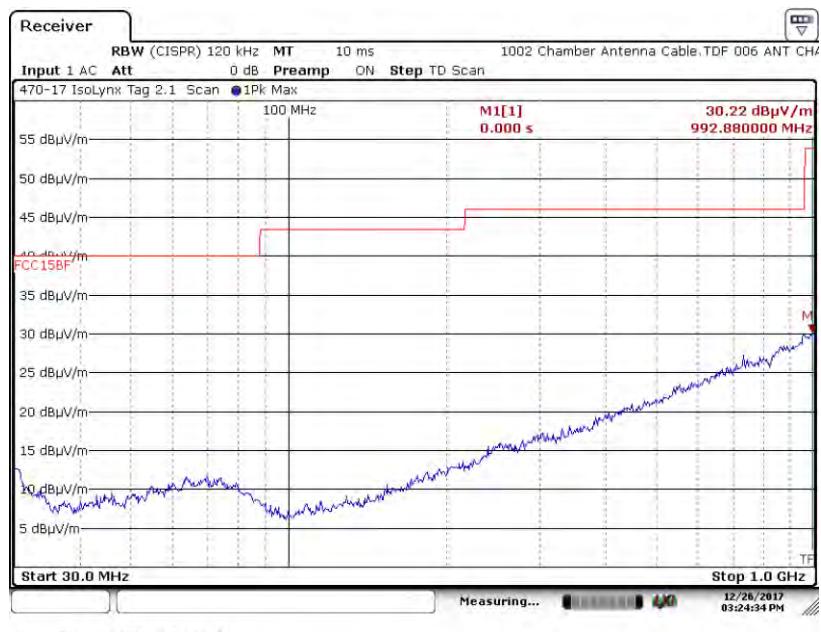
#### A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results

##### A3.3. Channel 39, 2480 MHz

###### A3.3.3. Measurement Results: Y-Axis, Horizontal Antenna



###### A3.3.4. Measurement Results: Y-Axis, Vertical Antenna



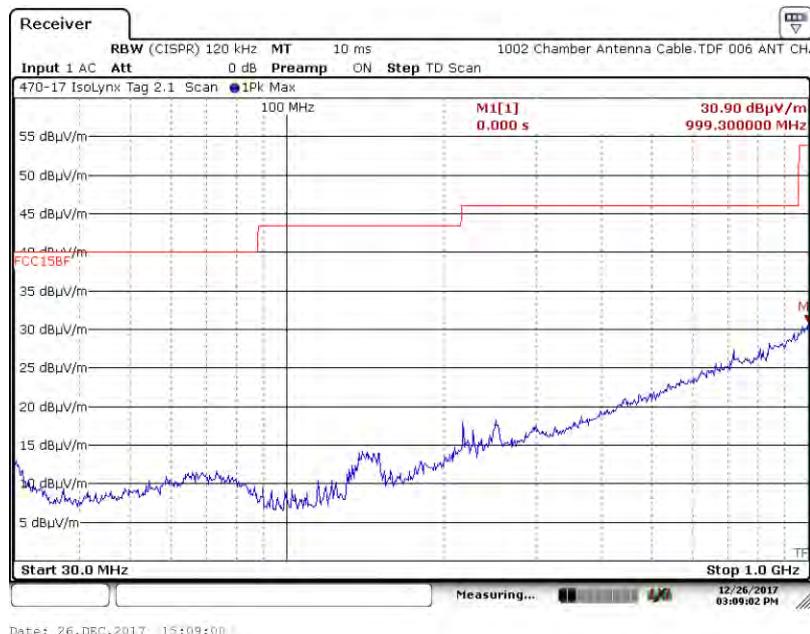
**Test Number: 470-17**
**Issue Date: 9/10/2018**

### **Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)**

#### **A3. Spurious Radiated Emissions (30 MHz – 1 GHz) Test Results**

##### **A3.3. Channel 39, 2480 MHz**

###### **A3.3.5. Measurement Results: Z-Axis, Horizontal Antenna**



###### **A3.3.6. Measurement Results: Z-Axis, Vertical Antenna**



Test Number: 470-17

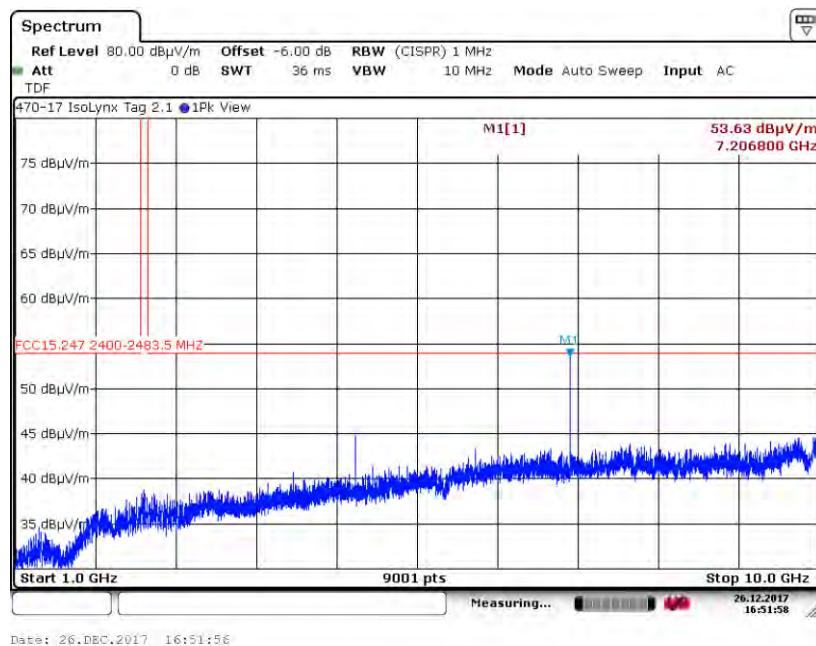
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

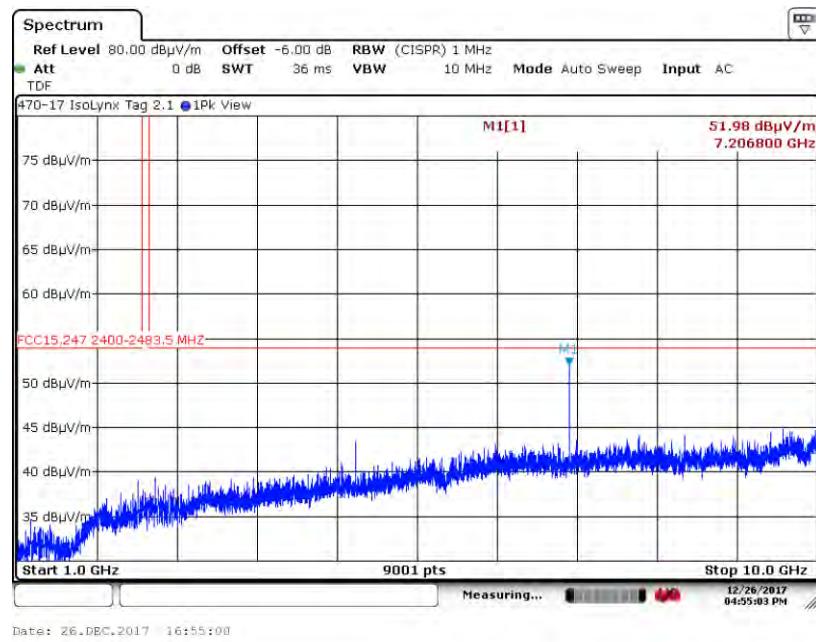
### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

#### A4.1. Channel 37, 2402 MHz

##### A4.1.1. Measurement Results: X-Axis, Horizontal Antenna



##### A4.1.2. Measurement Results: X-Axis, Vertical Antenna



Test Number: 470-17

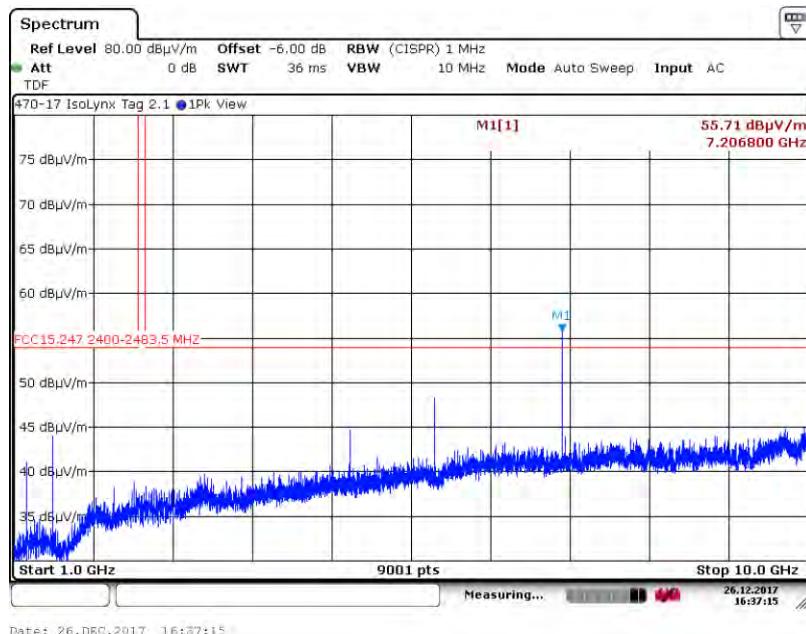
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

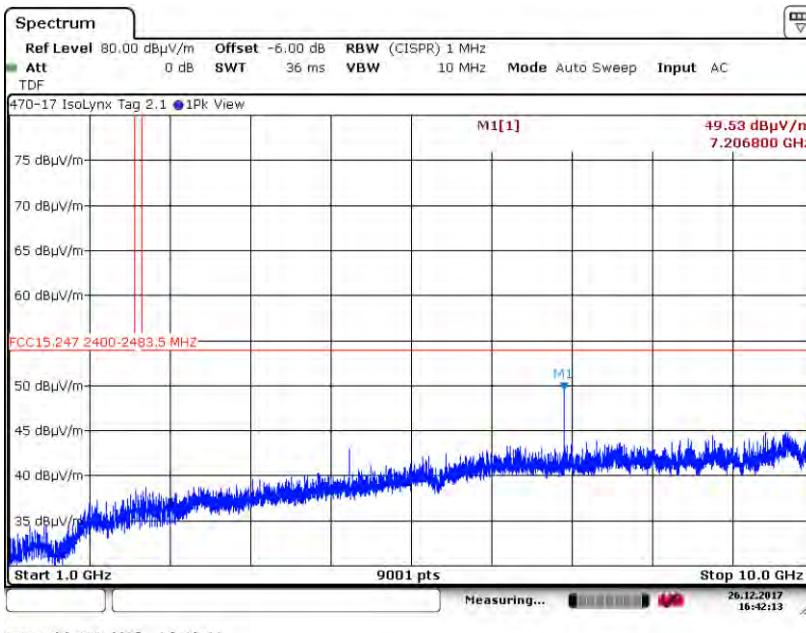
#### A4.1. Channel 37, 2402 MHz

##### A4.1.3. Measurement Results: Y-Axis, Horizontal Antenna



Date: 26.DEC.2017 16:37:15

##### A4.1.4. Measurement Results: Y-Axis, Vertical Antenna



Date: 26.DEC.2017 16:42:11

Test Number: 470-17

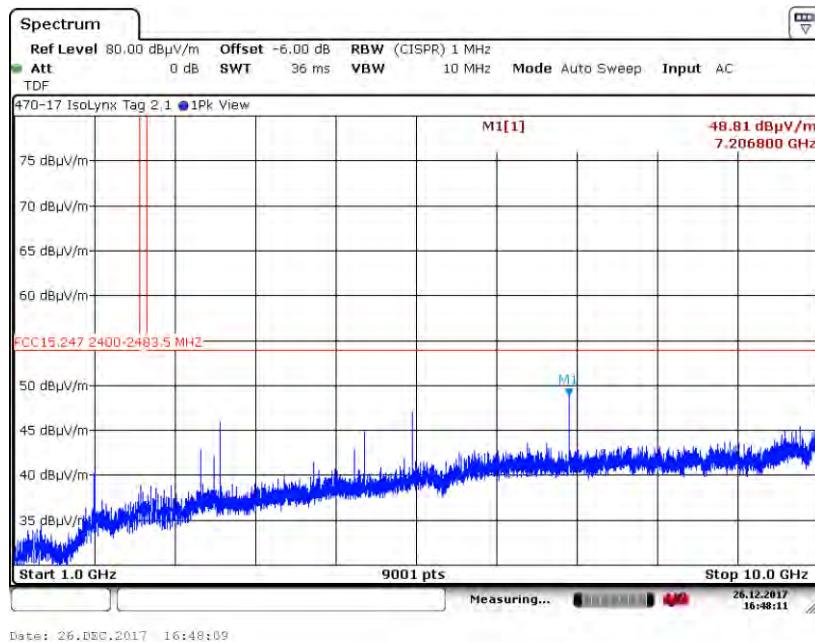
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

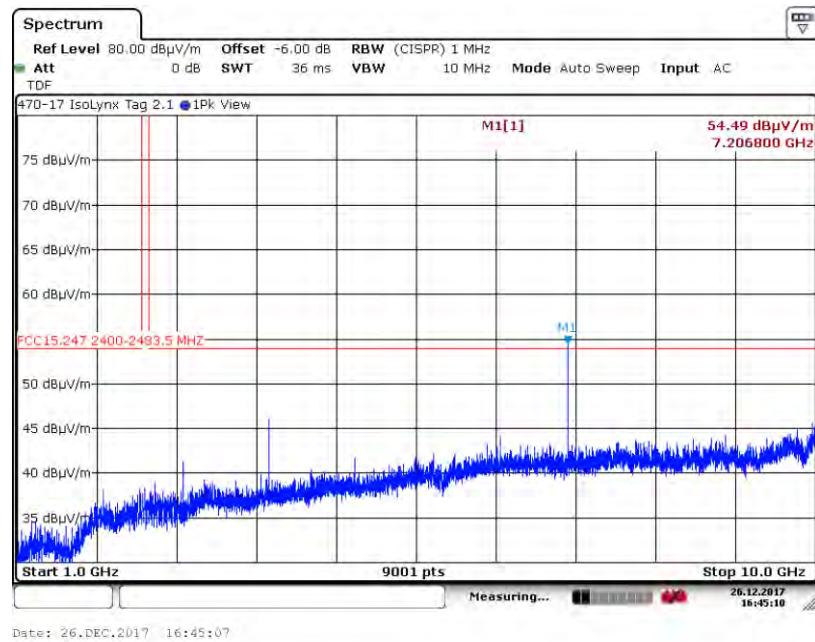
### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

#### A4.1. Channel 37, 2402 MHz

##### A4.1.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A4.1.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

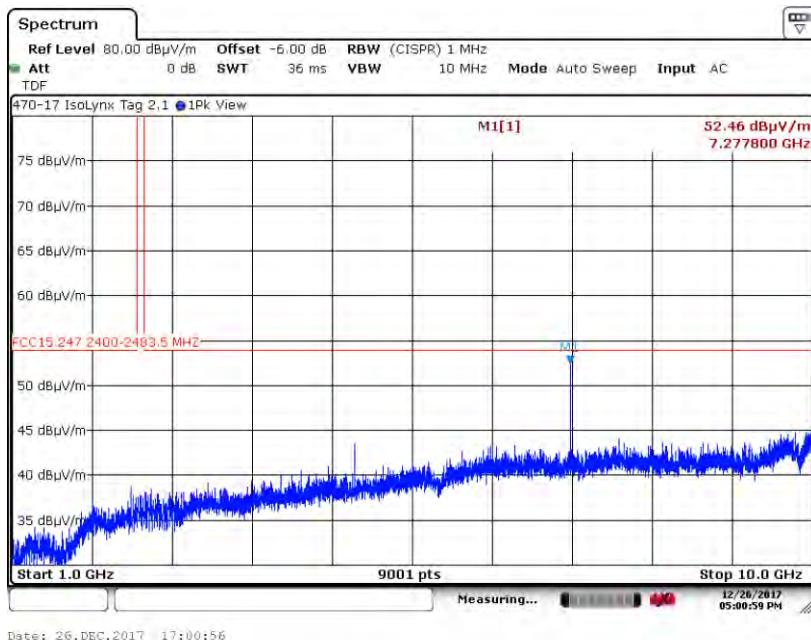
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

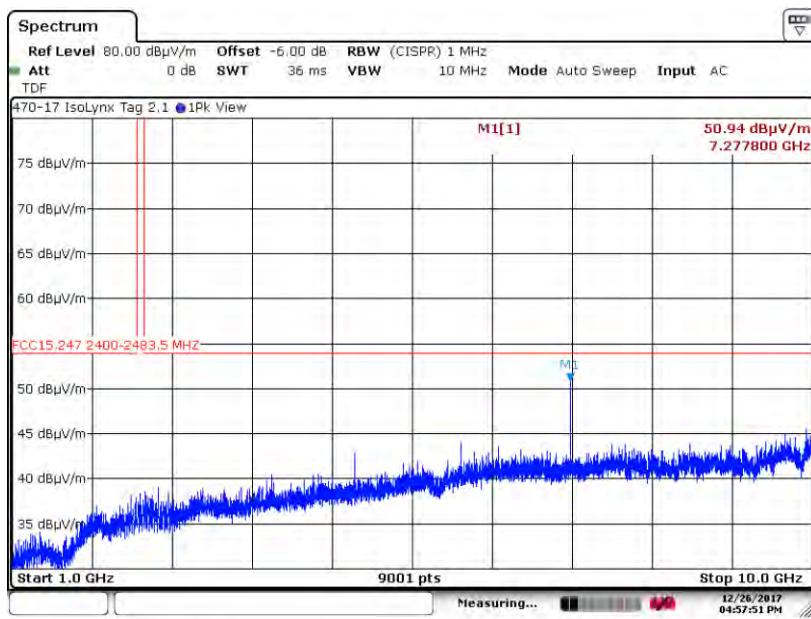
#### A4.2. Channel 38, 2426 MHz

##### A4.2.1. Measurement Results: X-Axis, Horizontal Antenna



Date: 26.DEC.2017 17:00:56

##### A4.2.2. Measurement Results: X-Axis, Vertical Antenna



Date: 26.DEC.2017 16:57:49

Test Number: 470-17

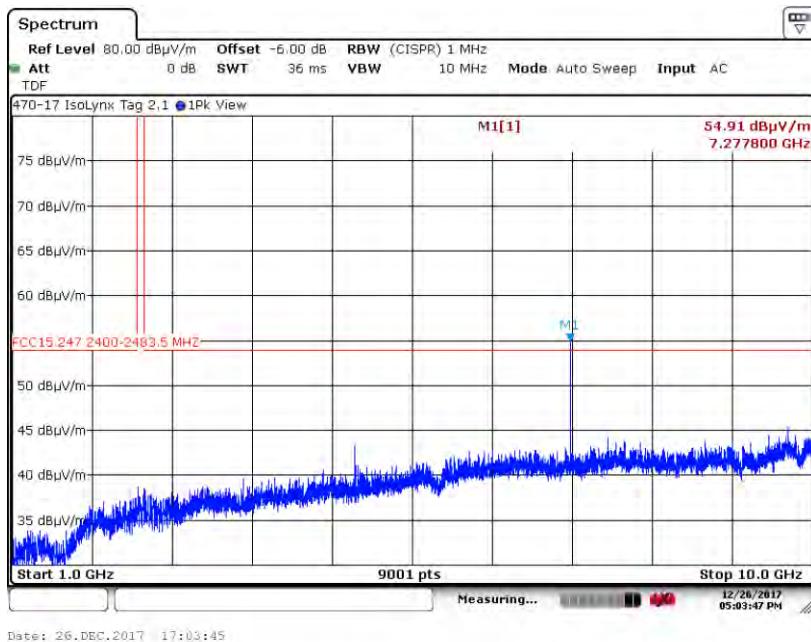
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

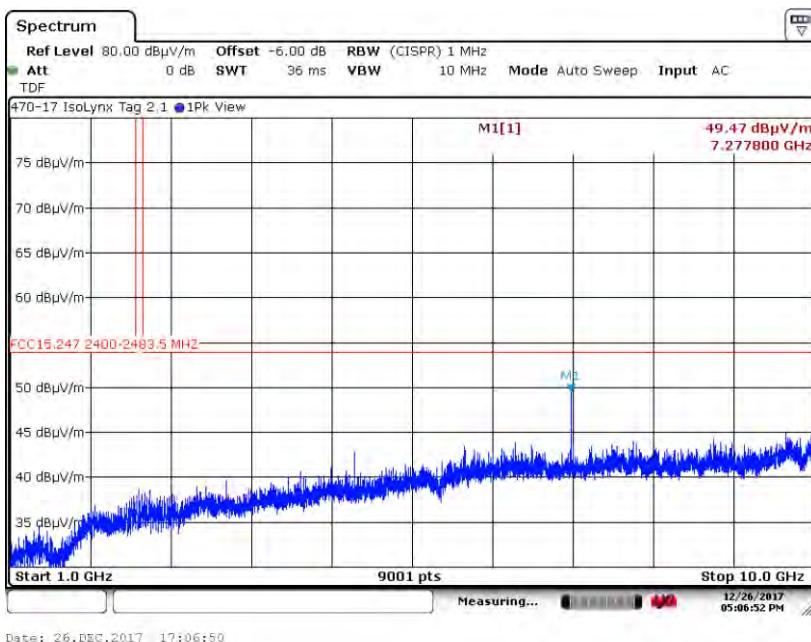
#### A4.2. Channel 38, 2426 MHz

##### A4.2.3. Measurement Results: Y-Axis, Horizontal Antenna



Date: 26.DEC.2017 17:03:45

##### A4.2.4. Measurement Results: Y-Axis, Vertical Antenna



Date: 26.DEC.2017 17:06:50

Test Number: 470-17

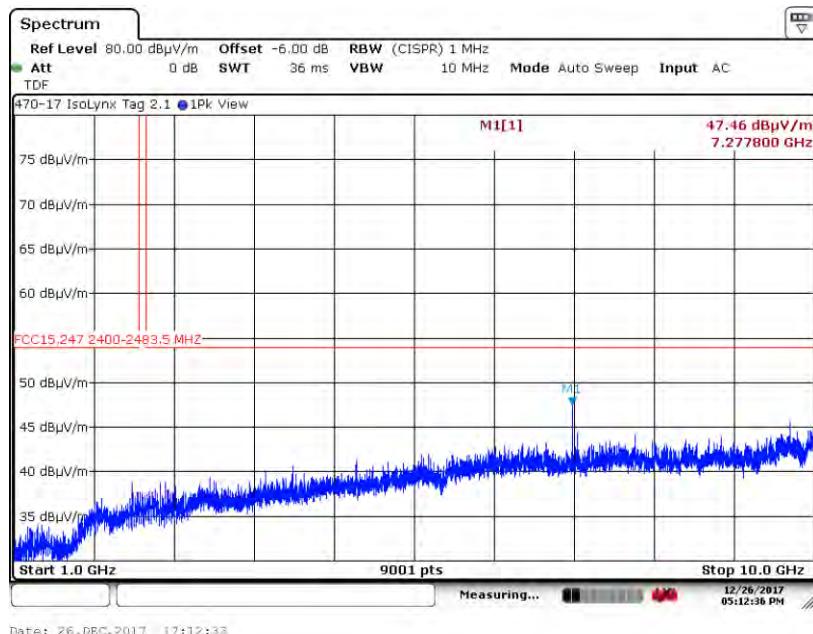
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

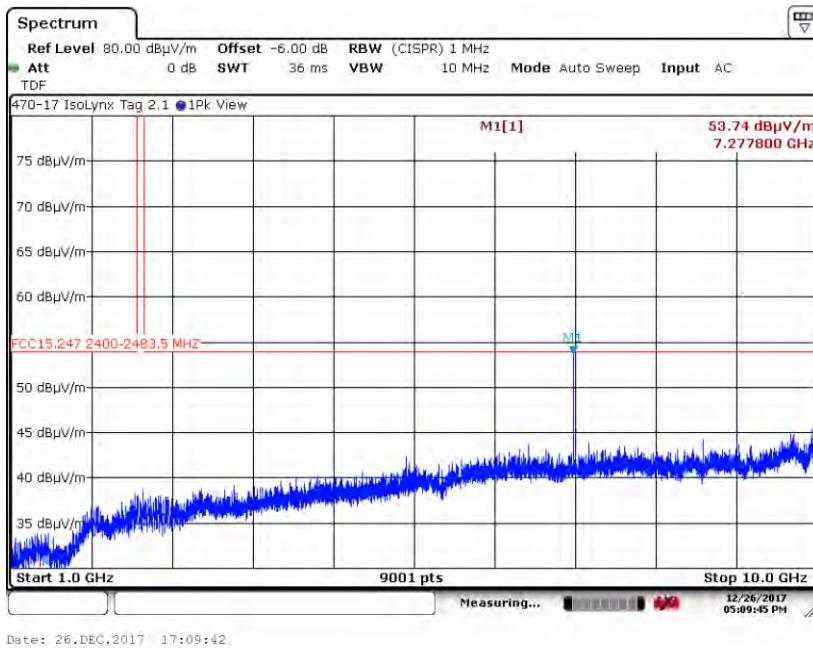
### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

#### A4.2. Channel 38, 2426 MHz

##### A4.2.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A4.2.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

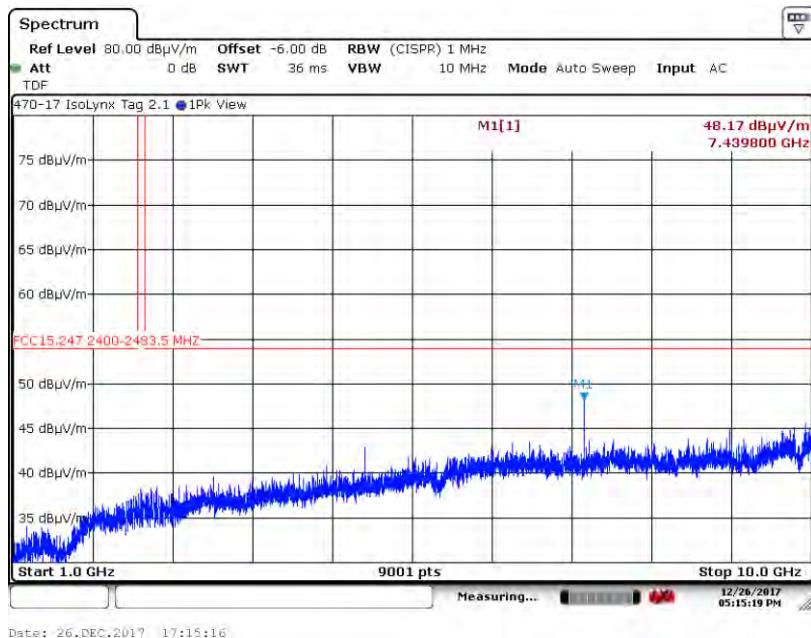
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

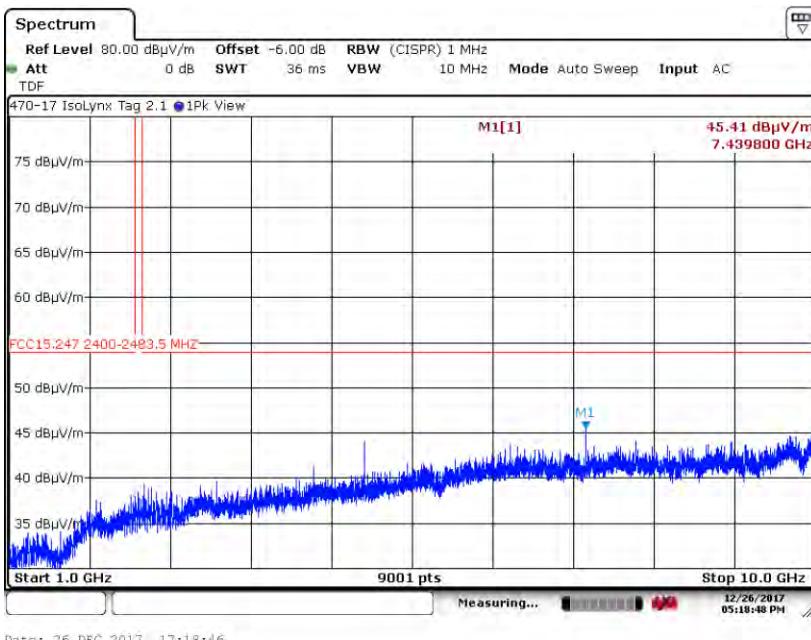
### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

#### A4.3. Channel 39, 2480 MHz

##### A4.3.1. Measurement Results: X-Axis, Horizontal Antenna



##### A4.3.2. Measurement Results: X-Axis, Vertical Antenna



**Test Number:** 470-17

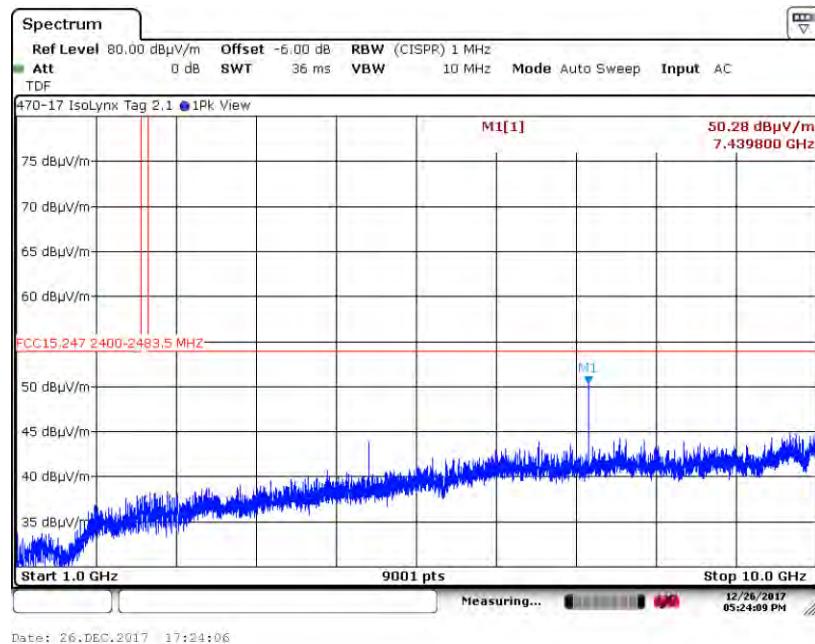
**Issue Date:** 9/10/2018

### **Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)**

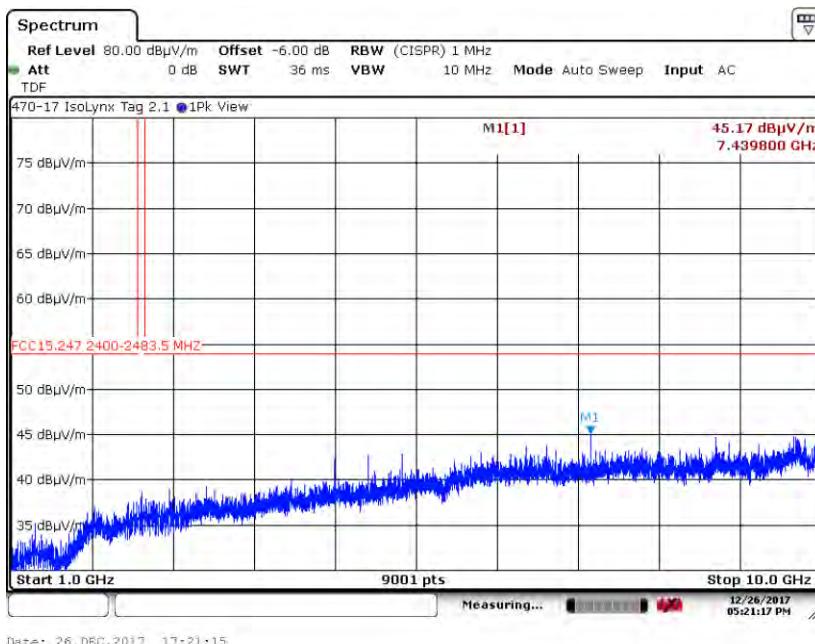
#### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

##### A4.3. Channel 39, 2480 MHz

###### A4.3.3. Measurement Results: Y-Axis, Horizontal Antenna



###### A4.3.4. Measurement Results: Y-Axis, Vertical Antenna



Test Number: 470-17

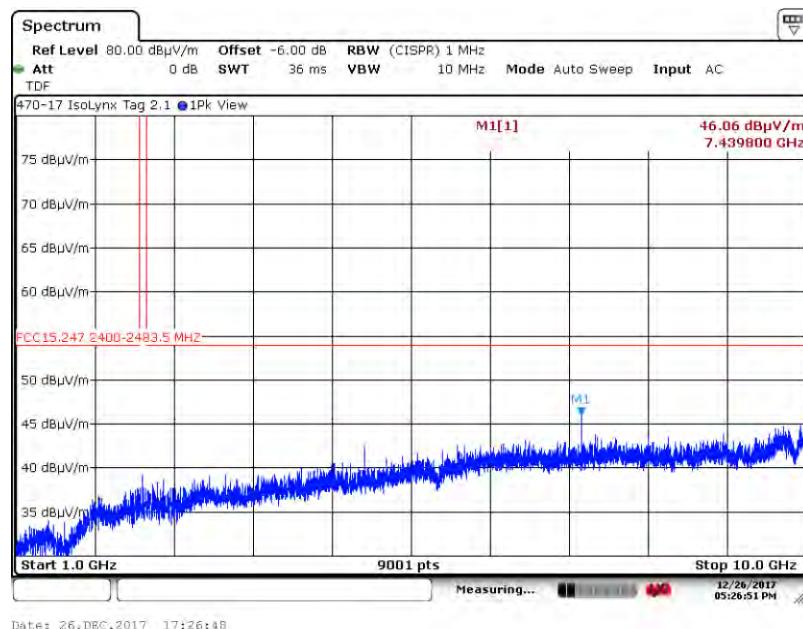
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

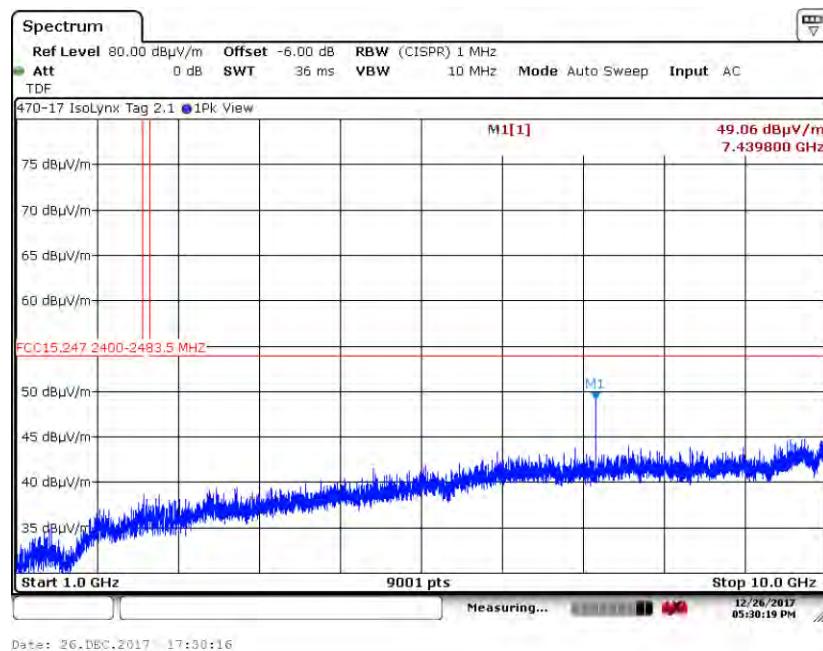
### A4. Spurious Radiated Emissions (1 GHz – 10 GHz) Test Results

#### A4.3. Channel 39, 2480 MHz

##### A4.3.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A4.3.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

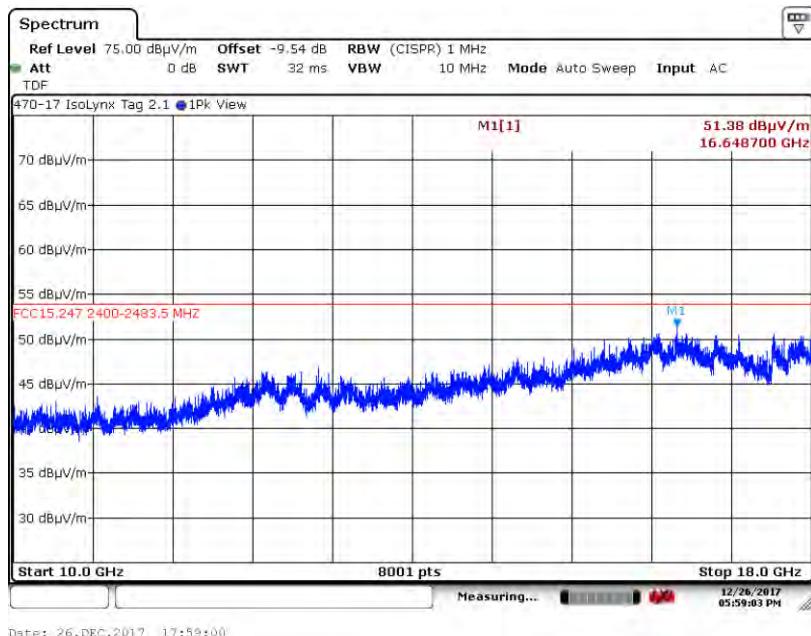
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

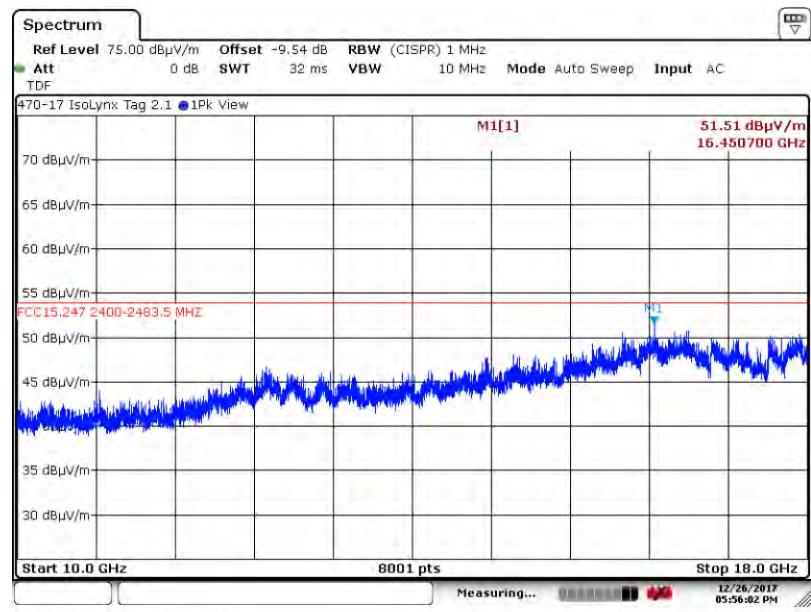
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.1. Channel 37, 2402 MHz

##### A5.1.1. Measurement Results: X-Axis, Horizontal Antenna



##### A5.1.2. Measurement Results: X-Axis, Vertical Antenna



Test Number: 470-17

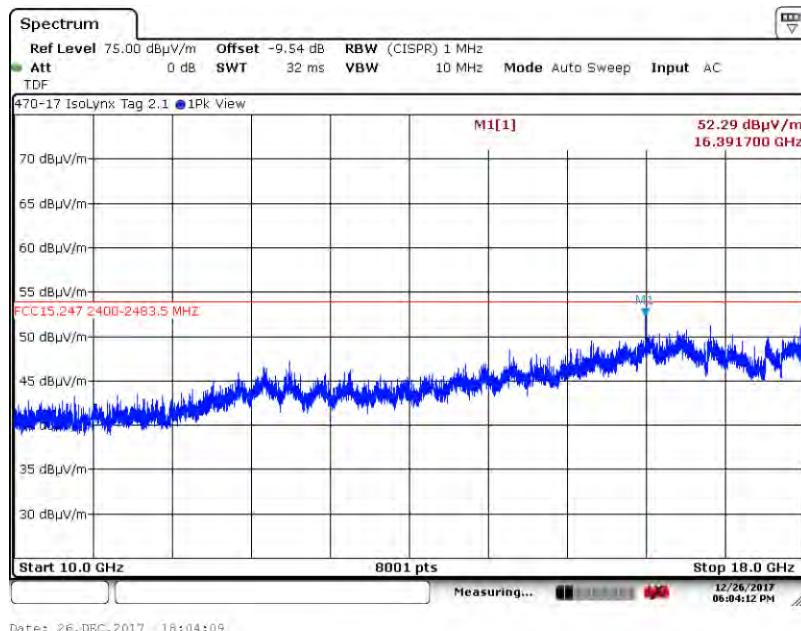
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

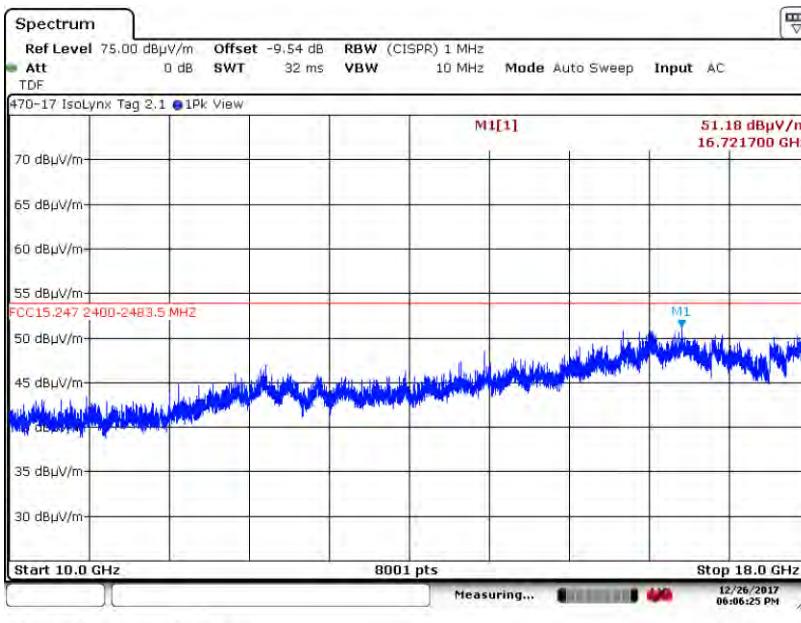
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.1. Channel 37, 2402 MHz

##### A5.1.3. Measurement Results: Y-Axis, Horizontal Antenna



##### A5.1.4. Measurement Results: Y-Axis, Vertical Antenna



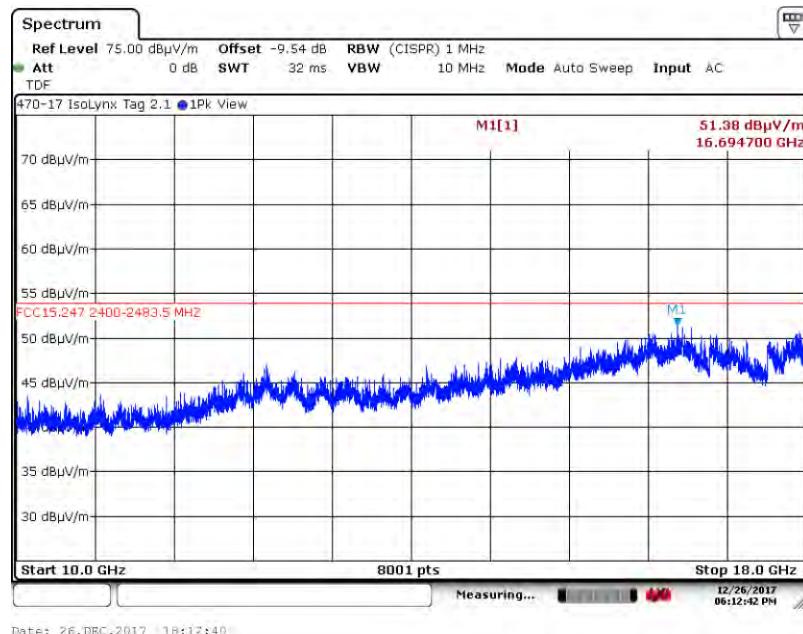
**Test Number: 470-17**
**Issue Date: 9/10/2018**

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

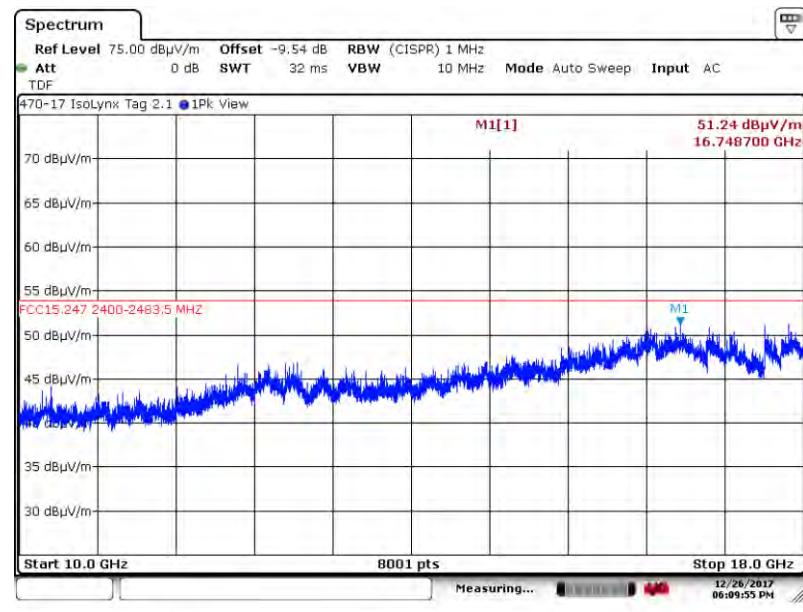
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.1. Channel 37, 2402 MHz

##### A5.1.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A5.1.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

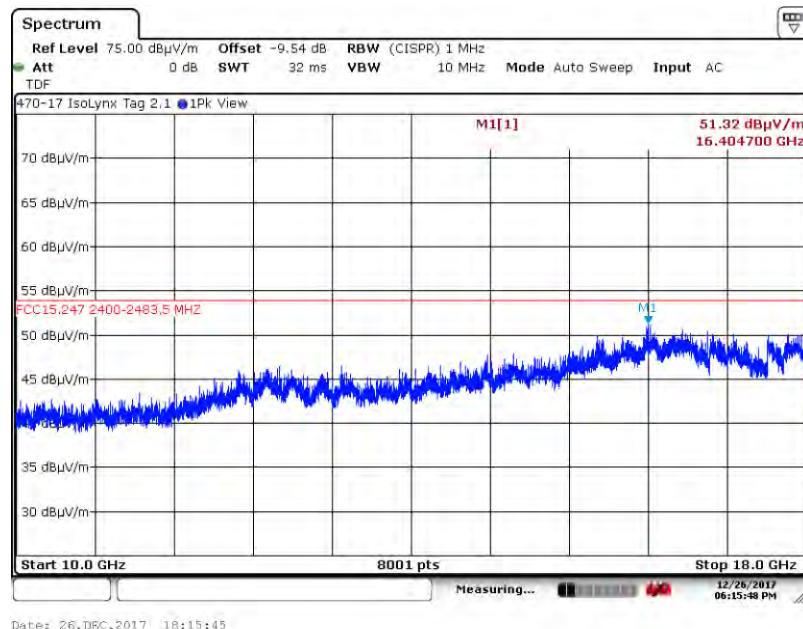
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

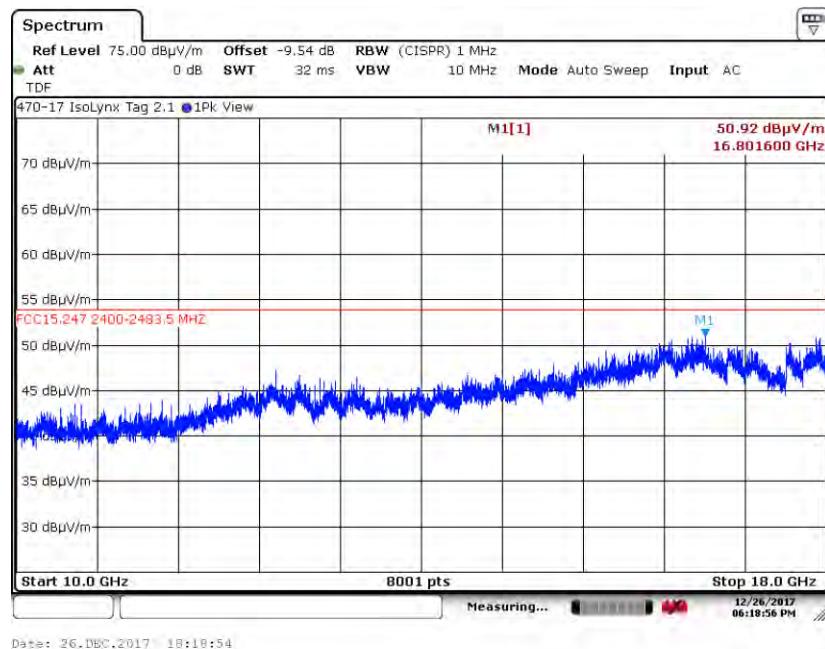
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.2. Channel 38, 2426 MHz

##### A5.2.1. Measurement Results: X-Axis, Horizontal Antenna



##### A5.2.2. Measurement Results: X-Axis, Vertical Antenna



Test Number: 470-17

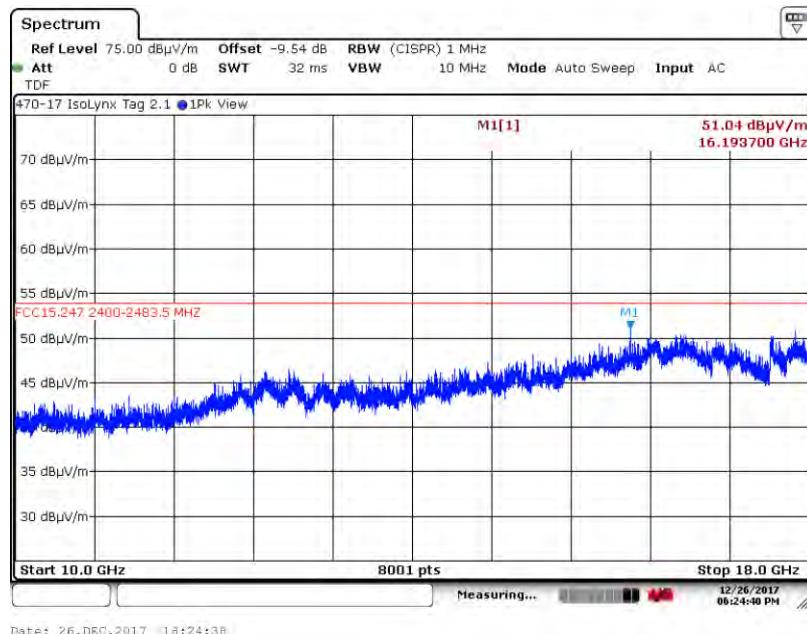
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

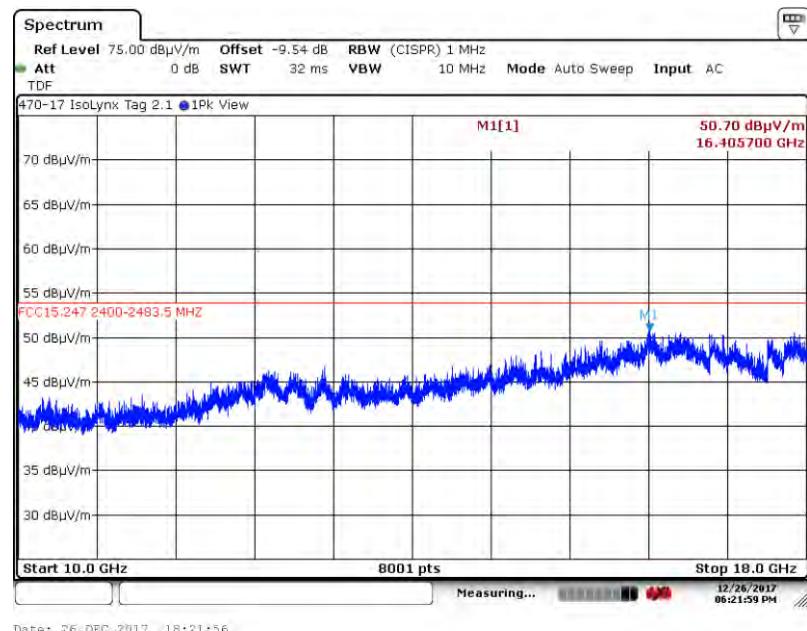
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.2. Channel 38, 2426 MHz

##### A5.2.3. Measurement Results: Y-Axis, Horizontal Antenna



##### A5.2.4. Measurement Results: Y-Axis, Vertical Antenna



Test Number: 470-17

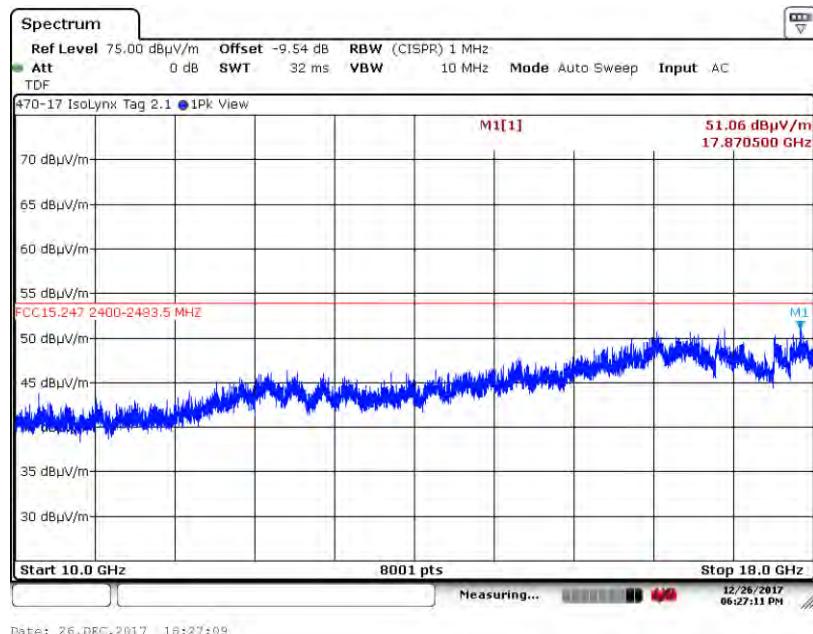
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

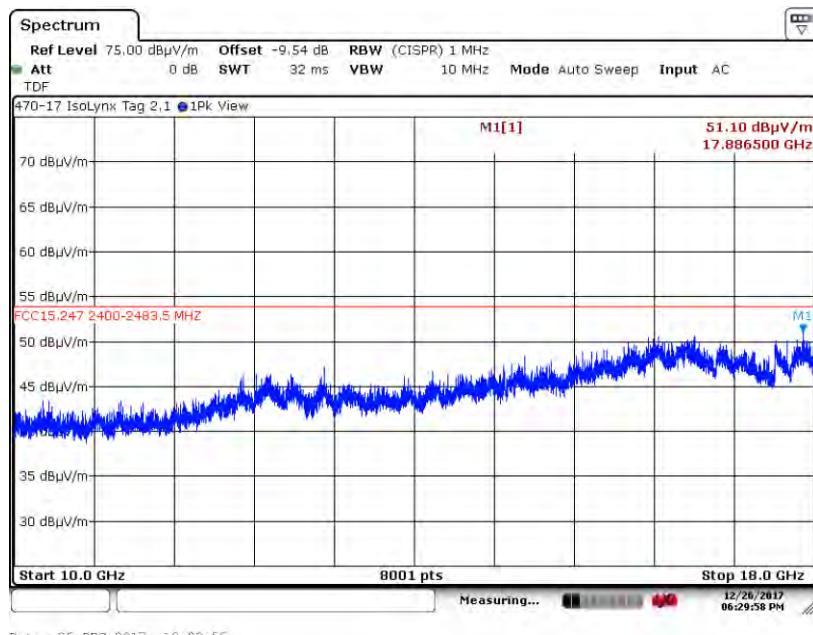
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.2. Channel 38, 2426 MHz

##### A5.2.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A5.2.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

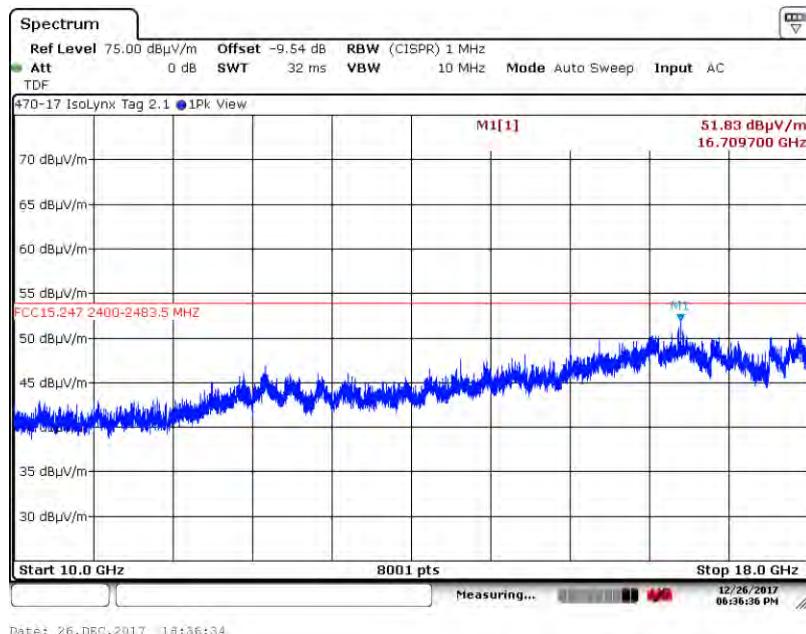
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

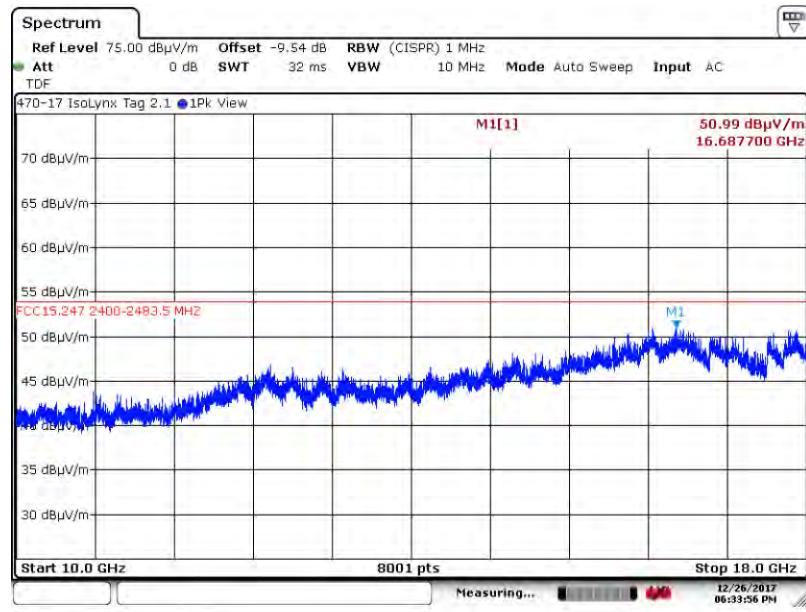
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.3. Channel 39, 2480 MHz

##### A5.3.1. Measurement Results: X-Axis, Horizontal Antenna



##### A5.3.2. Measurement Results: X-Axis, Vertical Antenna



Test Number: 470-17

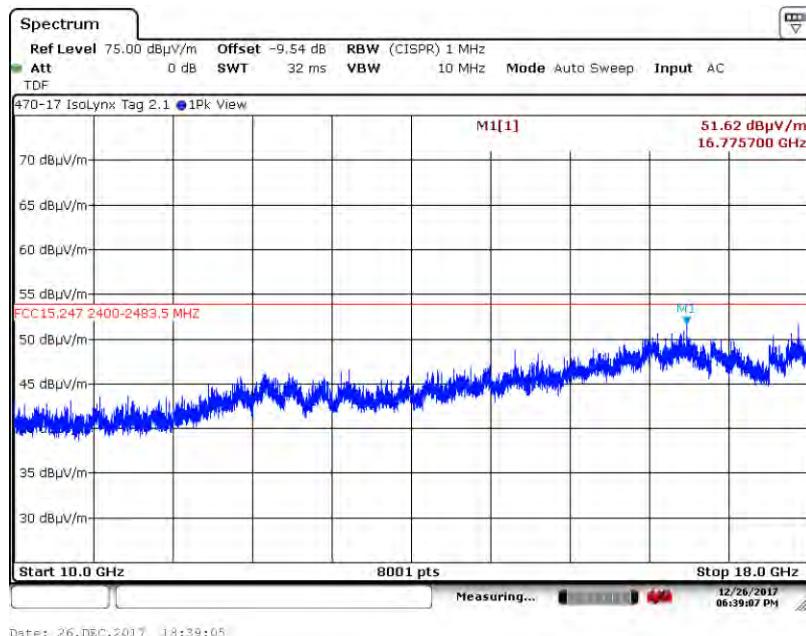
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

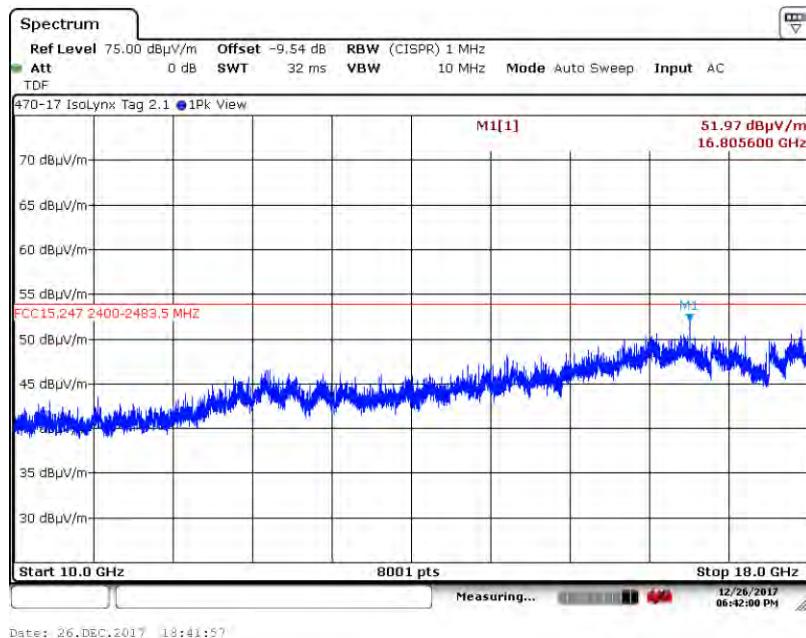
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.3. Channel 39, 2480 MHz

##### A5.3.3. Measurement Results: Y-Axis, Horizontal Antenna



##### A5.3.4. Measurement Results: Y-Axis, Vertical Antenna



Test Number: 470-17

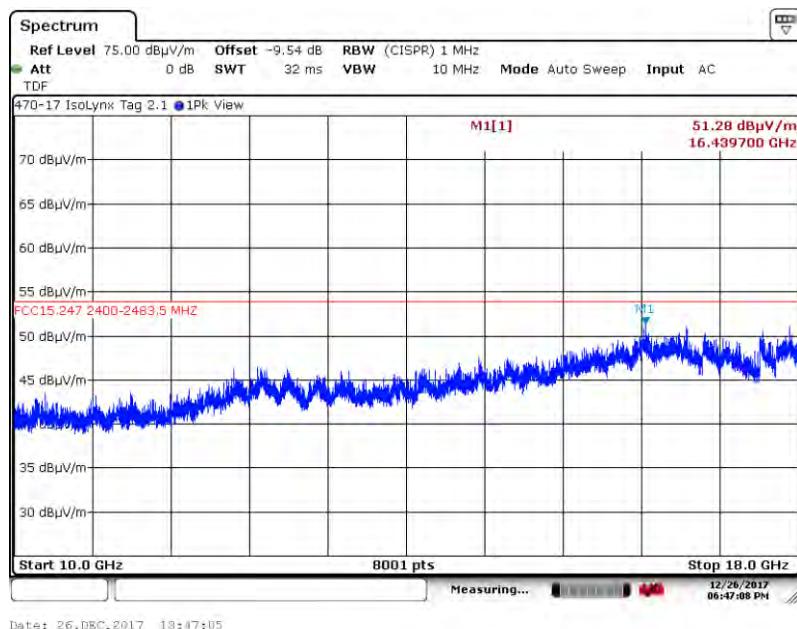
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

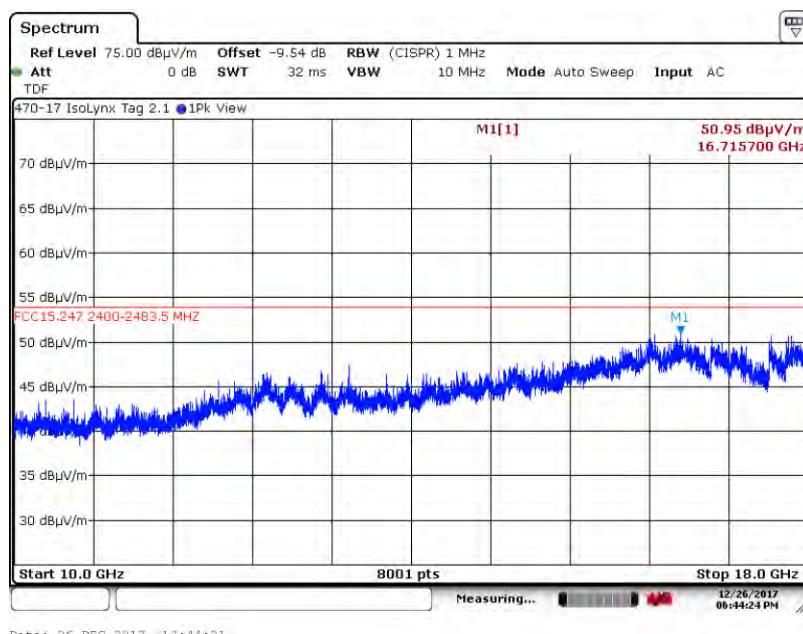
### A5. Spurious Radiated Emissions (10 GHz – 18 GHz) Test Results

#### A5.3. Channel 39, 2480 MHz

##### A5.3.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A5.3.6. Measurement Results: Z-Axis, Vertical Antenna



**Test Number:** 470-17

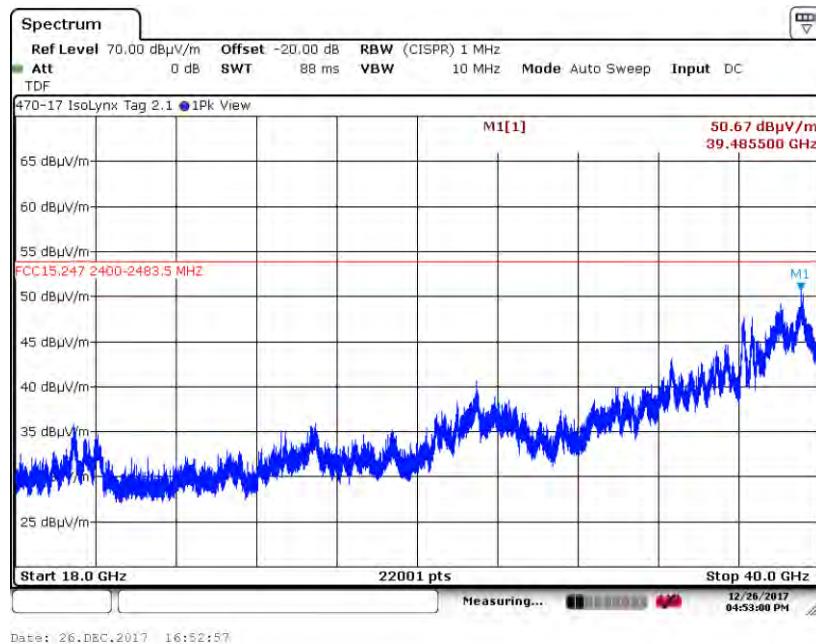
**Issue Date:** 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

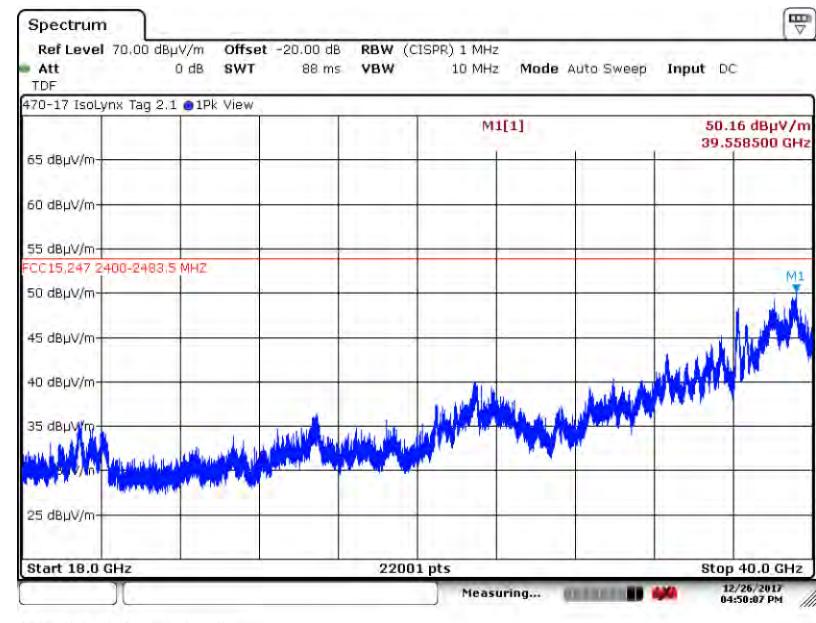
### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.1. Channel 37, 2402 MHz

##### A6.1.1. Measurement Results: X-Axis, Horizontal Antenna



##### A6.1.2. Measurement Results: X-Axis, Vertical Antenna



Test Number: 470-17

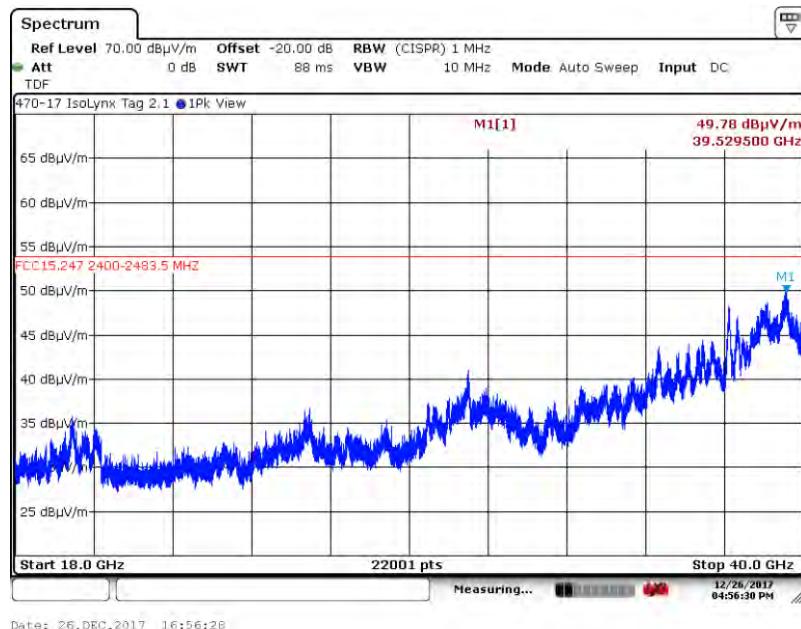
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

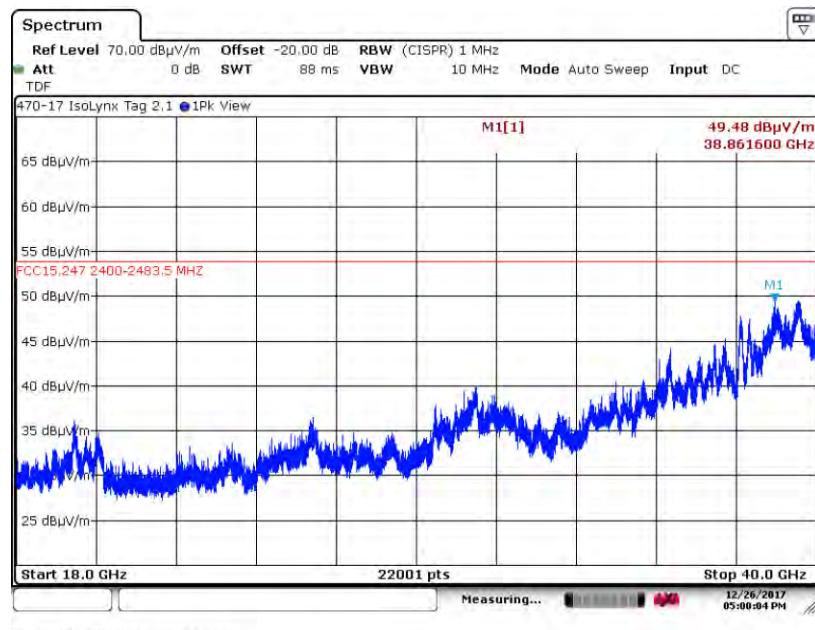
### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.1. Channel 37, 2402 MHz

##### A6.1.3. Measurement Results: Y-Axis, Horizontal Antenna



##### A6.1.4. Measurement Results: Y-Axis, Vertical Antenna



**Test Number:** 470-17

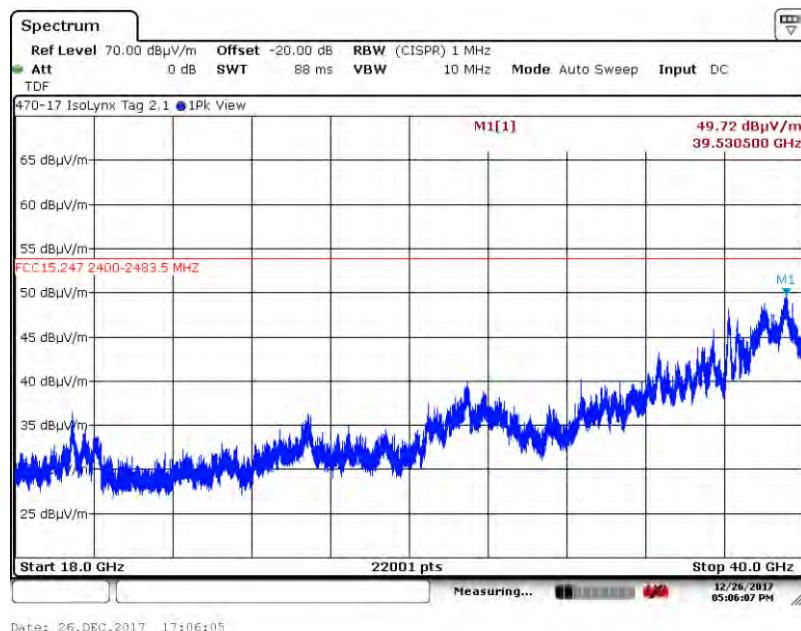
**Issue Date:** 9/10/2018

### **Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)**

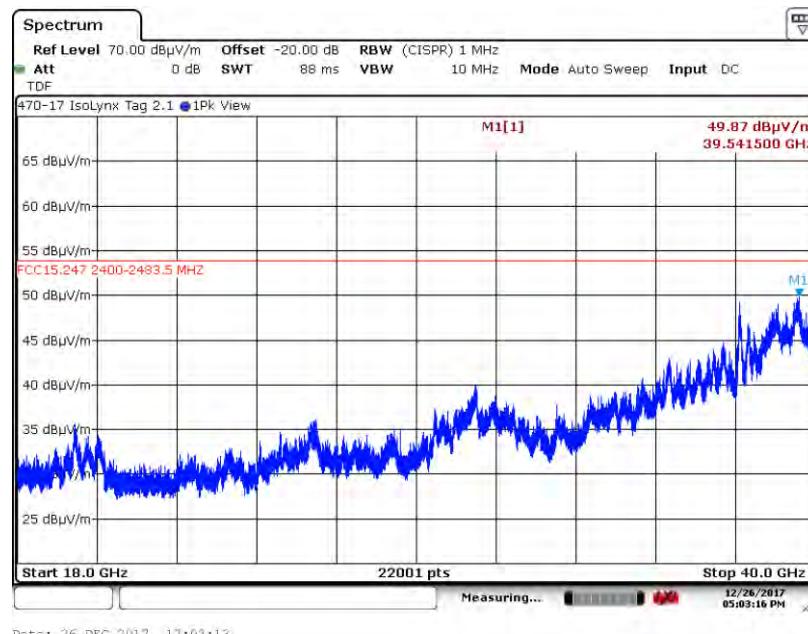
#### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

##### A6.1. Channel 37, 2402 MHz

###### A6.1.5. Measurement Results: Z-Axis, Horizontal Antenna



###### A6.1.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

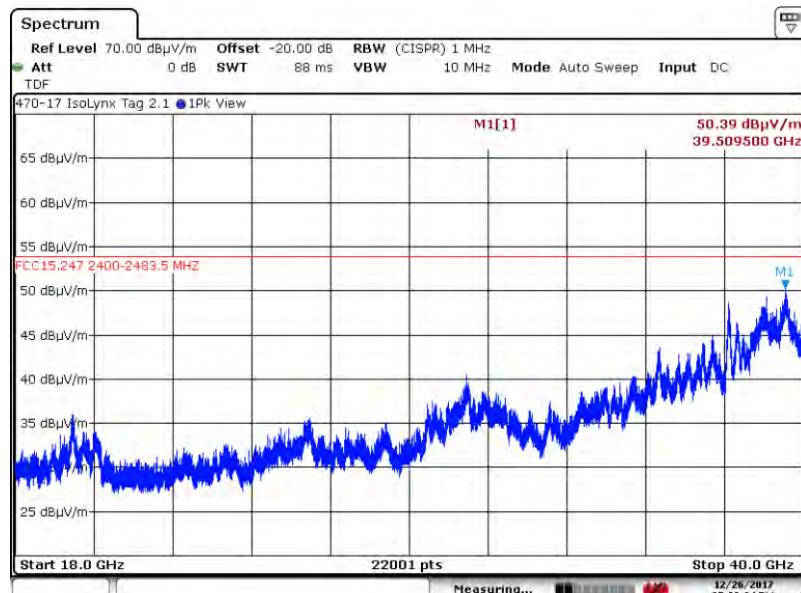
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

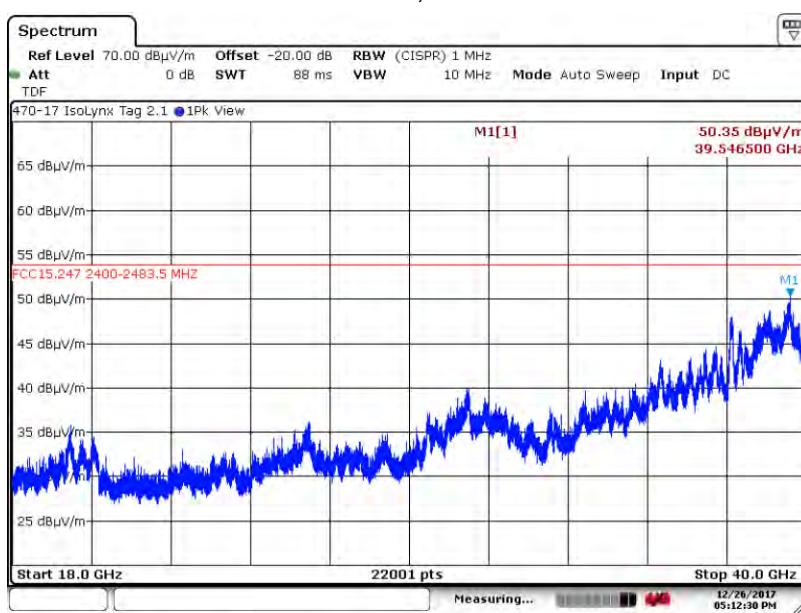
### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.2. Channel 38, 2426 MHz

##### A6.2.1. Measurement Results: X-Axis, Horizontal Antenna



##### A6.2.2. Measurement Results: X-Axis, Vertical Antenna



**Test Number:** 470-17

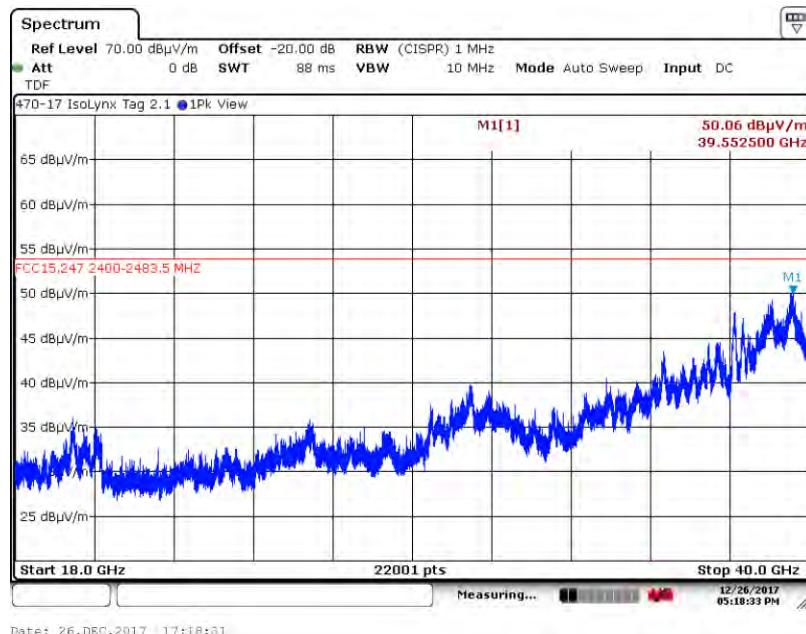
**Issue Date:** 9/10/2018

### **Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)**

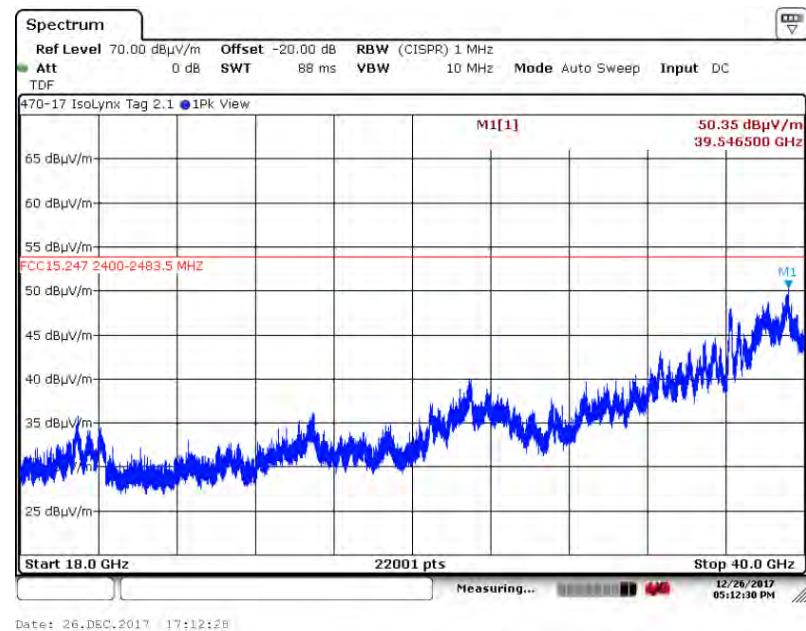
#### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

##### A6.2. Channel 38, 2426 MHz

###### A6.2.3. Measurement Results: Y-Axis, Horizontal Antenna



###### A6.2.4. Measurement Results: Y-Axis, Vertical Antenna



Test Number: 470-17

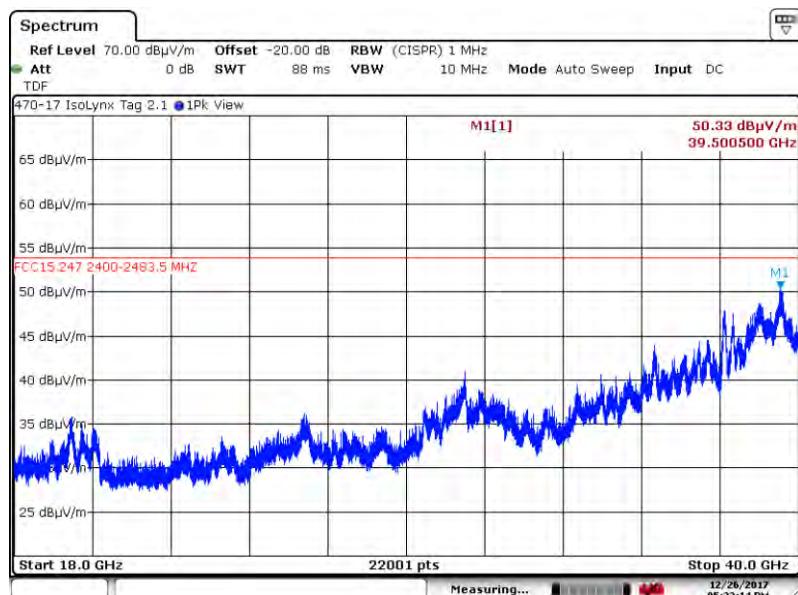
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

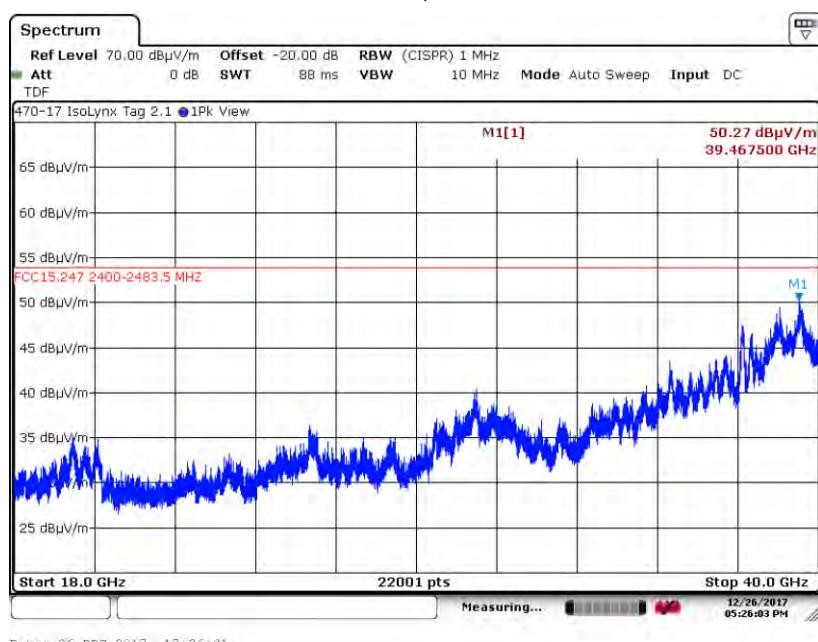
### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.2. Channel 38, 2426 MHz

##### A6.2.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A6.2.6. Measurement Results: Z-Axis, Vertical Antenna



Test Number: 470-17

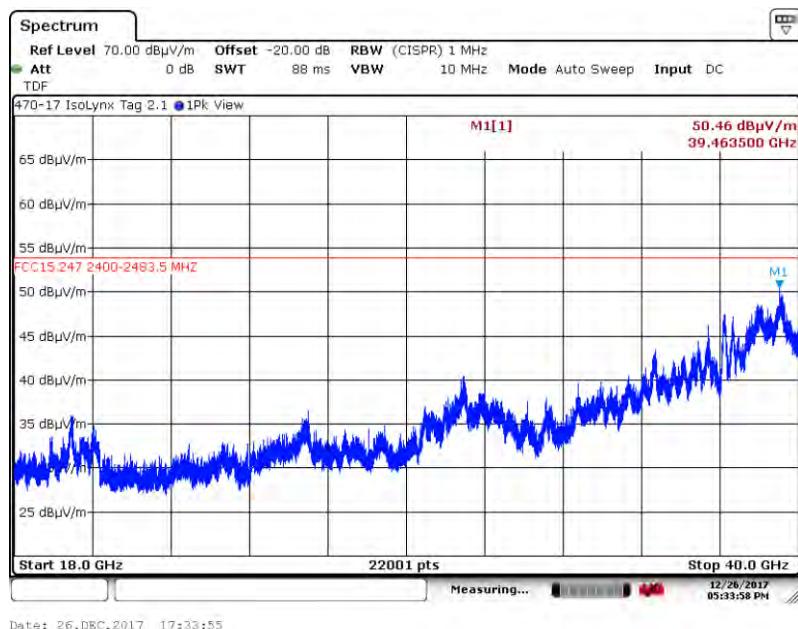
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

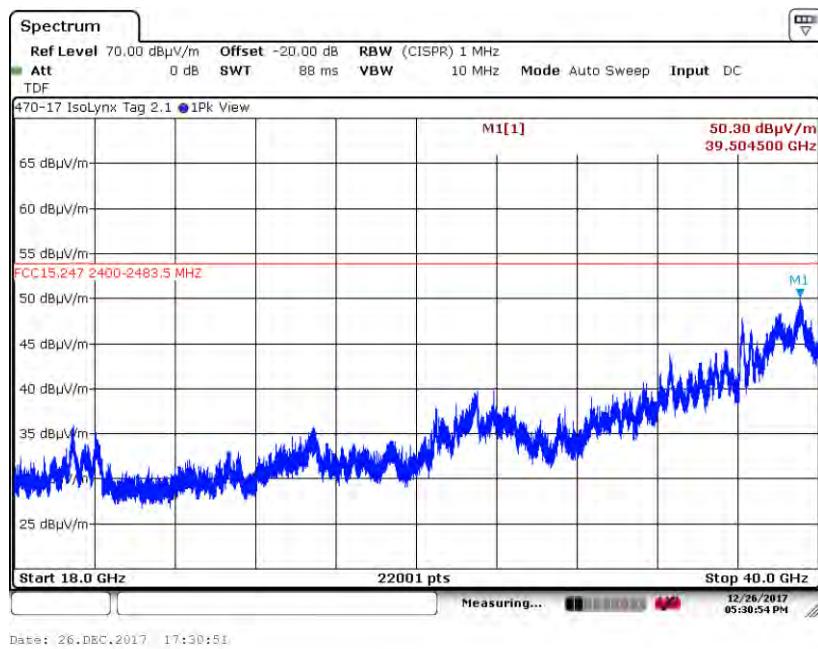
### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.3. Channel 39, 2480 MHz

##### A6.3.1. Measurement Results: X-Axis, Horizontal Antenna



##### A6.3.2. Measurement Results: X-Axis, Vertical Antenna



Test Number: 470-17

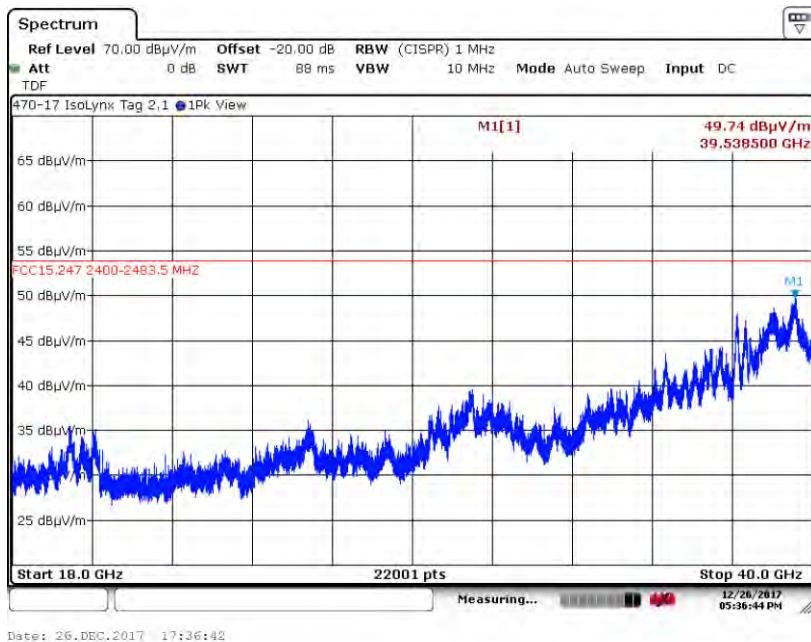
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

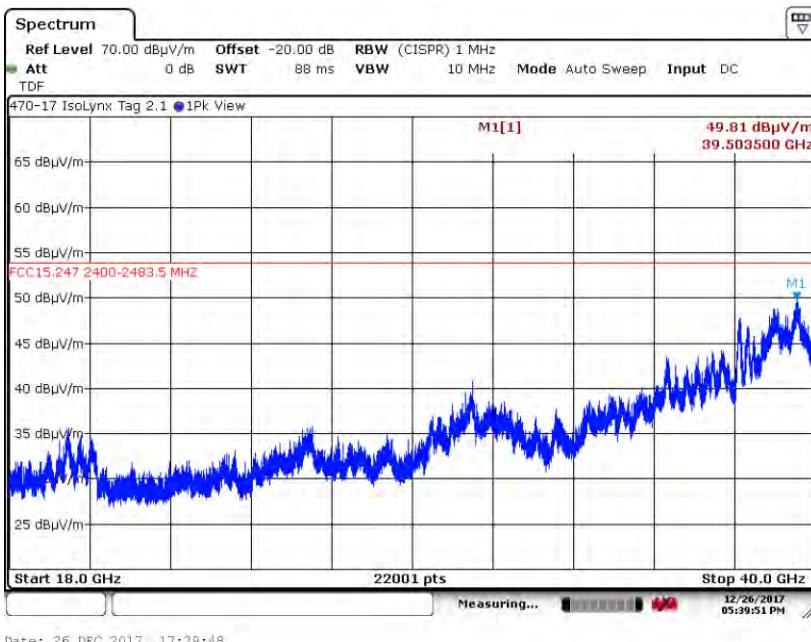
### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.3. Channel 39, 2480 MHz

##### A6.3.3. Measurement Results: Y-Axis, Horizontal Antenna



##### A6.3.4. Measurement Results: Y-Axis, Vertical Antenna



Test Number: 470-17

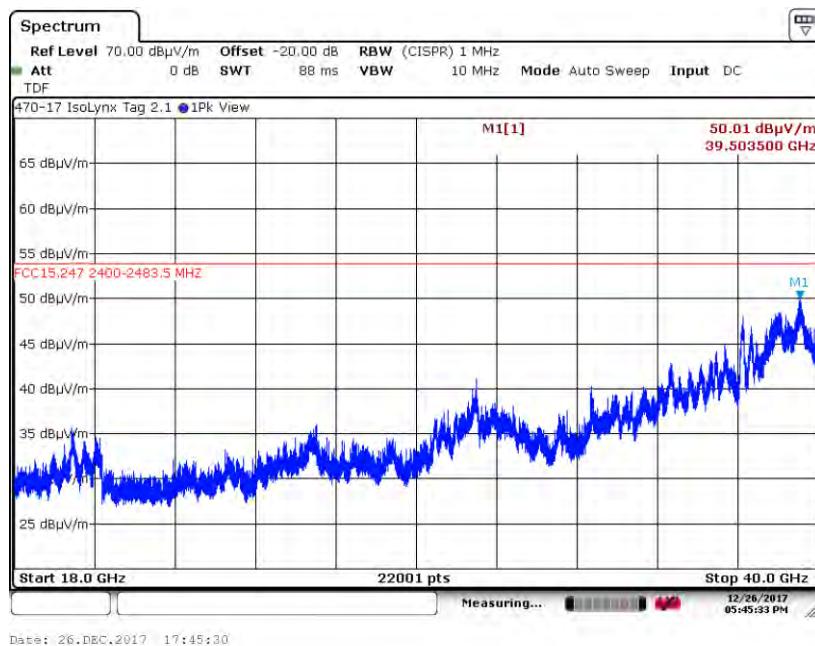
Issue Date: 9/10/2018

## Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 40 GHz)

### A6. Spurious Radiated Emissions (18 GHz – 40 GHz) Test Results

#### A6.3. Channel 39, 2480 MHz

##### A6.3.5. Measurement Results: Z-Axis, Horizontal Antenna



##### A6.3.6. Measurement Results: Z-Axis, Vertical Antenna

