

TEST REPORT

Report Number: R15339687-E1

Applicant : Energous Corporation
3590 North First Street, Suite 210
San Jose, CA 95134, USA

Model : YND-1800

FCC ID : 2ADNG-YND1800

EUT Description : Wireless Charger

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2024
ISED RSS-247 ISSUE 3: 2023
ISED RSS-GEN ISSUE 5 + A1 + A2: 2021

Date Of Issue:
2024-07-25

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2024-07-02	Initial Issue	Chandler Stanley
V2	2024-07-24	TCB Feedback: 1. Clarified Antenna Gain Array 2. Updated Output Power and PSD tables.	Noah Bennett

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Energous Corporation
3590 North First Street, Suite 210
San Jose, CA 95134, USA

EUT DESCRIPTION: Wireless Charger

MODEL: YND-1800

SERIAL NUMBER: Yondu 040A

SAMPLE RECEIPT DATE: 2024-06-11

DATE TESTED: 2024-06-11 TO 2024-06-15

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2024	Refer to Section 2
ISED RSS-247 Issue 3: 2023	Refer to Section 2
ISED RSS-GEN Issue 5 + A1 + 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:



Jeff Moser
Operations Manager
Consumer, Medical and IT Segment
UL LLC

Prepared By:



Chandler Stanley
Engineer
Consumer, Medical and IT Segment
UL LLC

2. TEST RESULTS SUMMARY

This report contains data provided by the customer 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.

Below is a list of the data provided by the customer:

1. Antenna gain and type (see section 6.3)
2. Supported data rates (see section 6.5)

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		
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		
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions		
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	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 C63.10-2020, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 3.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 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	825374
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

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}
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%

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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 dBuV + 0 dB + 10.1 dB + 0 dB = 46.6 dBuV

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is an over-the-air, at a distance charging transmitter with WPT and BLE. The wireless charger transmits power via a 52-tone frequency hopping signal in range 907MHz-920MHz and charges multiple receivers at a time. The EUT uses BLE to communicate with a client device. The EUT can be powered via 12W USB-C, 12VDC Power Supply, or a PoE.

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)
2402 - 2480	BLE - 1Mbps	20.39	109.40

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The radio utilizes a dual polarized patch antenna, with a maximum gain of 7.5 dBi per chain.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was direct_test_mode_pca10056.hex.
The test utility software used during testing was direct_test_mode_pca10056.hex.

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 power setting 0 on low, middle and high channels.

The EUT has the same power setting when in 1Tx and 2Tx mode. Therefore, all testing was done in 2Tx mode as worst-case.

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

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC adapter	HDP	HDP12-MD05024U	N/A	N/A
POE Injector	Cisco	DPSN-35FBA	DCA183510NA	N/A
Power Supply	Circuit Specialists	CSI3005X5	N/A	N/A
Laptop	Dell	Precision 5520	FK7QHM2	N/A
IOT Sensor	Energous	N/A	IOT-21DE	N/A
IOT Sensor	Energous	N/A	IOT-21DF	N/A

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB-C	shielded	<3m	
1	Ethernet	1	RJ45	unshielded	<3m	

TEST SETUP

The EUT was connected to an AC adapter for power.

SETUP DIAGRAMS

Please refer to 15339687-EP1 for setup diagrams

7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2020 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.2 Method PKPM1 Peak-reading power meter
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)

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

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1, 6.3-6.6 and
6.10.5

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

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.
	Common Equipment				
	Conducted Room 2				
90416	Spectrum Analyzer	Keysight Technologies	N9030A	2023-06-09	2024-06-30
90411	Spectrum Analyzer	Keysight Technologies	N9030A	2023-08-02	2024-08-02
179892	Environmental Meter	Fisher Scientific	15-077-963	2023-07-26	2024-06-31
238710	Environmental Meter	Fisher Scientific	15-077-963	2023-06-27	2024-06-27
245262	Conducted Switch Box	UL	CSB	2024-02-20	2025-02-20
211055	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2023-08-01	2024-08-01
211057	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2023-08-01	2024-08-01
SOFTEMI	Antenna Port Software	UL	Version 2024.2.23	NA	NA
Power Software	Boonton Power Analyzer	Boonton	Version 3.0.13.0	NA	NA

Test Equipment Used - Wireless Conducted Attenuators, Cables, and Couplers

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Attenuators				
226563	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2024-02-29	2025-02-28
226564	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2024-04-04	2025-04-04

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Equip. ID	Description	Manufacturer/ Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2024-01-24	2025-01-24
	30-1000 MHz				
90628	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2024-01-02	2026-01-02
	1-18 GHz				
89509	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-05-23	2025-05-23
	18-40 GHz				
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-826	2023-07-20	2025-07-20
	Gain-Loss Chains				
207638	Gain-loss string: 0.009-30MHz	Various	Various	2024-05-22	2025-05-22
207639	Gain-loss string: 25-1000MHz	Various	Various	2024-05-22	2025-05-22
207640	Gain-loss string: 1-18GHz	Various	Various	2024-05-22	2025-05-22
225795	Gain-loss string: 18-40GHz	Various	Various	2024-05-22	2025-05-22
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2024-04-16	2025-04-16
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
241204	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05
241848	10dB Pad, DC-18GHz, 5W	Mini-Circuits	BW-N10W5+	2023-11-09	2024-11-09

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	2024-04-04	2025-04-04
179892	Environmental Meter	Fisher Scientific	15-077-963	2023-07-26	2024-06-31
80391	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2023-07-31	2024-07-31
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2023-08-01	2024-08-01
52859	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2024-04-04	2025-04-04
PS214	AC Power Source	Elgar	CW2501M	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Miscellaneous (if needed)				
84681	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2024-04-04	2025-04-04
91432	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	NA	NA

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

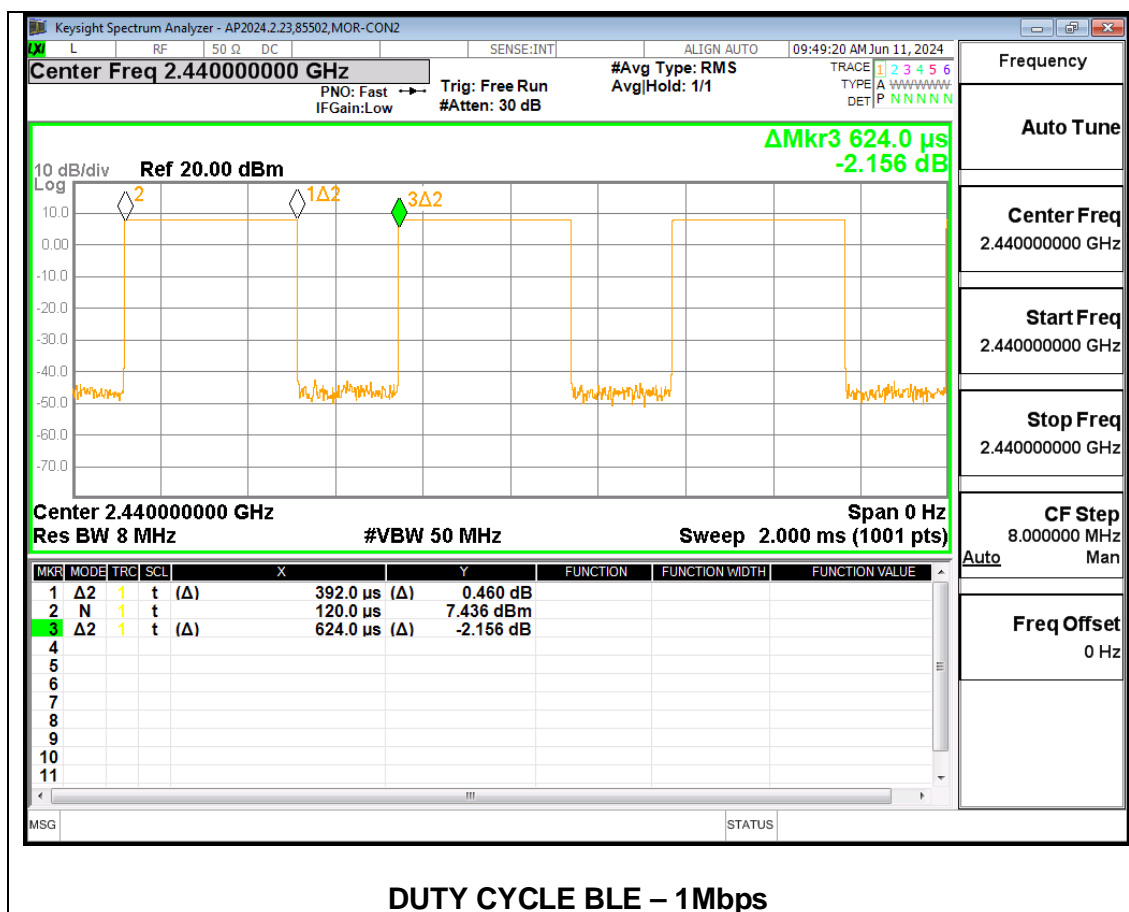
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE - 1 Mbps	0.392	0.624	0.628	62.82	2.02	2.551

DUTY CYCLE PLOTS



9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. BLE (1Mbps)

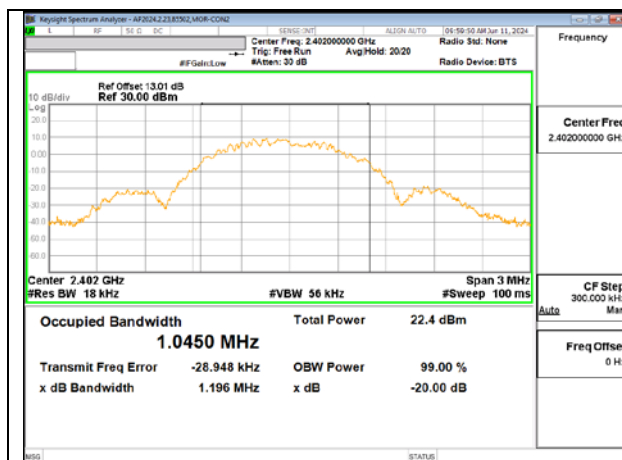
Antenna 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0485
Middle	2440	1.0495
High	2480	1.0485

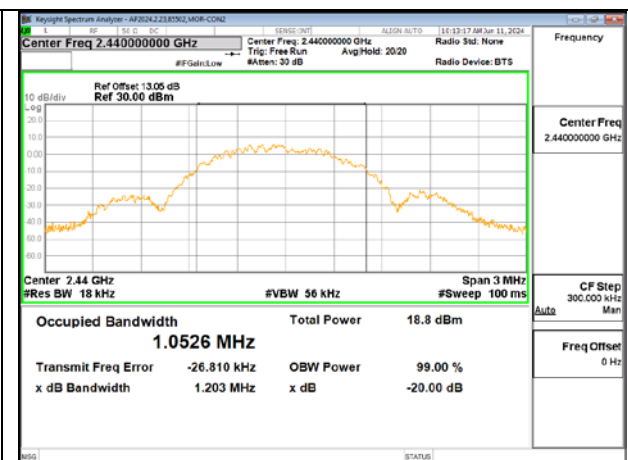


Antenna 2

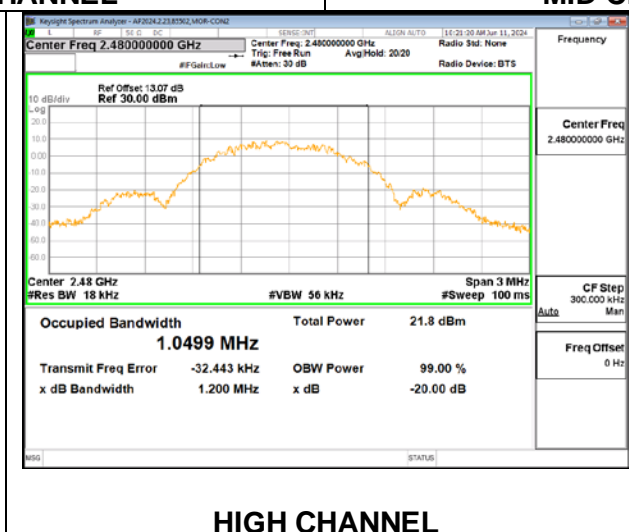
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0450
Middle	2440	1.0526
High	2480	1.0499



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

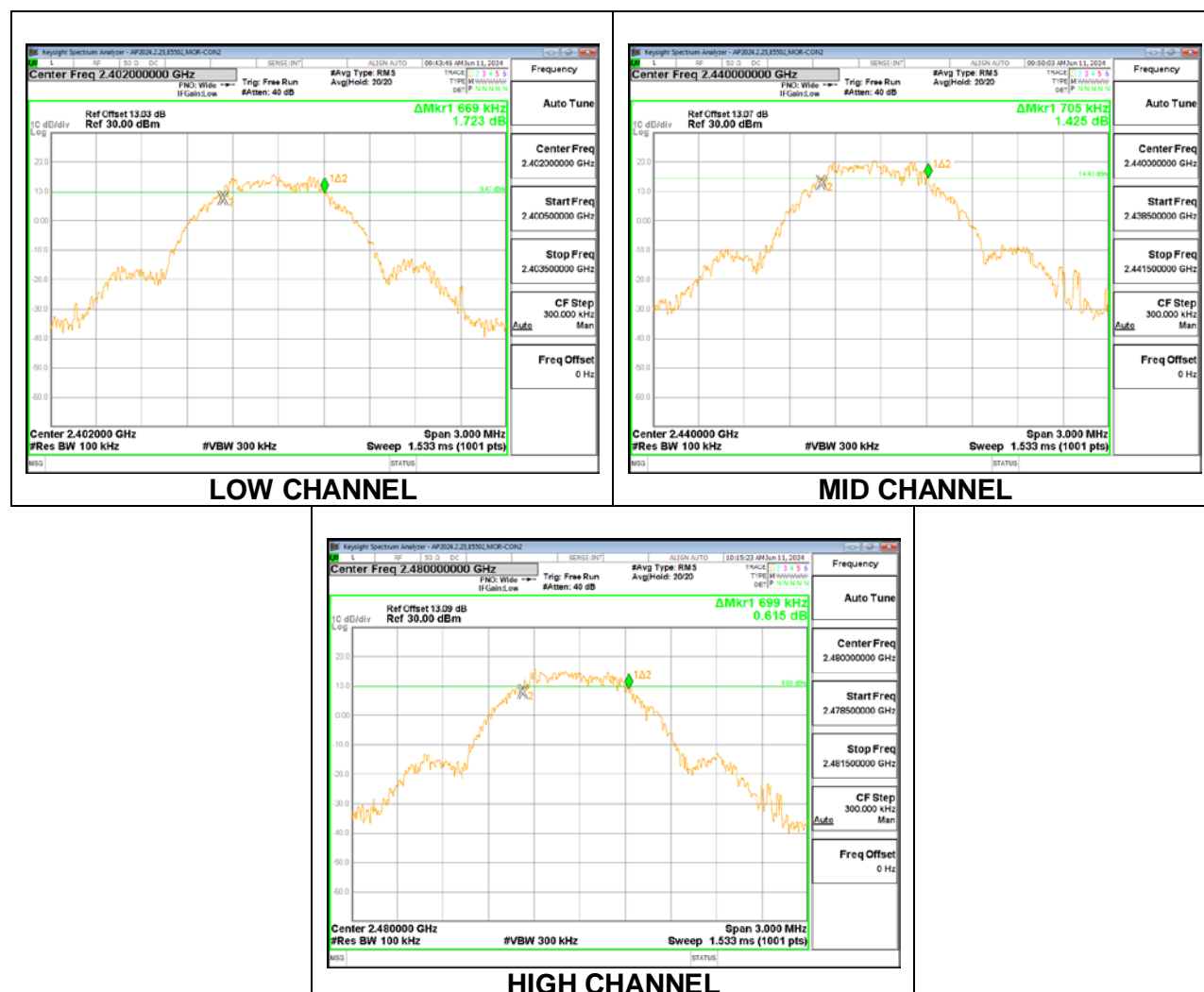
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

9.3.1. BLE (1Mbps)

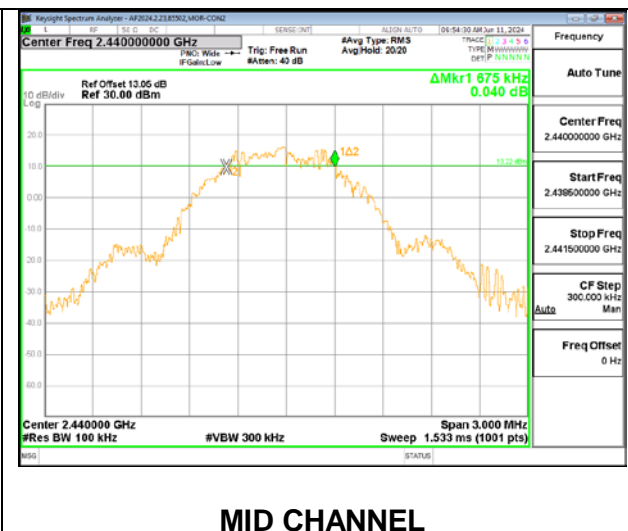
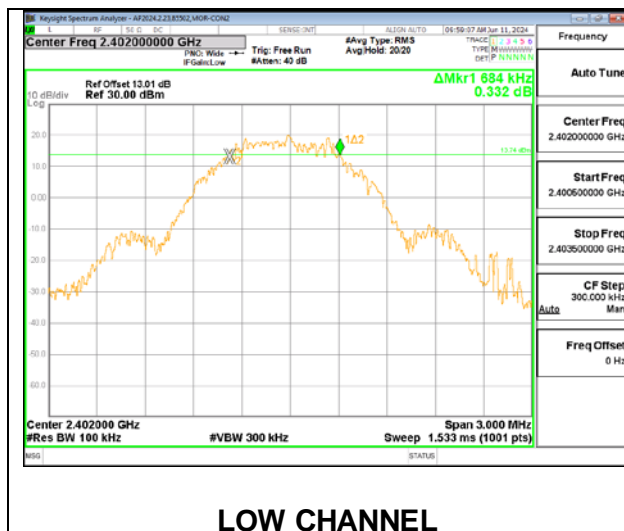
Antenna 1

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6690	0.5
Middle	2440	0.7050	0.5
High	2480	0.6990	0.5



Antenna 2

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6840	0.5
Middle	2440	0.6750	0.5
High	2480	0.7230	0.5



9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is 7.5 dBi, which is 1.5 dBi greater than the 6 dBi requirement; therefore, the limit is reduced from 30 dBm to 28.5dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.52 dB (including 9.68 dB pad and 0.84 dB cable) for Antenna 1 and 10.78 dB (including 9.94 dB pad and 0.84 dB cable) for Antenna 2 was entered as an offset in the power meter to allow for a peak reading of power.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband power sensor. Peak output power was read directly from power meter.

RESULTS

9.4.1. BLE (1Mbps)

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low	2402	7.50	29.00	28.50
Mid	2440	7.50	29.00	28.50
High	2480	7.50	29.00	28.50

Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2402	16.74	17.18	19.98	28.50	-8.52
Mid	2440	17.17	17.57	20.39	28.50	-8.11
High	2480	13.59	14.09	16.85	28.50	-11.65

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.52 dB (including 9.68 dB pad and 0.84 dB cable) for Antenna 1 and 10.78 dB (including 9.94 dB pad and 0.84 dB cable) for Antenna 2 was entered as an offset in the power meter to allow for a peak reading of power.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

RESULTS

9.5.1. BLE (1Mbps)

MIMO

Channel	Frequency (MHz)	Antenna 1 Power (dBm)	Antenna 2 Power (dBm)	Total Power (dBm)
Low	2402	16.55	16.98	19.78
Mid	2440	17.12	17.52	20.33
High	2480	13.39	13.92	16.67

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.

Note: The maximum antenna gain is **7.5 dBi**, which is **1.5 dBi** greater than the 6 dBi requirement; therefore, the limit is reduced from 8 dBm/3KHz to **6.5dBm/3KHz**.

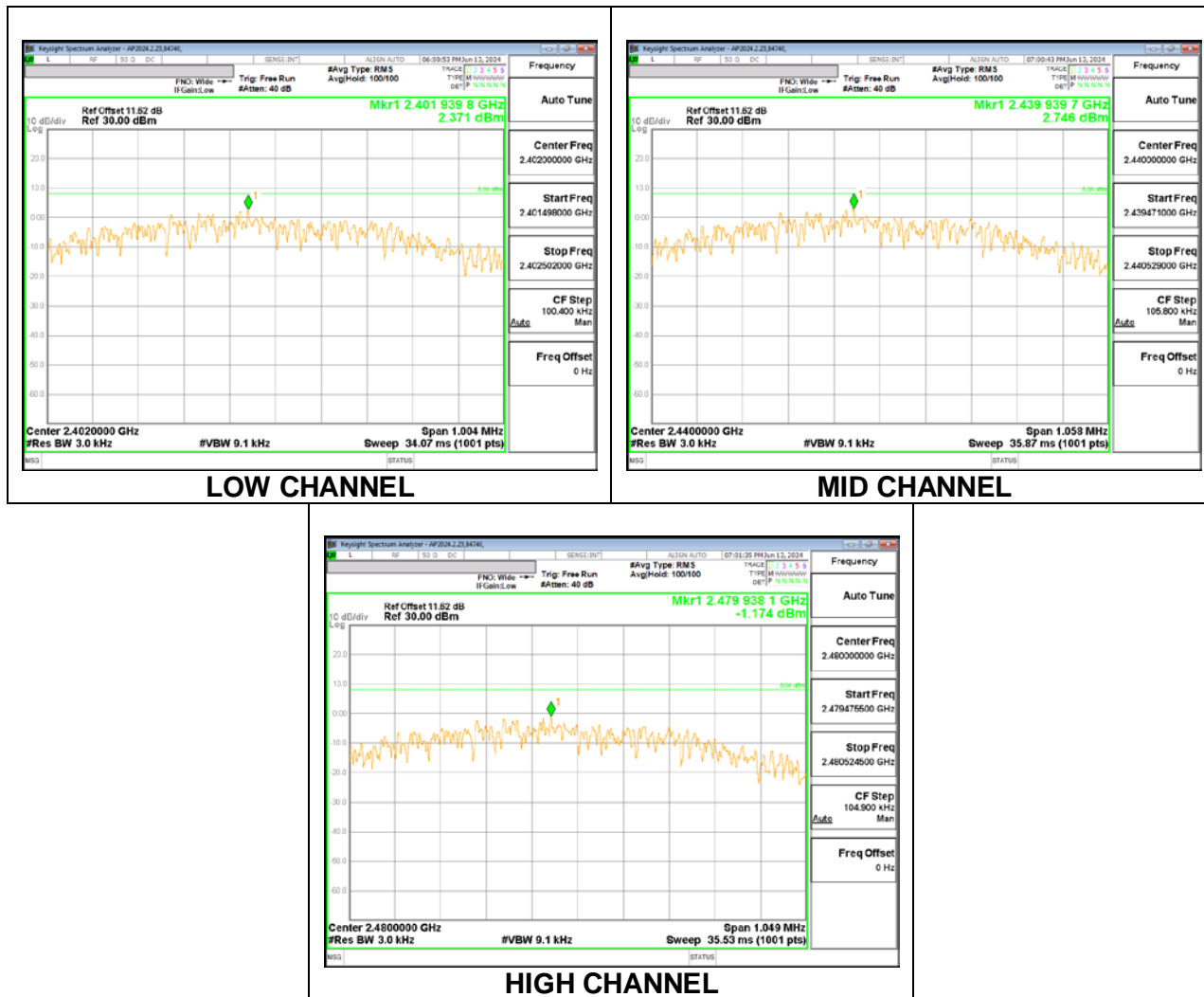
RESULTS

9.6.1. BLE (1Mbps)

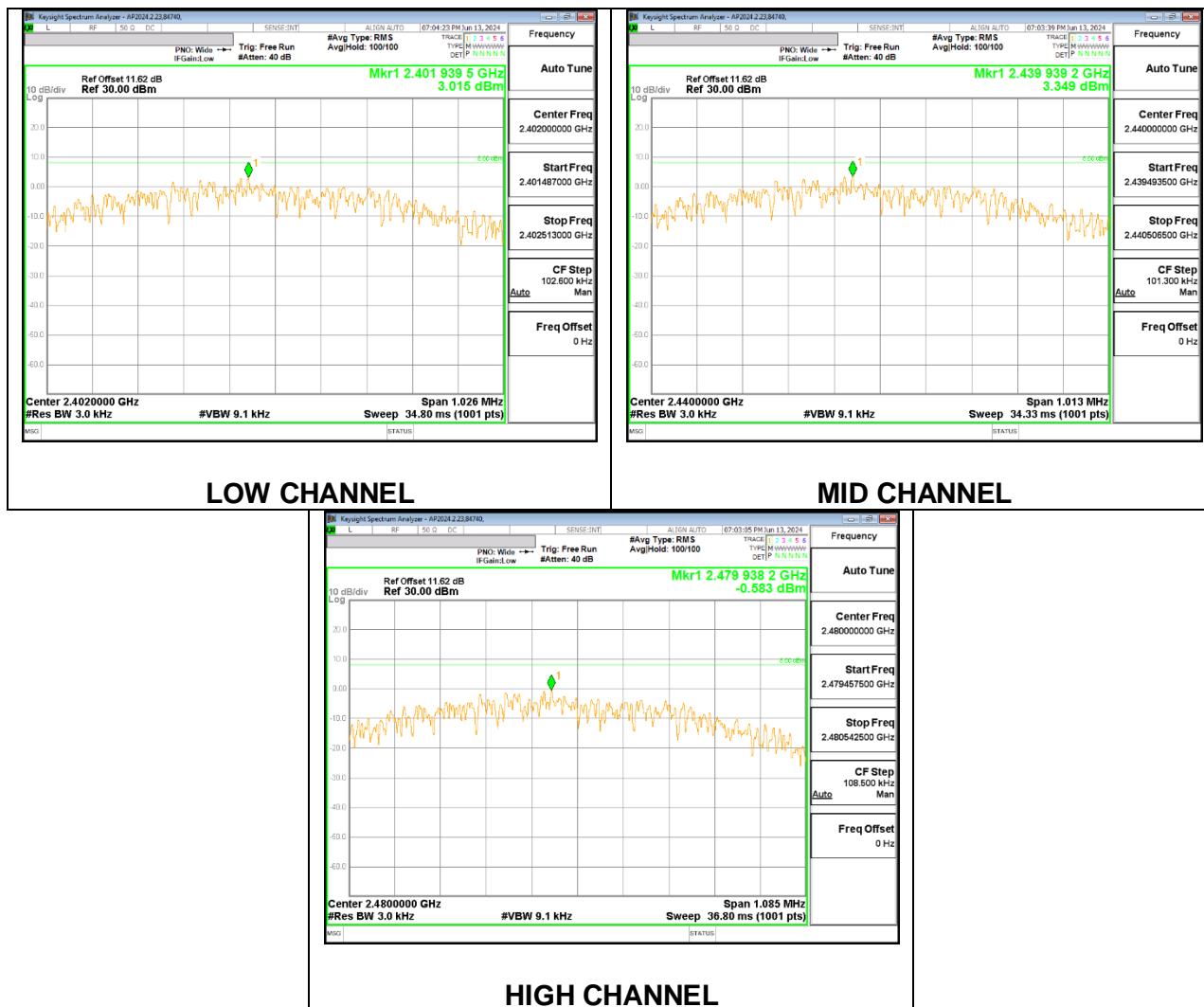
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2402	2.37	3.02	5.72	6.5	-0.78
Mid	2440	2.75	3.35	6.07	6.5	-0.43
High	2480	-1.17	-0.58	2.14	6.5	-4.36

Antenna 1



Antenna 2



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

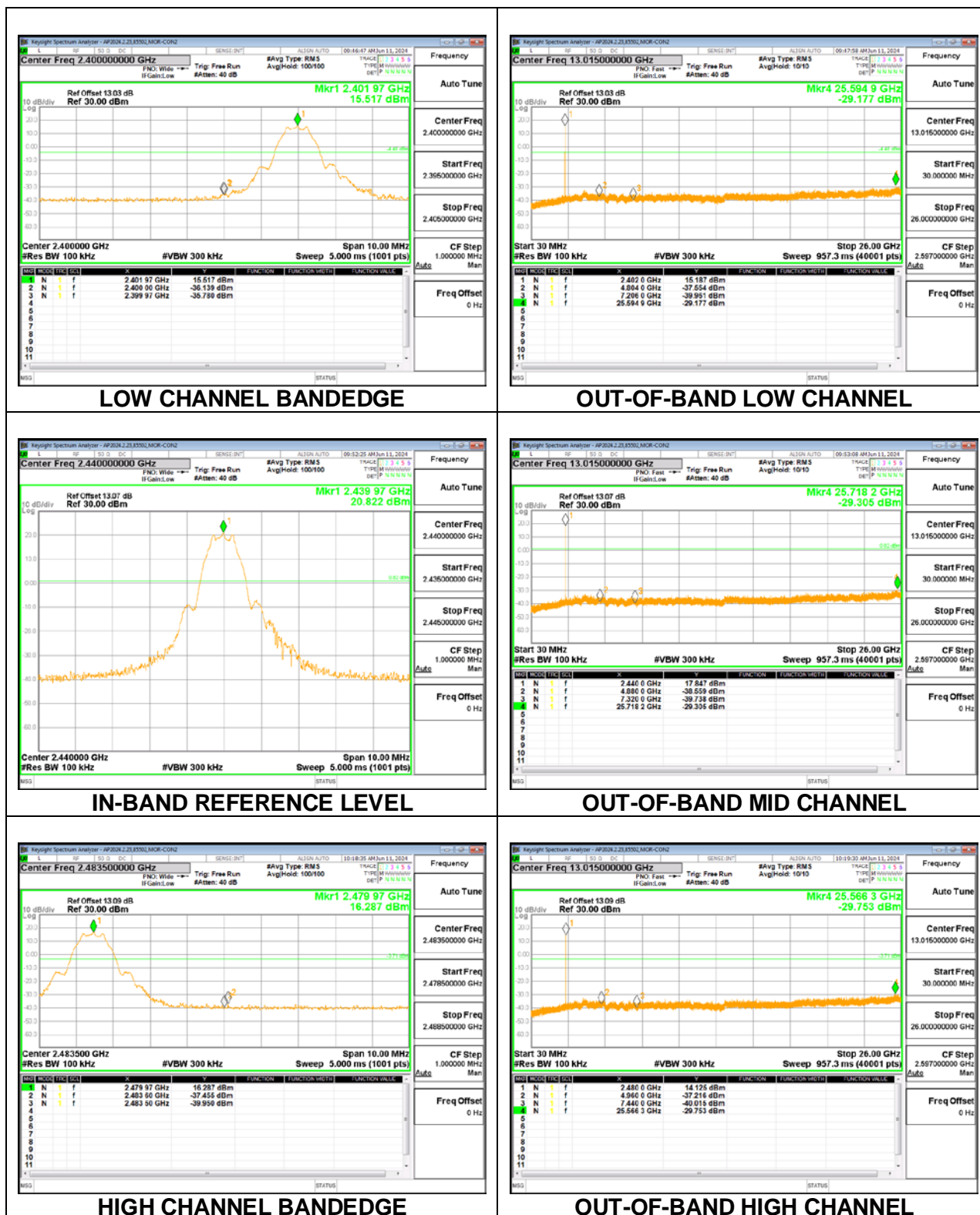
RSS-247 5.5

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

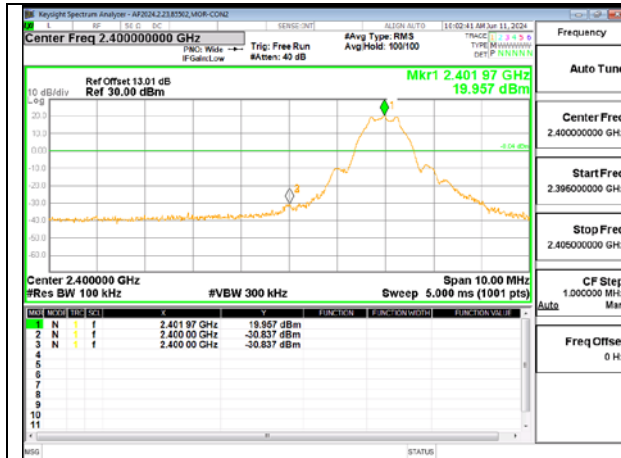
RESULTS

9.7.1. BLE (1Mbps)

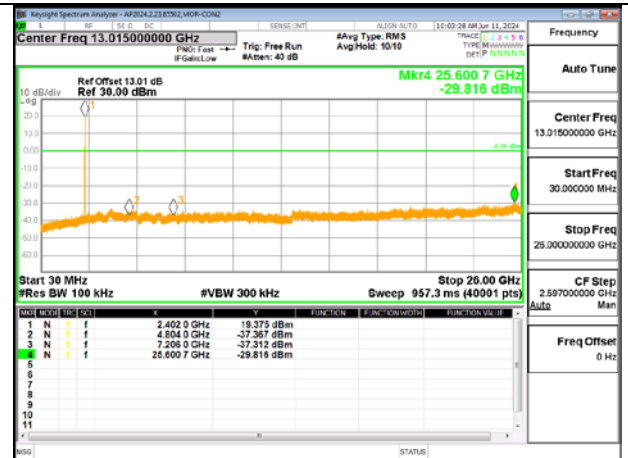
Antenna 1



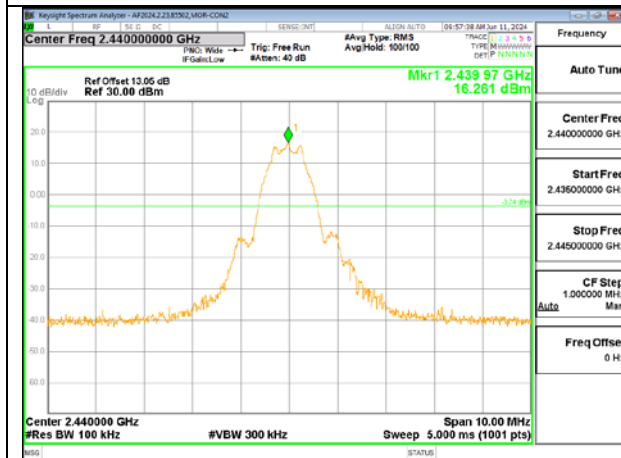
Antenna 2



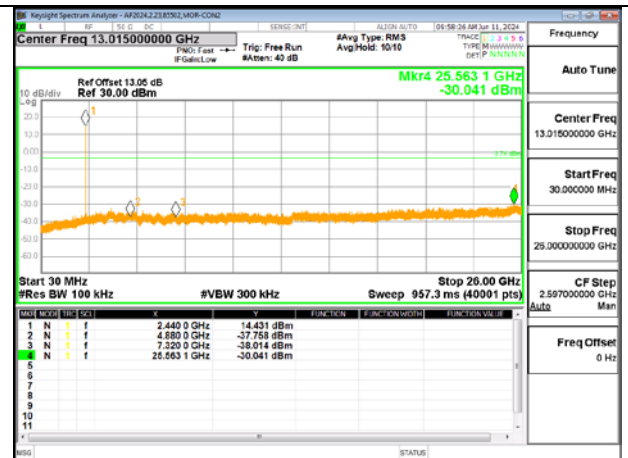
LOW CHANNEL BANDEDGE



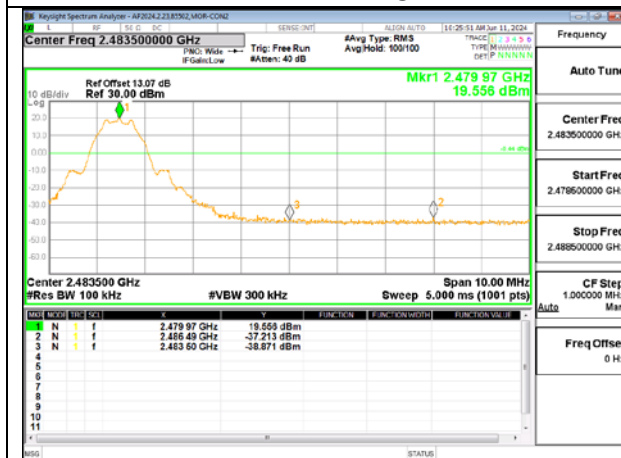
OUT-OF-BAND LOW CHANNEL



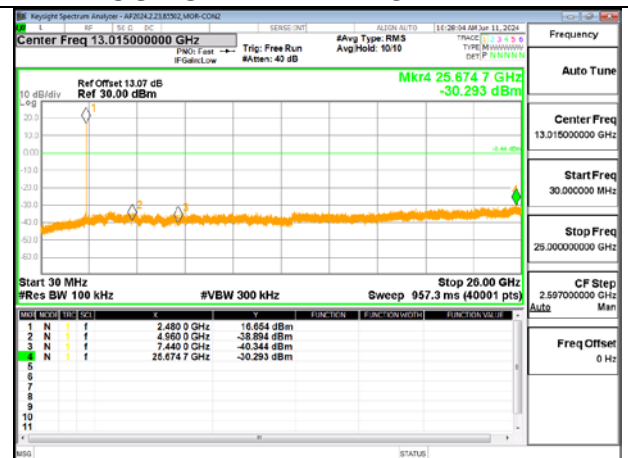
IN-BAND REFERENCE LEVEL



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 (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 and as applicable for average measurements. RMS Power Averaging was used.

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 power spectral density 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.

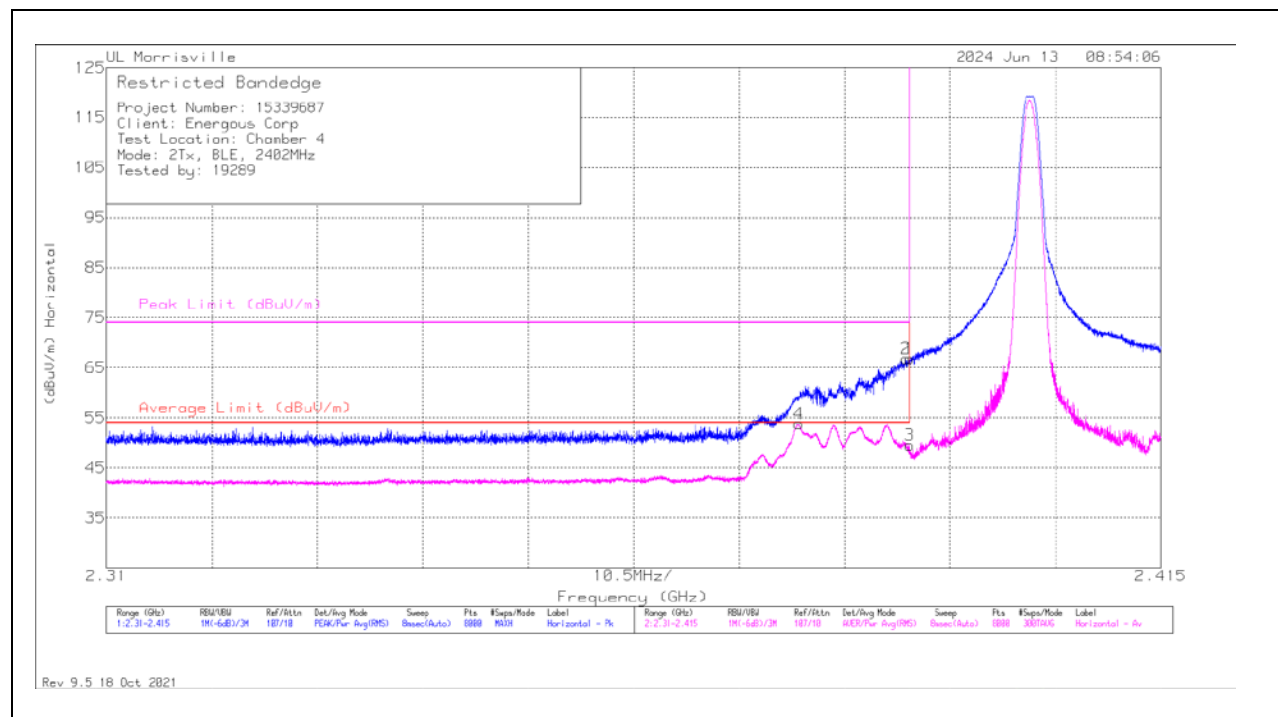
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	47.96	Pk	32	-23.2	10	0	66.76	-	-	74	-7.24	50	112	H
2	* ** 2.38962	48.02	Pk	32	-23.2	10	0	66.82	-	-	74	-7.18	50	112	H
3	* ** 2.39	28.72	RMS	32	-23.2	10	2.02	49.54	54	-4.46	-	-	50	112	H
4	* ** 2.37893	32.76	RMS	32	-23	10	2.02	53.78	54	-2.22	-	-	50	112	H

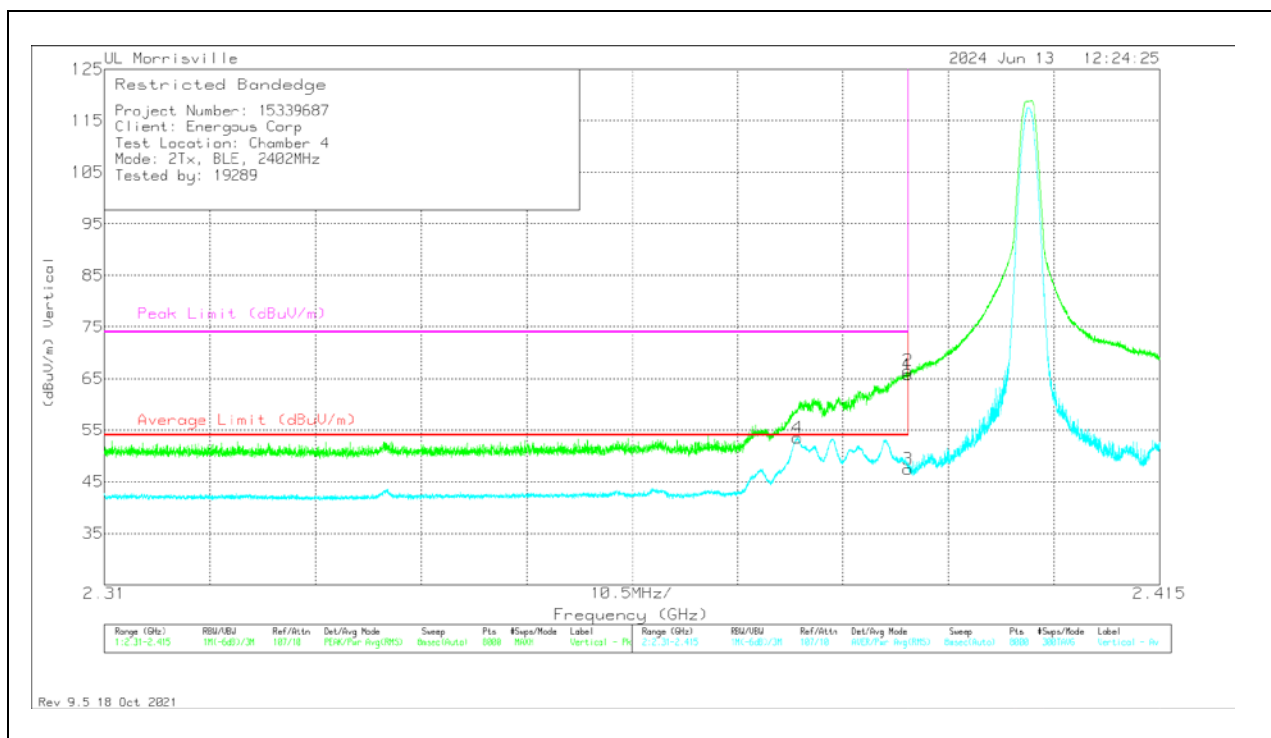
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	46.96	Pk	32	-23.2	10	0	65.76	-	-	74	-8.24	29	230	V
2	* ** 2.38997	47.73	Pk	32	-23.2	10	0	66.53	-	-	74	-7.47	29	230	V
3	* ** 2.39	26.62	RMS	32	-23.2	10	2.02	47.44	54	-6.56	-	-	29	230	V
4	* ** 2.37894	32.51	RMS	32	-23	10	2.02	53.53	54	-.47	-	-	29	230	V

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

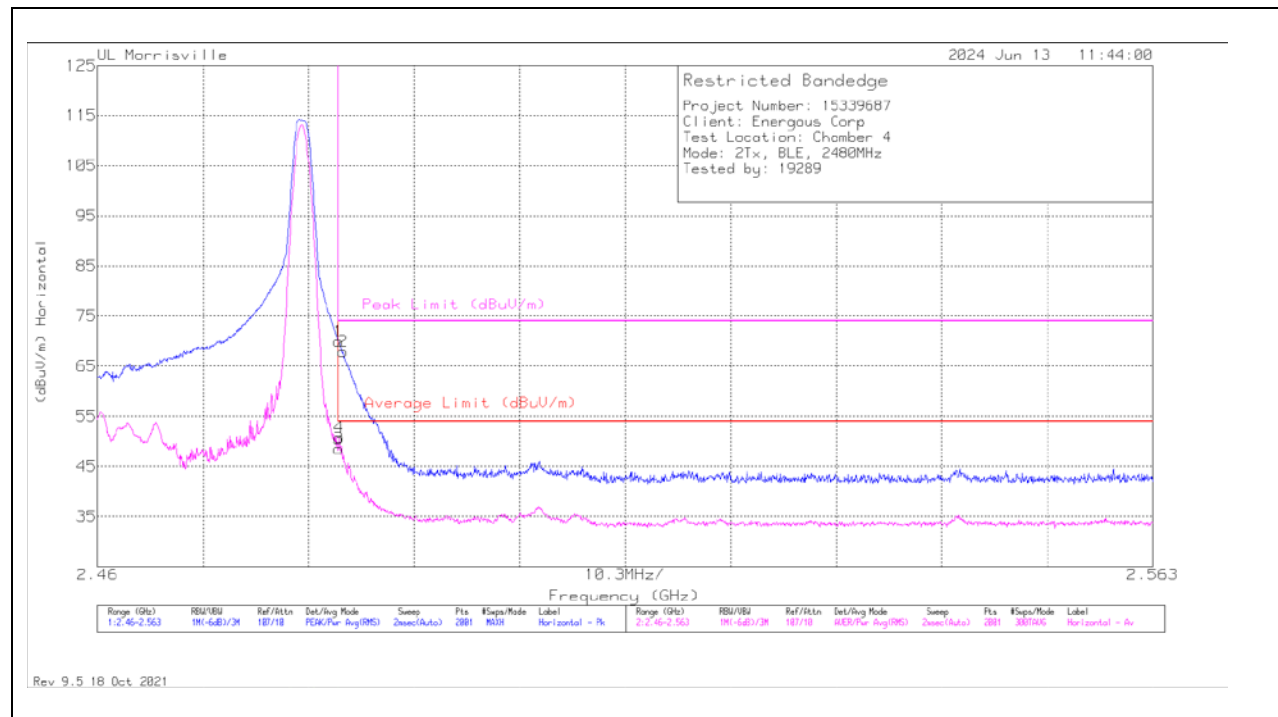
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	*** 2.48354	60.39	Pk	32.3	-22.8	0	69.89	-	-	74	-4.11	27	112	H
2	*** 2.48395	58.45	Pk	32.3	-22.8	0	67.95	-	-	74	-6.05	27	112	H
3	*** 2.48354	37.03	RMS	32.3	-22.8	2.02	48.55	54	-5.45	-	-	27	112	H
4	*** 2.48359	39.22	RMS	32.3	-22.8	2.02	50.74	54	-3.26	-	-	27	112	H

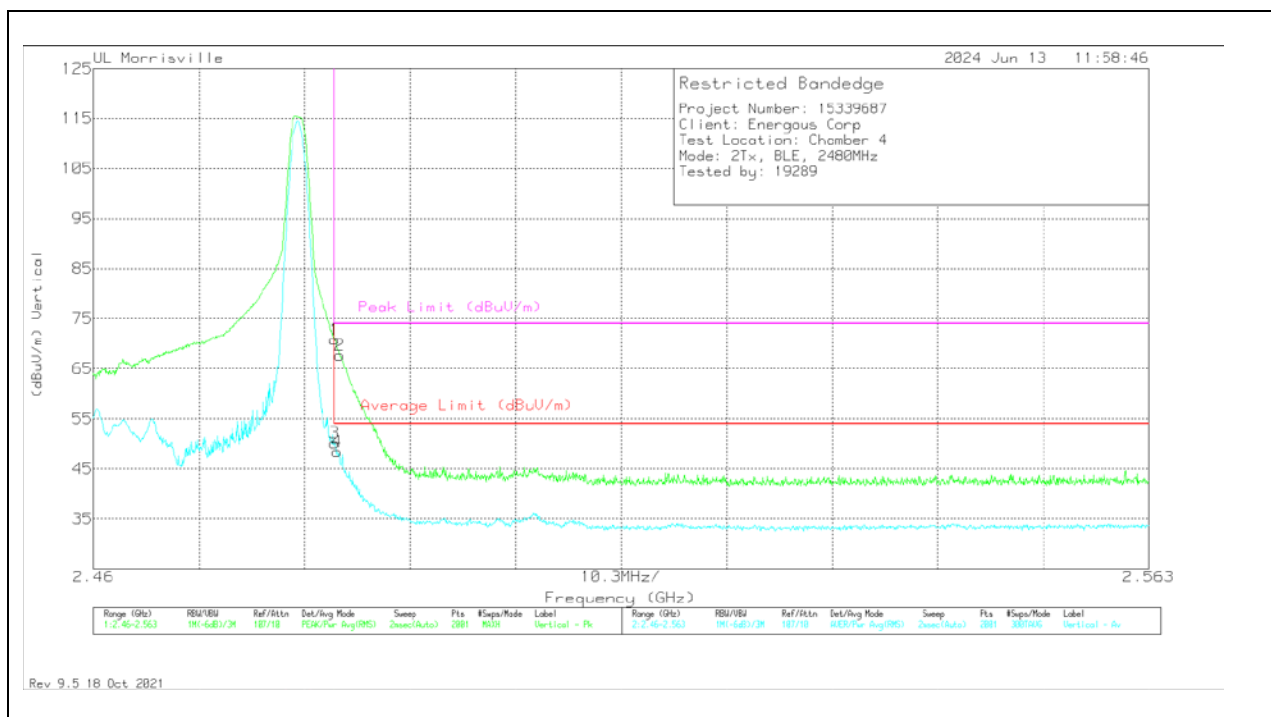
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBUV)	Det	89509 ACF (dB/m)	Gain/Loss (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	* ** 2.48354	61.36	Pk	32.3	-22.8	0	70.86	-	-	74	-3.14	4	142	V
2	* ** 2.48405	58.22	Pk	32.3	-22.8	0	67.72	-	-	74	-6.28	4	142	V
3	* ** 2.48354	38.6	RMS	32.3	-22.8	2.02	50.12	54	-3.88	-	-	4	142	V
4	* ** 2.48379	36.9	RMS	32.3	-22.8	2.02	48.42	54	-5.58	-	-	4	142	V

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

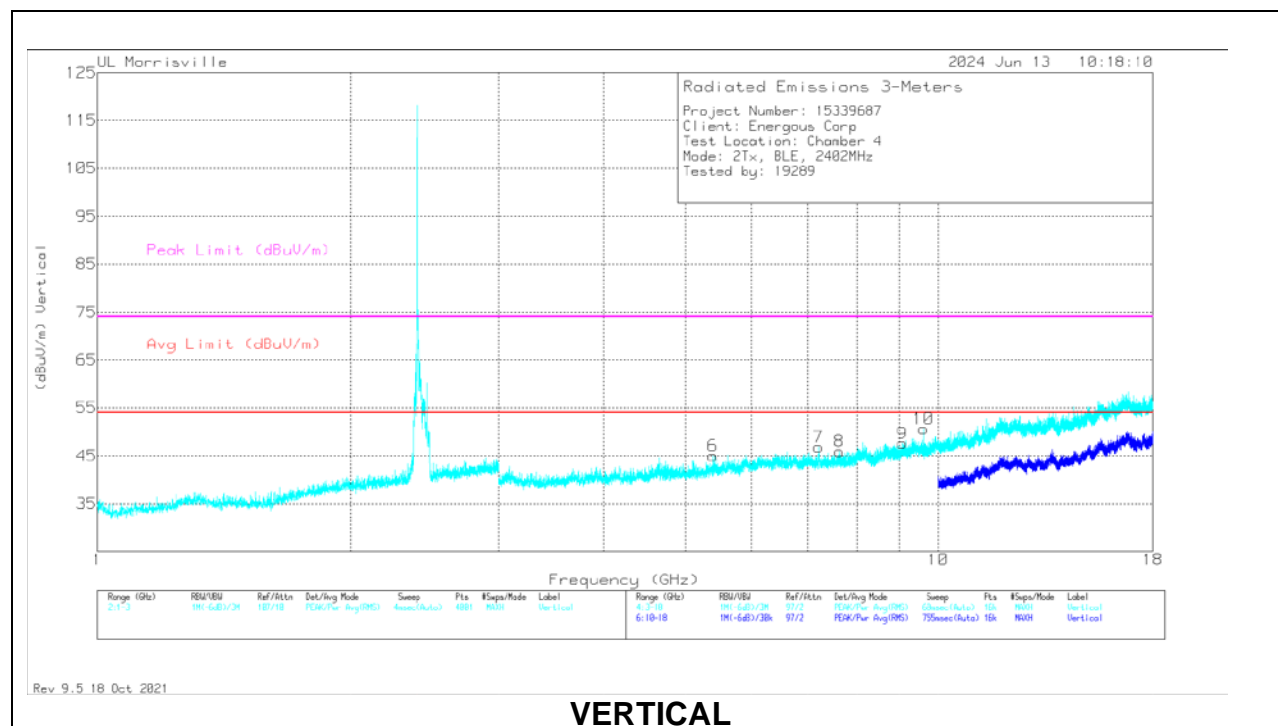
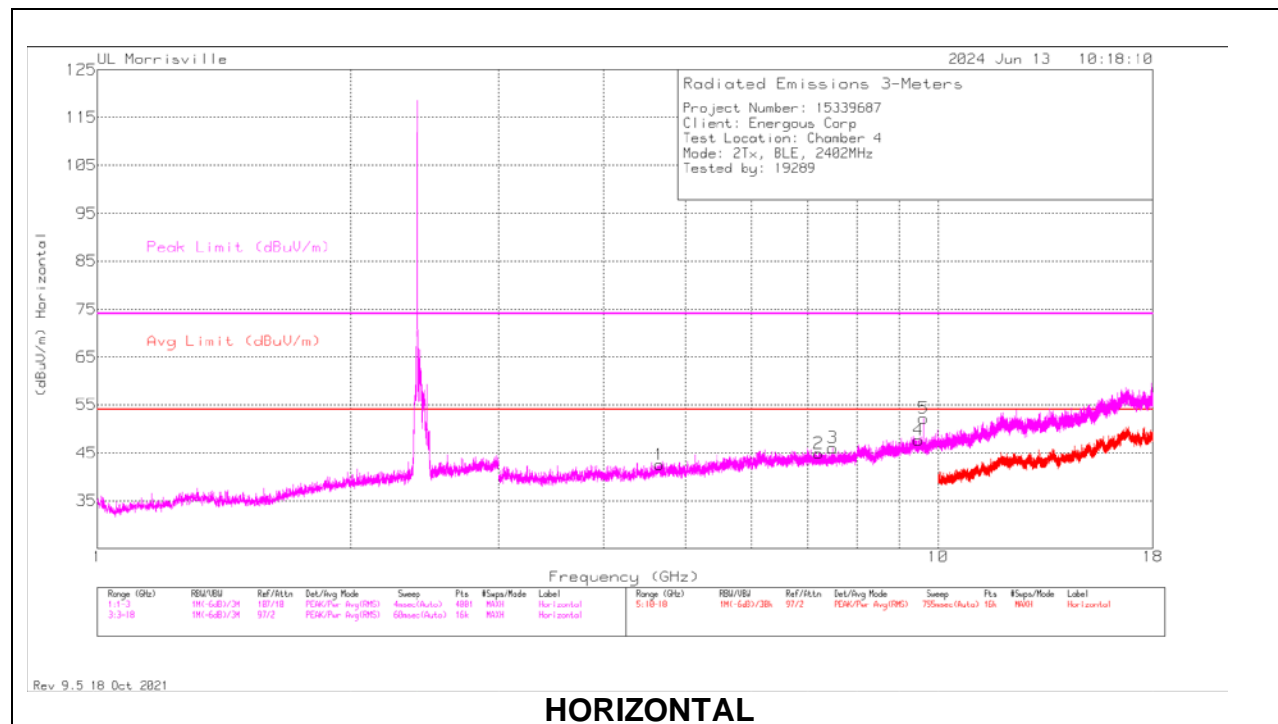
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

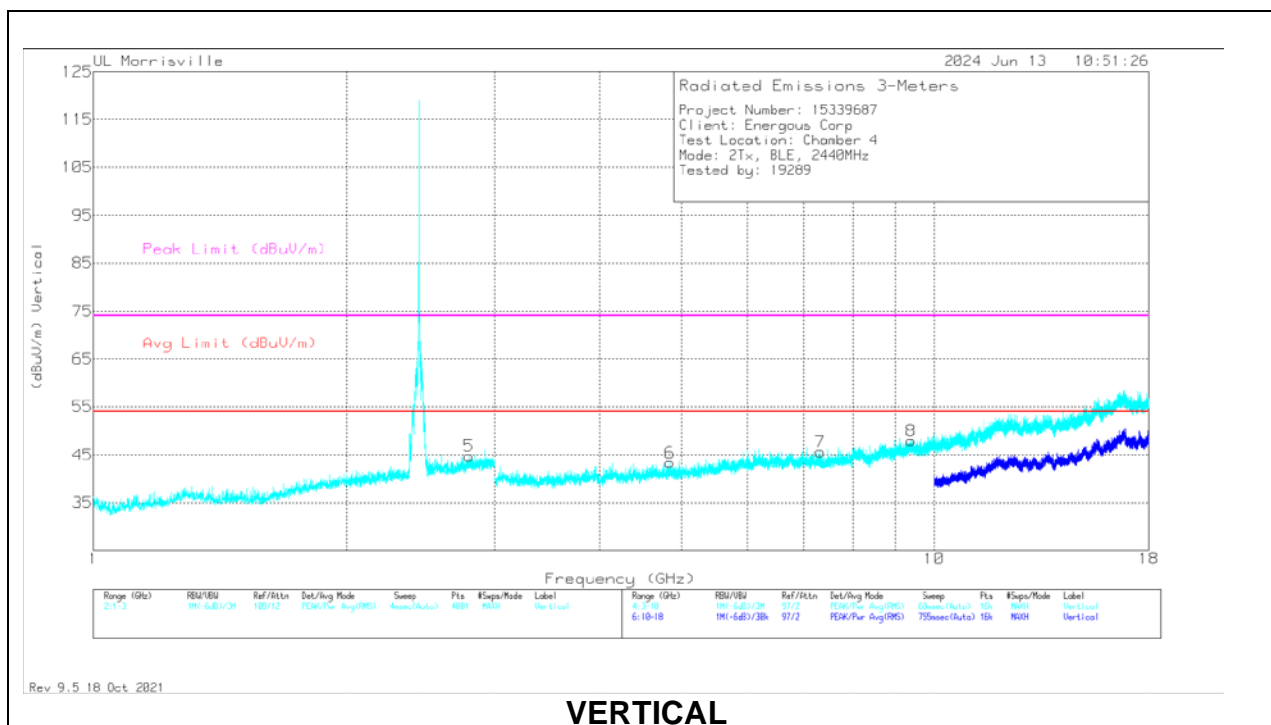
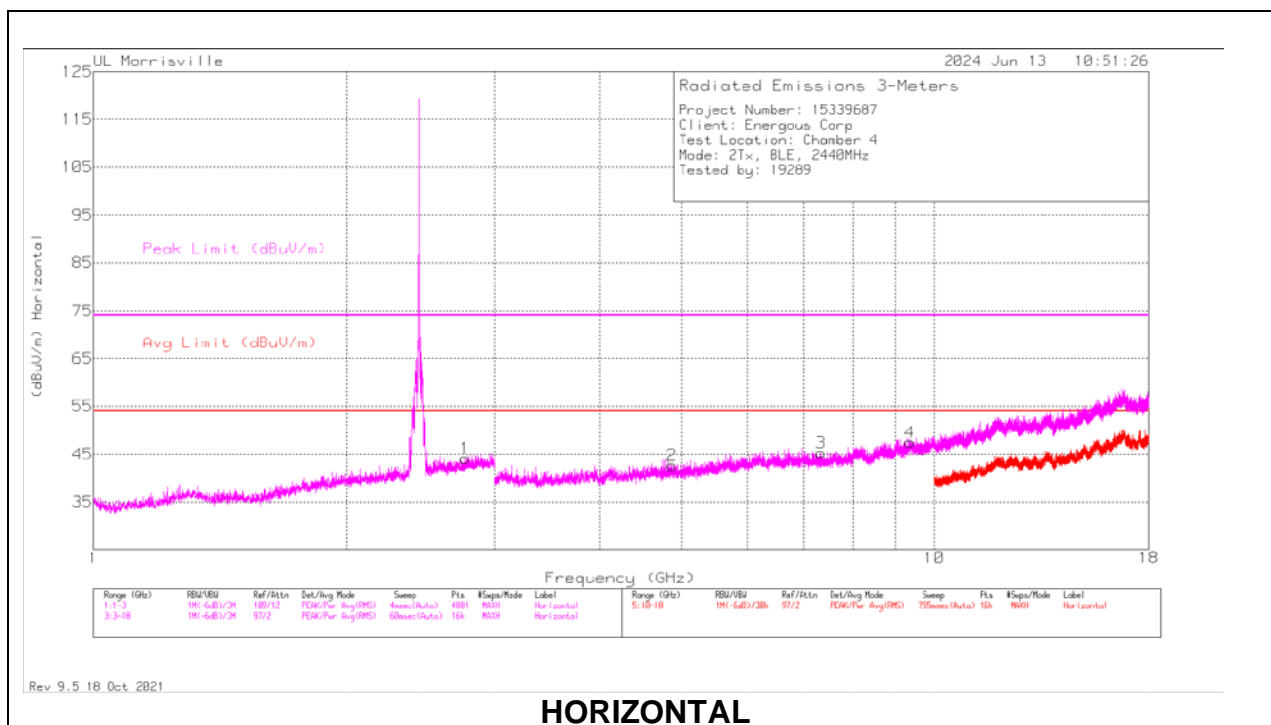
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.66219	39.47	Pk	34.1	-31	0	42.57	54	-11.43	74	-31.43	0-360	100	H
3	* ** 7.48781	38.21	Pk	35.6	-27.7	0	46.11	54	-7.89	74	-27.89	0-360	100	H
4	* ** 9.46688	36.3	Pk	36.7	-25.4	0	47.6	54	-6.4	74	-26.4	0-360	100	H
6	* ** 5.39438	40.52	Pk	34.6	-30.1	0	45.02	54	-8.98	74	-28.98	0-360	200	V
8	* ** 7.62938	37.48	Pk	35.7	-27.2	0	45.98	54	-8.02	74	-28.02	0-360	200	V
9	* ** 9.07313	35.78	Pk	36.2	-24.4	0	47.58	54	-6.42	74	-26.42	0-360	200	V
2	7.20469	36.99	Pk	35.6	-27.7	0	44.89	-	-	-	-	0-360	100	H
7	7.20563	38.94	Pk	35.6	-27.7	0	46.84	-	-	-	-	0-360	200	V
5	9.60656	40.39	Pk	36.8	-25	0	52.19	-	-	-	-	0-360	100	H
10	9.60656	38.85	Pk	36.8	-25	0	50.65	-	-	-	-	0-360	200	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

MID CHANNEL RESULTS



RADIATED EMISSIONS

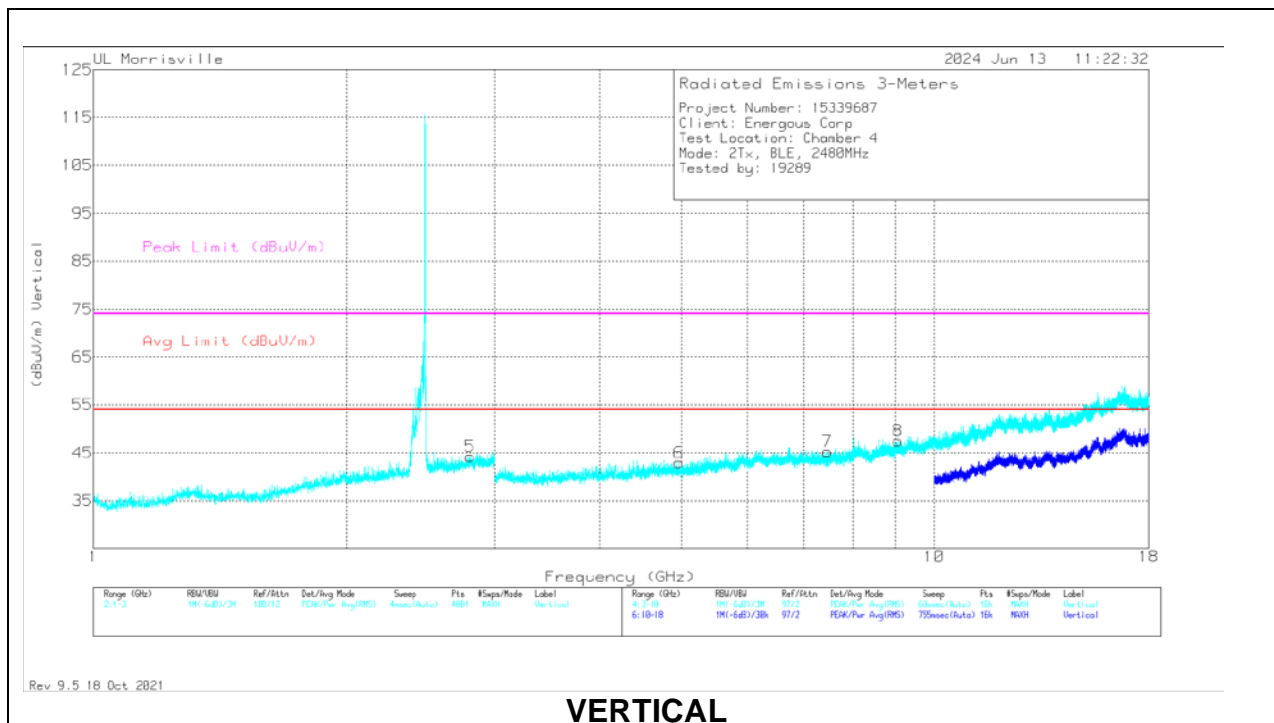
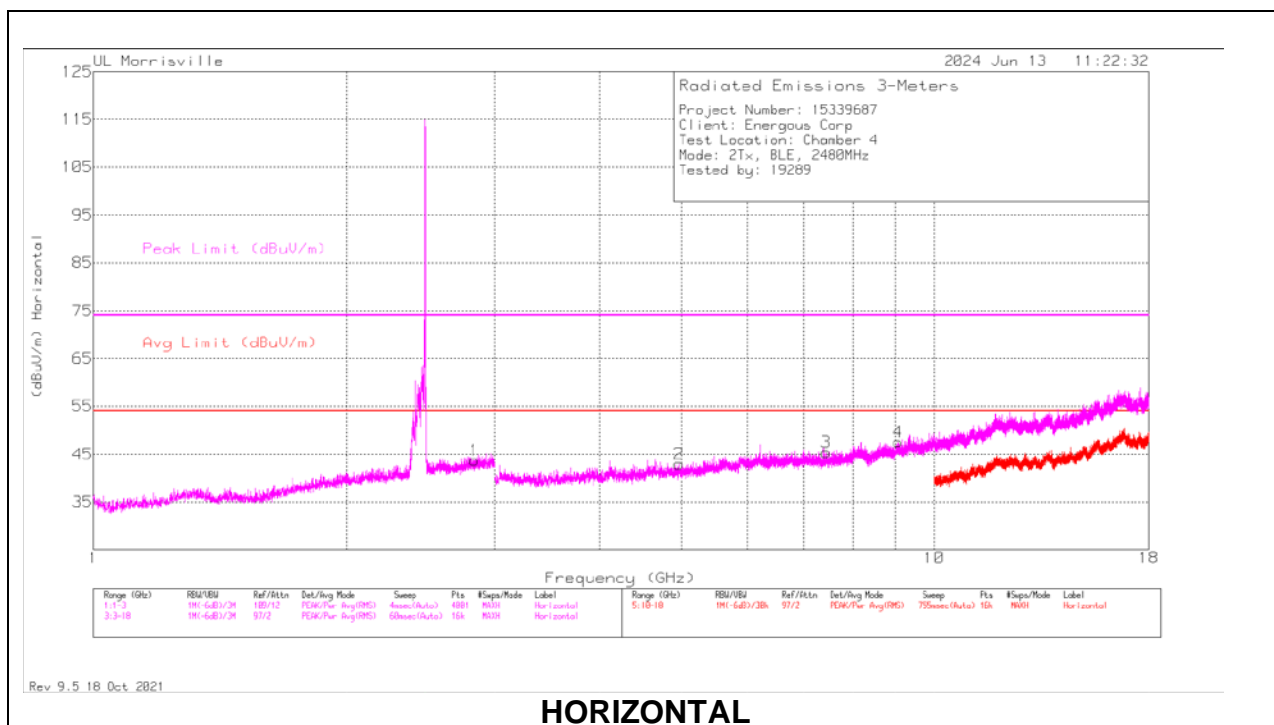
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.7655	33.93	Pk	32.5	-22.3	44.13	54	-9.87	74	-29.87	0-360	100	H
5	* ** 2.797	34.21	Pk	32.6	-22.1	44.71	54	-9.29	74	-29.29	0-360	200	V
2	* ** 4.87406	39.8	Pk	34.1	-31.2	42.7	54	-11.3	74	-31.3	0-360	100	H
3	* ** 7.33688	37.34	Pk	35.6	-27.6	45.34	54	-8.66	74	-28.66	0-360	100	H
4	* ** 9.36563	35.55	Pk	36.5	-24.6	47.45	54	-6.55	74	-26.55	0-360	100	H
6	* ** 4.8525	40.28	Pk	34.1	-31	43.38	54	-10.62	74	-30.62	0-360	200	V
7	* ** 7.32	37.72	Pk	35.6	-27.7	45.62	54	-8.38	74	-28.38	0-360	200	V
8	* ** 9.39469	36.06	Pk	36.6	-24.7	47.96	54	-6.04	74	-26.04	0-360	200	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.8385	33.63	Pk	32.3	-22.2	43.73	54	-10.27	74	-30.27	0-360	100	H
5	* ** 2.8025	33.72	Pk	32.6	-22.1	44.22	54	-9.78	74	-29.78	0-360	200	V
2	* ** 4.96406	39.48	Pk	34	-30.6	42.88	54	-11.12	74	-31.12	0-360	100	H
3	* ** 7.44094	37.61	Pk	35.7	-27.9	45.41	54	-8.59	74	-28.59	0-360	100	H
4	* ** 9.06563	35.97	Pk	36.2	-24.6	47.57	54	-6.43	74	-26.43	0-360	100	H
6	* ** 4.96875	39.76	Pk	34	-30.8	42.96	54	-11.04	74	-31.04	0-360	200	V
7	* ** 7.455	37.23	Pk	35.7	-27.6	45.33	54	-8.67	74	-28.67	0-360	200	V
8	* ** 9.05156	35.27	Pk	36.2	-24	47.47	54	-6.53	74	-26.53	0-360	200	V

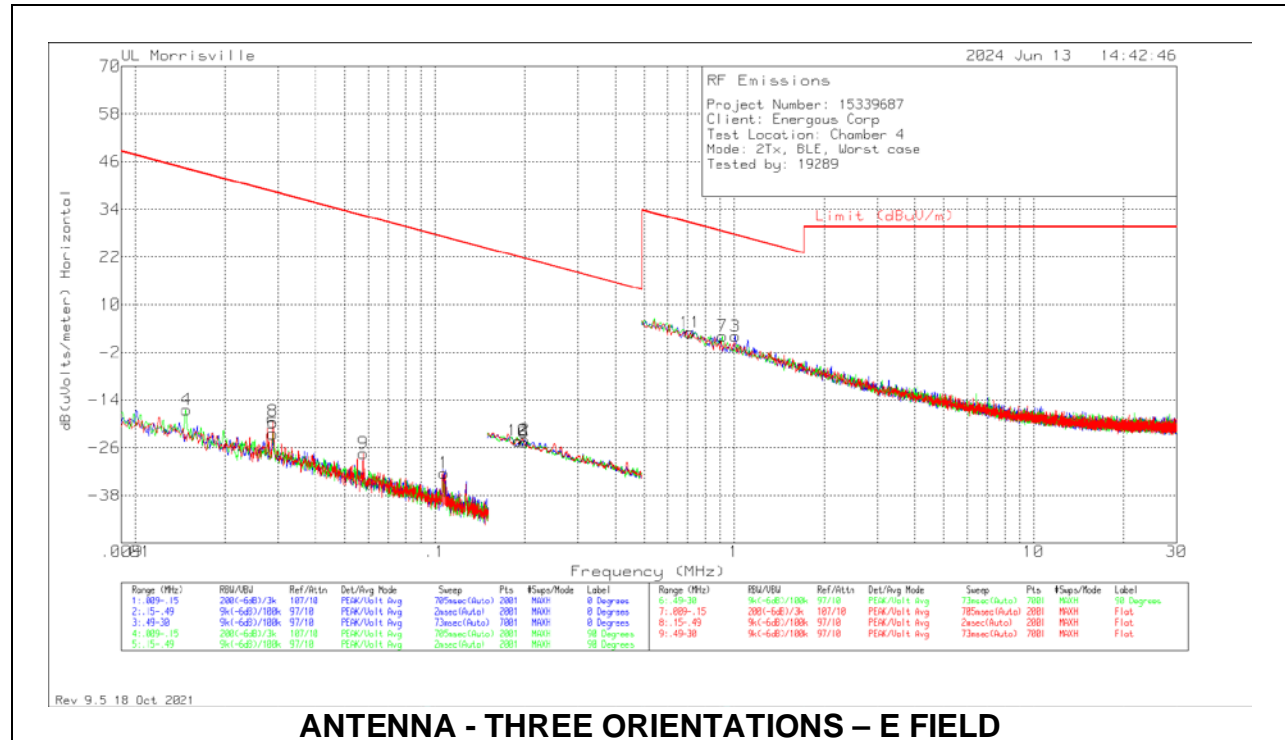
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA - THREE ORIENTATIONS – E FIELD

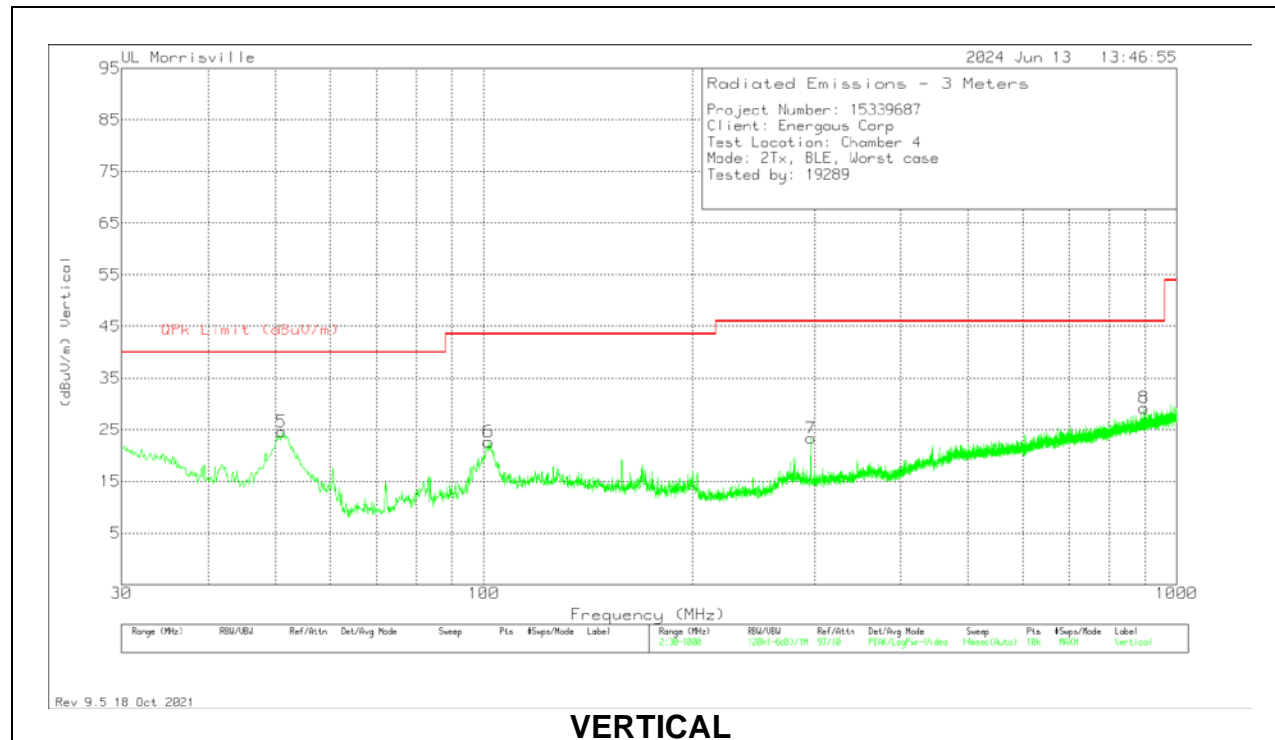
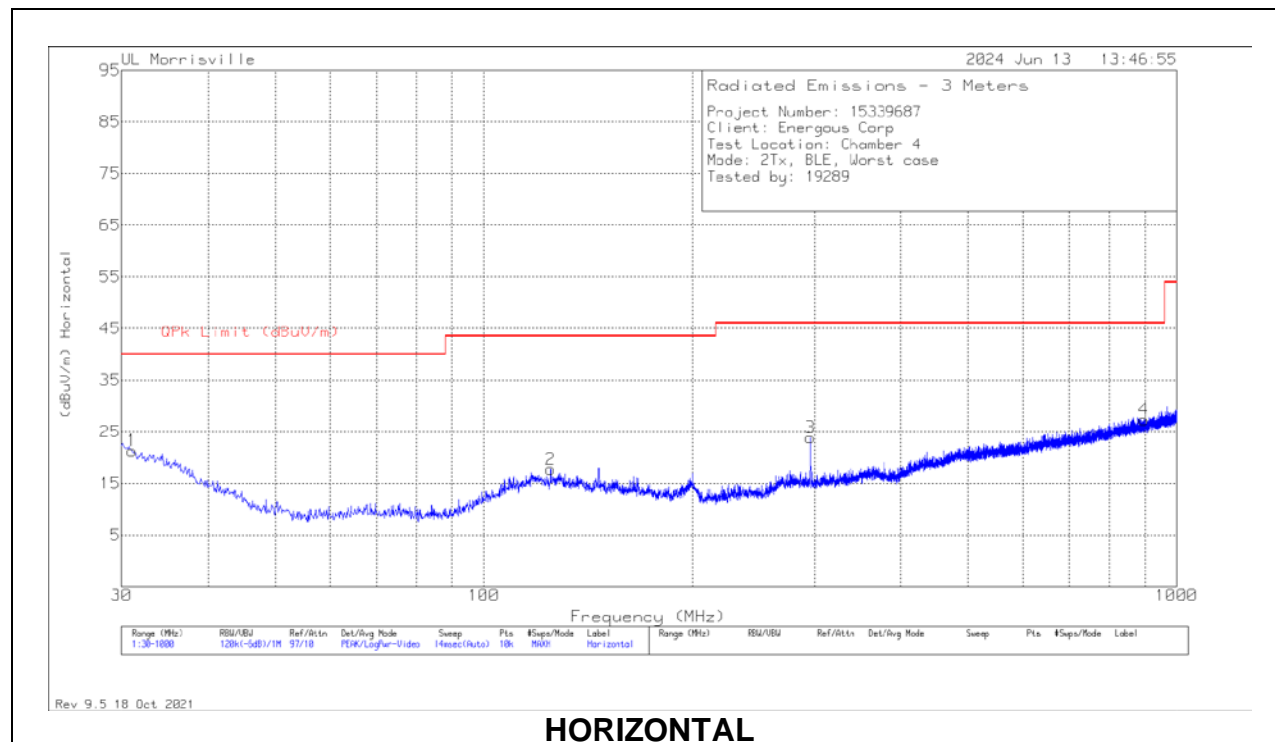
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dBuV/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
4	.01482	47.13	Pk	16.3	.1	-80	-16.47	44.19	-60.66	0-360	400	90 degs
5	.02874	43.79	Pk	13.6	.1	-80	-22.51	38.44	-60.95	0-360	400	90 degs
8	.02881	46.92	Pk	13.6	.1	-80	-19.38	38.41	-57.79	0-360	400	Flat
9	.05771	40.81	Pk	11.7	.1	-80	-27.39	32.38	-59.77	0-360	400	Flat
1	.10726	36.43	Pk	11.1	.1	-80	-32.37	27	-59.37	0-360	400	0 degs
10	.18961	44.52	Pk	11.1	.1	-80	-24.28	22.05	-46.33	0-360	400	Flat
6	.19913	44.13	Pk	11.1	.1	-80	-24.67	21.62	-46.29	0-360	400	90 degs
2	.1999	44.72	Pk	11.1	.1	-80	-24.08	21.59	-45.67	0-360	400	0 degs
11	.71345	31.58	Pk	11.2	.2	-40	2.98	30.54	-27.56	0-360	400	Flat
7	.91582	30.73	Pk	11.2	.2	-40	2.13	28.37	-26.24	0-360	400	90 degs
3	1.00857	30.48	Pk	11.4	.2	-40	2.08	27.53	-25.45	0-360	400	0 degs

Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



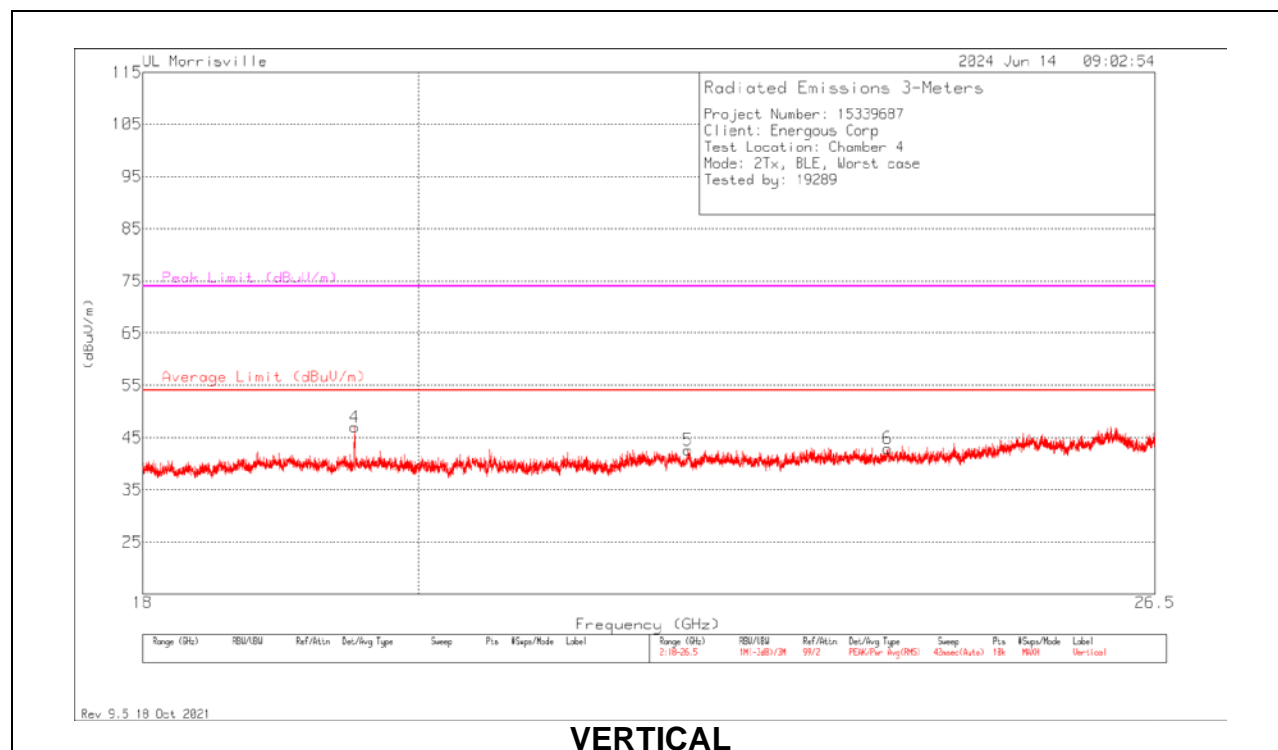
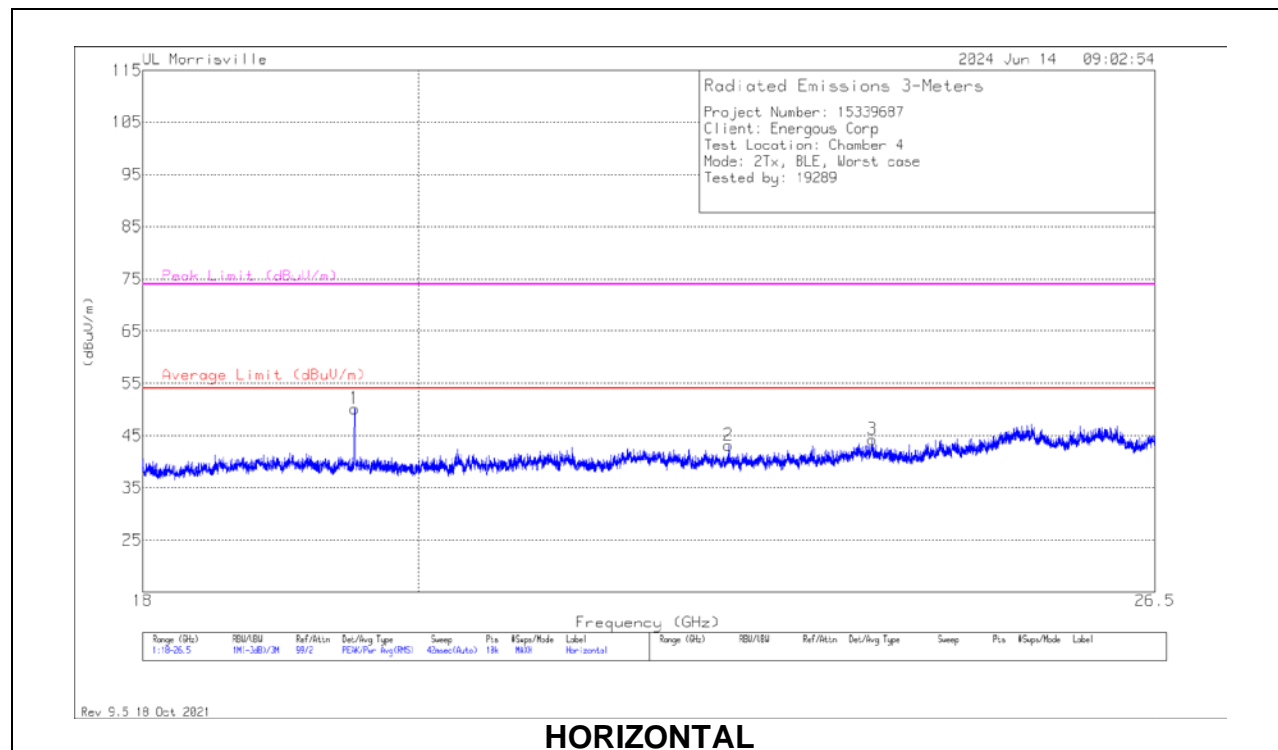
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	90628 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.067	27.34	Pk	26.1	-32.1	21.34	40	-18.66	0-360	200	H
5	51.049	42.61	Pk	13.9	-31.9	24.61	40	-15.39	0-360	100	V
6	101.683	37.17	Pk	16.9	-31.4	22.67	43.52	-20.85	0-360	100	V
2	124.963	28.91	Pk	20.1	-31.3	17.71	43.52	-25.81	0-360	100	H
3	295.78	34.76	Pk	19.5	-30.4	23.86	46.02	-22.16	0-360	100	H
7	296.459	34.14	Pk	19.5	-30.3	23.34	46.02	-22.68	0-360	100	V
4	896.404	26.55	Pk	28.1	-27.3	27.35	46.02	-18.67	0-360	100	H
8	896.792	28.35	Pk	28.2	-27.3	29.25	46.02	-16.77	0-360	200	V

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	204704 (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.52178	58.85	PK2	33.3	-41	0	51.15	-	-	74	-22.85	58	234	H
	* ** 19.51786	50.62	ADR	33.3	-41	2.02	44.94	54	-9.06	-	-	58	234	H
2	* ** 22.51645	48.73	Pk	34.2	-39.8	0	43.13	54	-10.87	74	-30.87	0-360	200	H
3	* ** 23.78622	47.89	Pk	34.4	-38	0	44.29	54	-9.71	74	-29.71	0-360	100	H
4	* ** 19.51795	54.67	Pk	33.3	-41	0	46.97	54	-7.03	74	-27.03	0-360	250	V
5	* ** 22.17053	48.19	Pk	34.3	-39.9	0	42.59	54	-11.41	74	-31.41	0-360	150	V
6	* ** 23.93241	46.64	Pk	34.4	-38.1	0	42.94	54	-11.06	74	-31.06	0-360	300	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

ADR - RMS average

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

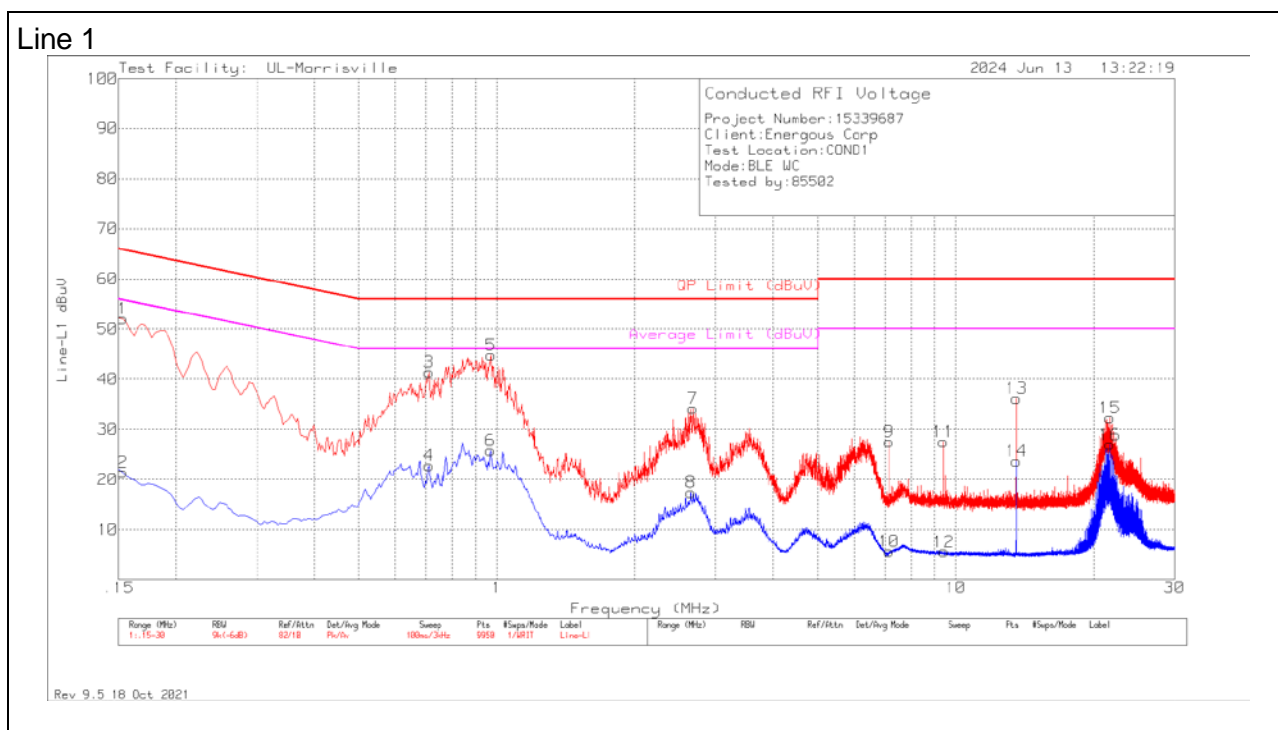
FCC §15.207 (a)
RSS-Gen 8.8

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

Conducted Emissions Graph



Conducted Emissions Data Points

Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VDF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.153	41.93	Pk	.3	9.8	52.03	65.84	-13.81	-	-
2	.153	11.31	Av	.3	9.8	21.41	-	-	55.84	-34.43
3	.711	31.52	Pk	.1	9.8	41.42	56	-14.58	-	-
4	.711	12.89	Av	.1	9.8	22.79	-	-	46	-23.21
5	.972	34.86	Pk	.1	9.8	44.76	56	-11.24	-	-
6	.969	15.89	Av	.1	9.8	25.79	-	-	46	-20.21
7	2.679	24.23	Pk	.1	9.8	34.13	56	-21.87	-	-
8	2.649	7.46	Av	.1	9.8	17.36	-	-	46	-28.64
9	7.161	17.5	Pk	.1	9.9	27.5	60	-32.5	-	-
10	7.155	-4.41	Av	.1	9.9	5.59	-	-	50	-44.41
11	9.384	17.48	Pk	.1	10	27.58	60	-32.42	-	-
12	9.411	-4.54	Av	.1	10	5.56	-	-	50	-44.44
**13	13.563	25.96	Pk	.2	10	36.16	60	-23.84	-	-
**14	13.56	13.45	Av	.2	10	23.65	-	-	50	-26.35
15	21.693	21.9	Pk	.2	10.2	32.3	60	-27.7	-	-
16	21.693	16.56	Av	.2	10.2	26.96	-	-	50	-23.04

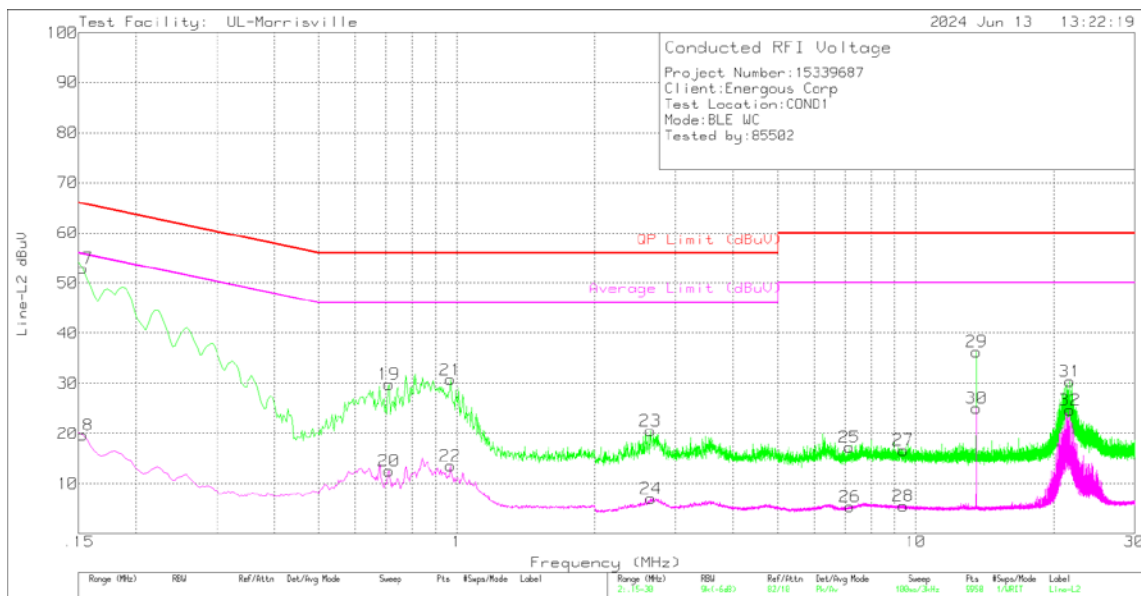
Pk - Peak detector

Av - Average detection

**NOTE: 13.56 MHz signal is from the badge reader and is not related to the EUT.

Conducted Emissions Graph

Line 2



Conducted Emissions Data Points

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VDF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
17	.153	42.85	Pk	.3	9.8	52.95	65.84	-12.89	-	-
18	.153	9.51	Av	.3	9.8	19.61	-	-	55.84	-36.23
19	.711	19.92	Pk	.1	9.8	29.82	56	-26.18	-	-
20	.711	2.62	Av	.1	9.8	12.52	-	-	46	-33.48
21	.969	20.82	Pk	.1	9.8	30.72	56	-25.28	-	-
22	.969	3.58	Av	.1	9.8	13.48	-	-	46	-32.52
23	2.643	10.59	Pk	.1	9.8	20.49	56	-35.51	-	-
24	2.649	-2.87	Av	.1	9.8	7.03	-	-	46	-38.97
25	7.167	7.21	Pk	.1	9.9	17.21	60	-42.79	-	-
26	7.185	-4.59	Av	.1	9.9	5.41	-	-	50	-44.59
27	9.402	6.56	Pk	.1	10	16.66	60	-43.34	-	-
28	9.399	-4.57	Av	.1	10	5.53	-	-	50	-44.47
**29	13.56	26.09	Pk	.2	10	36.29	60	-23.71	-	-
**30	13.563	14.81	Av	.2	10	25.01	-	-	50	-24.99
31	21.693	19.95	Pk	.2	10.2	30.35	60	-29.65	-	-
32	21.693	14.3	Av	.2	10.2	24.7	-	-	50	-25.3

Pk - Peak detector

Av - Average detection

Ca - CISPR average detection

**NOTE: 13.56 MHz signal is from the badge reader and is not related to the EUT.

12. SETUP PHOTOS

Please refer to 15339687-EP1 for setup photos

END OF TEST REPORT