



# **TEST REPORT**

**Report Number. :** R13551782-E1

**Applicant :** Lutron Electronics CO Inc.  
7200 Suter Rd.  
Coopersburg, PA, 18036-1249, USA

**Model :** DSW1

**FCC ID :** JPZ0135

**IC :** 2851A-JPZ0135

**EUT Description :** RF Switch

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C: 2020  
ISED RSS-247 ISSUE 2: 2017  
ISED RSS-GEN ISSUE 5 +Amendment 1: 2019

**Date Of Issue:**  
2021-03-04

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-02-05	Initial Issue	Haley Ackun
V2	2021-03-04	Updated Model Info	Haley Ackun

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Lutron Electronics CO. Inc.  
7200 Suter Rd.  
Coopersburg, PA, 18036-1249, USA

**EUT DESCRIPTION:** RF Switch

**MODEL:** DSW1

**SERIAL NUMBER:** Radiated: 4D7BR2047207250082  
Conducted: C1

**SAMPLE RECEIPT DATE:** 2020-12-30

**DATE TESTED:** 2020-12-30 TO 2021-01-27

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2020	Compliant
ISED RSS-247 Issue 2: 2017	Compliant
ISED RSS-GEN Issue 5 + Amendment 1: 2019	Compliant

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.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

Approved & Released For  
UL LLC By:



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Project Engineer  
Consumer Technology Division  
UL LLC

Prepared By:



Haley Ackun  
Laboratory Engineer  
Consumer Technology Division  
UL LLC

## 2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

### 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15: 2020, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5+ Amendment 1: 2019, and RSS-247 Issue 2: 2017.

### 4. 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., Suite B, 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.
<b>ISED Site Code: 2180C</b>	
<input type="checkbox"/> Chamber A RTP	<input checked="" type="checkbox"/> North Chamber
<input type="checkbox"/> Chamber C RTP	<input checked="" type="checkbox"/> South Chamber

The above test sites and facilities are covered under FCC Test Firm Registration # 703469. Chambers above are covered under Industry Canada company address and respective code.

UL LLC (RTP), CABID US00067, is accredited by NVLAP, Laboratory Code 200246-0

## 5. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

### 5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
RF output power, radiated (SAC) < 180 MHz	6.18 dB
RF output power, radiated (SAC) >=180 MHz	3.23 dB
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%
Time	3.39%

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



## 5.4. 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.

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

## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

The EUT is an RF switch that supports BLE and 802.15.4. This report only covers 802.15.4.

### 6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2405 - 2480	802.15.4	18.55	71.61

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole on a PCB antenna, with a maximum gain of 1.0 dBi.

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 0799327.

The test utility version used during testing was 2.2.

### 6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

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.

## 6.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	L470	PF0ZV764	N/A
Lightbulb	GW	100 Watt	N/A	N/A

### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	1	1	Wire to screws	Power cables	<3m	Cables connected to the load.
2	1	1	Quick connect	Single conductor	<1m	Connects to AC Power.

### SETUP DIAGRAMS

Please refer to R13551782-EP1 for setup diagrams

## 7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10 Subclause -11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW  $\geq$  DTS BW

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)

Emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

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

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

KDB 558074 D01 15.247 Meas Guidance v05r02 FAQ #3

## 8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0027 (PRE0126407)	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
PWS001 (PRE0137347)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31
HI0090 (PRE0191271)	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2020.12.3		
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2020-04-30	2021-04-30
PWM005 (PRE0136341)	RF Power Meter	Keysight Technologies	N1912A	2020-07-14	2021-07-14
PWS005 (S/N MY55090030)	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	N1912A	2020-05-26	2021-05-26
HI0090 (PRE0191271)	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	Antenna Port Software	UL	Version 2020.12.3		
<b>Additional Equipment used</b>					
A-20-702145	Isolation Transformer	ACME Transformer	NA		

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	2020-03-26	2021-03-26
HI0091	Environmental Meter	Fisher Scientific	14-650-118	2020-06-26	2021-06-26
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2020-08-18	2021-08-18
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2020-08-18	2021-08-18
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2015-08-20)		
HPF017	100kHz High-pass Filter	Solar Electronics Co.	7801-100	2020-02-19	2021-02-19
ATTEN007	10dB, 5Watt, Attenuator	Mini-Circuits	BW-N10W5	2020-02-19	2021-02-19

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	<b>1-18 GHz</b>				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	<b>18-40 GHz</b>				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
	<b>Gain-Loss Chains</b>				
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-28	2021-07-28
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-31	2021-07-31
	<b>Receiver &amp; Software</b>				
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-07-16	2021-07-16
SOFTEMI	EMI Software	UL	Version 9.5(2021-01-02) and Version 9.5 (2020-08-18)		
	<b>Additional Equipment used</b>				
s/n 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	<b>0.009-30MHz</b>	<b>(Loop Ant.)</b>			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	<b>30-1000 MHz</b>				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	<b>Gain-Loss Chains</b>				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-10	2021-07-10
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
	<b>Receiver &amp; Software</b>				
SA0025	Spectrum Analyzer	Agilent	N9030A	2020-03-17	2021-03-17
SOFTEMI	EMI Software	UL	Version 9.5 (2020-08-18)		
	<b>Additional Equipment used</b>				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

#### ON TIME AND DUTY CYCLE RESULTS

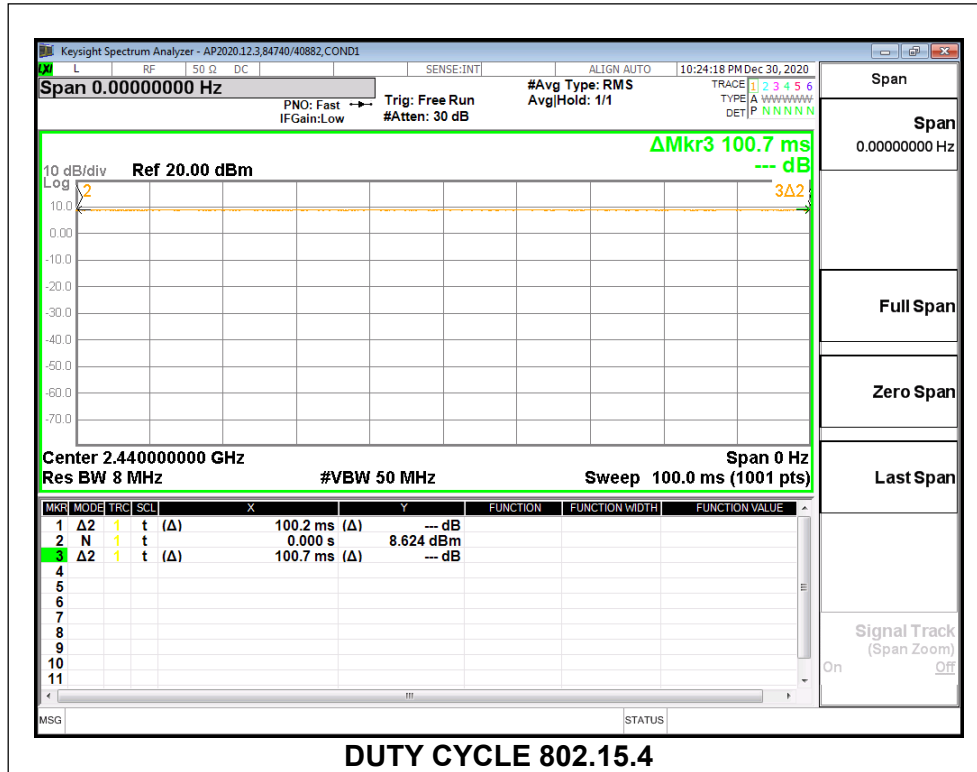
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
<b>2.4GHz Band</b>						
802.15.4	100.2	100.7	0.995	99.50%	0.00	0.010

\*Note: The “real world” duty cycle of the EUT is 30% as declared by the manufacturer. This value is used to derive the duty cycle correction factor used in this report. A duty cycle correction factor of -10.45 was applied to all radiated average data. See calculation below.

Duty Cycle Correction Factor =  $20 \cdot \log(\text{DC}) = 20 \cdot \log(0.30) = -10.46\text{dB}$



DUTY CYCLE PLOT



## **9.2. 99% BANDWIDTH**

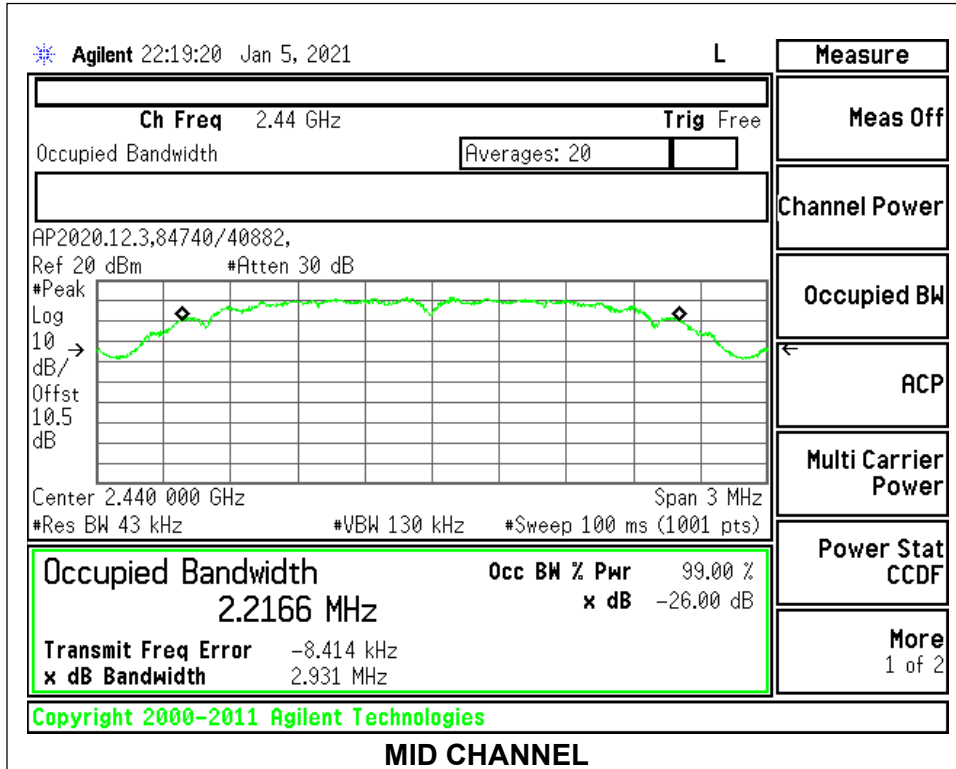
### **LIMITS**

None; for reporting purposes only.

### **RESULTS**

**9.2.1. 802.15.4**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.225
Middle	2440	2.217
High	2480	2.220



### **9.3. 6 dB BANDWIDTH**

#### **LIMITS**

FCC §15.247 (a) (2)

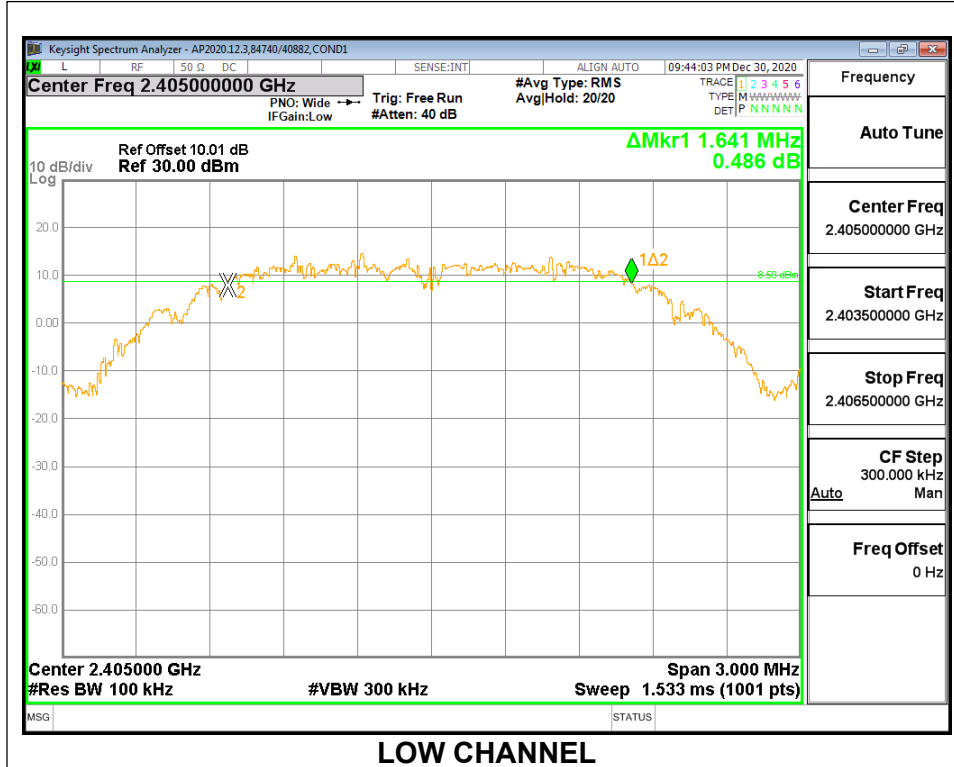
RSS-247 5.2 (a)

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

#### **RESULTS**

9.3.1. 802.15.4

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.641	0.5
Middle	2440	1.647	0.5
High	2480	1.857	0.5



## 9.4. 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 10.01 dB (including 9.75 dB pad and 0.26 dB cable) was entered as an offset in the power meter.

### **RESULTS**

#### 9.4.1. 802.15.4

<b>Tested By:</b>	84740/40882
<b>Date:</b>	2020-12-30

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Power Reading (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
Low	2405	18.44	30	-11.560
Middle	2440	18.55	30	-11.450
High	2480	18.23	30	-11.770

## 9.5. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a gated average power meter.

The cable assembly insertion loss of 10.01 dB (including 9.75 dB pad and 0.26 dB cable) was entered as an offset in the power meter.

### RESULTS

#### 9.5.1. 802.15.4

<b>Tested By:</b>	84740/40882
<b>Date:</b>	2020-12-30

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>AV power (dBm)</b>
Low	2405	18.32
Middle	2440	18.20
High	2480	17.97

## **9.6. POWER SPECTRAL DENSITY**

### **LIMITS**

FCC §15.247 (e)

RSS-247 (5.2) (b)

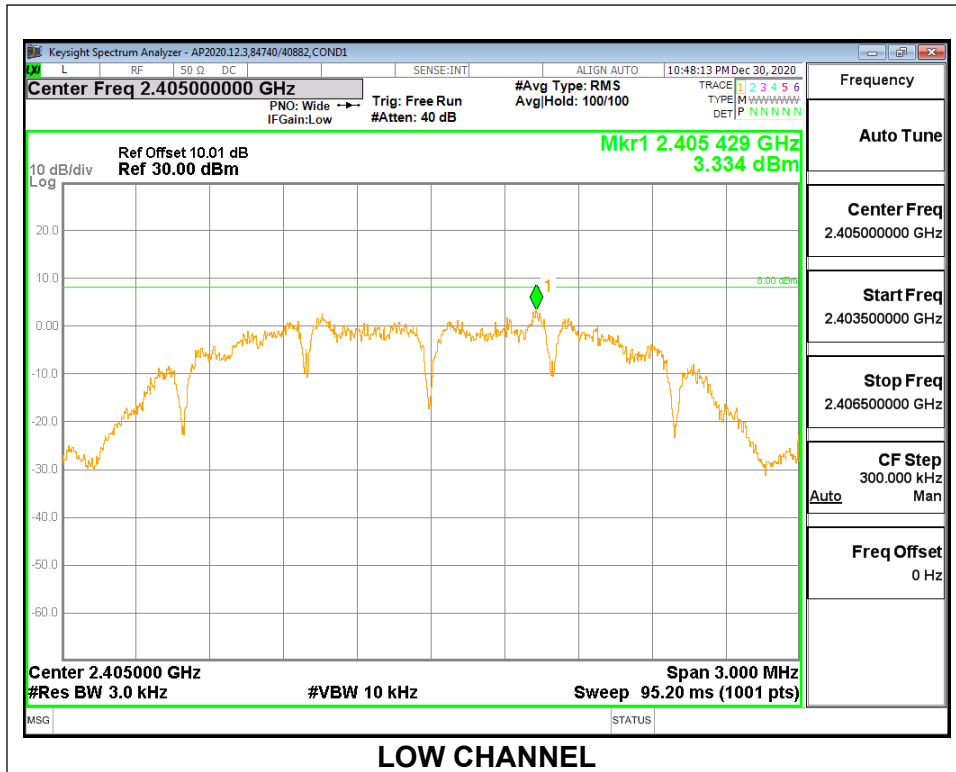
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### **RESULTS**



9.6.1. 802.15.4

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2405	3.33	8	-4.67
Middle	2440	2.67	8	-5.33
High	2480	2.11	8	-5.89



## **9.7. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

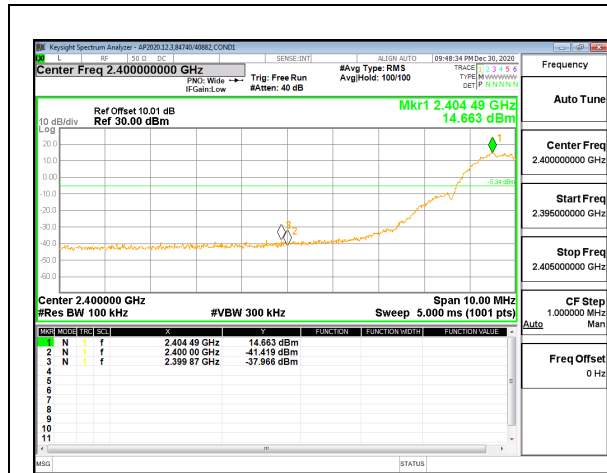
FCC §15.247 (d)

RSS-247 5.5

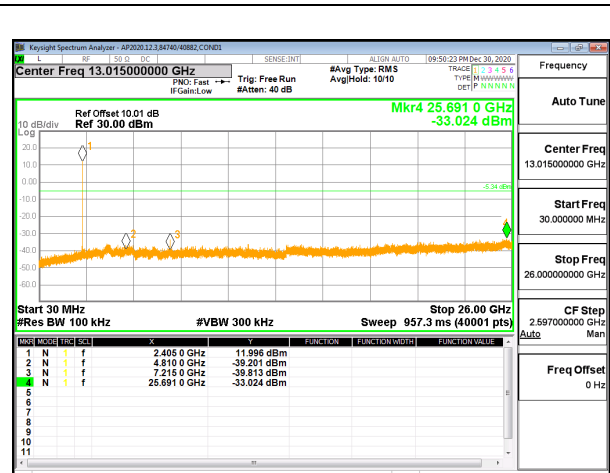
Output power was measured based on the use of a peak measurement, therefore the required attenuation is -20 dBc.

### **RESULTS**

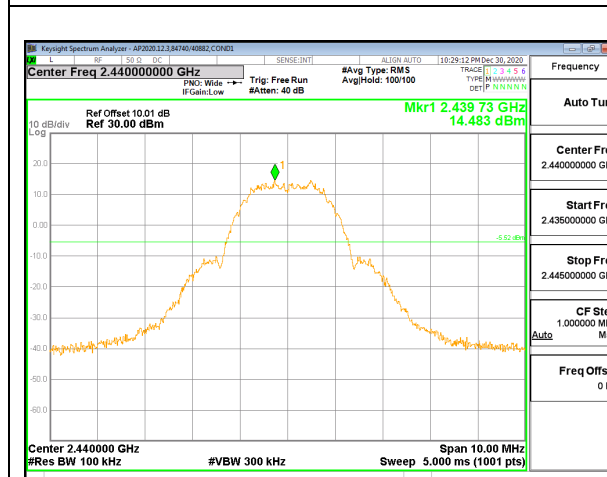
9.7.1. 802.15.4



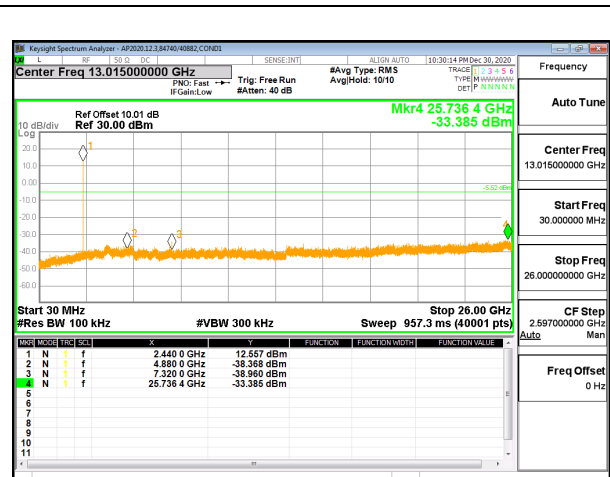
LOW CHANNEL BANDEDGE



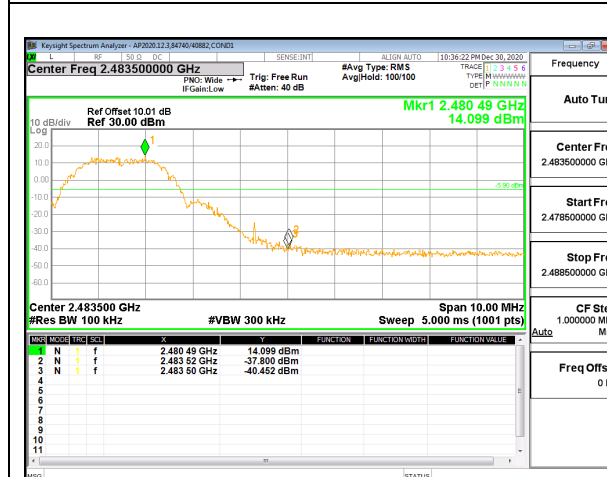
OUT-OF-BAND LOW CHANNEL



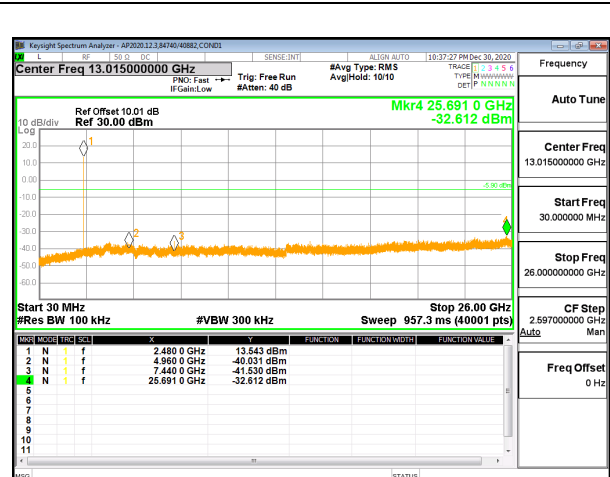
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

## 10. RADIATED TEST RESULTS

### 10.1. 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 100 kHz for peak detection measurements or 120 kHz for 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 or average (9-90kHz and 110-490kHz).

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 and as applicable for linear voltage averaging measurements.

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.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

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.

**KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification**

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

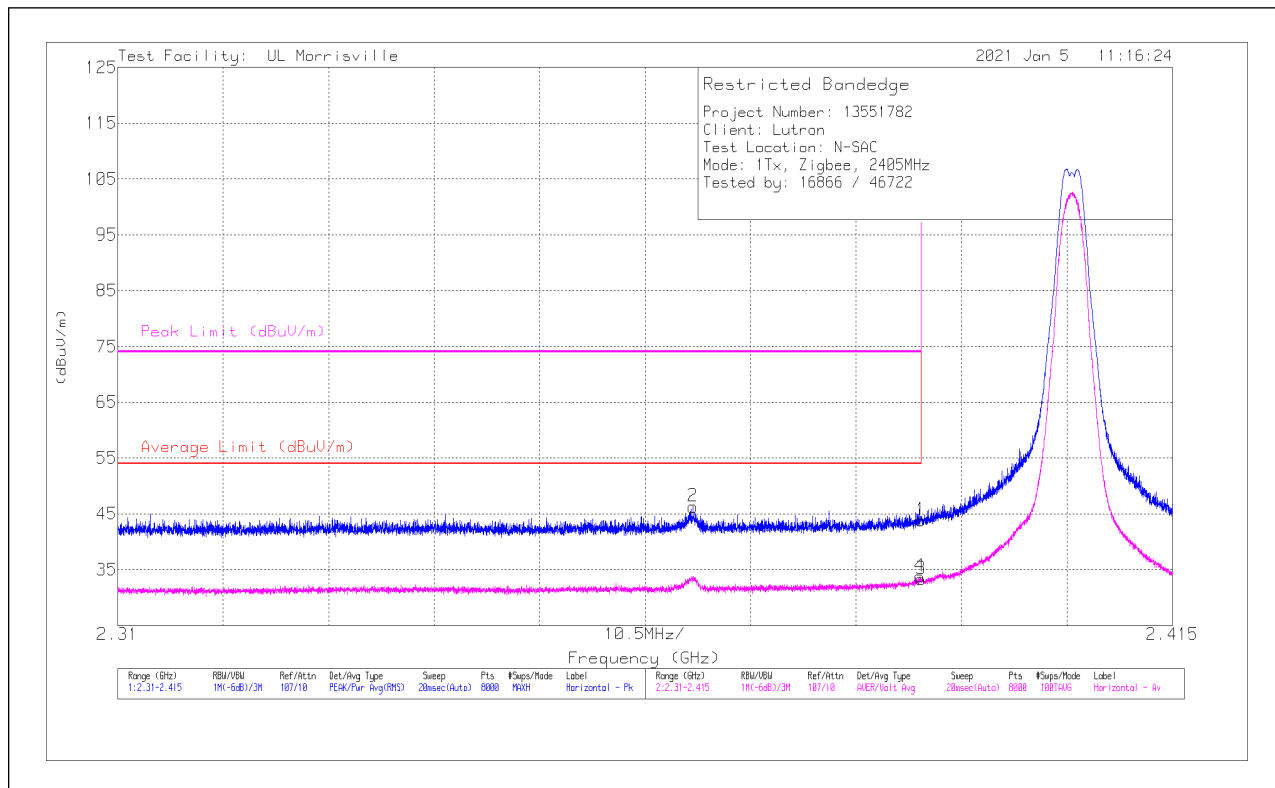
## 10.2. TRANSMITTER ABOVE 1 GHz

### 10.2.1. 802.15.4

#### Antenna 1

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB/(m)	Amp/Cbl/Filtr/Pad (dB)	Duty Cycle 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	36.46	Pk	31.8	-24.4	0	43.86	-	-	74	-30.14	156	283	H
3	** 2.39	25.87	ADV	31.8	-24.4	-10.46	22.81	54	-31.19	-	-	156	283	H
2	*** 2.36726	38.96	Pk	31.7	-24.4	0	46.26	-	-	74	-27.74	156	283	H
4	*** 2.38984	26.39	ADV	31.8	-24.4	-10.46	23.33	54	-30.67	-	-	156	283	H

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

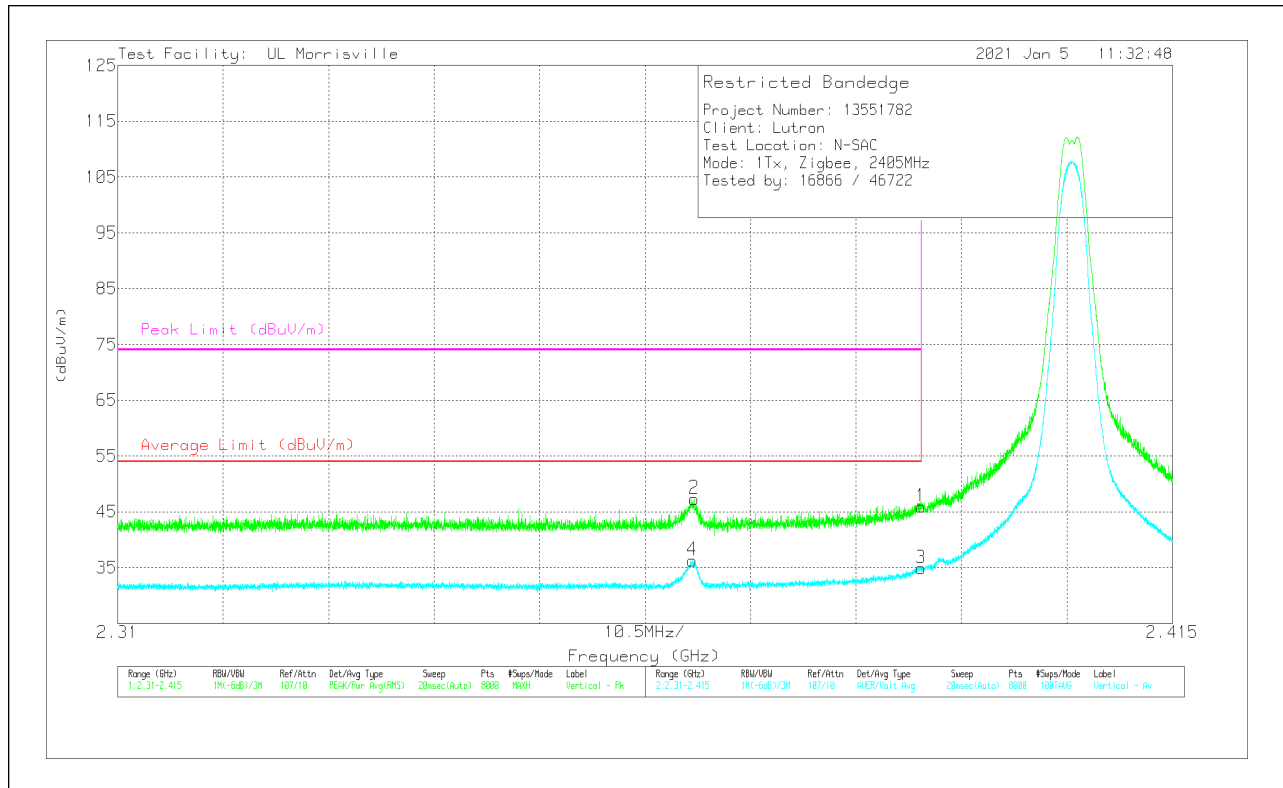
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.

### VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Filtr/Pad (dB)	Duty Cycle 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	38.49	Pk	31.8	-24.4	0	45.89	-	-	74	-28.11	49	268	V
3	*** 2.39	27.44	ADV	31.8	-24.4	-10.46	24.38	54	-29.62	-	-	49	268	V
2	*** 2.3674	40.07	Pk	31.7	-24.4	0	47.37	-	-	74	-26.63	49	268	V
4	*** 2.36719	29.02	ADV	31.7	-24.4	-10.46	25.86	54	-28.14	-	-	49	268	V

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

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

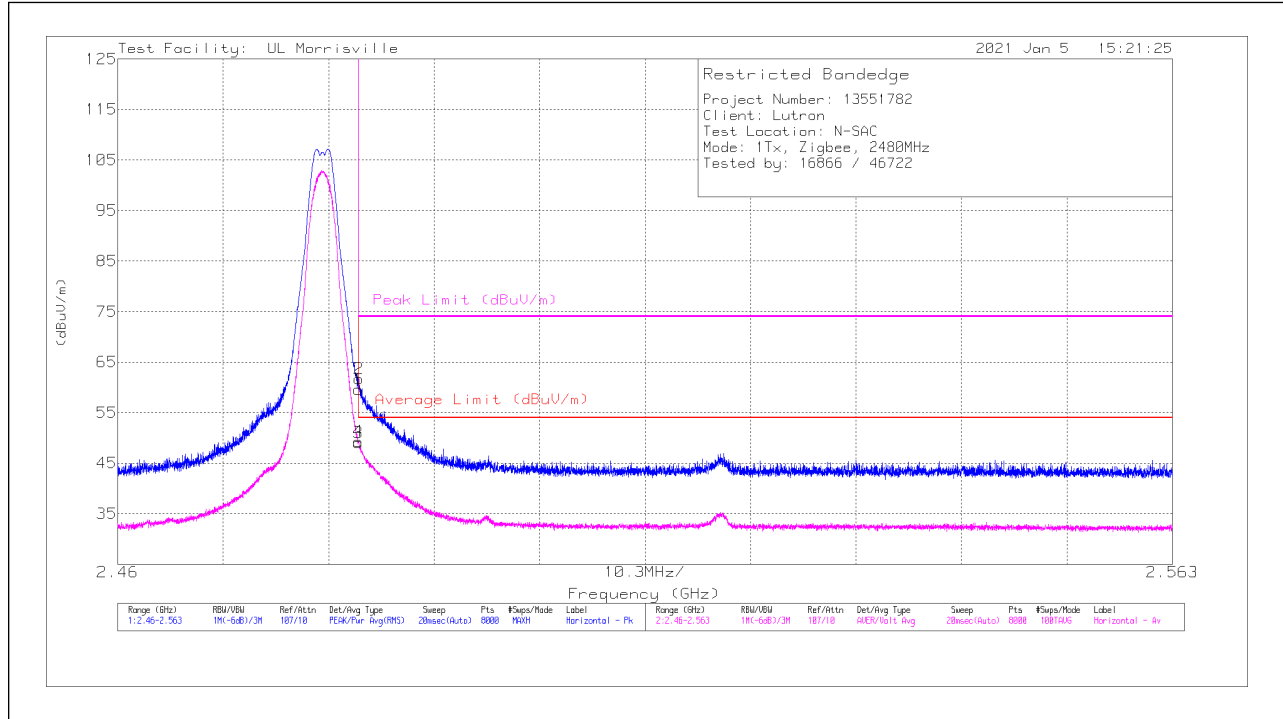
Pk - Peak detector

ADV - Linear Voltage Average

\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB/(m)	Amp/Cbl/Filtr/Pad (dB)	Duty Cycle 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	* ** 2.4835	51.48	Pk	32.4	-24.3	0	59.58	-	-	74	-14.42	194	142	H
2	* ** 2.48356	53.65	Pk	32.4	-24.3	0	61.75	-	-	74	-12.25	194	142	H
3	* ** 2.4835	40.9	ADV	32.4	-24.3	-10.46	38.54	54	-15.46	-	-	194	142	H
4	* ** 2.48351	41.15	ADV	32.4	-24.3	-10.46	38.79	54	-15.21	-	-	194	142	H

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

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

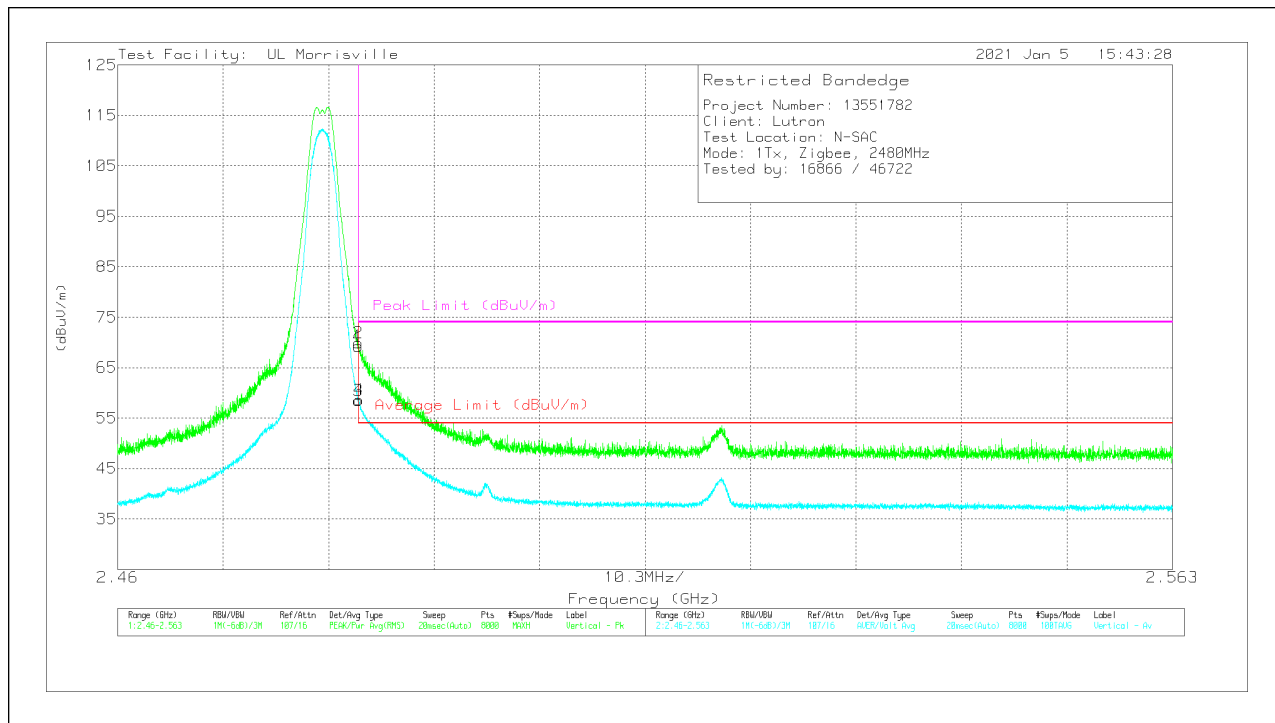
Pk - Peak detector

ADV - Linear Voltage Average

\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.



### VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB/(m)	Amp/Cbl/Filtr/Pad (dB)	Duty Cycle 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	*** 2.4835	61.13	Pk	32.4	-24.3	0	69.23	-	-	74	-4.77	246	113	V
2	*** 2.48351	61.84	Pk	32.4	-24.3	0	69.94	-	-	74	-4.06	246	113	V
3	** 2.4835	50.39	ADV	32.4	-24.3	-10.46	48.03	54	-5.97	-	-	246	112	V
4	*** 2.48354	50.56	ADV	32.4	-24.3	-10.46	48.20	54	-5.80	-	-	246	112	V

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

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

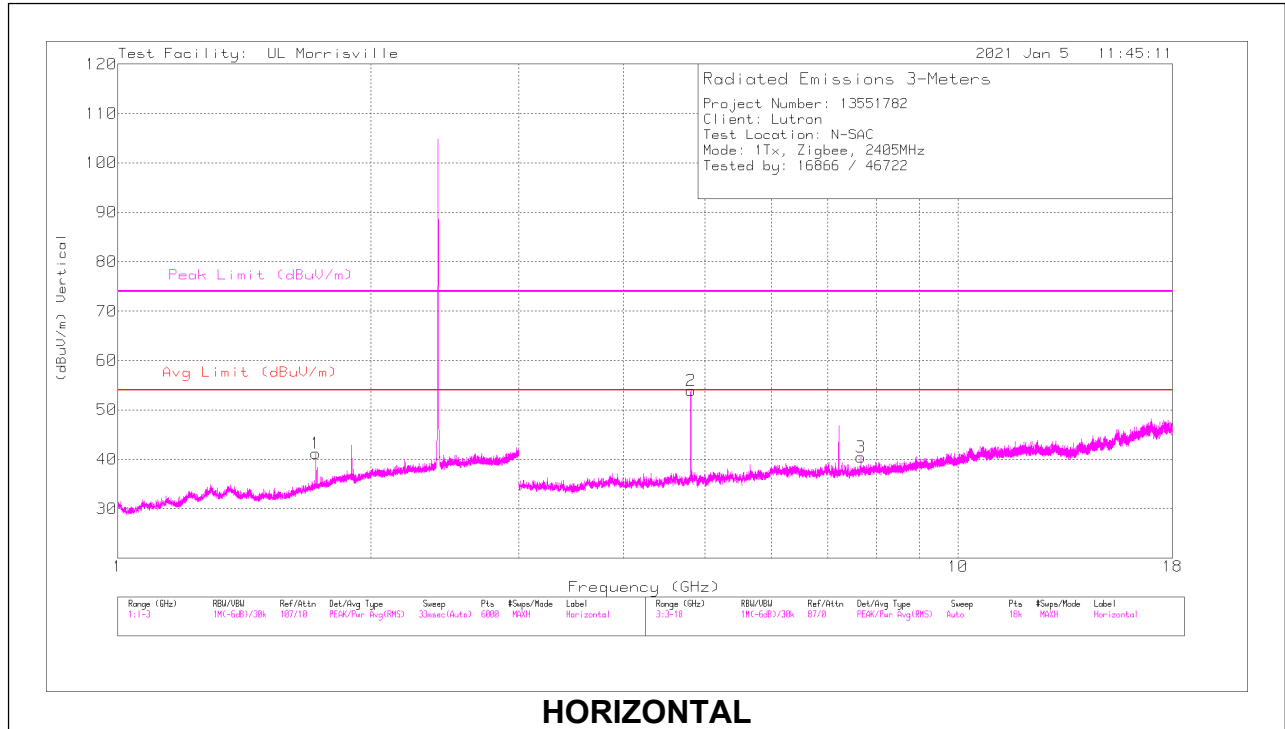
Pk - Peak detector

ADV - Linear Voltage Average

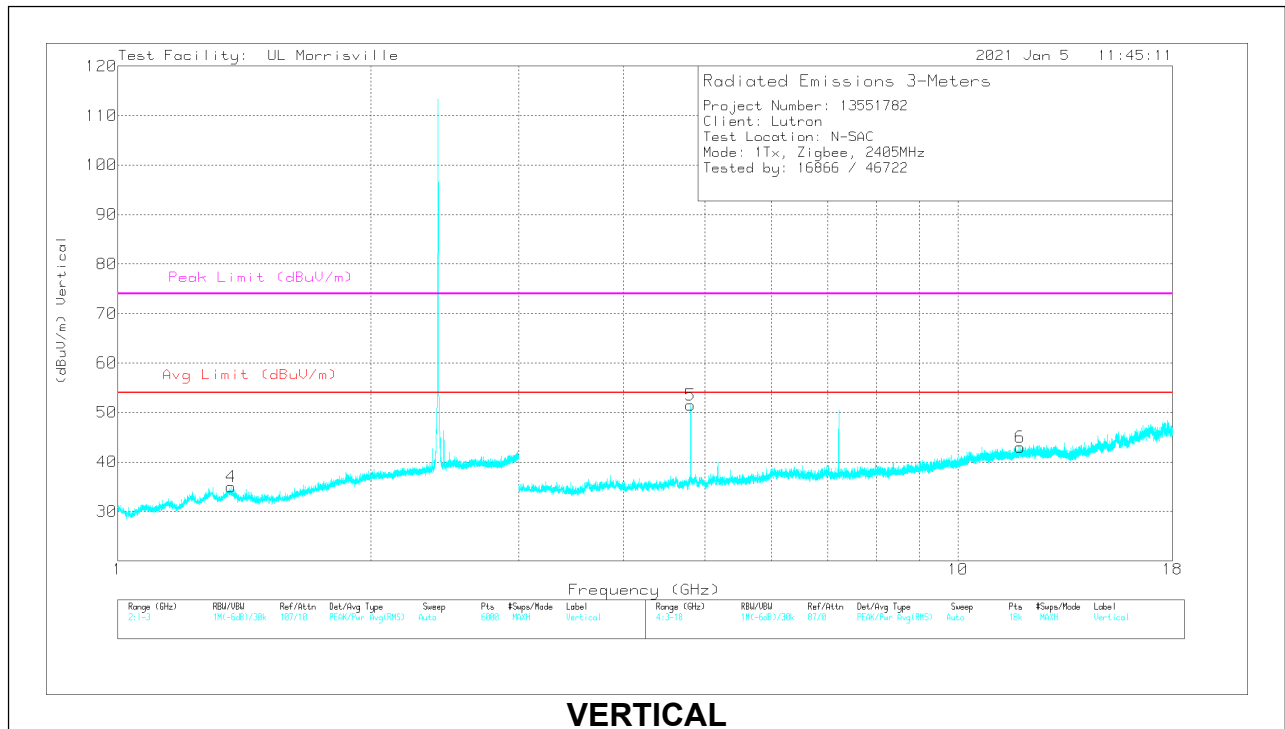
\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.

# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (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	*** 1.72218	35.85	PK2	29.5	-24.3	0	41.05	-	-	74	-32.95	105	320	H
	*** 1.72008	23.06	ADV	29.5	-24.3	-10.46	17.80	54	-36.20	-	-	105	320	H
4	*** 1.36414	37	PK2	29.4	-25.3	0	41.1	-	-	74	-32.9	116	215	V
	*** 1.36425	24.17	ADV	29.4	-25.3	-10.46	17.81	54	-36.19	-	-	116	215	V
2	*** 4.81028	40.22	PK2	34.2	-31.5	0	42.92	-	-	74	-31.08	360	324	H
	*** 4.8094	27.93	ADV	34.2	-31.5	-10.46	20.17	54	-33.83	-	-	360	324	H
3	*** 7.66102	37.75	PK2	35.8	-29	0	44.55	-	-	74	-29.45	231	198	H
	*** 7.66029	25.42	ADV	35.8	-29	-10.46	21.76	54	-32.24	-	-	231	198	H
5	*** 4.80888	52.99	PK2	34.2	-31.5	0	55.69	-	-	74	-18.31	299	208	V
	*** 4.80897	45.13	ADV	34.2	-31.5	-10.46	37.37	54	-16.63	-	-	299	208	V
6	*** 11.85234	35.78	PK2	38.5	-25.7	0	48.58	-	-	74	-25.42	268	197	V
	*** 11.85285	23.4	ADV	38.5	-25.8	-10.46	25.64	54	-28.36	-	-	268	197	V

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

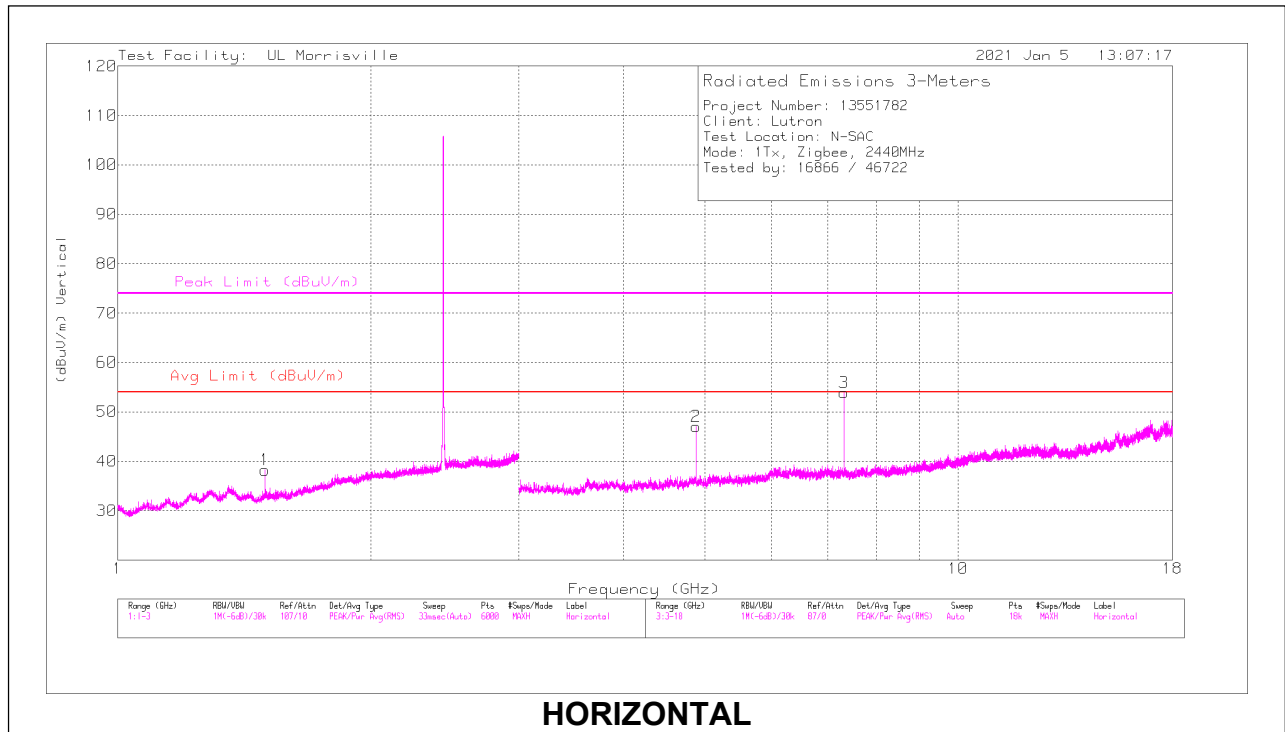
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

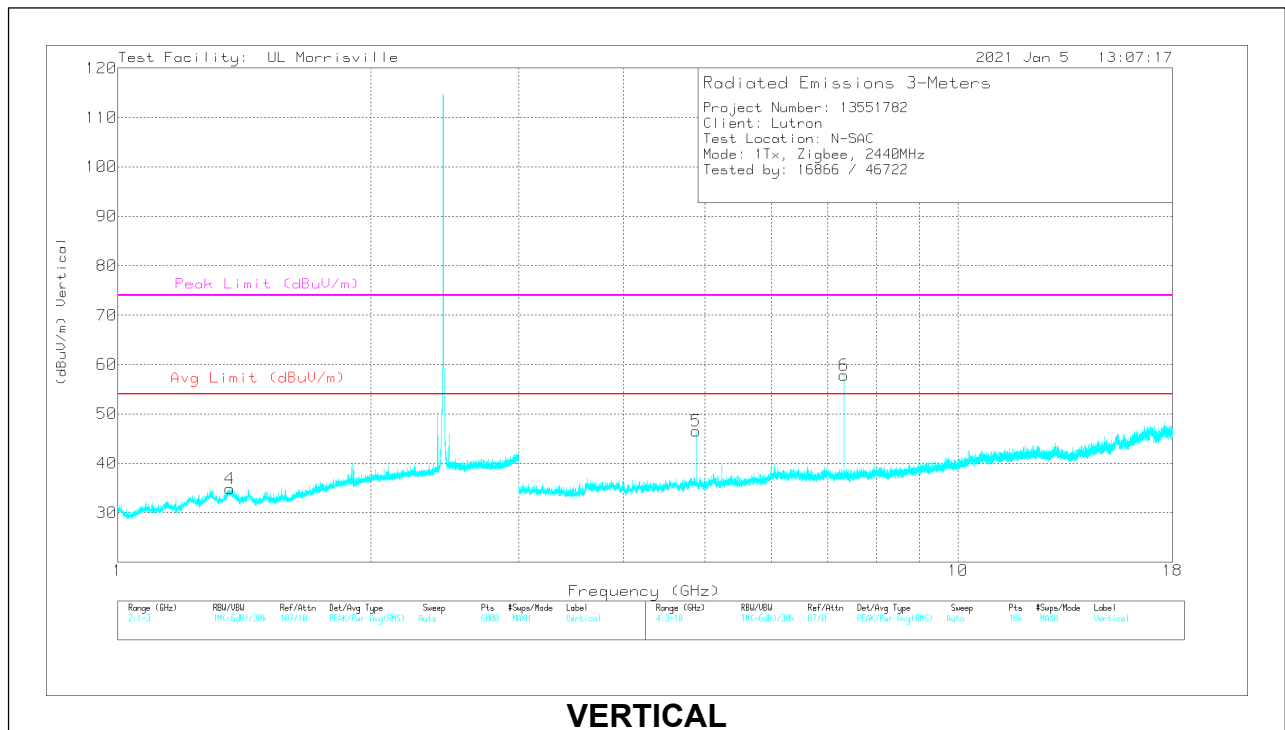
ADV - Linear Voltage Average

\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.

### MID CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 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	*** 1.499	36.99	PK2	27.8	-24.8	0	39.99	-	-	74	-34.01	352	298	H
	*** 1.49942	24.15	ADV	27.8	-24.8	-10.46	16.69	54	-37.31	-	-	352	298	H
4	*** 1.36156	37.34	PK2	29.4	-25.3	0	41.44	-	-	74	-32.56	320	161	V
	*** 1.36111	24.17	ADV	29.4	-25.3	-10.46	17.81	54	-36.19	-	-	320	161	V
2	*** 4.87902	49.47	PK2	34.1	-31.4	0	52.17	-	-	74	-21.83	143	104	H
	*** 4.879	39.86	ADV	34.1	-31.4	-10.46	32.10	54	-21.90	-	-	143	104	H
5	*** 4.87909	50.44	PK2	34.1	-31.4	0	53.14	-	-	74	-20.86	80	305	V
	*** 4.87897	41.63	ADV	34.1	-31.4	-10.46	33.87	54	-20.13	-	-	80	305	V
3	*** 7.32156	51.97	PK2	35.6	-29.2	0	58.37	-	-	74	-15.63	223	392	H
	*** 7.32152	43.66	ADV	35.6	-29.2	-10.46	39.60	54	-14.40	-	-	223	392	H
6	*** 7.32156	55.92	PK2	35.6	-29.2	0	62.32	-	-	74	-11.68	286	235	V
	*** 7.32157	48.02	ADV	35.6	-29.2	-10.46	43.96	54	-10.04	-	-	286	235	V

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

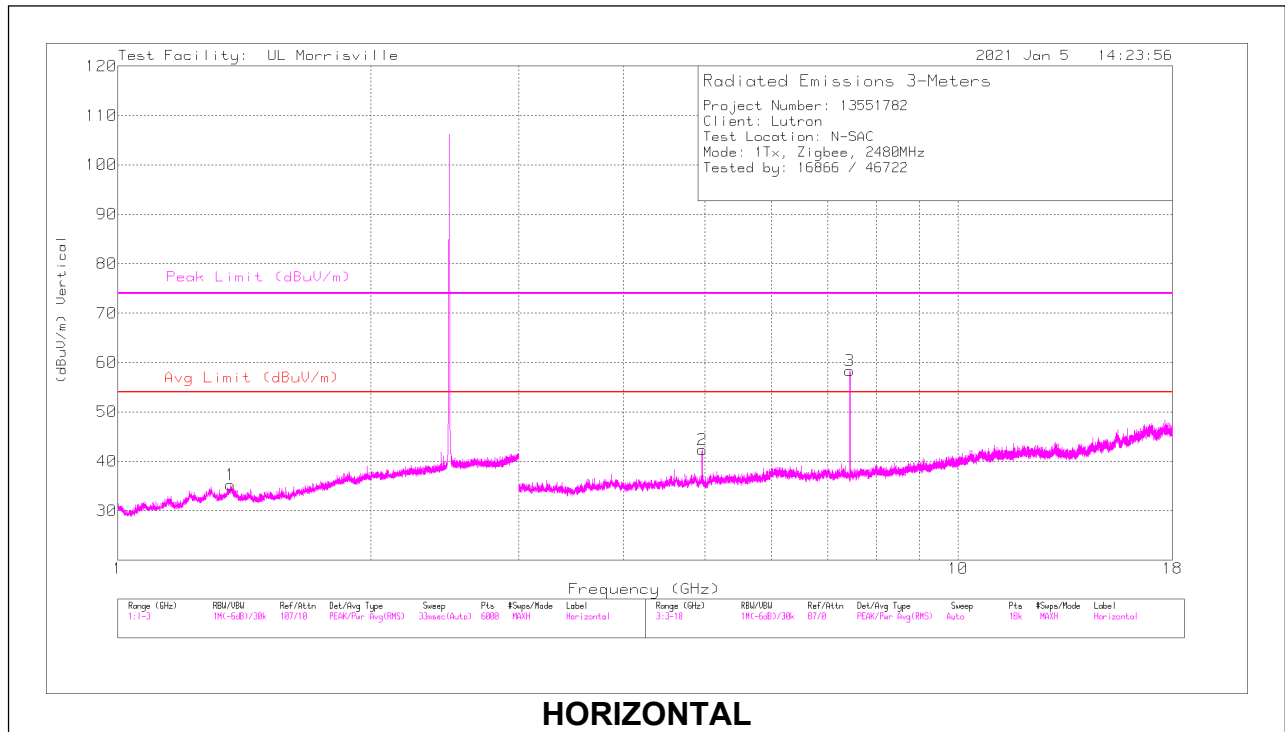
\*\* - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

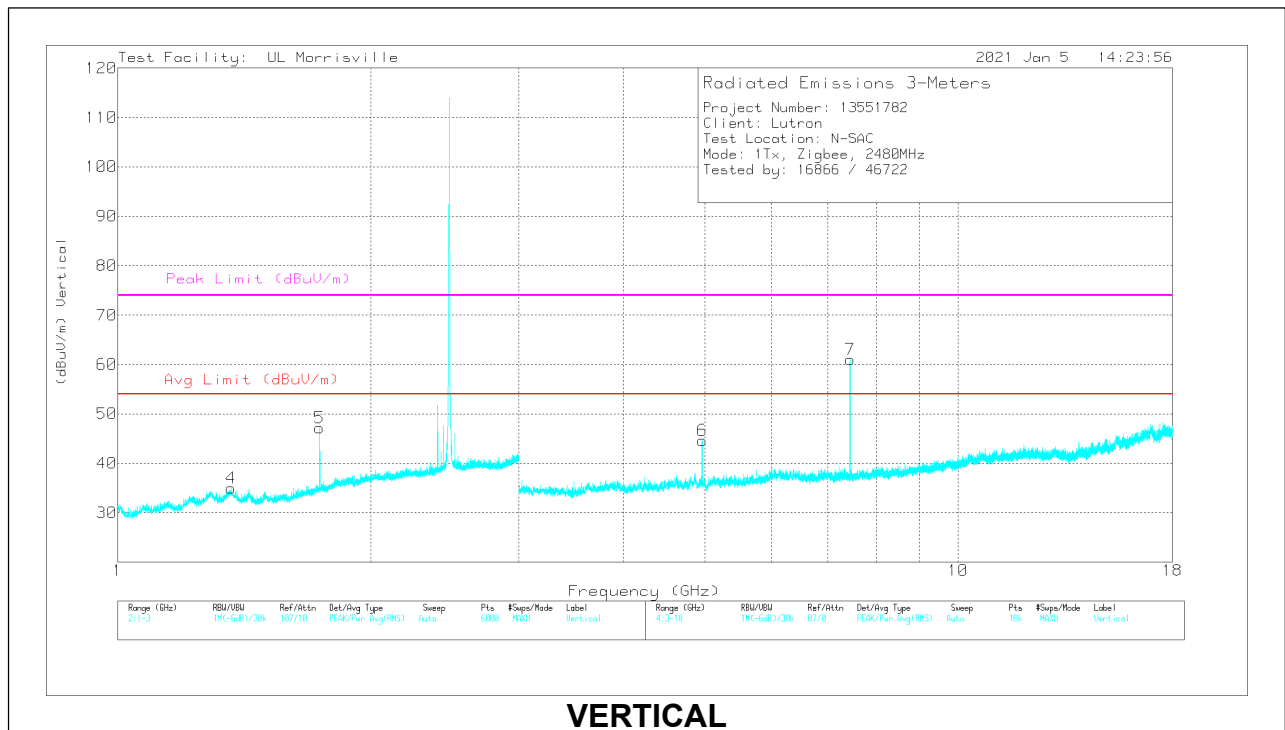
ADV - Linear Voltage Average

\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 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	*** 1.36235	36.68	PK2	29.4	-25.3	0	40.78	-	-	74	-33.22	149	114	H
	*** 1.36112	24.14	ADV	29.4	-25.3	-10.46	17.78	54	-36.22	-	-	149	114	H
4	** 1.73955	36.92	PK2	29.5	-24.3	0	42.12	-	-	74	-31.88	19	156	V
	** 1.73963	23.51	ADV	29.5	-24.3	-10.46	18.25	54	-35.75	-	-	19	156	V
2	*** 4.96103	46.31	PK2	34.1	-32.4	0	48.01	-	-	74	-25.99	298	201	H
	*** 4.96098	36.76	ADV	34.1	-32.4	-10.46	28.00	54	-26.00	-	-	298	201	H
5	*** 4.96106	48.8	PK2	34.1	-32.4	0	50.5	-	-	74	-23.5	308	115	V
	*** 4.96095	38.79	ADV	34.1	-32.4	-10.46	30.03	54	-23.97	-	-	308	115	V
3	*** 7.43834	51.97	PK2	35.7	-29.3	0	58.37	-	-	74	-15.63	329	197	H
	*** 7.43829	43.5	ADV	35.7	-29.3	-10.46	39.44	54	-14.56	-	-	329	197	H
6	*** 7.44152	58.99	PK2	35.7	-29.3	0	65.39	-	-	74	-8.61	277	232	V
	*** 7.44165	50.67	ADV	35.7	-29.3	-10.46	46.61	54	-7.39	-	-	277	232	V

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

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

PK2 - Maximum Peak

ADV - Linear Voltage Average

PK - Peak detector

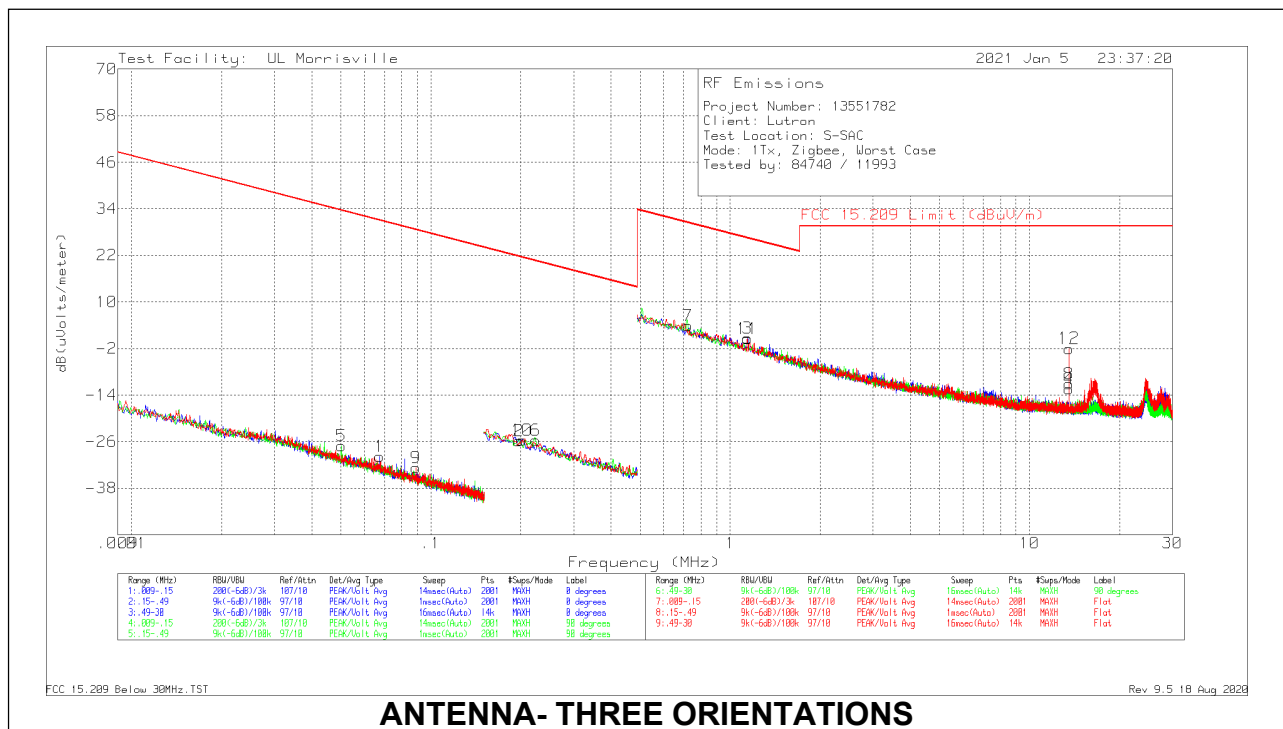
\*Note: Duty cycle correction factor of -10.45 applied based on manufacturer declared duty cycle of 30%.

### 10.3. WORST CASE BELOW 30MHZ

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  $40 \cdot \log(\text{test distance} / \text{specification distance})$ .

The below 30 MHz limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of  $377\Omega$ . For example, the measurement frequency 67.5 kHz resulted in a level of -29.85 dBuV/m, which is equivalent to  $-29.85 - 51.5 = -81.35$  dBuA/m, which has the same margin, -60.87 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

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





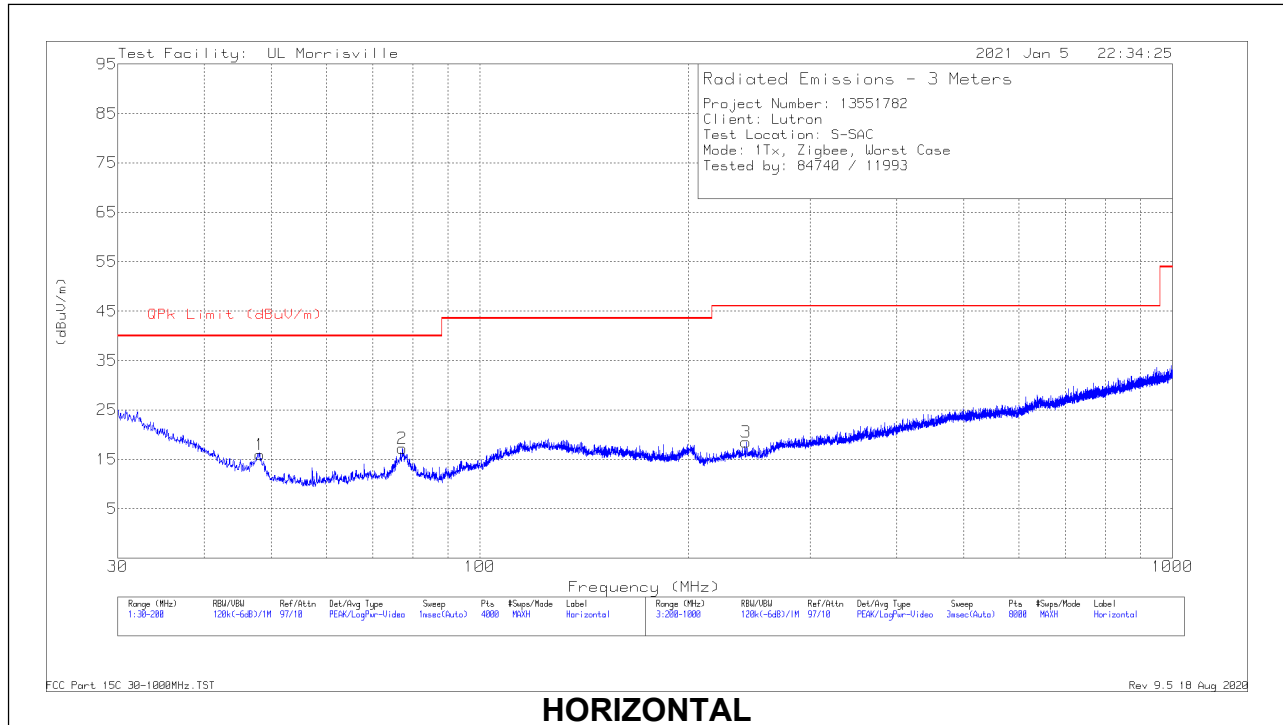
**Below 30MHz Data**

Marker	Frequency (MHz)	Meter Reading (dBUV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 Qp/Avg Limit (dBUV/m)	FCC 15.209 Pk Limit (dBUV/m)	Margin (dB)	Azimuth (Degs)	Antenna Position
1	.0675	38.75	Pk	11.3	.1	-80	-29.85	31.02	51.02	-60.87	0-360	Face On
2	.19658	43.35	Pk	10.8	.1	-80	-25.75	21.73	41.73	-47.48	0-360	Face On
3	1.14348	29.5	Pk	11	.2	-40	.7	26.44	-	-25.74	0-360	Face On
4	13.5596	16.45	Pk	10.4	.7	-40	-12.45	29.54	-	-41.99	0-360	Face On
5	.05018	41.25	Pk	11.5	.1	-80	-27.15	33.59	53.59	-60.74	0-360	Face Off
6	.22429	43.49	Pk	10.8	.1	-80	-25.61	20.59	40.59	-46.2	0-360	Face Off
7	.72188	32.9	Pk	10.8	.2	-40	3.9	30.43	-	-26.53	0-360	Face Off
8	13.5596	17.76	Pk	10.4	.7	-40	-11.14	29.54	-	-40.68	0-360	Face Off
9	.08916	35.97	Pk	11.2	.1	-80	-32.73	28.6	48.6	-61.33	0-360	Flat
10	.20126	43.4	Pk	10.8	.1	-80	-25.7	21.53	41.53	-47.23	0-360	Flat
11	1.14137	29.24	Pk	11	.2	-40	.44	26.46	-	-26.02	0-360	Flat
12	13.5596	26.9	Pk	10.4	.7	-40	-2	29.54	-	-31.54	0-360	Flat

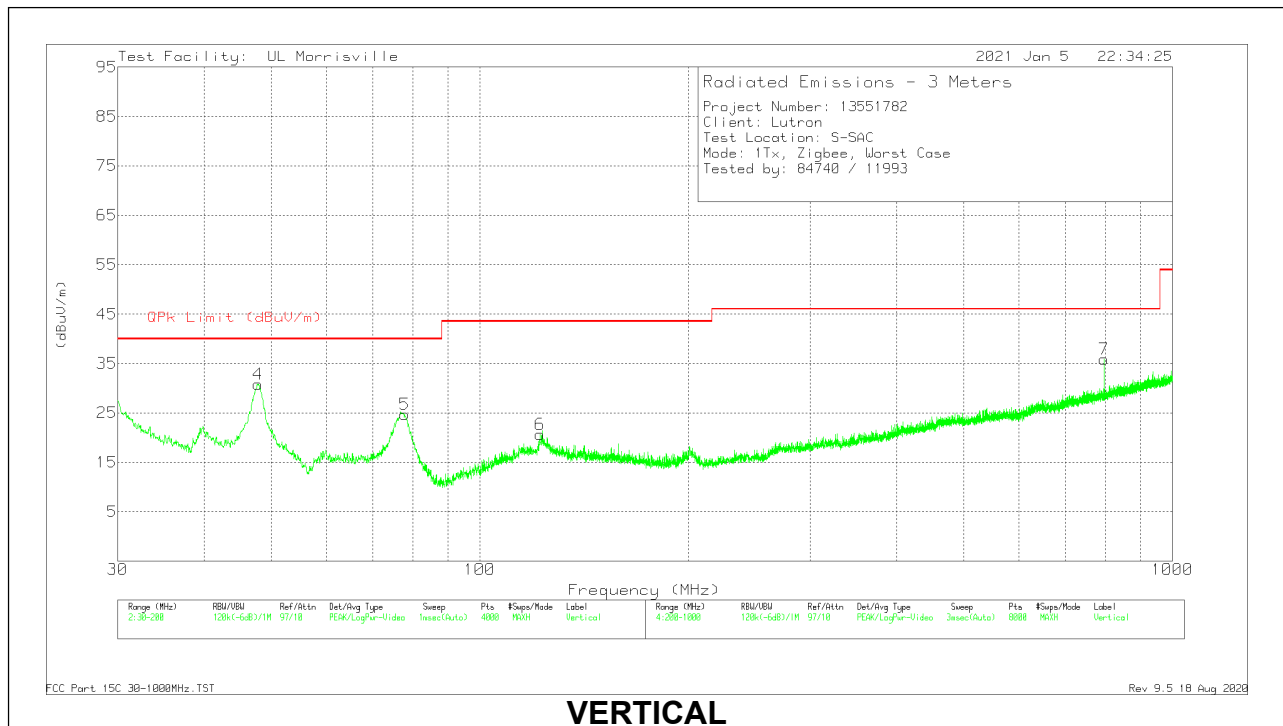
Pk - Peak detector

### 10.4. WORST CASE BELOW 1 GHZ

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



**HORIZONTAL**



**VERTICAL**

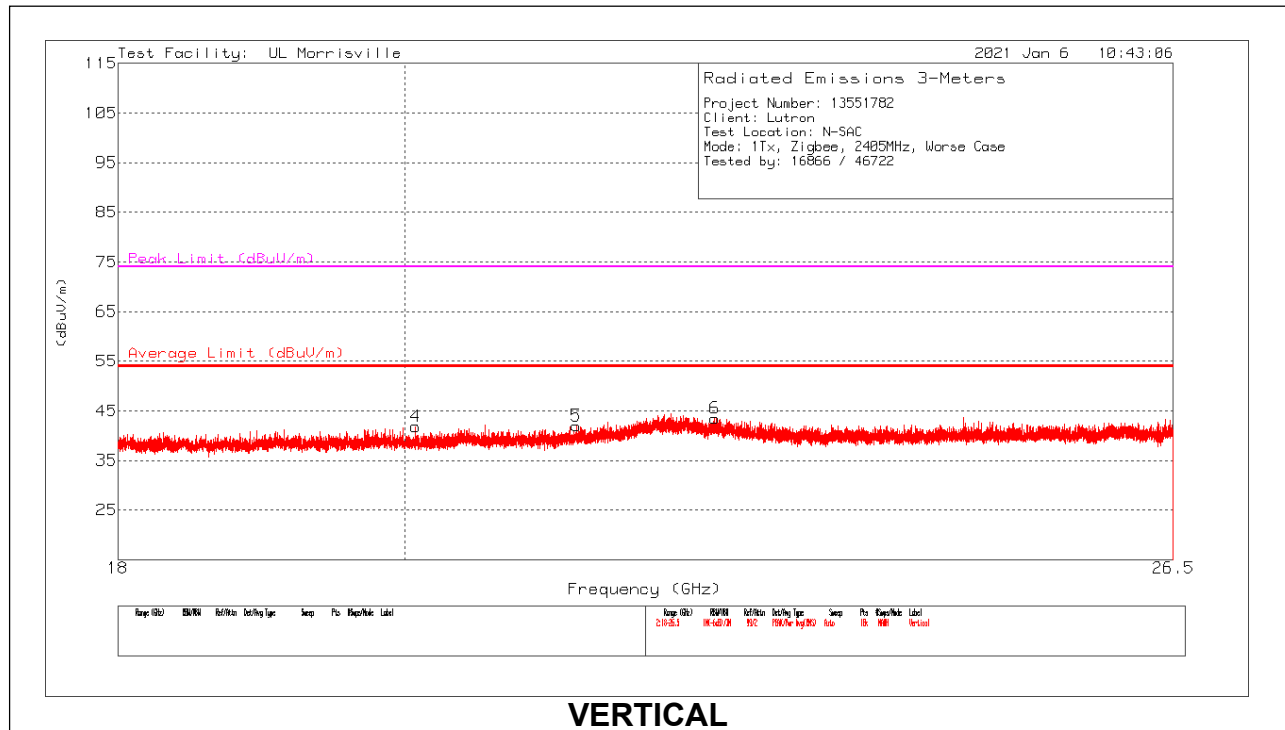
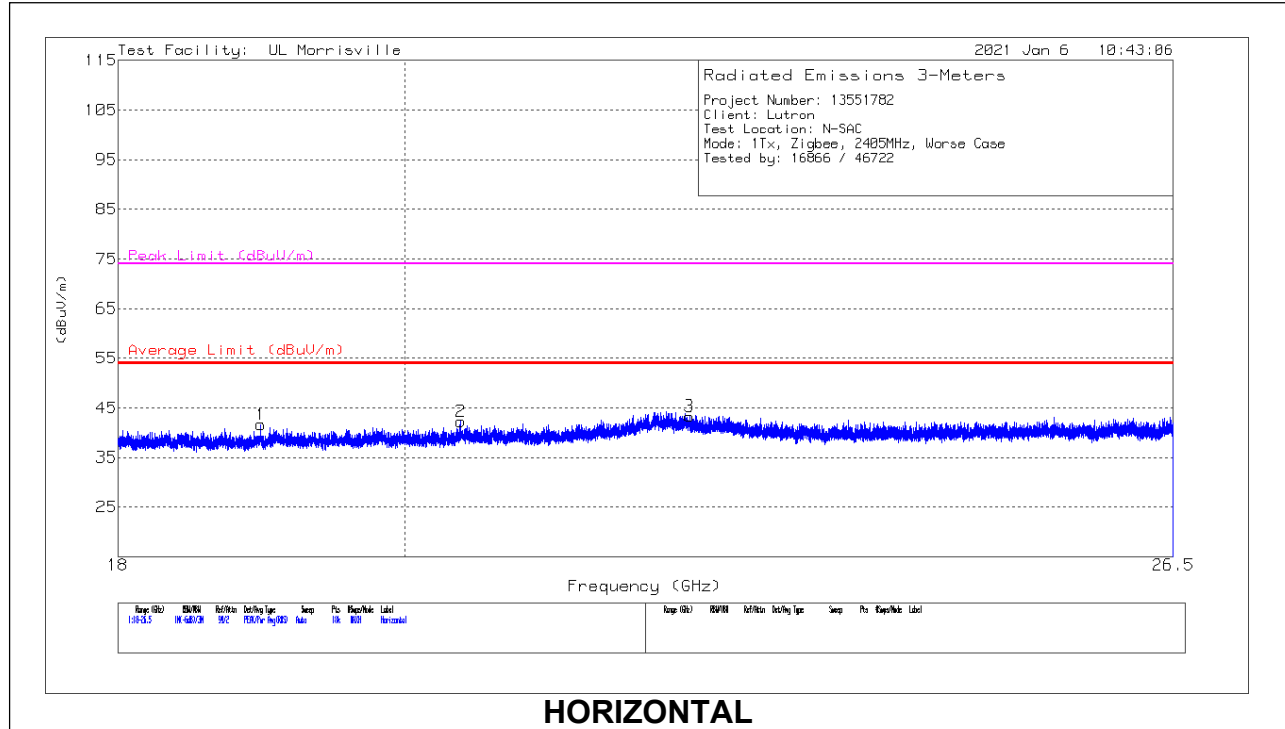
**Below 1GHz Data**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	48.1097	32.27	Pk	14.9	-31.2	15.97	40	-24.03	0-360	300	H
2	77.3147	34.01	Pk	14.1	-30.9	17.21	40	-22.79	0-360	300	H
3	242.2055	29.99	Pk	17.8	-29.3	18.49	46.02	-27.53	0-360	399	H
4	47.8546	47.14	Pk	15	-31.3	30.84	40	-9.16	0-360	101	V
5	77.8249	41.63	Pk	14	-30.9	24.73	40	-15.27	0-360	101	V
6	122.1213	30.83	Pk	20.1	-30.3	20.63	43.52	-22.89	0-360	101	V
7	796.7776	35.14	Pk	27.3	-26.6	35.84	46.02	-10.18	0-360	199	V

Pk - Peak detector

### 10.5. WORST CASE 18-26 GHz

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



**18-26 GHz DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 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	*** 18.96953	48.71	Pk	33.3	-40.4	41.61	54	-12.39	74	-32.39	0-360	200	H
2	*** 20.40941	49.08	Pk	33.9	-40.7	42.28	54	-11.72	74	-31.72	0-360	150	H
3	*** 22.19545	47.69	Pk	36.7	-41.1	43.29	54	-10.71	74	-30.71	0-360	200	H
4	*** 20.07647	48.91	Pk	33.6	-40.7	41.81	54	-12.19	74	-32.19	0-360	150	V
5	*** 21.29251	48.26	Pk	34.5	-40.8	41.96	54	-12.04	74	-32.04	0-360	101	V
6	*** 22.39993	47.89	Pk	36.6	-41	43.49	54	-10.51	74	-30.51	0-360	101	V

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

## 11. AC POWER LINE CONDUCTED EMISSIONS

### **LIMITS**

FCC §15.207 (a)

RSS-Gen 8.8

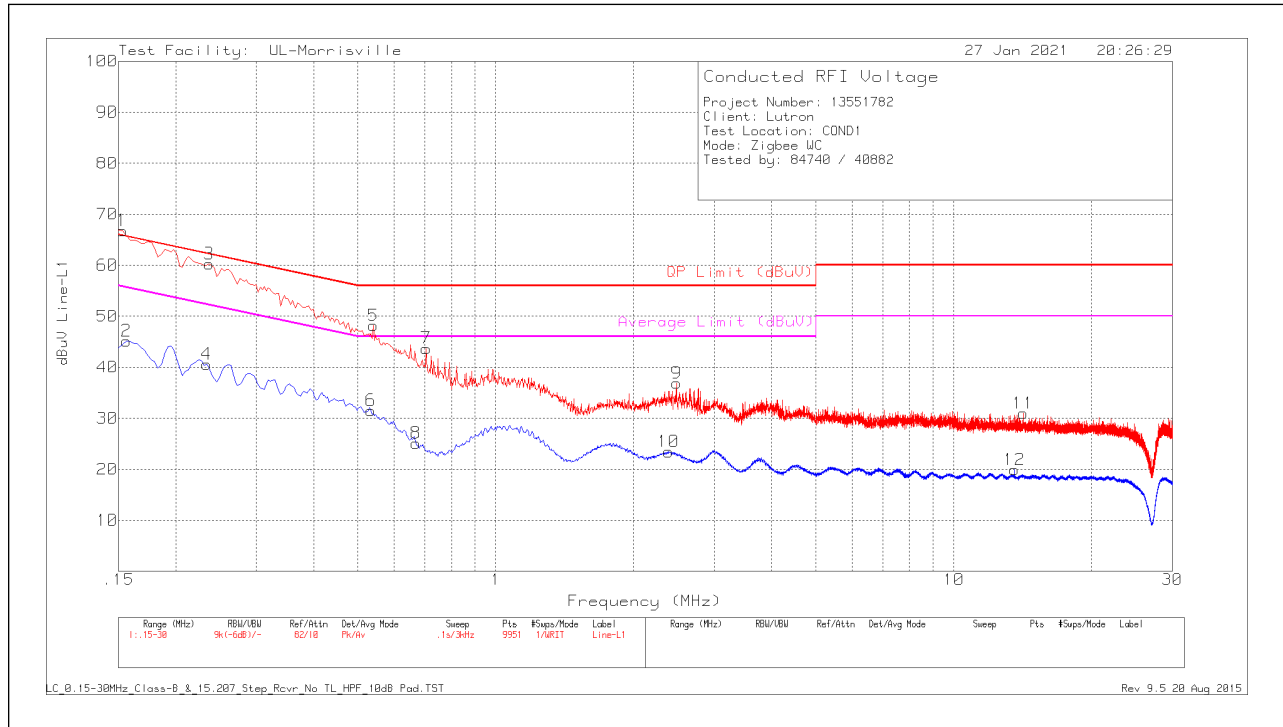
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### **RESULTS**

### 11.1.1. AC Power Line Host

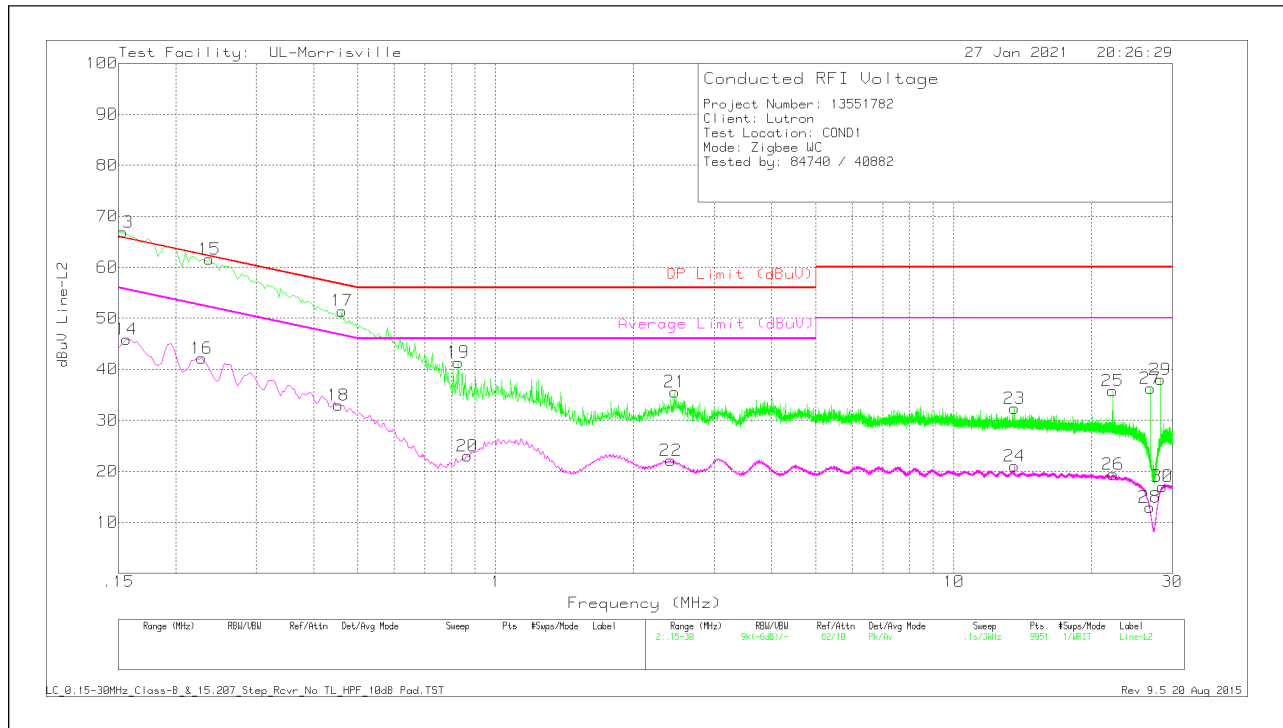
### LINE 1 RESULTS



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Filter (dB)	Pad (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.15279	51.42	Qp	.2	1	9.9	62.52	65.85	-3.33	-	-
2	.156	34.08	Av	.2	1	9.9	45.18	-	-	55.67	-10.49
3	.23324	46.01	Qp	.1	.6	9.9	56.61	62.33	-5.72	-	-
4	.234	30.03	Av	.1	.6	9.9	40.63	-	-	52.31	-11.68
5	.54	38.03	Pk	0	.3	9.9	48.23	56	-7.77	-	-
6	.534	21.34	Av	0	.3	9.9	31.54	-	-	46	-14.46
7	.705	33.62	Pk	0	.2	9.9	43.72	56	-12.28	-	-
8	.669	15.05	Av	0	.2	9.9	25.15	-	-	46	-20.85
9	2.481	26.91	Pk	0	.1	9.9	36.91	56	-19.09	-	-
10	2.382	13.45	Av	0	.1	9.9	23.45	-	-	46	-22.55
11	14.16	20.8	Pk	.1	.2	9.9	31	60	-29	-	-
12	13.563	9.74	Av	.1	.2	9.9	19.94	-	-	50	-30.06

Pk - Peak detector  
 Av - Average detection  
 Qp - Quasi-Peak detector

### LINE 2 RESULTS



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Filter (dB)	Pad (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.15344	51.41	Qp	.2	1	9.9	62.51	65.81	-3.3	-	-
14	.156	34.78	Av	.2	1	9.9	45.88	-	-	55.67	-9.79
15	.2249	46.95	Qp	.1	.7	9.9	57.65	62.64	-4.99	-	-
16	.228	31.54	Av	.1	.6	9.9	42.14	-	-	52.52	-10.38
17	.44933	36.37	Qp	.1	.3	9.9	46.67	56.89	-10.22	-	-
18	.453	22.68	Av	.1	.3	9.9	32.98	-	-	46.82	-13.84
19	.828	31.27	Pk	0	.2	9.9	41.37	56	-14.63	-	-
20	.867	12.89	Av	0	.2	9.9	22.99	-	-	46	-23.01
21	2.457	25.58	Pk	0	.1	9.9	35.58	56	-20.42	-	-
22	2.409	12.13	Av	0	.1	9.9	22.13	-	-	46	-23.87
23	13.56	22.13	Pk	.1	.2	9.9	32.33	60	-27.67	-	-
24	13.56	10.8	Av	.1	.2	9.9	21	-	-	50	-29
25	22.206	25.45	Pk	.2	.2	9.9	35.75	60	-24.25	-	-
26	22.272	9.1	Av	.2	.2	9.9	19.4	-	-	50	-30.6
27	26.847	25.97	Pk	.2	.2	9.9	36.27	60	-23.73	-	-
28	26.751	2.68	Av	.2	.2	9.9	12.98	-	-	50	-37.02
29	28.221	27.61	Pk	.3	.2	9.9	38.01	60	-21.99	-	-
30	28.548	6.63	Av	.3	.2	9.9	17.03	-	-	50	-32.97

Pk - Peak detector  
 Av - Average detection  
 Qp - Quasi-Peak detector



## 12. SETUP PHOTOS

Please refer to R13551782-EP1 for setup photos

**END OF TEST REPORT**