

TEST REPORT

Report Number: 13684121-E2V3

Applicant : SRAM LLC
1000 W Fulton Market 4th Floor
Chicago, IL 60607, United States

Model : 00230

FCC ID : C9O-SPMB2

ISED : 10161A-SPMB2

EUT Description : Electronic Controller with BLE and AIREA Radios

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

Date of Issue:
2024-01-11

Prepared by:
UL VERIFICATION SERVICES
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-04-06	Initial Issue	
V2	2021-05-11	Updated Section 10.2, 10.3 and 10.4	Kiya Kedida
V3	2024-01-11	Updated Section Cover Page, Section 1, 4, 5.3 and 10.3	Kiya Kedida

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS.....	5
2. TEST RESULTS SUMMARY	7
3. TEST METHODOLOGY	7
4. FACILITIES AND ACCREDITATION.....	7
5. DECISION RULES AND MEASUREMENT UNCERTAINTY.....	8
5.1. METROLOGICAL TRACEABILITY	8
5.2. DECISION RULES	8
5.3. MEASUREMENT UNCERTAINTY	9
5.4. SAMPLE CALCULATION.....	9
6. EQUIPMENT UNDER TEST	10
6.1. EUT DESCRIPTION.....	10
6.2. MAXIMUM OUTPUT POWER.....	10
6.3. DESCRIPTION OF AVAILABLE ANTENNAS	10
6.4. SOFTWARE AND FIRMWARE	10
6.5. WORST-CASE CONFIGURATION AND MODE.....	10
6.6. DESCRIPTION OF TEST SETUP.....	11
7. MEASUREMENT METHOD	14
8. TEST AND MEASUREMENT EQUIPMENT	15
9. ANTENNA PORT TEST RESULTS	16
9.1. ON TIME AND DUTY CYCLE	16
9.2. 99% BANDWIDTH.....	17
9.3. 6 dB BANDWIDTH	18
9.4. OUTPUT POWER	19
9.5. AVERAGE POWER.....	20
9.6. POWER SPECTRAL DENSITY	21
9.7. CONDUCTED SPURIOUS EMISSIONS.....	22
10. RADIATED TEST RESULTS.....	24
10.1. LIMITS AND PROCEDURE.....	24

10.2.	TRANSMITTER ABOVE 1 GHz	26
10.3.	WORST CASE BELOW 30MHz	36
10.4.	WORST CASE BELOW 1 GHz.....	38
10.5.	WORST CASE 18-26 GHz	40
11.	SETUP PHOTOS	42

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SRAM LLC
1000 W Fulton Market 4th Floor
Chicago, IL 60607, United States

EUT DESCRIPTION: Electronic Controller with BLE and AIREA Radios

MODEL: 00230

SERIAL NUMBER: Conducted: 1801242003
Radiated: 1801242002

DATE TESTED: JANUARY 28 – FEBRUARY 04, 2021

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

UL Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



Dan Corona
Operations Leader
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Brian Shen
Laboratory Engineer
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



Kiya Kedida
Senior Project Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.

This report contains data provided by the customer, which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, Certificate Number 0751.05, 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 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	550739
☐	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A			
☒	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A			

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)	141.16 Hz
Occupied Bandwidth	1.22%
Power Spectral Density	2.47 dB
RF Power Measurement Direct Method Using Power Meter	1.3 dB (PK) / 0.45 dB (AV)
Unwanted Emissions, Conducted	1.94 dB
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB
Time Domain Measurements	3.39%
Temperature	0.57°C
Humidity	3.39%
DC Supply Voltages	0.57%

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is an Electronic Controller with BLE and AIREA Radios.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Peak		Average	
		Output Power (dBm)	Output Power (mW)	Output Power (dBm)	Output Power (mW)
2405 - 2475	AIREA	5.77	3.78	5.74	3.75

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows: The radio utilizes a ceramic chip antenna, with a maximum gain of 1.7 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version B-1.0.
The test utility software used during testing was nRF Connect version 3.6.1.

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 output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle, and high channels.

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

Worst-case data rate as provided by the client was 250kbps.

Note:

The EUT was operating by a CR2032 battery at 3V; therefore, the AC Power Line Conduction was not applicable.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	Lenovo	T460s	PC0C3EDZ
AC/DC Adapter	Lenovo	ADLX45DLC2A	N/A
USB Dongle	Segger	E204460	680803009
DC Power Supply	TDK.Lambda	GENH60-25	08H7946V
DC Power Supply	Kenwood Corporation	PA36-3A	7060074

I/O CABLES (CONDUCTED EMISSIONS)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Unshielded	1.5	AC Main to DC Supply, to Analyzer
2	DC	1	DC	Unshielded	0.5	Power Supply to EUT
3	Antenna Port	1	SMA	Unshielded	0.1	EUT to Analyzer

I/O CABLES (RADIATED EMISSIONS)

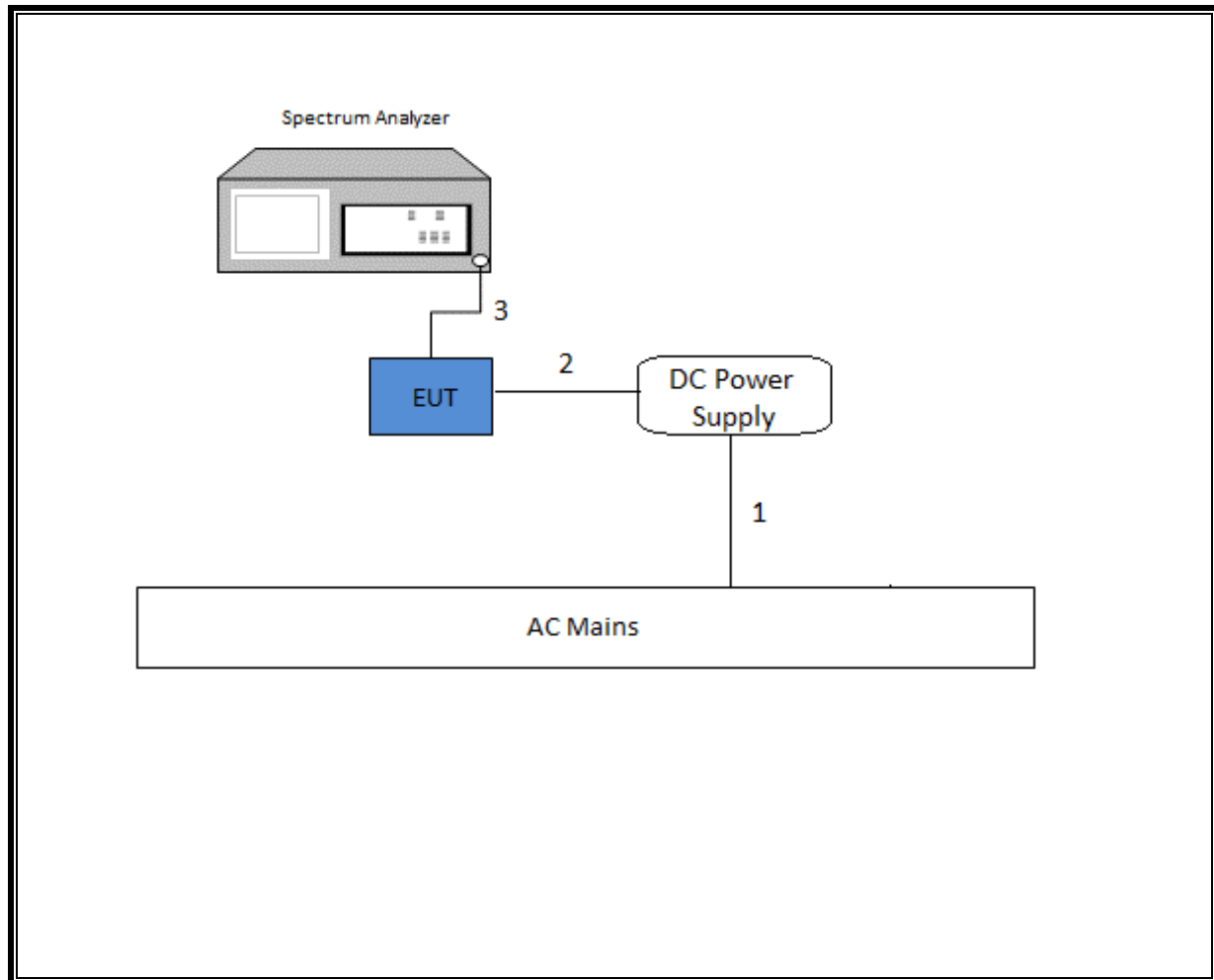
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Unshielded	1.5	AC Main to DC Supply
2	DC	1	DC	Unshielded	0.5	Power Supply to EUT

TEST SETUP

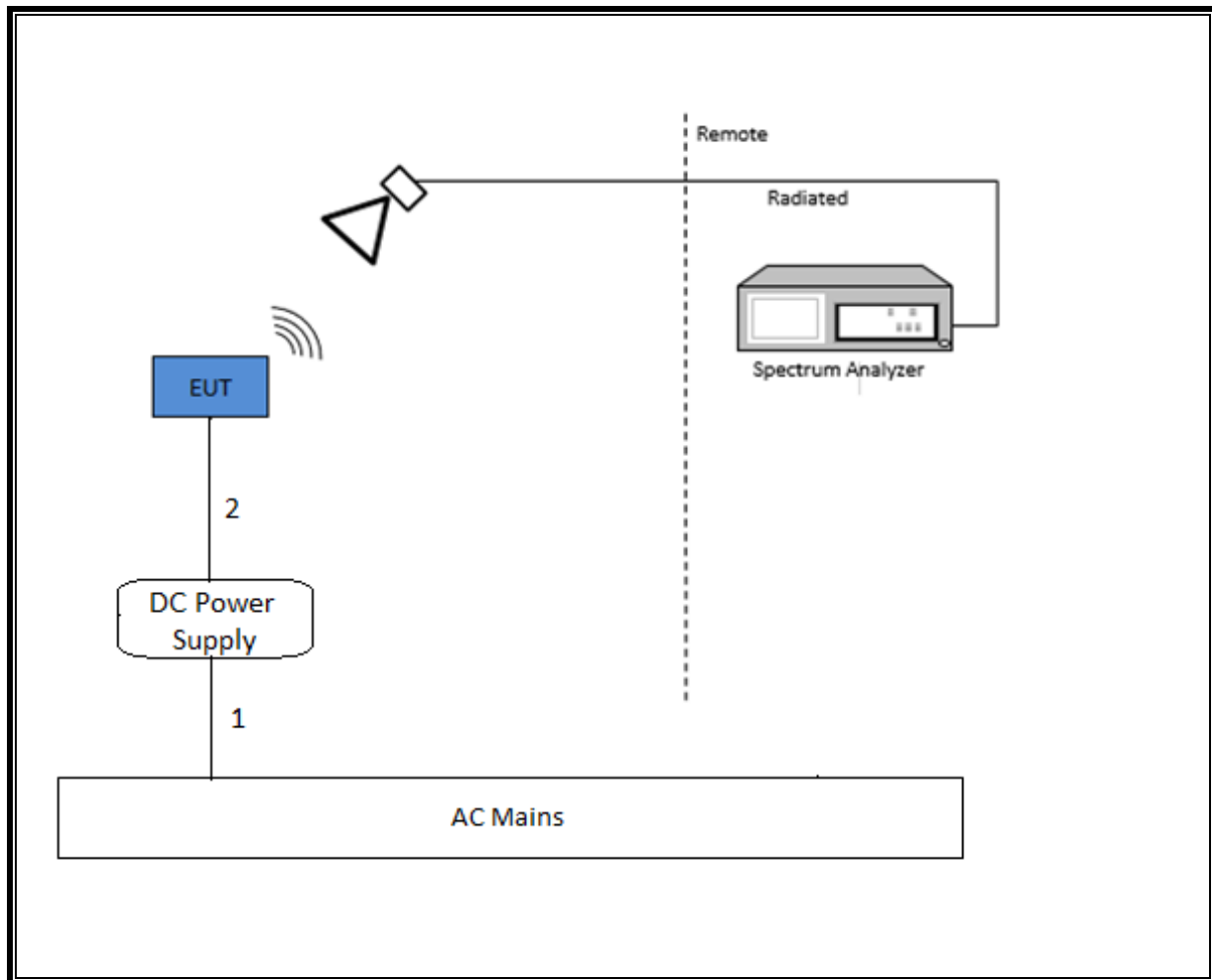
For the purposes of testing, the EUT is connected to a 3V DC Power supply for radiated emissions above 1GHz. The EUT is normally powered by a CR2032 battery at 3V. The laptop and USB dongle were used for setting up purposes and were removed during testing

SETUP DIAGRAMS

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section -11.6.

6 dB BW: ANSI C63.10 Section -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment were utilized for the tests documented in this report:

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179376	4/3/2021	4/3/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	8/31/2021	8/31/2020
Amplifier, 100MHz-18GHz	AMPLICAL	AMP0.1G18-47-20	PRE0197319	5/4/2021	5/4/2020
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	T477	9/24/2021	9/24/2020
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	1/21/2022	1/21/2021
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179466	5/27/2021	5/27/2020
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179468	5/27/2021	5/27/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T342	1/25/2022	1/25/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T123	1/22/2022	1/22/2021
Power Sensor P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T413	2/26/2021	2/26/2020
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1269	1/25/2022	1/25/2021
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	9/24/2021	9/24/2020
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	PRE0181238	6/7/2021	6/7/2020
Power Supply, DC	TDK-LAMBDA	GENH60-25	PRE0074666	CnR	CnR
Power Supply, DC	Kenwood Corporation	PA36-3A	T599	CnR	CnR
Test Software List					
Description	Manufacturer	Model	Version		
Radiated Software	UL	UL EMC	Rev 9.5, April 30, 2020		
Antenna Port Software	UL	UL RF	AP 2021.1.19		

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

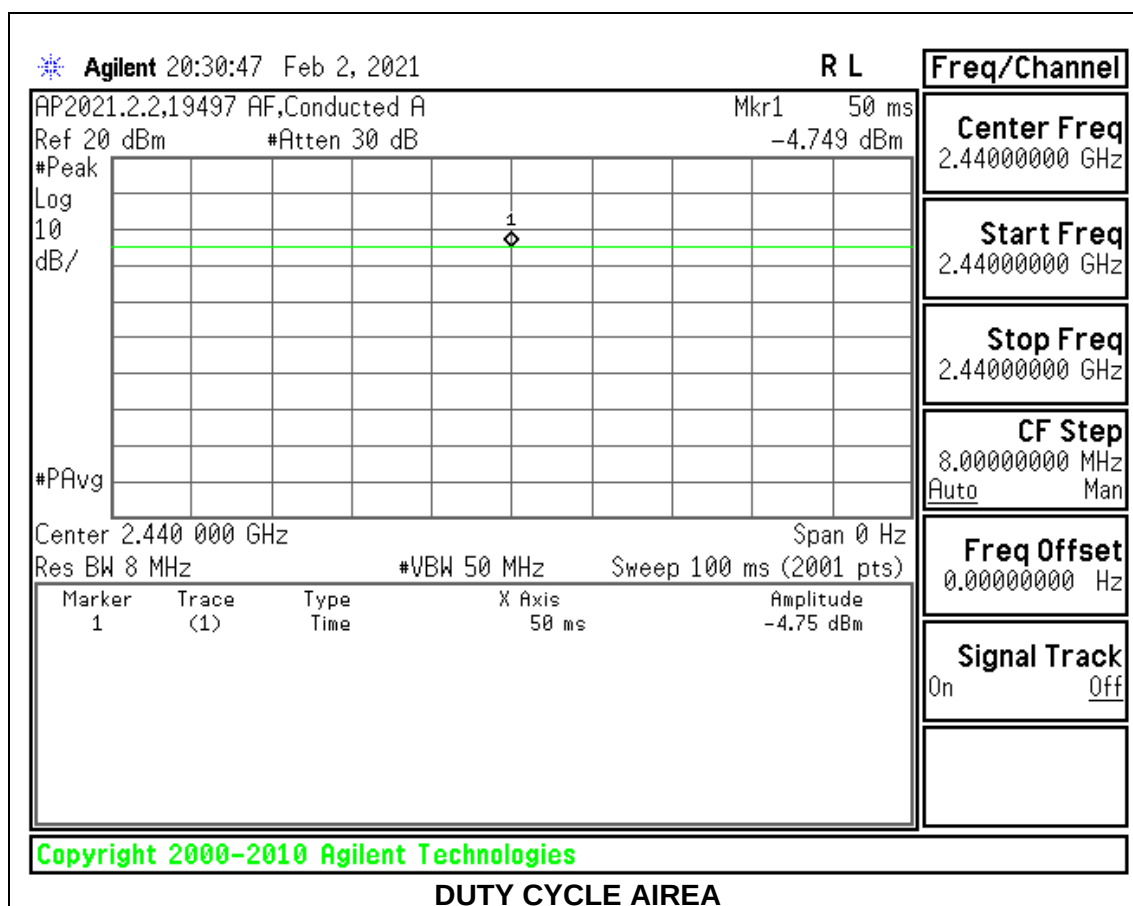
PROCEDURE

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						
AIREA	50.00	50.00	1.00	100.00	0.00	0.010

DUTY CYCLE PLOT



9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.2381
Middle	2440	2.2456
High	2475	2.2505



9.3. 6 dB BANDWIDTH

LIMITS

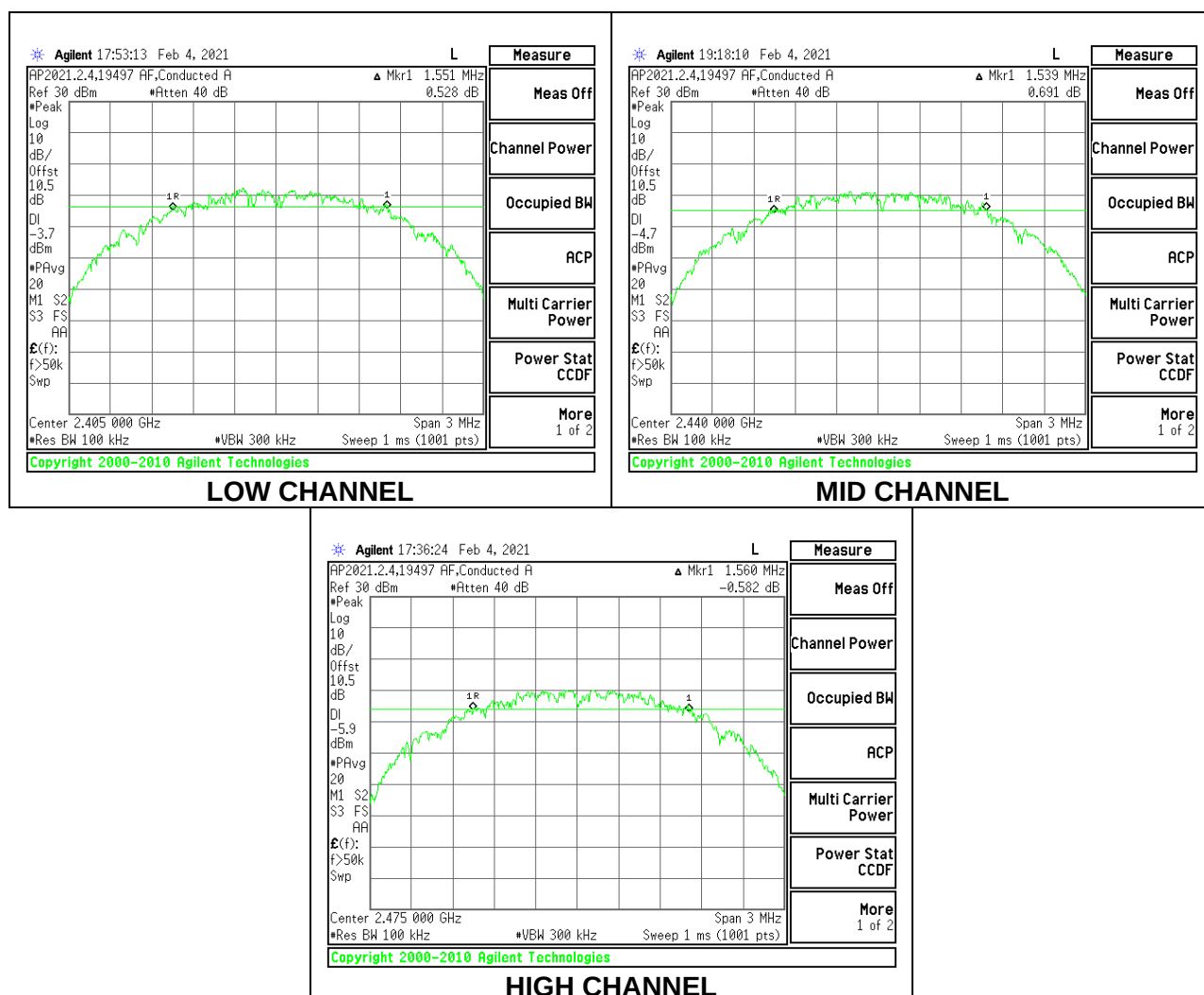
FCC §15.247 (a) (2)

RSS-247 5.2 (a)

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

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.551	0.5
Middle	2440	1.539	0.5
High	2480	1.560	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 was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

Tested By:	19497 AF
Date:	1/29/2021

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2405	5.77	30	-24.230
Middle	2440	5.21	30	-24.790
High	2475	4.46	30	-25.540

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 was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

Tested By:	19497 AF
Date:	1/29/2021

Channel	Frequency (MHz)	AV power (dBm)
Low	2405	5.74
Middle	2440	5.19
High	2475	4.45

9.6. POWER SPECTRAL DENSITY

LIMITS

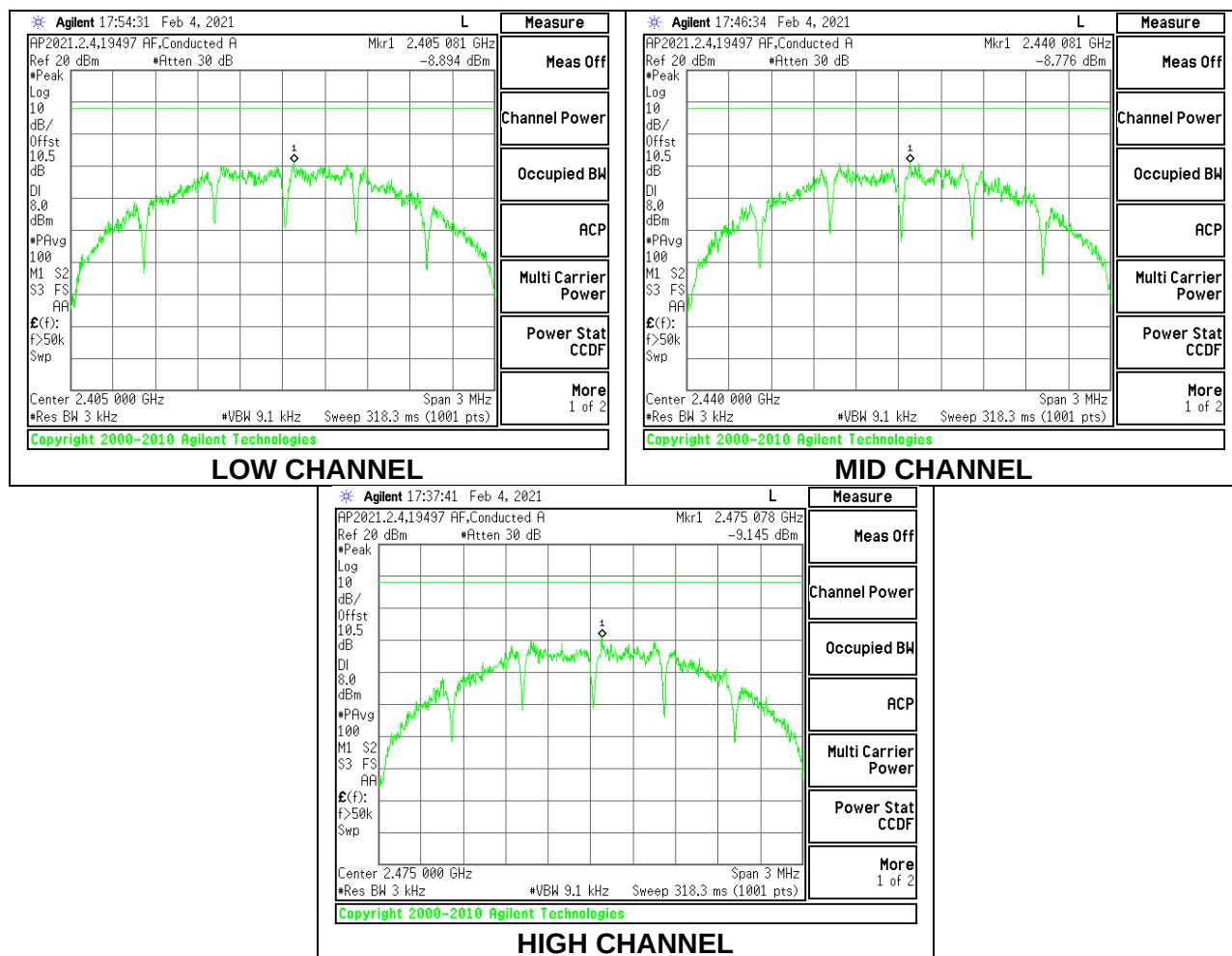
FCC §15.247 (e)

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

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2405	-8.89	8	-16.89
Middle	2440	-8.78	8	-16.78
High	2475	-9.15	8	-17.15



9.7. CONDUCTED SPURIOUS EMISSIONS

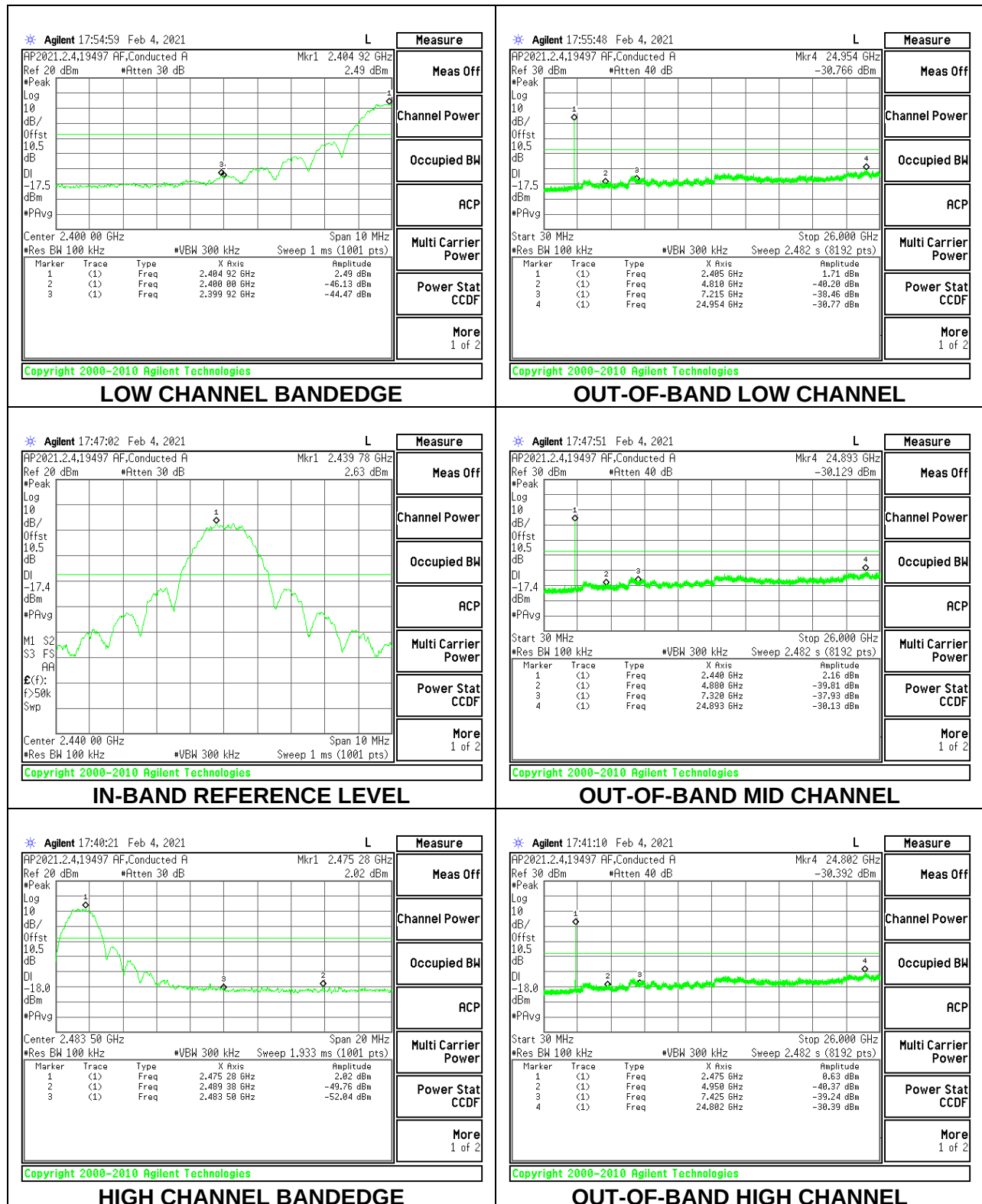
LIMITS

FCC §15.247 (d)

RSS-247 5.5

Output power was measured based on the use of a peak measurement; therefore, spurious emissions are required to be 20 dBc.

RESULTS



10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 kHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power 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.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (Face-On, Face-Off, and ground-parallel); Face-On and Face-Off are the worst orientations, therefore testing was performed on these two orientations only.

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.

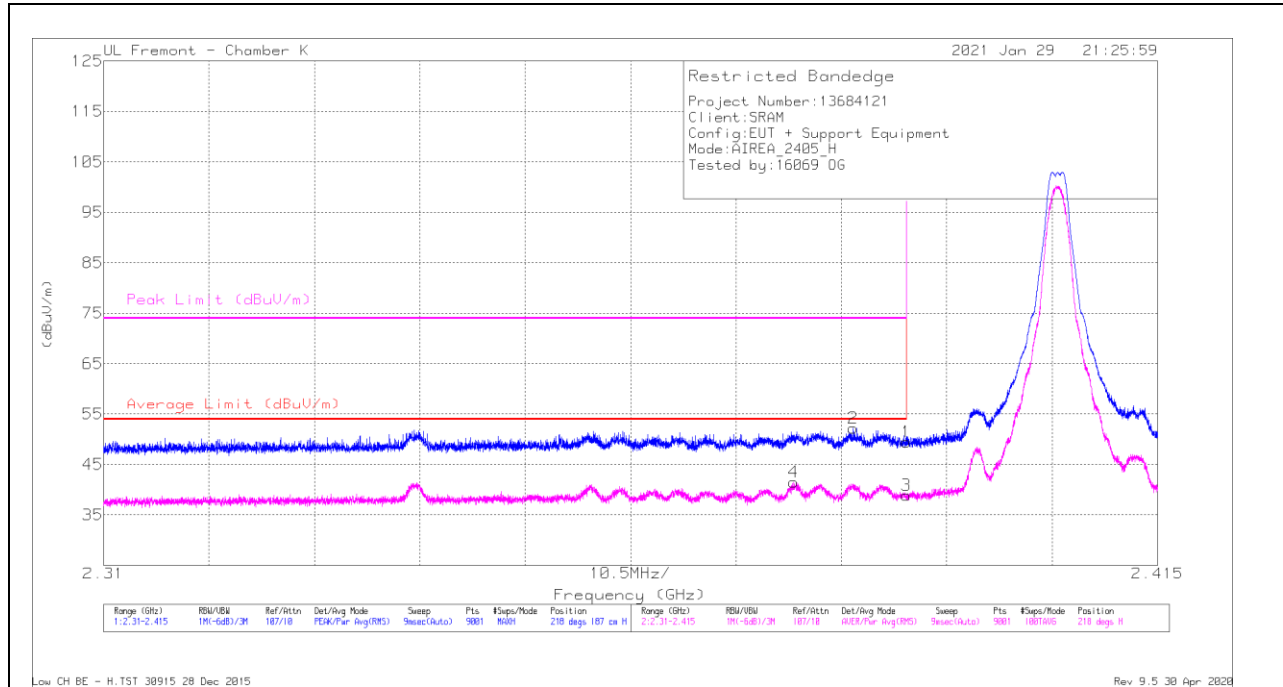
KDB 414788 Open Field Site (OFS) and Chamber Correlation Justification

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

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



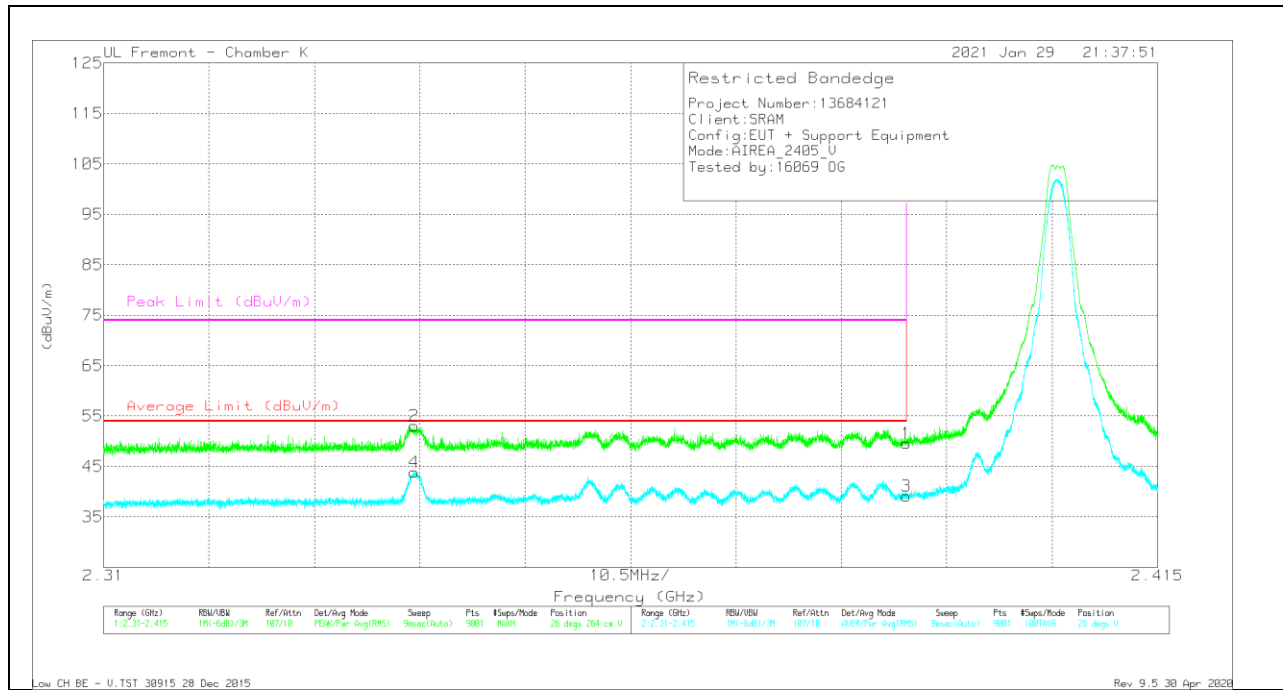
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	52.04	Pk	32.4	-35	49.44	-	-	74	-24.56	218	187	H
2	* 2.3847	54.85	Pk	32.4	-35	52.25	-	-	74	-21.75	218	187	H
3	* 2.38999	41.5	RMS	32.4	-35	38.9	54	-15.1	-	-	218	187	H
4	* 2.37874	44.09	RMS	32.4	-35	41.49	54	-12.51	-	-	218	187	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filt/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	52.21	Pk	32.4	-35	49.61	-	-	74	-24.39	26	264	V
2	* 2.34096	56.03	Pk	32.2	-35.2	53.03	-	-	74	-20.97	26	264	V
3	* 2.38999	41.79	RMS	32.4	-35	39.19	54	-14.81	-	-	26	264	V
4	* 2.34092	46.83	RMS	32.2	-35.2	43.83	54	-10.17	-	-	26	264	V

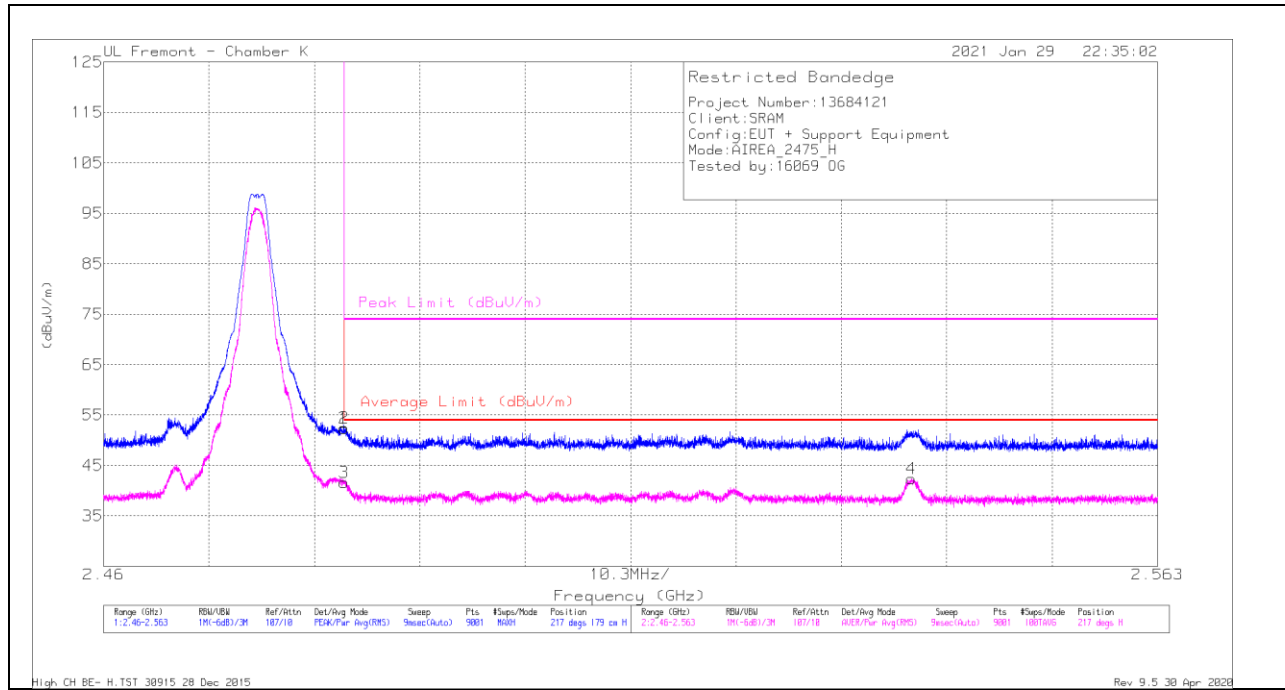
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



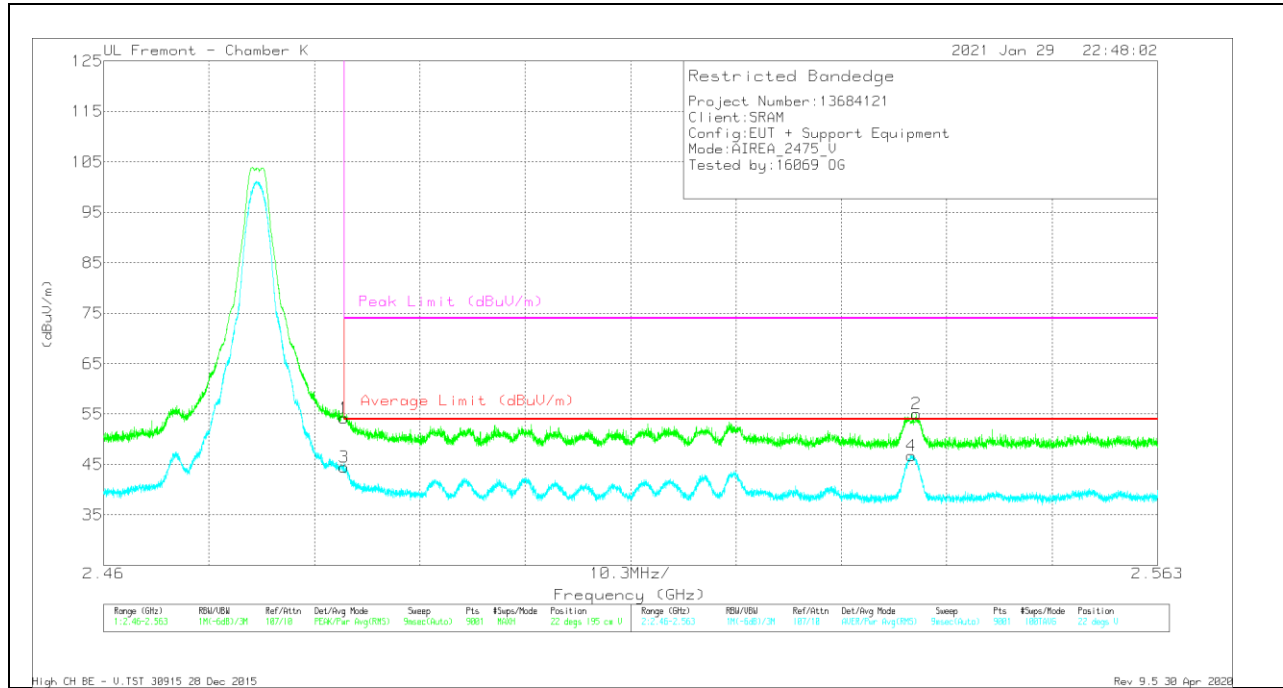
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	54.41	Pk	32.5	-34.6	52.31	-	-	74	-21.69	217	179	H
2	* 2.48352	54.49	Pk	32.5	-34.6	52.39	-	-	74	-21.61	217	179	H
3	* 2.48351	43.77	RMS	32.5	-34.6	41.67	54	-12.33	-	-	217	179	H
4	2.53896	44.22	RMS	32.7	-34.5	42.42	54	-11.58	-	-	217	179	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filt/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	56.24	Pk	32.5	-34.6	54.14	-	-	74	-19.86	22	195	V
2	2.53941	56.88	Pk	32.7	-34.5	55.08	-	-	74	-18.92	22	195	V
3	* 2.48351	46.63	RMS	32.5	-34.6	44.53	54	-9.47	-	-	22	195	V
4	2.53892	48.58	RMS	32.7	-34.5	46.78	54	-7.22	-	-	22	195	V

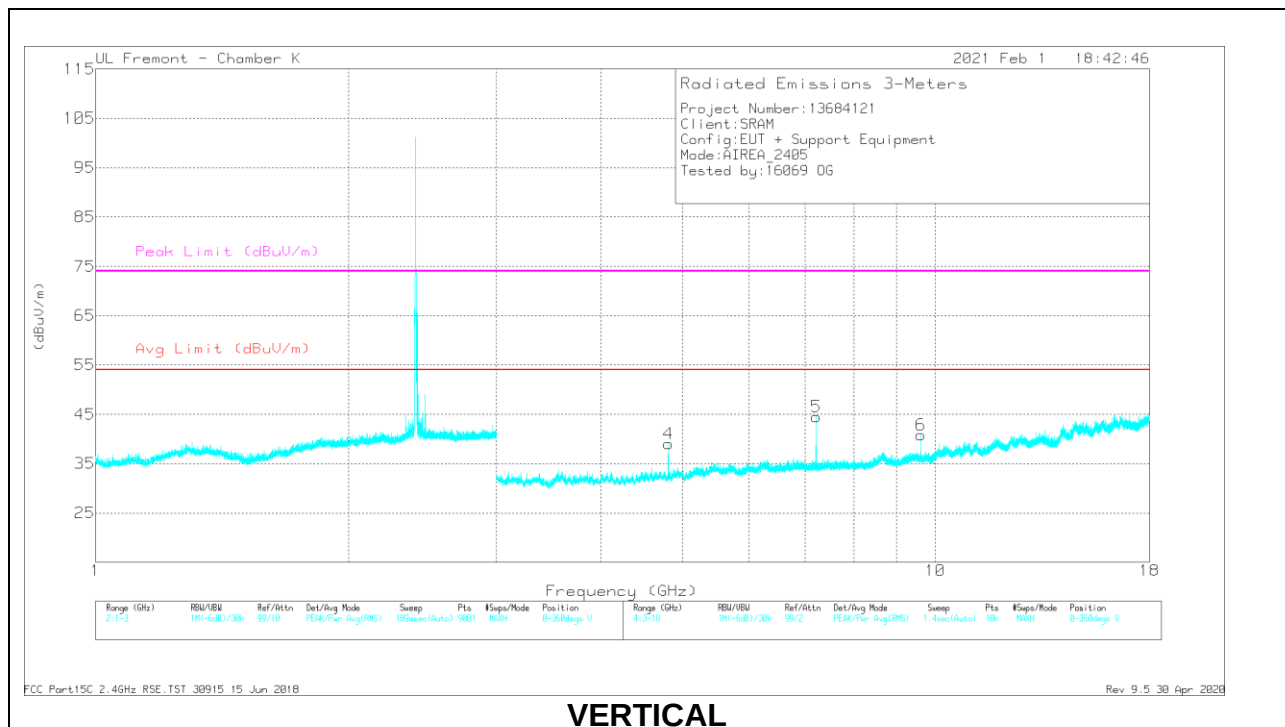
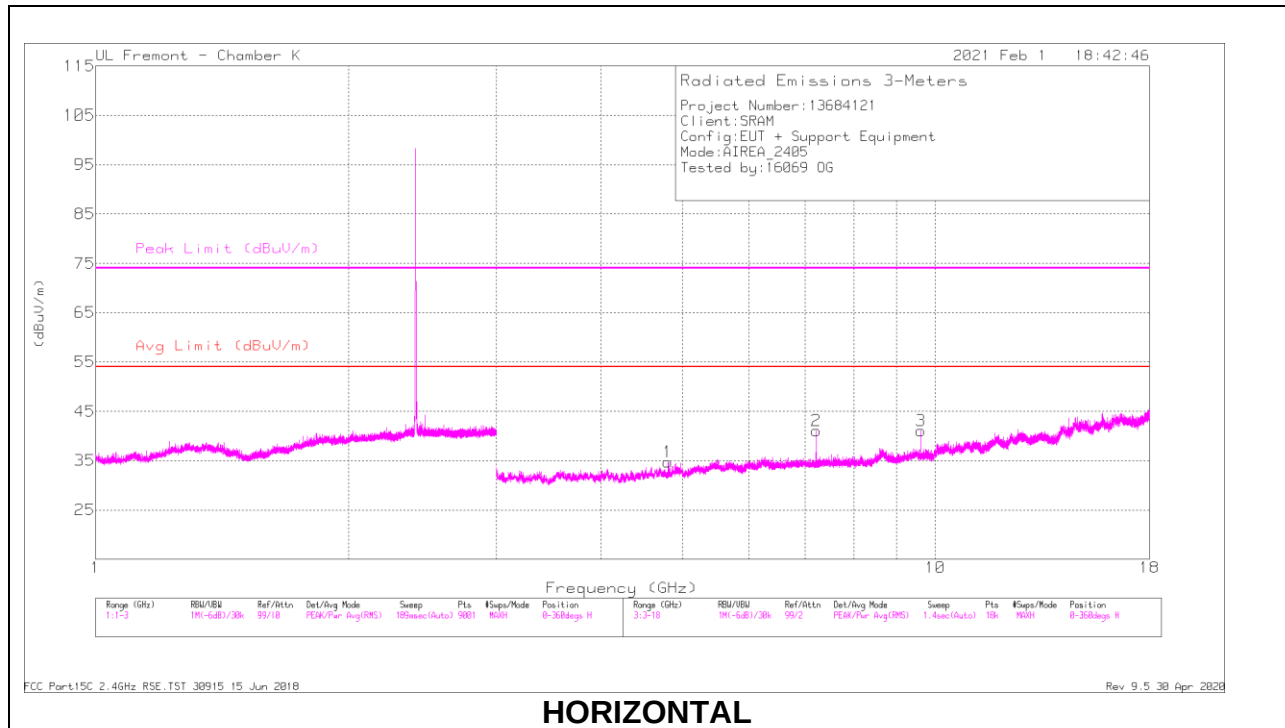
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

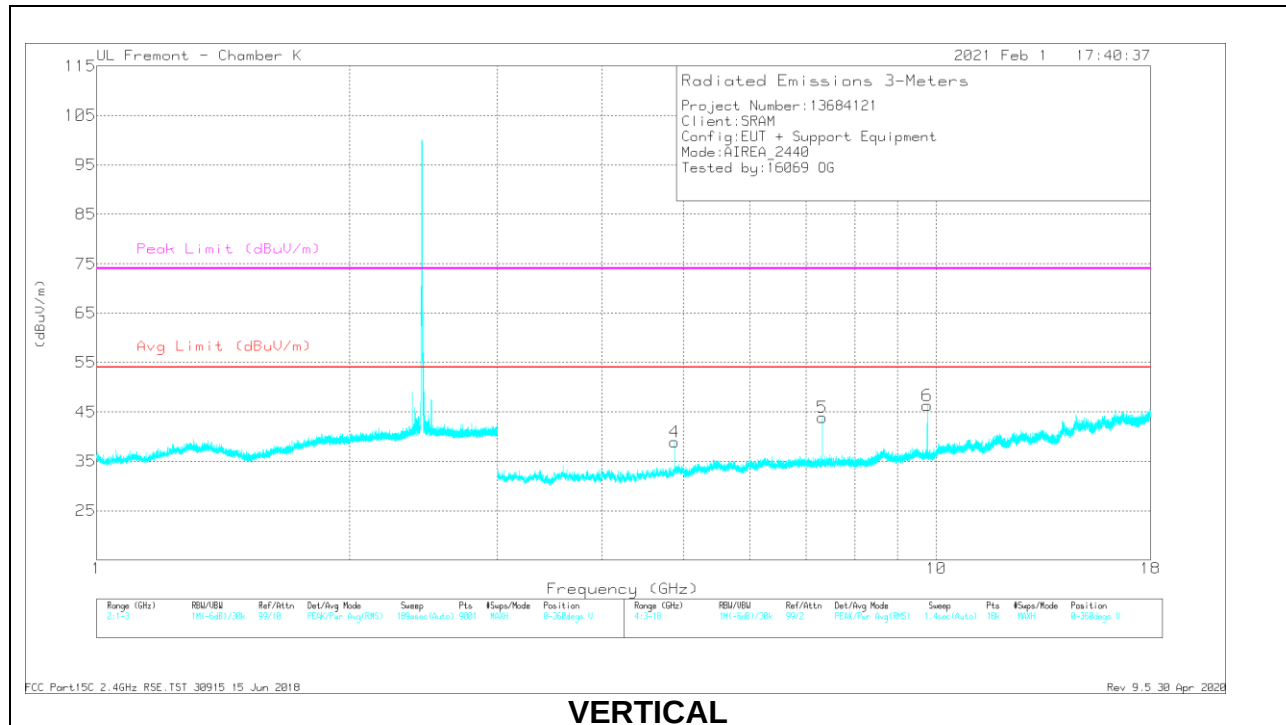
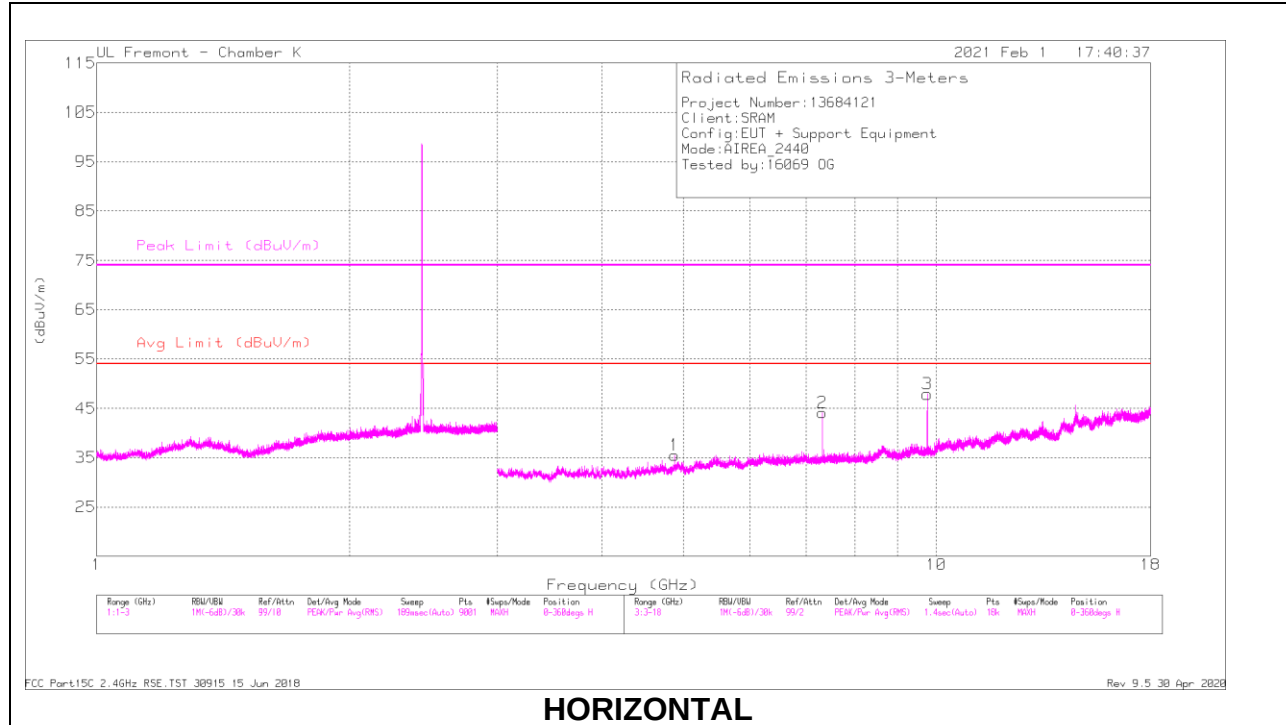
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.80899	49.89	PK2	34.3	-40.7	43.49	-	-	74	-30.51	193	207	H
	* 4.80915	38.65	MAv1	34.3	-40.7	32.25	54	-21.75	-	-	193	207	H
2	7.21661	51.3	PK2	36.1	-38.6	48.8	-	-	-	-	198	109	H
3	9.6218	49.35	PK2	36.8	-36.8	49.35	-	-	-	-	38	207	H
4	* 4.8091	50.25	PK2	34.3	-40.7	43.85	-	-	74	-30.15	342	124	V
	* 4.80913	39.79	MAv1	34.3	-40.7	33.39	54	-20.61	-	-	342	124	V
5	7.21653	54.16	PK2	36.1	-38.6	51.66	-	-	-	-	166	147	V
6	9.61833	48.45	PK2	36.8	-36.8	48.45	-	-	-	-	311	97	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL RESULTS



RADIATED EMISSIONS

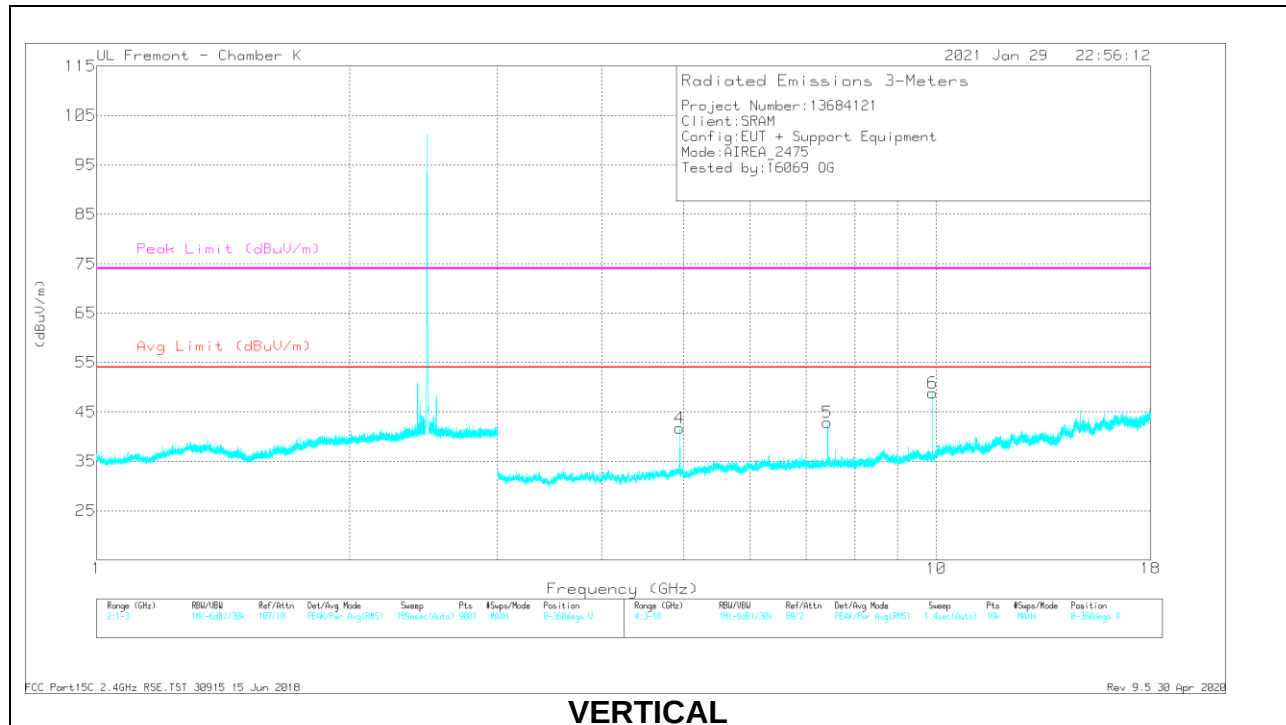
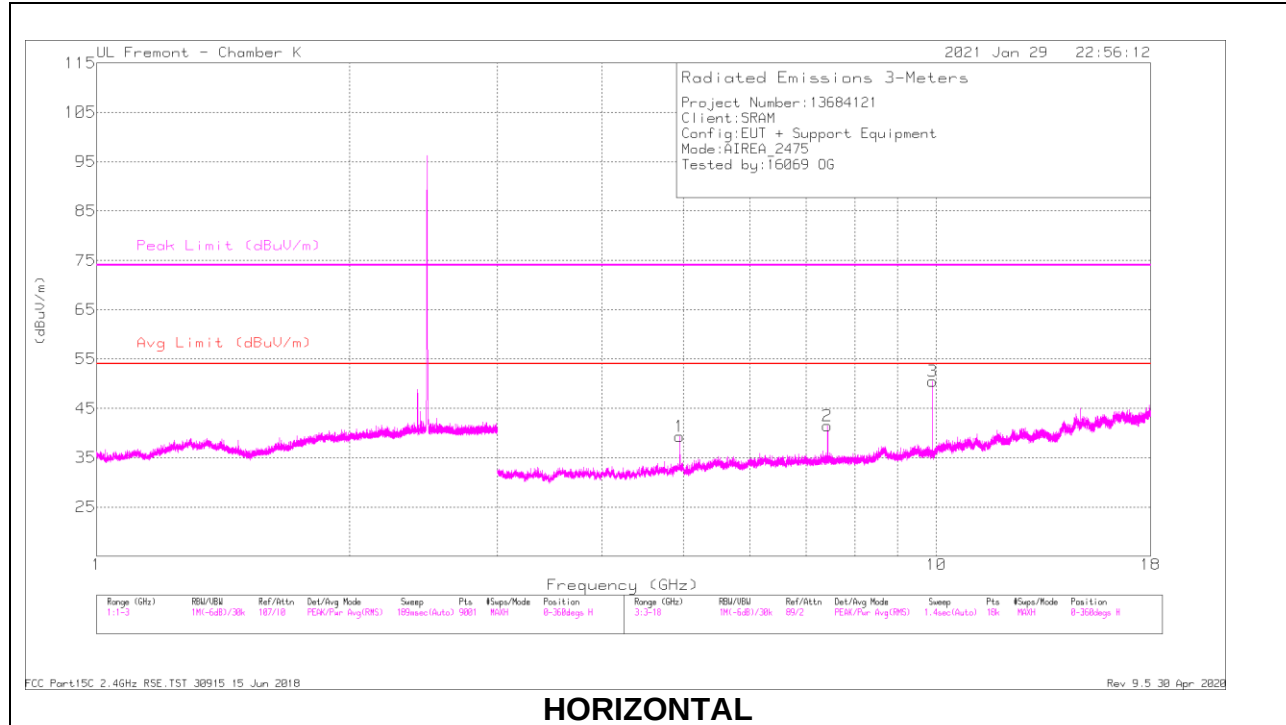
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.87918	50.29	PK2	34.4	-40.6	44.09	-	-	74	-29.91	33	196	H
	* 4.88096	39.68	MAv1	34.4	-40.6	33.48	54	-20.52	-	-	33	196	H
2	* 7.31852	52.47	PK2	36	-38.2	50.27	-	-	74	-23.73	197	135	H
	* 7.31889	44.19	MAv1	36	-38.2	41.99	54	-12.01	-	-	197	135	H
3	9.75803	51.25	PK2	37	-36.7	51.55	-	-	-	-	127	231	H
	* 4.87912	53.1	PK2	34.4	-40.6	46.9	-	-	74	-27.1	32	211	V
4	* 4.87904	43.75	MAv1	34.4	-40.6	37.55	54	-16.45	-	-	32	211	V
	* 7.3215	51.86	PK2	36	-38.2	49.66	-	-	74	-24.34	183	131	V
5	* 7.31908	42.1	MAv1	36	-38.2	39.9	54	-14.1	-	-	183	131	V
	9.75809	51.98	PK2	37	-36.7	52.28	-	-	-	-	25	232	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL RESULTS



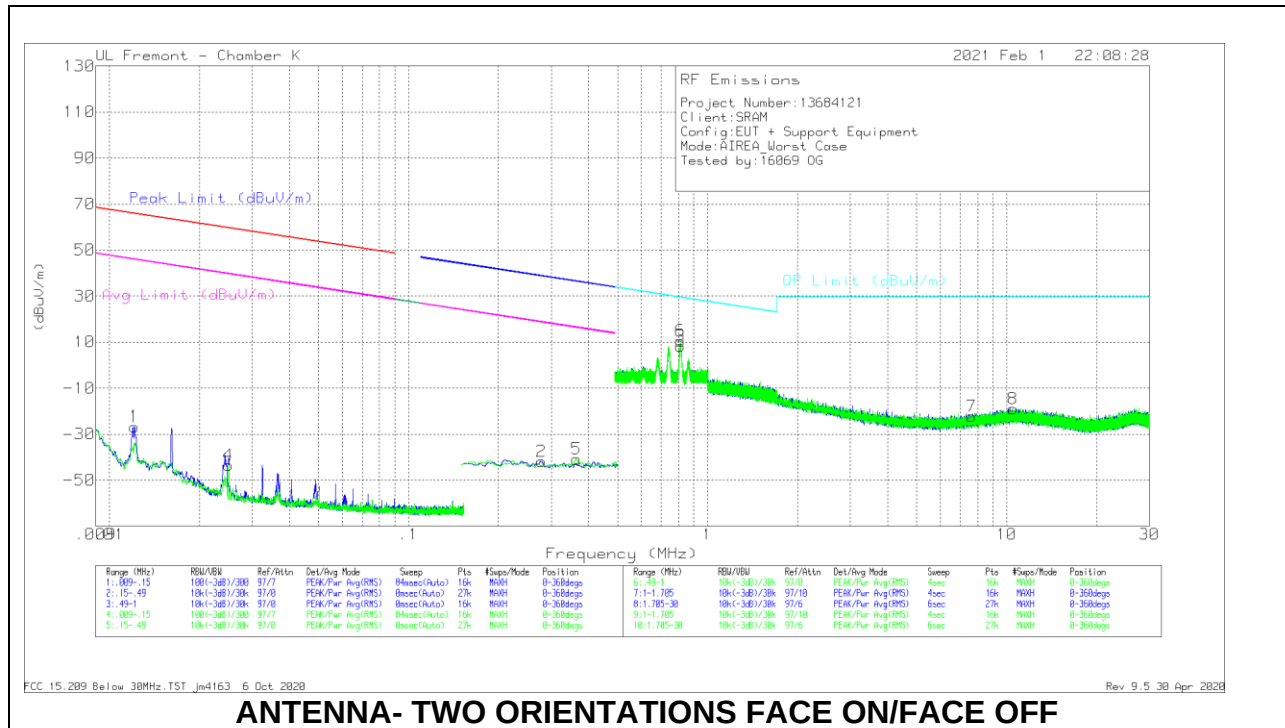
RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.94906	53.15	PK2	34.3	-40.7	0	46.75	-	-	74	-27.25	265	96	H
	* 4.94914	43.99	MAv1	34.3	-40.7	0	37.59	54	-16.41	-	-	265	96	H
2	* 7.42366	50.41	PK2	36.1	-38.1	0	48.41	-	-	74	-25.59	257	98	H
	* 7.42375	41.2	MAv1	36.1	-38.1	0	39.2	54	-14.8	-	-	257	98	H
3	9.90214	57.03	PK2	37.1	-36.3	0	57.83	-	-	-	-	235	97	H
4	* 4.94905	53.18	PK2	34.3	-40.7	0	46.78	-	-	74	-27.22	358	100	V
	* 4.9491	44.46	MAv1	34.3	-40.7	0	38.06	54	-15.94	-	-	358	100	V
5	* 7.42353	50.75	PK2	36.1	-38.1	0	48.75	-	-	74	-25.25	165	99	V
	* 7.42384	41.42	MAv1	36.1	-38.1	0	39.42	54	-14.58	-	-	165	99	V
6	9.90201	52.73	PK2	37.1	-36.3	0	53.53	-	-	-	-	9	125	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

10.3. WORST CASE BELOW 30MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E ACF (dB/m)	Amp/Cbl (dB)	Dist Corr 300m (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Orientation
1	.01215	24.79	Pk	60	-31.5	-80	-26.71	65.89	-92.6	45.89	-72.6	-	-	-	-	0-360	Face on
2	.27808	14.26	Pk	56.2	-32.2	-80	-41.74	-	-	-	-	38.73	-80.47	18.73	-60.47	0-360	Face on
4	.02505	10.2	Pk	58.5	-32.1	-80	-43.4	59.61	-103.01	39.61	-83.01	-	-	-	-	0-360	Face off
5	.36455	15.13	Pk	56.2	-32.2	-80	-40.87	-	-	-	-	36.37	-77.24	16.37	-57.24	0-360	Face off

Pk - Peak detector

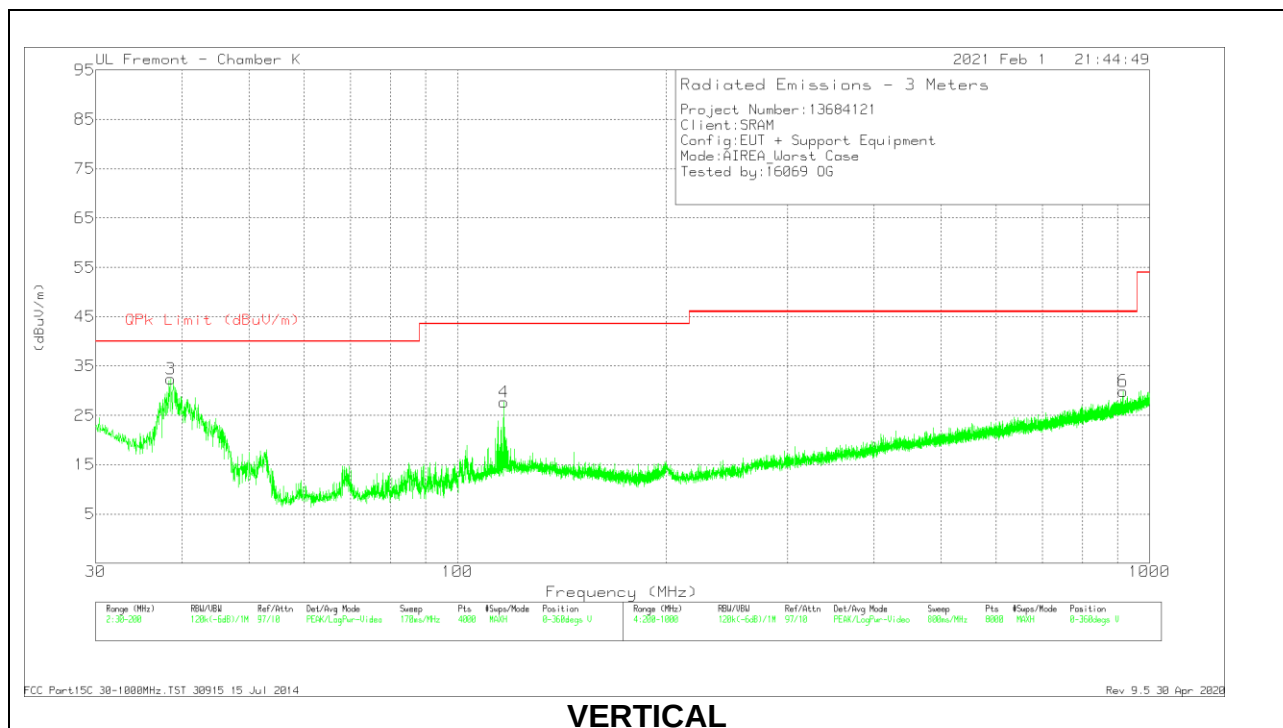
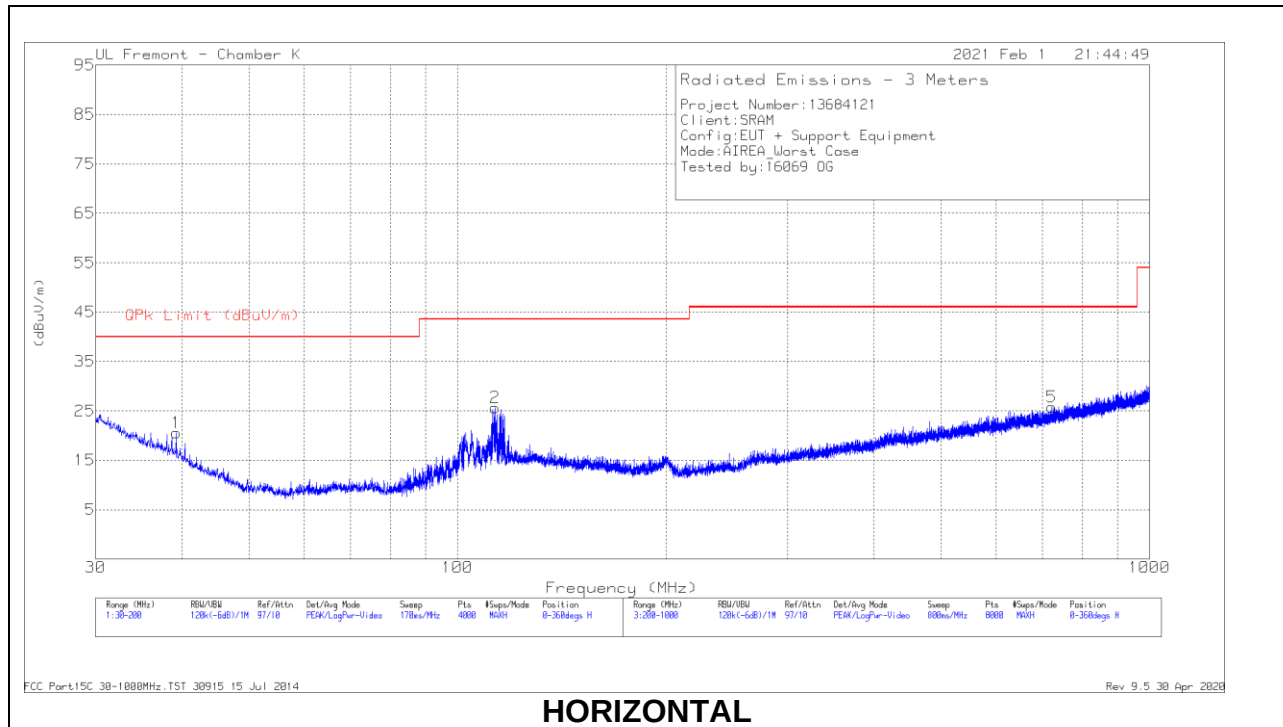
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E ACF (dB/m)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Orientation
3	.81158	24.17	Pk	56.3	-32.2	-40	8.27	29.43	-21.16	0-360	Face on
6	.81141	26.51	Pk	56.3	-32.2	-40	10.61	29.43	-18.82	0-360	Face off
7	7.63249	14.96	Pk	34.6	-31.9	-40	-22.34	29.5	-51.84	0-360	Face on
8	10.48514	18.37	Pk	34.6	-31.8	-40	-18.83	29.5	-48.33	0-360	Face off

Pk - Peak detector

NOTE: The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to $Y - 51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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	AF 81560 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	39.2249	31.23	Pk	20.9	-31.5	20.63	40	-19.37	0-360	401	H
2	* 113.3641	37.39	Pk	19.1	-30.8	25.69	43.52	-17.83	0-360	301	H
3	38.7079	45.67	Pk	21.3	-31.5	35.47	40	-4.53	171	106	V
	38.4792	32.69	Qp	21.5	-31.5	22.69	40	-17.31	171	106	V
4	* 116.8075	38.97	Pk	19.5	-30.8	27.67	43.52	-15.85	0-360	100	V
5	722.3679	27.6	Pk	26.8	-28.6	25.8	46.02	-20.22	0-360	100	H
6	916.4931	28.21	Pk	28.8	-27.1	29.91	46.02	-16.11	0-360	301	V

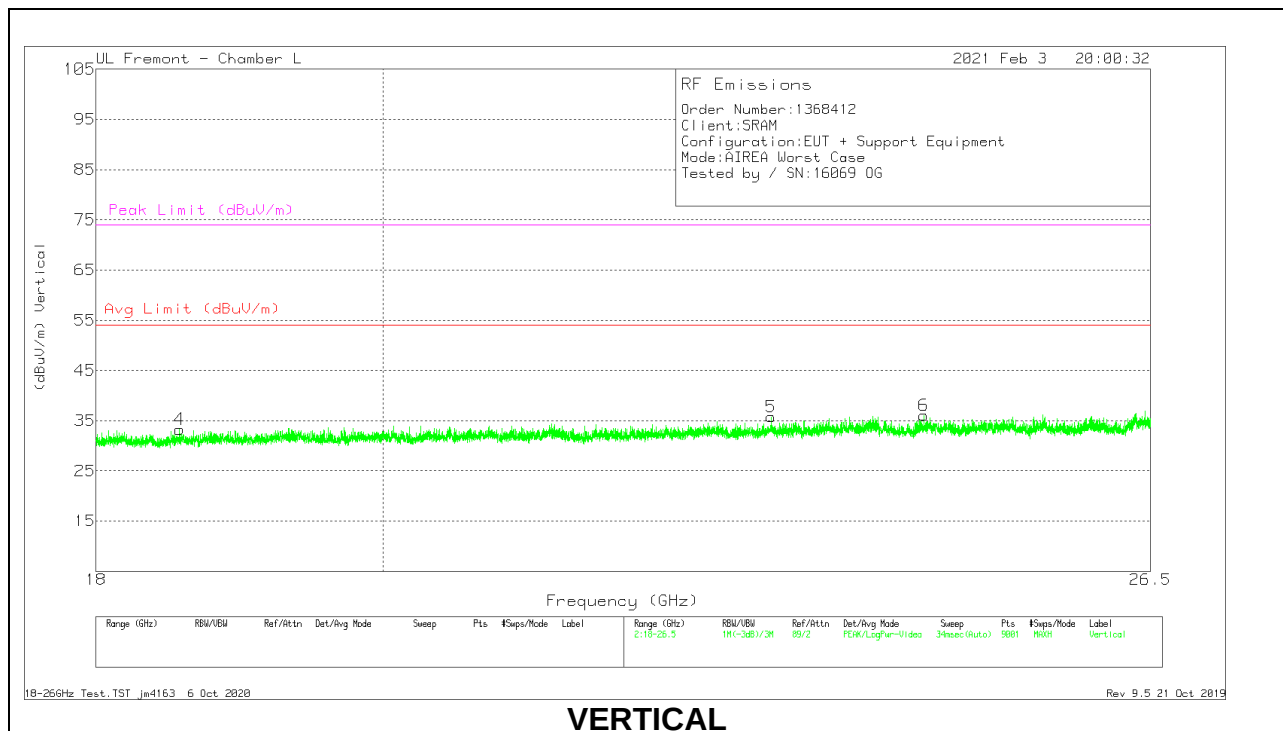
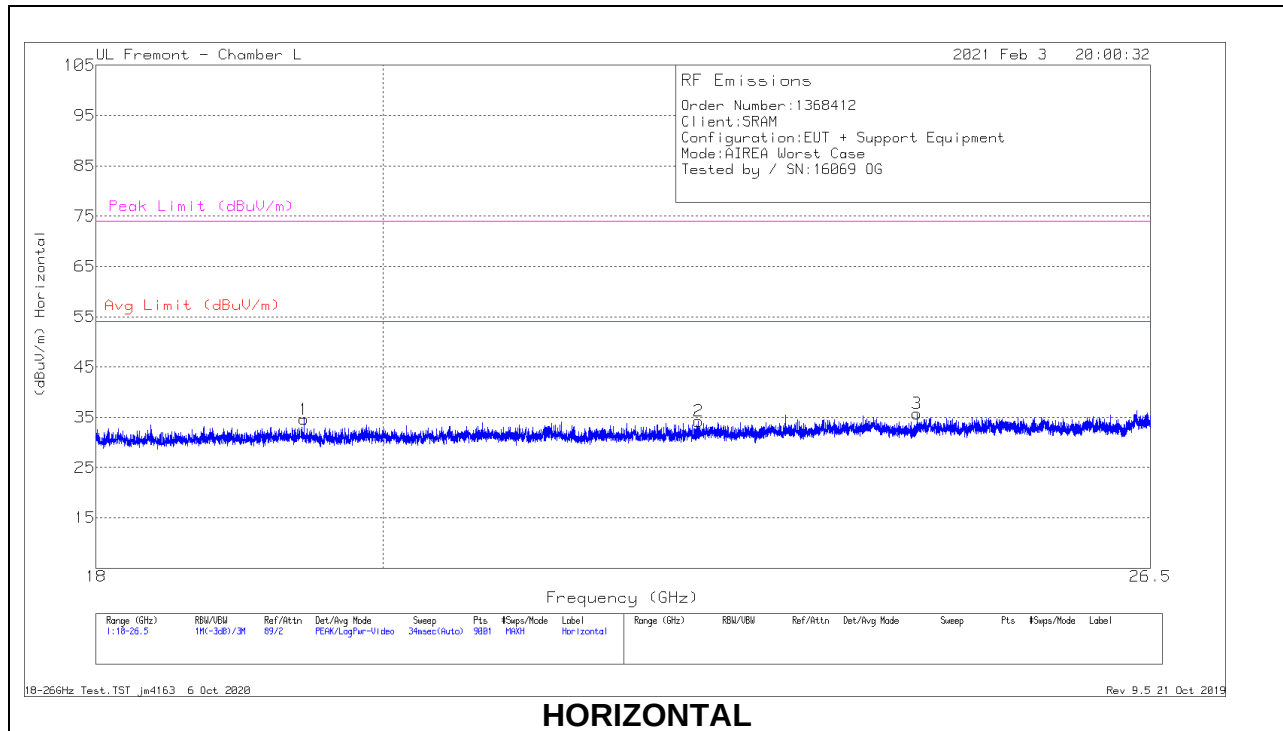
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

10.5. WORST CASE 18-26 GHz

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



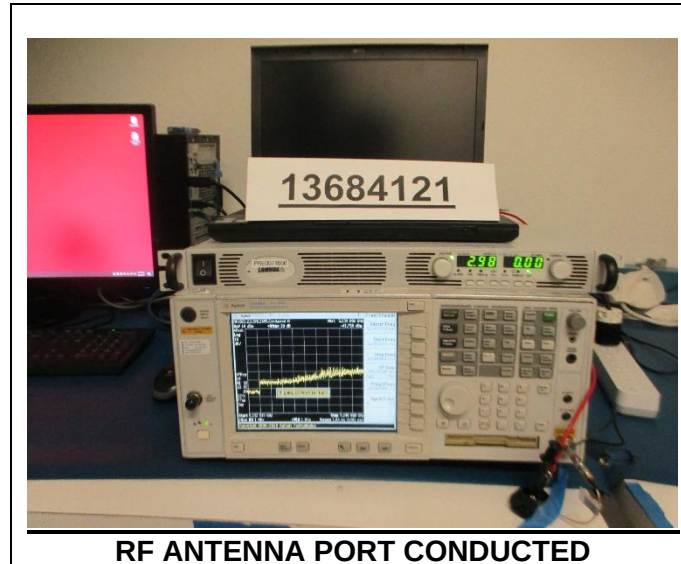
18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.428	68.52	Pk	32.7	-57.1	-9.5	34.62	54	-19.38	74	-39.38
2	22.45116	67.84	Pk	33.6	-57.7	-9.5	34.24	54	-19.76	74	-39.76
3	24.32494	67.5	Pk	34.3	-56.6	-9.5	35.7	54	-18.3	74	-38.3
4	18.56006	69.38	Pk	32.4	-59	-9.5	33.28	54	-20.72	74	-40.72
5	23.0575	68.86	Pk	33.8	-57.4	-9.5	35.76	54	-18.24	74	-38.24
6	24.38633	67.76	Pk	34.3	-56.5	-9.5	36.06	54	-17.94	74	-37.94

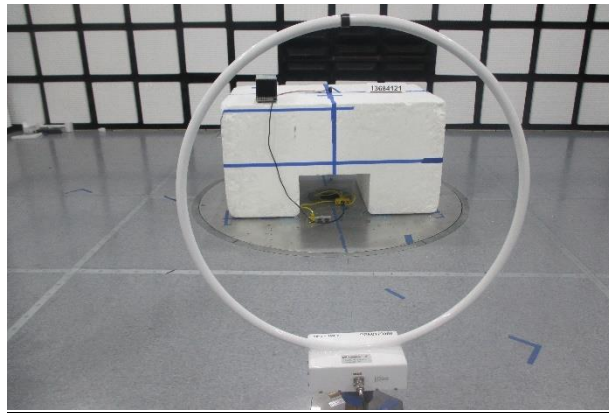
Pk - Peak detector

11. SETUP PHOTOS

ANTENNA PORT CONDUCTED SETUP



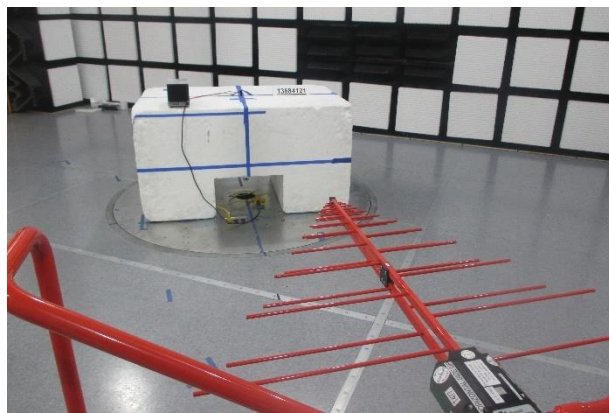
RADIATED RF MEASUREMENT SETUP



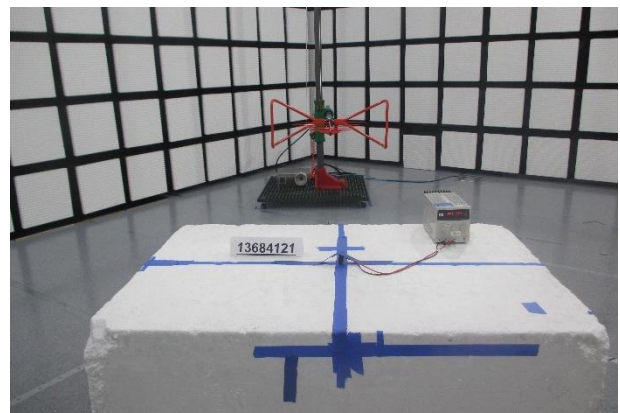
BELOW 30MHz (FRONT)



BELOW 30MHz (BACK)



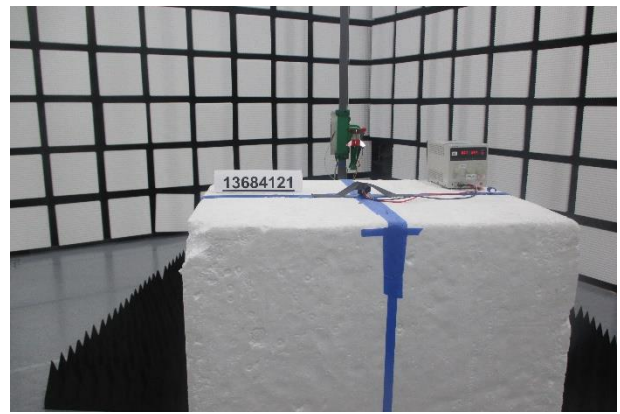
BELOW 1GHz (FRONT)



BELOW 1GHz (BACK)

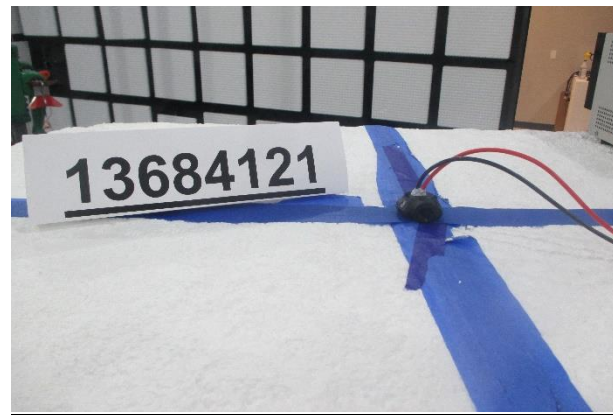


ABOVE 1GHz (FRONT)



ABOVE 1GHz (BACK)

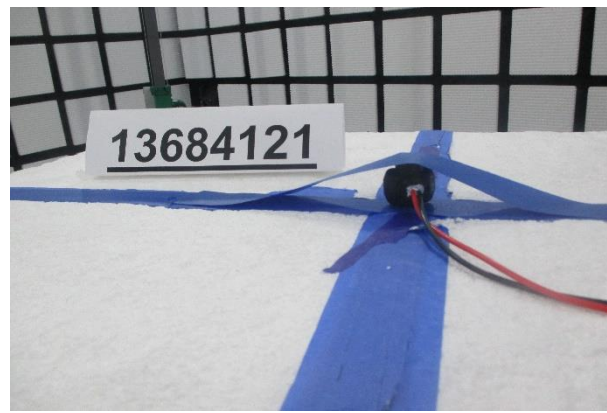
ORIENTATIONS



X-ORIENTATION



Y-ORIENTATION



Z-ORIENTATION

END OF TEST REPORT