



TEST REPORT

Report Number. : R13852487-E2

Applicant : Pi-Lit Technologies
3002 Dow Ave. #138
Tustin, CA, 92780, U.S.A

Model : Gateway

FCC ID : 2AZQW-IDS1GATEWAY

IC : 27831- IDS1GATEWAY

EUT Description : Radio Module

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2021
ISED RSS-247 ISSUE 2: 2017
ISED RSS-GEN ISSUE 5 + A2: 2021

Date Of Issue:
2022-05-04

Prepared by:
UL LLC
12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
TEL: (919) 549-1400



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2022-05-04	Initial Issue	Haley Ackun

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST RESULTS SUMMARY.....	6
3. TEST METHODOLOGY	7
4. FACILITIES AND ACCREDITATION	7
5. DECISION RULES AND MEASUREMENT UNCERTAINTY.....	8
5.1. <i>METROLOGICAL TRACEABILITY</i>	8
5.2. <i>DECISION RULES</i>	8
5.3. <i>MEASUREMENT UNCERTAINTY</i>	8
5.4. <i>SAMPLE CALCULATION</i>	8
6. EQUIPMENT UNDER TEST	9
6.1. <i>EUT DESCRIPTION</i>	9
6.2. <i>MAXIMUM OUTPUT POWER</i>	9
6.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	9
6.4. <i>SOFTWARE AND FIRMWARE</i>	9
6.5. <i>WORST-CASE CONFIGURATION AND MODE</i>	9
6.6. <i>DESCRIPTION OF TEST SETUP</i>	10
7. MEASUREMENT METHOD.....	11
8. TEST AND MEASUREMENT EQUIPMENT	12
9. ANTENNA PORT TEST RESULTS	14
9.1. <i>ON TIME AND DUTY CYCLE</i>	14
9.2. <i>99% BANDWIDTH</i>	16
9.2.1. 802.15.4.....	16
9.3. <i>6 dB BANDWIDTH</i>	17
9.3.1. 802.15.4.....	17
9.4. <i>OUTPUT POWER</i>	18
9.4.1. 802.15.4.....	18
9.5. <i>AVERAGE POWER</i>	19
9.5.1. 802.15.4.....	19
9.6. <i>POWER SPECTRAL DENSITY</i>	20

9.6.1. 802.15.4.....	20
9.7. CONDUCTED SPURIOUS EMISSIONS.....	21
9.7.1. 802.15.4.....	22
10. RADIATED TEST RESULTS	23
10.1. LIMITS AND PROCEDURE.....	23
10.2. TRANSMITTER ABOVE 1 GHZ.....	25
10.2.1. 802.15.4	25
10.3. WORST CASE BELOW 30MHZ.....	31
10.4. WORST CASE BELOW 1 GHZ	33
10.5. WORST CASE 18-26 GHZ.....	35
11. SETUP PHOTOS	37

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Pi-Lit Technologies
3002 Dow Ave #138
Tustin, CA, 92780, USA

EUT DESCRIPTION: Radio Module

MODEL: Gateway

SERIAL NUMBER: Non-serialized

SAMPLE RECEIPT DATE: 2021-09-13

DATE TESTED: 2021-10-12 TO 2021-11-10

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2021	Refer to Section 2
ISED RSS-247 Issue 2: 2017	Refer to Section 2
ISED RSS-GEN Issue 5 + A2:2021	Refer to Section 2

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.

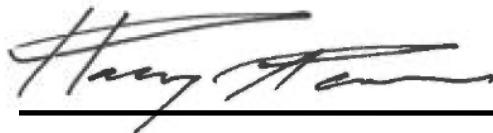
This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For
UL LLC. By:



Brian T. Kiewra
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	Refer to section 10.2.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Not Performed	Refer to Note.

Note: The EUT is powered via battery in the field; therefore AC line conducted emissions were not performed.

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: 2021, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A2: 2021, and RSS-247 Issue 2: 2017.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by a2La, cert. # 0751.06 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 type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	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	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)
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 (dB_{uV/m}) = Measured Voltage (dB_{uV}) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dB_{uV}) = Measured Voltage (dB_{uV}) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a radio module that supports SISO for 802.15.4 and LTE Cat-M1. This report covers testing for 802.15.4 only. The EUT only has channels 2405MHz & 2410MHz enabled.

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	20.77	119.40

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an inverted-F antenna, with a maximum gain of 3.3 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was PIV025C BoardConfig v01.00.5656abf0 Oct 11 10-47-48 2021.

6.5. WORST-CASE CONFIGURATION AND MODE

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

Band edge was performed with the EUT set to transmit at the highest power on 2405MHz channel only. Radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on 2405MHz channel and set to a script setting of 10 on channel 2410MHz.

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

The EUT is battery operated in the “real-world”; therefore AC Line power conducted emissions were not performed. The EUT was also tested in its enclosure in the “real-world”, to account for the position of the antenna in the enclosure.

All testing on channel 2405MHz was ran at a script setting of 12.
All testing on channel 2410MHz was ran at a script setting of 10.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Supply	CircuitSpecialists	CS13005XS	76022	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	DC	UART	<1m	Positive and Negative leads used to power the EUT.

TEST SETUP

Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R13852487-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

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)

Radiated 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 Section 6.3 to 6.6

8. 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/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
	30-1000 MHz				
AT0066	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB1	2021-02-19	2022-02-19
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	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	2021-07-20	2022-07-20
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2021-07-20	2022-07-20
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-20	2022-07-20
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2021-07-20	2022-07-20
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-30	2022-03-30
SOFTEMI	EMI Software	UL	Version 9.5 (09 Aug 2021 & 18 Oct 2021)		

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

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	Gain-Loss Chains				
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2021-07-09	2022-07-09
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
76022	DC Regulated Power Supply	CircuitSpecialists.com	CSI3005X5	NA	NA
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2021-04-01	2022-04-01
PWM003	RF Power Meter	Keysight Technologies	N1911A	2021-08-30	2022-08-30
PWS004	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2021-08-19	2022-08-19
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2021-07-12	2022-07-12
SOFTEMI	Antenna Port Software	UL	Version 2021.09.30	NA	NA
446557	DC Power Supply	CircuitSpecialists.com	CSI12001X	NA	NA

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

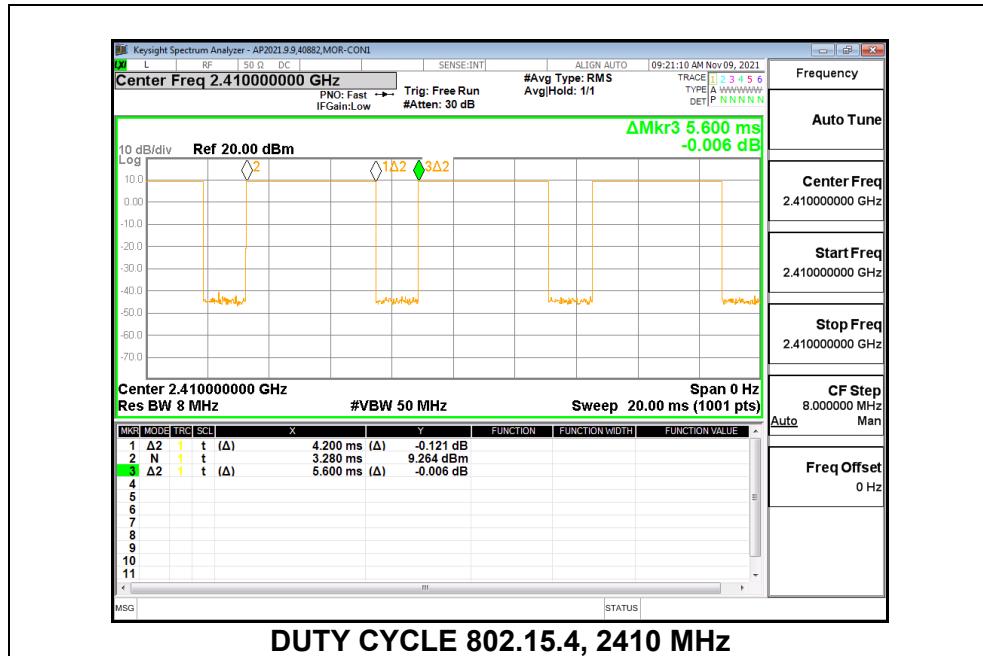
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.
ANSI C63.10 Section 11.6

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						
802.15.4	4.2000	5.600	0.750	75.00%	2.50	0.238

DUTY CYCLE PLOT



Test Info

Date: 2021-11-09

Tester: 40882

*Note: The operational duty cycle of the EUT is 2% 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 -33.98 was applied to all radiated peak data to get the average measurement. See calculation below.

Duty Cycle Correction Factor = $20 \log(0.02) = 20 \log(0.02) = -33.98 \text{ dB}$

9.2. 99% BANDWIDTH

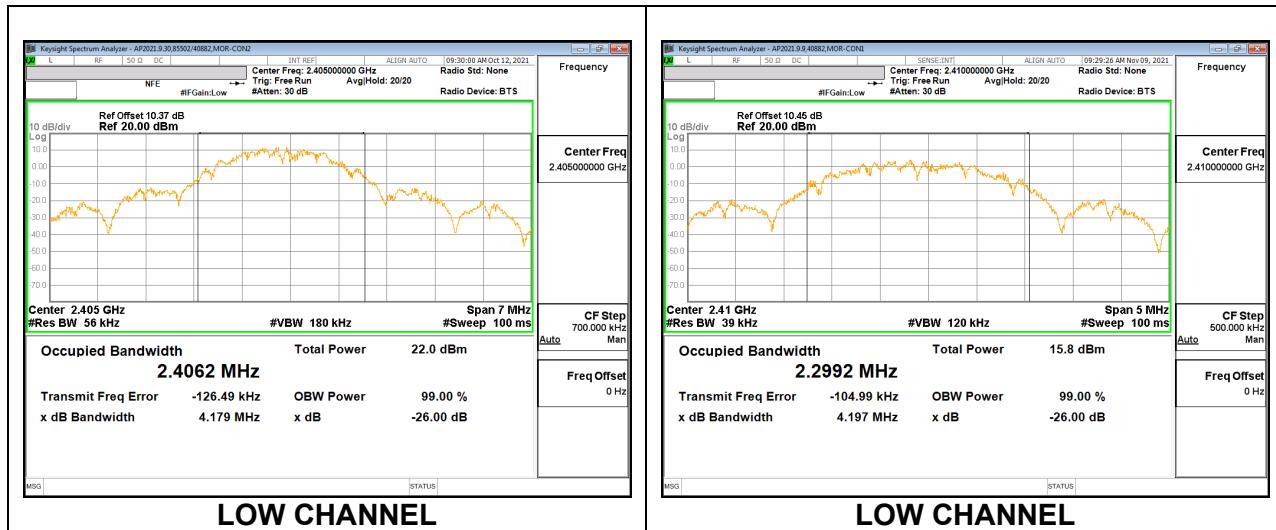
LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. 802.15.4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.4062
Low	2410	2.2992



9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

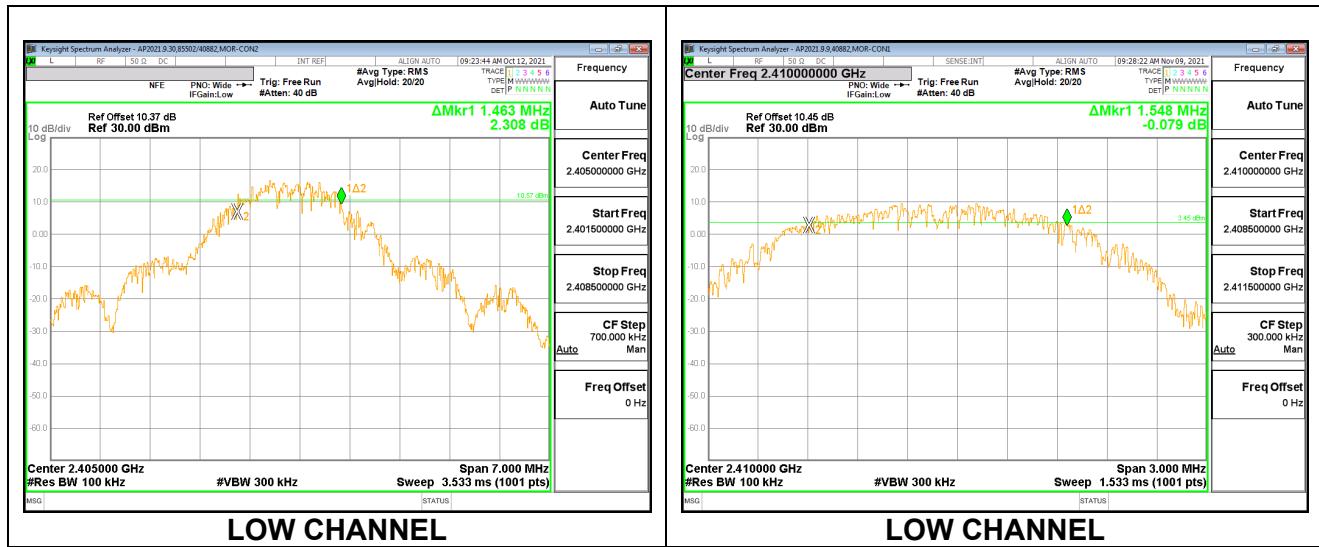
RSS-247 5.2 (a)

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	1.463	0.5
Middle	2410	1.548	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 peak power meter.

The cable assembly insertion loss of 10.37 dB (including 9.71 dB pad and 0.66 dB cable) was entered as an offset in the power meter.

RESULTS

9.4.1. 802.15.4

Tested By:	85502/40882
Date:	2021-10-20 & 2021-11-10

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2405	20.77	30	-9.230
Low	2410	18.64	30	-11.360

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 10.37 dB (including 9.71 dB pad and 0.66 dB cable) was entered as an offset in the power meter.

RESULTS

9.5.1. 802.15.4

Tested By:	85502/40882
Date:	2021-10-20 & 2021-11-10

Channel	Frequency	AV power
	(MHz)	(dBm)
Low	2405	20.57
Low	2410	18.38

9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

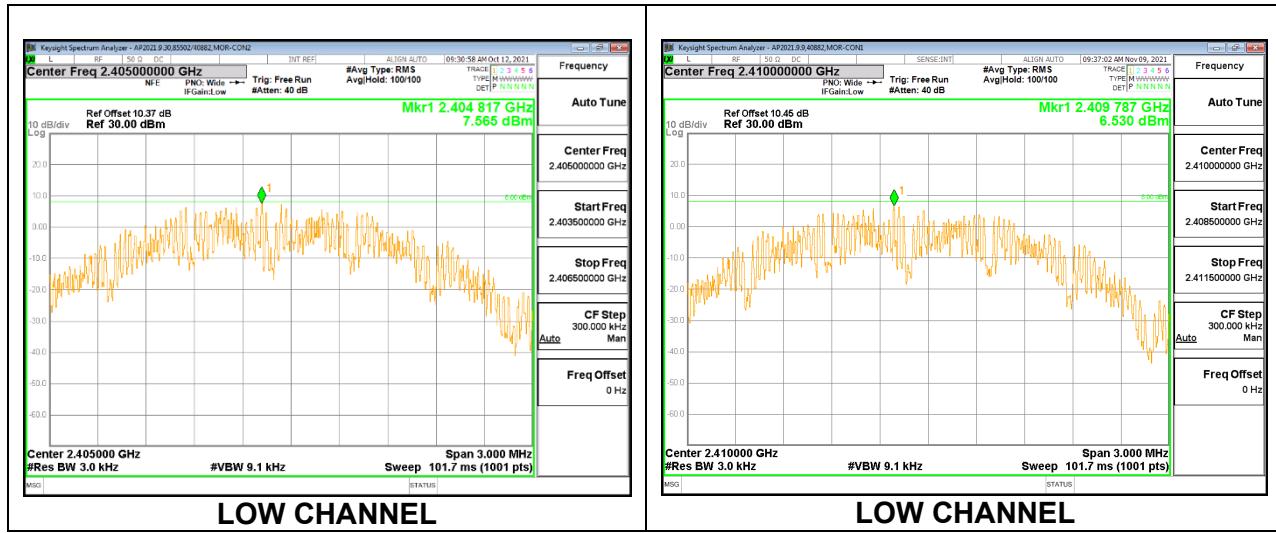
RSS-247 (5.2) (b)

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. 802.15.4

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2405	7.565	8	-0.44
Low	2410	6.530	8	-1.47



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

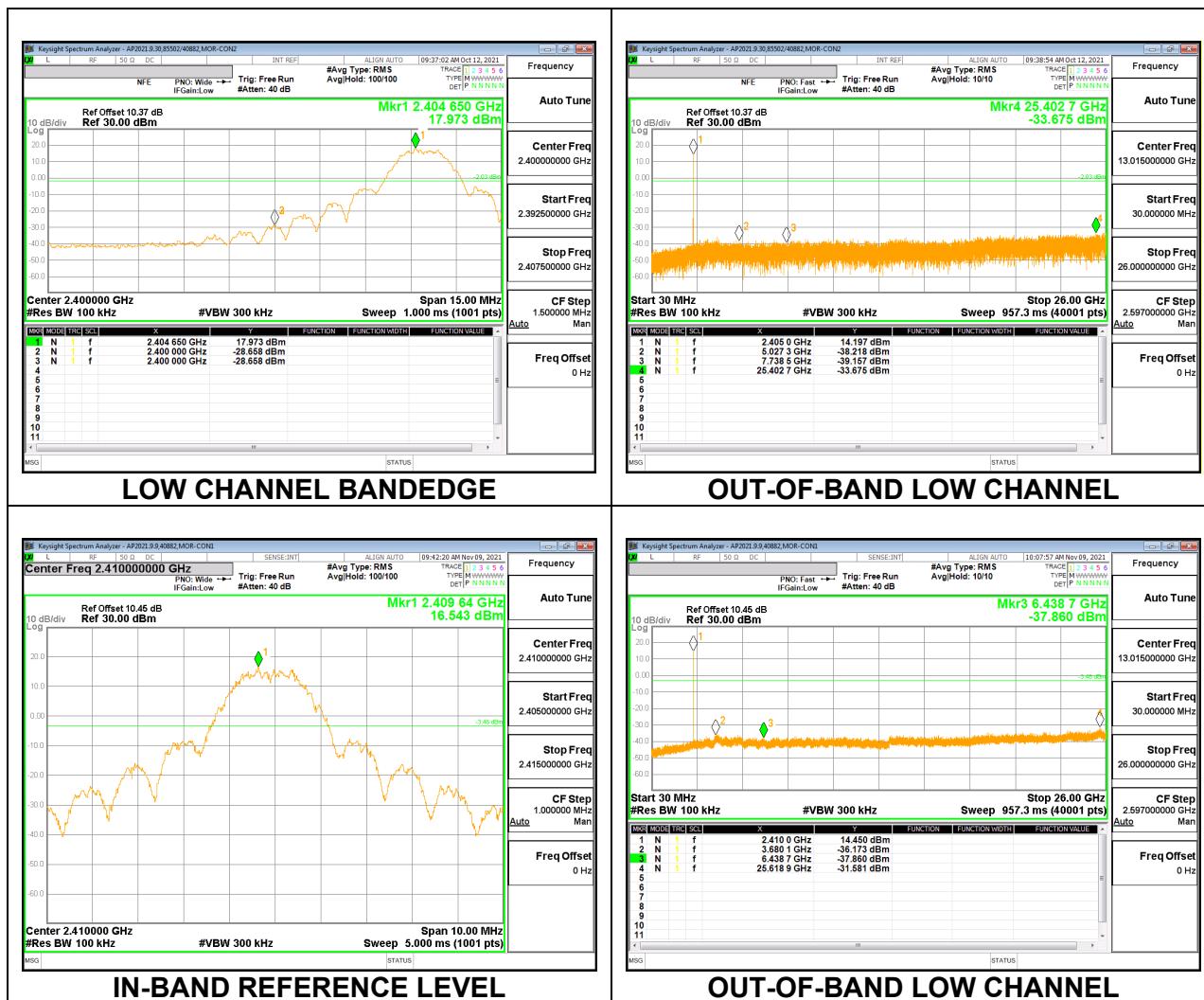
FCC §15.247 (d)

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



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 (uA/m) at 3 m	Field Strength Limit (dBuA/m) at 3 m
0.009-0.490	6.37/F(kHz) @ 300 m	-
0.490-1.705	63.7/F(kHz) @ 30 m	-
1.705 - 30	0.08 @ 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 3 MHz 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. The declared DCCF was applied to the peak measurements to obtain the calculated average measurement.

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.

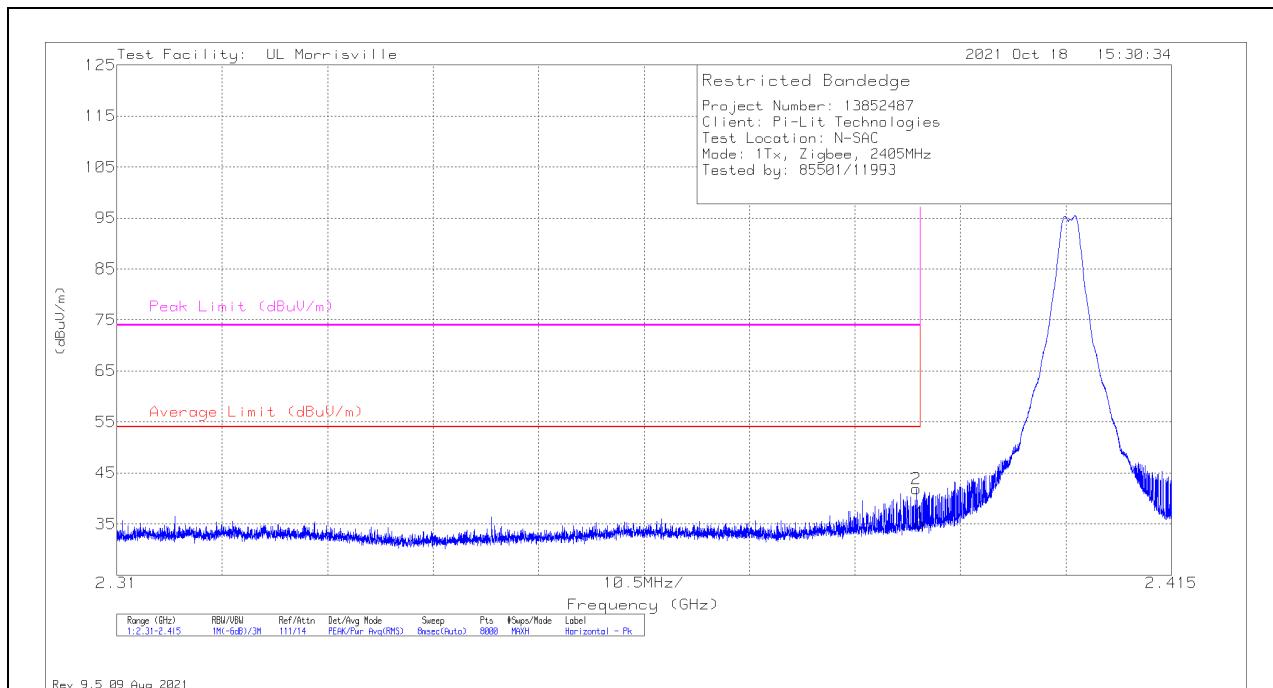
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. 802.15.4

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078	Amp/Cbl/Pad (dB)	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	37.6	Pk	31.8	-24.3	-10	0	35.1	-	-	74	-38.9	132	346	H
	* *** 2.39	37.6	Pk	31.8	-24.3	-10	-33.98	1.12	54	-52.88	-	-	132	346	H
2	* *** 2.38958	44.36	Pk	31.8	-24.3	-10	0	41.86	-	-	74	-32.14	132	346	H
	* *** 2.38958	44.36	Pk	31.8	-24.3	-10	-33.98	7.88	54	-46.12	-	-	132	346	H

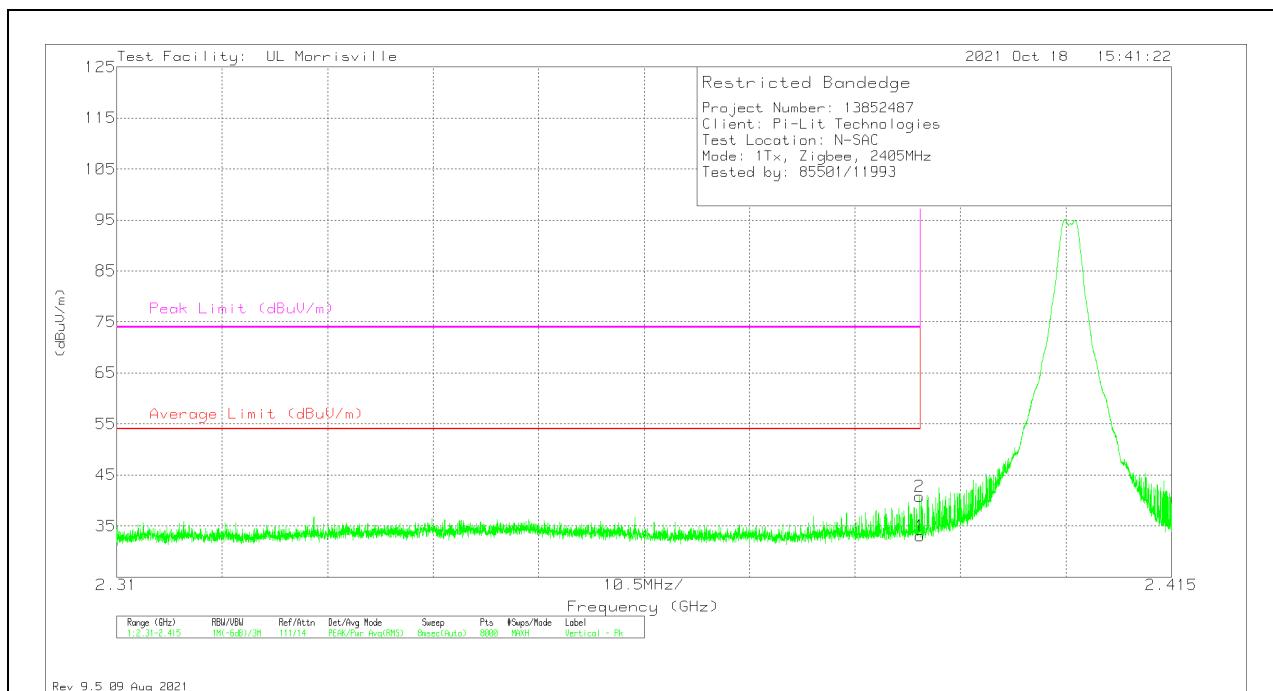
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

Note: The DCCF was subtracted off the peak value to get the average measurement. The DCCF is based off the client's declared operational duty cycle. Refer to section 9.1.

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Pad (dB)	Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* *** 2.39	35.6	Pk	31.8	-24.3	-10	0	33.1	-	-	74	-40.9	121	107	V
	* *** 2.39	35.6	Pk	31.8	-24.3	-10	-33.98	-0.88	54	-54.88	-	-	121	107	V
2	* *** 2.38992	43.24	Pk	31.8	-24.3	-10	0	40.74	-	-	74	-33.26	121	107	V
	* *** 2.38992	43.24	Pk	31.8	-24.3	-10	-33.98	6.76	54	-47.24	-	-	121	107	V

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

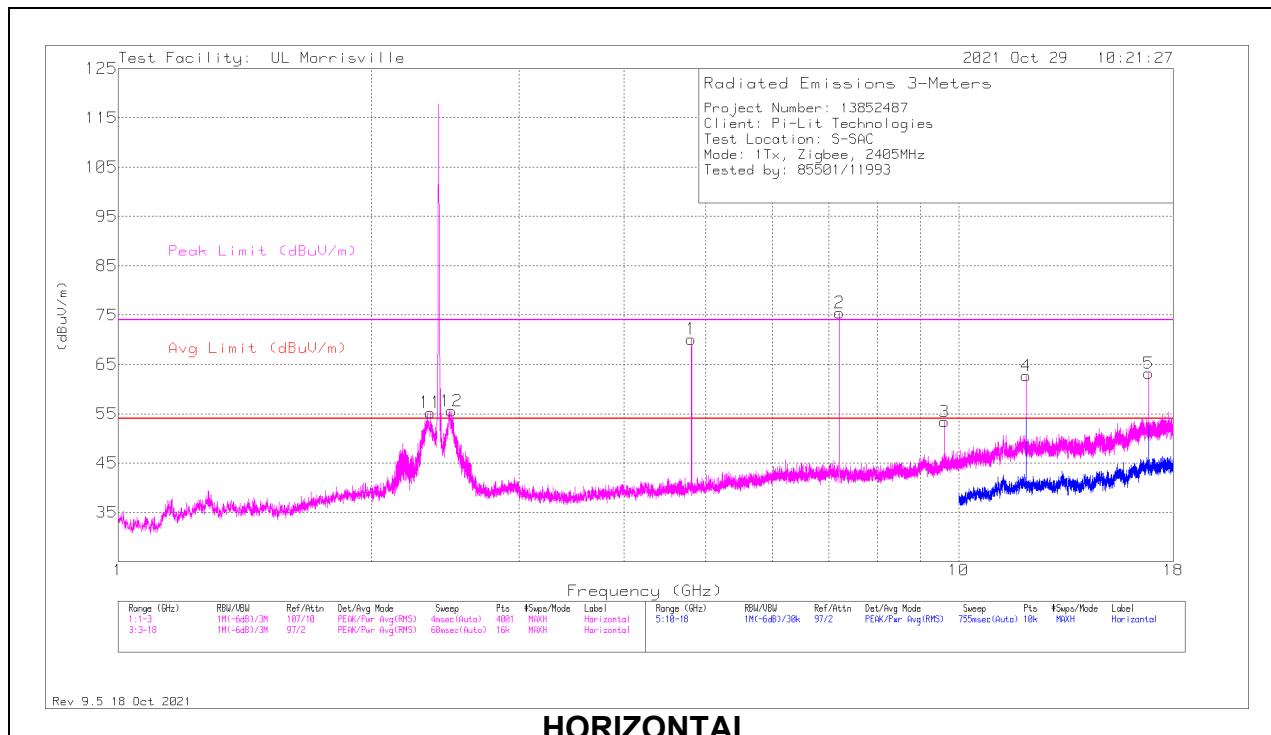
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

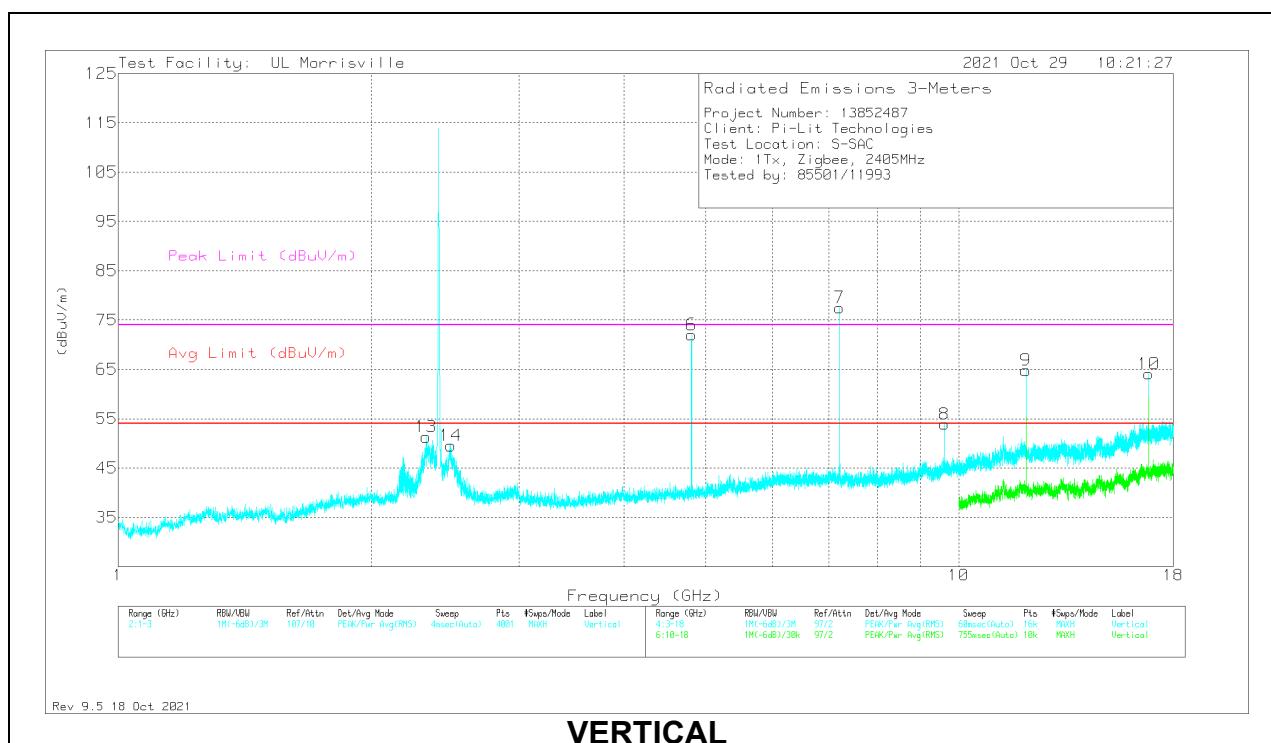
Note: The DCCF was subtracted off the peak value to get the average measurement. The DCCF is based off the client's declared operational duty cycle. Refer to section 9.1.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL (2405MHz) RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/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
11	* ** 2.35142	50.64	PK2	32.2	-24.2	0	58.64	-	-	74	-15.36	287	122	H
	* ** 2.35142	50.64	PK2	32.2	-24.2	-33.98	24.66	54	-29.34	-	-	287	122	H
12	* ** 2.492	50.06	PK2	32.4	-25.3	0	57.16	-	-	74	-16.84	223	200	H
	* ** 2.492	50.06	PK2	32.4	-25.3	-33.98	23.18	54	-30.82	-	-	223	200	H
13	* ** 2.32482	47.98	PK2	31.6	-24.1	0	55.48	-	-	74	-18.52	20	104	V
	* ** 2.32482	47.98	PK2	31.6	-24.1	-33.98	21.5	54	-32.5	-	-	20	104	V
14	* ** 2.4851	47.54	PK2	32.5	-24.8	0	55.24	-	-	74	-18.76	46	383	V
	* ** 2.4851	47.54	PK2	32.5	-24.8	-33.98	21.26	54	-32.74	-	-	46	383	V
9	* ** 12.02179	48.77	PK2	38.8	-22.4	0	65.17	-	-	74	-8.83	187	101	V
	* ** 12.02179	48.77	PK2	38.8	-22.4	-33.98	31.19	54	-22.81	-	-	187	101	V
4	* ** 12.02185	48.8	PK2	38.8	-22.4	0	65.2	-	-	74	-8.8	117	112	H
	* ** 12.02185	48.8	PK2	38.8	-22.4	-33.98	31.22	54	-22.78	-	-	117	112	H
1	* ** 4.80871	67.33	PK2	34.1	-30.2	0	71.23	-	-	74	-2.77	67	115	H
	* ** 4.80871	67.33	PK2	34.1	-30.2	-33.98	37.25	54	-16.75	-	-	67	115	H
6	* ** 4.81079	67.89	PK2	34.1	-30.2	0	71.79	-	-	74	-2.21	31	110	V
	* ** 4.81079	67.89	PK2	34.1	-30.2	-33.98	37.81	54	-16.19	-	-	31	110	V
10	16.8375	44.7	Pk	41.7	-22.3	0	64.1	-	-	-	-	0-360	101	V
5	16.83844	43.51	Pk	41.7	-22	0	63.21	-	-	-	-	0-360	101	H
2	7.21594	66.94	Pk	35.7	-27.2	0	75.44	-	-	-	-	0-360	101	H
7	7.21594	68.98	Pk	35.7	-27.2	0	77.48	-	-	-	-	0-360	101	V
3	9.62156	42.27	Pk	36.9	-25.8	0	53.37	-	-	-	-	0-360	101	H
8	9.62156	42.79	Pk	36.9	-25.8	0	53.89	-	-	-	-	0-360	200	V

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

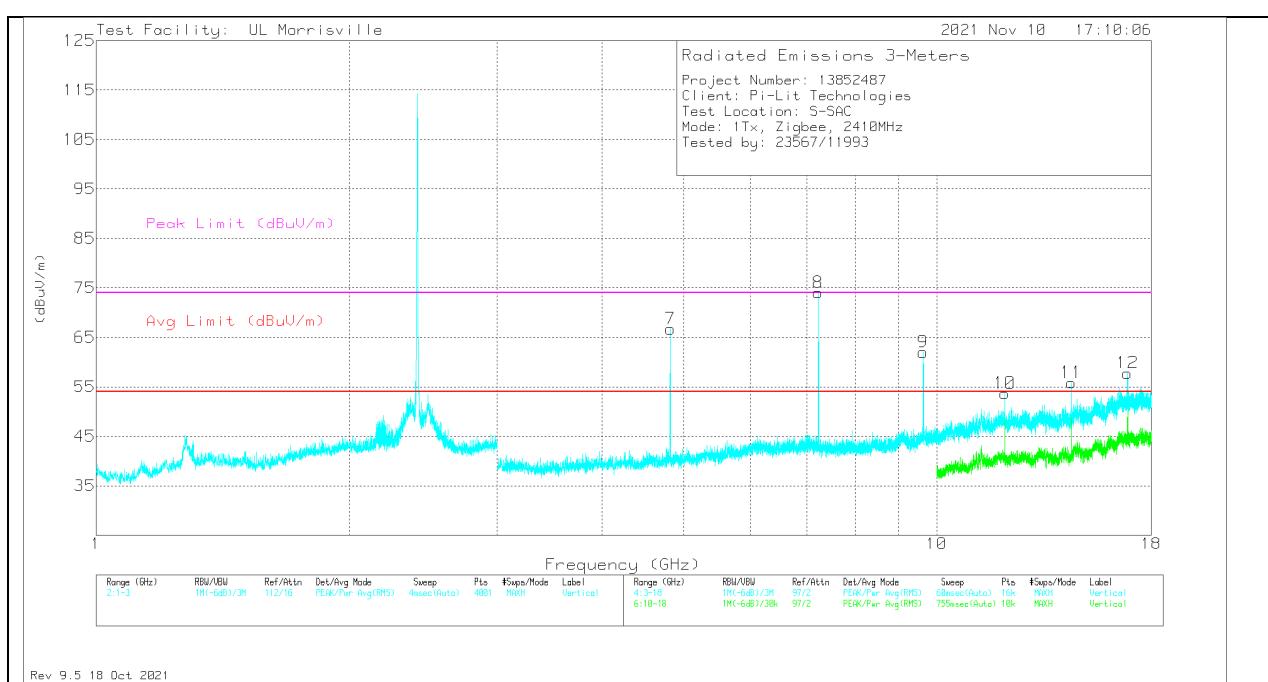
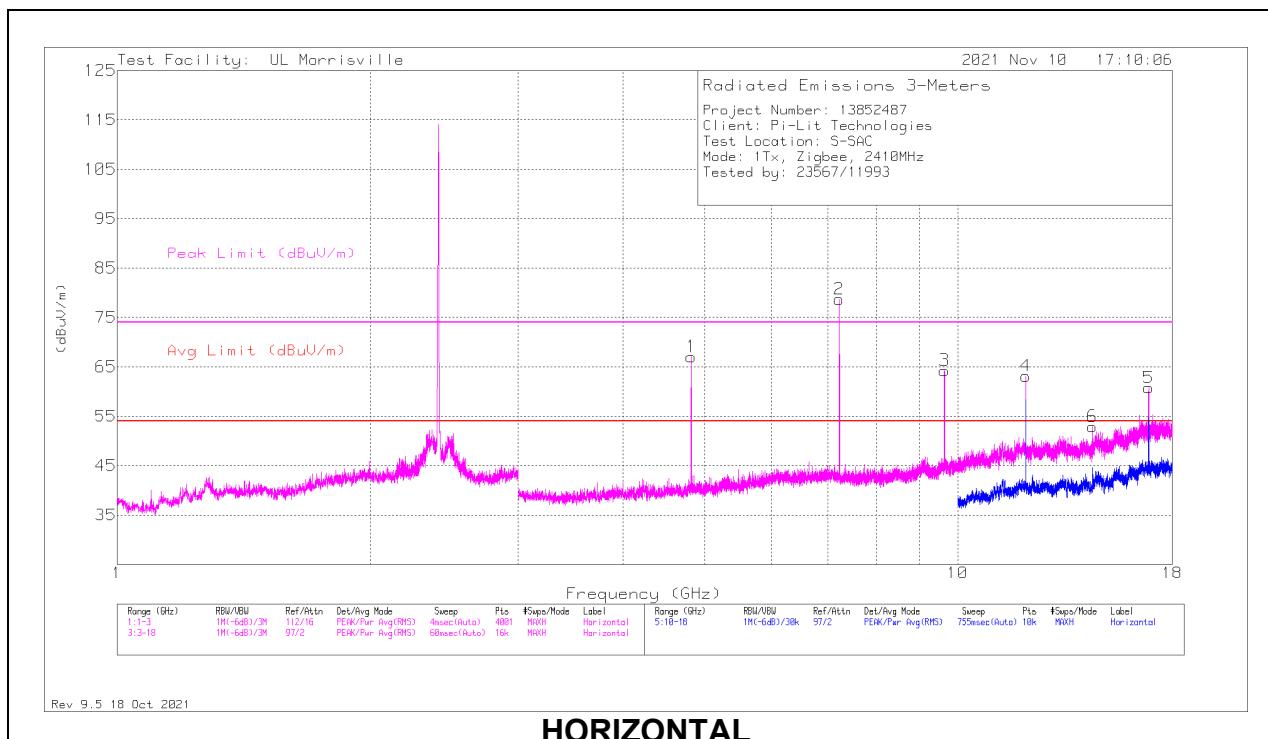
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

Pk - Peak detector

Note: The DCCF was subtracted off the peak value to get the average measurement. The DCCF is based off the client's declared operational duty cycle. Refer to section 9.1.

LOW CHANNEL (2410MHz) RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr (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	* *** 4.81873	64.42	PK2	34.1	-30.2	0	68.32	-	-	74	-5.68	183	184	H
	* *** 4.81873	64.42	PK2	34.1	-30.2	-33.98	34.34	54	-19.66	-	-	183	184	H
4	* *** 12.05196	49.75	PK2	38.8	-23.2	0	65.35	-	-	74	-8.65	228	167	H
	* *** 12.05196	49.75	PK2	38.8	-23.2	-33.98	31.37	54	-22.63	-	-	228	167	H
7	* *** 4.82074	63.56	PK2	34.1	-30.4	0	67.26	-	-	74	-6.74	313	109	V
	* *** 4.82074	63.56	PK2	34.1	-30.4	-33.98	33.28	54	-20.72	-	-	313	109	V
10	* *** 12.05206	42	PK2	38.8	-23.2	0	57.6	-	-	74	-16.4	208	229	V
	* *** 12.05206	42	PK2	38.8	-23.2	-33.98	23.62	54	-30.38	-	-	208	229	V
2	7.23094	70.09	Pk	35.6	-27	-	78.69	-	-	-	-	0-360	101	H
8	7.23094	65.44	Pk	35.6	-27	-	74.04	-	-	-	-	0-360	101	V
9	9.6375	50.62	Pk	36.9	-25.5	-	62.02	-	-	-	-	0-360	101	V
3	9.64125	53.07	Pk	36.9	-25.7	-	64.27	-	-	-	-	0-360	101	H
6	14.46281	37.6	Pk	39.6	-24.3	-	52.9	-	-	-	-	0-360	199	H
11	14.46281	40.56	Pk	39.6	-24.3	-	55.86	-	-	-	-	0-360	199	V
12	16.86656	38.49	Pk	41.6	-22.3	-	57.79	-	-	-	-	0-360	199	V
5	16.87313	41.79	Pk	41.6	-22.6	-	60.79	-	-	-	-	0-360	199	H

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

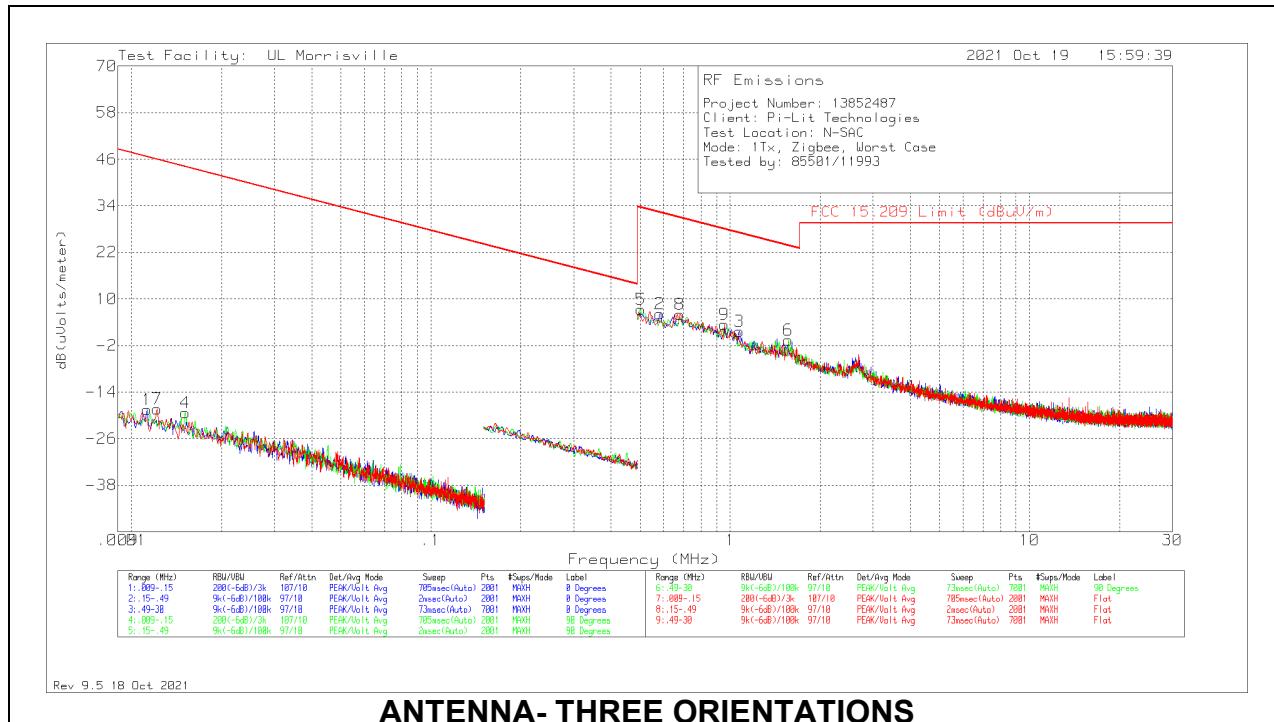
Pk - Peak detector

Note: The DCCF was subtracted off the peak value to get the average measurement. The DCCF is based off the client's declared operational duty cycle. Refer to section 9.1.

10.3. WORST CASE BELOW 30MHZ

Note for below 30 MHz scans: 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).

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION E-FIELD)

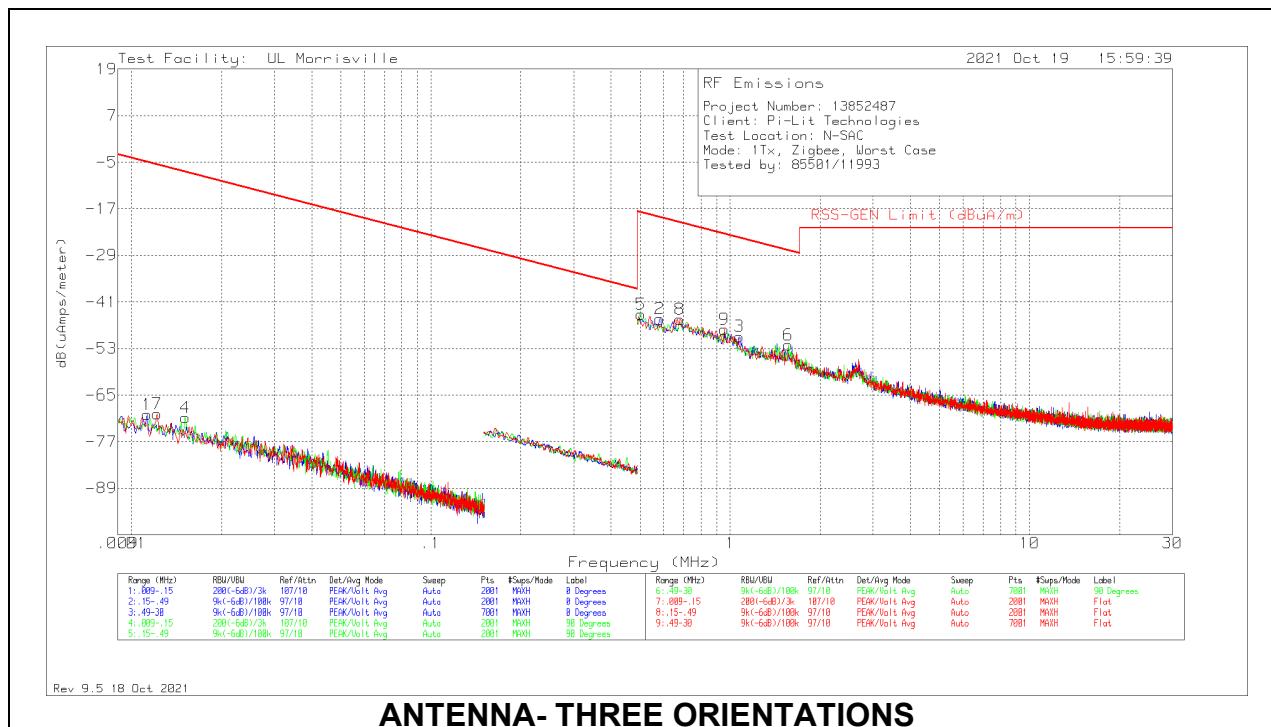


Below 30MHz Data

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/Av Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01127	43.42	Pk	17.9	.1	-80	-18.58	46.56	66.56	-65.14	0-360	403	0 degs
7	.0122	44.07	Pk	17.5	.1	-80	-18.33	45.88	65.88	-64.21	0-360	403	Flat
4	.01511	44.4	Pk	16.2	.1	-80	-19.3	44.02	64.02	-63.32	0-360	403	90 degs
5	.50265	35.91	Pk	11.2	.2	-40	7.31	33.58	-	-26.27	0-360	403	90 degs
2	.58275	34.69	Pk	11.2	.2	-40	6.09	32.29	-	-26.2	0-360	403	0 degs
8	.67972	34.54	Pk	11.3	.2	-40	6.04	30.96	-	-24.92	0-360	403	Flat
9	.95376	31.92	Pk	11.3	.2	-40	3.42	28.02	-	3	0-360	403	Flat
3	1.07181	30.07	Pk	11.3	.2	-40	1.57	27	-	-25.43	0-360	403	0 degs
6	1.56508	27.79	Pk	11.4	.2	-40	-.61	23.71	-	-24.32	0-360	403	90 degs

Pk - Peak detector

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION H-FIELD)



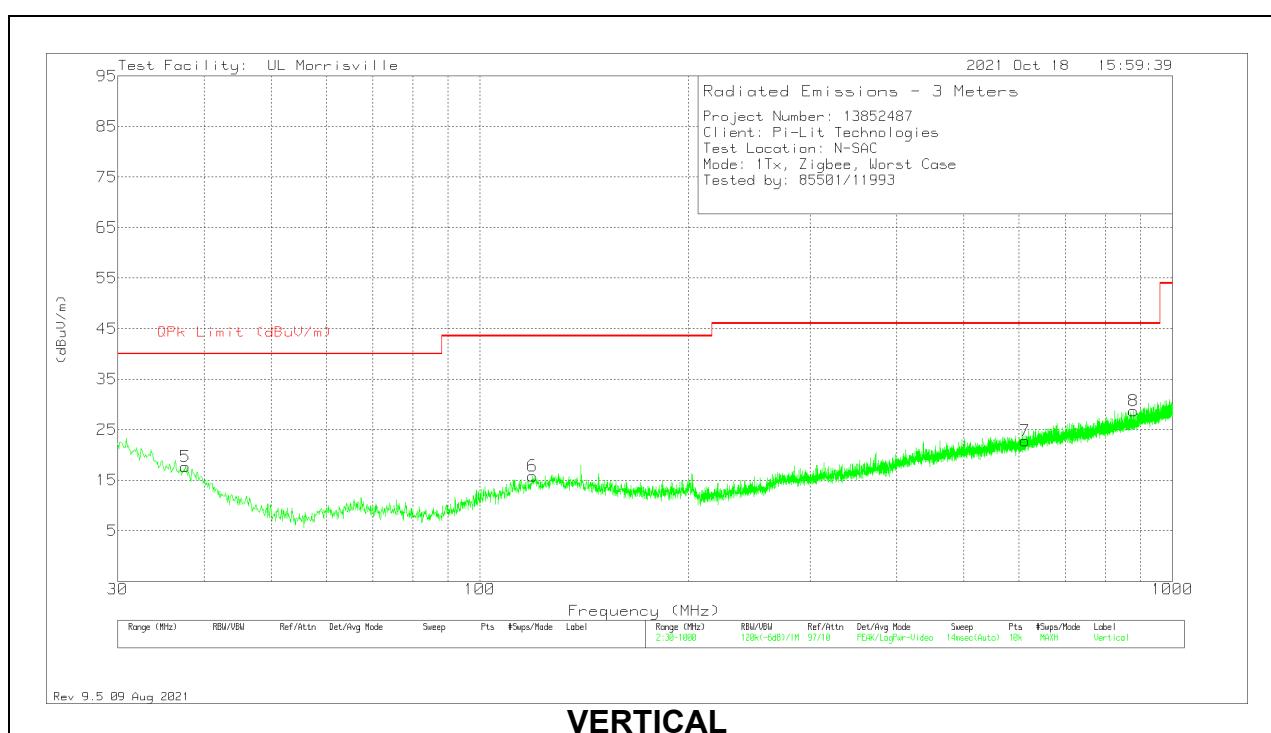
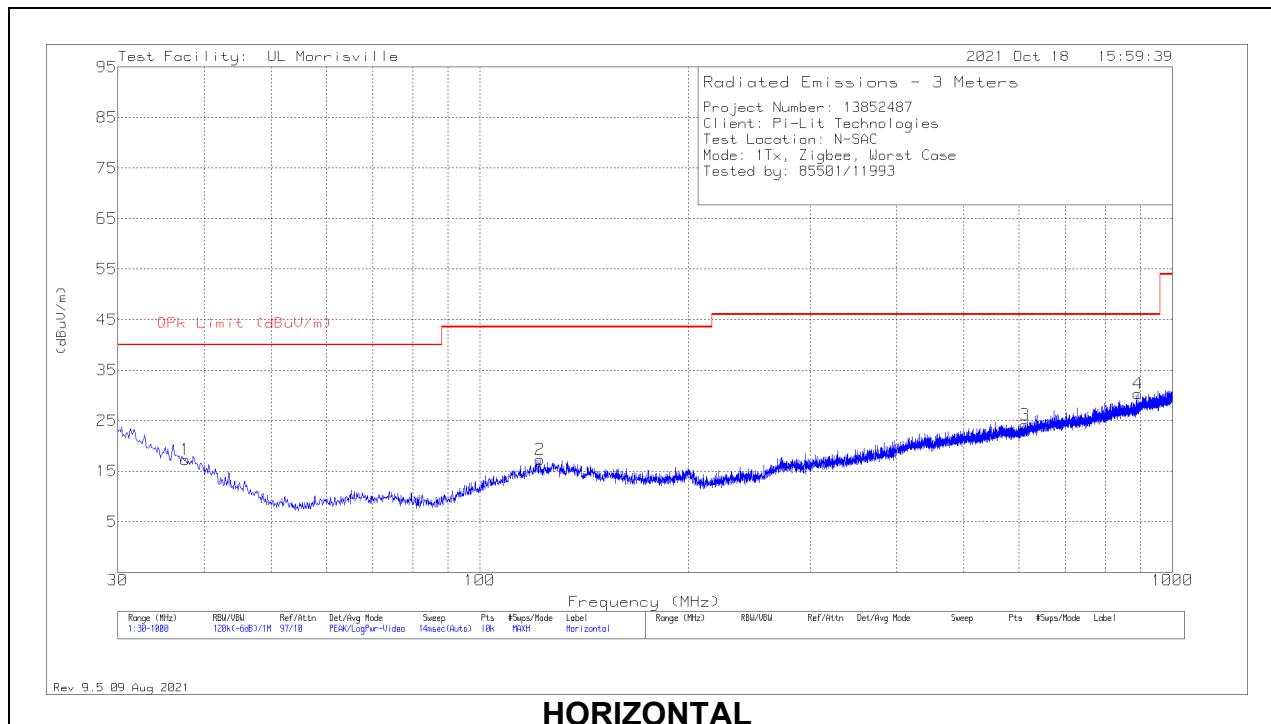
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	RSS-GEN Qp/Av Limit (dBuA/m)	RSS-GEN Qp/Av Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.01127	43.42	Pk	-33.6	.1	-80	-70.08	-4.94	15.06	-65.14	0-360	403	0 degs
7	.0122	44.07	Pk	-34	.1	-80	-69.83	-5.62	14.38	-64.21	0-360	403	Flat
4	.01511	44.4	Pk	-35.3	.1	-80	-70.8	-7.48	12.52	-63.32	0-360	403	90 degs
5	.50265	35.91	Pk	-40.3	.2	-40	-44.19	-17.92	-	-26.27	0-360	403	90 degs
2	.58275	34.69	Pk	-40.3	.2	-40	-45.41	-19.21	-	-26.2	0-360	403	0 degs
8	.67972	34.54	Pk	-40.2	.2	-40	-45.46	-20.54	-	-24.92	0-360	403	Flat
9	.95376	31.92	Pk	-40.2	.2	-40	-48.08	-23.48	-	-24.6	0-360	403	Flat
3	1.07181	30.07	Pk	-40.2	.2	-40	-49.93	-24.5	-	-25.43	0-360	403	0 degs
6	1.56508	27.79	Pk	-40.1	.2	-40	-52.11	-27.79	-	-24.32	0-360	403	90 degs

Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0066 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* *** 37.566	26.59	Pk	22.1	-31.4	17.29	40	-22.71	0-360	399	H
2	* *** 122.053	27.89	Pk	19.7	-30.3	17.29	43.52	-26.23	0-360	199	H
3	* *** 613.164	25.53	Pk	25.3	-26.7	24.13	46.02	-21.89	0-360	199	H
4	** 891.263	26.51	Pk	28.5	-24.7	30.31	46.02	-15.71	0-360	99	H
5	* *** 37.566	27.02	Pk	22.1	-31.4	17.72	40	-22.28	0-360	100	V
6	* *** 119.046	26.49	Pk	19.4	-30.1	15.79	43.52	-27.73	0-360	100	V
7	* *** 613.358	24.27	Pk	25.3	-26.8	22.77	46.02	-23.25	0-360	100	V
8	** 879.235	25.28	Pk	28.3	-24.8	28.78	46.02	-17.24	0-360	100	V

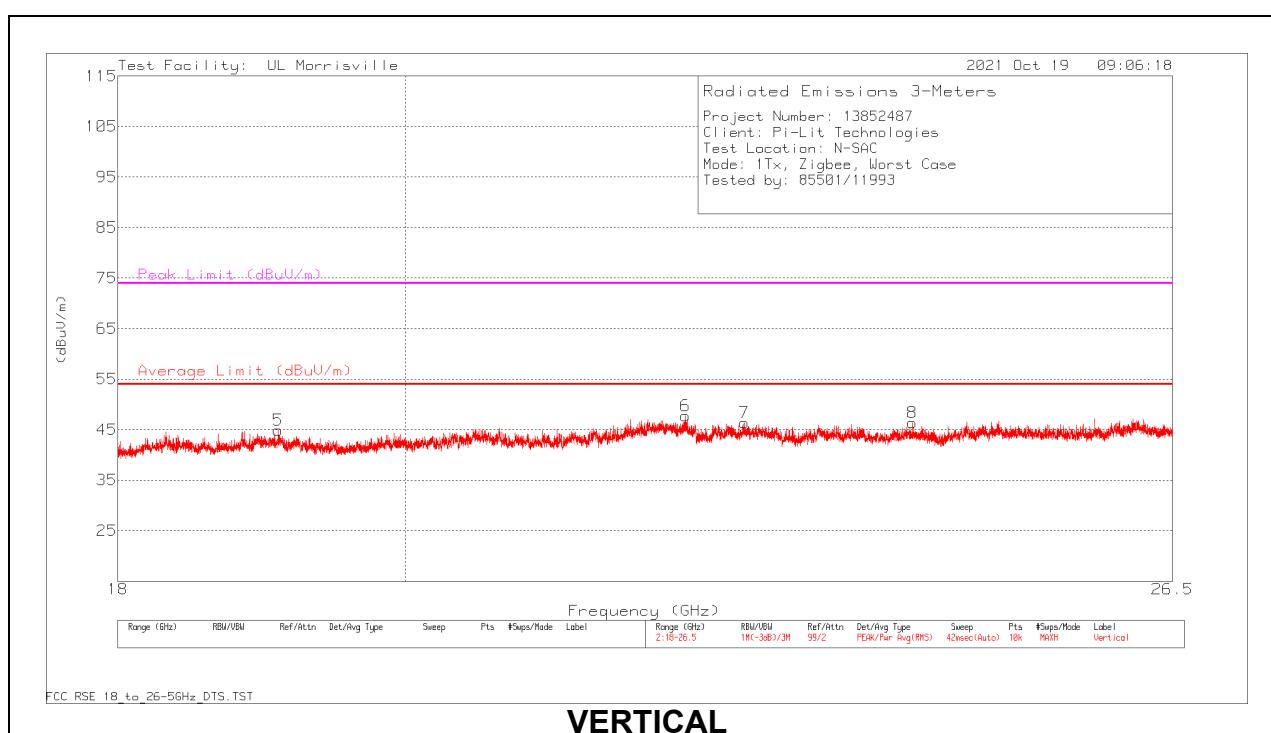
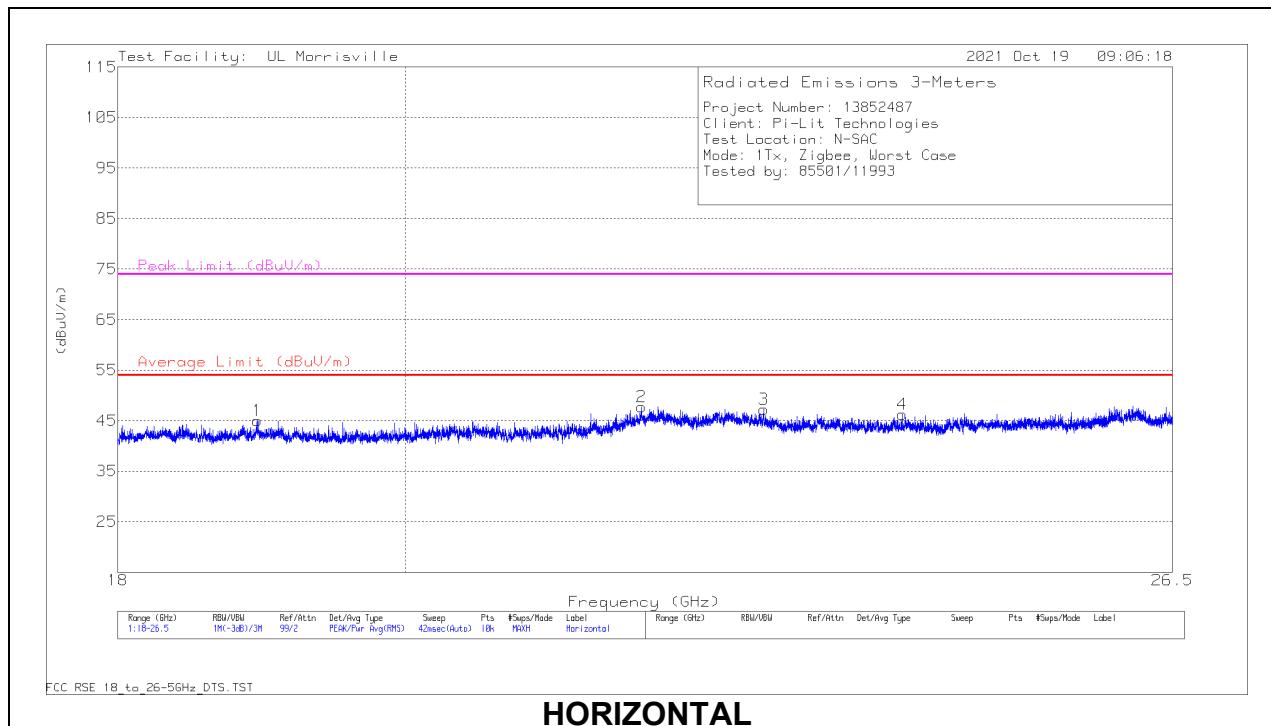
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - 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	* ** 18.94596	50.58	Pk	33.3	-38.9	44.98	54	-9.02	74	-29.02	0-360	249	H
3	* ** 22.80967	50.72	Pk	35.5	-39	47.22	54	-6.78	74	-26.78	0-360	200	H
4	* ** 23.9987	50.17	Pk	34.9	-38.8	46.27	54	-7.73	74	-27.73	0-360	101	H
5	* ** 19.09214	50.63	Pk	33.5	-39.3	44.83	54	-9.17	74	-29.17	0-360	251	V
6	* ** 22.16798	50.51	Pk	36.7	-39.5	47.71	54	-6.29	74	-26.29	0-360	201	V
7	* ** 22.64904	49.62	Pk	36	-39.2	46.42	54	-7.58	74	-27.58	0-360	300	V
2	21.81017	50.12	Pk	36.5	-38.9	47.72	54	-6.28	74	-26.28	0-360	200	H
8	24.08794	50.45	Pk	34.8	-38.9	46.35	54	-7.65	74	-27.65	0-360	251	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

11. SETUP PHOTOS

Please refer to R138852487-EP1 for setup photos

END OF TEST REPORT