



TEST REPORT

Report Number: R13547611-E2

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

Model : DDM1

FCC ID : JPZ0134

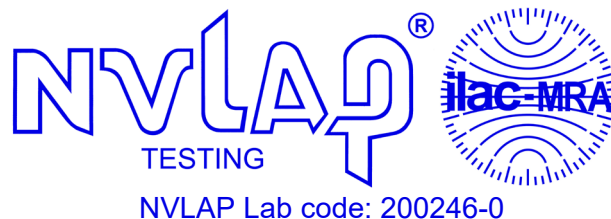
IC : 2851A-JPZ0134

EUT Description : RF Light Dimmer

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2021
ISED RSS-247 ISSUE 2: 2017
ISED RSS-GEN ISSUE 5 + A1: 2019

Date Of Issue:
2021-03-11

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	2021-02-24	Initial Issue	Noah Bennett
2	2021-03-04	Minor typographical revisions	Noah Bennett
3	2021-03-11	Revised Maximum output power in Section 6.2	Brian T. Kiewra

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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 Light dimmer

MODEL: DDM1

SERIAL NUMBER: Radiated Sample: D1
Conducted Sample: DC1

SAMPLE RECEIPT DATE: 2021-02-12

DATE TESTED: 2021-02-15 TO 2021-02-19

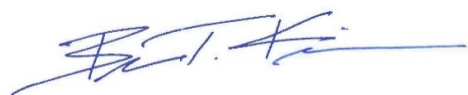
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C 2021	Complies
ISED RSS-247 Issue 2: 2017	Complies
ISED RSS-GEN Issue 5 + A1: 2019	Complies

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.

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:



Brian T. Kiewra
Project Engineer
Consumer Technology Division
UL LLC.

Prepared By:



Noah Bennett
Engineer
Consumer Technology Division
UL LLC.

2. TEST RESULTS SUMMARY

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.

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	Compliant	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Compliant	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	Compliant	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Compliant	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant	None.

3. 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, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by NVLAP, Laboratory Code 200246-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input checked="" type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469

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	U _{Lab}
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB

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 light dimmer with a BLE and Zigbee radio module. This report only concerns the Zigbee radio.

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	Zigbee	18.88	77.27

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a monopole antenna, with a maximum gain of 1 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 0799307

The test utility software used during testing was Docklight v2.3.26.

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 Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Stream 14	5CG016B3DL	NA
AC adapter	HP	L25296-00	NA	NA
Wireless adapter	National Control Devices	NA	NA	OUR-XBEEPRO

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 loads
2	1	1	Quick connect	Single conductor	<1m	Connects to AC Power.

TEST SETUP

The EUT is configured via a test laptop during the tests. Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R13547611-EP1 for setup diagrams

7. MEASUREMENT METHOD

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

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

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 - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1) HPF and 10dB pad in cal at time of testing

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
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 08-20-2015	NA	NA
	Miscellaneous (if needed)				
HPF017	100kHz High-pass Filter	Solar Electronics Co.	7801-100	2020-02-19	2021-02-19
ATTEN007	10dB Pad	NA	NA	2020-02-19	2021-02-19
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2020-08-08	2021-08-08

Test Equipment Used – Antenna Port Conducted (Morrisville – Conducted 2)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0027 (PRE0126407)	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
SOFTEMI	Antenna Port Software	UL	Version AP2021.2.2	NA	NA
PWS001 (PRE013734)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWM001 (MY55136012)	RF Power Meter	Keysight Technologies	N1911A	2020-07-17	2021-07-17
HI0091	Environmental Meter	Fisher Scientific	14-650-118	2020-06-26	2021-06-26

N-SAC - Radiated Disturbance Emissions Test Equipment Used

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	(Loop Ant.)			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-07-27	2021-07-27
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-08-07	2021-08-07
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-08-07	2021-08-07
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-08-07	2021-08-07
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-08-07	2021-08-07
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-07-16	2021-07-16
SOFTEMI	EMI Software	UL	Version 9.5 2020-08-19	NA	NA
	Additional Equipment Used				
HI0094	Environmental Meter	Fisher Scientific	06-662-4 11725843	2020-01-21	2022-01-21

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

**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 -10.46dB was applied to all radiated average data. See calculation below.

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

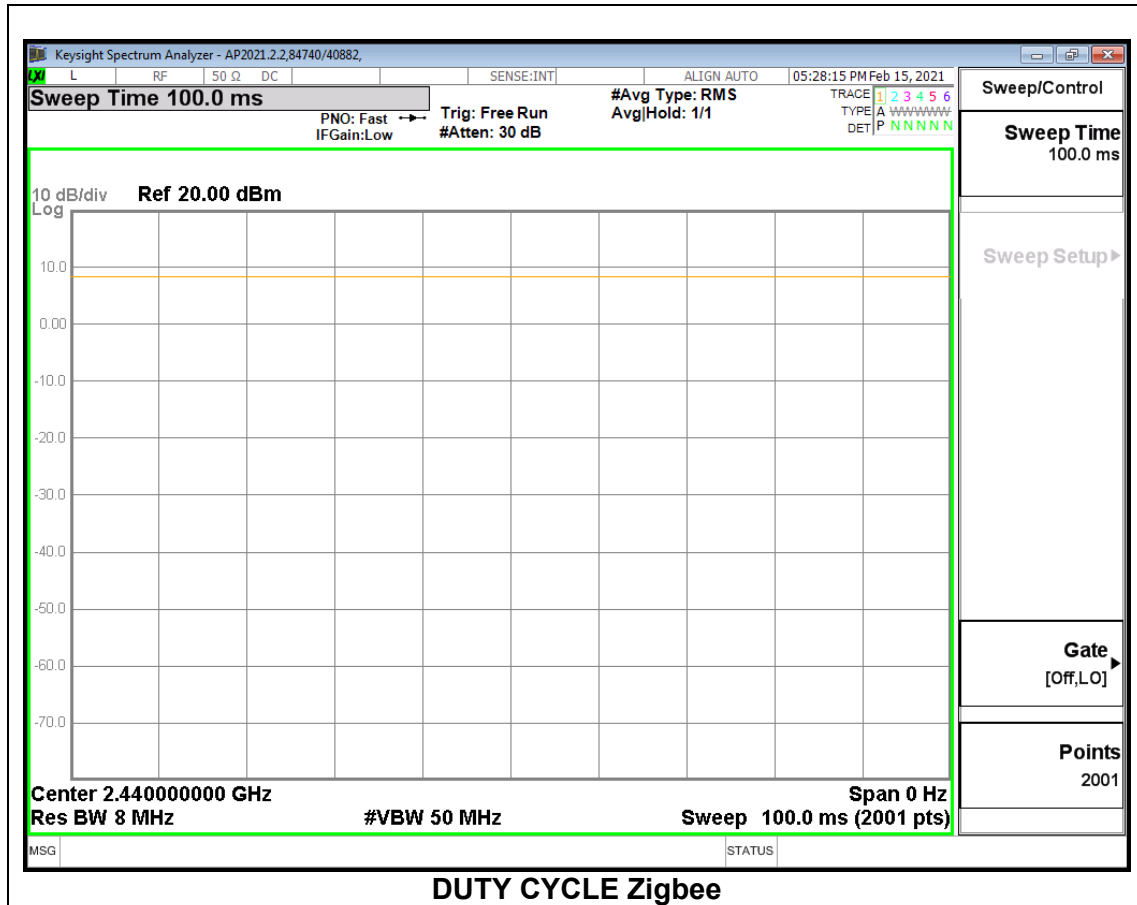
PROCEDURE

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)
2.4GHz Band						
Zigbee	100.000	100.000	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOTS



9.2. 99% BANDWIDTH

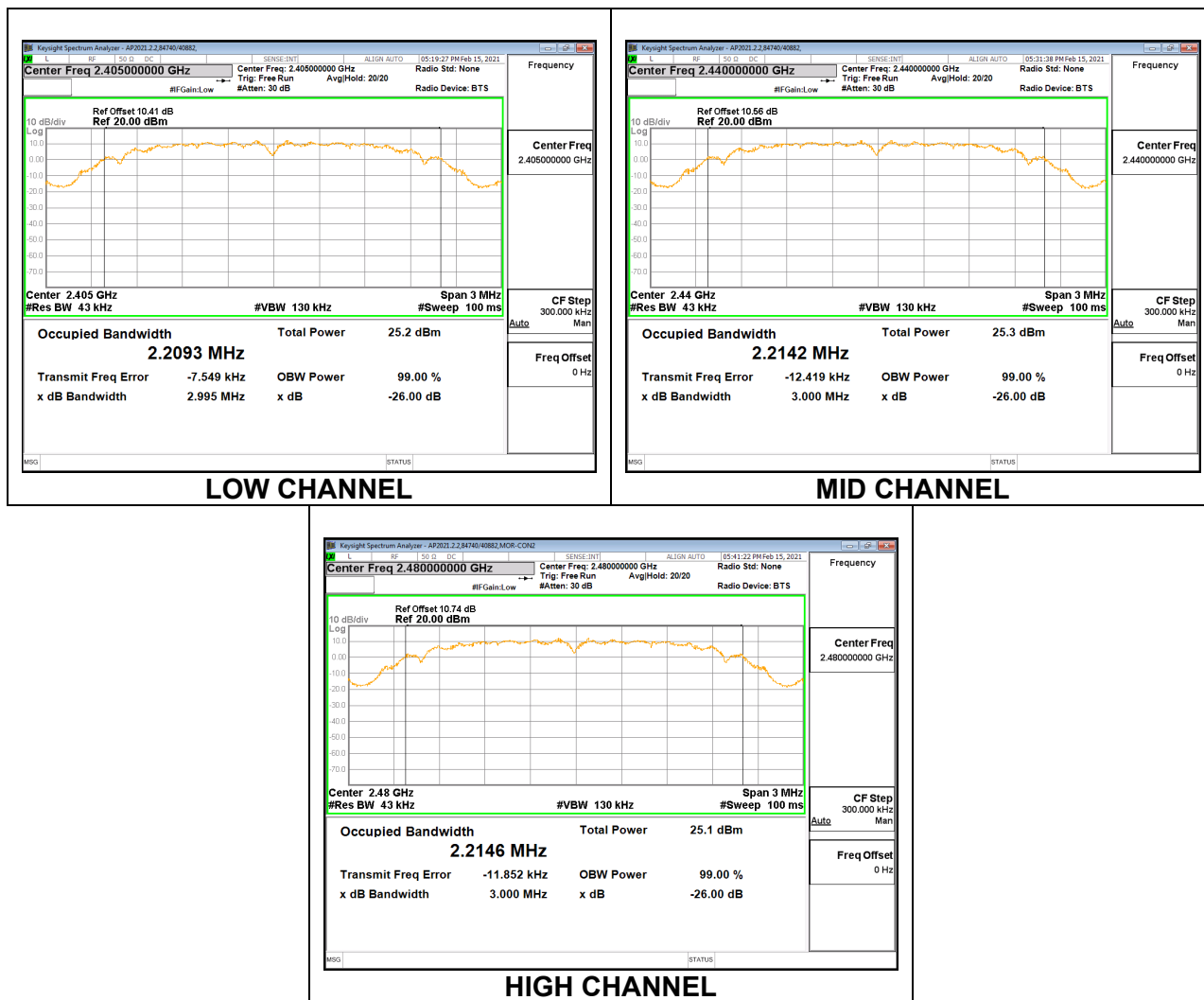
LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. Zigbee

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.2093
Middle	2440	2.2142
High	2480	2.2146



9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

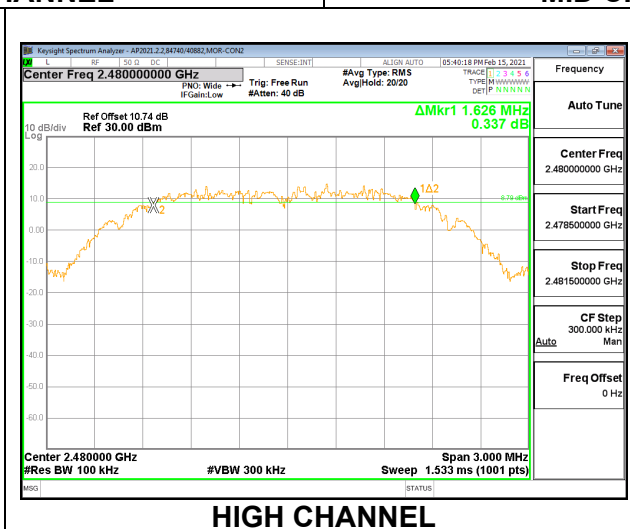
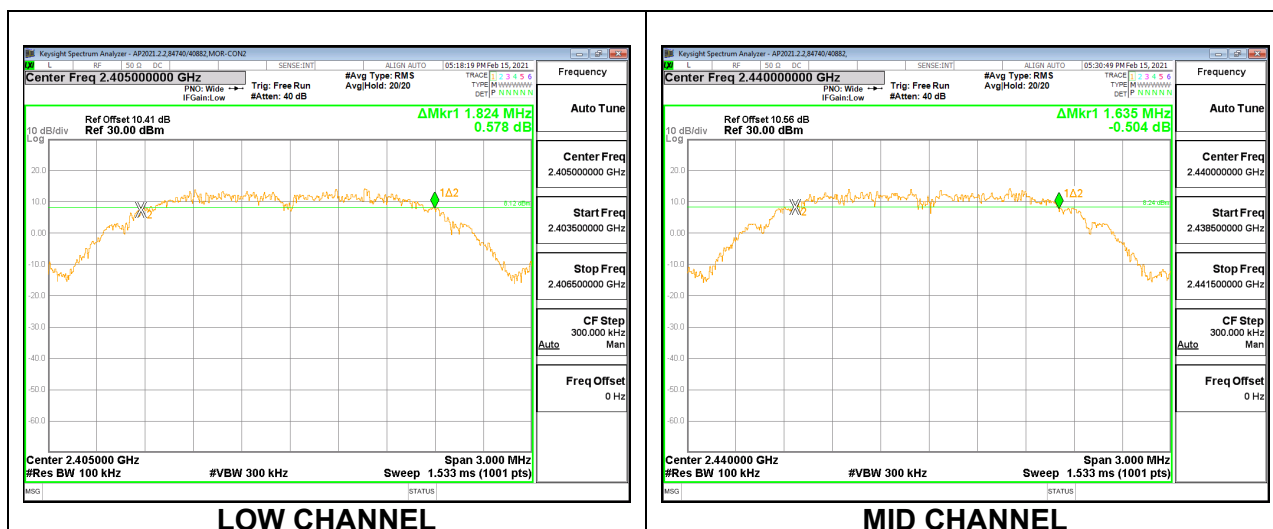
RSS-247 5.2 (a)

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

RESULTS

9.3.1. ZIGBEE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.8240	0.5
Middle	2440	1.6350	0.5
High	2480	1.6260	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 10.39 dB (including 10.28 dB pad and 0.11 dB EUT) was entered as an offset in the power meter.

RESULTS

9.4.1. ZIGBEE

Tested By:	84740/40882
Date:	2021-02-15

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2405	18.880	30	-11.120
Middle	2440	18.720	30	-11.280
High	2480	18.490	30	-11.510

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 10.39 dB (including 10.28 dB pad and 0.11 dB EUT) was entered as an offset in the power meter.

RESULTS

9.5.1. ZIGBEE

Tested By:	84740/40882
Date:	2021-02-15

Channel	Frequency (MHz)	AV power (dBm)
Low	2405	18.79
Middle	2440	18.61
High	2480	18.38

9.6. POWER SPECTRAL DENSITY

LIMITS

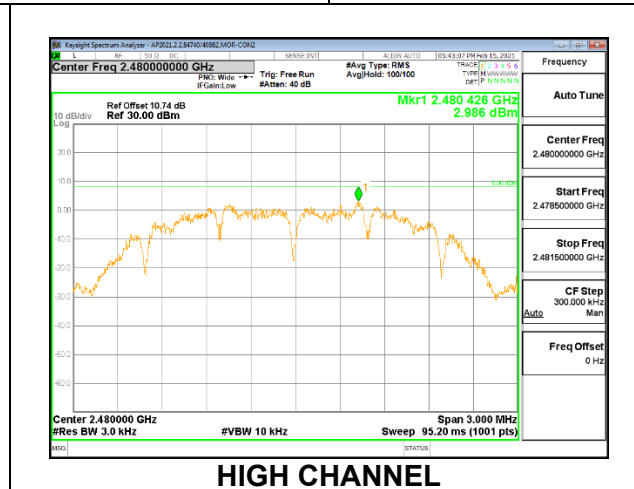
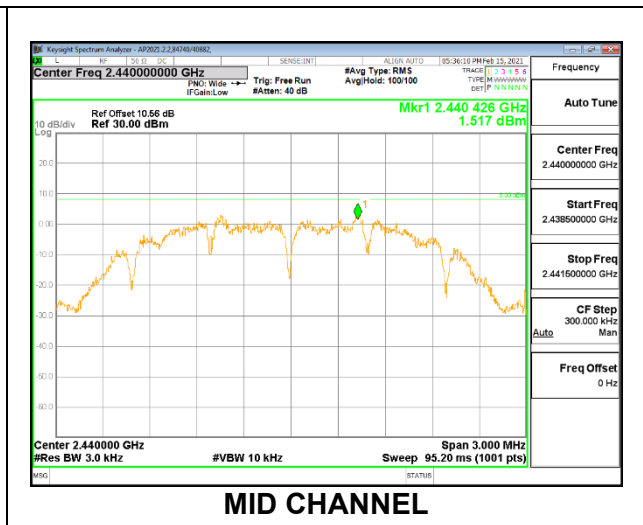
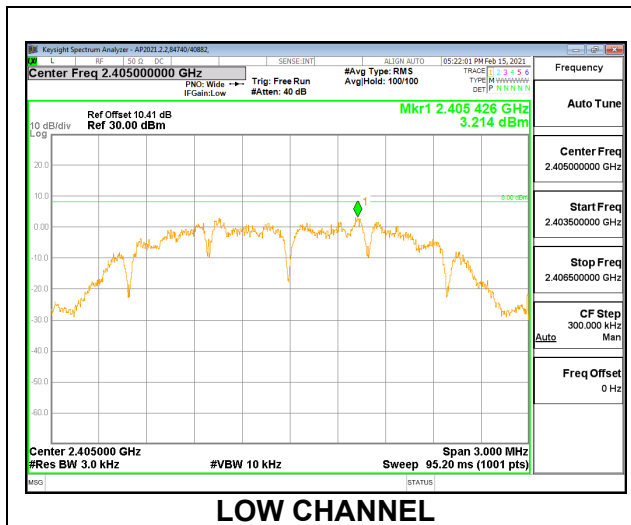
FCC §15.247 (e)
 RSS-247 (5.2) (b)

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. ZIGBEE

Channel	Frequency (MHz)	Meas PSD (dBm)	Limit (dBm/3kHz)	Margin (dB)
Low	2405	3.21	8	-4.79
Middle	2440	1.52	8	-6.48
High	2480	2.99	8	-5.01



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

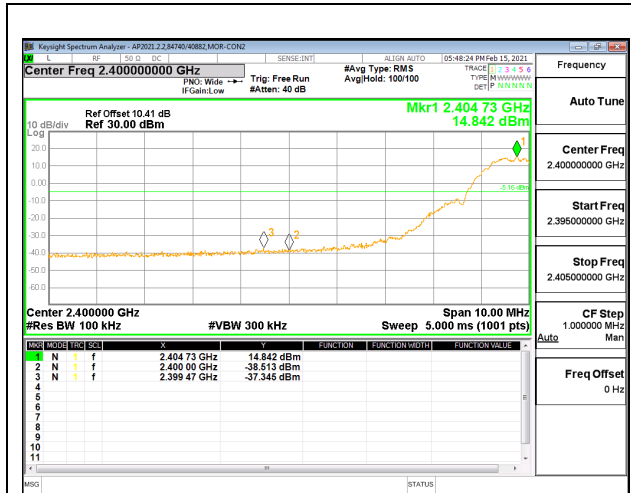
FCC §15.247 (d)

RSS-247 5.5

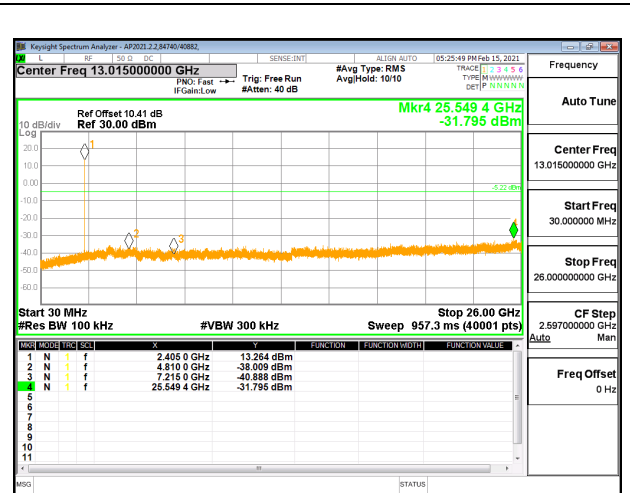
Output power was measured based on the use of a peak measurement; therefore the required attenuation is -20 dBc.

RESULTS

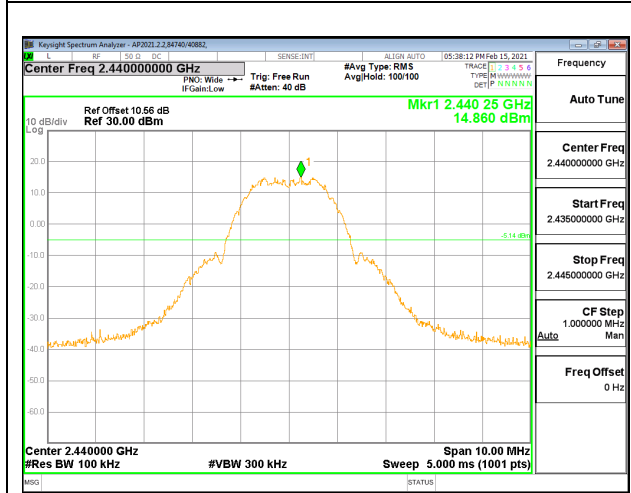
9.7.1. ZIGBEE



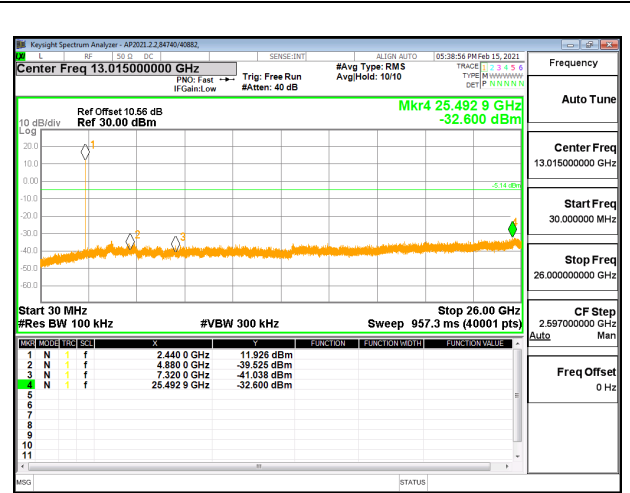
LOW CHANNEL BANDEDGE



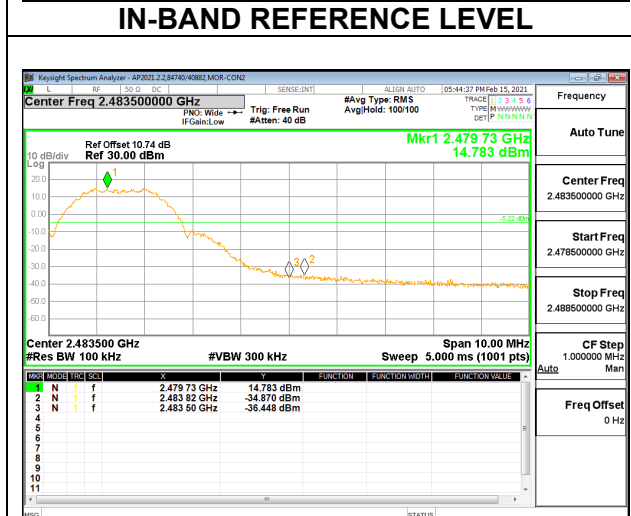
OUT-OF-BAND LOW CHANNEL



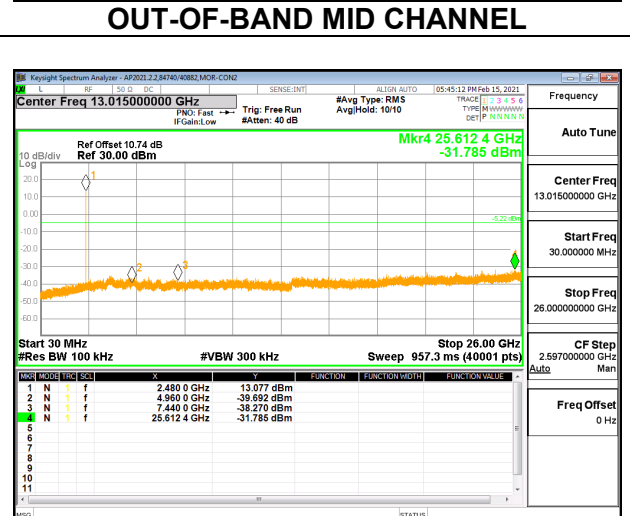
IN-BAND REFERENCE LEVEL



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

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

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	-

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
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 average 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 and PSD 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.

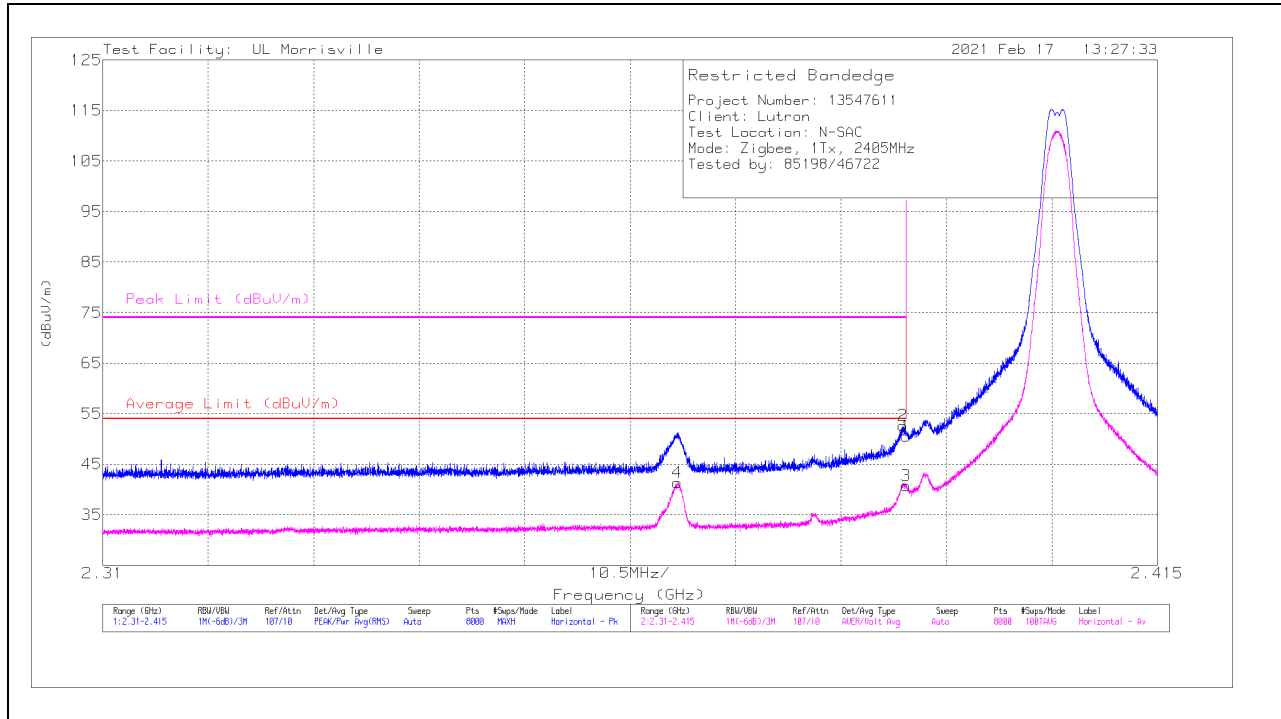
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. ZIGBEE

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT007 2 (dB/m)	Amp/Cbl/Ftr/ Pad (dB)	Real Life Duty Cycle Correction	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	43.14	Pk	31.8	-24.4	0	50.54	-	-	74	-23.46	99	167	H
3	* ** 2.39	33.36	ADV	31.8	-24.4	-10.46	30.30	54	-23.70	-	-	99	167	H
2	* ** 2.38969	45.2	Pk	31.8	-24.4	0	52.60	-	-	74	-21.4	99	167	H
4	* ** 2.36723	34.09	ADV	31.7	-24.4	-10.46	30.93	54	-23.07	-	-	99	167	H

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

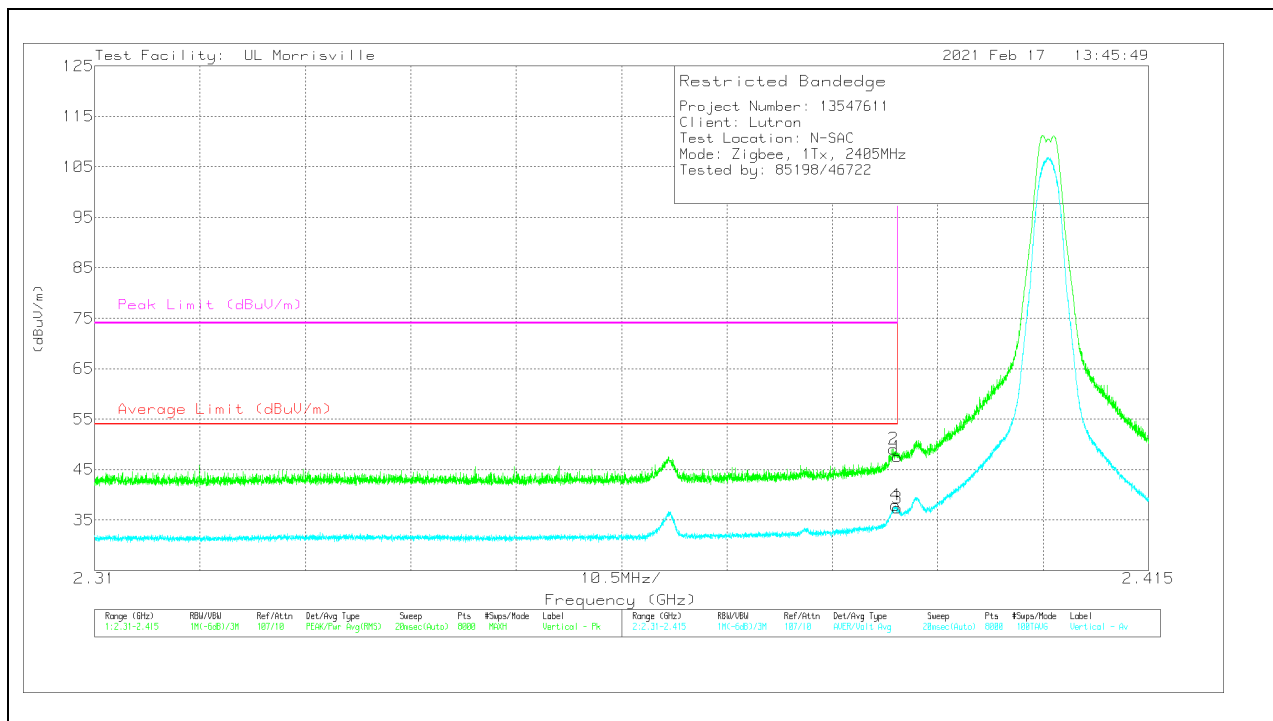
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average;

Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Real Life Duty Cycle Correction	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	40.21	Pk	31.8	-24.4	0	47.61	-	-	74	-26.39	243	269	V
3	*** 2.39	29.97	ADV	31.8	-24.4	-10.46	26.91	54	-27.09	-	-	243	269	V
2	*** 2.38958	41.71	Pk	31.8	-24.4	0	49.11	-	-	74	-24.89	243	269	V
4	*** 2.3898	30.54	ADV	31.8	-24.4	-10.46	27.48	54	-26.52	-	-	243	269	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

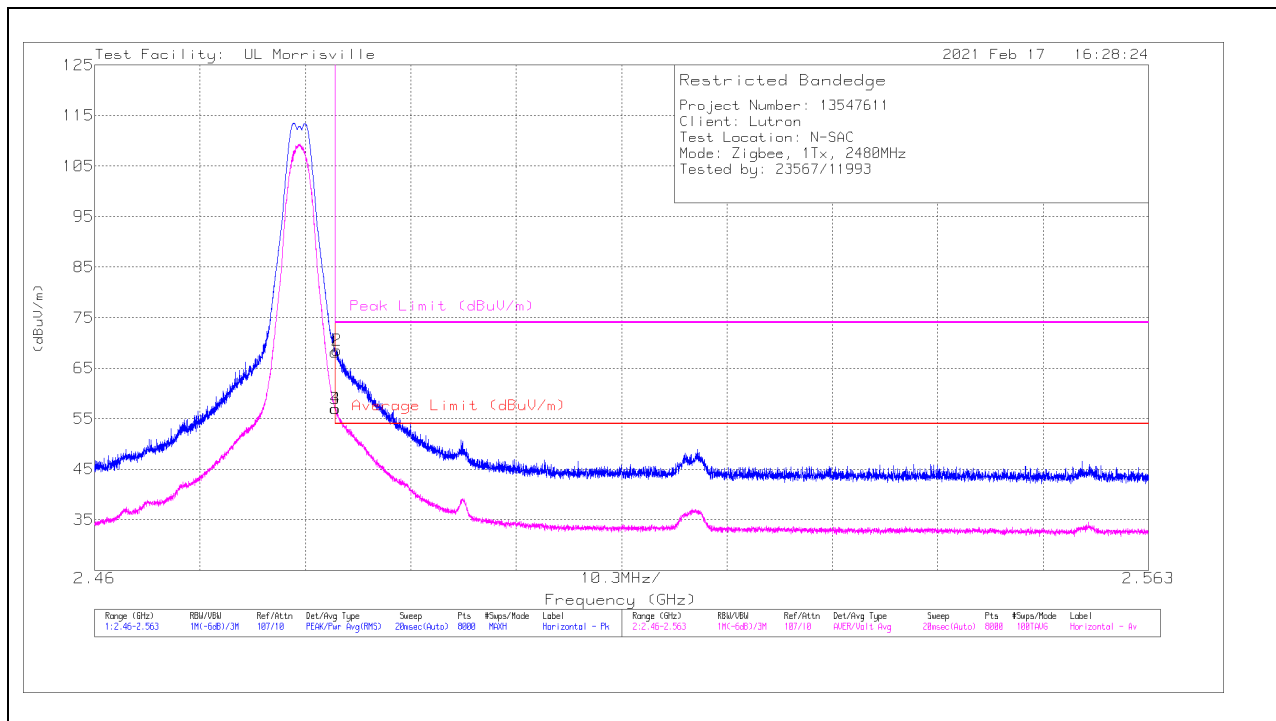
Pk - Peak detector

ADV - Linear Voltage Average

Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Real Life Duty Cycle Correction	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	60.05	Pk	32.4	-24.3	0	68.15	-	-	74	-5.85	3	115	H
2	* ** 2.48366	60.45	Pk	32.4	-24.3	0	68.55	-	-	74	-5.45	3	115	H
3	* ** 2.4835	48.84	ADV	32.4	-24.3	-10.46	46.48	54	-7.52	-	-	3	115	H
4	* ** 2.48355	48.9	ADV	32.4	-24.3	-10.46	46.54	54	-7.46	-	-	3	115	H

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

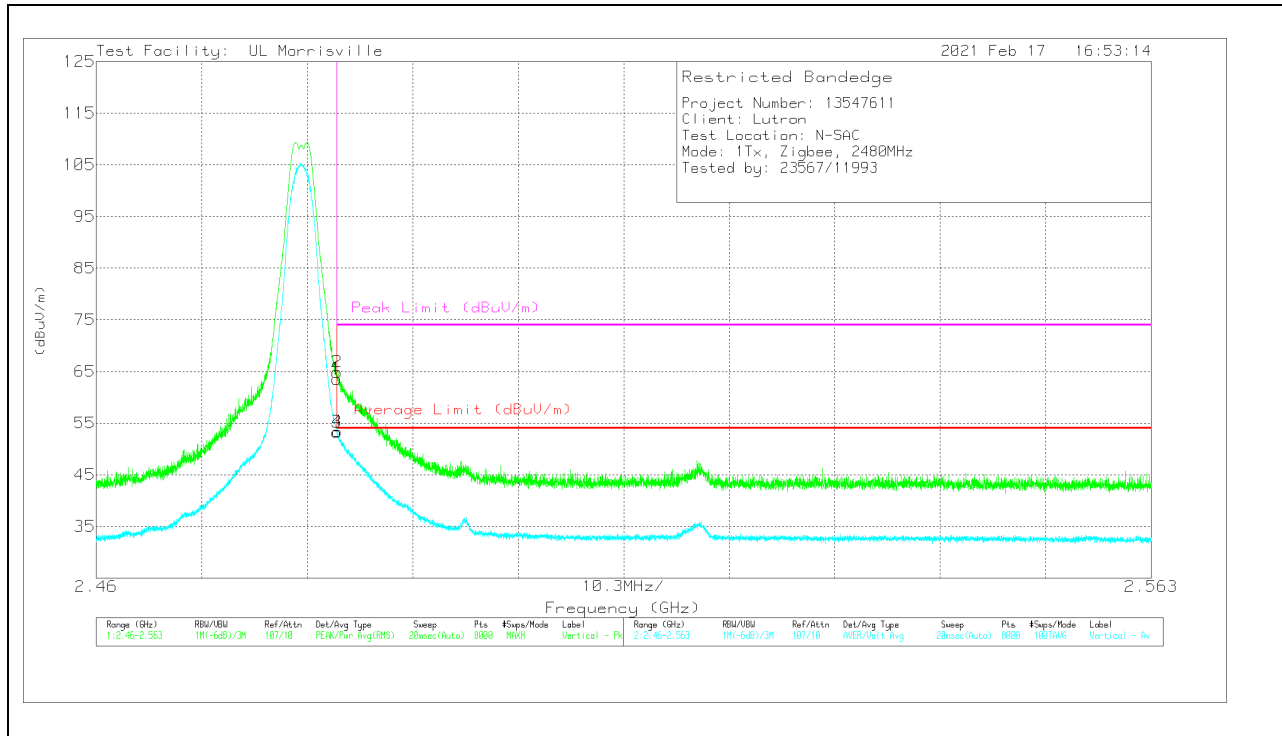
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Real Life Duty Cycle Correction	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	55.46	Pk	32.4	-24.3	0	63.56	-	-	74	-10.44	259	118	V
2	* ** 2.48351	56.78	Pk	32.4	-24.3	0	64.88	-	-	74	-9.12	259	118	V
3	* ** 2.4835	45.19	ADV	32.4	-24.3	-10.46	42.83	54	-11.17	-	-	259	118	V
4	* ** 2.48355	45.24	ADV	32.4	-24.3	-10.46	42.88	54	-11.12	-	-	259	118	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

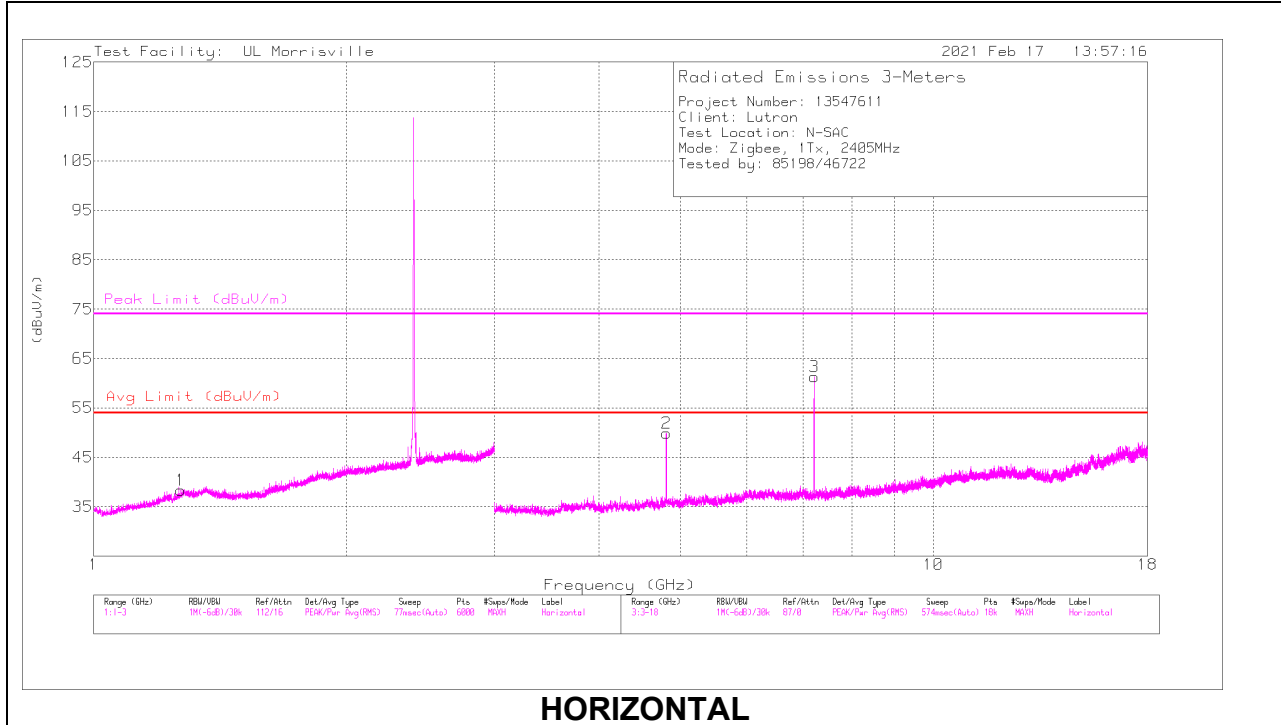
Pk - Peak detector

ADV - Linear Voltage Average

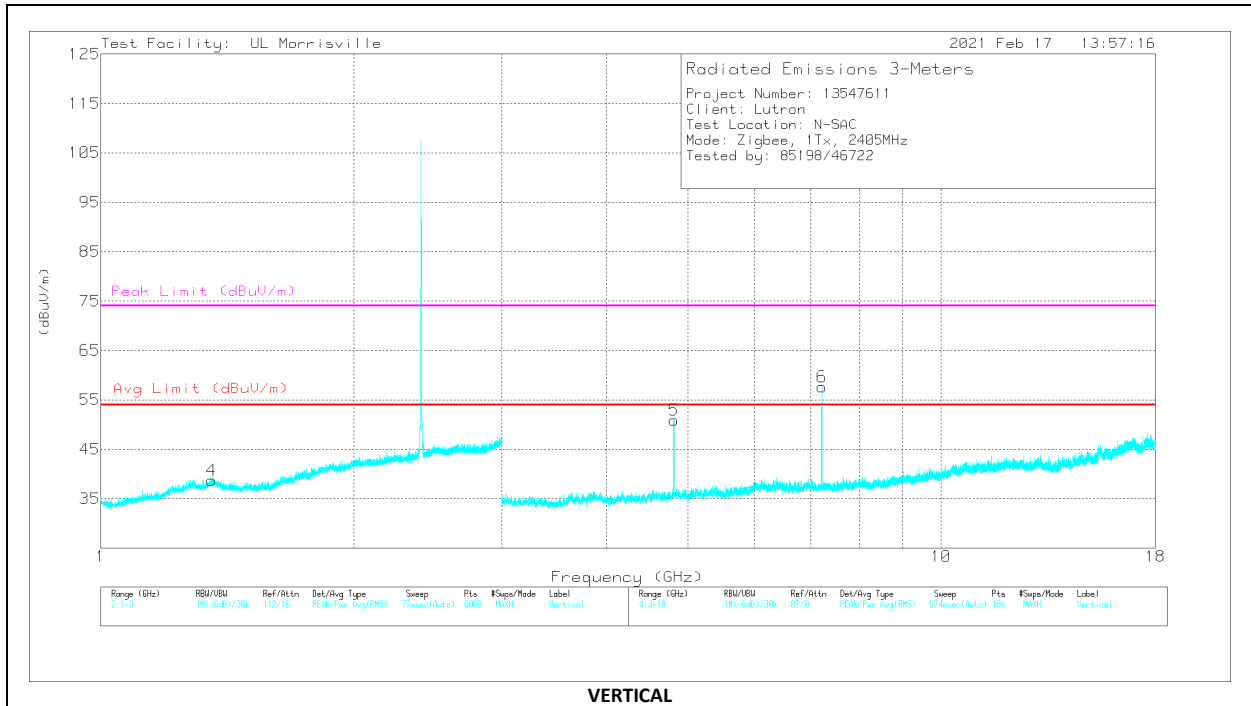
Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Real Life Duty Cycle Correction	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.27016	40.55	PK2	29.4	-25.7	0	44.25	-	-	74	-29.75	133	380	H
	* 1.26987	27.51	ADV	29.4	-25.7	-10.46	20.75	54	-33.25	-	-	133	380	H
4	*** 1.35596	40.97	PK2	29.5	-25.4	0	45.07	-	-	74	-28.93	187	353	V
	*** 1.35455	27.99	ADV	29.5	-25.3	-10.46	21.73	54	-32.27	-	-	187	353	V
2	*** 4.80896	51.38	PK2	34.2	-31.5	0	54.08	-	-	74	-19.92	297	119	H
	*** 4.80901	42.63	ADV	34.2	-31.5	-10.46	34.87	54	-19.13	-	-	297	119	H
5	*** 4.81103	53.89	PK2	34.1	-31.5	0	56.49	-	-	74	-17.51	231	250	V
	*** 4.81106	45.88	ADV	34.1	-31.5	-10.46	38.02	54	-15.98	-	-	231	250	V
6	7.21274	51.78	PK	35.7	-29.9	0	57.58	-	-	-	-	0-360	101	V
3	7.21607	55.27	PK	35.8	-29.8	0	61.27	-	-	-	-	0-360	101	H

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

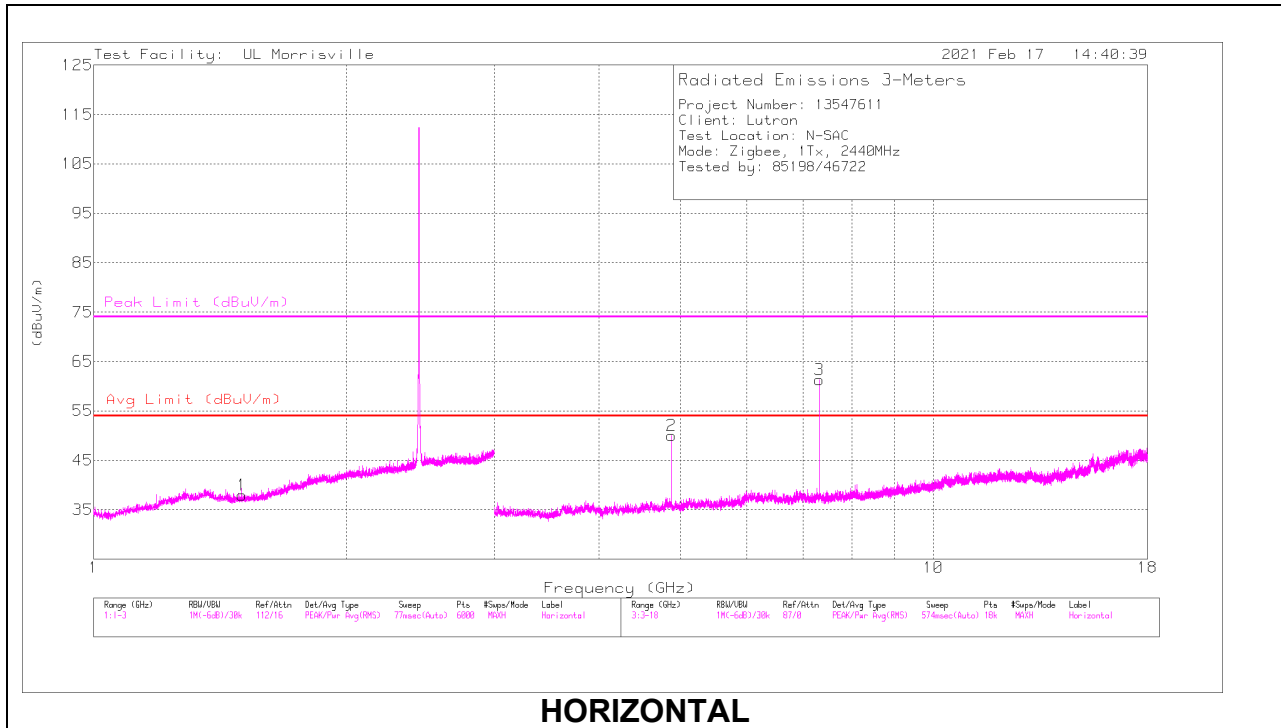
Pk - Peak detector

PK2 - Maximum Peak

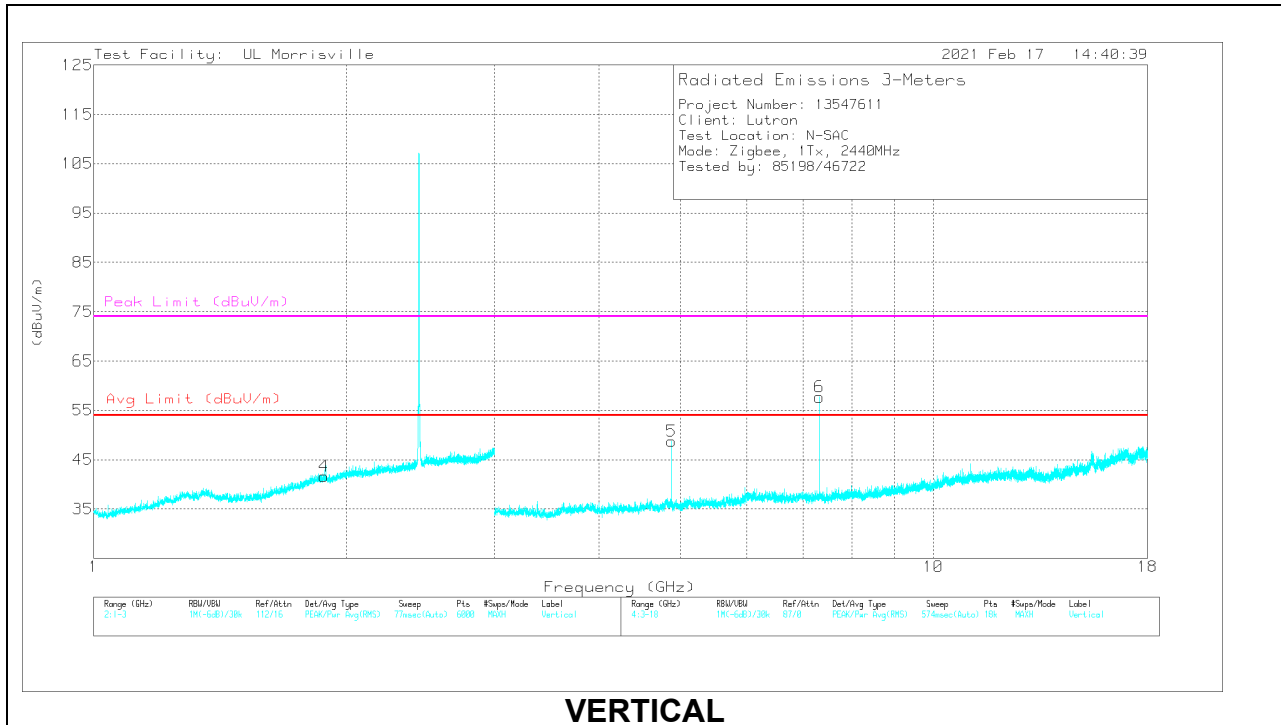
ADV - Linear Voltage Average

Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/ Pad (dB)	Real Life Duty Cycle Correction	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.49949	41.34	PK2	27.8	-24.8	0	44.34	-	-	74	-29.66	42	228	H
	*** 1.50305	28.15	ADV	27.8	-24.7	-10.46	20.79	54	-33.21	-	-	42	228	H
4	** 1.87981	35.01	Pk	30.9	-24.3	0	41.61	-	-	-	-	0-360	101	V
2	*** 4.87902	53.81	PK2	34.1	-31.4	0	56.51	-	-	74	-17.49	303	102	H
	*** 4.87895	44.16	ADV	34.1	-31.4	-10.46	36.40	54	-17.60	-	-	303	102	H
3	*** 7.31835	59.03	PK2	35.6	-29.3	0	65.33	-	-	74	-8.67	255	101	H
	*** 7.31844	51.24	ADV	35.6	-29.3	-10.46	47.08	54	-6.92	-	-	255	101	H
5	*** 4.87893	53.81	PK2	34.1	-31.4	0	56.51	-	-	74	-17.49	98	106	V
	*** 4.87902	43.28	ADV	34.1	-31.4	-10.46	35.52	54	-18.48	-	-	98	106	V
6	*** 7.31847	54.75	PK2	35.6	-29.3	0	61.05	-	-	74	-12.95	239	104	V
	*** 7.31841	46.81	ADV	35.6	-29.3	-10.46	42.65	54	-11.35	-	-	239	104	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

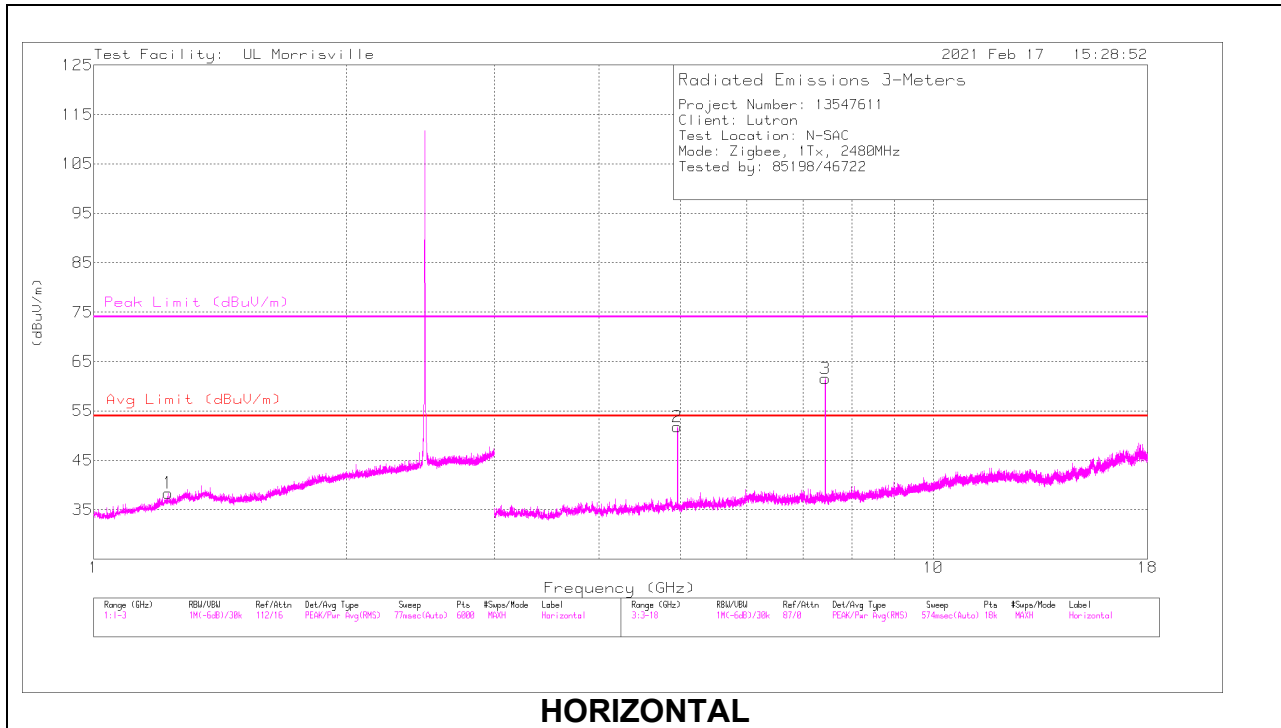
Pk - Peak detector

PK2 - Maximum Peak

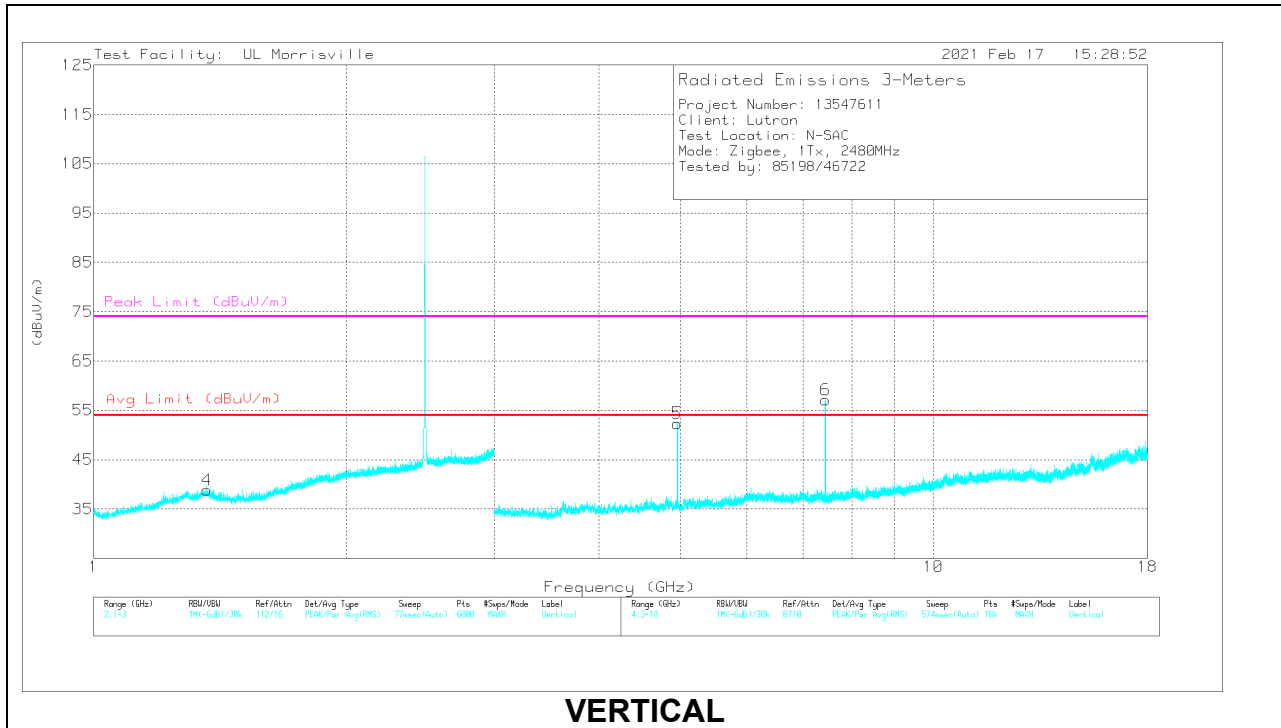
ADV - Linear Voltage Average

Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Real Life Duty Cycle Correction	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.2272	40.89	PK2	28.8	-26	0	43.69	-	-	74	-30.31	129	352	H
	*** 1.2258	27.91	ADV	28.8	-26	-10.46	20.25	54	-33.75	-	-	129	352	H
4	*** 1.3664	40.95	PK2	29.5	-25.3	0	45.15	-	-	74	-28.85	84	395	V
	*** 1.36324	27.99	ADV	29.4	-25.3	-10.46	21.63	54	-32.37	-	-	84	395	V
2	*** 4.9588	55.19	PK2	34.1	-32.3	0	56.99	-	-	74	-17.01	320	113	H
	*** 4.95895	45.24	ADV	34.1	-32.3	-10.46	36.58	54	-17.48	-	-	320	113	H
3	*** 7.43852	58.44	PK2	35.7	-29.3	0	64.84	-	-	74	-9.16	252	101	H
	*** 7.43846	50.79	ADV	35.7	-29.3	-10.46	46.73	54	-7.27	-	-	252	101	H
5	*** 4.95892	59.03	PK2	34.1	-32.3	0	60.83	-	-	74	-13.17	253	103	V
	*** 4.95902	47.08	ADV	34.1	-32.3	-10.46	36.42	54	-17.58	-	-	253	103	V
6	*** 7.4415	54.14	PK2	35.7	-29.3	0	60.54	-	-	74	-13.46	283	104	V
	*** 7.44164	45.93	ADV	35.7	-29.3	-10.46	41.87	54	-12.13	-	-	283	104	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

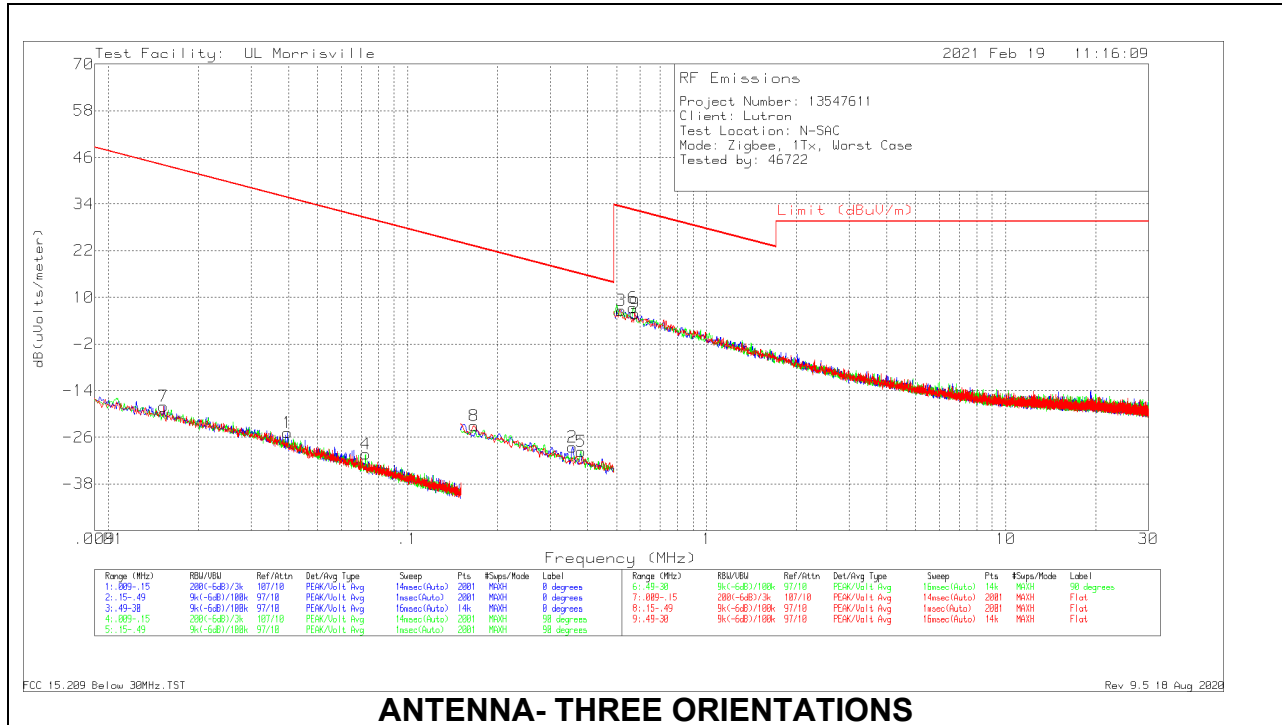
Note: Real word duty cycle was declared as 30% resulting in a duty cycle correction factor of $20\log(.30) = -10.46$.

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 377Ω . For example, the measurement frequency 15.32 kHz resulted in a level of -18.04 dBuV/m, which is equivalent to $-18.04 - 51.5 = -69.54$ dBuA/m, which has the same margin, -61.94 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)



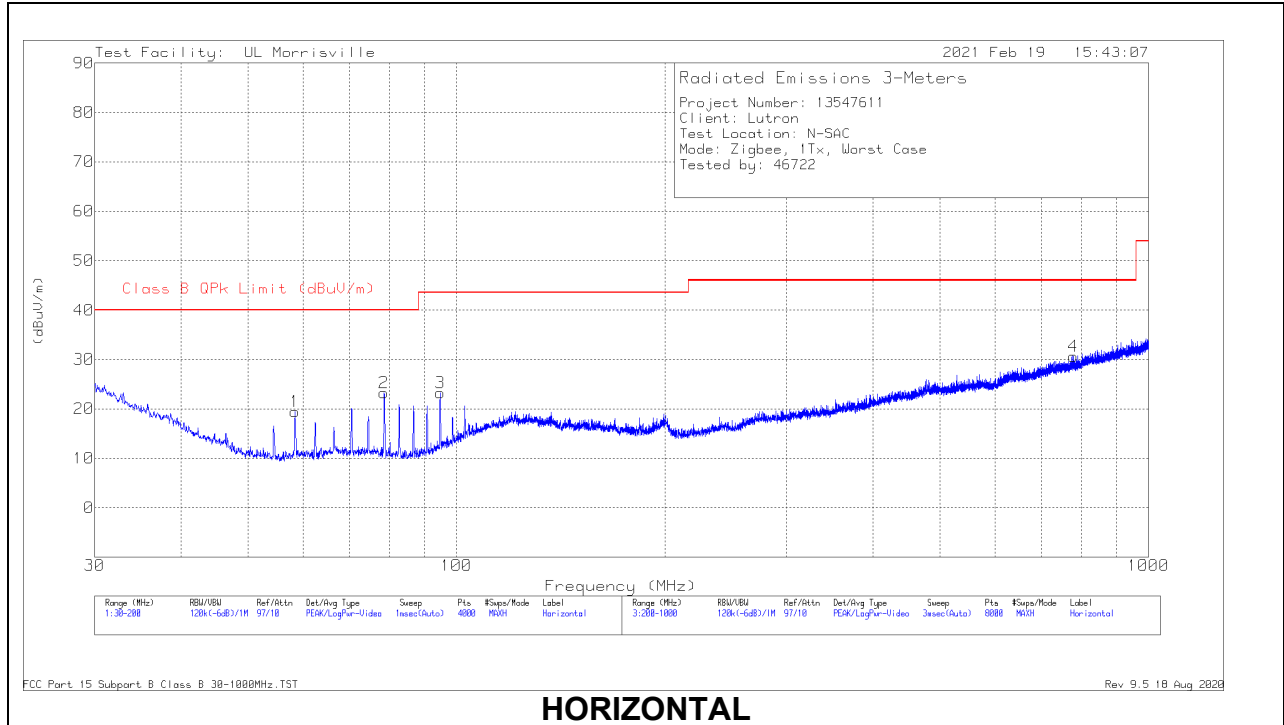
Below 30MHz Data

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	FCC 15.209 Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
7	.01532	46.16	Pk	15.7	.1	-80	-18.04	23.90	43.9	-61.94	0-360
1	.03974	42.71	Pk	12.3	.1	-80	-24.89	15.62	35.62	-60.51	0-360
4	.0724	38.43	Pk	11.2	.1	-80	-30.27	10.41	30.41	-60.68	0-360
8	.16675	46.01	Pk	10.8	.1	-80	-23.09	3.16	23.16	-46.25	0-360
2	.35647	40.71	Pk	10.6	.1	-80	-28.59	-3.44	16.56	-45.15	0-360
5	.3801	39.66	Pk	10.6	.1	-80	-29.64	-3.99	16.01	-45.65	0-360
3	.5174	35.66	Pk	10.8	.2	-40	6.66	-	33.33	-26.67	0-360
6	.568	36.32	Pk	10.8	.2	-40	7.32	-	32.52	-25.2	0-360
9	.57643	34.82	Pk	10.8	.2	-40	5.82	-	32.39	-26.57	0-360

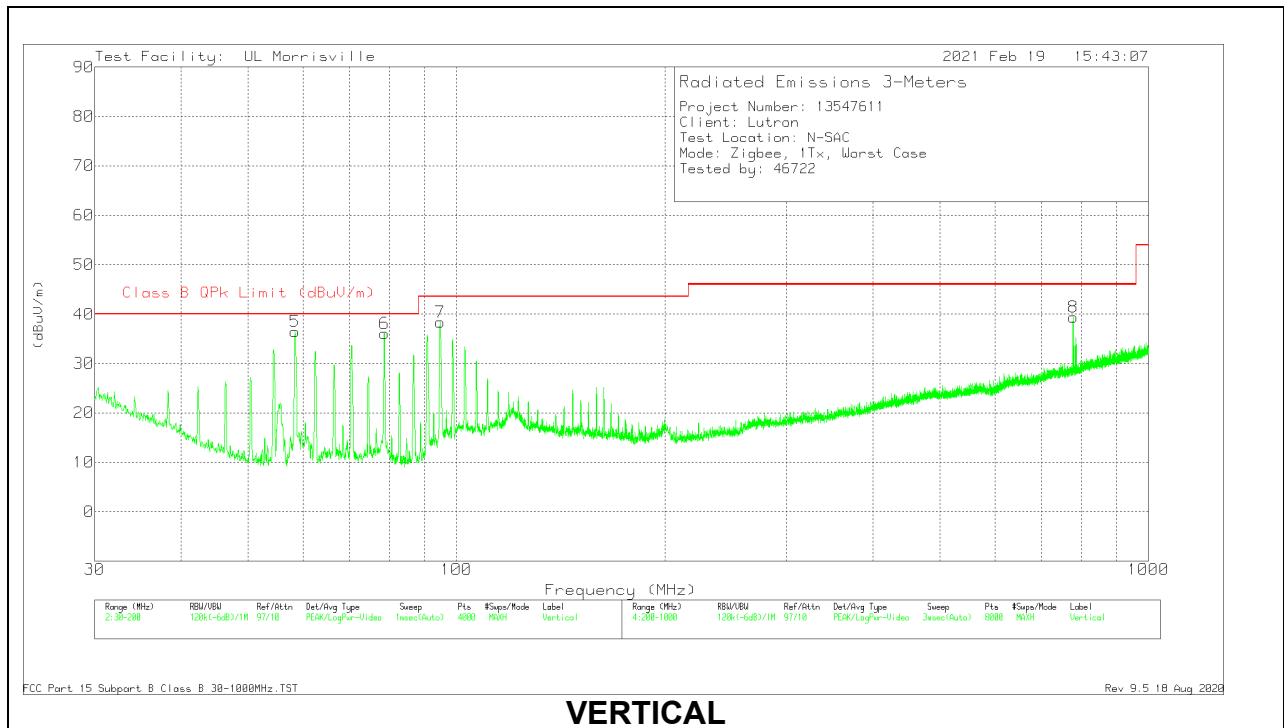
Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

Below 1GHz Data

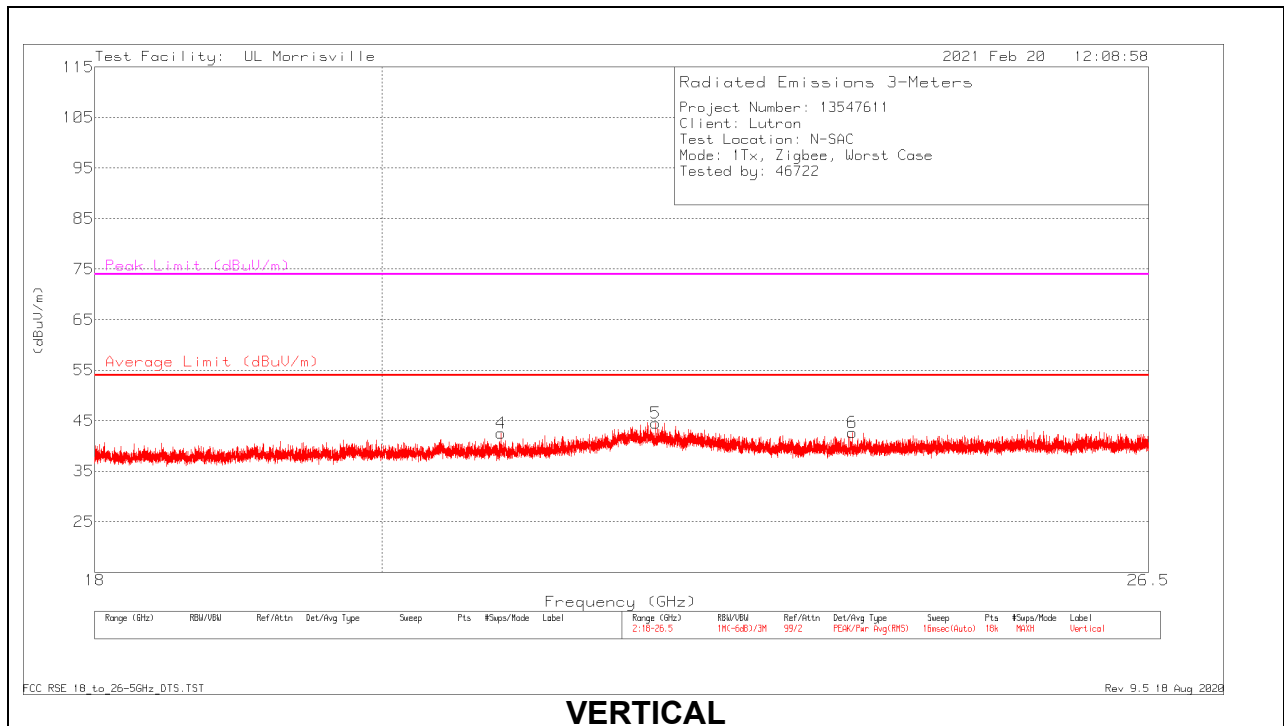
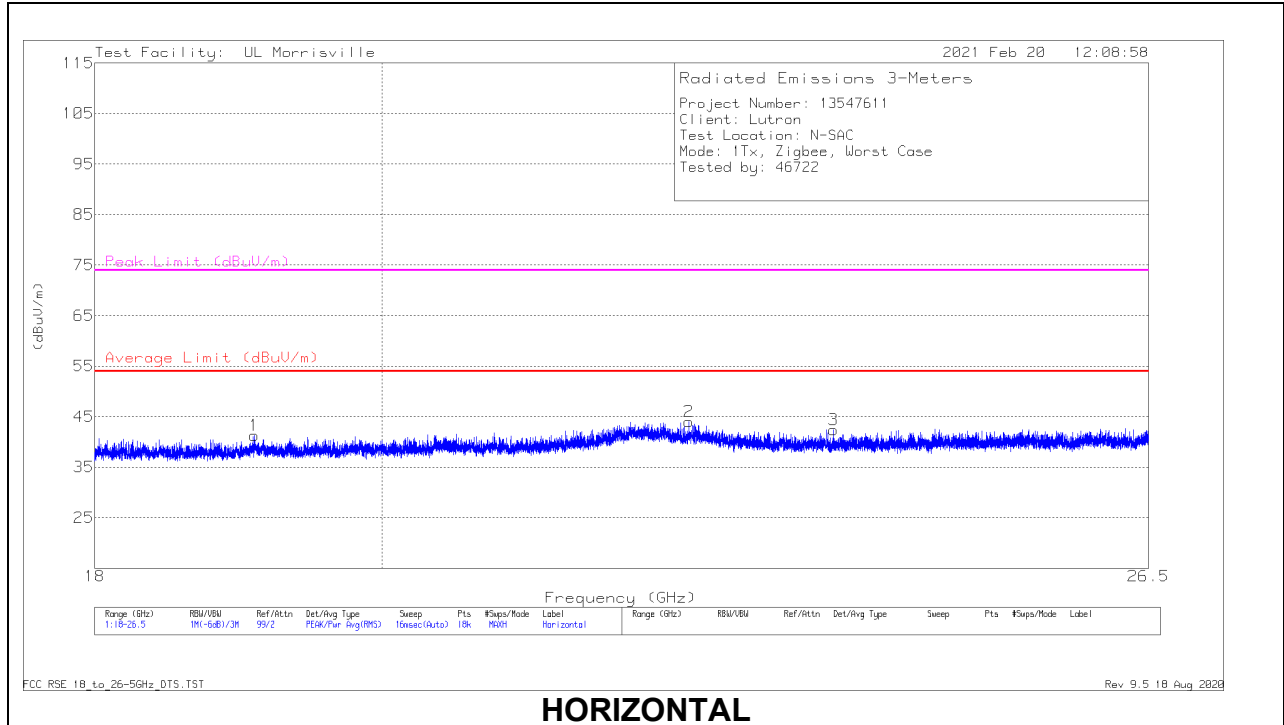
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	58.4399	37.1	Pk	13.4	-31	19.5	40	-20.5	0-360	99	H
5	58.4927	52.95	Qp	13.4	-31	35.35	40	-4.65	321	107	V
2	78.5901	40.28	Pk	13.7	-30.7	23.28	40	-16.72	0-360	299	H
6	78.634	50.31	Qp	13.7	-30.7	33.31	40	-6.69	259	141	V
3	94.7443	38.96	Pk	14.8	-30.5	23.26	43.52	-20.26	0-360	199	H
7	94.6747	52.1	Qp	14.8	-30.5	36.4	43.52	-7.12	99	113	V
8	777.9751	38.23	Pk	27.1	-25.9	39.43	46.02	-6.59	0-360	199	V
4	778.7752	29.32	Pk	27.2	-25.9	30.62	46.02	-15.4	0-360	299	H

Pk - Peak detector

Qp - Quasi-Peak detector

10.5. WORST CASE 18-26 GHZ

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



18 – 26GHz 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	*** 19.08759	48.14	Pk	33.5	-40.3	41.34	54	-12.66	74	-32.66	0-360	200	H
2	** 22.38766	48.41	Pk	36.6	-41	44.01	54	-9.99	74	-29.99	0-360	200	H
3	*** 23.60842	48.09	Pk	34.9	-40.6	42.39	54	-11.61	74	-31.61	0-360	300	H
4	*** 20.89582	49.13	Pk	34.1	-40.7	42.53	54	-11.47	74	-31.47	0-360	150	V
5	*** 22.11375	48.58	Pk	36.7	-40.8	44.48	54	-9.52	74	-29.52	0-360	101	V
6	*** 23.76993	48.33	Pk	34.8	-40.5	42.63	54	-11.37	74	-31.37	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)

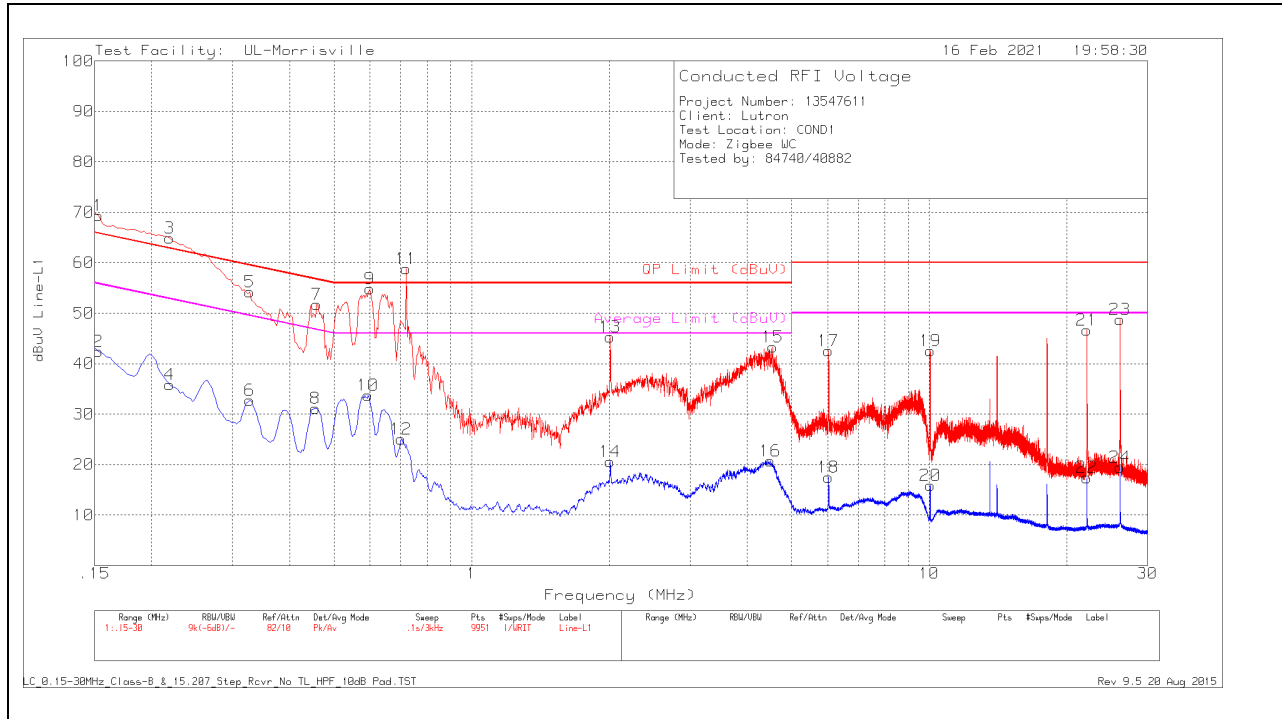
RSS-Gen 8.8

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

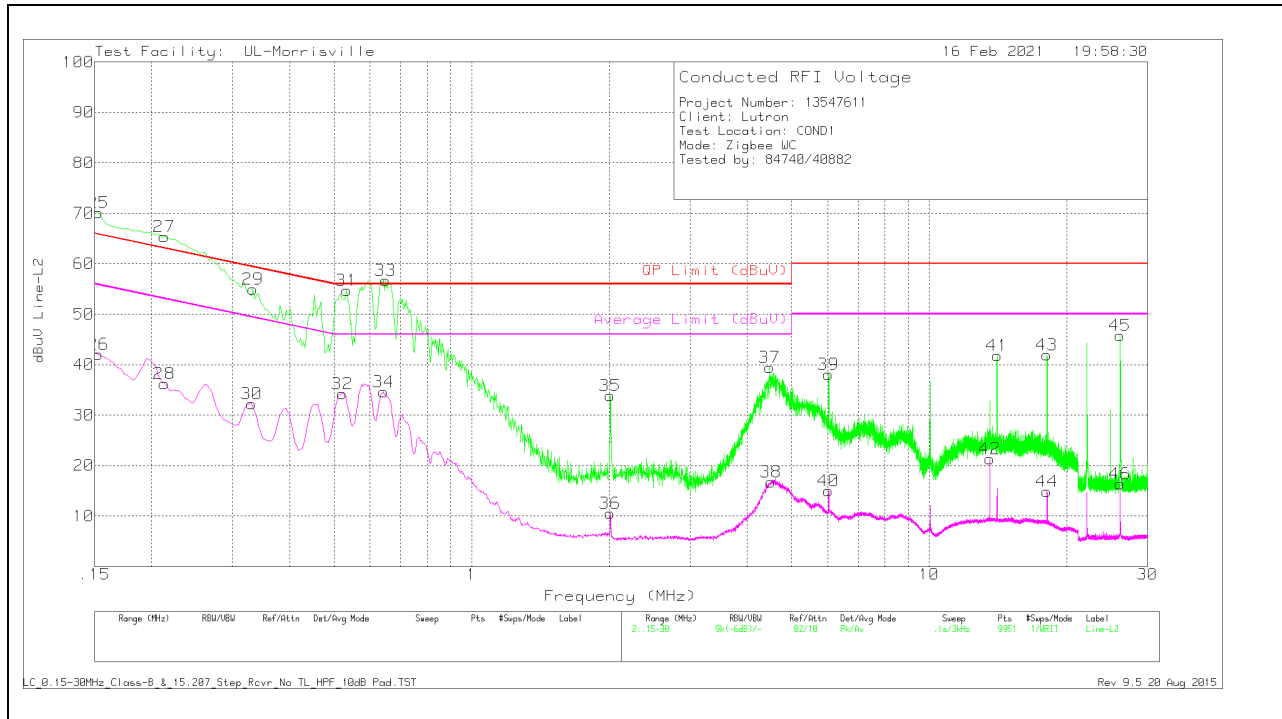
11.1.1. AC Power Line Norm LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz												
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	.15562	51.76	Qp	.2	1	9.9	62.86	65.69	-2.83	-	-	
2	.153	31.35	Av	.2	1	9.9	42.45	-	-	55.84	-13.39	
3	.21458	47.79	Qp	.1	.7	9.9	58.49	63.03	-4.54	-	-	
4	.219	25.19	Av	.1	.7	9.9	35.89	-	-	52.86	-16.97	
5	.318	37.88	Qp	.1	.5	9.9	48.38	59.76	-11.38	-	-	
6	.327	22.21	Av	.1	.5	9.9	32.71	-	-	49.53	-16.82	
7	.45324	33.08	Qp	.1	.3	9.9	43.38	56.82	-13.44	-	-	
8	.456	20.8	Av	.1	.3	9.9	31.1	-	-	46.77	-15.67	
9	.59554	37.52	Qp	0	.3	9.9	47.72	56	-8.28	-	-	
10	.594	23.59	Av	0	.3	9.9	33.79	-	-	46	-12.21	
11	.7184	29.09	Qp	0	.2	9.9	39.19	56	-16.81	-	-	
12	.702	14.89	Av	0	.2	9.9	24.99	-	-	46	-21.01	
13	2.01	35.3	Pk	0	.1	9.9	45.3	56	-10.7	-	-	
14	2.01	10.52	Av	0	.1	9.9	20.52	-	-	46	-25.48	
15	4.545	33.24	Pk	0	.1	9.9	43.24	56	-12.76	-	-	
16	4.497	10.71	Av	0	.1	9.9	20.71	-	-	46	-25.29	
17	6.027	32.41	Pk	.1	.1	9.9	42.51	60	-17.49	-	-	
18	6.027	7.38	Av	.1	.1	9.9	17.48	-	-	50	-32.52	
19	10.047	32.42	Pk	.1	.1	9.9	42.52	60	-17.48	-	-	
20	10.047	5.76	Av	.1	.1	9.9	15.86	-	-	50	-34.14	
21	22.11	36.32	Pk	.2	.2	9.9	46.62	60	-13.38	-	-	
22	22.116	7.11	Av	.2	.2	9.9	17.41	-	-	50	-32.59	
23	26.133	38.39	Pk	.3	.2	9.9	48.79	60	-11.21	-	-	
24	26.133	9.1	Av	.3	.2	9.9	19.5	-	-	50	-30.5	

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

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
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)
25	.1555	52.11	Qp	.2	1	9.9	63.21	65.7	-2.49	-	-
26	.153	30.99	Av	.2	1	9.9	42.09	-	-	55.84	-13.75
27	.21371	48.15	Qp	.1	.7	9.9	58.85	63.06	-4.21	-	-
28	.213	25.53	Av	.1	.7	9.9	36.23	-	-	53.09	-16.86
29	.31774	38.22	Qp	.1	.5	9.9	48.72	59.77	-11.05	-	-
30	.33	21.8	Av	.1	.4	9.9	32.2	-	-	49.45	-17.25
31	.52842	37.66	Qp	.1	.3	9.9	47.96	56	-8.04	-	-
32	.522	23.98	Av	.1	.3	9.9	34.28	-	-	46	-11.72
33	.64094	39.41	Qp	0	.2	9.9	49.51	56	-6.49	-	-
34	.642	24.48	Av	0	.2	9.9	34.58	-	-	46	-11.42
35	2.01	23.84	Pk	0	.1	9.9	33.84	56	-22.16	-	-
36	2.01	.51	Av	0	.1	9.9	10.51	-	-	46	-35.49
37	4.485	29.31	Pk	.1	.1	9.9	39.41	56	-16.59	-	-
38	4.509	6.66	Av	.1	.1	9.9	16.76	-	-	46	-29.24
39	6.03	28.02	Pk	.1	.1	9.9	38.12	60	-21.88	-	-
40	6.03	4.84	Av	.1	.1	9.9	14.94	-	-	50	-35.06
41	14.07	31.66	Pk	.1	.2	9.9	41.86	60	-18.14	-	-
42	13.56	11.14	Av	.1	.2	9.9	21.34	-	-	50	-28.66
43	18.093	31.7	Pk	.1	.2	9.9	41.9	60	-18.1	-	-
44	18.096	4.65	Av	.1	.2	9.9	14.85	-	-	50	-35.15
45	26.136	35.45	Pk	.2	.2	9.9	45.75	60	-14.25	-	-
46	26.139	6.04	Av	.2	.2	9.9	16.34	-	-	50	-33.66

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

12. SETUP PHOTOS

Please refer to R13547611-EP1 for setup photos

END OF TEST REPORT