TEST REPORT

Report Number. : R14641114-E1

Applicant	:	Axon Enterprise Inc. 17800 N. 85th Street Scottsdale, AZ 85255, USA
Model	:	AX1037
FCC ID	:	X4GS01506
IC	:	8803A-S01506
EUT Description	:	Body Worn Camera
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C: 2023 ISED RSS-247 ISSUE 2: 2017 ISED RSS-GEN ISSUE 5 + A2: 2021

Date Of Issue:
2023-06-19

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

ACCREDITED
CERT #0751.06

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2023-03-28	Initial Issue	Charles Moody
V2	2023-05-12	Updated Hardware/Firmware Version	Charles Moody
V3	2023-06-19	Updated Section 6.5 Regarding Testing Configurations	Charles Moody

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TABLE OF CONTENTS

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Axon Enterprise Inc.
17800 N. 85th Street
Scottsdale, AZ 85255, USA

EUT DESCRIPTION: Body Worn Camera

MODEL: AX1037

SERIAL NUMBER: D01A01381, D01A02481, D01A01401

SAMPLE RECEIPT DATE: 2023-03-06

DATE TESTED: 2023-03-06 TO 2023-03-24

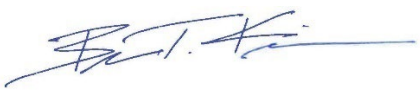
APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Refer to Section 2
ISED RSS-247 Issue 2	Refer to Section 2
ISED RSS-GEN Issue 5 + A2	Refer to Section 2

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.

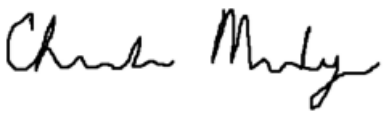
This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For
UL LLC By:



Brian Kiewra
Project Engineer
Consumer, Medical, and IT Segment
UL LLC

Prepared By:



Charles Moody
Engineer
Consumer, Medical, and IT Segment
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.

Below is a list of the data provided by the customer:
1) Antenna gain and type (see section 6.3)
2) Cable loss (see section 9.4 and 9.5)

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	Compliant	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	Compliant	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		

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 + A2, and RSS-247 Issue 2.

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
☒	Building 2800 Suite Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	825374
☐	Building 12 Laboratory Dr RTP, NC 27709, U.S.A.		2180C	

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

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a body worn video camera that uses a rechargeable battery back. The EUT contains a BLE, BT, 2.4 WLAN, 5 WLAN, NFC, GNSS, and WWAN radio. This report covers the full testing of the BLE 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)
2402 - 2480	BLE 1Mbps	7.30	5.37
2402 - 2480	BLE 2Mbps	7.63	5.79

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes a combination loop + IFA antenna, with a maximum gain of 1.55 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT hardware installed during testing was HW v.DVT2

The firmware version used during testing was FW v.01.01.NA.01.08

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 average output power as worst-case scenario. This was found to be 2Mbps, high channel.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low and high channels, as well as mid channel for radiated emissions. Bandedge was ran at 2Mbps based on being the worst-case signal width and average output power. Harmonics were only run on 1Mbps as worst-case based on PSD. Only 1Mbps and 2Mbps data rate were supported by the EUT.

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.

The EUT was tested in four configurations: dock charging, ac adapter charging, connected to POV camera, and battery powered, to find the worst-case emissions configuration. Through pretesting, it was determined that charging with the AC adapter was the worst-case radiated emissions and AC line configuration. Therefore, all radiated emissions and AC lines testing was performed with the EUT charging when connected to the AC adapter.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	L470	PF0ZV66P	PD98260NG
AC Adapter	Protégé	PG60-100015434-01	NA	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	1	1	USB-C	Unshielded	<3m	Connects to AC Adapter

TEST SETUP

The EUT is connected to a support laptop and configured prior to testing. For final testing, the EUT is disconnected from the support laptop and left connected to the AC Adapter.

SETUP DIAGRAMS

Please refer to R14641114-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 C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.2.3.1 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)

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

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2

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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				
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2022-07-07	2023-07-07
PWS002	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2022-09-27	2023-09-27
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2022-05-02	2023-05-02
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16	NA	NA
	Additional Equipment used				
226565	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CENTRICRF	C18S2-10	2023-02-16	2024-02-16
CBL101	Micro-Coax UTiFLEX Cable Assembly, Low Loss,40Ghz, 39.3", Connectors 2	Carlisle Interconnect Technologies	UFA147A-0-0180-200200	2023-01-24	2024-01-24

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	2022-04-05	2023-04-05
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2022-08-01	2023-08-01
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2022-08-03	2023-08-03
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2022-04-05	2023-04-05
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Miscellaneous (if needed)				
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2022-09-12	2023-09-12

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Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2023-01-17	2024-01-17
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2022-09-07	2023-09-07
	1-18 GHz				
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-03-21	2023-03-21
	18-40 GHz				
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-626	2022-07-11	2023-07-11
	Gain-Loss Chains				
91975	Gain-loss string: 0.009-30MHz	Various	Various	2022-05-10	2023-05-10
91978	Gain-loss string: 25-1000MHz	Various	Various	2022-05-10	2023-05-10
91977	Gain-loss string: 1-18GHz	Various	Various	2022-05-10	2023-05-10
136042	Gain-loss string: 18-40GHz	Various	Various	2022-05-10	2023-05-10
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-03-08	2023-03-31
SA0026	Spectrum Analyzer	Keysight	N9030A	2022-08-02	2023-08-02
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
200540	Environmental Meter	Fisher Scientific	15-077-963 s/n 181474409	2022-10-05	2023-10-05
208721	Wideband Radio Communications Tester	Rohde and Schwarz	CMW500	2022-05-05	2023-05-05
207639	10dB, DC-18GHz, 5W	Mini-Circuits	BW-N10W5+	2022-08-11	2023-08-11

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 - 1Mbps	0.390	0.624	0.625	62.50	4.08	2.564
BLE - 2Mbps	0.206	0.624	0.330	33.01	9.63	4.854

DUTY CYCLE PLOTS

DUTY CYCLE BLE – 1Mbps

DUTY CYCLE BLE – 2Mbps

9.2. 99% BANDWIDTH

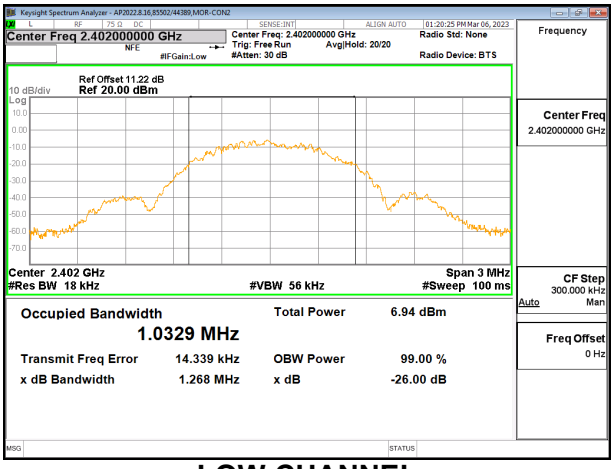
LIMITS

None; for reporting purposes only.

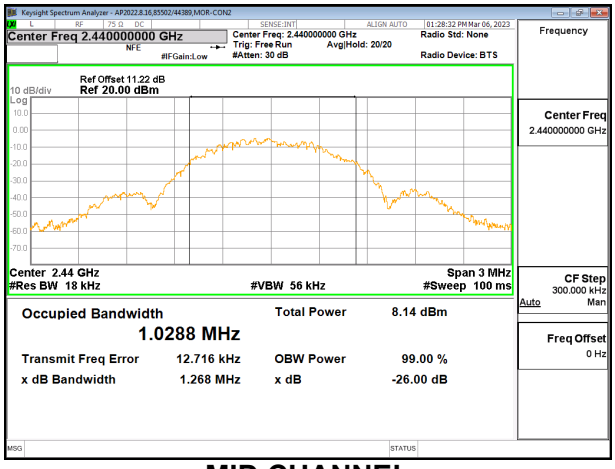
RESULTS

9.2.1. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0329
Middle	2440	1.0288
High	2480	1.0310



LOW CHANNEL



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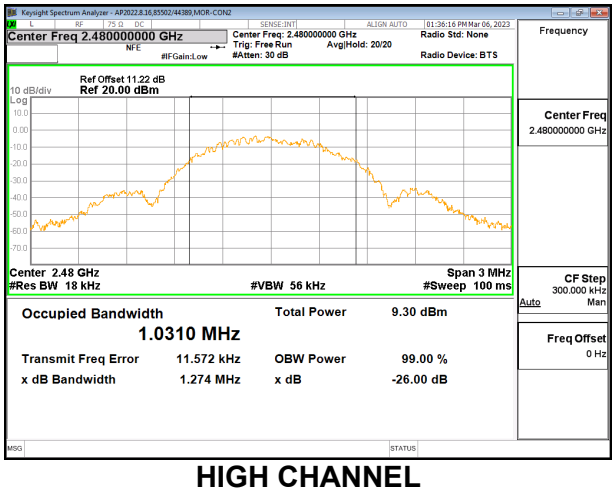
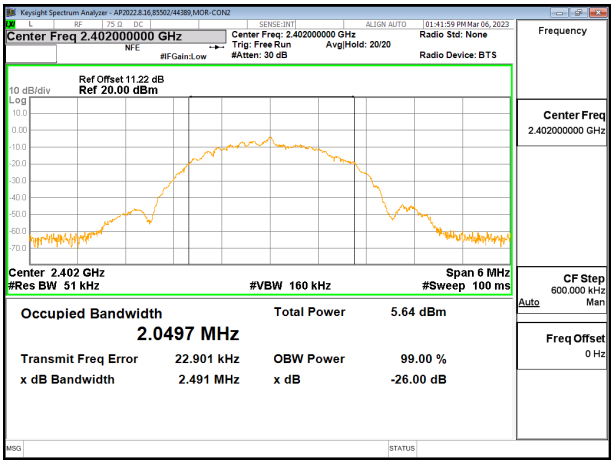


HIGH CHANNEL

9.2.2. BLE (2Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0497
Middle	2440	2.0452
High	2480	2.0502



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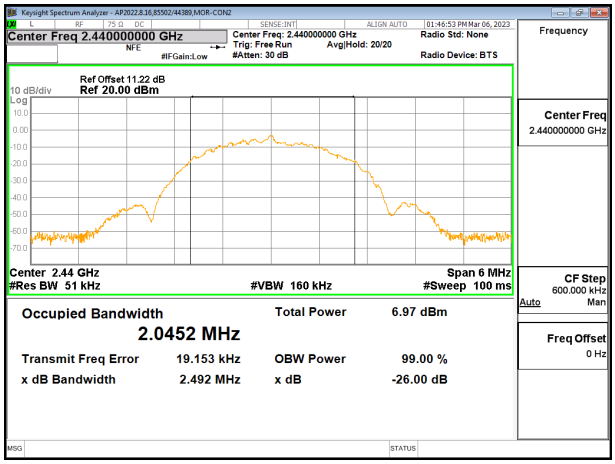

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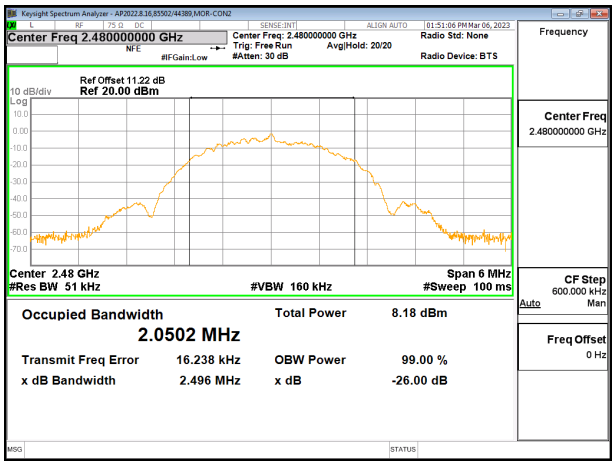


HIGH CHANNEL

9.3. 6 dB BANDWIDTH

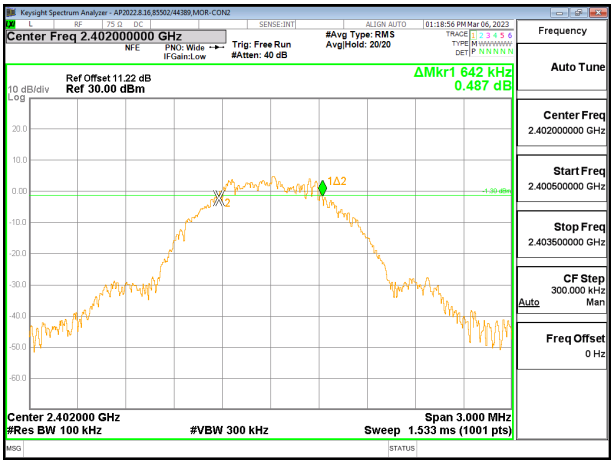
LIMITS

FCC §15.247 (a) (2)
RSS-247 5.2 (a)
The minimum 6 dB bandwidth shall be at least 500 kHz.

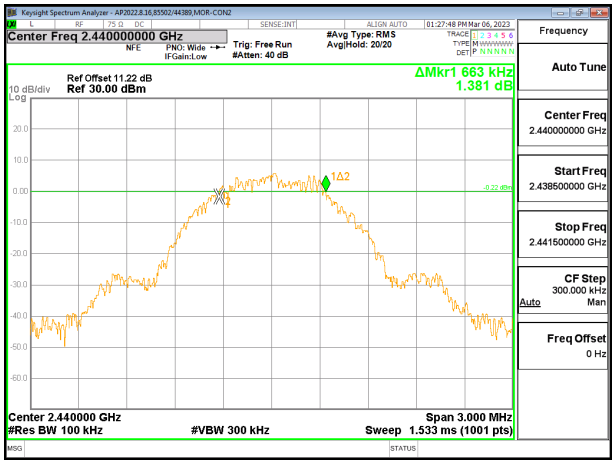
RESULTS

9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.642	0.5
Middle	2440	0.663	0.5
High	2480	0.642	0.5



LOW CHANNEL

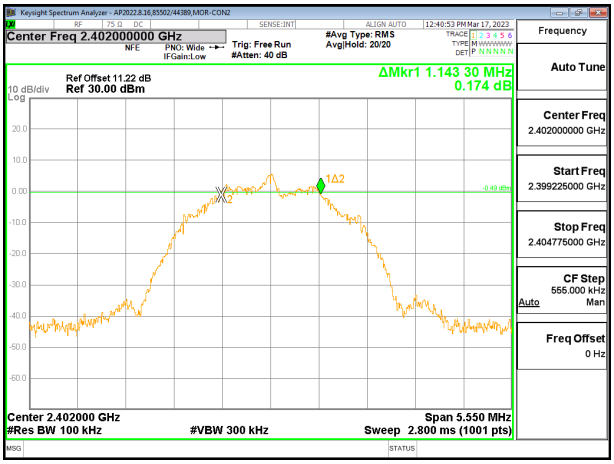


MID CHANNEL

HIGH CHANNEL

9.3.2. BLE (2Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.143	0.5
Middle	2440	1.260	0.5
High	2480	1.266	0.5



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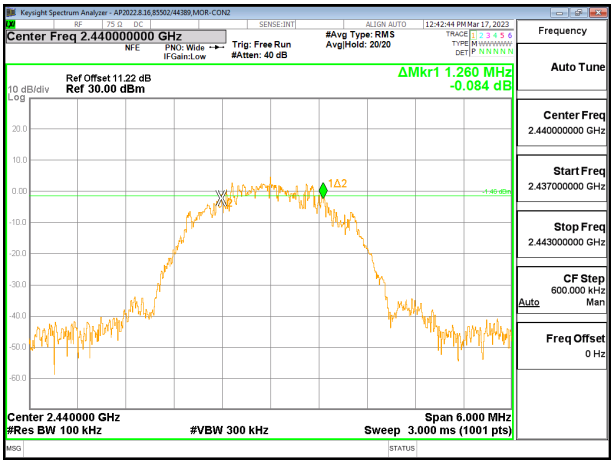

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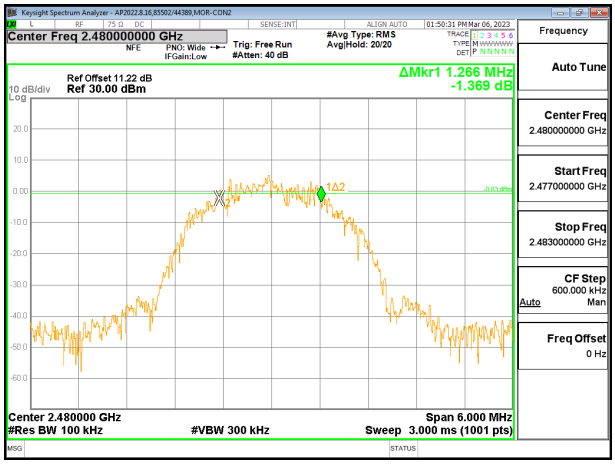

HIGH CHANNEL

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 11.22 dB (including 9.68 dB pad, a 1 dB EUT cable, and a 0.54 dB test cable) was entered as an offset in the power meter

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)

Tested By:	85502/44389
Date:	2023-03-06

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.03	30	-24.970
Middle	2440	6.06	30	-23.940
High	2480	7.30	30	-22.700

9.4.2. BLE (2Mbps)

Tested By:	85502/44389
Date:	2023-03-06

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.27	30	-24.730
Middle	2440	6.39	30	-23.610
High	2480	7.63	30	-22.370

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9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The cable assembly insertion loss of 11.22 dB (including 9.68 dB pad, a 1 dB EUT cable, and a 0.54 dB test cable) was entered as an offset in the power meter.

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)

Tested By:	85502/44389
Date:	2023-03-06

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	4.74
Middle	2440	5.86
High	2480	7.12

9.5.2. BLE (2Mbps)

Tested By:	85502/44389
Date:	2023-03-06

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	4.71
Middle	2440	5.86
High	2480	7.12

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9.6. POWER SPECTRAL DENSITY

LIMITS

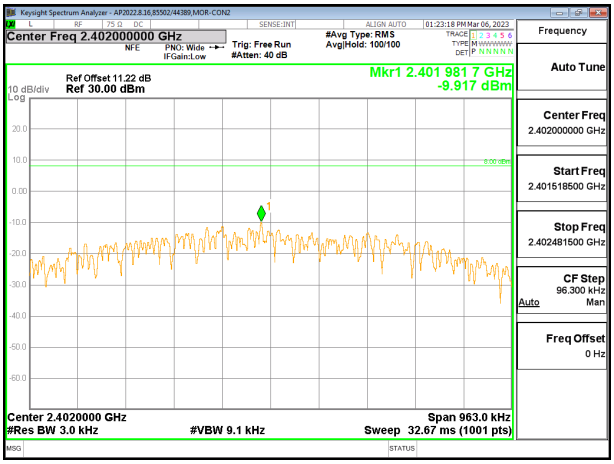
FCC §15.247 (e)
RSS-247 (5.2) (b)

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.

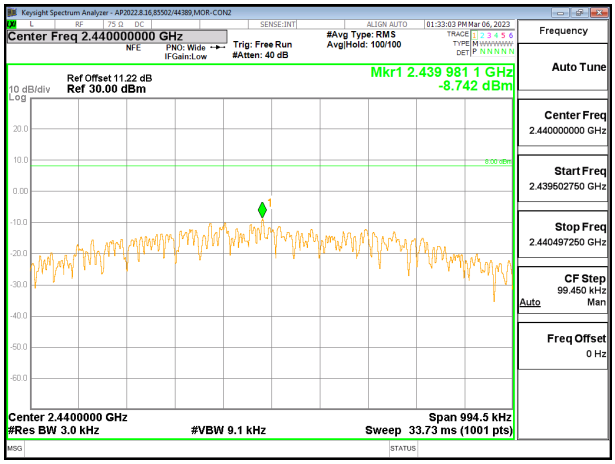
RESULTS

9.6.1. BLE (1Mbps)

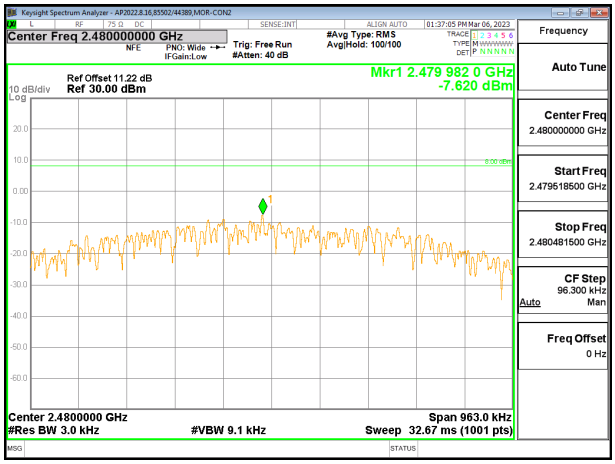
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-9.917	8	-17.92
Middle	2440	-8.742	8	-16.74
High	2480	-7.620	8	-15.62



LOW CHANNEL



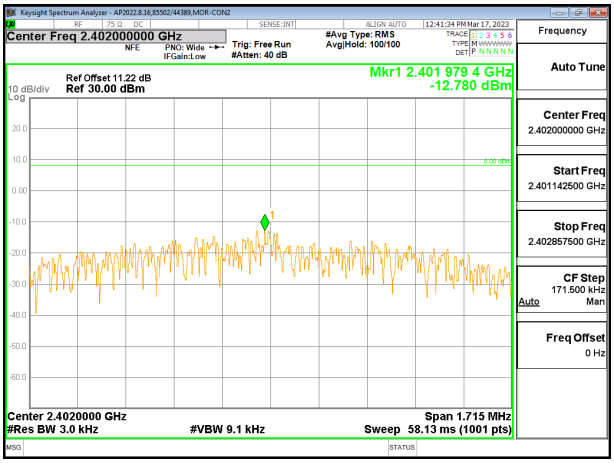
MID CHANNEL



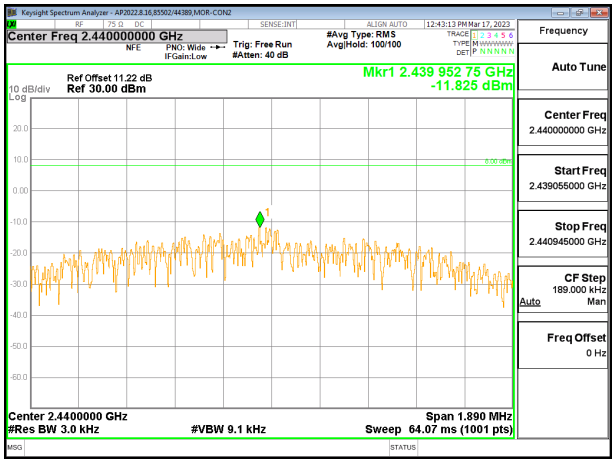
HIGH CHANNEL

9.6.2. BLE (2Mbps)

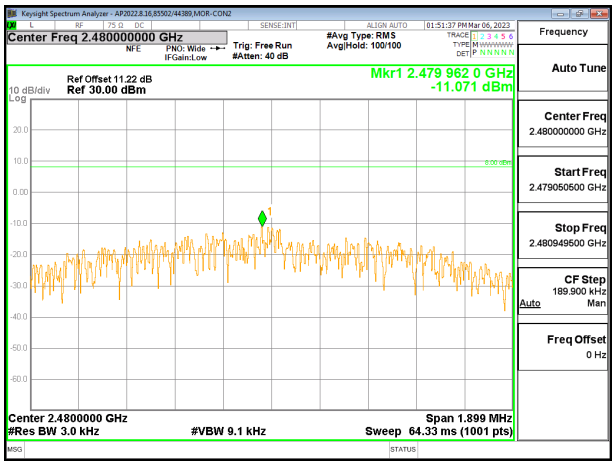
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-12.780	8	-20.78
Middle	2440	-11.825	8	-19.83
High	2480	-11.071	8	-19.07



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.7. CONDUCTED SPURIOUS EMISSIONS

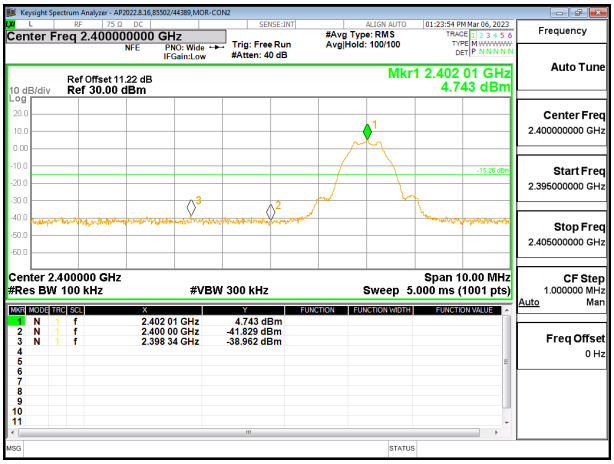
LIMITS

FCC §15.247 (d)
RSS-247 5.5

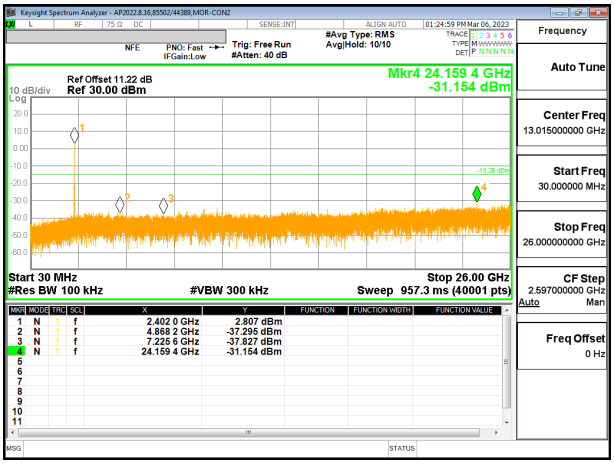
Output power was measured based on the use of a peak measurement, therefore the required attenuation is -20 dBc.

RESULTS

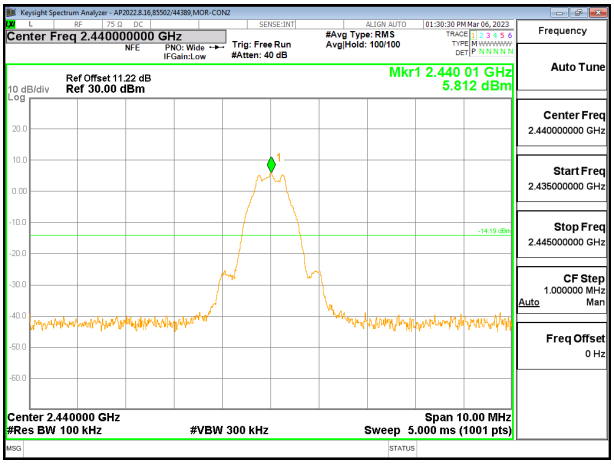
9.7.1. BLE (1Mbps)



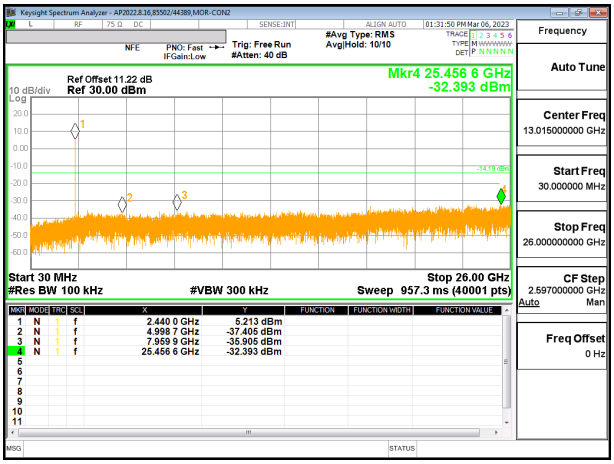
LOW CHANNEL BANDEDGE



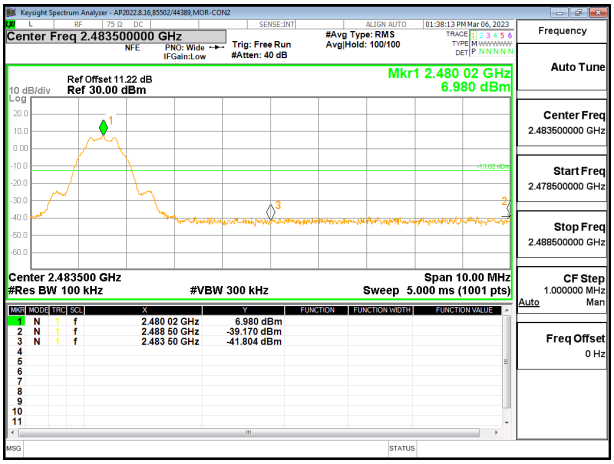
OUT-OF-BAND LOW CHANNEL



IN-BAND REFERENCE LEVEL



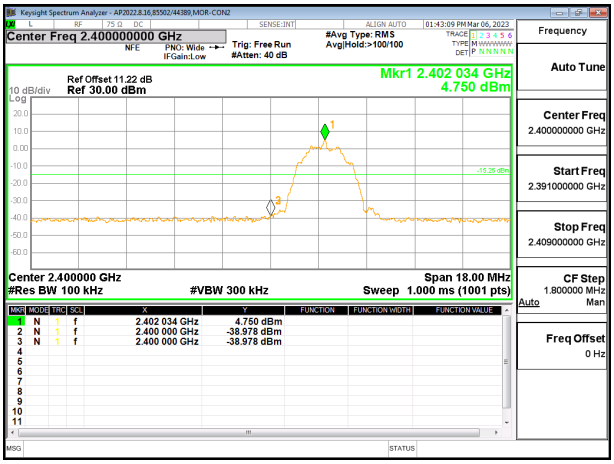
OUT-OF-BAND MID CHANNEL



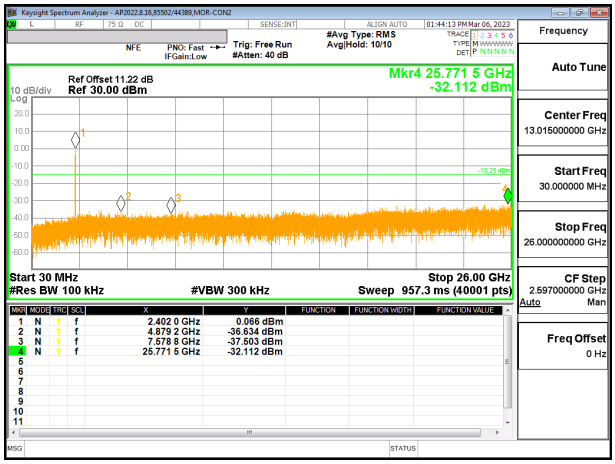
HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

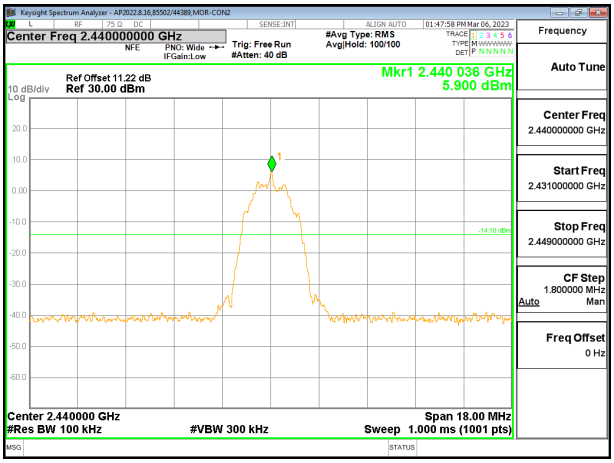
9.7.2. BLE (2Mbps)



LOW CHANNEL BANDEDGE

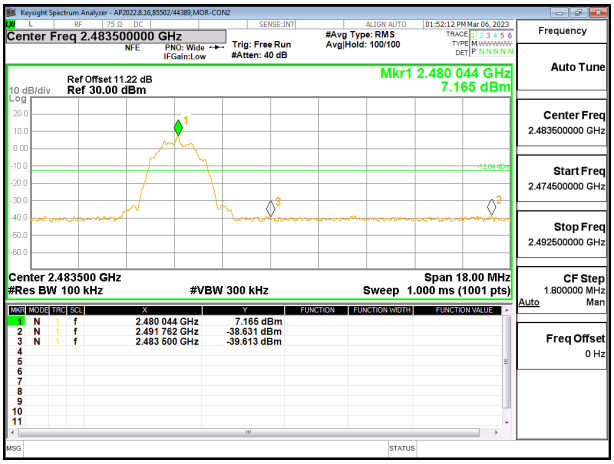


OUT-OF-BAND LOW CHANNEL

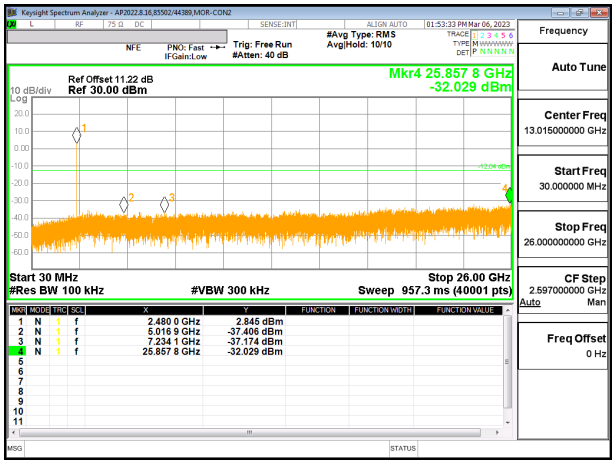


IN-BAND REFERENCE LEVEL

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. Linear Voltage 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 average 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

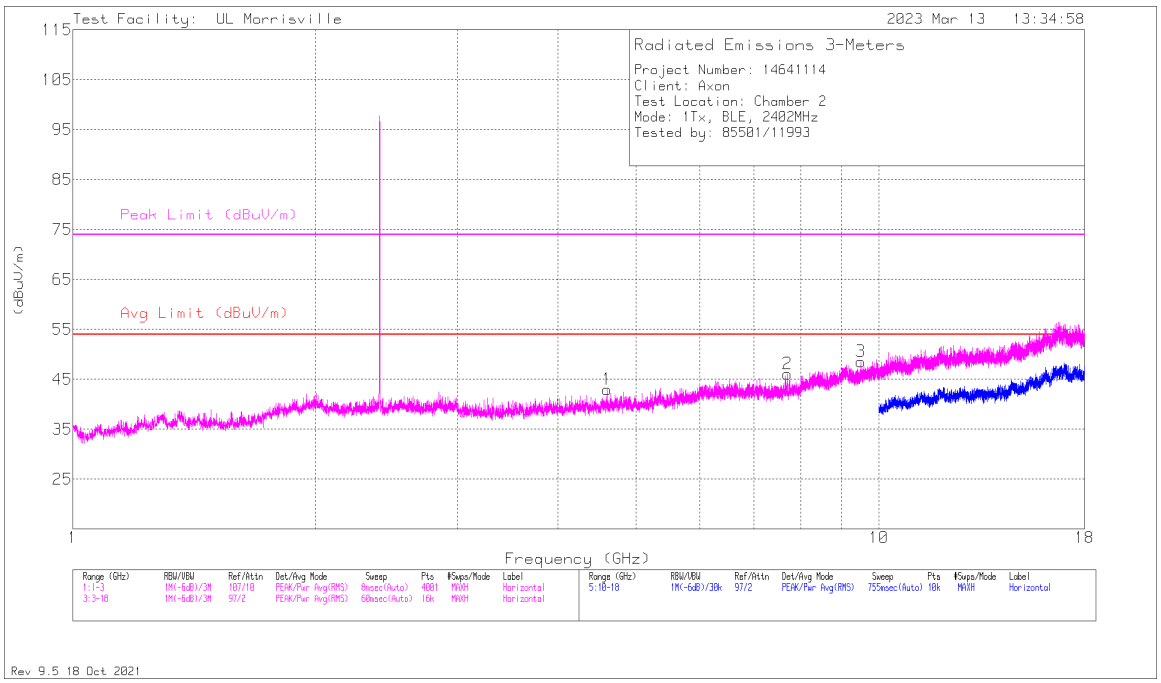
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

10.2. TRANSMITTER ABOVE 1 GHz

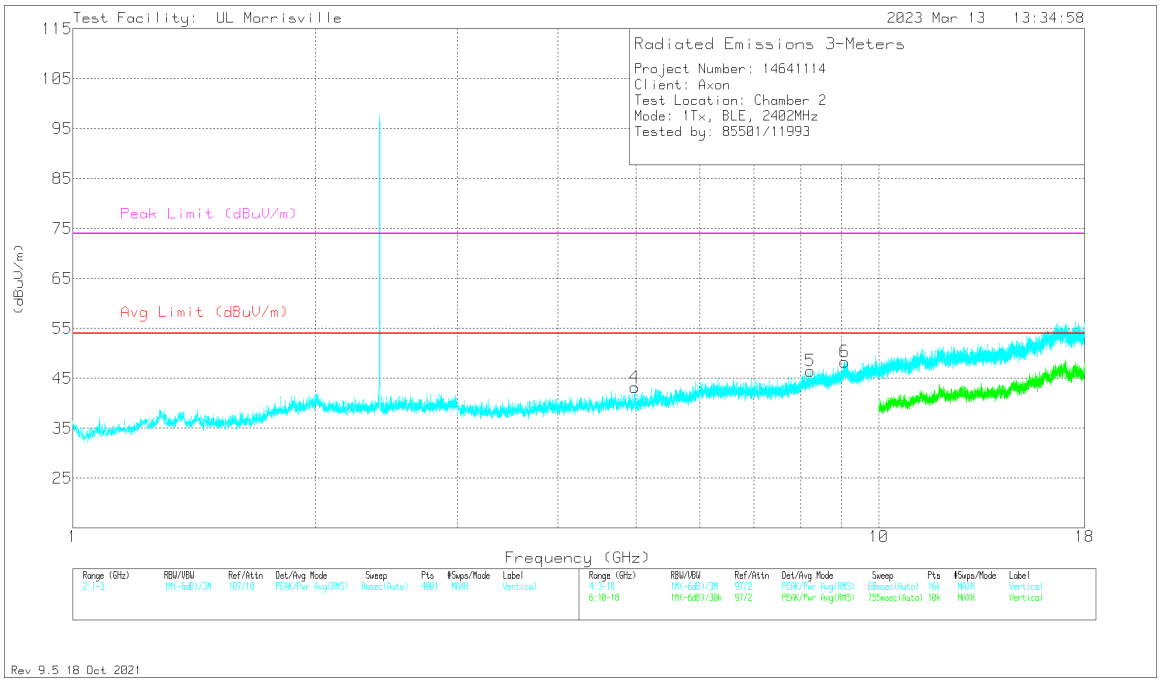
10.2.1. BLE (1Mbps)

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



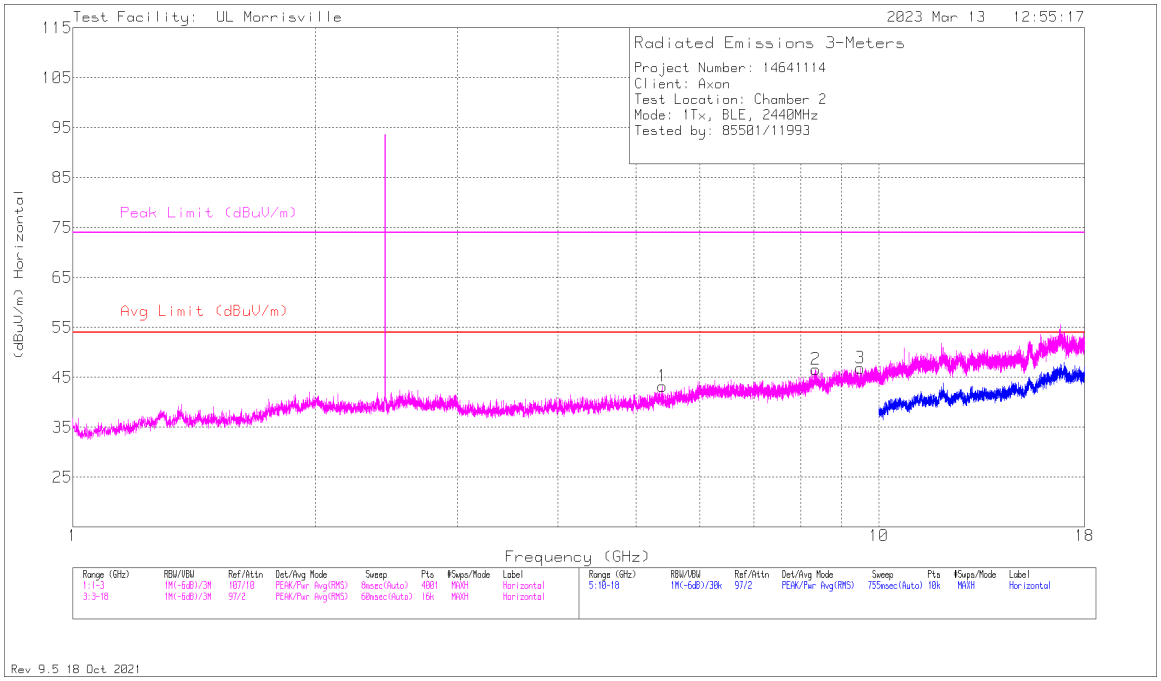
VERTICAL

RADIATED EMISSIONS

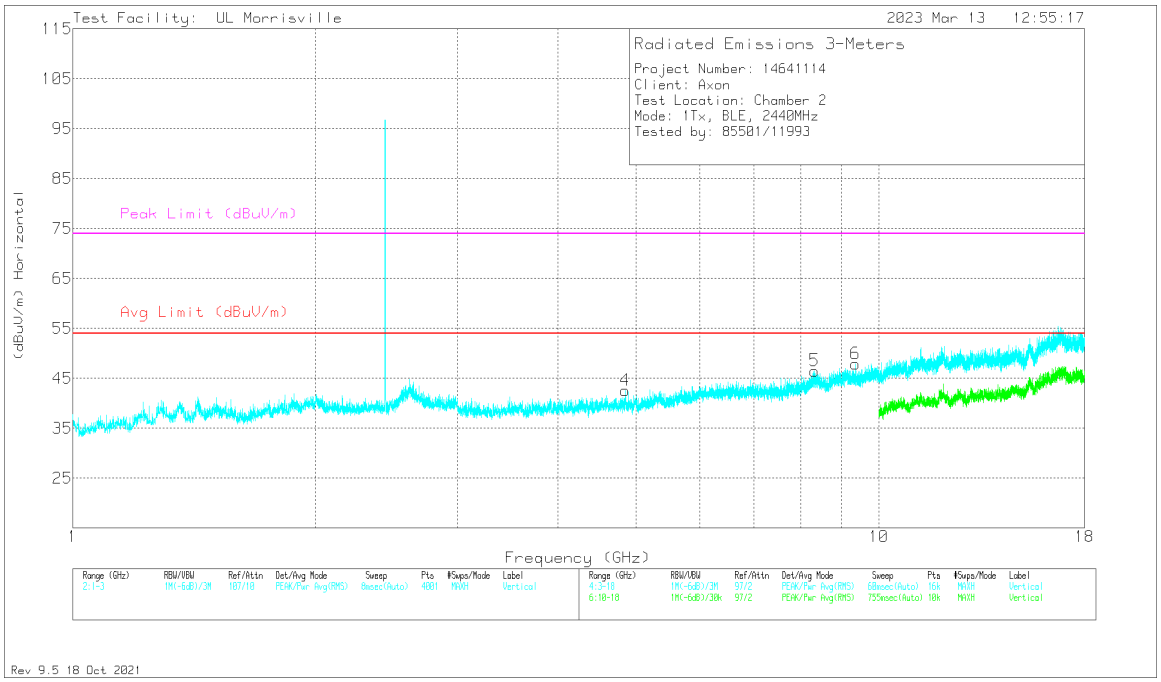
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.60125	39.95	Pk	34.1	-31.1	0	42.95	54	-11.05	74	-31.05	0-360	200	H
2	* ** 7.70625	37.59	Pk	35.7	-27.2	0	46.09	54	-7.91	74	-27.91	0-360	101	H
3	* ** 9.49862	36.9	PK2	36.8	-25.5	0	48.2	-	-	74	-25.8	208	126	H
	* ** 9.49555	24.47	ADV	36.7	-25.3	4.08	39.95	54	-14.05	-	-	208	126	H
4	* ** 4.97719	39.6	Pk	34.1	-30.5	0	43.2	54	-10.8	74	-30.8	0-360	200	V
5	* ** 8.2275	37.35	Pk	35.8	-26.7	0	46.45	54	-7.55	74	-27.55	0-360	101	V
6	* ** 9.0691	38.11	PK2	36.2	-25.4	0	48.91	-	-	74	-25.09	169	229	V
	* ** 9.07013	25.51	ADV	36.2	-25.5	4.08	40.29	54	-13.71	-	-	169	229	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

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

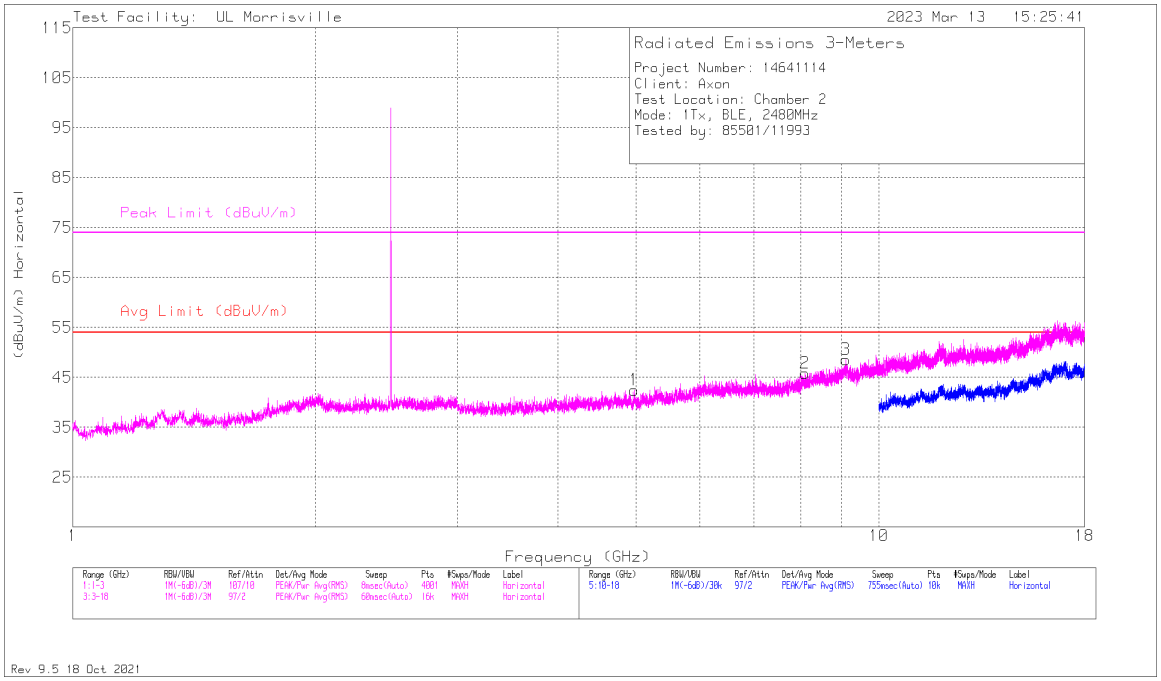
RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (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	* ** 5.39156	38.05	Pk	34.4	-29.2	0	43.25	54	-10.75	74	-30.75	0-360	199	H
2	* ** 8.34938	37.45	Pk	35.8	-26.6	0	46.65	54	-7.35	74	-27.35	0-360	101	H
3	* ** 9.47813	35.91	Pk	36.7	-25.8	0	46.81	54	-7.19	74	-27.19	0-360	199	H
4	* ** 4.845	38.84	Pk	34.1	-30.4	0	42.54	54	-11.46	74	-31.46	0-360	199	V
5	* ** 8.32031	37.24	Pk	35.8	-26.5	0	46.54	54	-7.46	74	-27.46	0-360	101	V
6	* ** 9.36281	36.7	Pk	36.6	-25.4	0	47.9	54	-6.1	74	-26.1	0-360	199	V

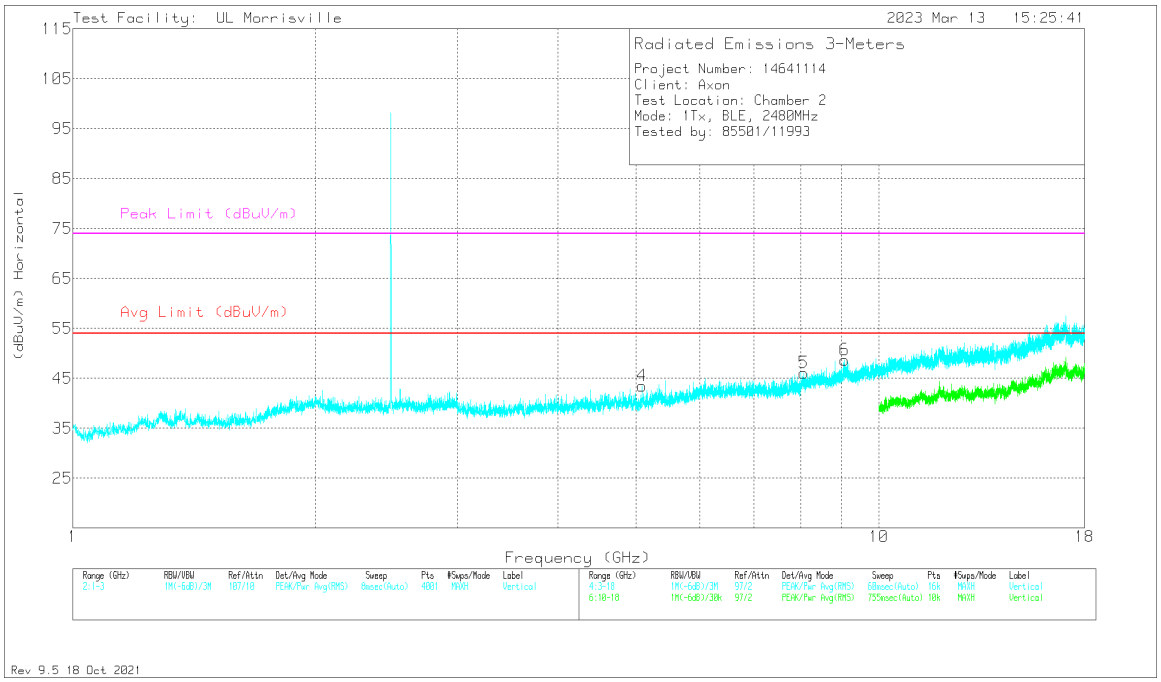
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector

UL LLC
2800 Suite Perimeter Park Dr. Suite B, Morrisville, NC 27560; USA TEL:(919) 549-1400

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

UL LLC
2800 Suite Perimeter Park Dr. Suite B, Morrisville, NC 27560; USA TEL:(919) 549-1400

RADIATED EMISSIONS

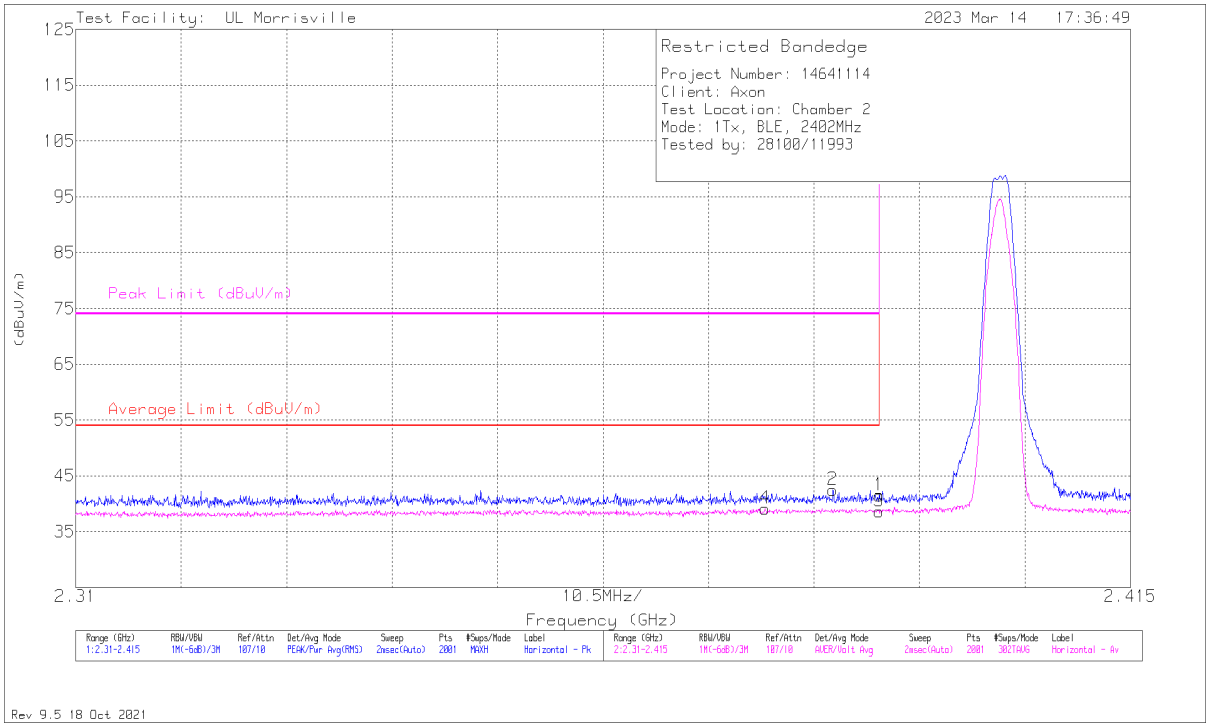
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.9725	38.91	Pk	34.1	-30.5	0	42.51	54	-11.49	74	-31.49	0-360	101	H
2	* ** 8.10094	36.97	Pk	35.9	-27	0	45.87	54	-8.13	74	-28.13	0-360	199	H
3	* ** 9.09898	38.56	PK2	36.3	-25.4	0	49.46	-	-	74	-24.54	95	140	H
	* ** 9.09917	25.51	ADV	36.3	-25.4	4.08	40.49	54	-13.51	-	-	95	140	H
4	* ** 5.08313	39.85	Pk	34.2	-30.6	0	43.45	54	-10.55	74	-30.55	0-360	199	V
5	* ** 8.07469	36.97	Pk	35.9	-26.8	0	46.07	54	-7.93	74	-27.93	0-360	101	V
6	* ** 9.06838	38.46	PK2	36.2	-25.4	0	49.26	-	-	74	-24.74	279	360	V
	* ** 9.06608	25.67	ADV	36.2	-25.2	4.08	40.75	54	-13.25	-	-	279	360	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

10.2.2. BLE (2Mbps)

BANDEDGE (LOW CHANNEL)

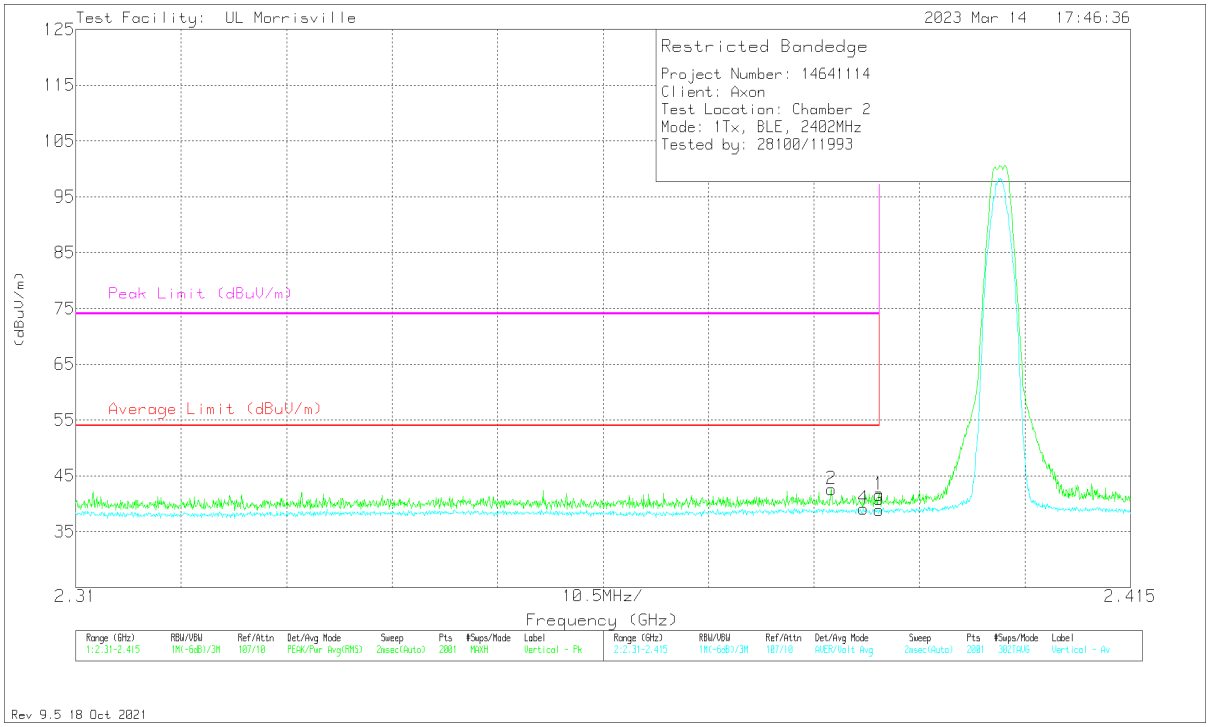
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (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	* ** 2.38996	33.29	Pk	32	-23.8	0	41.49	-	-	74	-32.51	230	116	H
2	* ** 2.38539	34.25	Pk	32	-23.8	0	42.45	-	-	74	-31.55	230	116	H
3	* ** 2.38996	20.78	ADV	32	-23.8	9.63	38.61	54	-15.39	-	-	230	116	H
4	* ** 2.37862	21.42	ADV	32	-23.9	9.63	39.15	54	-14.85	-	-	230	116	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

VERTICAL RESULT

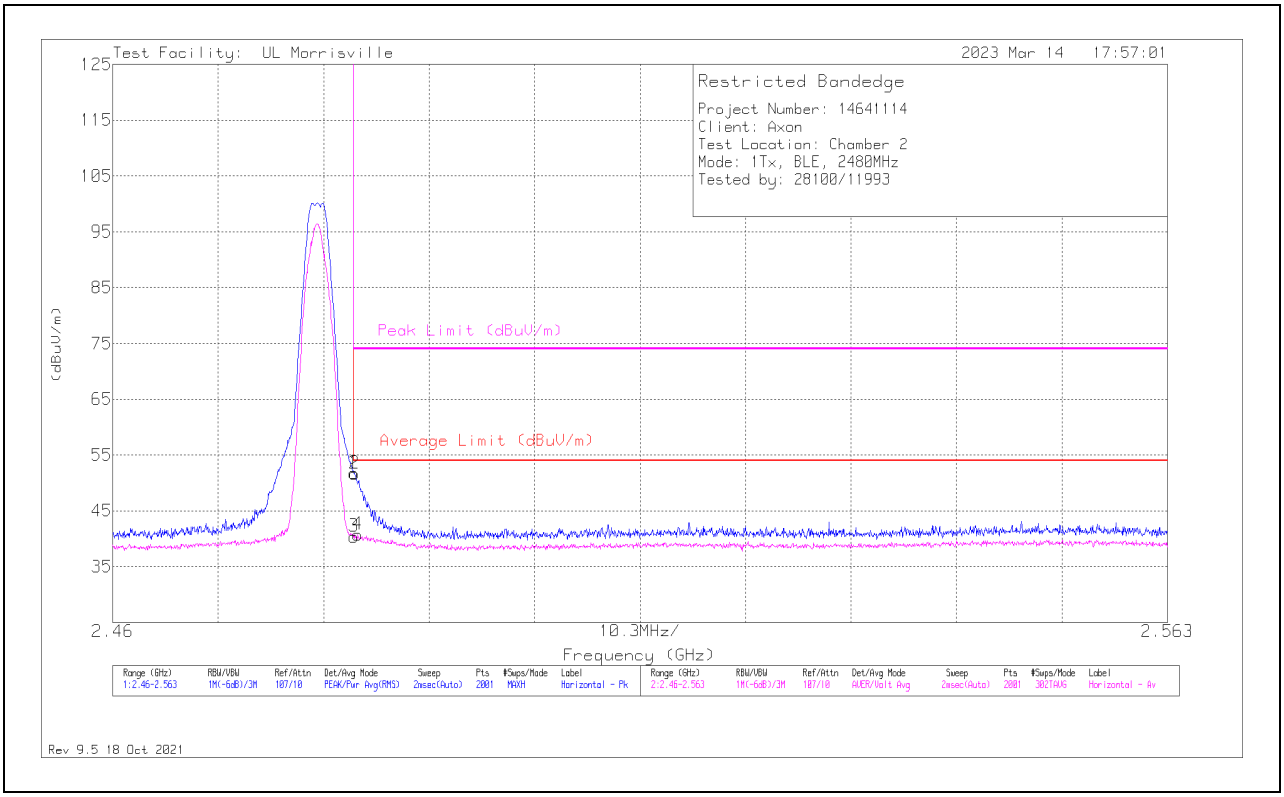


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.38996	33.4	Pk	32	-23.8	0	41.6	-	-	74	-32.4	349	117	V
2	* ** 2.38523	34.36	Pk	32	-23.8	0	42.56	-	-	74	-31.44	349	117	V
3	* ** 2.38996	21.02	ADV	32	-23.8	9.63	38.85	54	-15.15	-	-	349	117	V
4	* ** 2.38844	21.32	ADV	32	-23.8	9.63	39.15	54	-14.85	-	-	349	117	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

BANDEDGE (HIGH CHANNEL)

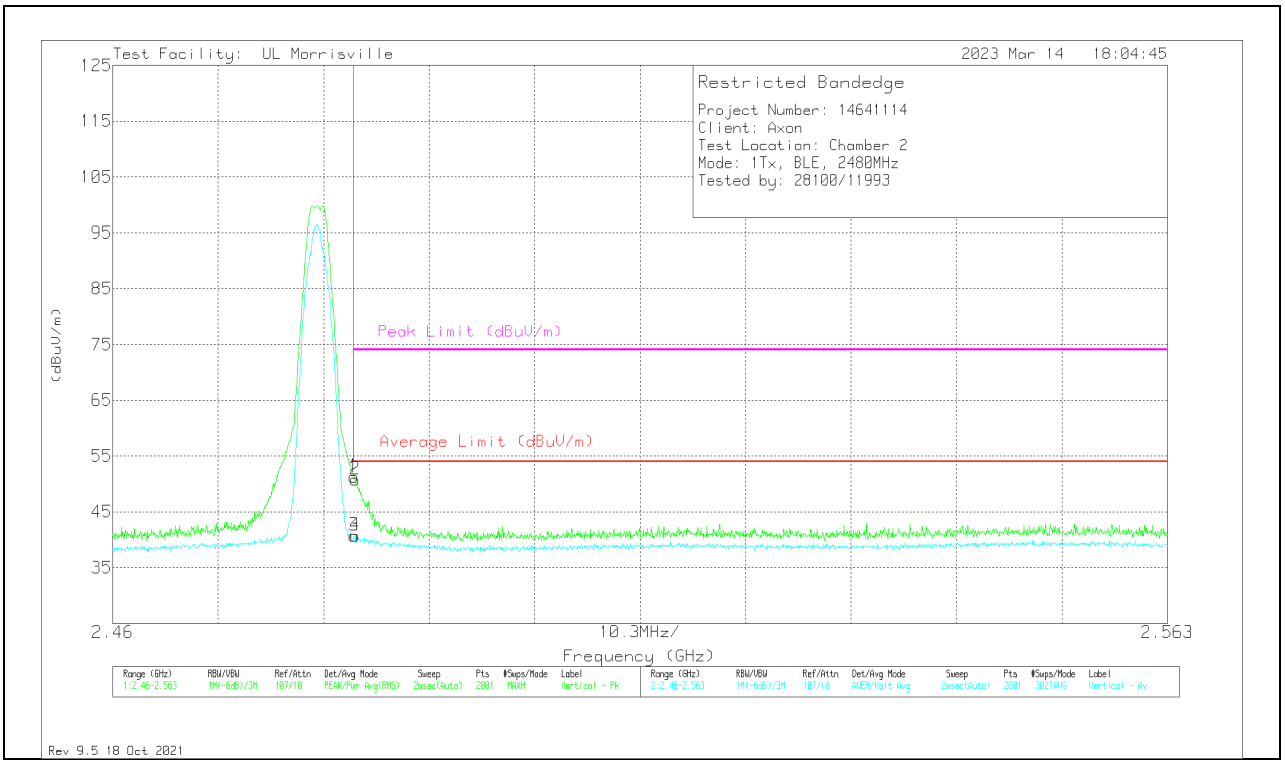
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (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	43.58	Pk	32.5	-24.3	0	51.78	-	-	74	-22.22	217	112	H
2	* ** 2.48364	43.46	Pk	32.5	-24.3	0	51.66	-	-	74	-22.34	217	112	H
3	* ** 2.48354	22.57	ADV	32.5	-24.3	9.63	40.4	54	-13.6	-	-	217	112	H
4	* ** 2.4839	23.02	ADV	32.5	-24.4	9.63	40.75	54	-13.25	-	-	217	112	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

VERTICAL RESULT



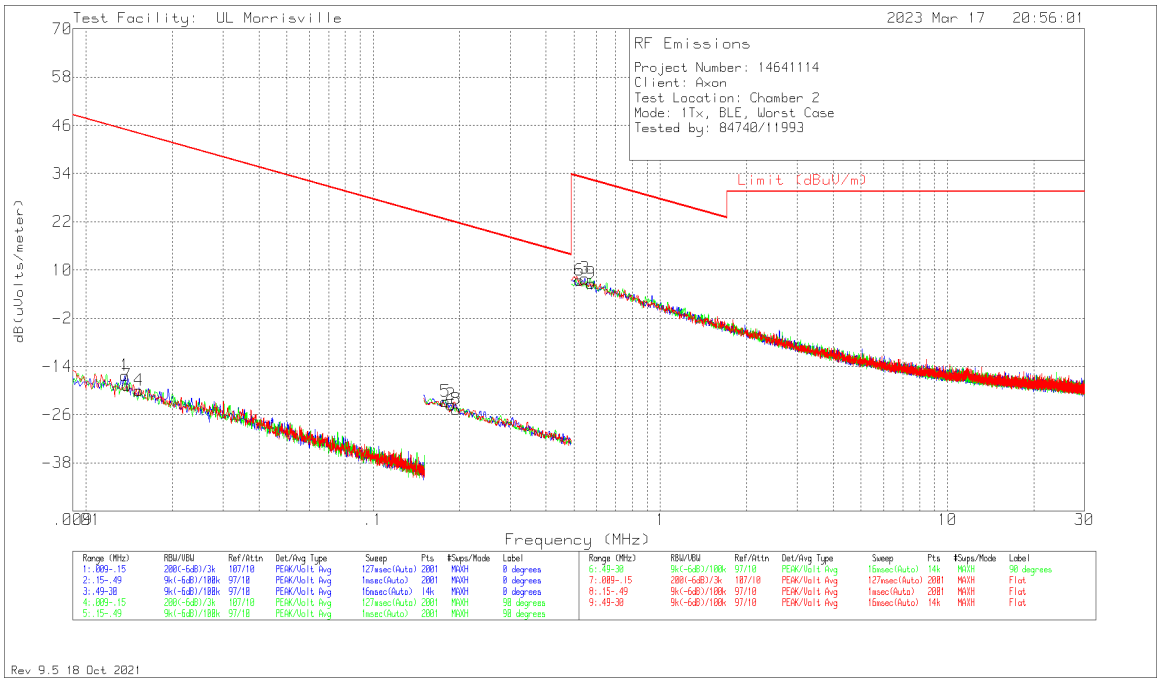
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Gain/Loss (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.48354	43.05	Pk	32.5	-24.3	0	51.25	-	-	74	-22.75	321	107	V
2	* ** 2.48369	42.56	Pk	32.5	-24.3	0	50.76	-	-	74	-23.24	321	107	V
3	* ** 2.48354	22.89	ADV	32.5	-24.3	9.63	40.72	54	-13.28	-	-	321	107	V
4	* ** 2.48369	22.88	ADV	32.5	-24.3	9.63	40.71	54	-13.29	-	-	321	107	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

10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

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

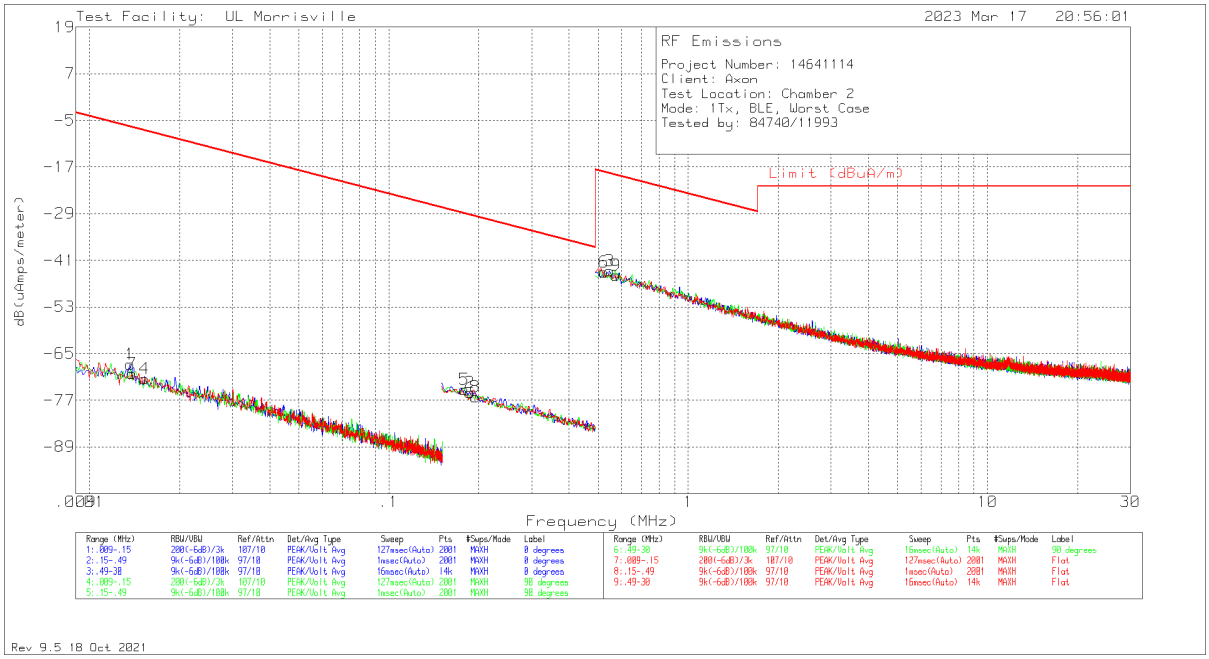


ANTENNA- THREE ORIENTATIONS E-FIELD

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
1	.01369	45.93	Pk	17.7	.1	-80	-16.27	44.88	64.88	-61.15	0-360	0 deg
7	.0139	43.66	Pk	17.6	.1	-80	-18.64	44.75	64.75	-63.39	0-360	Flat
4	.01532	42.96	Pk	17	.1	-80	-19.94	43.9	63.9	-63.84	0-360	90 deg
5	.17856	45	Pk	12.2	.1	-80	-22.7	22.57	42.57	-45.27	0-360	90 deg
2	.18613	44.16	Pk	12.2	.1	-80	-23.54	22.21	42.21	-45.75	0-360	0 deg
8	.19488	43.09	Pk	12.2	.1	-80	-24.61	21.81	41.81	-46.42	0-360	Flat
6	.52373	35.18	Pk	12.2	.1	-40	7.48	33.22	-	-25.74	0-360	90 deg
3	.54692	35.55	Pk	12.2	.1	-40	7.85	32.85	-	-25	0-360	0 deg
9	.57221	34.22	Pk	12.2	.2	-40	6.62	32.45	-	-25.83	0-360	Flat

Pk - Peak detector



ANTENNA- THREE ORIENTATIONS H-FIELD

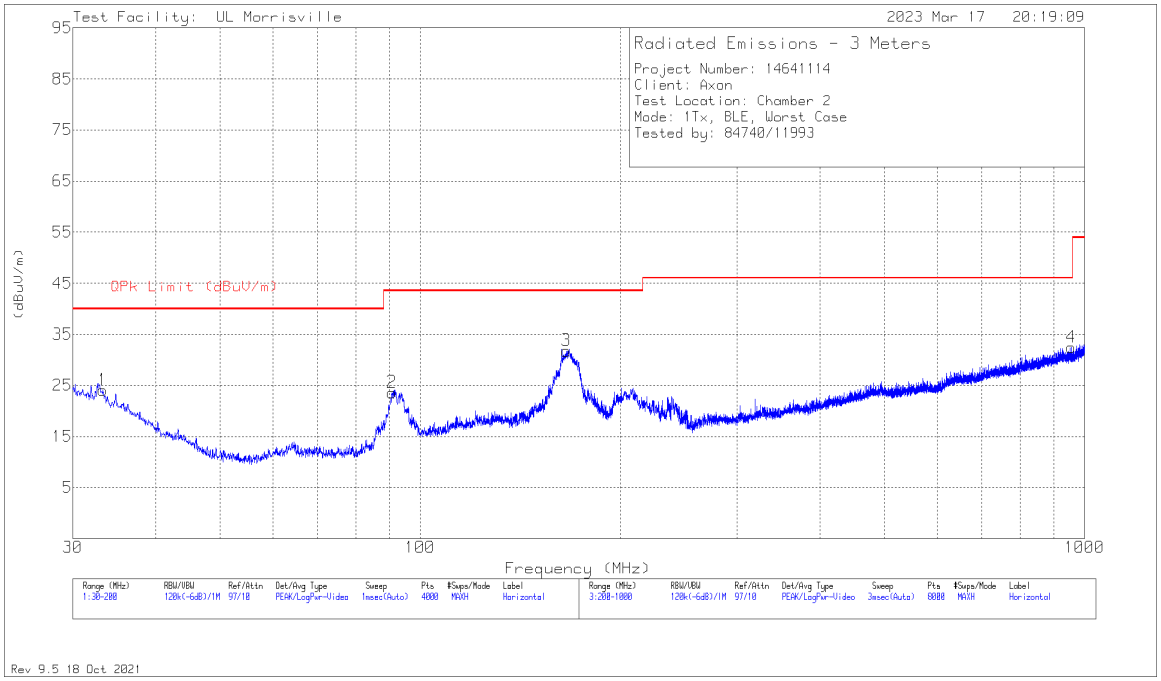
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuA)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	QP/AV Limit (dBuA/m)	PK Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
1	.01369	45.93	Pk	-33.8	.1	-80	-67.77	-6.62	13.38	-61.15	0-360	0 deg
7	.0139	43.66	Pk	-33.9	.1	-80	-70.14	-6.75	13.25	-63.39	0-360	Flat
4	.01532	42.96	Pk	-34.5	.1	-80	-71.44	-7.6	12.4	-63.84	0-360	90 deg
5	.17856	45	Pk	-39.3	.1	-80	-74.2	-28.93	-8.93	-45.27	0-360	90 deg
2	.18613	44.16	Pk	-39.3	.1	-80	-75.04	-29.29	-9.29	-45.75	0-360	0 deg
8	.19488	43.09	Pk	-39.3	.1	-80	-76.11	-29.69	-9.69	-46.42	0-360	Flat
6	.52373	35.18	Pk	-39.3	.1	-40	-44.02	-18.28	-	-25.74	0-360	90 deg
3	.54692	35.55	Pk	-39.3	.1	-40	-43.65	-18.65	-	-25	0-360	0 deg
9	.57221	34.22	Pk	-39.3	.2	-40	-44.88	-19.05	-	-25.83	0-360	Flat

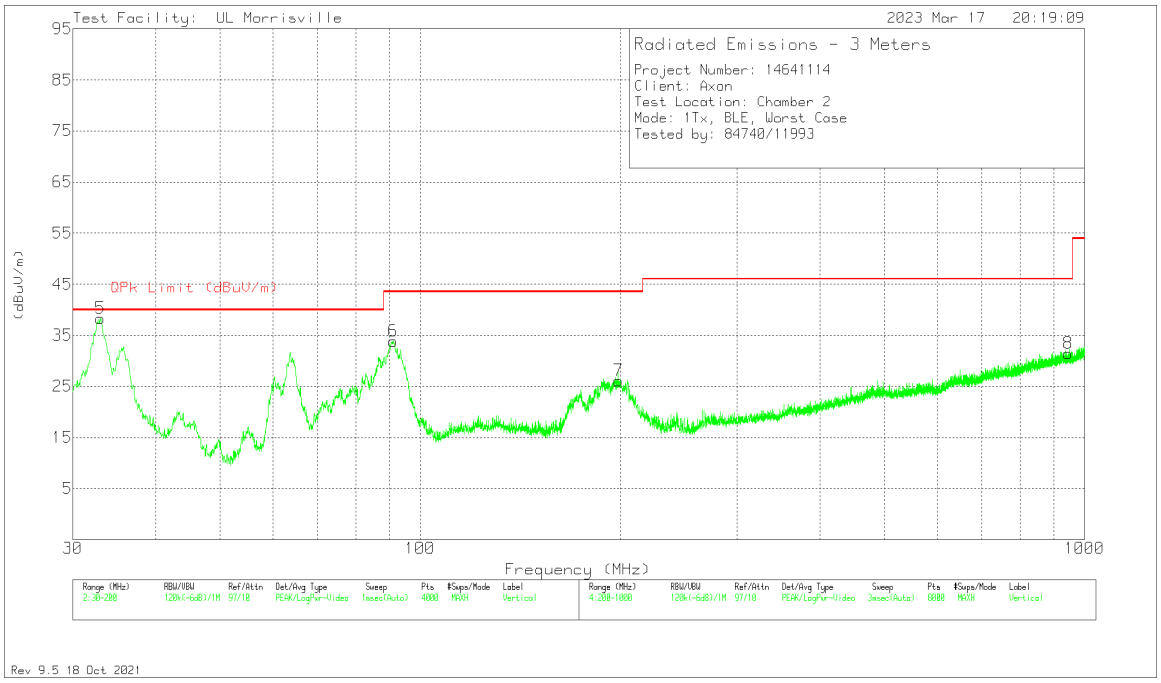
Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

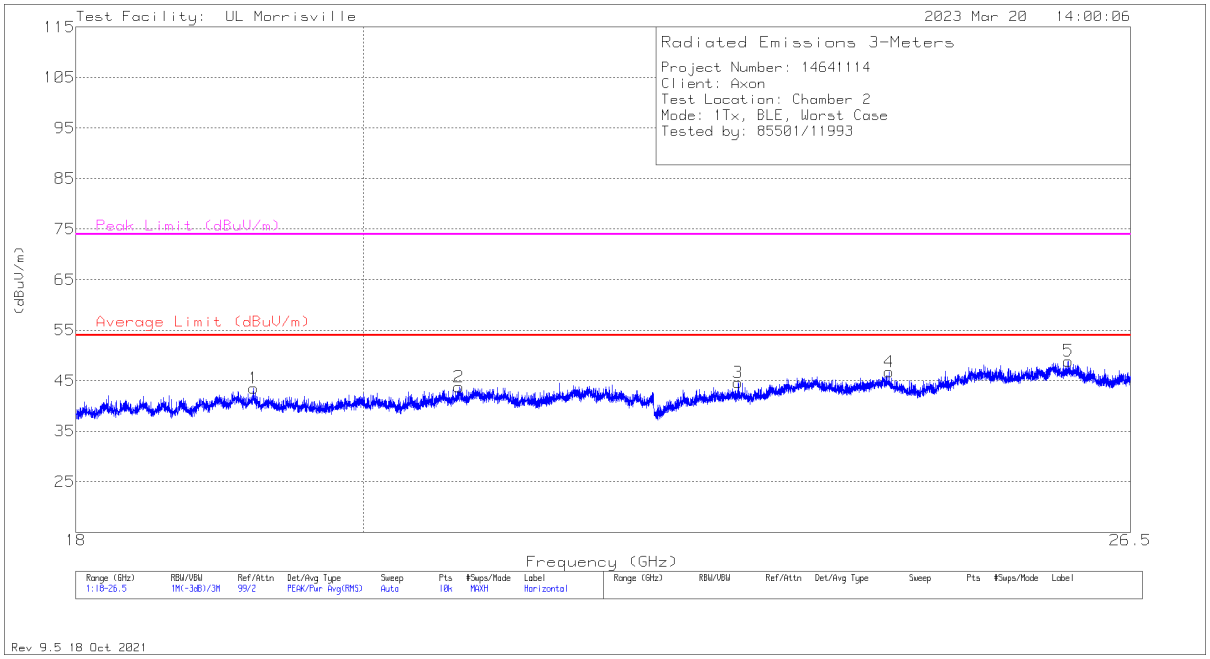
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	33.3159	30.74	Pk	24.9	-31.6	24.04	40	-15.96	0-360	398	H
2	90.6632	40.13	Pk	14.1	-30.6	23.63	43.52	-19.89	0-360	398	H
3	166.0139	43.36	Pk	18.2	-29.8	31.76	43.52	-11.76	0-360	198	H
4	954.3981	28.91	Pk	28.4	-24.9	32.41	46.02	-13.61	0-360	199	H
5	32.8297	39.63	Qp	25.3	-31.5	33.43	40	-6.57	275	102	V
6	91.0033	50.2	Pk	14.2	-30.6	33.8	43.52	-9.72	0-360	101	V
7	198.8537	36.58	Pk	19	-29.5	26.08	43.52	-17.44	0-360	101	V
8	944.9968	28.04	Pk	28.3	-24.9	31.44	46.02	-14.58	0-360	199	V

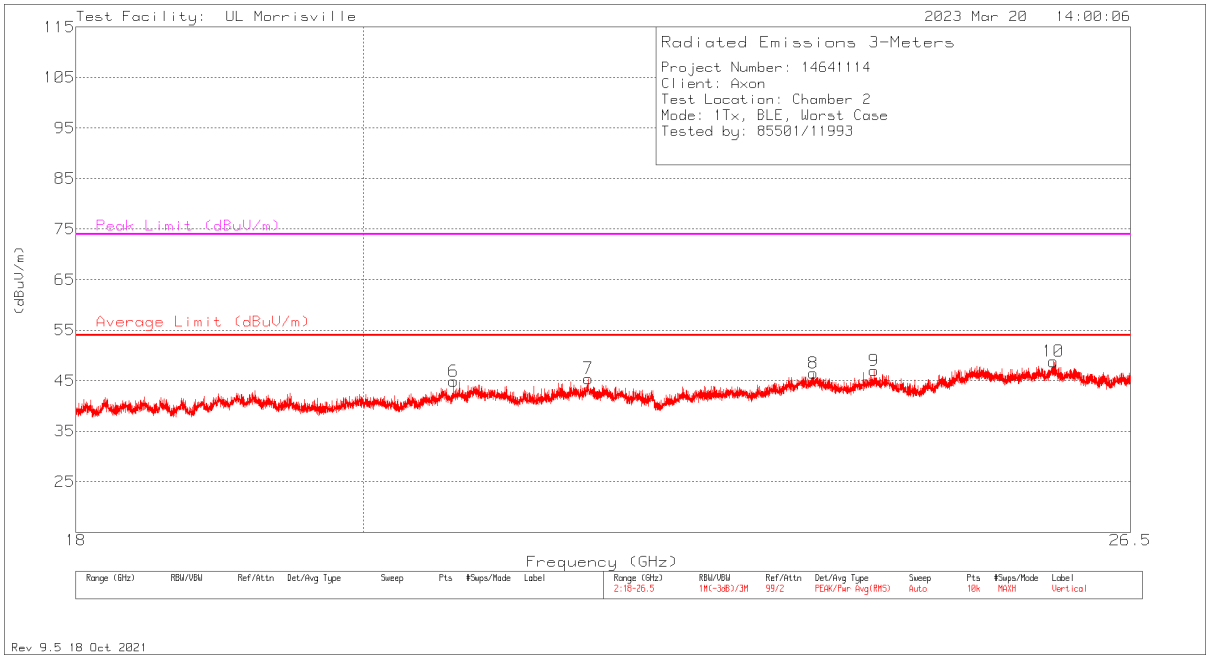
Pk - Peak detector
Qp - Quasi-Peak detector

10.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

18 – 26GHz Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	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	* ** 19.21538	48.21	Pk	33.7	-38.4	0	43.51	54	-10.49	74	-30.49	0-360	101	H
2	* ** 20.71548	48.37	Pk	34	-38.6	0	43.77	54	-10.23	74	-30.23	0-360	150	H
3	* ** 22.95075	48.34	Pk	34.5	-38.2	0	44.64	54	-9.36	74	-29.36	0-360	300	H
6	* ** 20.67468	49.35	Pk	34	-38.5	0	44.85	54	-9.15	74	-29.15	0-360	101	V
7	21.72178	49.44	Pk	34.4	-38.4	0	45.44	54	-8.56	74	-28.56	0-360	300	V
8	23.58904	48.84	Pk	35.3	-37.6	0	46.54	54	-7.46	74	-27.46	0-360	201	V
9	24.12449	49.34	Pk	35.1	-37.5	0	46.94	54	-7.06	74	-27.06	0-360	250	V
4	24.25537	49.08	Pk	35.1	-37.4	0	46.78	54	-7.22	74	-27.22	0-360	199	H
10	25.76455	49.93	PK2	35.9	-36.1	0	49.73	-	-	74	-24.27	12	300	V
	25.76114	36.73	ADV	35.9	-36.1	4.08	40.61	54	-13.39	-	-	12	300	V
5	25.90229	48.75	PK2	35.9	-36.3	0	48.35	-	-	74	-25.65	332	376	H
	25.90223	36.19	ADV	35.9	-36.3	4.08	39.87	54	-14.13	-	-	332	376	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

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.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

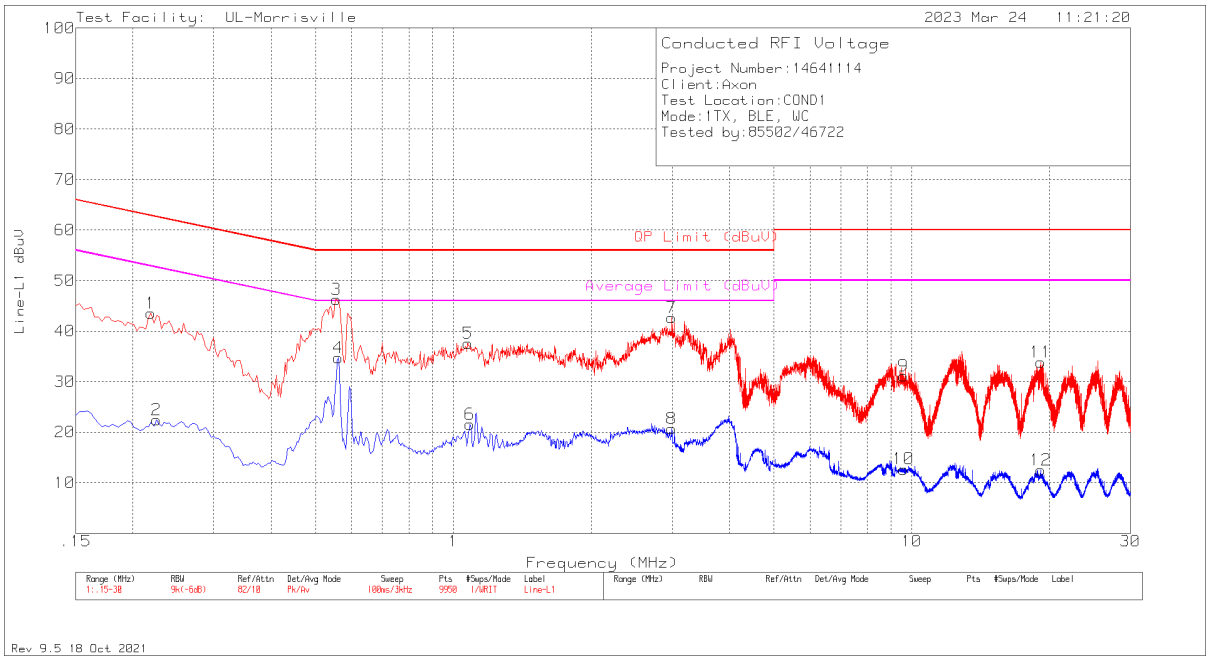
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

11.1.1. AC Power Line Norm

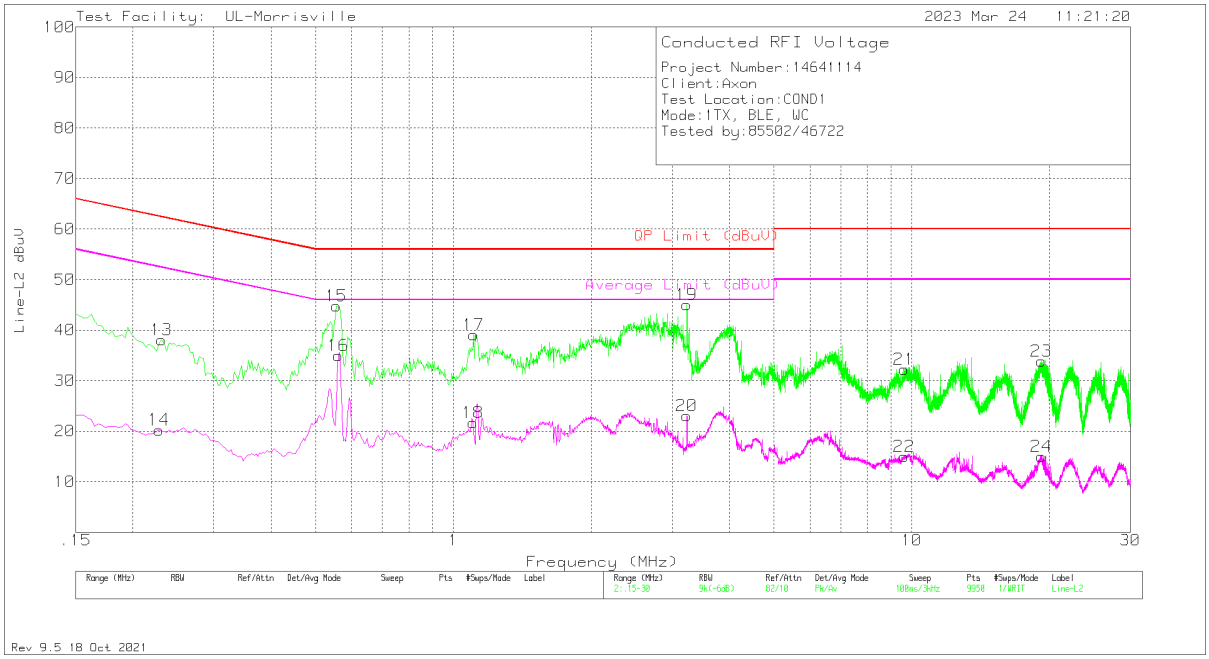
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.219	33.59	Pk	.1	9.8	43.49	62.86	-19.37	-	-
2	.225	12.5	Av	.1	9.8	22.4	-	-	52.63	-30.23
3	.555	36.53	Pk	0	9.8	46.33	56	-9.67	-	-
4	.561	24.98	Av	0	9.8	34.78	-	-	46	-11.22
5	1.077	27.73	Pk	0	9.8	37.53	56	-18.47	-	-
6	1.086	11.81	Av	0	9.8	21.61	-	-	46	-24.39
7	2.997	32.92	Pk	0	9.8	42.72	56	-13.28	-	-
8	2.997	10.88	Av	0	9.8	20.68	-	-	46	-25.32
9	9.594	21.08	Pk	.1	10	31.18	60	-28.82	-	-
10	9.594	2.59	Av	.1	10	12.69	-	-	50	-37.31
11	19.113	23.55	Pk	.2	10.1	33.85	60	-26.15	-	-
12	19.113	2.16	Av	.2	10.1	12.46	-	-	50	-37.54

Pk - Peak detector
Av - Average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.231	28.21	Pk	.1	9.8	38.11	62.41	-24.3	-	-
14	.228	10.36	Av	.1	9.8	20.26	-	-	52.52	-32.26
15	.555	34.95	Pk	0	9.8	44.75	56	-11.25	-	-
16	.561	25.17	Av	0	9.8	34.97	-	-	46	-11.03
17	1.107	29.27	Pk	0	9.8	39.07	56	-16.93	-	-
18	1.104	11.9	Av	0	9.8	21.7	-	-	46	-24.3
19	3.228	35.14	Pk	0	9.9	45.04	56	-10.96	-	-
20	3.228	13.18	Av	0	9.9	23.08	-	-	46	-22.92
21	9.621	22.15	Pk	.1	10	32.25	60	-27.75	-	-
22	9.63	4.83	Av	.1	10	14.93	-	-	50	-35.07
23	19.17	23.56	Pk	.2	10.1	33.86	60	-26.14	-	-
24	19.17	4.69	Av	.2	10.1	14.99	-	-	50	-35.01

Pk - Peak detector
Av - Average detection

12. SETUP PHOTOS

Please refer to R14641114-EP1 for setup photos

END OF TEST REPORT