



# **CERTIFICATION TEST REPORT**

**Report Number. :** R12707136-E1

**Applicant :** MAGIC LEAP, INC.  
7500 WEST SUNRISE BOULEVARD  
PLANTATION, FL 33322, USA

**Model :** M2001, M2010

**FCC ID :** 2AM5NM2000

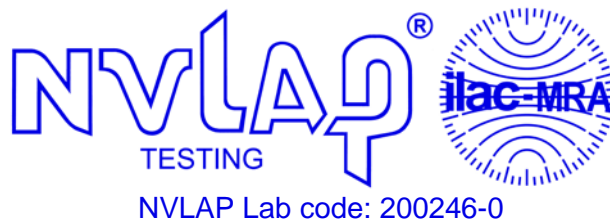
**IC :** 23045-M2000

**EUT Description :** MAGIC LEAP ONE - CONTROL BLE RADIO AND EM  
TRANSMITTER

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
ISED RSS-247 ISSUE 2  
ISED RSS-GEN ISSUE 5

**Date Of Issue:**  
March 18, 2019

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	3/15/2019	Initial Issue	Niklas Haydon
V2	3/15/2019	Included M2001 and M2010 model numbers.	Niklas Haydon
V3	3/18/2019	Revised EUT description section.	Jeff Moser

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Magic Leap, Inc.  
**EUT DESCRIPTION:** Magic Leap One - Control BLE Radio And EM Transmitter  
**MODEL:** M2001, M2010  
**SERIAL NUMBER:** Antenna Port Conducted: G820EM003737, Radiated and Line Conducted: G820EM005745  
**DATE TESTED:** 2019-01-16 to 2019-01-30

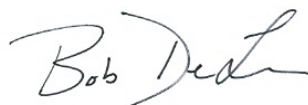
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

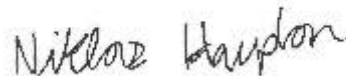
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Approved & Released For  
UL LCC By:



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Engineering Project Handler  
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UL LLC

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 5, and RSS-247 Issue 2.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, North Carolina, USA and 2800 Perimeter Park Dr., Morrisville, North Carolina, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.	2800 Suite Perimeter Park Dr.
<input type="checkbox"/> Chamber A (ISED:2180C-1)	<input checked="" type="checkbox"/> Chamber North (ISED:2180C-3)
<input type="checkbox"/> Chamber C (ISED:2180C-2)	<input type="checkbox"/> Chamber South (ISED:2180C-4)

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Occupied Channel Bandwidth	2.00%
RF output power, conducted	1.3 dB (PK), 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	3.05 dB
Radiated 9KHz to 26000 MHz	4.88 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. EUT DESCRIPTION

The EUT is a handheld controller with EM (28.5 - 42.42kHz) and BLE (2402 - 2480MHz) or 2.4GHz Proprietary (2401 - 2478MHz) transmitters. There are no hardware differences between M2001 and M2010, just SW to enable BLE. Model M2010 supports BLE while model M2001 supports BLE or 2.4GHz proprietary.

This report covers BLE for model M2001 and M2010. Report R11694639-E2 covers 2.4 GHz proprietary for Model M2001.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	7.5	5.62

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antenna, with a maximum gain of +2.2 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v0.12\_1.

### 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions 1-18GHz were performed with the EUT set to low, mid, and high channels. Radiated emission (<1GHz and >18GHz) and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power and PSD as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Worst-case data rates as provided by the client were:

BLE: 1 Mbps.



## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Supply	Magic Leap	M3001	173700055201	NA

### I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB-C	1	USB-C	USB	<3m	None

### TEST SETUP

The EUT is setup as standalone equipment.

### SETUP DIAGRAMS

Please refer to R12707136-EP1 for setup diagrams

## 6. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section 11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3 – 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

Out-of-band emissions in non-restricted bands: ANSI C63.10-2013 Section 11.11 & 6.10.4

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

## 7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	<b>0.009-30MHz</b>	<b>(Loop Ant.)</b>			
AT0059	Active Loop Antenna	EMCO	6502	2018-07-20	2019-07-20
	<b>30-1000 MHz</b>				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2018-08-06	2019-08-06
	<b>1-18 GHz</b>				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2018-04-30	2019-04-30
	<b>18-40 GHz</b>				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2018-11-08	2019-11-08
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2018-11-08	2019-11-08
	<b>Gain-Loss Chains</b>				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2018-09-06	2019-09-06
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2018-05-20	2019-05-20
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2018-03-23	2019-03-23
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2018-09-30	2019-03-31
	<b>Receiver &amp; Software</b>				
SA0027	Spectrum Analyzer	Agilent	N9030A	2018-04-04	2019-04-04
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	<b>Additional Equipment used</b>				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2018-06-19	2019-06-19
s/n 181562858	Environmental Meter	Fisher Brand	14-650-118	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2018-08-21	2019-08-21
PRE0101521 (75141)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2018-08-22	2019-08-22
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2018-06-13	2019-06-13
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
<b>Conducted Room 2</b>					
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2018-04-12	2019-04-12
PWM003 (PRE0137345)	RF Power Meter	Keysight Technologies	N1911A	2018-07-30	2019-07-30
PWS003 (PRE0126442)	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2018-07-30	2019-07-30

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

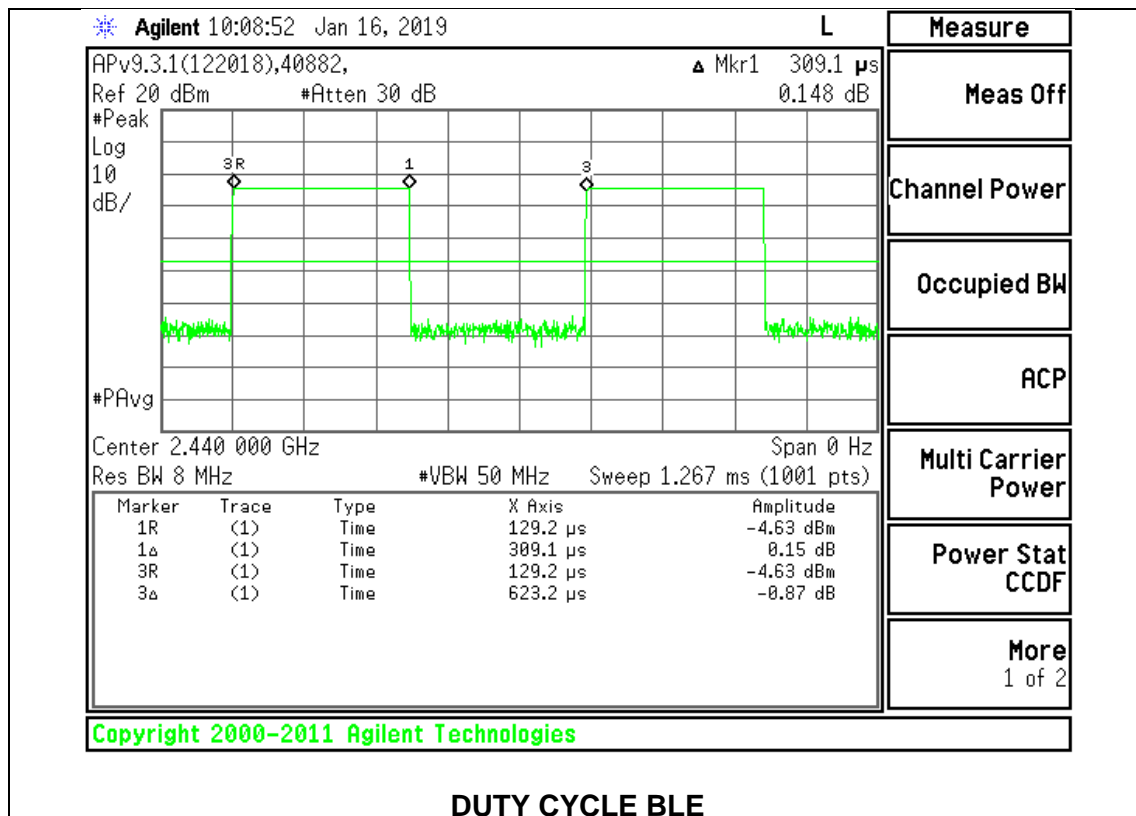
#### PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

#### ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	0.309	0.623	0.496	49.60%	3.05	3.235

#### DUTY CYCLE PLOTS



## 8.2. 99% BANDWIDTH

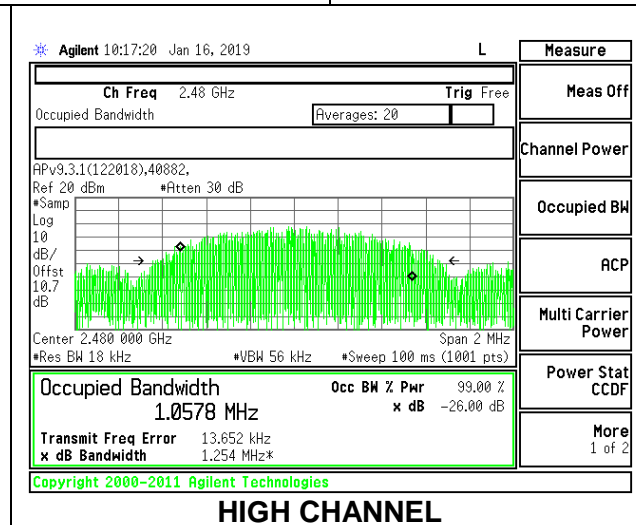
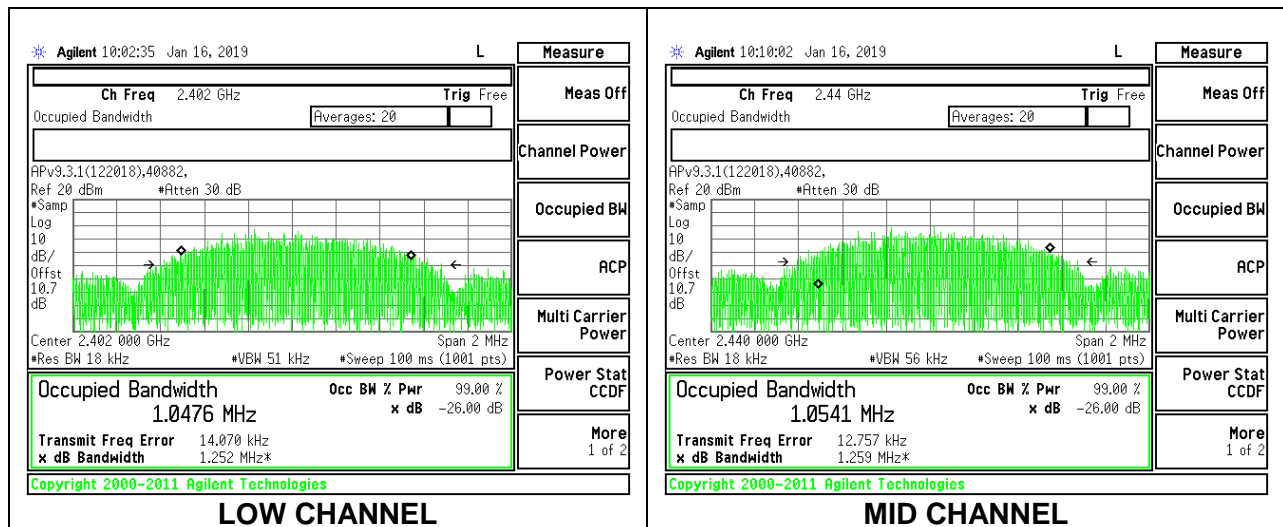
### LIMITS

None; for reporting purposes only.

### RESULTS

#### 8.2.1. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0480
Middle	2440	1.0540
High	2480	1.0580



### 8.3. 6 dB BANDWIDTH

#### LIMITS

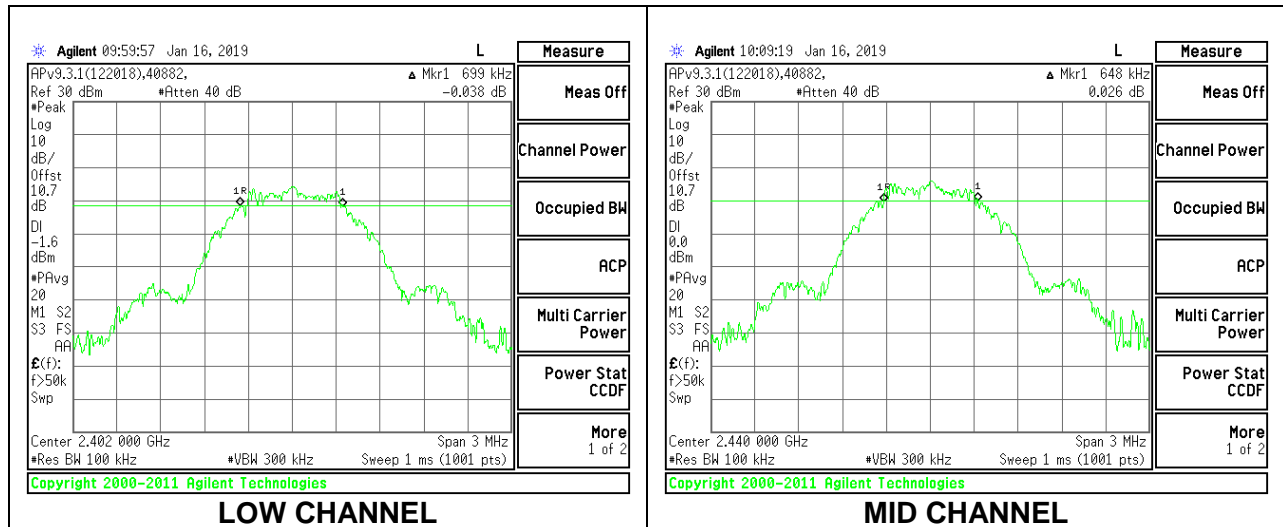
FCC §15.247 (a) (2)  
 RSS-247 5.2 (a)

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

#### RESULTS

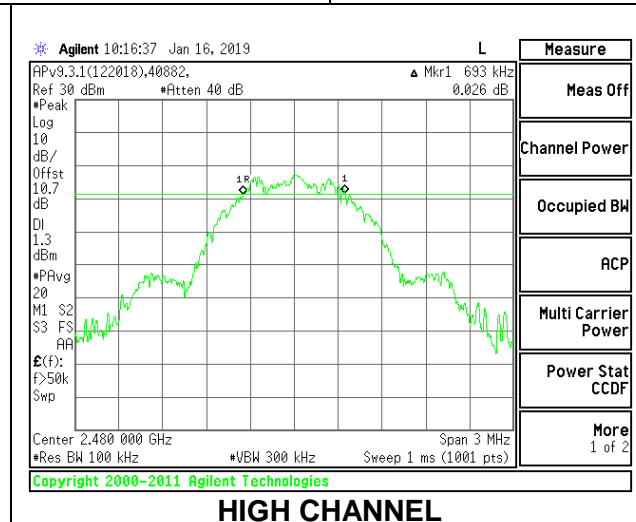
##### 8.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6990	0.5
Middle	2440	0.6480	0.5
High	2480	0.6930	0.5



**LOW CHANNEL**

**MID CHANNEL**



**HIGH CHANNEL**

## 8.4. OUTPUT POWER

### LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

### RESULTS

#### 8.4.1. BLE (1Mbps)

<b>Tested By:</b>	40882
<b>Date:</b>	2019-01-16

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2402	4.5	30	-25.500
Middle	2440	6.2	30	-23.850
High	2480	7.5	30	-22.490



## 8.5. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### RESULTS

#### 8.5.1. BLE (1Mbps)

<b>Tested By:</b>	40882
<b>Date:</b>	2019-01-16

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2402	4.3
Middle	2440	6.0
High	2480	7.4

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## **8.6. POWER SPECTRAL DENSITY**

### **LIMITS**

FCC §15.247 (e)

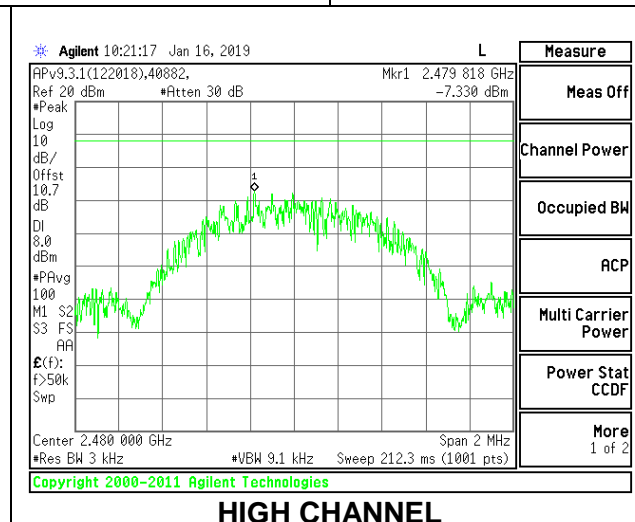
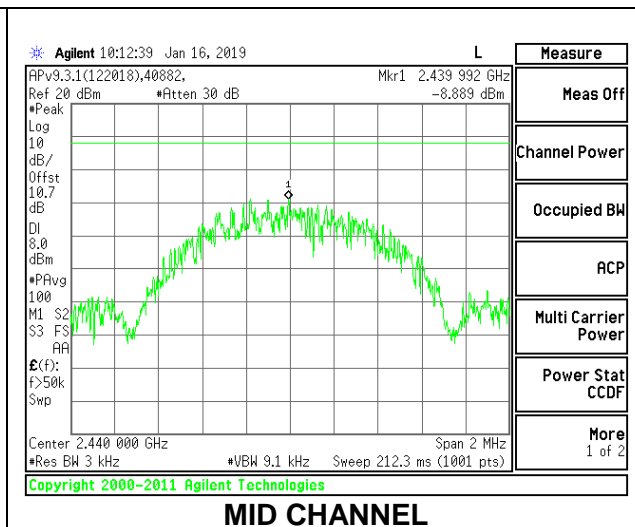
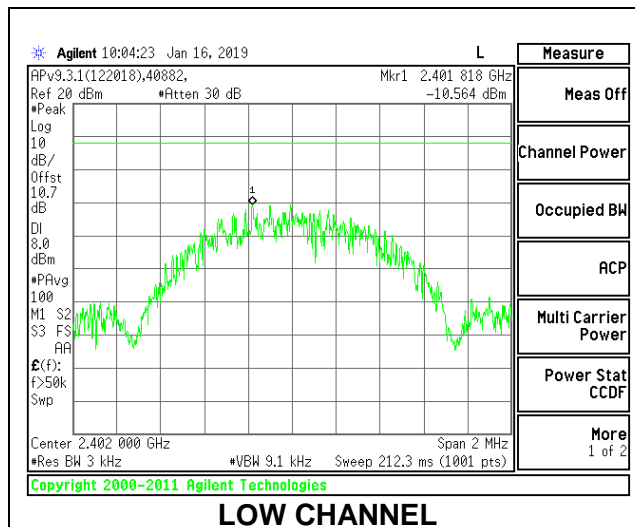
RSS-247 (5.2) (b)

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

**RESULTS**

**8.6.1. BLE (1Mbps)**

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-10.56	8	-18.56
Middle	2440	-8.89	8	-16.89
High	2480	-7.33	8	-15.33



## 8.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

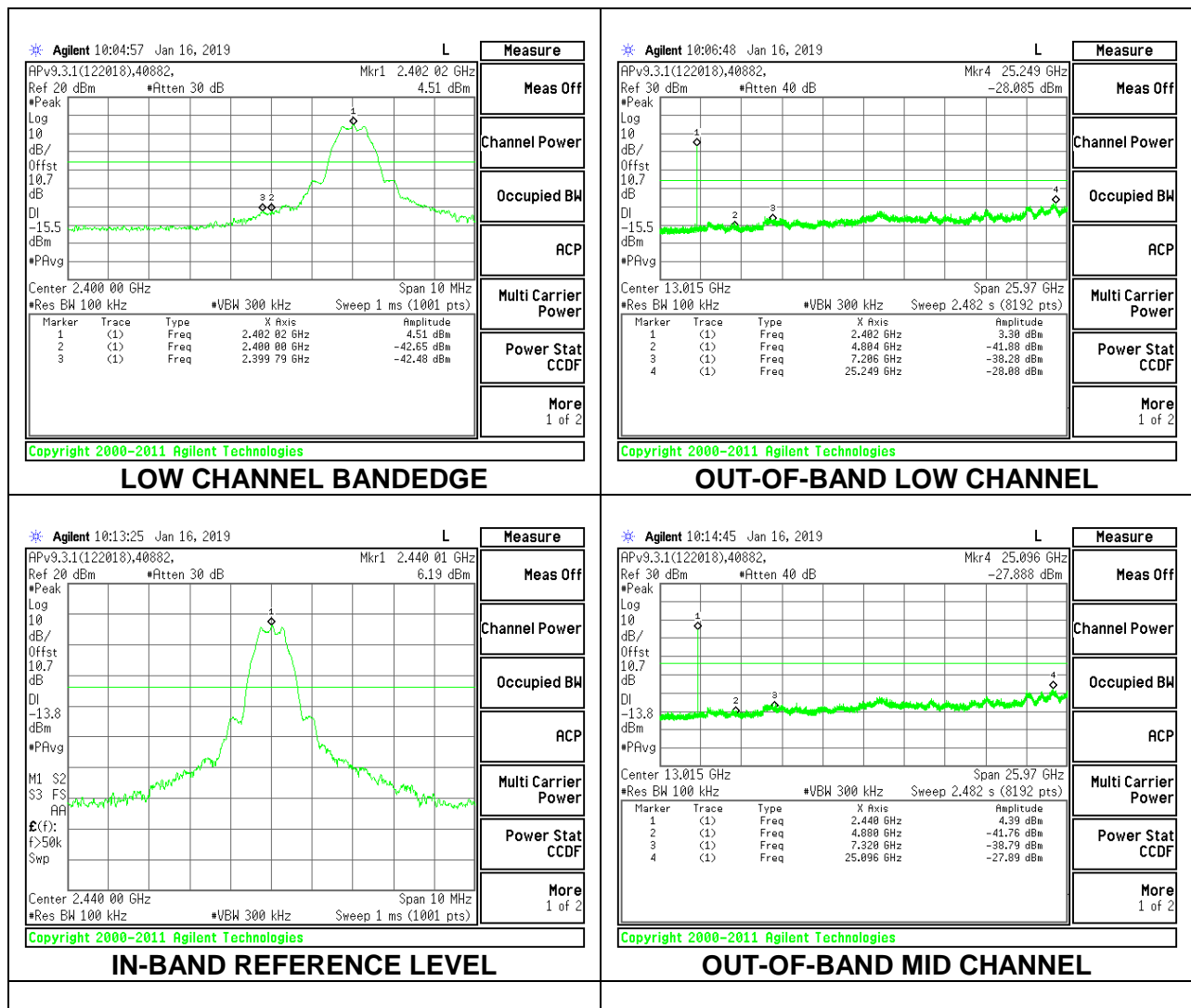
FCC §15.247 (d)

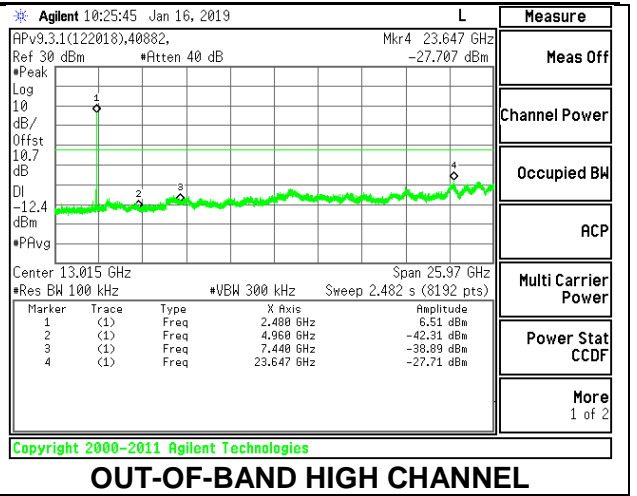
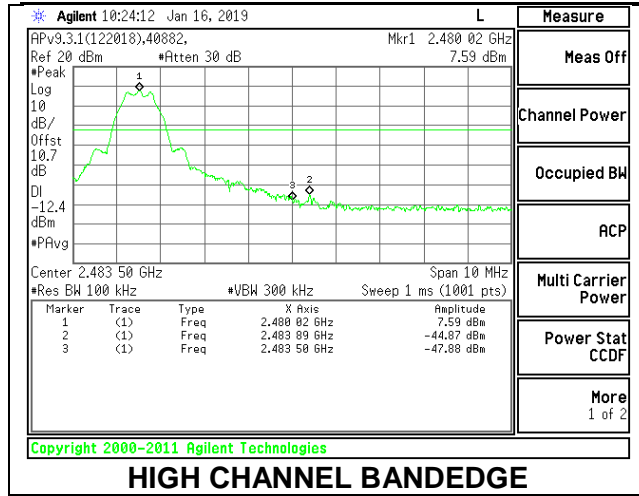
RSS-247 5.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

### RESULTS

#### 8.7.1. BLE (1Mbps)





## 9. RADIATED TEST RESULTS

### 9.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak and/or quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was RMS.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

**KDB 414788 OATS and Chamber Correlation Justification**

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

**Note**

Project number on radiated emissions plots is incorrect and should state 12707136.

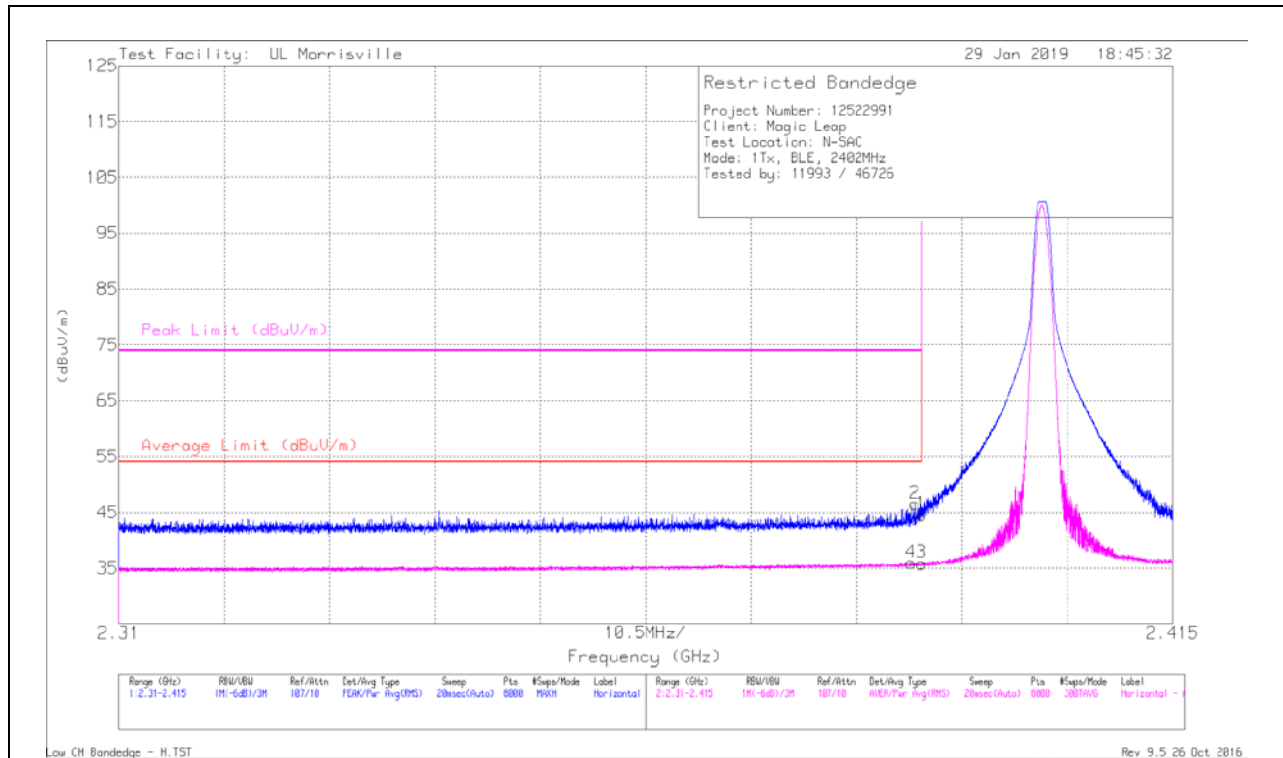
## 9.2. TRANSMITTER ABOVE 1 GHz

### 9.2.1. BLE (1Mbps)

#### Antenna 1

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT

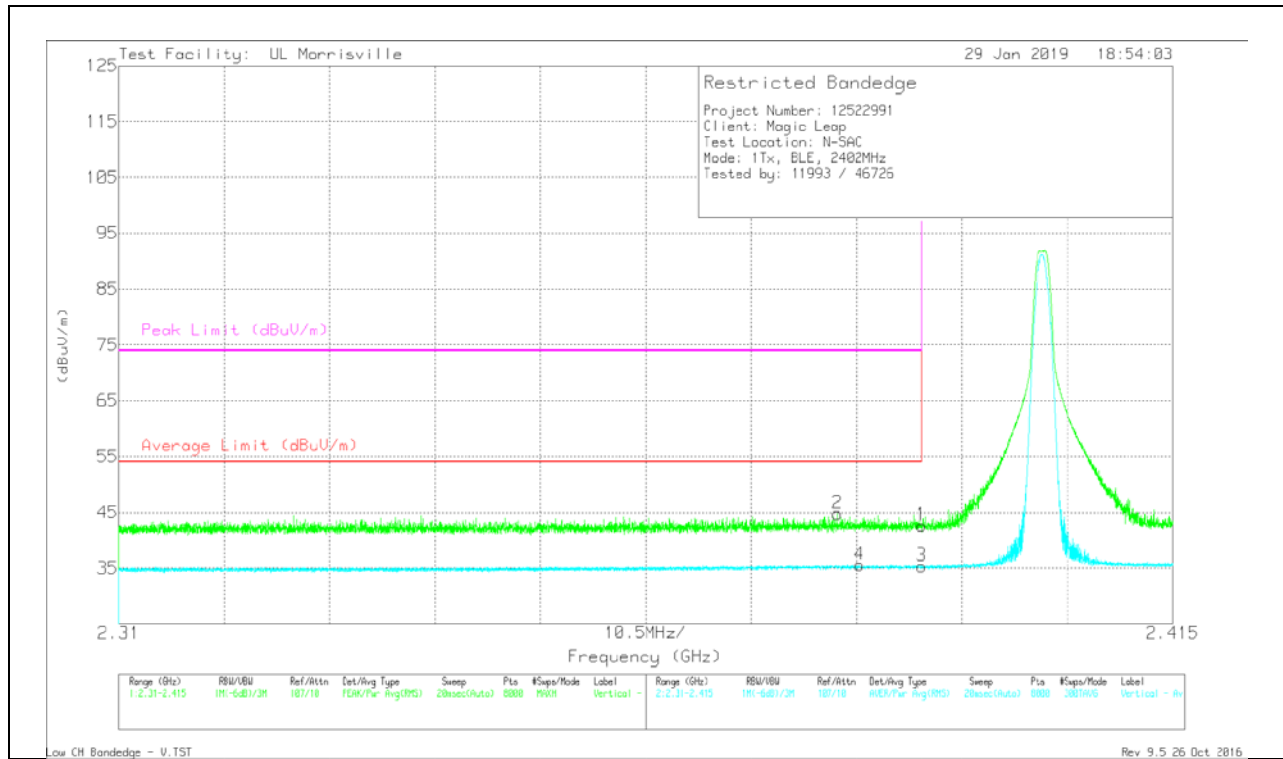


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dBm)	Amp/Chl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.39	37.13	Pk	32	-24.5	0	44.63	-	-	74	-29.37	188	169	H
2	** 2.389	39.03	Pk	32	-24.5	0	46.53	-	-	74	-27.47	188	169	H
3	** 2.39	25.35	RMS	32	-24.5	3.05	35.9	54	-18.1	-	-	188	169	H
4	*** 2.389	25.43	RMS	32	-24.5	3.05	35.98	54	-18.02	-	-	188	169	H

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 \*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band  
 Pk - Peak detector  
 RMS - RMS detection



### VERTICAL RESULT

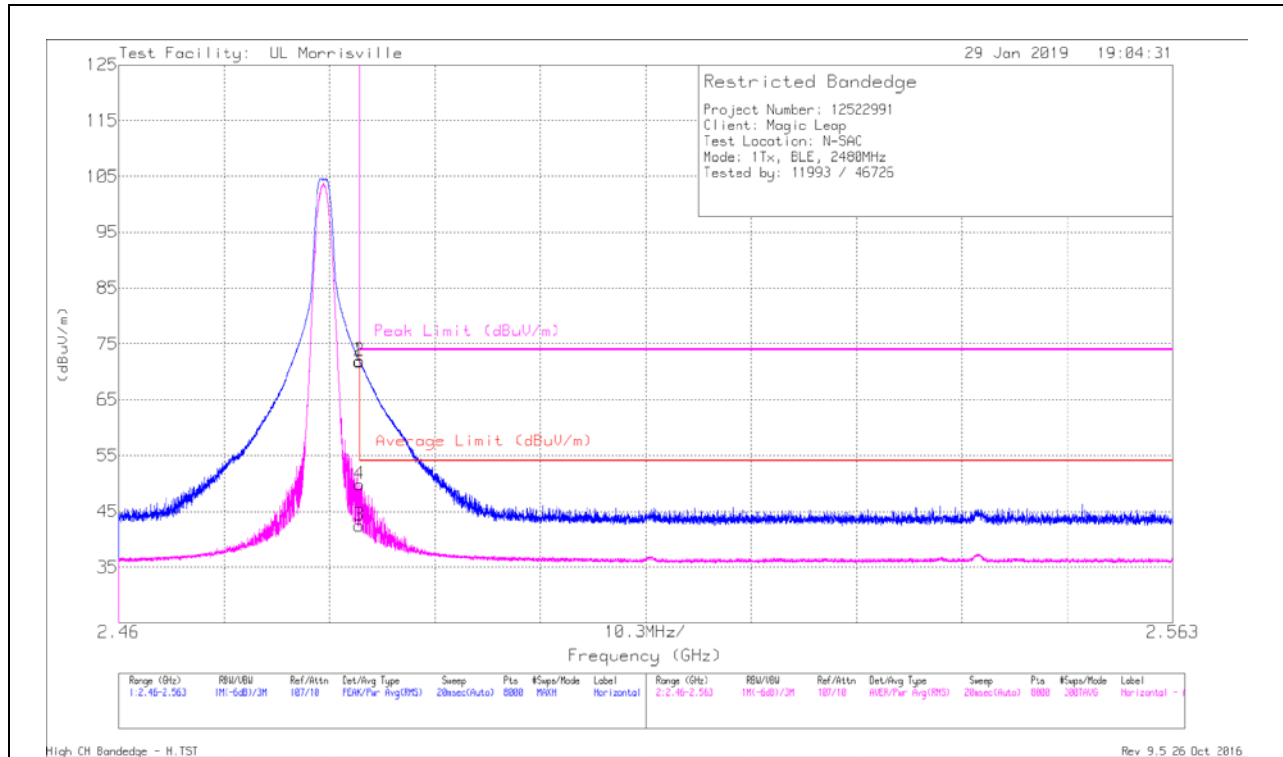


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dBm)	Amp/Chl/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.39	35.14	Pk	32	-24.5	0	42.64	-	-	74	-31.36	138	379	V
2	** 2.382	37.27	Pk	32	-24.5	0	44.77	-	-	74	-29.23	138	379	V
3	** 2.39	24.84	RMS	32	-24.5	3.05	35.39	54	-18.61	-	-	138	379	V
4	** 2.384	25.06	RMS	32	-24.5	3.05	35.61	54	-18.39	-	-	138	379	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 \*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band  
 Pk - Peak detector  
 RMS - RMS detection

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dBm)	Amp/Cb/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.484	63.84	Pk	32.4	-24.4	0	71.84	-	-	74	-2.16	0	103	H
2	** 2.484	63.95	Pk	32.4	-24.4	0	71.95	-	-	74	-2.05	0	103	H
3	** 2.484	31.41	RMS	32.4	-24.4	3.05	42.46	54	-11.54	-	-	0	103	H
4	** 2.484	38.77	RMS	32.4	-24.4	3.05	49.82	54	-4.18	-	-	0	103	H

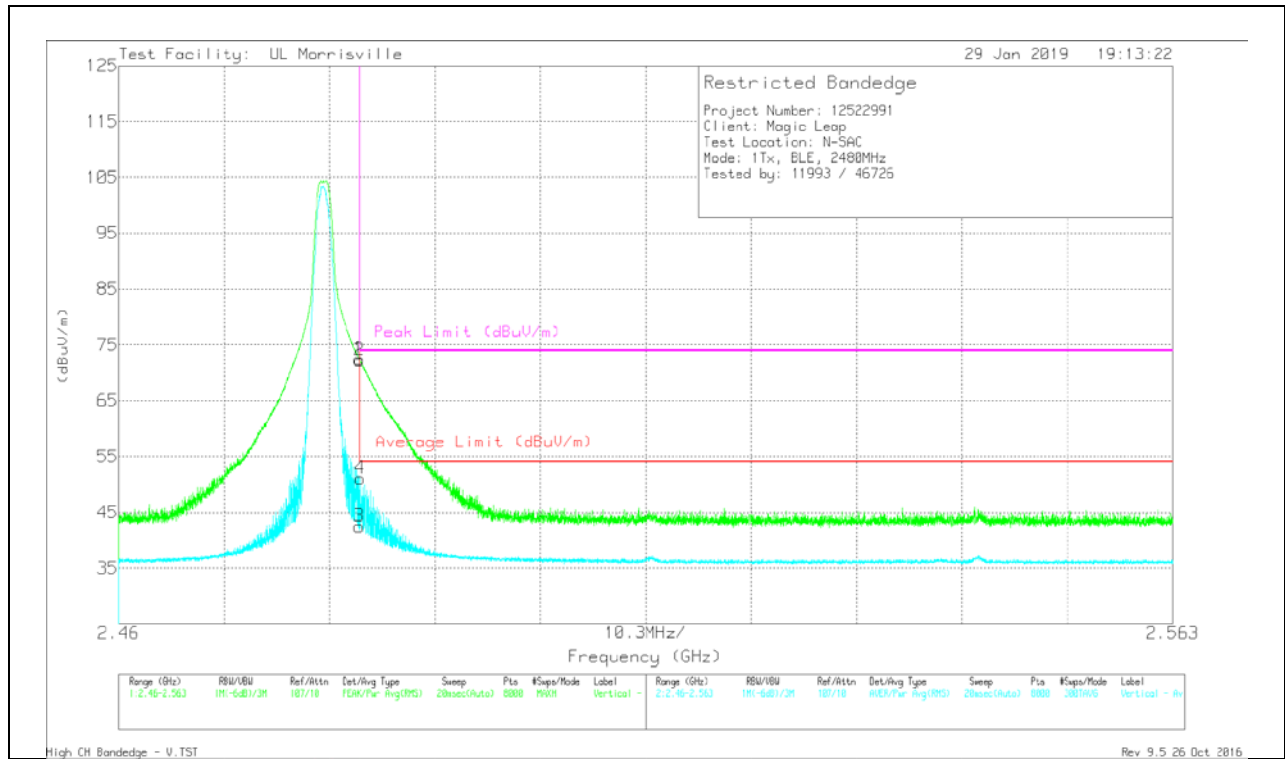
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

RMS - RMS detection

### VERTICAL RESULT

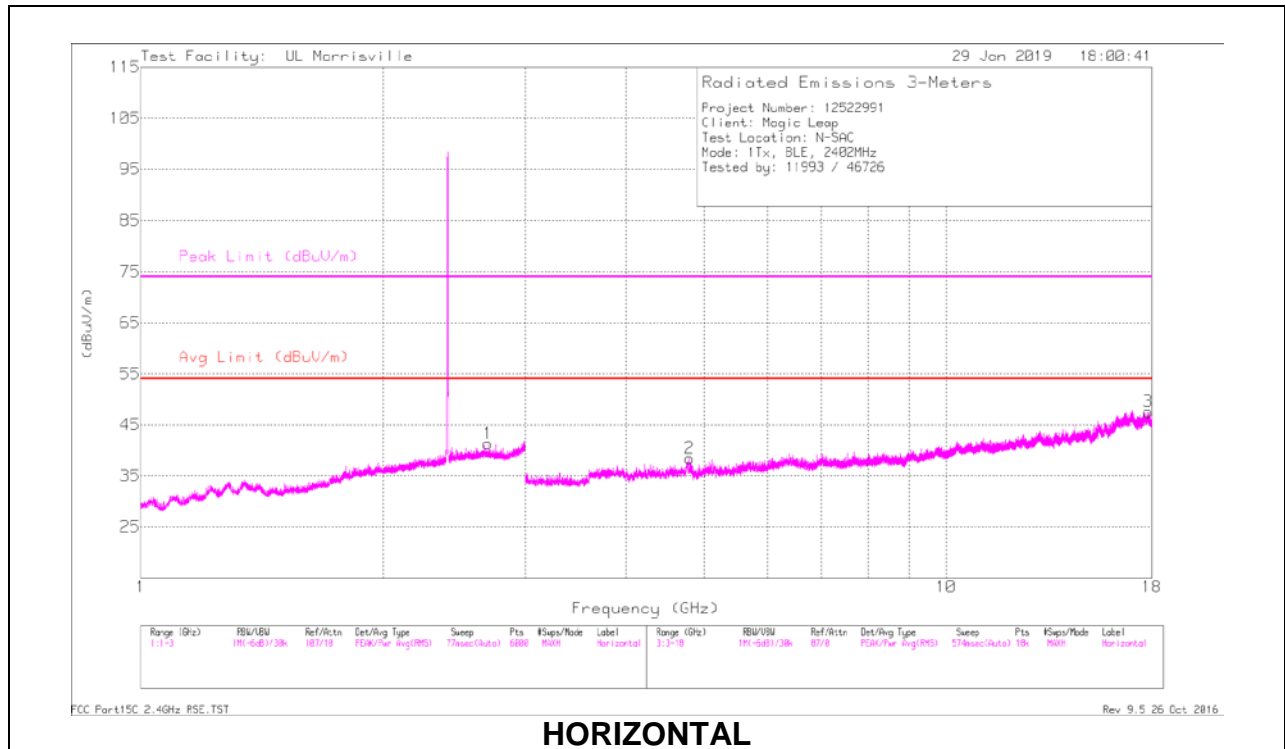


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dBm)	Amp/Chl/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.484	64.48	Pk	32.4	-24.4	0	72.48	-	-	74	-1.52	156	234	V
2	** 2.484	64.24	Pk	32.4	-24.4	0	72.24	-	-	74	-1.76	156	234	V
3	** 2.484	31.41	RMS	32.4	-24.4	3.05	42.46	54	-11.54	-	-	156	234	V
4	** 2.484	40.04	RMS	32.4	-24.4	3.05	51.09	54	-2.91	-	-	156	234	V

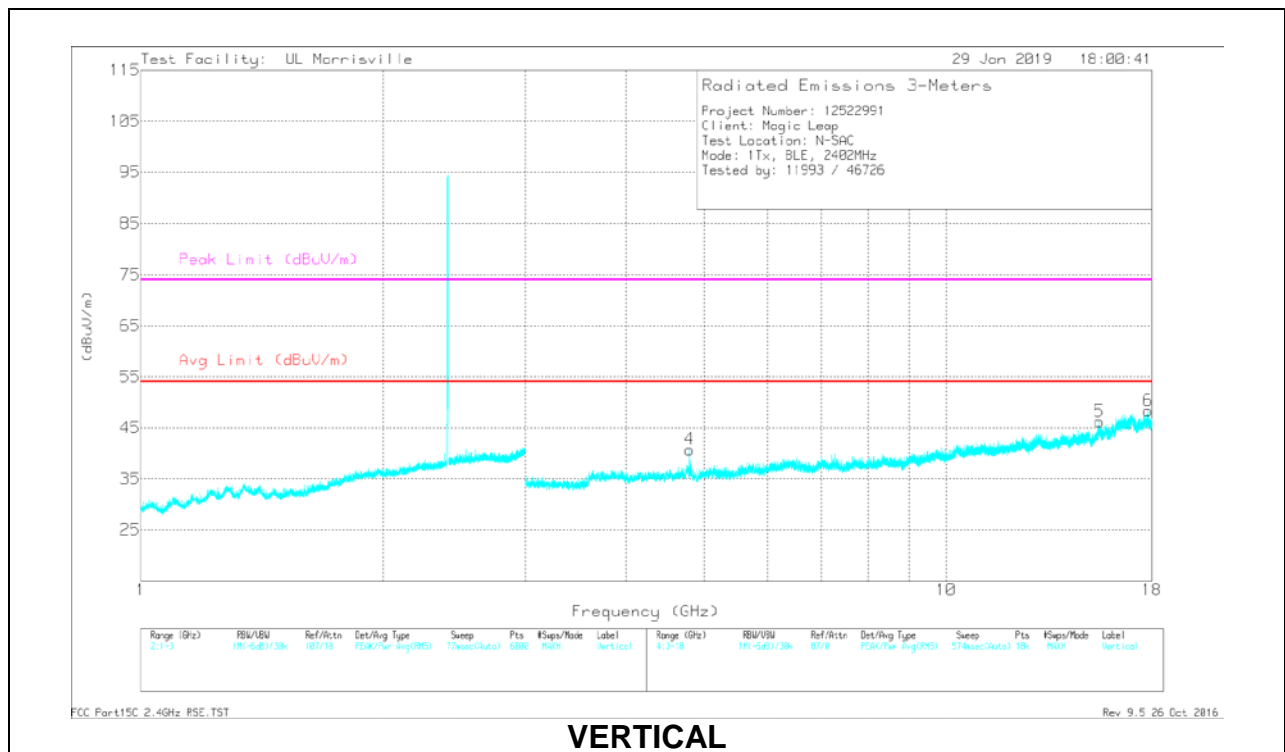
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 \*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band  
 Pk - Peak detector  
 RMS - RMS detection

**HARMONICS AND SPURIOUS EMISSIONS**

**LOW CHANNEL RESULTS**



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.697	37.26	PK2	32.4	-24	0	45.66	-	-	74	-28.34	113	254	H
	*** 2.698	25.52	MAv1	32.5	-24	3.05	37.07	54	-16.93	-	-	113	254	H
2	** 4.804	43.38	PK2	34.1	-31.8	0	45.68	-	-	74	-28.32	299	108	H
	*** 4.804	32.99	MAv1	34.1	-31.8	3.05	38.34	54	-15.66	-	-	299	108	H
3	** 17.804	34.23	PK2	41.6	-23	0	52.83	-	-	74	-21.17	81	110	H
	*** 17.805	22.99	MAv1	41.6	-23	3.05	44.64	54	-9.36	-	-	81	110	H
4	** 4.804	45.71	PK2	34.1	-31.8	0	48.01	-	-	74	-25.99	31	106	V
	*** 4.804	36.09	MAv1	34.1	-31.8	3.05	41.44	54	-12.56	-	-	31	106	V
5	** 15.492	34.8	PK2	40.2	-24.1	0	50.9	-	-	74	-23.1	11	384	V
	*** 15.489	23.55	MAv1	40.2	-24.1	3.05	42.7	54	-11.3	-	-	11	384	V
6	** 17.823	34.64	PK2	41.6	-22.6	0	53.64	-	-	74	-20.36	111	372	V
	*** 17.822	23.32	MAv1	41.6	-22.6	3.05	45.37	54	-8.63	-	-	111	372	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

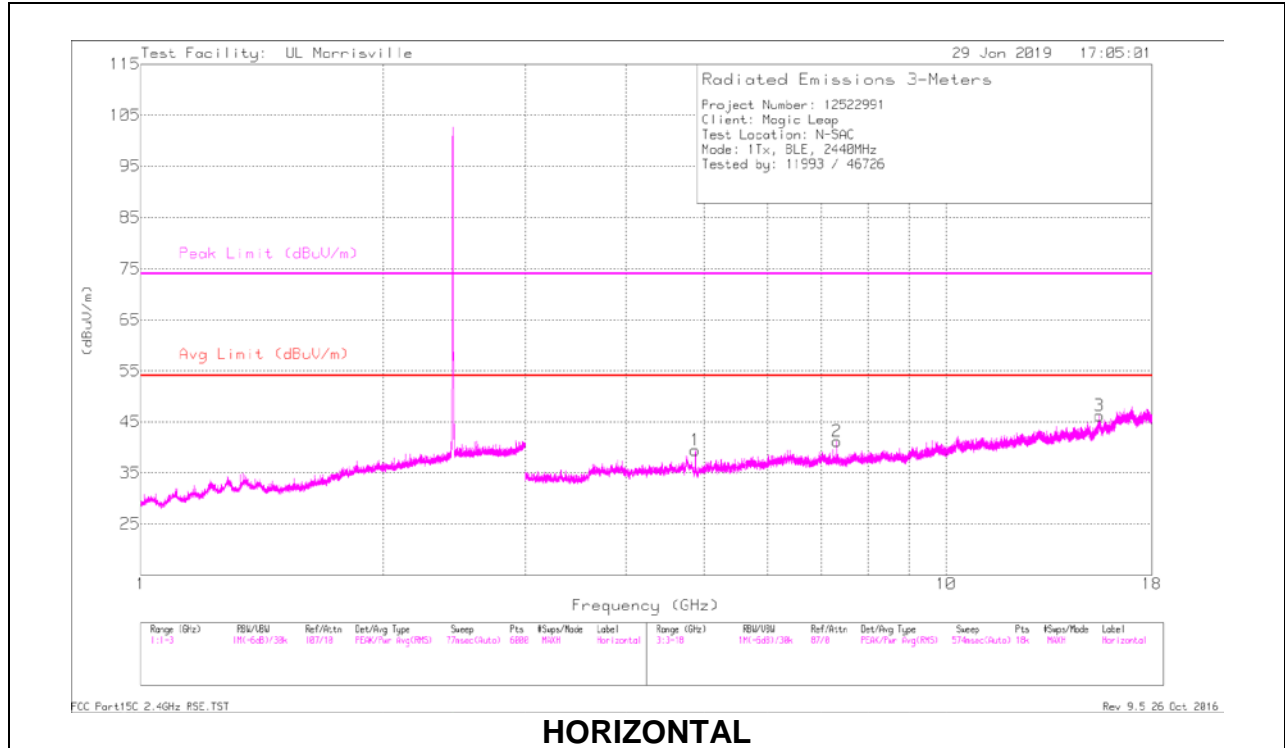
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Av - Average detection

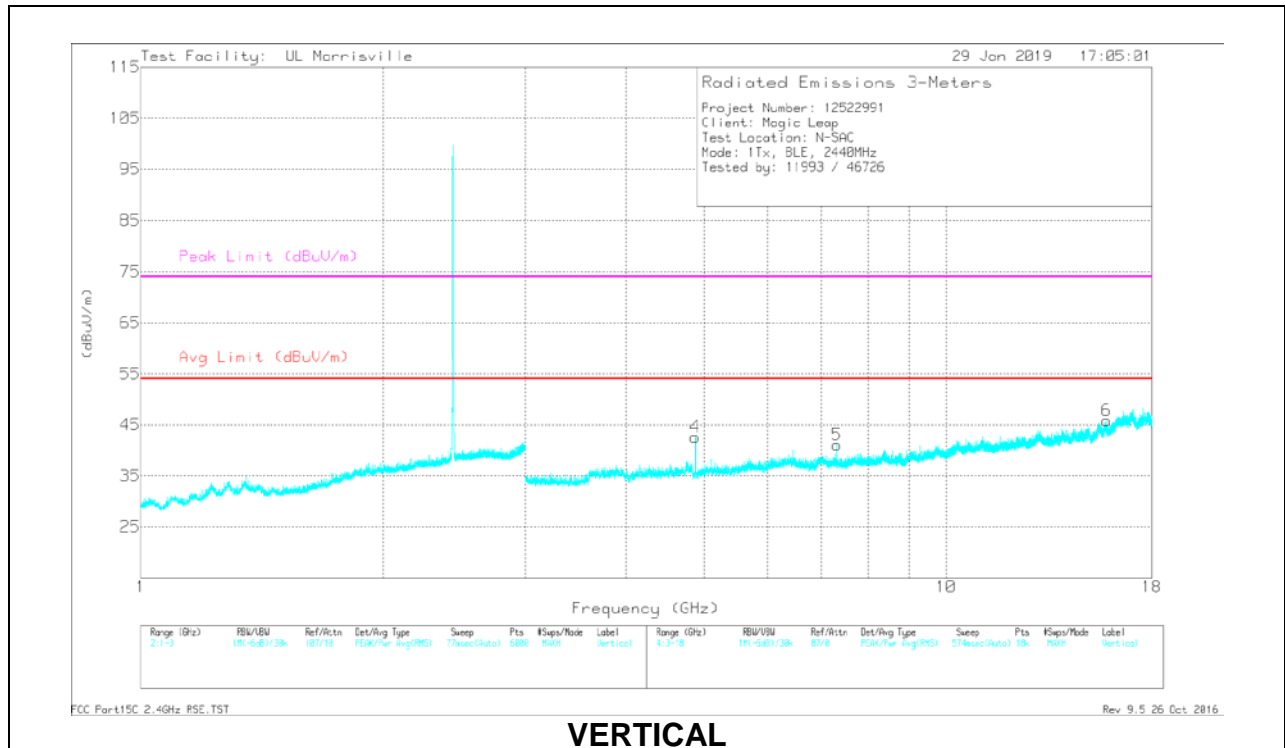
PK2 - Maximum Peak

MAv1 - Maximum RMS Average

### MID CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 4.88	43.56	PK2	34.1	-31.6	0	46.06	-	-	74	-27.94	316	106	H
	*** 4.88	32.81	MAv1	34.1	-31.6	3.05	38.36	54	-15.64	-	-	316	106	H
2	*** 7.32	39.6	PK2	35.6	-29.2	0	46	-	-	74	-28	42	117	H
	*** 7.319	28.57	MAv1	35.6	-29.2	3.05	38.02	54	-15.98	-	-	42	117	H
3	*** 15.486	36.2	PK2	40.2	-24.1	0	52.3	-	-	74	-21.7	189	219	H
	*** 15.486	24.02	MAv1	40.2	-24.1	3.05	43.17	54	-10.83	-	-	189	219	H
4	*** 4.88	45.77	PK2	34.1	-31.6	0	48.27	-	-	74	-25.73	106	102	V
	*** 4.88	37.02	MAv1	34.1	-31.6	3.05	42.57	54	-11.43	-	-	106	102	V
5	*** 7.319	40.78	PK2	35.6	-29.2	0	47.18	-	-	74	-26.82	198	272	V
	*** 7.319	29.86	MAv1	35.6	-29.2	3.05	39.31	54	-14.69	-	-	198	272	V
6	*** 15.814	36.58	PK2	40.2	-25.1	0	51.68	-	-	74	-22.32	281	385	V
	*** 15.815	24.86	MAv1	40.2	-25.2	3.05	42.91	54	-11.09	-	-	281	385	V

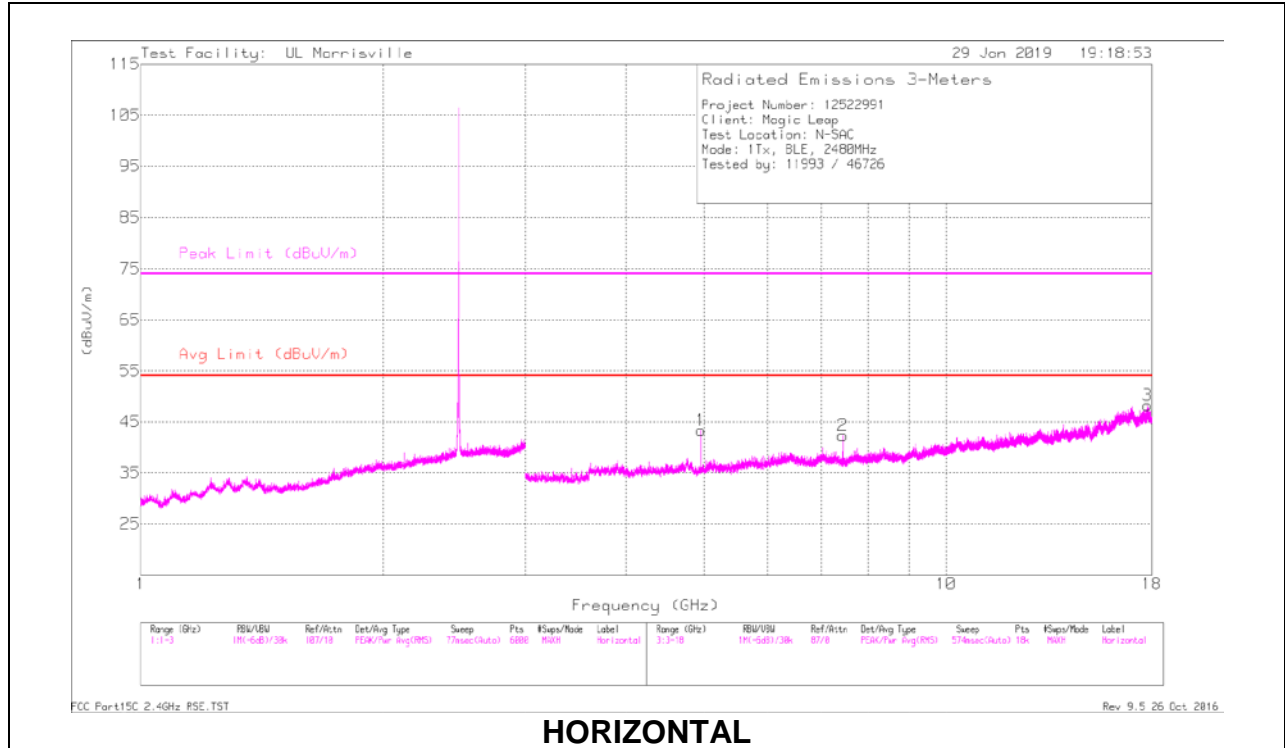
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

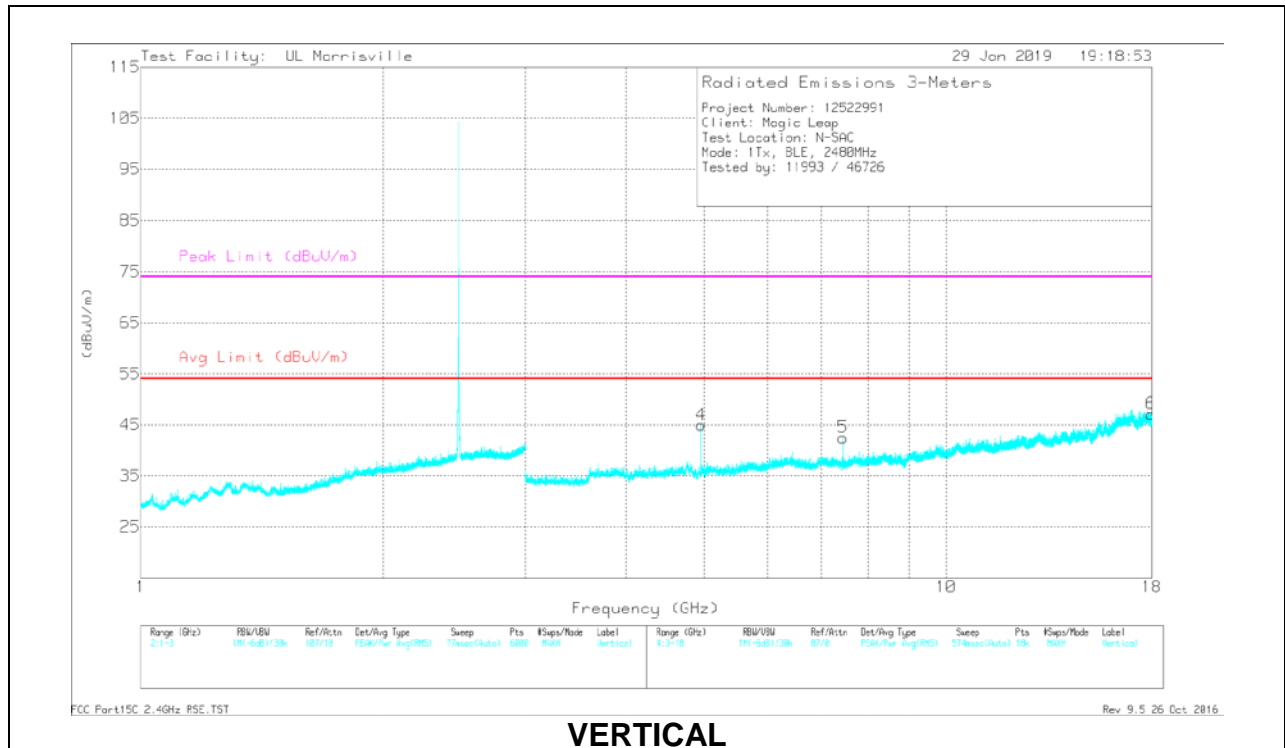
PK2 - Maximum Peak

MAv1 - Maximum RMS Average

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**



**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 AF (dB/m)	Amp/Cbl/Filtr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 4.961	46.78	PK2	34.1	-32.5	0	48.38	-	-	74	-25.62	302	111	H
	*** 4.96	38.52	MAv1	34.1	-32.5	3.05	43.17	54	-10.83	-	-	302	111	H
2	*** 7.439	41.22	PK2	35.6	-29.2	0	47.62	-	-	74	-26.38	44	106	H
	*** 7.439	30.37	MAv1	35.6	-29.2	3.05	39.82	54	-14.18	-	-	44	106	H
3	** 17.784	34.91	PK2	41.6	-23.1	0	53.41	-	-	74	-20.59	78	295	H
	** 17.781	23.51	MAv1	41.6	-23.1	3.05	45.06	54	-8.94	-	-	78	295	H
4	** 4.959	46.96	PK2	34.1	-32.5	0	48.56	-	-	74	-25.44	182	121	V
	*** 4.96	37.64	MAv1	34.1	-32.5	3.05	42.29	54	-11.71	-	-	182	121	V
5	*** 7.439	43.21	PK2	35.6	-29.2	0	49.61	-	-	74	-24.39	104	107	V
	*** 7.439	33.59	MAv1	35.6	-29.2	3.05	43.04	54	-10.96	-	-	104	107	V
6	** 17.969	35.87	PK2	41.4	-24.4	0	52.87	-	-	74	-21.13	286	195	V
	** 17.971	24.03	MAv1	41.4	-24.4	3.05	44.08	54	-9.92	-	-	286	195	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

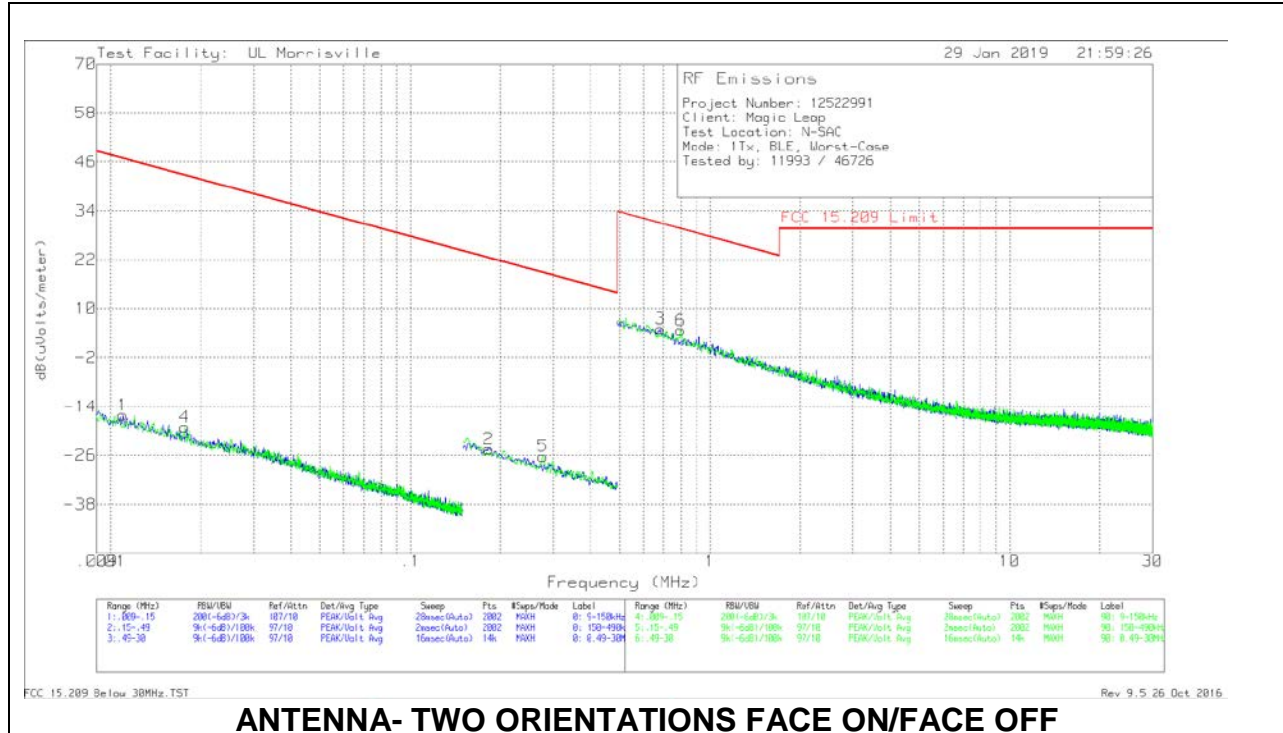
PK2 - Maximum Peak

MAv1 - Maximum RMS Average

### 9.3. Worst Case Below 30MHz

#### SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40\*Log (test distance / specification distance).



#### ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

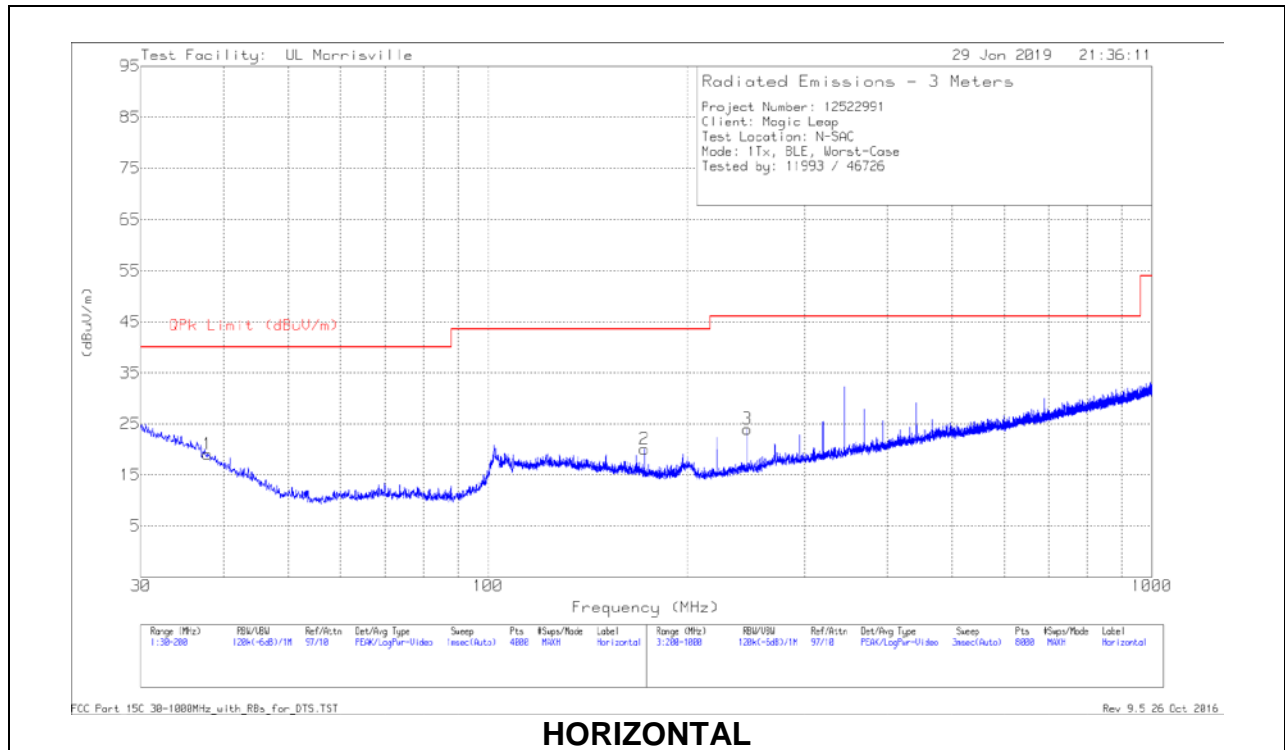
#### Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0059 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uV/m)	FCC 15.209 QP Limit	FCC 15.209 AV Limit	FCC 15.209 PK Limit	Worst-Case Margin (dB)	Azimuth (Degs)
1	.01096	44.98	Pk	18.8	.1	-80	-16.12	-	46.81	66.81	-62.93	0-360
4	.01768	45.23	Pk	15.6	.1	-80	-19.07	-	42.66	62.66	-61.73	0-360
2	.18247	45.12	Pk	10.3	.1	-80	-24.48	-	22.38	42.38	-46.86	0-360
5	.27674	43.47	Pk	10.2	.1	-80	-26.23	-	18.76	38.76	-44.99	0-360
3	.68394	34.57	Pk	10.4	.1	-40	5.07	30.9	-	-	-25.83	0-360
6	.79777	34.27	Pk	10.3	.1	-40	4.67	29.57	-	-	-24.9	0-360

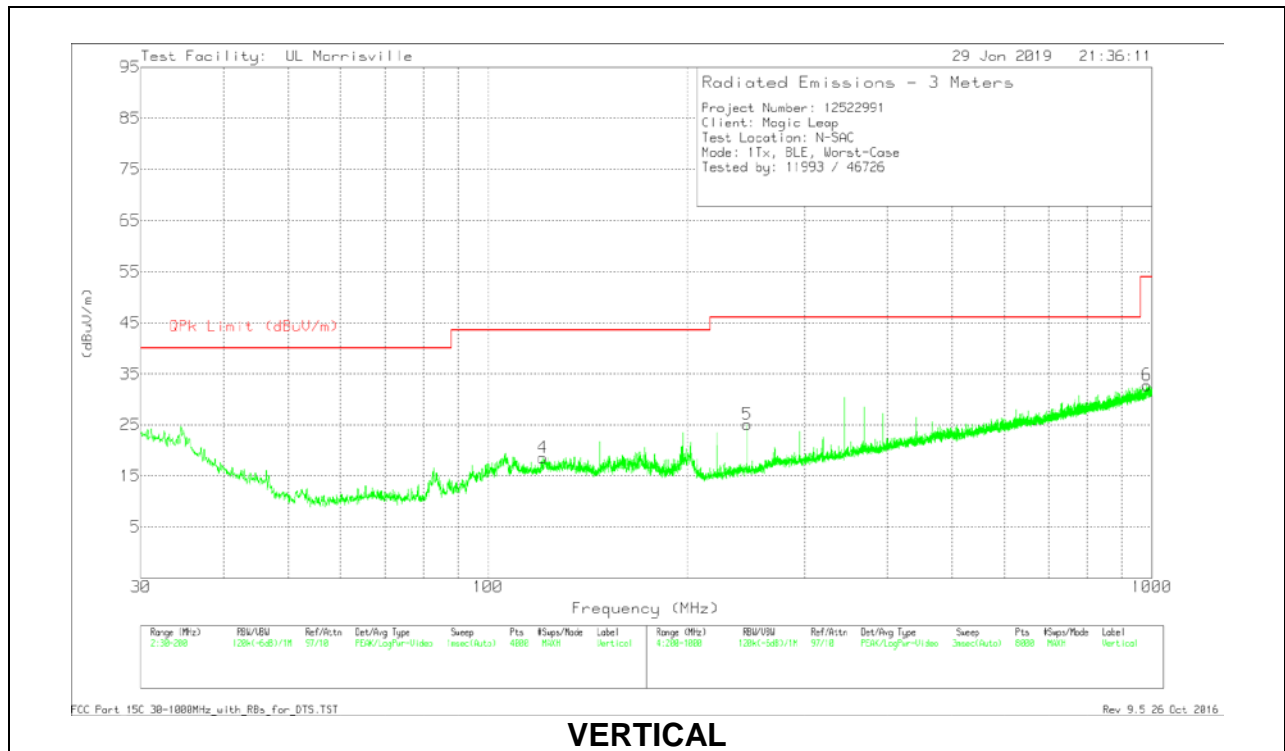
Pk - Peak Detector

### 9.4. Worst Case Below 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



**HORIZONTAL**



**VERTICAL**

**Below 1GHz Data**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 ACF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 37.7795	28.54	Pk	22.2	-31.7	19.04	40	-20.96	0-360	299	H
2	* ** 172.0293	32.33	Pk	18.1	-30.4	20.03	43.52	-23.49	0-360	199	H
4	* ** 120.9735	29.37	Pk	20	-30.8	18.57	43.52	-24.95	0-360	102	V
3	* ** 245.7059	35.59	Pk	18.2	-29.8	23.99	46.02	-22.03	0-360	103	H
5	* ** 245.7059	36.67	Pk	18.2	-29.8	25.07	46.02	-20.95	0-360	199	V
6	* ** 983.9019	28.39	Pk	29.7	-25.3	32.79	53.97	-21.18	0-360	299	V

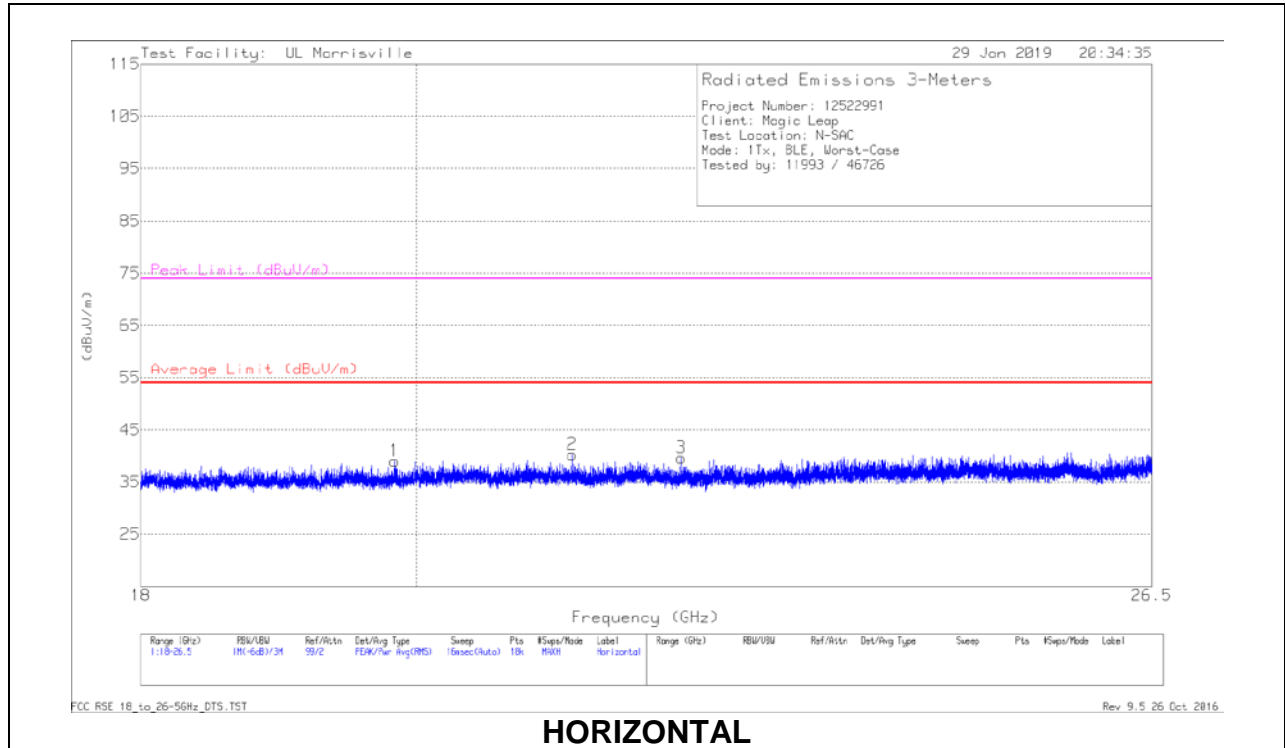
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

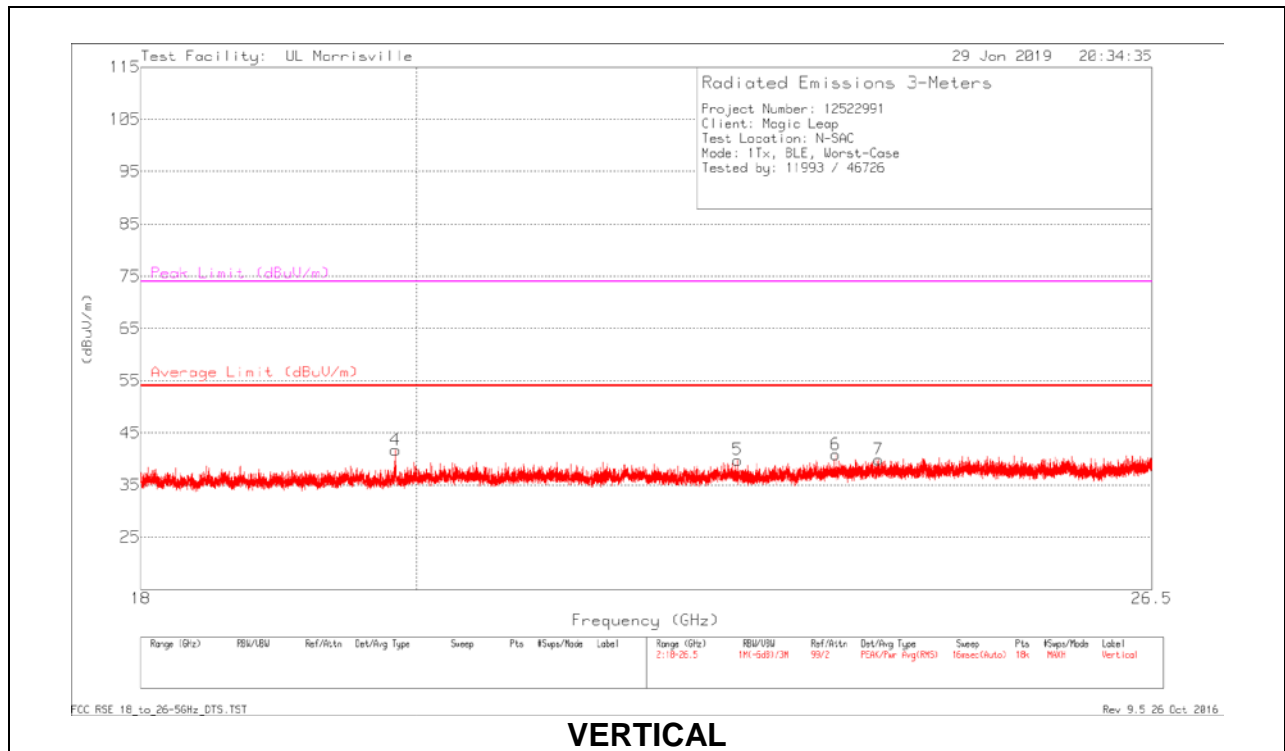
Pk – Peak Detector

### 9.5. Worst Case 18-26 GHz

#### SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



**HORIZONTAL**



**VERTICAL**

**18 – 26GHz DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 19.838	45.94	Pk	32.8	-39.7	39.04	54	-14.96	74	-34.96	0-360	299	H
2	** 21.23	46.87	Pk	33	-39.6	40.27	54	-13.73	74	-33.73	0-360	299	H
3	** 22.134	45.45	Pk	33.4	-39.2	39.65	54	-14.35	74	-34.35	0-360	299	H
4	*** 19.842	48.56	Pk	32.8	-39.7	41.66	54	-12.34	74	-32.34	0-360	252	V
5	*** 22.617	45.59	Pk	33.4	-39.2	39.79	54	-14.21	74	-34.21	0-360	152	V
7	*** 23.867	44.88	Pk	34	-39	39.88	54	-14.12	74	-34.12	0-360	252	V
6	23.48	46.04	Pk	34	-39.2	40.84	54	-13.16	74	-33.16	0-360	252	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

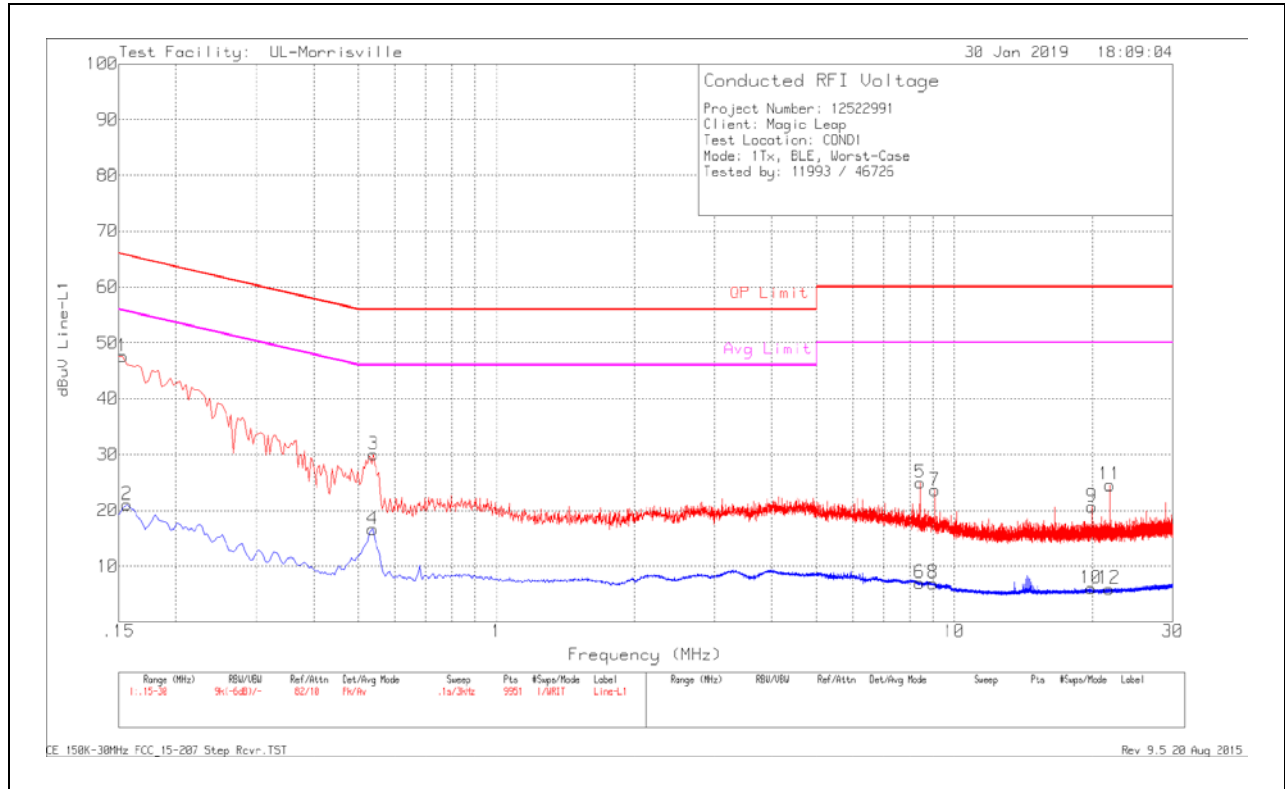
### Note

Project number on line conducted emissions plots is incorrect and should state 12707136.

**RESULTS**

**10.1.1. AC Power Line Norm**

**LINE 1 RESULTS**

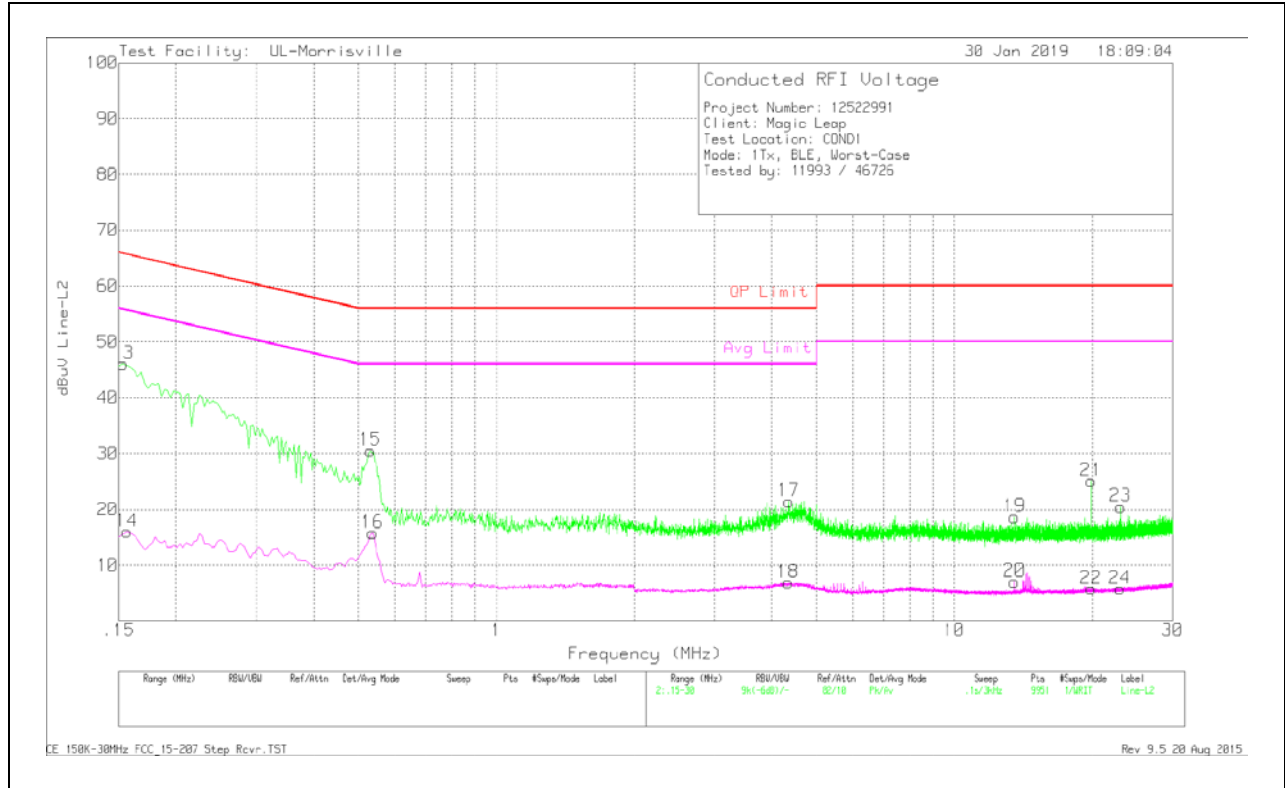


Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
1	.153	37.4	Pk	.2	10	47.6	65.84	-18.24	-	-
2	.156	10.86	Av	.2	10	21.06	-	-	55.67	-34.61
3	.54	20.03	Pk	0	10	30.03	56	-25.97	-	-
4	.537	6.59	Av	0	10	16.59	-	-	46	-29.41
5	8.427	14.54	Pk	.1	10.3	24.94	60	-35.06	-	-
6	8.4	-3.35	Av	.1	10.3	7.05	-	-	50	-42.95
7	9.069	13.23	Pk	.1	10.3	23.63	60	-36.37	-	-
8	8.979	-3.45	Av	.1	10.3	6.95	-	-	50	-43.05
9	19.971	9.95	Pk	.2	10.5	20.65	60	-39.35	-	-
10	19.887	-4.66	Av	.2	10.5	6.04	-	-	50	-43.96
11	21.873	13.75	Pk	.2	10.6	24.55	60	-35.45	-	-
12	21.807	-4.83	Av	.2	10.6	5.97	-	-	50	-44.03

Pk - Peak detector  
 Av- Average detector



**LINE 2 RESULTS**



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading (dBuV)	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
13	.153	35.87	Pk	.2	10	46.07	65.84	-19.77	-	-
14	.156	5.79	Av	.2	10	15.99	-	-	55.67	-39.68
15	.531	20.56	Pk	0	10	30.56	56	-25.44	-	-
16	.537	5.79	Av	0	10	15.79	-	-	46	-30.21
17	4.347	11.35	Pk	0	10.1	21.45	56	-34.55	-	-
18	4.341	-3.22	Av	0	10.1	6.88	-	-	46	-39.12
19	13.56	8.15	Pk	.1	10.4	18.65	60	-41.35	-	-
20	13.56	-3.42	Av	.1	10.4	7.08	-	-	50	-42.92
21	19.884	14.48	Pk	.1	10.5	25.08	60	-34.92	-	-
22	19.896	-4.79	Av	.1	10.5	5.81	-	-	50	-44.19
23	23.073	9.69	Pk	.2	10.6	20.49	60	-39.51	-	-
24	23.007	-4.98	Av	.2	10.6	5.82	-	-	50	-44.18

Pk - Peak detector  
 Av- Average detector

## 11. SETUP PHOTOS

Please refer to R12707136-EP1 for setup photos

**END OF TEST REPORT**