

TEST REPORT

Report Number: R14956064-E9

Applicant : Whoop Inc.
1 Kenmore Square, Suite 601
Boston, MA 02215, USA

Model : WG50

FCC ID : 2AJ2X-WG50

IC : 22056-WG50

EUT Description : Sensor Device

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:

2025-01-02

Prepared by:

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2025-01-02	Initial Issue	Charles Moody

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Whoop Inc.
1 Kenmore Square, Suite 601
Boston, MA 02215, USA

EUT DESCRIPTION: Sensor Device

MODEL: WG50

SERIAL NUMBER: 5AGE005715

SAMPLE RECEIPT DATE: 2024-06-17, 2024-10-22

DATE TESTED: 2024-06-17 TO 2024-11-08

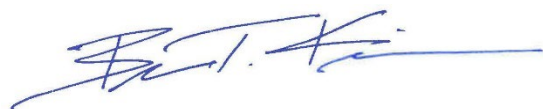
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2024	See Section 2
ISED RSS-247 Issue 3: 2023	See Section 2
ISED RSS-GEN Issue 5 + A1 + A2: 2021	See Section 2

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:



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Project Engineer
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Prepared By:



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Senior Project 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	N/A	The EUT is battery powered and is charged through WPT.

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
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
☒	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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a wearable strap device that contains a BLE radio. This report covers the full emissions 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	4.11	2.58
2402 - 2480	BLE - 2Mbps	4.10	2.57

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes an integral PIFA antenna, with a maximum gain of -1.22 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 50.25.0.1.

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 power spectral density as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at power setting 6 on low and high channels, as well as middle channel for radiated spurious emissions. Radiated Spurious emissions was performed on the worst-case PSD mode (1Mbps).

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 investigated on battery power and when charging via WPT using support equipment. The worst-case configuration was used for testing.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Latitude 7320	FPC60F3	-
AC Adapter	Dewalt	DXMA1310851	C4A46001454	NA
Laptop	Dell	P112F	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB C	1	USB C	Shielded	<3m	Removed during tests

TEST SETUP

The EUT is connected to a support laptop to configure the EUT radio module prior to testing. For final testing, the EUT was disconnected from the support laptop.

SETUP DIAGRAM

Please refer to R14956064-EP5 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 Spurious Emissions: ANSI C63.10-2020 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 - 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
**238710	Environmental Meter	Fisher Scientific	15-077-963	2023-06-27	2024-06-27
**211057	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2023-08-01	2024-08-01
SOFTMI	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.
	Cables				
188125 (CBL099)	Micro-Coax UTiFLEX Cable Assembly, Low Loss, 40GHz, 39.3", Connectors 2	Carlisle Interconnect Technologies	UFA147A-0-0180-200200	2024-04-11	2025-04-11

****NOTE:** Testing on this equipment was performed prior to the equipment going out of calibration.

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
81018	Spectrum Analyzer	Agilent	E4446A	2024-07-31	2025-07-31
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

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

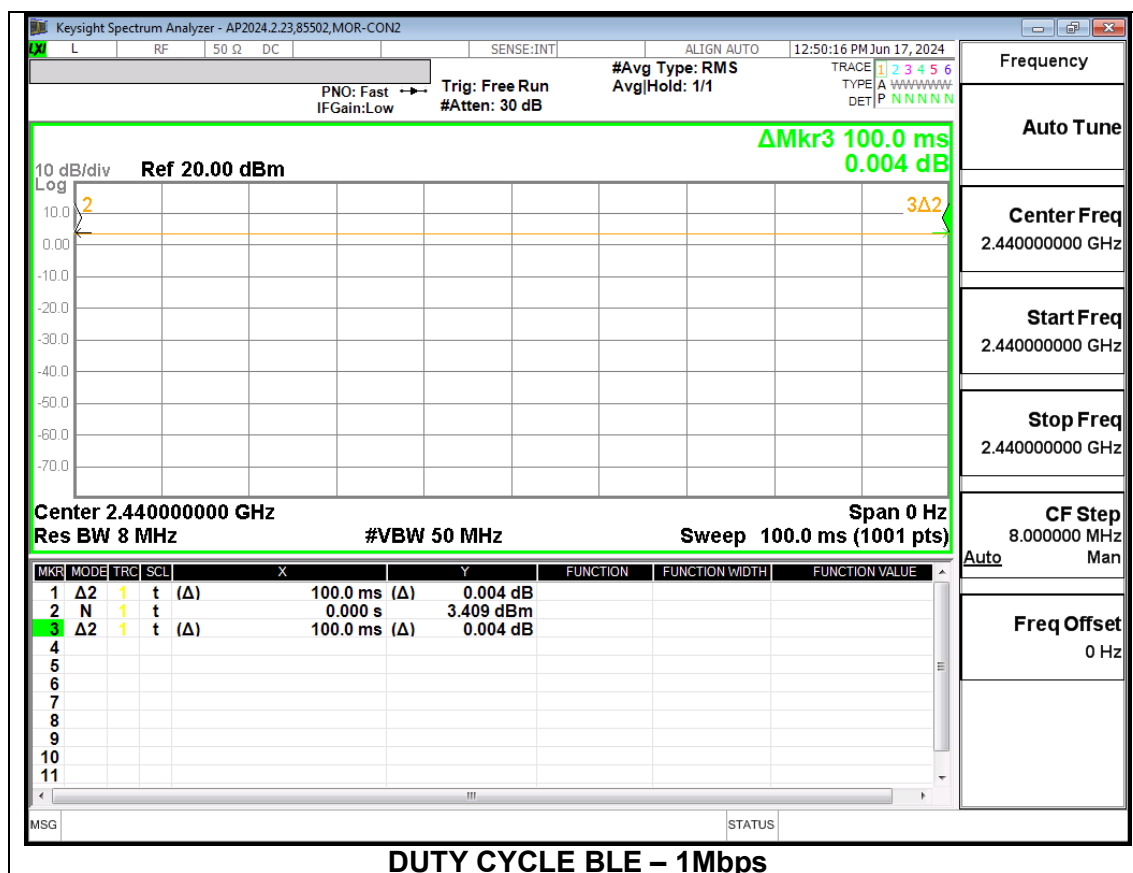
PROCEDURE

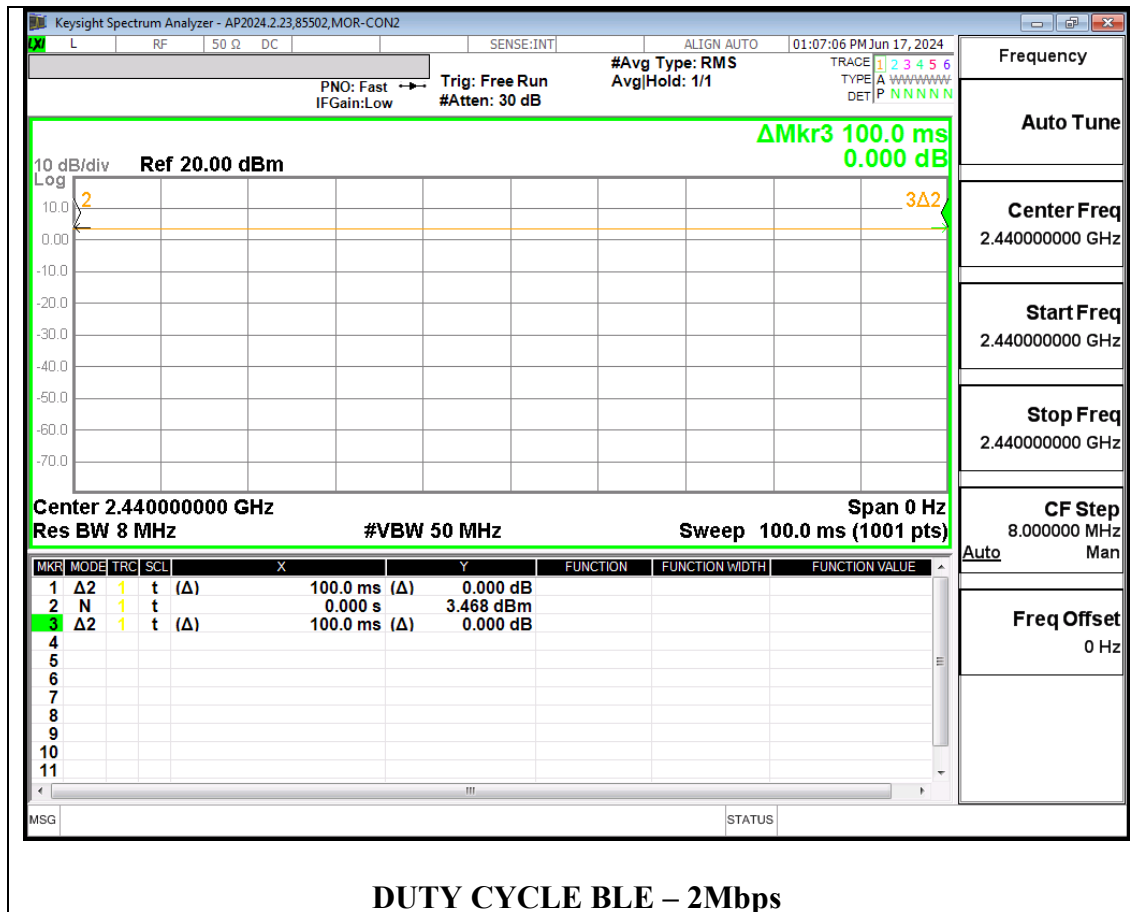
KDB 558074 Zero-Span Spectrum Analyzer Method.

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	100.000	100.000	1.000	100.00	0.00	0.010
BLE - 2Mbps	100.000	100.000	1.000	100.00	0.00	0.010

DUTY CYCLE PLOTS





9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

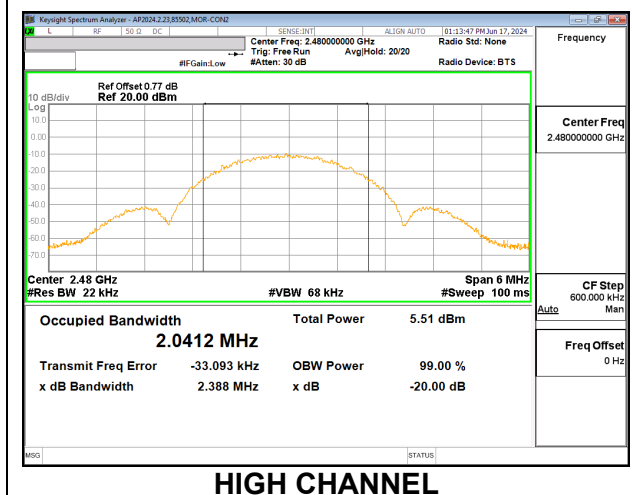
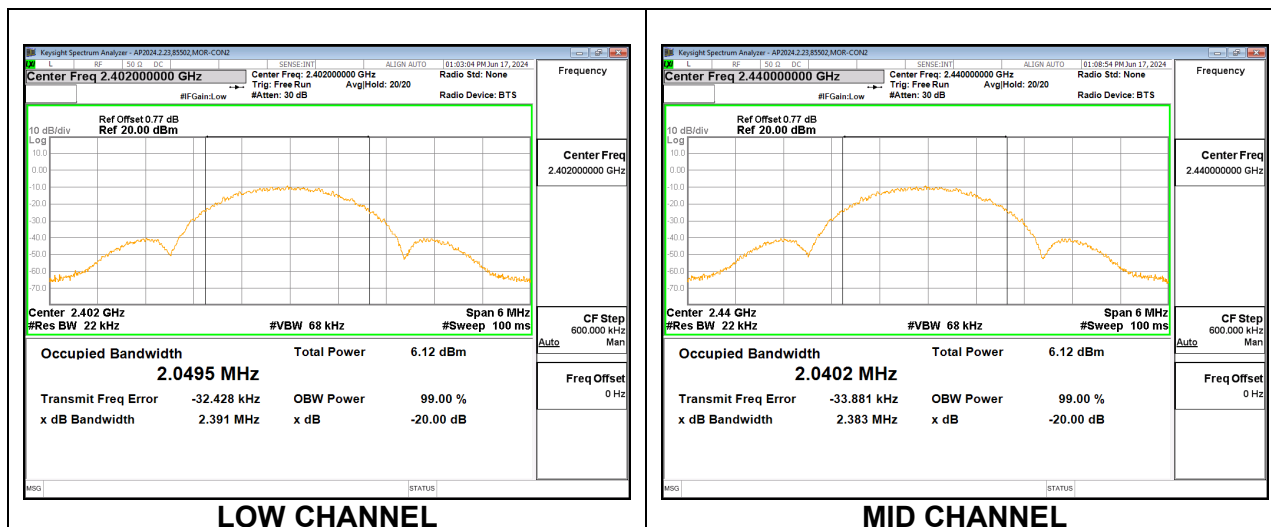
9.2.1. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0468
Middle	2440	1.0463
High	2480	1.0499



9.2.2. BLE (2Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0495
Middle	2440	2.0402
High	2480	2.0412



9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

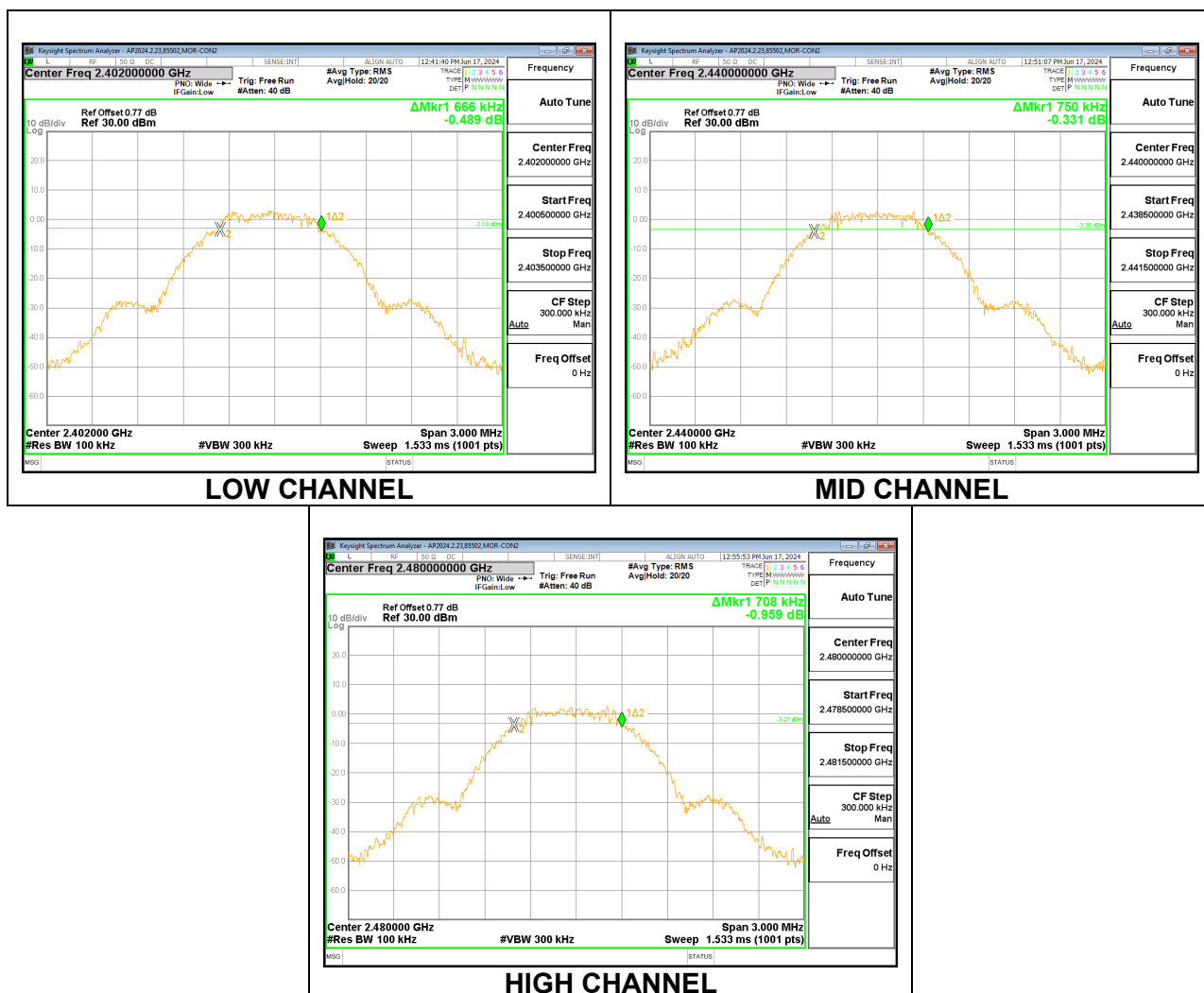
RSS-247 5.2 (a)

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

RESULTS

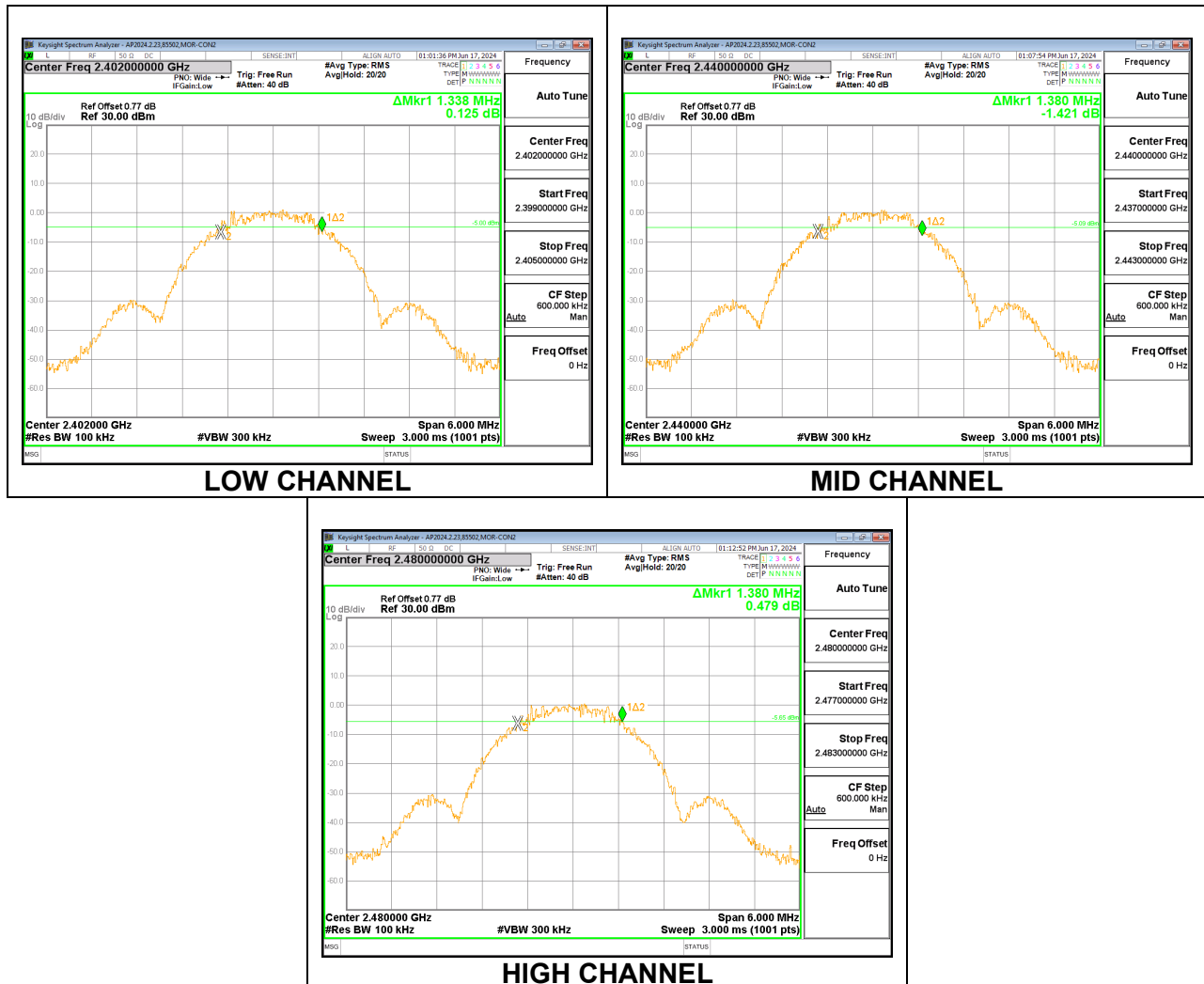
9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6660	0.5
Middle	2440	0.7500	0.5
High	2480	0.7080	0.5



9.3.2. BLE (2Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.3380	0.5
Middle	2440	1.3800	0.5
High	2480	1.3800	0.5



9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of .55 dB (including .55 dB EUT cable) was entered as an offset in the power meter.

The power output was measured on the EUT antenna port using SMA cable 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
Date:	2024-06-17

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.110	30	-25.890
Middle	2440	3.940	30	-26.060
High	2480	3.660	30	-26.340

9.4.2. BLE (2Mbps)

Tested By:	85502
Date:	2024-06-17

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.100	30	-25.900
Middle	2440	3.920	30	-26.080
High	2480	3.700	30	-26.300

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 .55 dB (including .55 dB EUT cable) was entered as an offset in the power meter.

The power output was measured on the EUT antenna port using SMA cable 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:	88502
Date:	2024-06-17

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.89
Middle	2440	3.71
High	2480	3.45

9.5.2. BLE (2Mbps)

Tested By:	88502
Date:	2024-06-17

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.9
Middle	2440	3.71
High	2480	3.47

9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

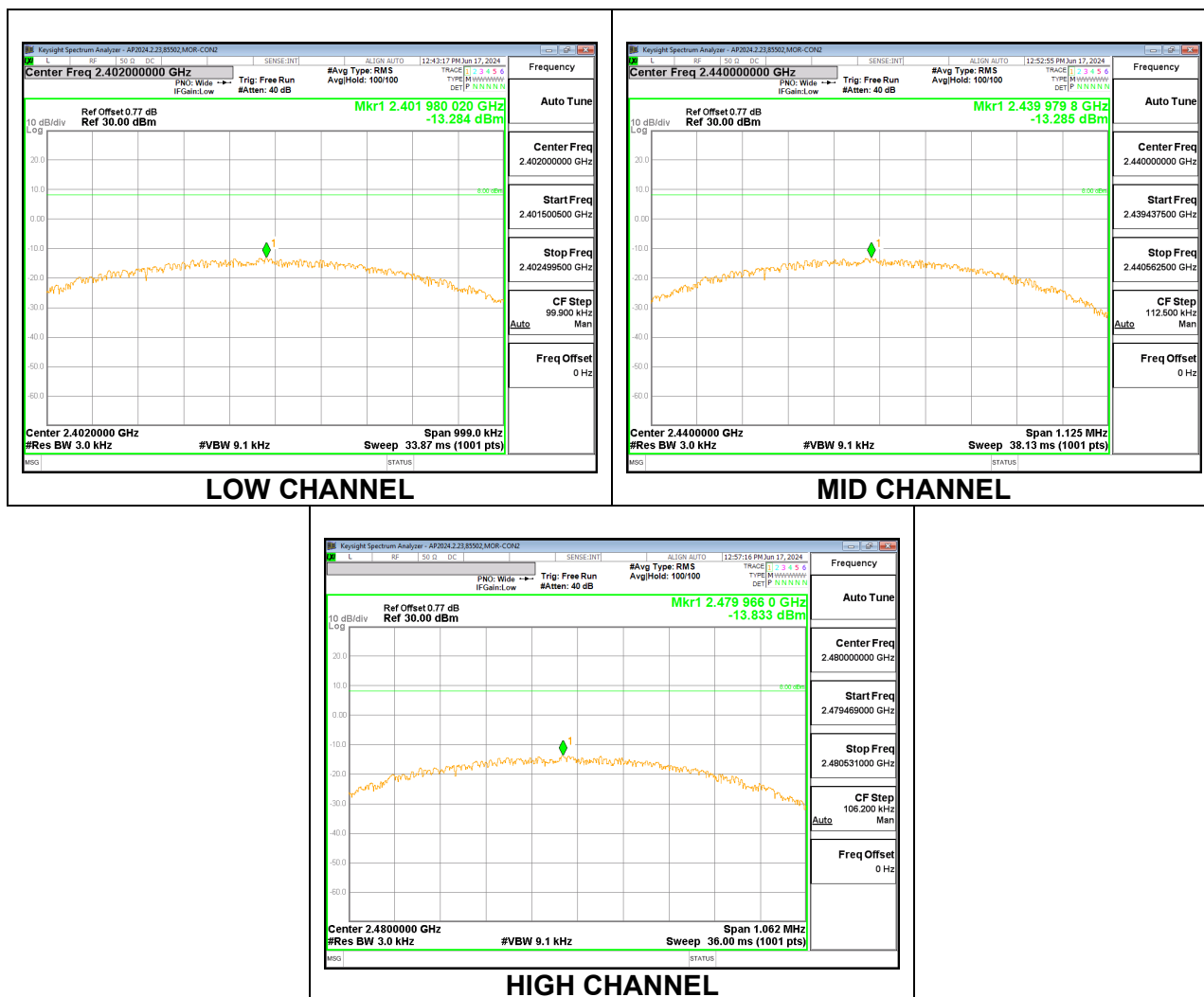
RSS-247 (5.2) (b)

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

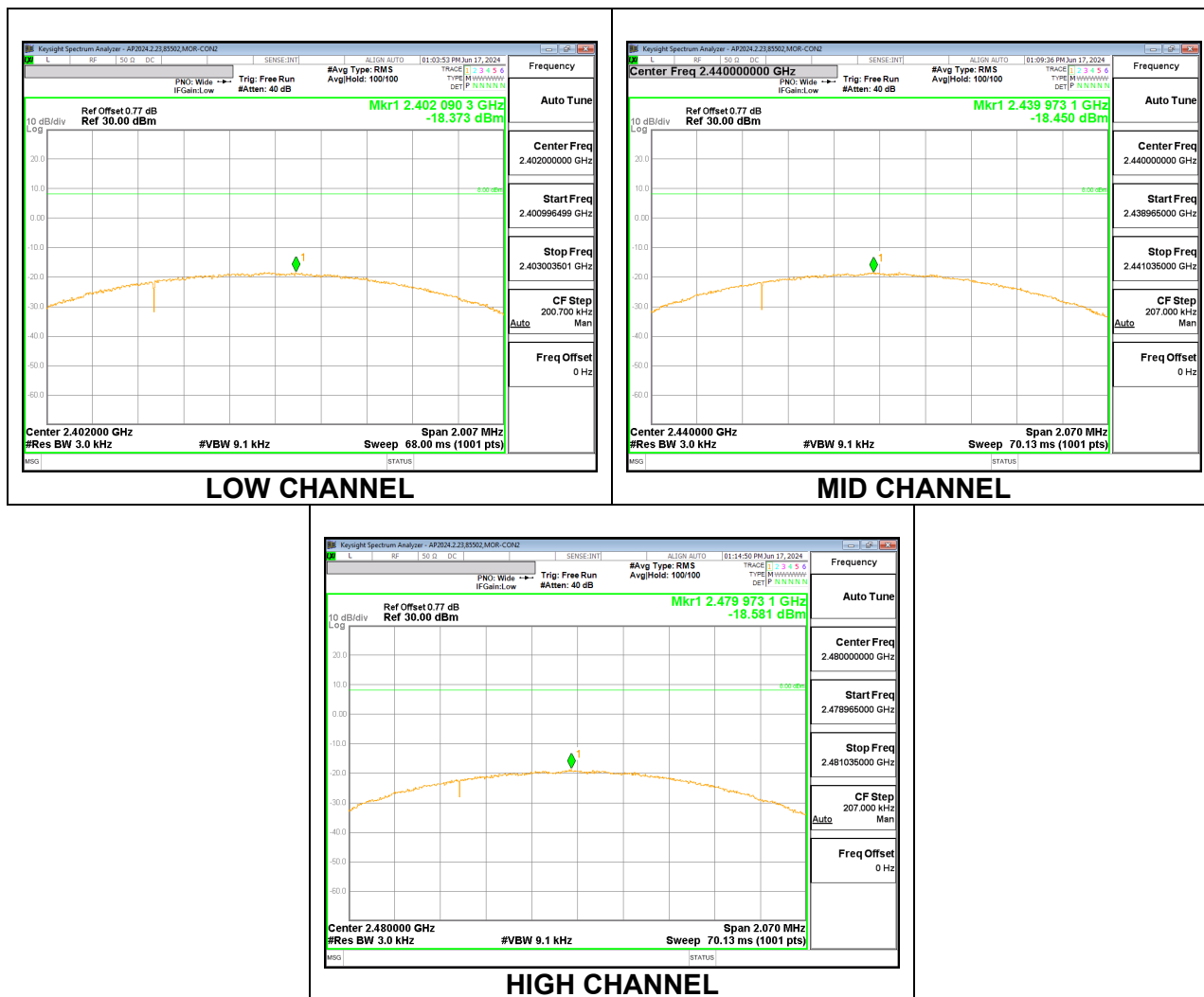
9.6.1. BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-13.28	8	-21.28
Middle	2440	-13.29	8	-21.29
High	2480	-13.83	8	-21.83



9.6.2. BLE (2Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-18.37	8	-26.37
Middle	2440	-18.45	8	-26.45
High	2480	-18.58	8	-26.58



9.7. CONDUCTED SPURIOUS EMISSIONS

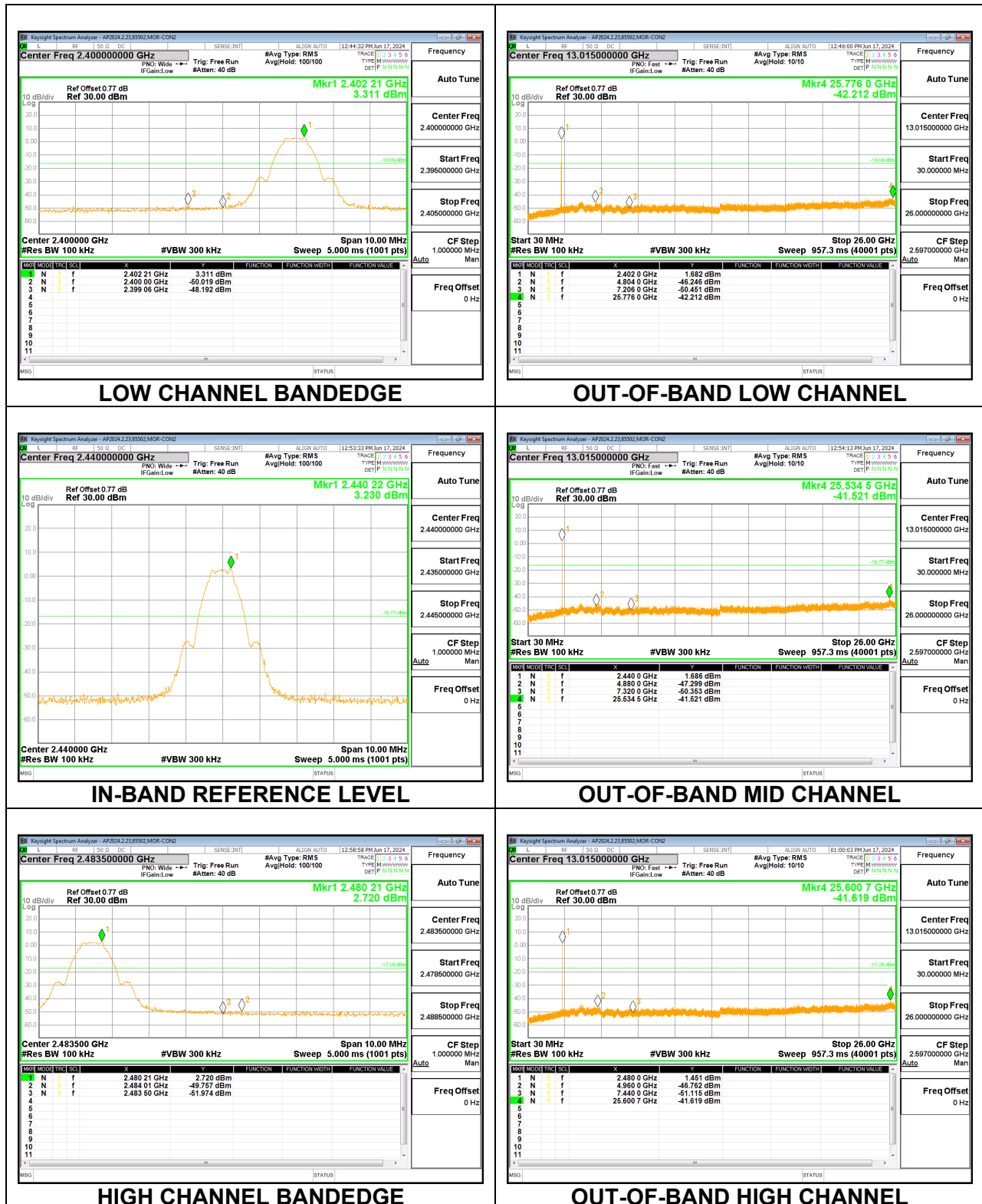
LIMITS

FCC §15.247 (d)
RSS-247 5.5

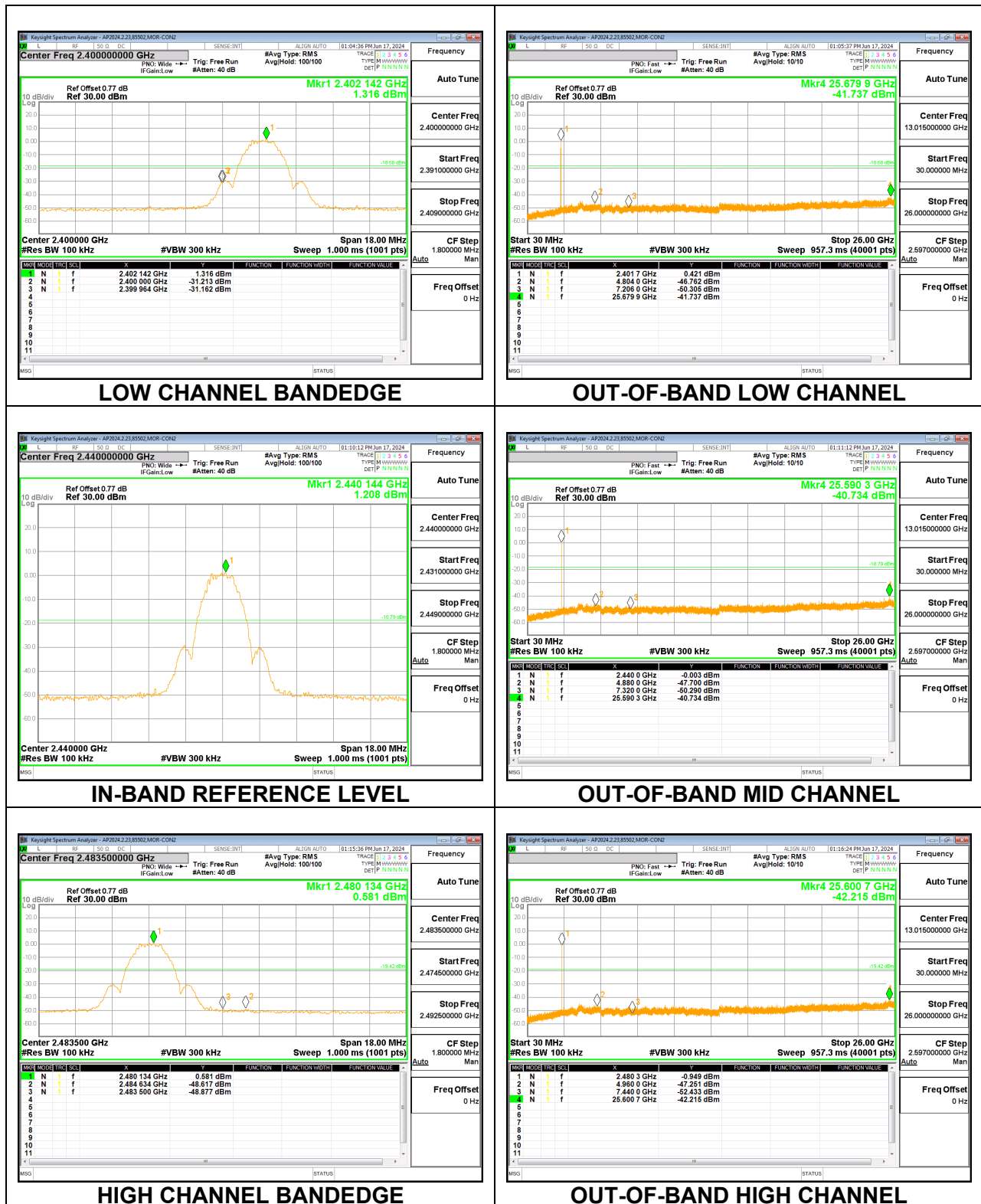
Output power was measured based on the use of a peak measurement, therefore the required attenuation is -20 dBc.

RESULTS

9.7.1. BLE (1Mbps)



9.7.2. BLE (2Mbps)



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 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

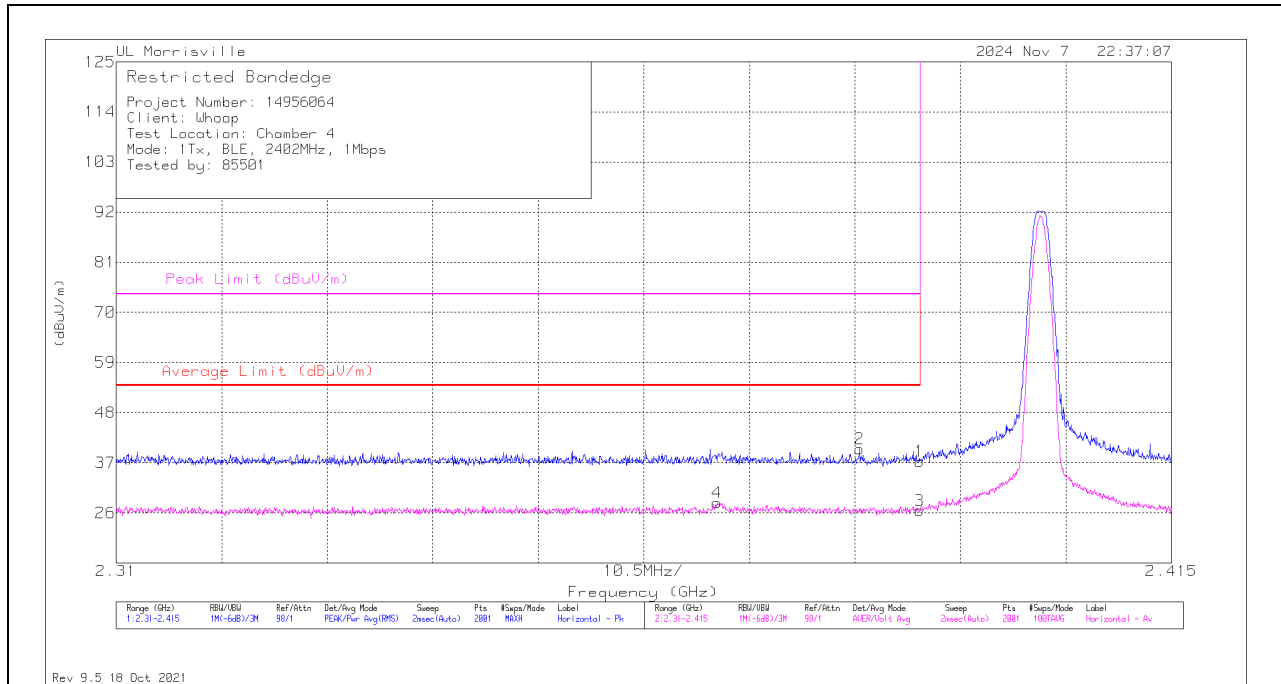
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	28.47	Pk	32	-23.2	37.27	-	-	74	-36.73	14	143	H
2	* ** 2.38397	31.23	Pk	32	-23.2	40.03	-	-	74	-33.97	14	143	H
3	* ** 2.38996	17.69	ADV	32	-23.2	26.49	54	-27.51	-	-	14	143	V
4	* ** 2.3698	19.27	ADV	31.9	-23	28.17	54	-25.83	-	-	14	143	V

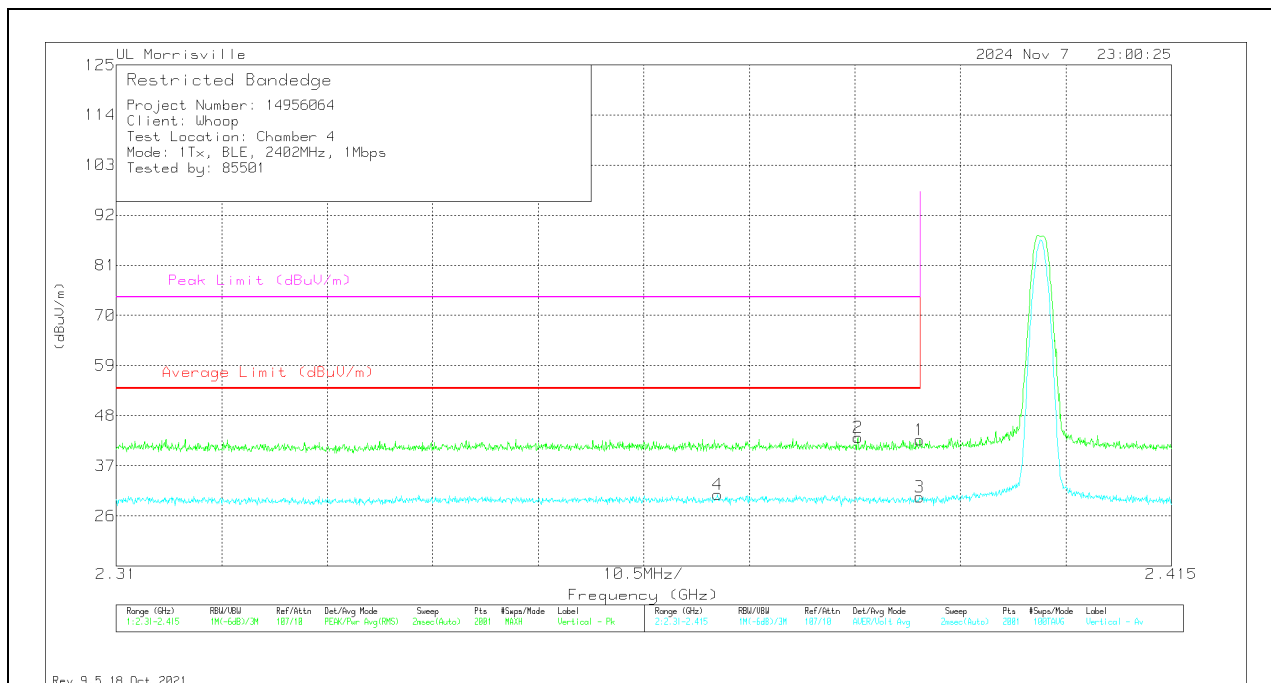
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	33.83	Pk	32	-23.2	42.63	-	-	74	-31.37	239	349	V
2	*** 2.38382	34.38	Pk	32	-23.2	43.18	-	-	74	-30.82	239	349	V
3	*** 2.38996	21.31	ADV	32	-23.2	30.11	54	-23.89	-	-	239	349	V
4	*** 2.36985	21.84	ADV	31.9	-23	30.74	54	-23.26	-	-	239	349	V

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

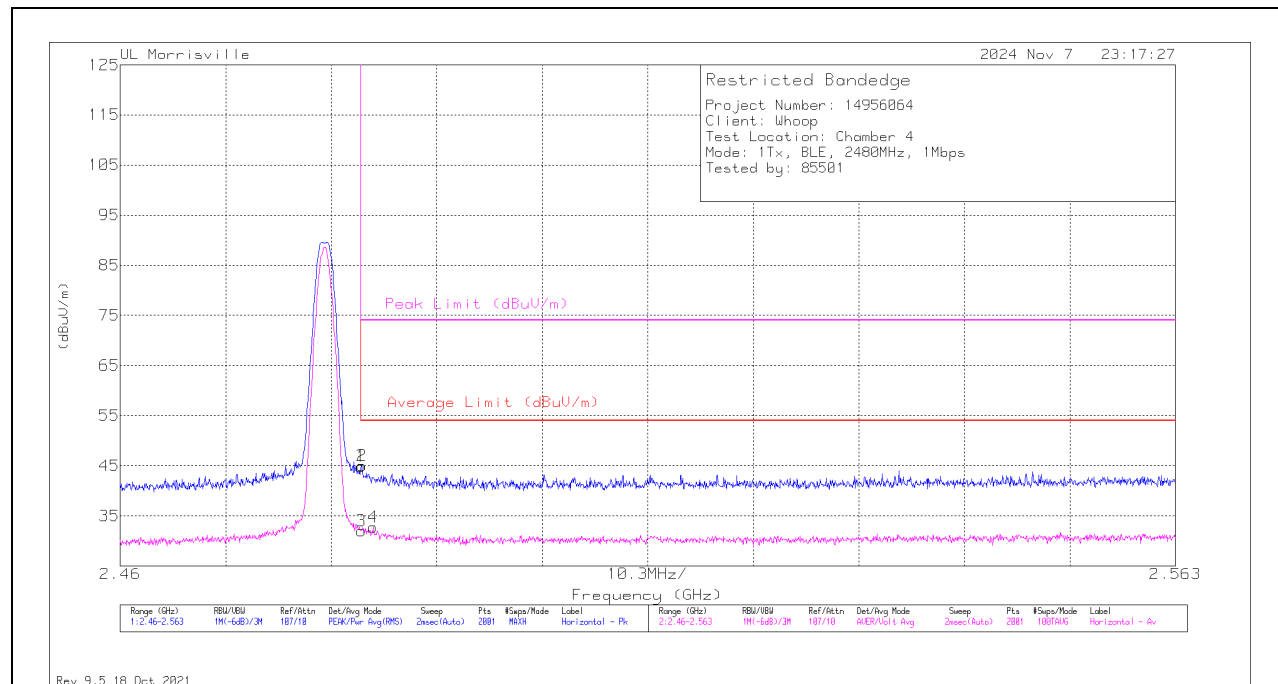
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	35.36	Pk	32.3	-22.8	44.86	-	-	74	-29.14	9	187	H
2	* ** 2.48359	35.52	Pk	32.3	-22.8	45.02	-	-	74	-28.98	9	187	H
3	* ** 2.48354	22.55	ADV	32.3	-22.8	32.05	54	-21.95	-	-	9	187	H
4	* ** 2.48467	23.23	ADV	32.3	-22.8	32.73	54	-21.27	-	-	9	187	H

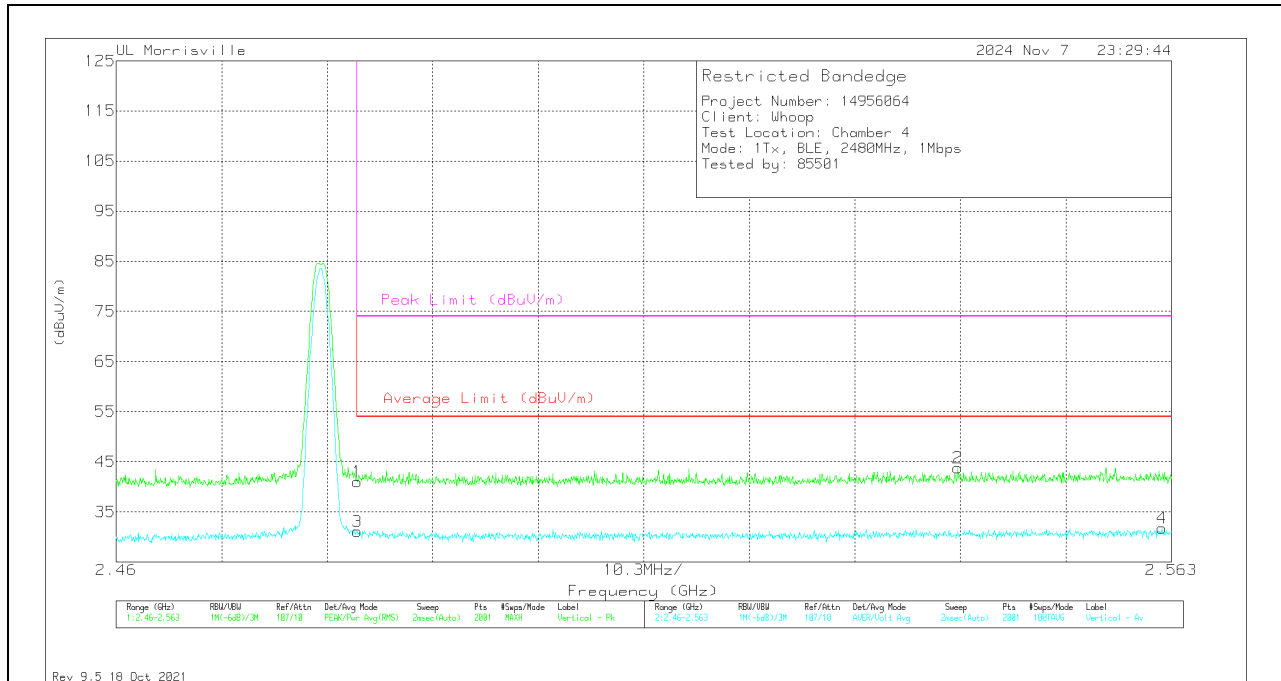
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	31.54	Pk	32.3	-22.8	41.04	-	-	74	-32.96	179	144	V
2	** 2.54214	33.97	Pk	32.5	-22.7	43.77	-	-	74	-30.23	179	144	V
3	* ** 2.48354	21.57	ADV	32.3	-22.8	31.07	54	-22.93	-	-	179	144	V
4	** 2.56207	21.81	ADV	32.5	-22.6	31.71	54	-22.29	-	-	179	144	V

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

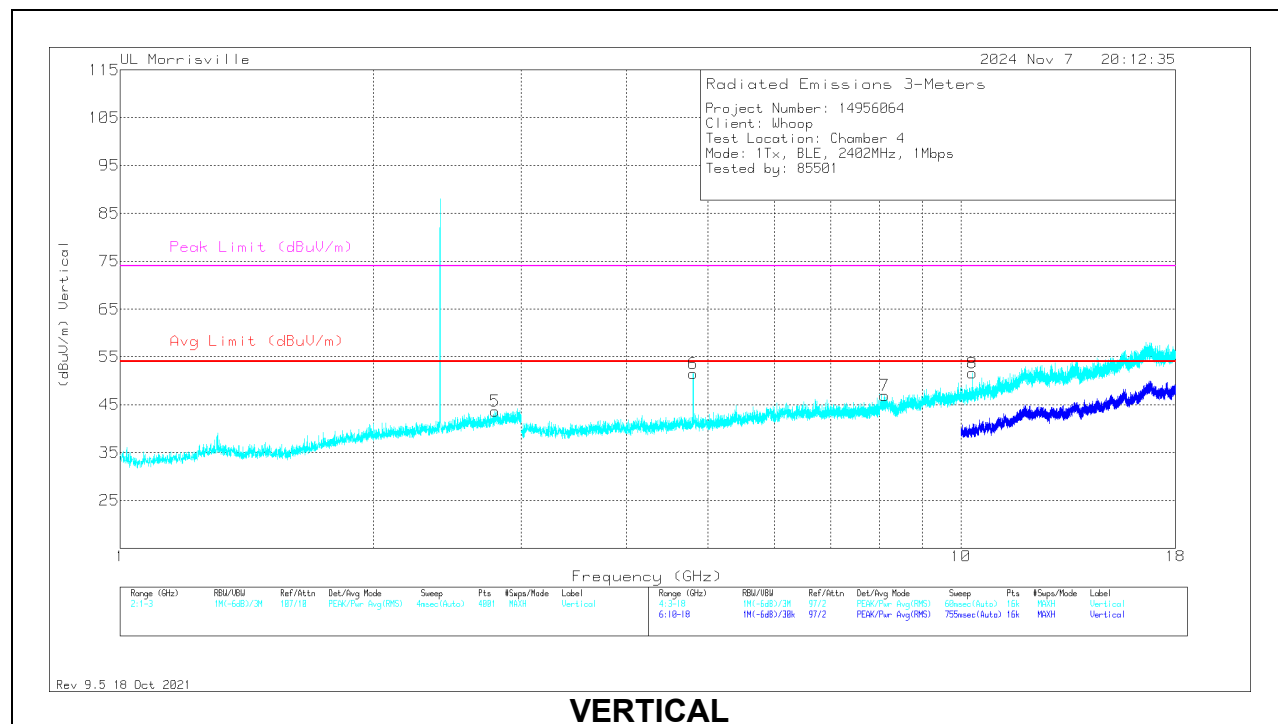
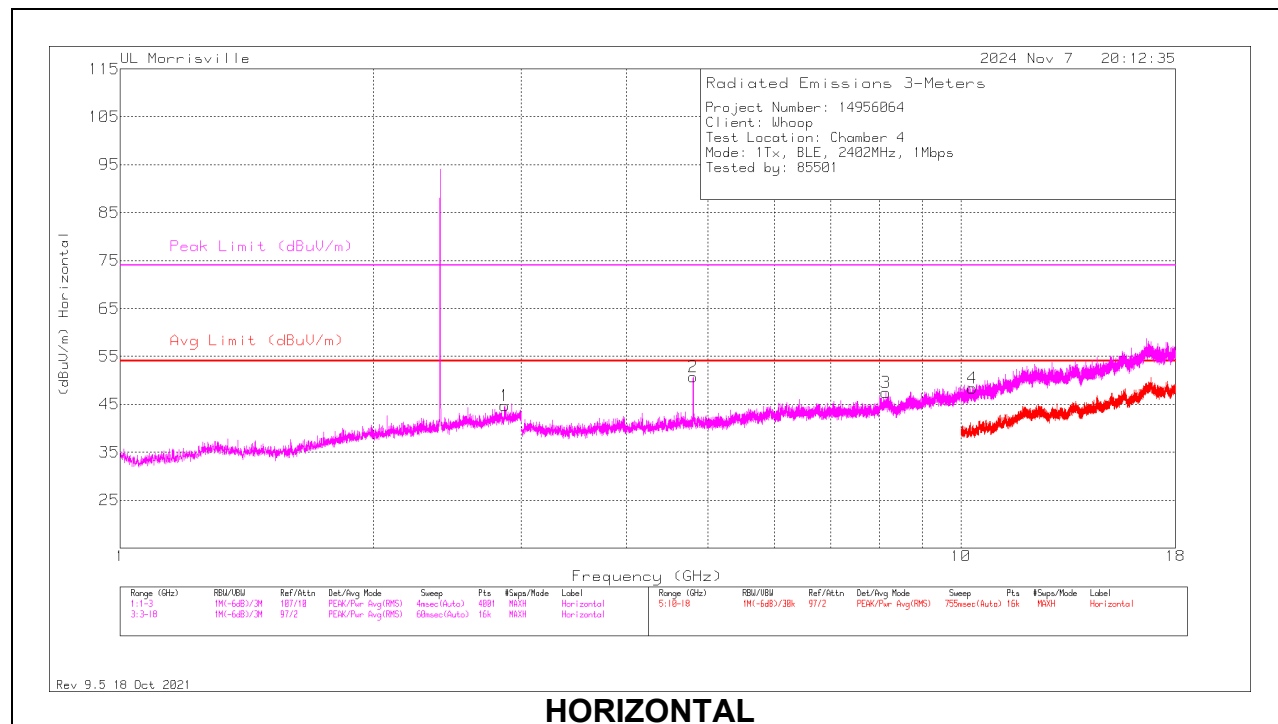
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

HARMONICS AND SPURIOUS EMISSIONS

LOW 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	* ** 2.8655	34.16	Pk	32.4	-21.9	44.66	54	-9.34	74	-29.34	0-360	100	H
5	* ** 2.7925	33.27	Pk	32.6	-22.2	43.67	54	-10.33	74	-30.33	0-360	200	V
2	* ** 4.80429	50.8	PK2	34.1	-31.4	53.5	-	-	74	-20.5	268	122	H
	* ** 4.80401	44.83	ADV	34.1	-31.4	47.53	54	-6.47	-	-	268	122	H
3	* ** 8.14313	38.61	Pk	35.8	-27	47.41	54	-6.59	74	-26.59	0-360	100	H
6	* ** 4.8043	51.22	PK2	34.1	-31.4	53.92	-	-	74	-20.08	190	134	V
	* ** 4.80375	45.59	ADV	34.1	-31.4	48.29	54	-5.71	-	-	190	134	V
7	* ** 8.11688	37.8	Pk	35.8	-26.7	46.9	54	-7.1	74	-27.1	0-360	200	V
8	10.3125	39.59	Pk	37.4	-25.4	51.59	-	-	74	-22.41	0-360	200	V
4	10.31719	36.33	Pk	37.4	-25.3	48.43	-	-	74	-25.57	0-360	100	H

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

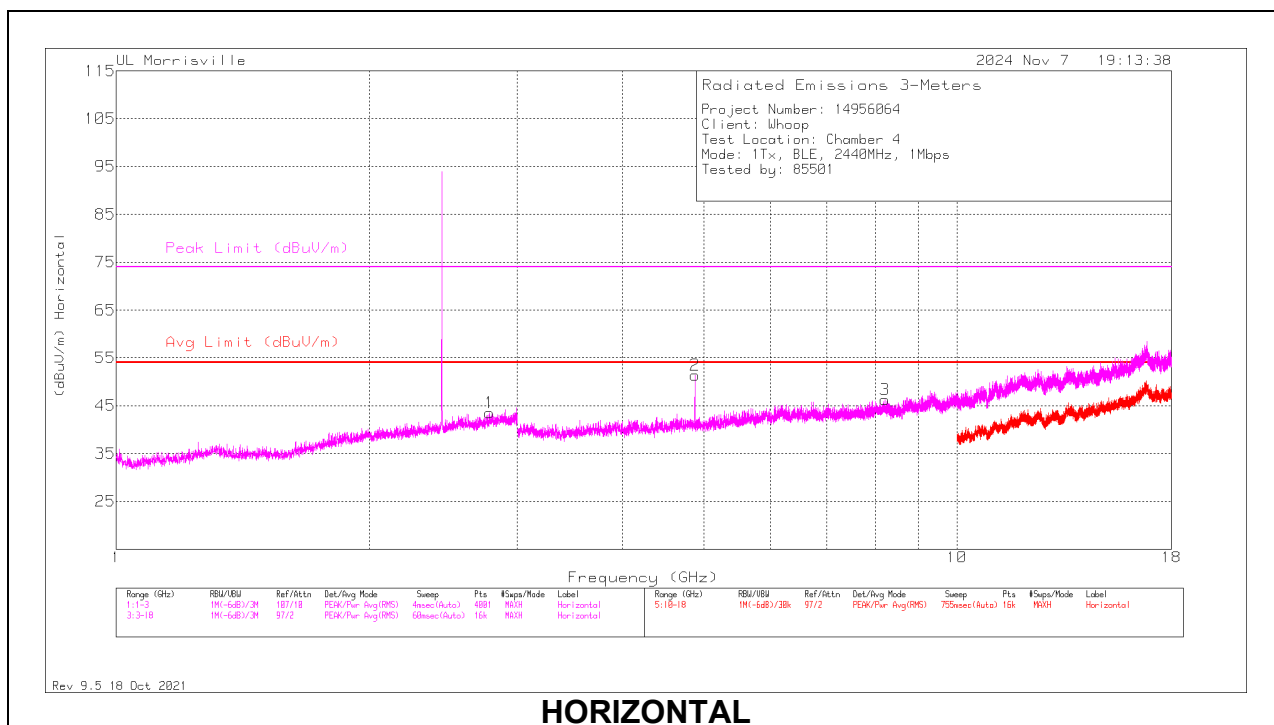
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

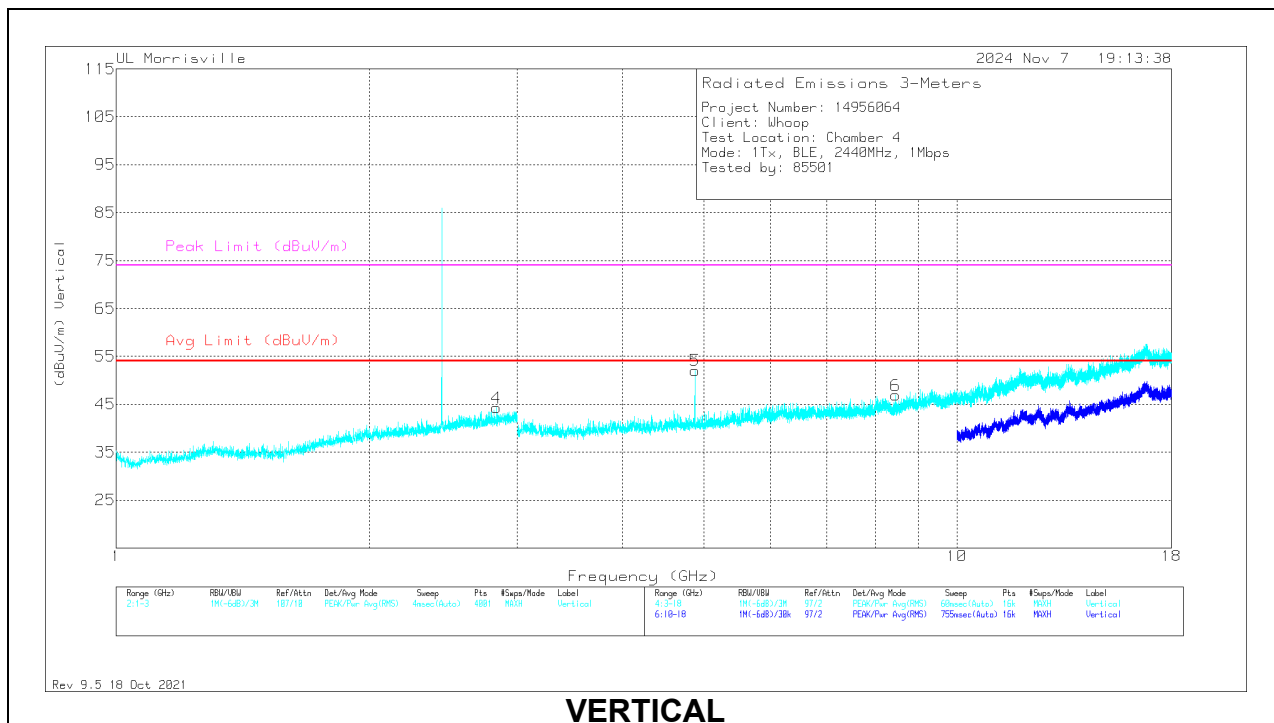
PK2 - Maximum Peak

ADV - Linear Voltage Average

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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	* ** 2.782	33.1	Pk	32.6	-22.2	43.5	54	-10.5	74	-30.5	0-360	100	H
4	* ** 2.833	34.05	Pk	32.4	-22.2	44.25	54	-9.75	74	-29.75	0-360	200	V
2	* ** 4.87768	40.88	PK2	34	-31	43.88	-	-	74	-30.12	355	266	H
	* ** 4.87945	28.41	ADV	34	-31	31.41	54	-22.59	-	-	355	266	H
3	* ** 8.21063	36.83	Pk	35.8	-26.3	46.33	54	-7.67	74	-27.67	0-360	100	H
5	* ** 4.87978	40.88	PK2	34	-31	43.88	-	-	74	-30.12	155	236	V
	* ** 4.87773	28.27	ADV	34	-31	31.27	54	-22.73	-	-	155	236	V
6	* ** 8.45906	36.87	Pk	35.8	-25.8	46.87	54	-7.13	74	-27.13	0-360	200	V

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

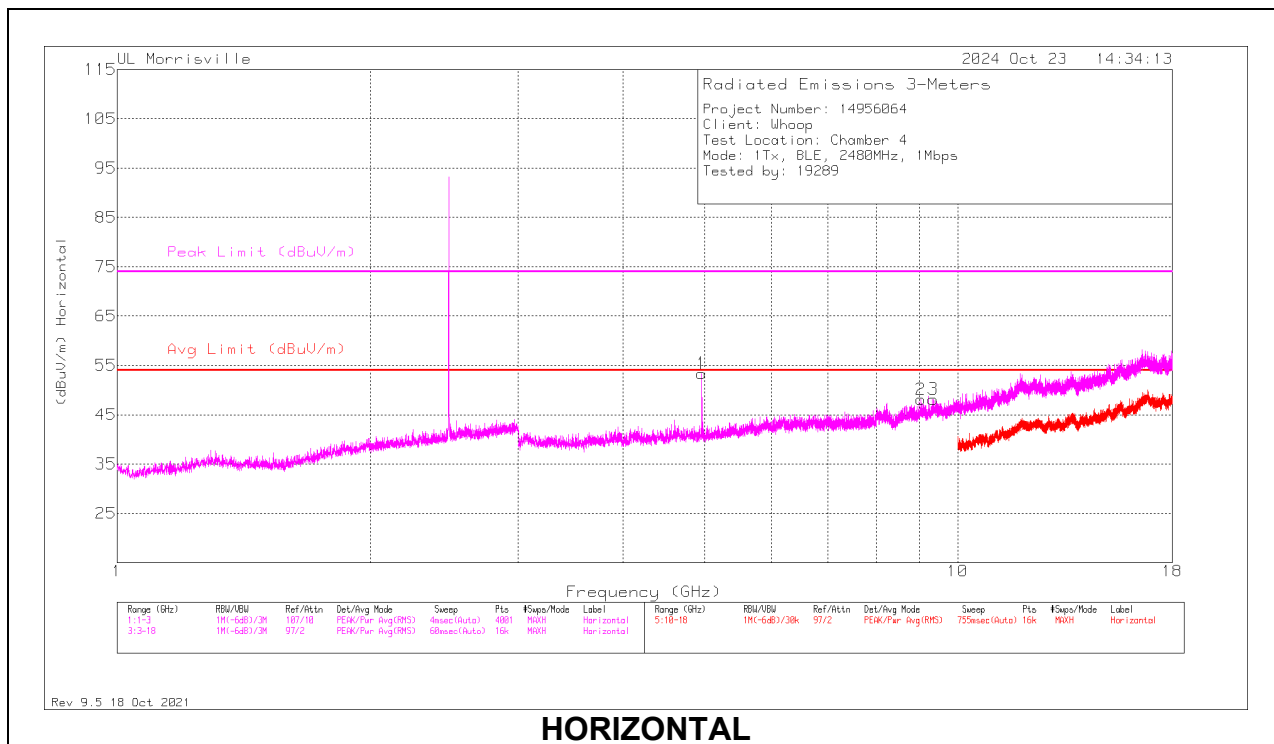
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

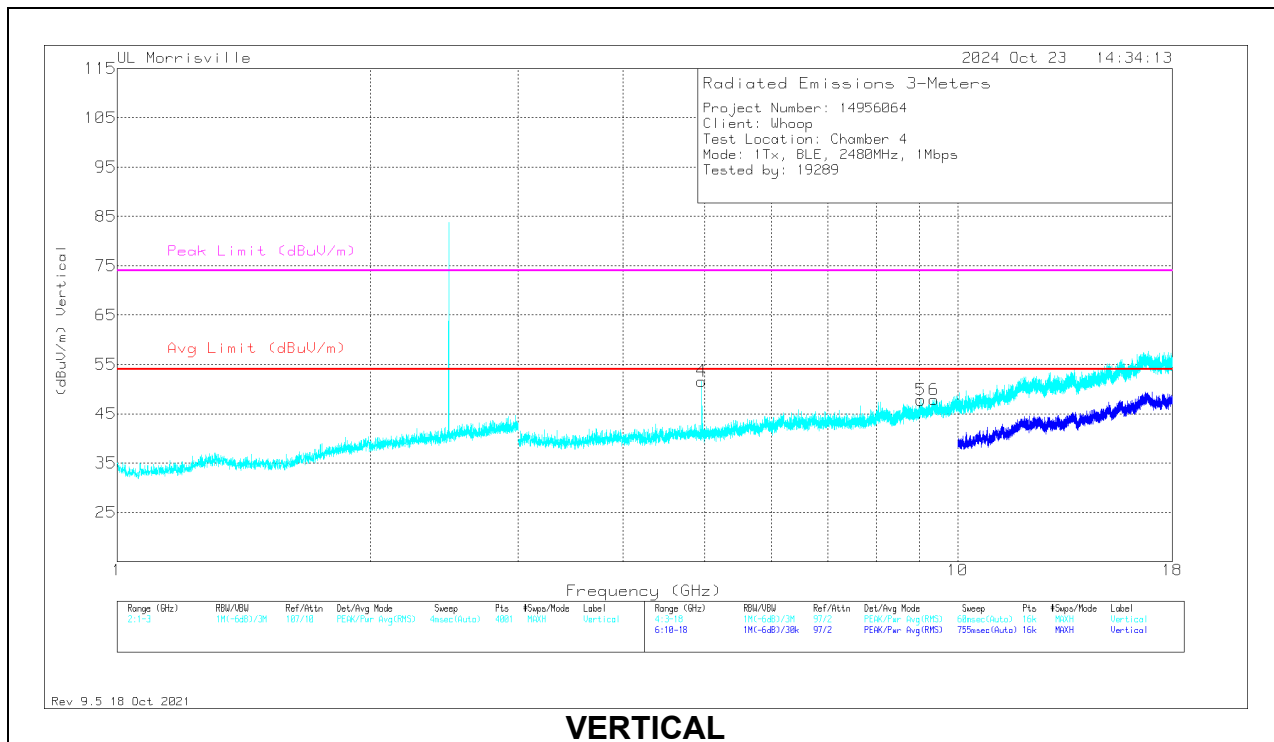
PK2 - Maximum Peak

ADV - Linear Voltage Average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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	* ** 4.95929	52.64	PK2	33.9	-30.8	55.74	-	-	74	-18.26	346	118	H
	* ** 4.95982	47.69	ADV	33.9	-30.8	50.79	54	-3.21	-	-	346	118	H
2	* ** 9.04361	36.63	PK2	36.2	-24	48.83	-	-	74	-25.17	25	187	H
	* ** 9.04405	23.95	ADV	36.2	-24	36.15	54	-17.85	-	-	25	187	H
3	* ** 9.35159	36.26	PK2	36.5	-24.4	48.36	-	-	74	-25.64	271	112	H
	* ** 9.35153	24.7	ADV	36.5	-24.4	36.8	54	-17.2	-	-	271	112	H
4	* ** 4.95933	50.54	PK2	33.9	-30.8	53.64	-	-	74	-20.36	347	119	V
	* ** 4.95991	44.81	ADV	33.9	-30.8	47.91	54	-6.09	-	-	347	119	V
5	* ** 9.045	35.62	Pk	36.2	-24	47.82	54	-6.18	74	-26.18	0-360	200	V
6	* ** 9.36656	35.95	Pk	36.5	-24.6	47.85	54	-6.15	74	-26.15	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

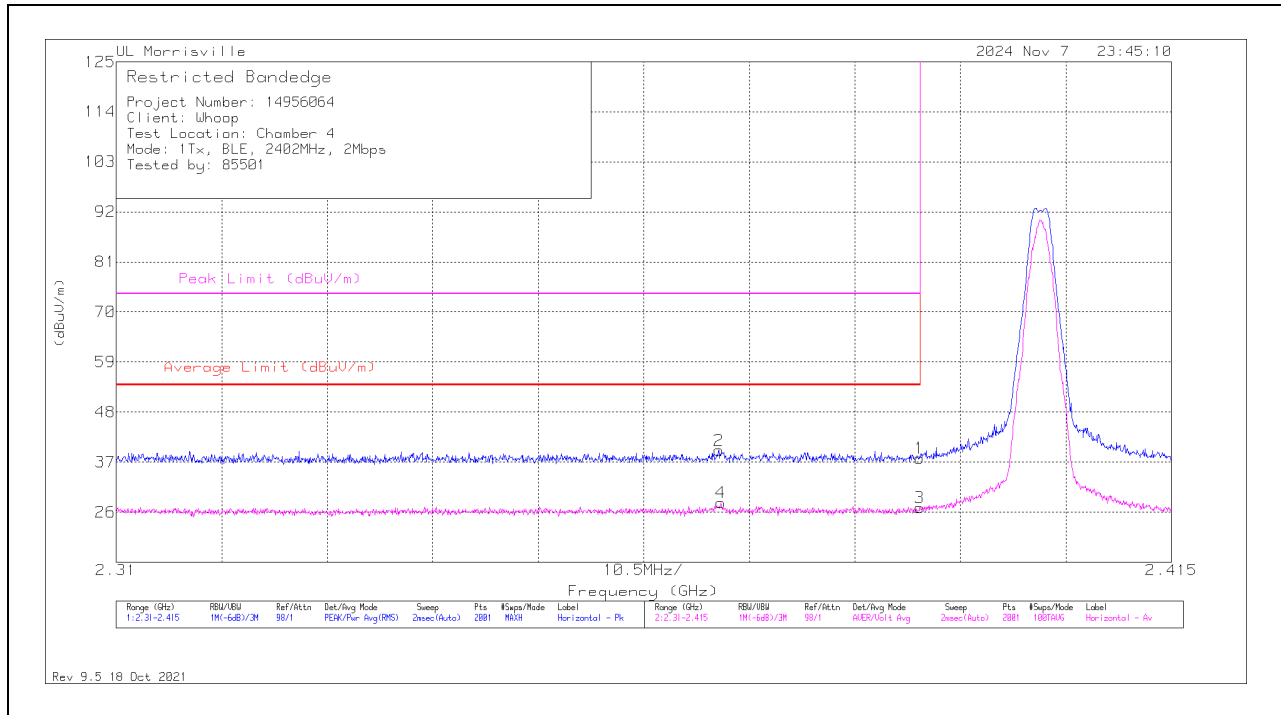
PK2 - Maximum Peak

ADV - Linear Voltage Average

10.2.2. BLE (2Mbps)

BANDEGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	29.09	Pk	32	-23.2	37.89	-	-	74	-36.11	172	137	H
2	*** 2.36996	30.67	Pk	31.9	-23	39.57	-	-	74	-34.43	172	137	H
3	*** 2.38996	18.2	ADV	32	-23.2	27	54	-27	-	-	172	137	V
4	*** 2.37017	19.18	ADV	31.9	-23	28.08	54	-25.92	-	-	172	137	V

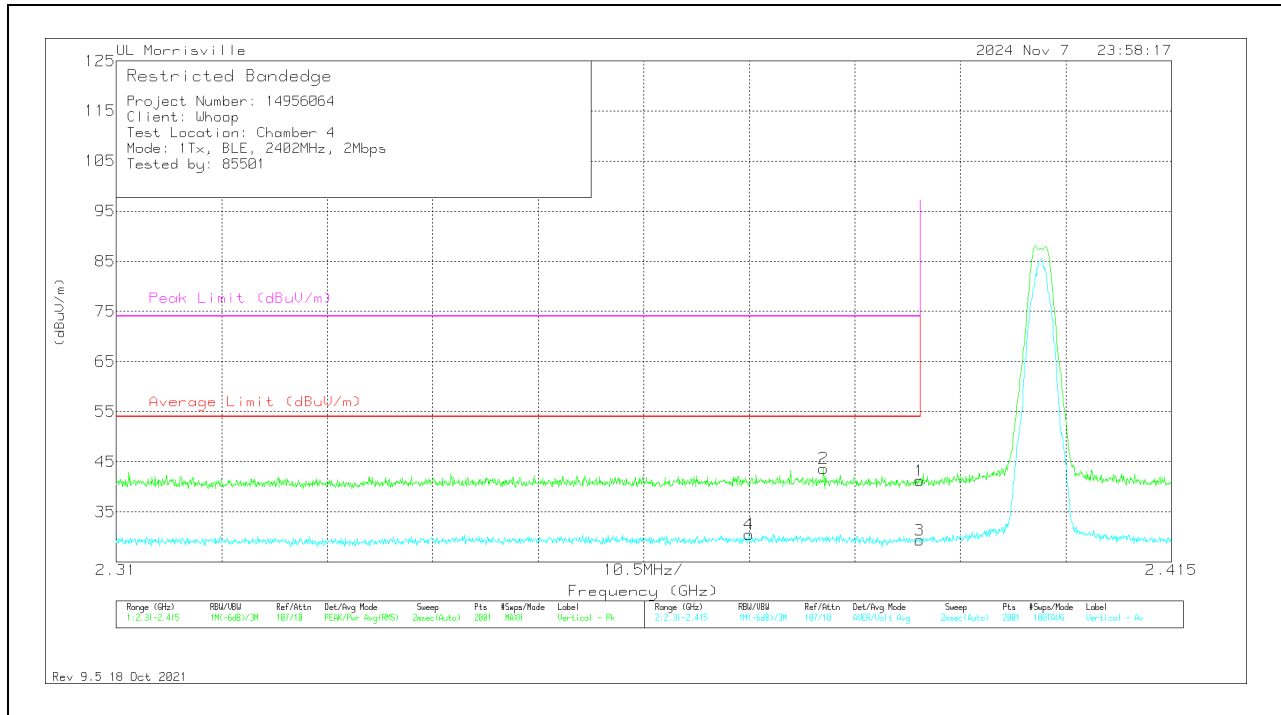
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	32.41	Pk	32	-23.2	41.21	-	-	74	-32.79	85	351	V
2	* ** 2.3804	34.72	Pk	32	-23.1	43.62	-	-	74	-30.38	85	351	V
3	* ** 2.38996	20.52	ADV	32	-23.2	29.32	54	-24.68	-	-	85	351	V
4	* ** 2.37295	21.59	ADV	31.9	-23	30.49	54	-23.51	-	-	85	351	V

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

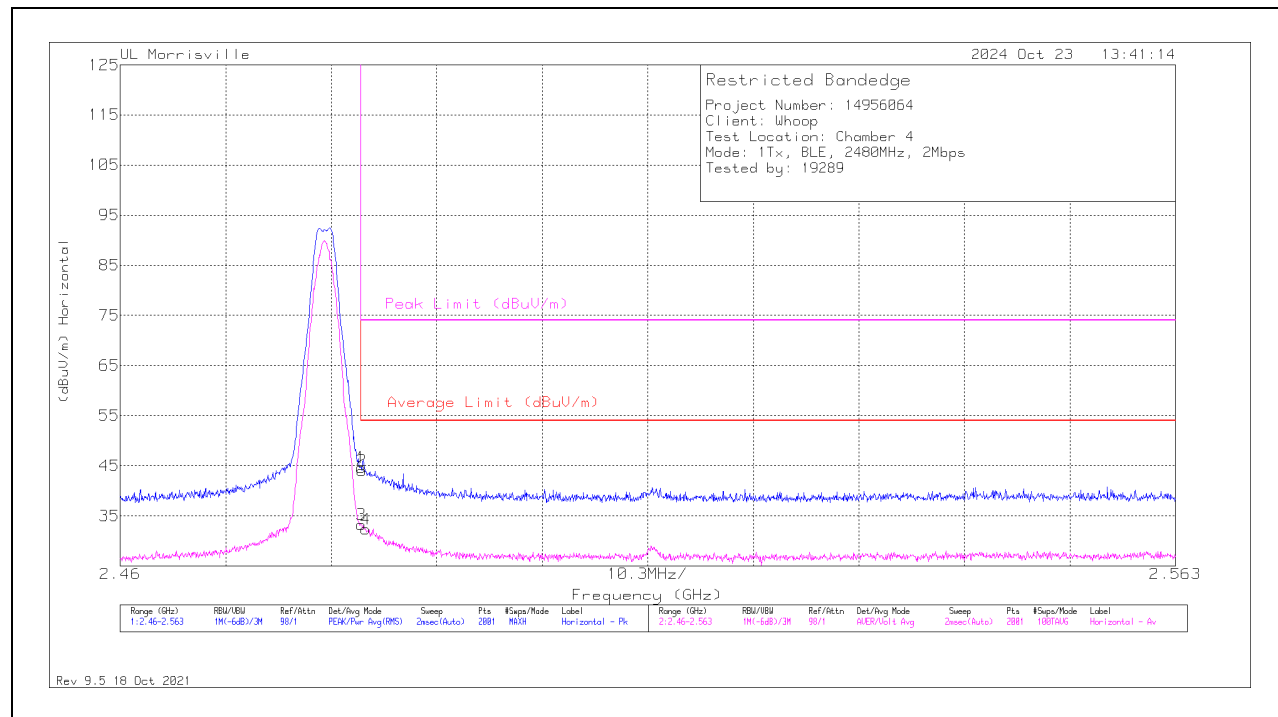
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	35.13	Pk	32.3	-22.8	44.63	-	-	74	-29.37	35	133	H
2	* ** 2.48359	34.49	Pk	32.3	-22.8	43.99	-	-	74	-30.01	35	133	H
3	* ** 2.48354	23.75	ADV	32.3	-22.8	33.25	54	-20.75	-	-	35	133	H
4	* ** 2.48395	22.82	ADV	32.3	-22.8	32.32	54	-21.68	-	-	35	133	H

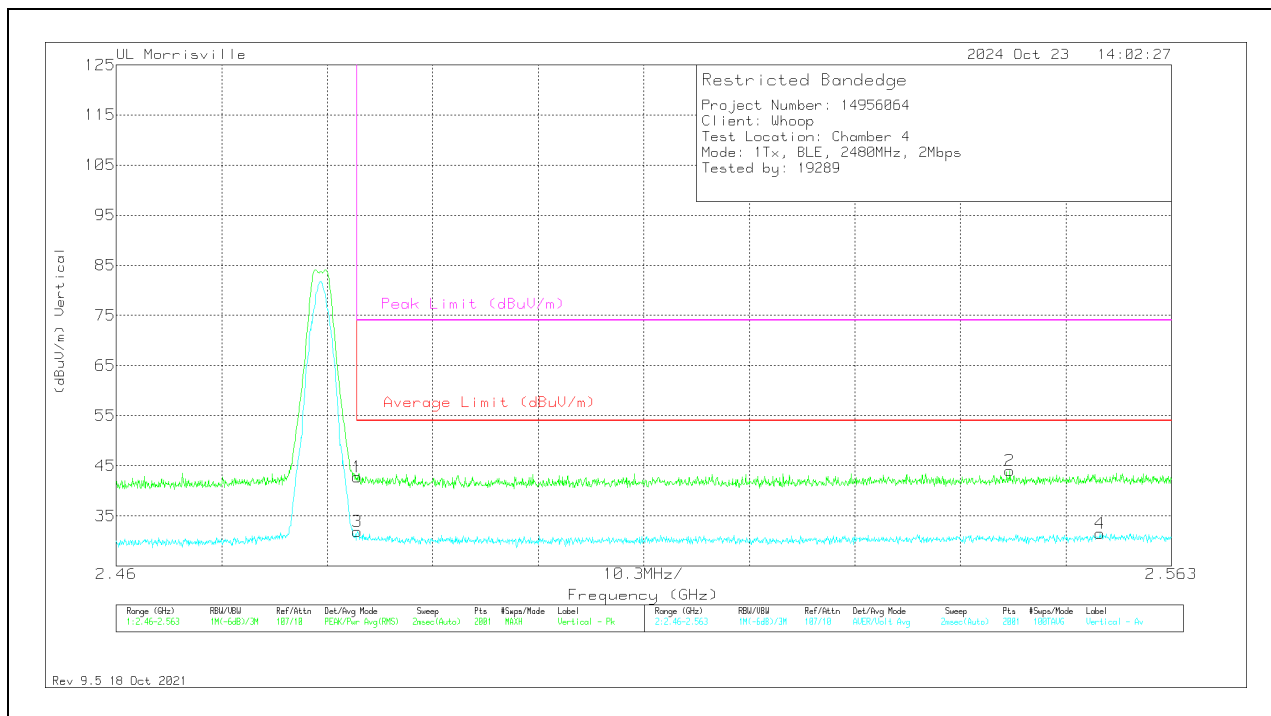
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 ACF (dB/m)	Gain/Loss (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	33.24	Pk	32.3	-22.8	42.74	-	-	74	-31.26	195	101	V
2	** 2.54724	34.29	Pk	32.4	-22.7	43.99	-	-	74	-30.01	195	101	V
3	* ** 2.48354	22.35	ADV	32.3	-22.8	31.85	54	-22.15	-	-	195	100	V
4	** 2.556	21.58	ADV	32.5	-22.6	31.48	54	-22.52	-	-	195	100	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

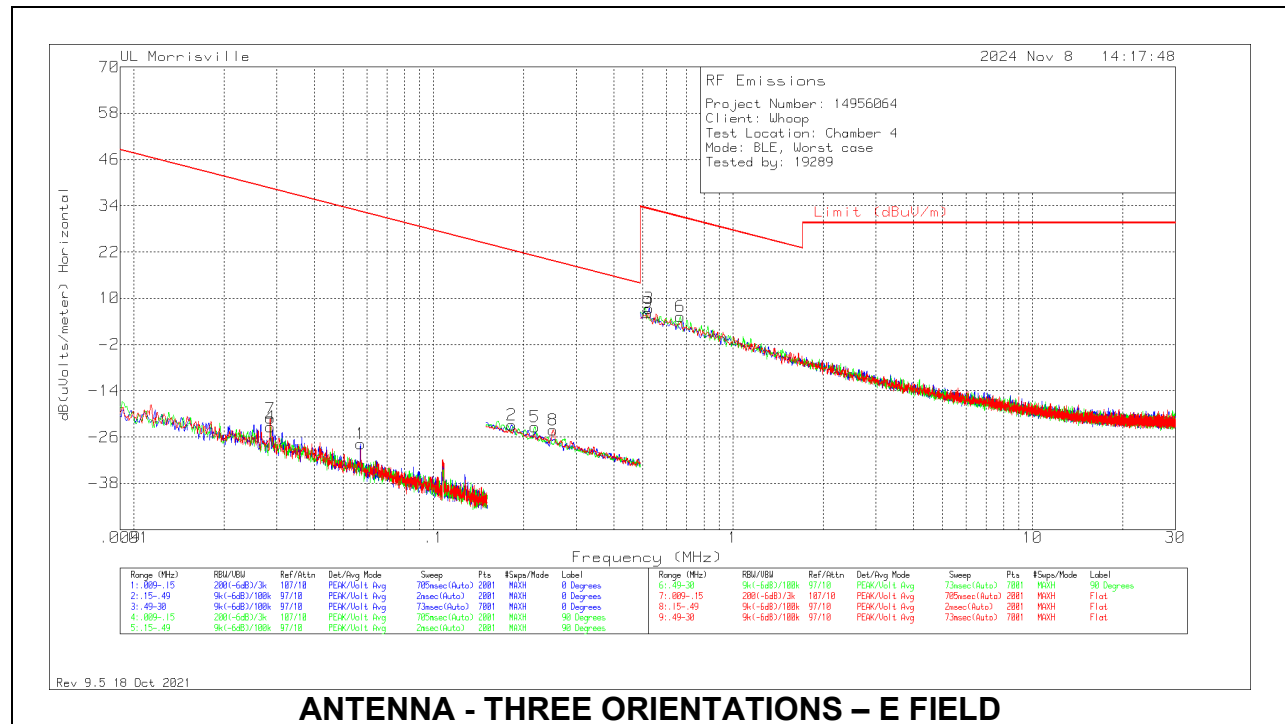
Pk - Peak detector

ADV - Linear Voltage Average

10.3. WORST CASE BELOW 30MHZ

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).

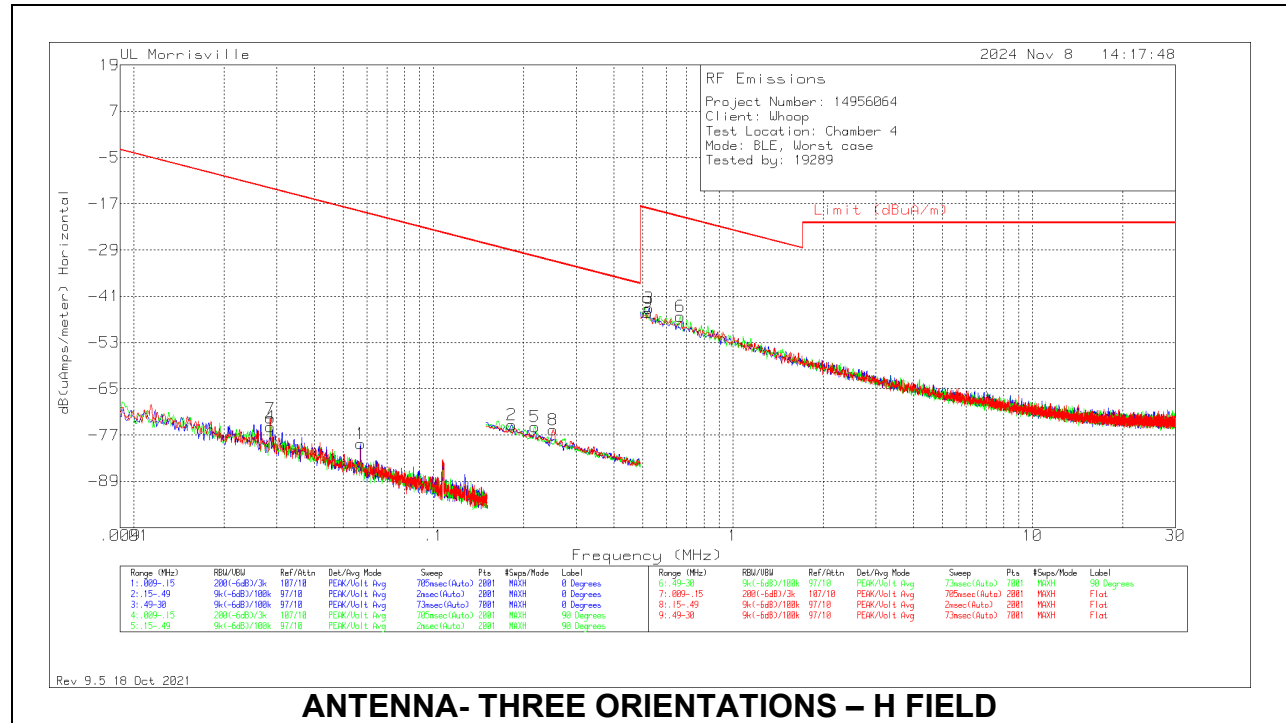
SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA - THREE ORIENTATIONS – E FIELD

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
4	.02853	43.29	Pk	13.2	.1	-80	-23.41	38.5	58.5	-61.91	0-360	90 degs
7	.02853	45.54	Pk	13.2	.1	-80	-21.16	38.5	58.5	-59.66	0-360	Flat
1	.05707	40.78	Pk	11.4	.1	-80	-27.72	32.48	52.48	-60.2	0-360	0 degs
2	.18222	46.01	Pk	11	.1	-80	-22.89	22.39	42.39	-45.28	0-360	0 degs
5	.21792	45.66	Pk	10.9	.1	-80	-23.34	20.84	40.84	-44.18	0-360	90 degs
8	.25107	44.84	Pk	10.9	.1	-80	-24.16	19.61	39.61	-43.77	0-360	Flat
9	.51951	35.12	Pk	11	.1	-40	6.22	33.29	-	-27.07	0-360	Flat
3	.52373	36.28	Pk	11	.1	-40	7.38	33.22	-	-25.84	0-360	0 degs
6	.66707	34.12	Pk	11	.2	-40	5.32	31.12	-	-25.8	0-360	90 degs

Pk - Peak detector



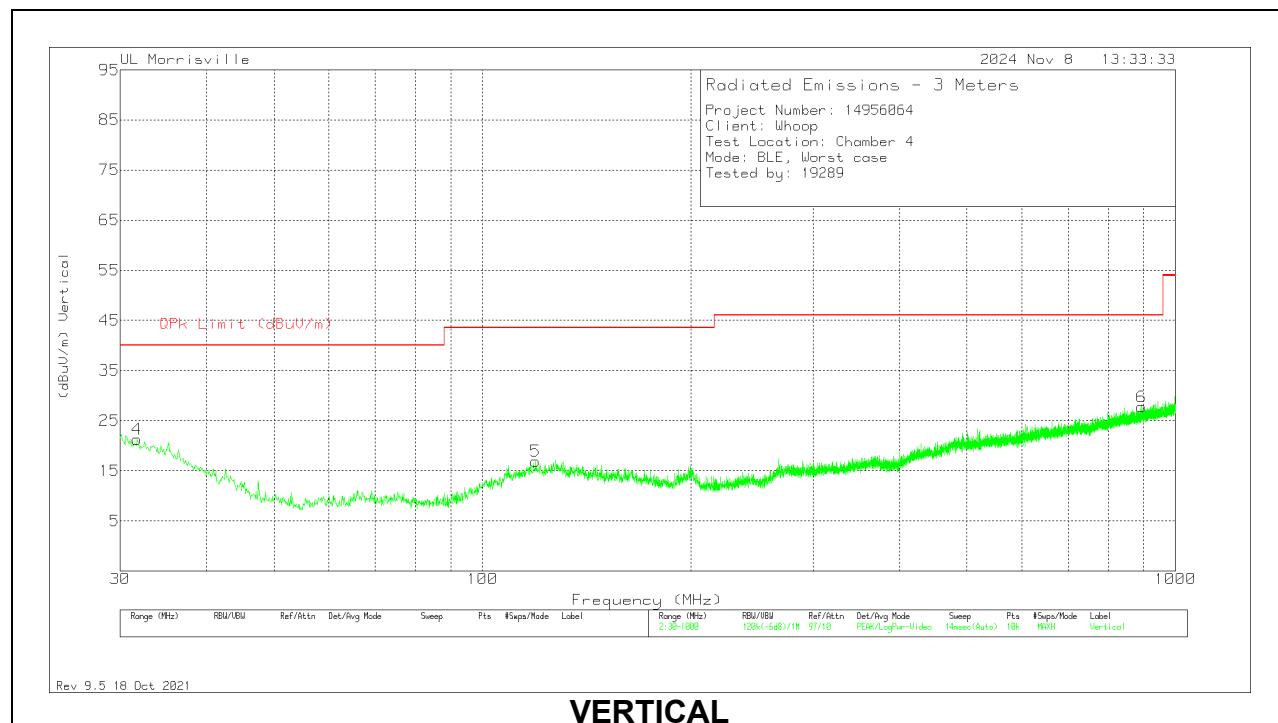
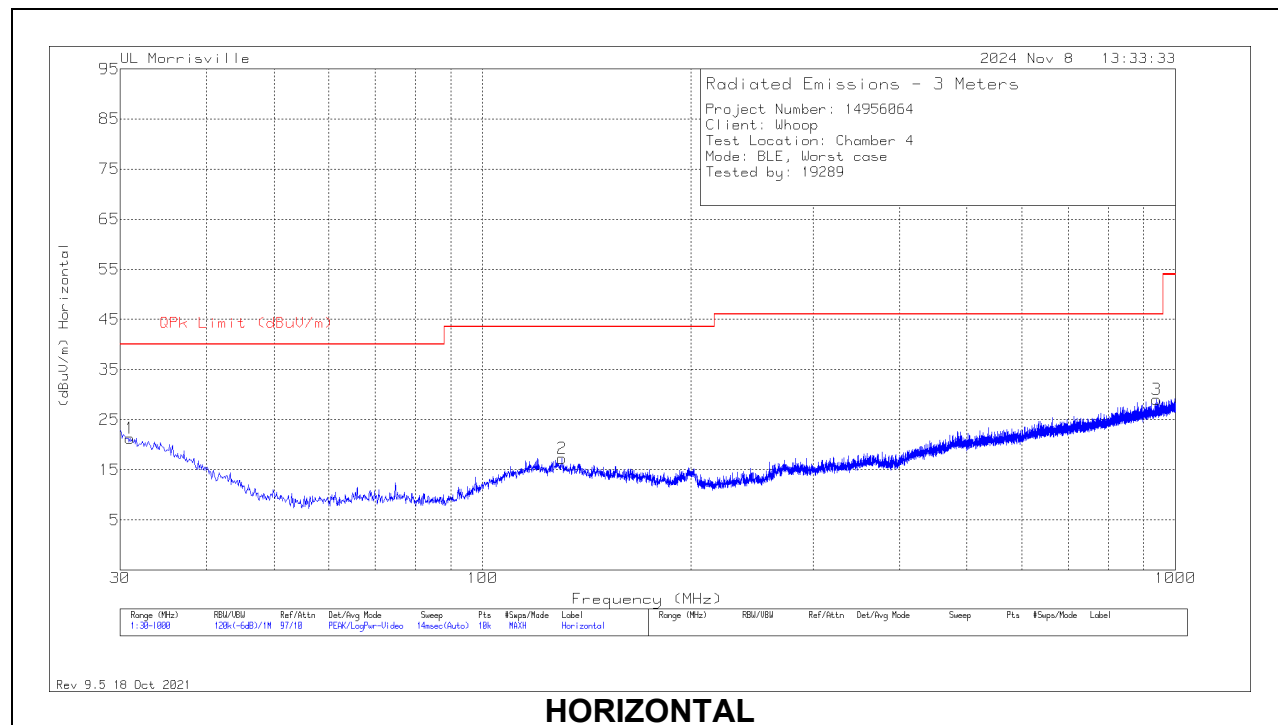
ANTENNA- THREE ORIENTATIONS – H FIELD

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	QP/AV Limit (dBuA/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
4	.02853	43.29	Pk	-38.3	.1	-80	-74.91	-13	7	-61.91	0-360	90 degs
7	.02853	45.54	Pk	-38.3	.1	-80	-72.66	-13	7	-59.66	0-360	Flat
1	.05707	40.78	Pk	-40.1	.1	-80	-79.22	-19.02	0.98	-60.2	0-360	0 degs
2	.18222	46.01	Pk	-40.5	.1	-80	-74.39	-29.11	-9.11	-45.28	0-360	0 degs
5	.21792	45.66	Pk	-40.6	.1	-80	-74.84	-30.66	-10.66	-44.18	0-360	90 degs
8	.25107	44.84	Pk	-40.6	.1	-80	-75.66	-31.89	-11.89	-43.77	0-360	Flat
9	.51951	35.12	Pk	-40.5	.1	-40	-45.28	-18.21	-	-27.07	0-360	Flat
3	.52373	36.28	Pk	-40.5	.1	-40	-44.12	-18.28	-	-25.84	0-360	0 degs
6	.66707	34.12	Pk	-40.5	.2	-40	-46.18	-20.38	-	-25.8	0-360	90 degs

Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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

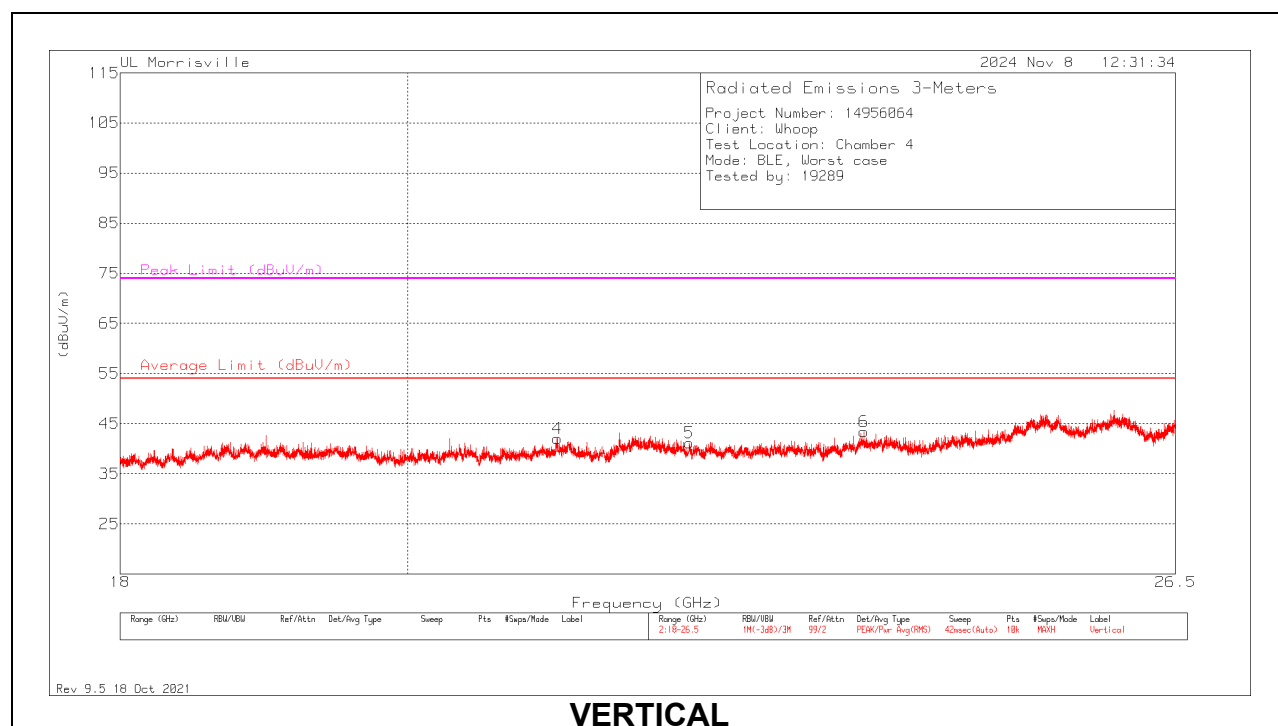
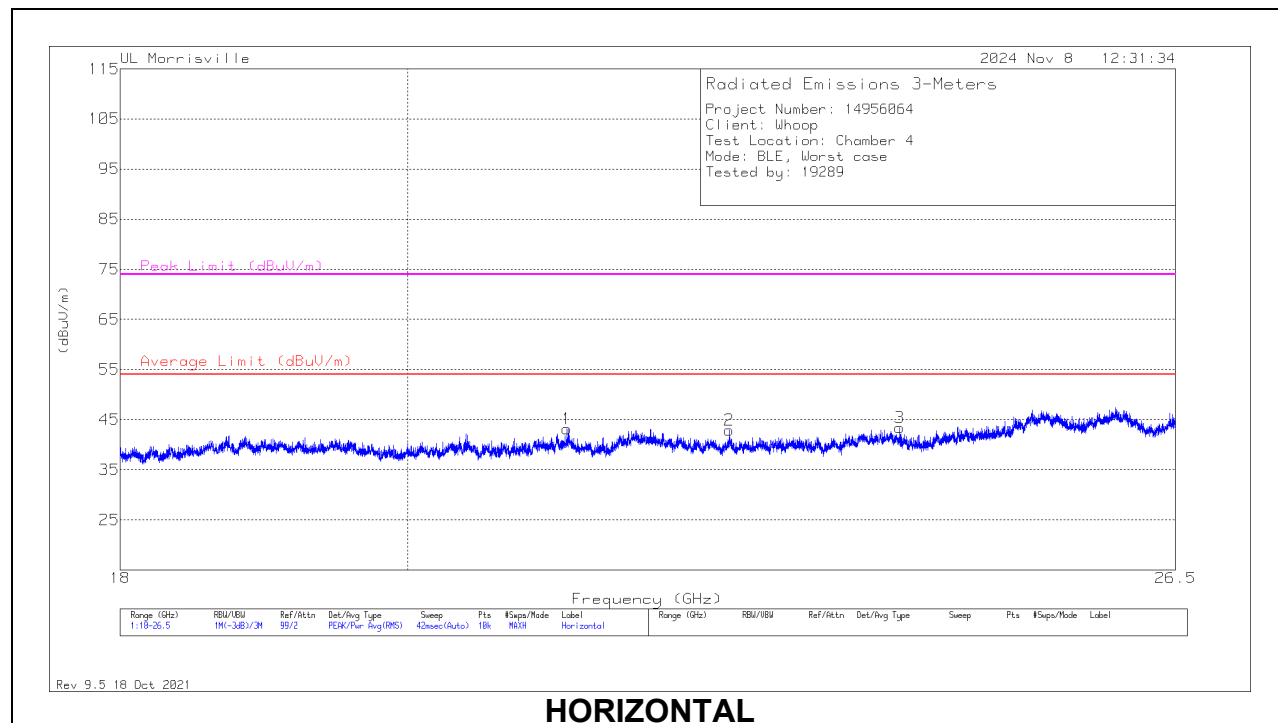


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	90628 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	30.97	27.18	Pk	26.2	-32.1	21.28	40	-18.72	0-360	200	H
4	31.746	27.72	Pk	25.6	-32	21.32	40	-18.68	0-360	100	V
5	119.337	28.25	Pk	20	-31.3	16.95	43.52	-26.57	0-360	100	V
2	130.298	28.47	Pk	20	-31.2	17.27	43.52	-26.25	0-360	100	H
6	893.494	26.93	Pk	28.1	-27.3	27.73	46.02	-18.29	0-360	200	V
3	939.763	27.29	Pk	28.6	-26.8	29.09	46.02	-16.93	0-360	200	H

Pk - Peak detector

10.5. WORST CASE 18-26 GHZ

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



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	204704 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 21.20163	50.27	Pk	33.6	-40.7	43.17	54	-10.83	74	-30.83	0-360	100	H
2	* ** 22.502	48.29	Pk	34.2	-39.6	42.89	54	-11.11	74	-31.11	0-360	250	H
3	* ** 23.9545	46.99	Pk	34.5	-38.1	43.39	54	-10.61	74	-30.61	0-360	100	H
4	* ** 21.12854	48.75	Pk	33.7	-40.4	42.05	54	-11.95	74	-31.95	0-360	150	V
5	* ** 22.17563	46.52	Pk	34.3	-39.7	41.12	54	-12.88	74	-32.88	0-360	300	V
6	* ** 23.64174	47.35	Pk	34.6	-38.5	43.45	54	-10.55	74	-30.55	0-360	150	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 R14956064-EP5 for setup photos

END OF TEST REPORT