



# **TEST REPORT**

**Report Number. :** 13117430-E3V4

**Applicant :** SRAM LLC  
1000 W Fulton Market 4<sup>th</sup> Floor  
Chicago, IL 60607, United States

**Model :** 13000

**FCC ID :** C90-FSMB2

**ISED :** 10161A-FSMB2

**EUT Description :** Front Suspension with BLE, AIREA and ANT+ Radios

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
ISED RSS-210 ISSUE 9  
ISED RSS-GEN Issue 5

**Date Of Issue:**

April 14, 2020

**Prepared by:**

UL Verification Services Inc.  
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	3/18/2020	Initial Issue	
V2	4/8/2020	Updated Section 2	K.Kedida
V3	4/13/2020	Updated Section 9.3	K.Kedida
V4	4/14/2020	Updated Section 9.1	K.Kedida

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SRAM LLC  
1000 W Fulton Market 4<sup>th</sup> Floor  
Chicago, IL 60607, United States

**EUT DESCRIPTION:** Front Suspension with BLE, AIREA and ANT+ Radios

**MODEL:** 13000

**SERIAL NUMBER:** Radiated: 1724010107  
Conducted: 1724010103

**DATE TESTED:** FEBRUARY 11 – 24, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-210 Issue 9	Complies
ISED RSS-GEN Issue 5	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 NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For  
UL Verification Services Inc. By:

Prepared By:



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



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Glenn Escano  
Test Engineer  
Consumer Technology Division  
UL Verification Services Inc.

Reviewed By:



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

## 2. 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 414788 D01 Radiated Test Site v01r01, ISED RSS-GEN Issue 5 and ISED RSS-210 Issue 9.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D	<input type="checkbox"/> Chamber I
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E	<input checked="" type="checkbox"/> Chamber J
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F	<input checked="" type="checkbox"/> Chamber K
	<input type="checkbox"/> Chamber G	<input type="checkbox"/> Chamber L
	<input type="checkbox"/> Chamber H	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

## 4. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 4.1. METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. 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.)

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U <sub>Lab</sub>
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

### 4.4. SAMPLE CALCULATION

#### **RADIATED EMISSIONS**

Where relevant, the following sample calculation is provided:

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

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

#### **MAINS CONDUCTED EMISSIONS**

Where relevant, the following sample calculation is provided:

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

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

## 5. EQUIPMENT UNDER TEST

### 5.1. EUT DESCRIPTION

The EUT is a Front Suspension with BLE, AIREA and ANT+ Radios, powered by 7.4v, 2.2wh Li-Ion battery.

### 5.2. MAXIMUM FUNDAMENTAL FIELD STRENGTH

The transmitter has a maximum peak fundamental field strength as follows:

Frequency Range (MHz)	Mode	Peak E-field Strength (dBuV/m)	Avg E-field Strength (dBuV/m)	Distance (m)
2405-2475	ANT +	103.76	44.12	3.00

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a ceramic chip antenna, with a maximum gain of 1.5 dBi.

### 5.4. 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 3.3.0

### 5.5. 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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.



## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	Lenovo	T450s	PC044FTD
AC/DC Adapter	Lenovo	ADLX45NCC2A	N/A
USB Dongle	Segger	E204460	680435024
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	0.5	EUT to Analyzer

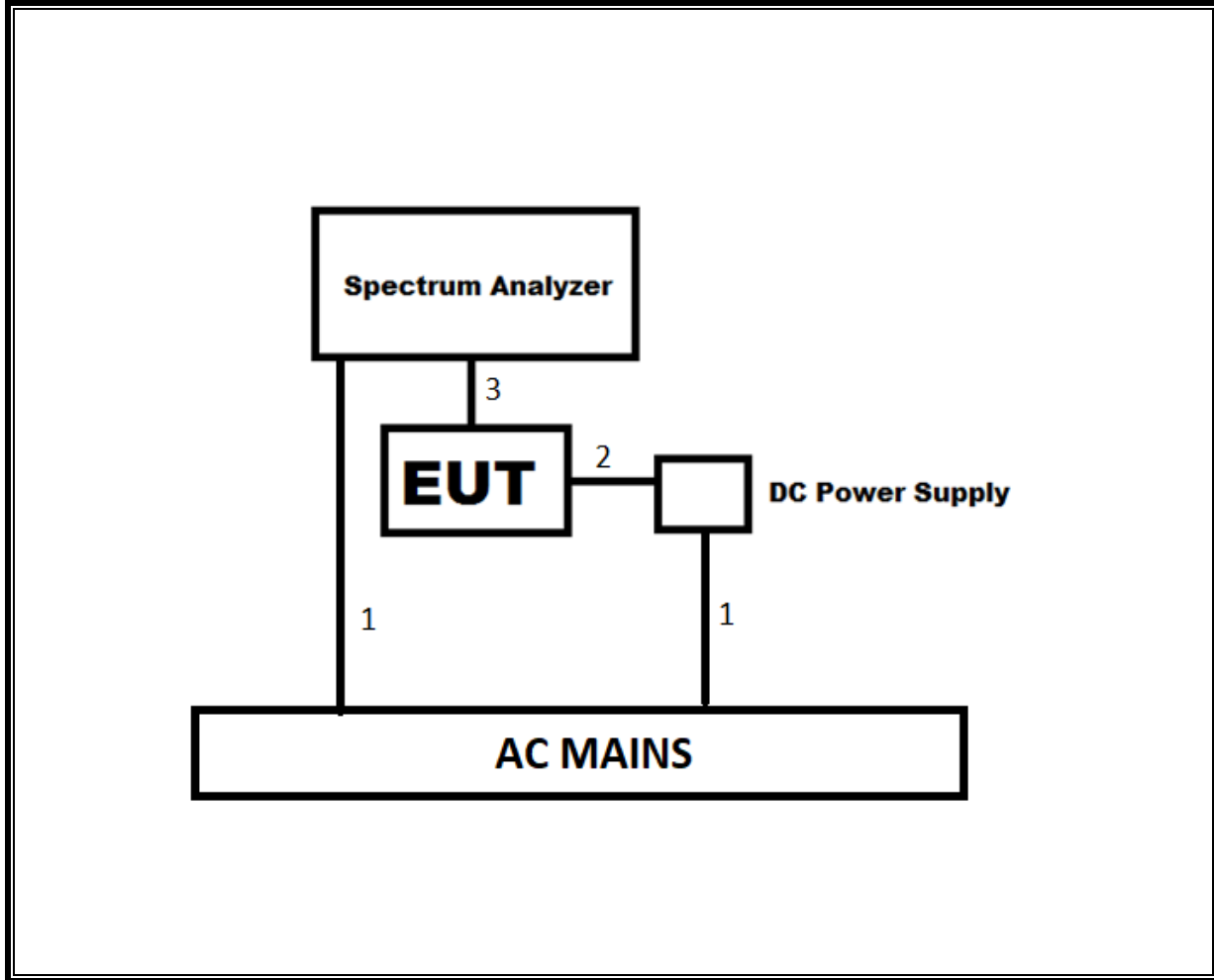
### I/O CABLES (RADIATED EMISSIONS)

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

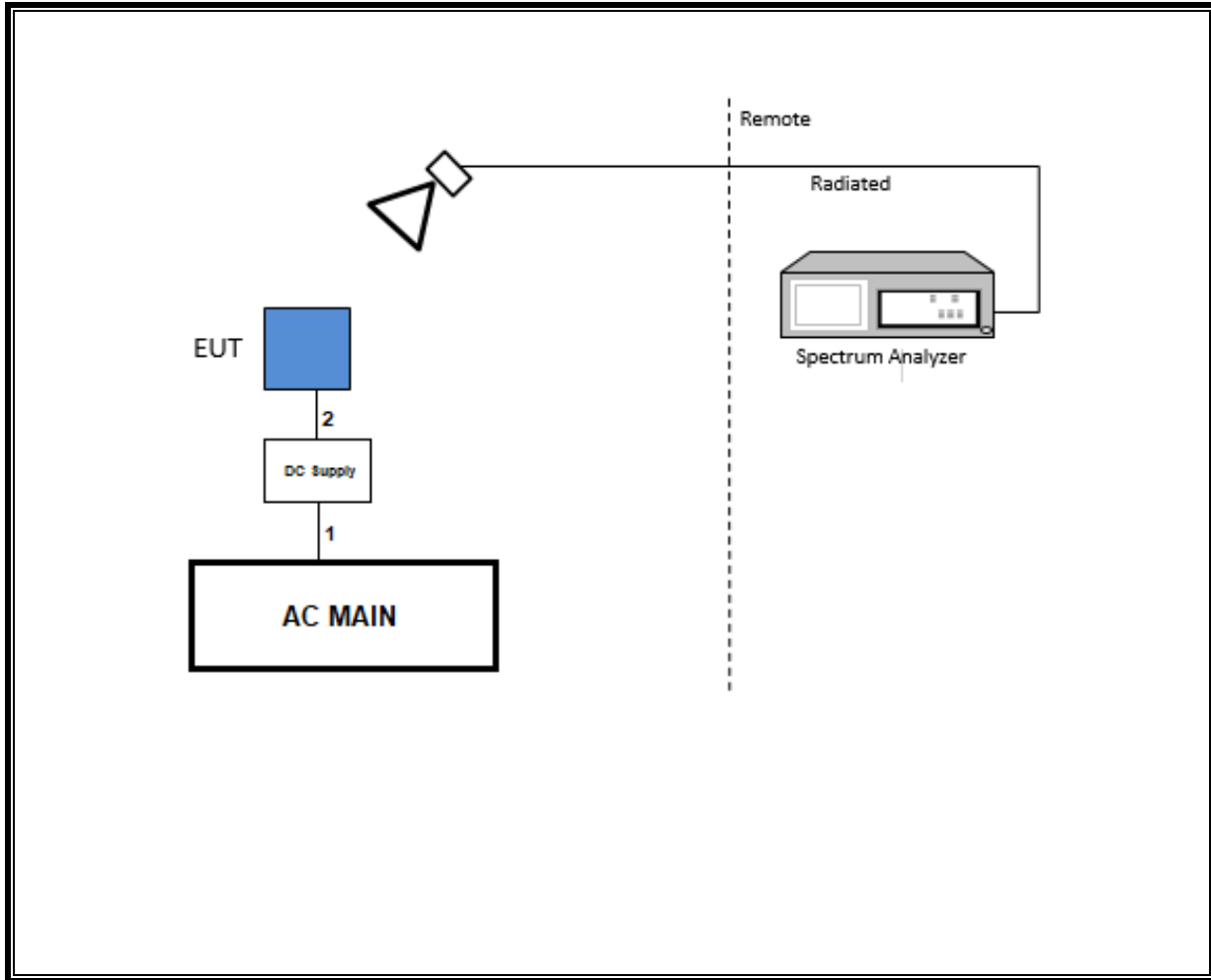
### TEST SETUP

For the purposes of testing, the EUT was powered by a 7.4V DC Power supply. The EUT is normally powered by a Li-Ion battery.

**SETUP DIAGRAM FOR CONDUCTED TESTS**



**SETUP DIAGRAM FOR RADIATED TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

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

<b>TEST EQUIPMENT LIST</b>				
<b>Description</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Asset</b>	<b>Cal Due</b>
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	05/16/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T899	08/23/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	06/01/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	05/07/2020
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	05/28/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020
Antenna	ETS-Lindgren	3117	EMC4294	06/14/2020
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1569	01/30/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T146	01/29/2021
Antenna, Active Loop 9kHz - 30MHz	COM-POWER CORP	AL-130R	PRE0165308	04/11/2020
Antenna Horn, 18 to 26.5GHz	ARA	MWH-1826/B	T447	08/13/2020
Pre-Amp 1-26.5 GHz	AMPLICAL	AMP18G26.5-60	PRE0181238	05/01/2020
<b>UL AUTOMATION SOFTWARE</b>				
Radiated Software	UL	UL EMC	Ver 9.5, Oct 21, 2019	
Antenna Port Software	UL	UL RF	Ver 2020.1.8	

### **NOTES:**

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

## 7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

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

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

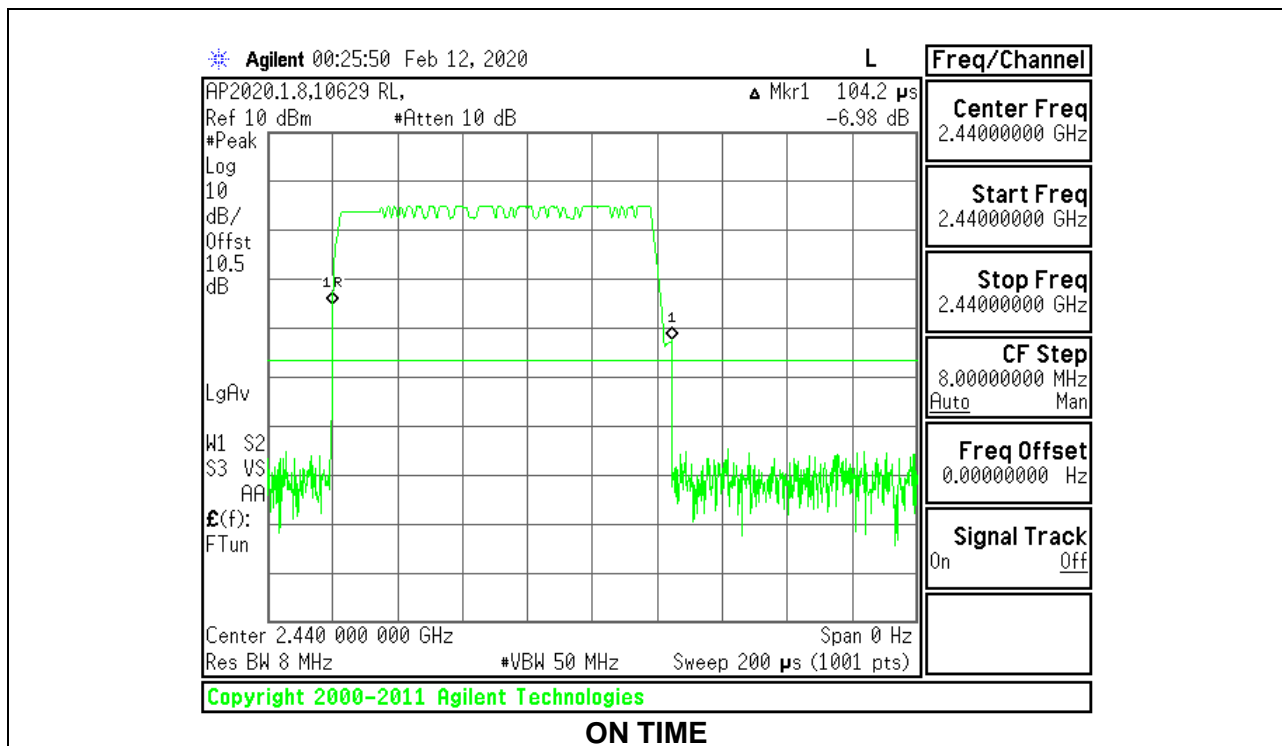
#### ON TIME AND DUTY CYCLE RESULTS

#### Note:

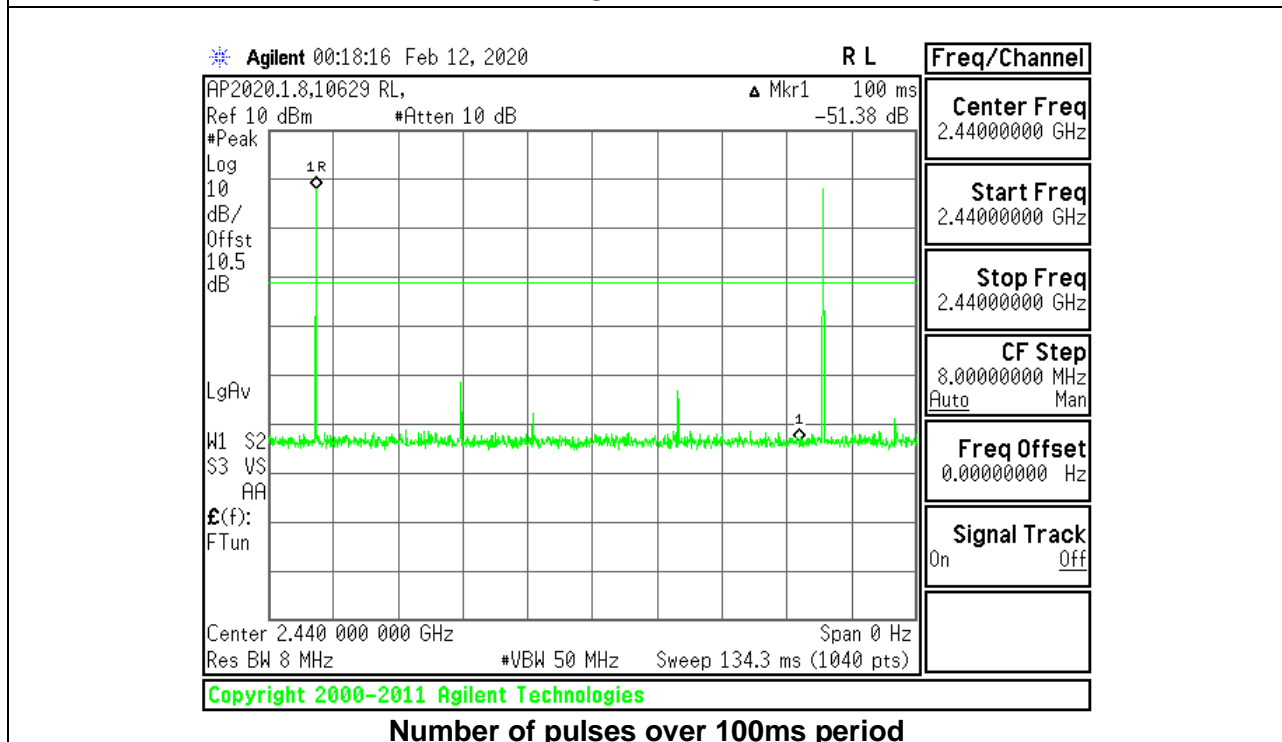
ON Time (over 100ms period) = ON Time x No. of pulses over 100msec period.

Mode	ON Time (msec)	Number of Pulses over 100msec	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor for Average Measurements (dB)	1/B Minimum VBW (kHz)
ANT+	0.1042	1	0.1042	100.00	0.00104	0.104	-59.64	9.597

### DUTY CYCLE PLOTS



**ON TIME**



**Number of pulses over 100ms period**

## 8.2. 99% BANDWIDTH

### LIMITS

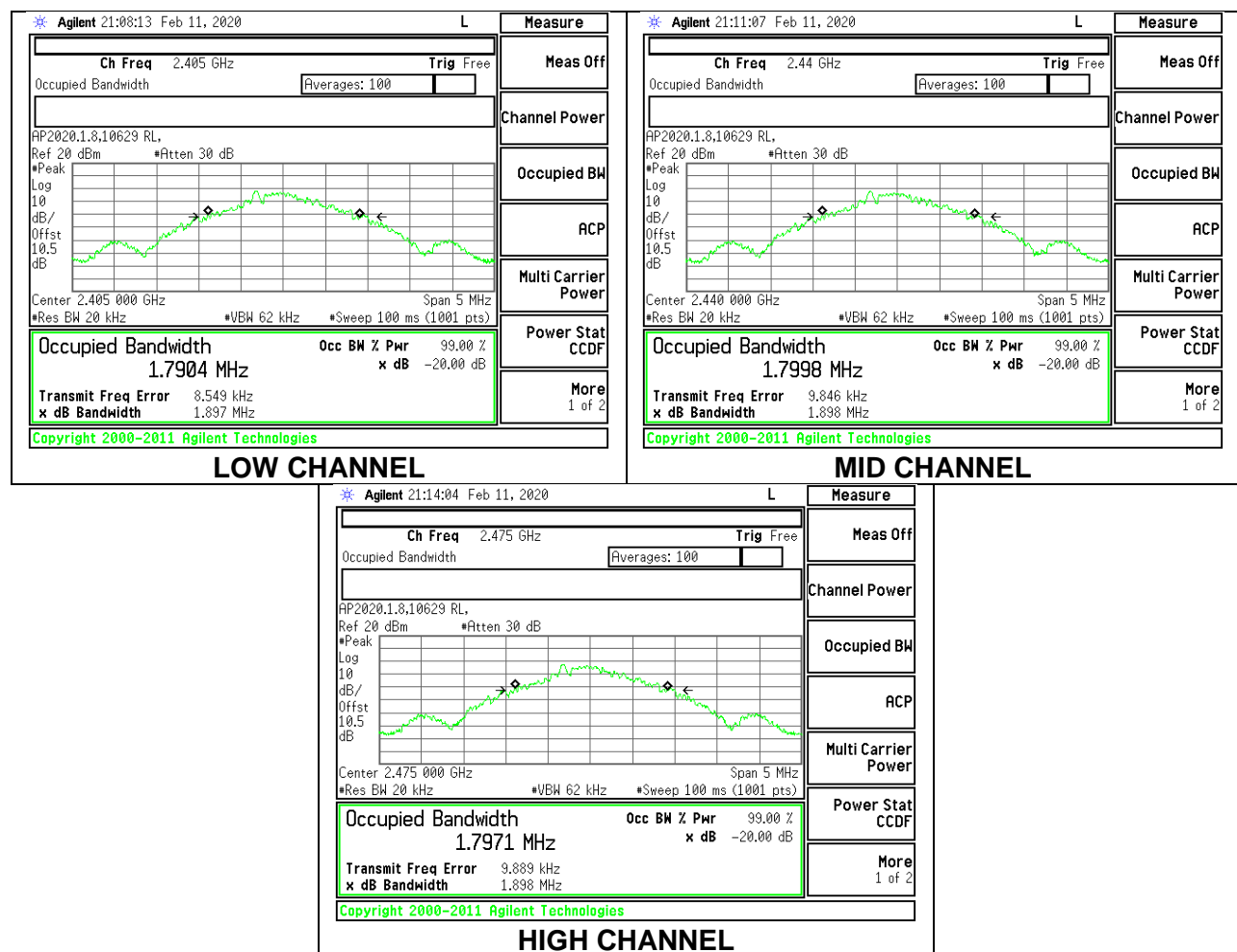
None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	1.7904
Mid	2440	1.7998
High	2475	1.7971





### 8.3. 20dB BANDWIDTH

#### LIMITS

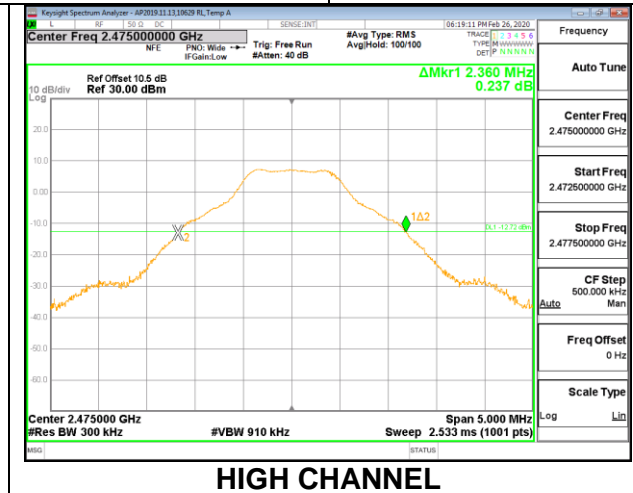
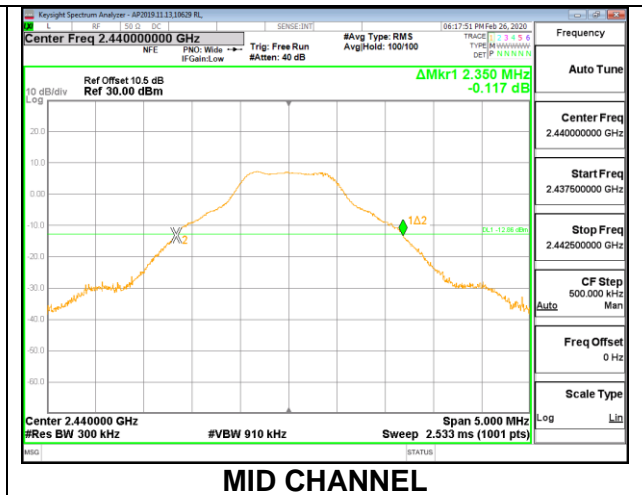
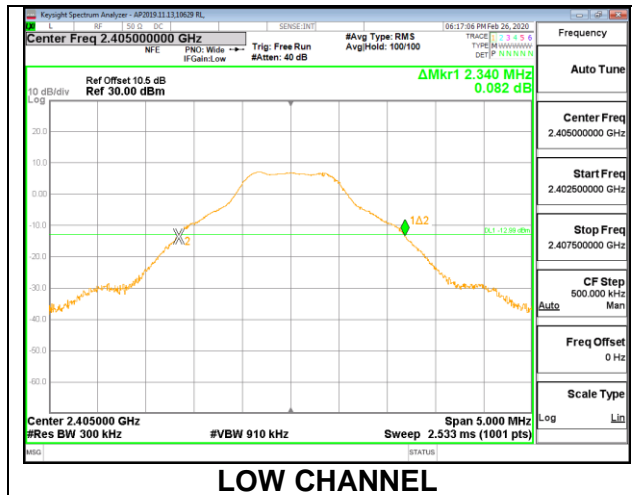
None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 5% of the 20 dB bandwidth. The VBW is set to approximately three times RBW. The sweep time is coupled

#### RESULTS

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Frequency Edge (MHz)	Limit (MHz)	Margin (MHz)
Low	2405	2.340	2403.8300	2400	-3.83
Mid	2440	2.350	N/A	N/A	N/A
High	2475	2.360	2476.1800	2483.5	-7.32



## 9. RADIATED TEST RESULTS

### LIMITS

FCC §15.249

FCC §15.205 and §15.209

ISED RSS-GEN, Section 8.9 and 8.10

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz .....	50	500
2400–2483.5 MHz .....	50	500
5725–5875 MHz .....	50	500
24.0–24.25 GHz .....	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(e) As shown in Sec. 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

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. Peak detection is used unless otherwise noted as quasi-peak.

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 1 MHz resolution bandwidth with 1/T (10 kHz) video bandwidth with peak detector 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 (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

### **KDB 414788 OFS and Chamber Correlation Justification**

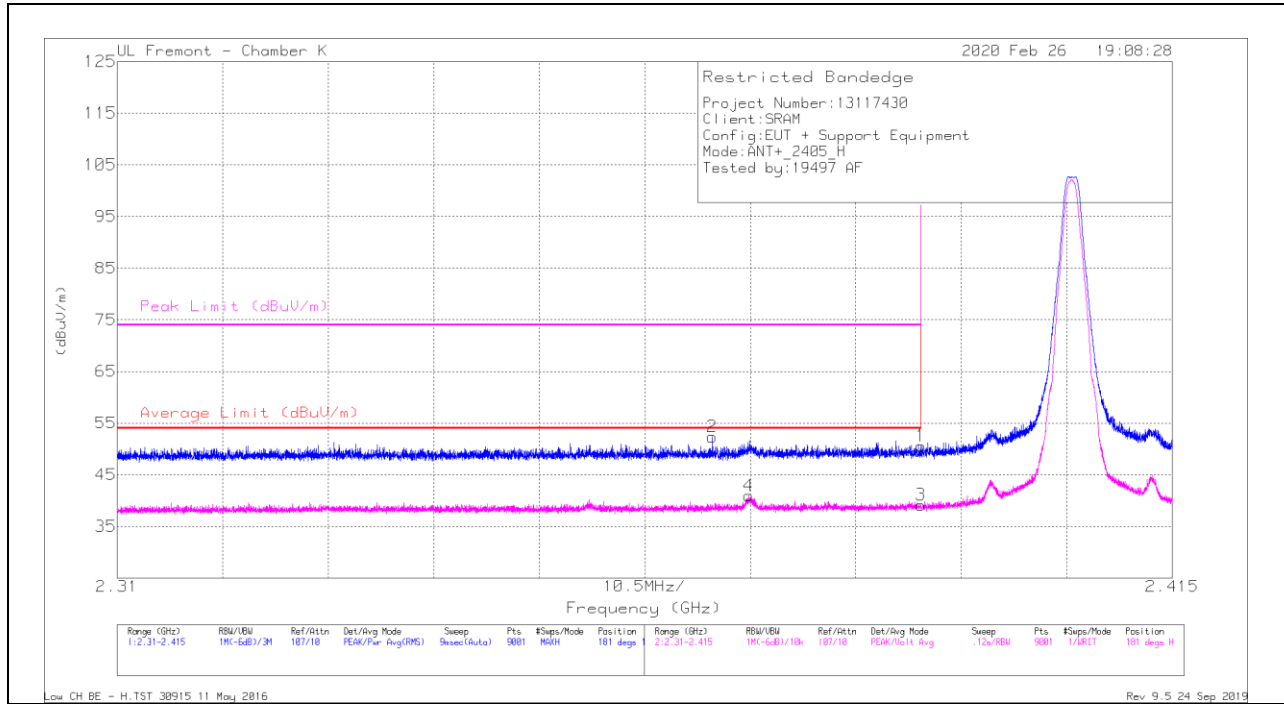
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

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

# 9.1. TRANSMITTER ABOVE 1 GHz

## BANDEDGE (LOW CHANNEL)

### HORIZONTAL RESULT



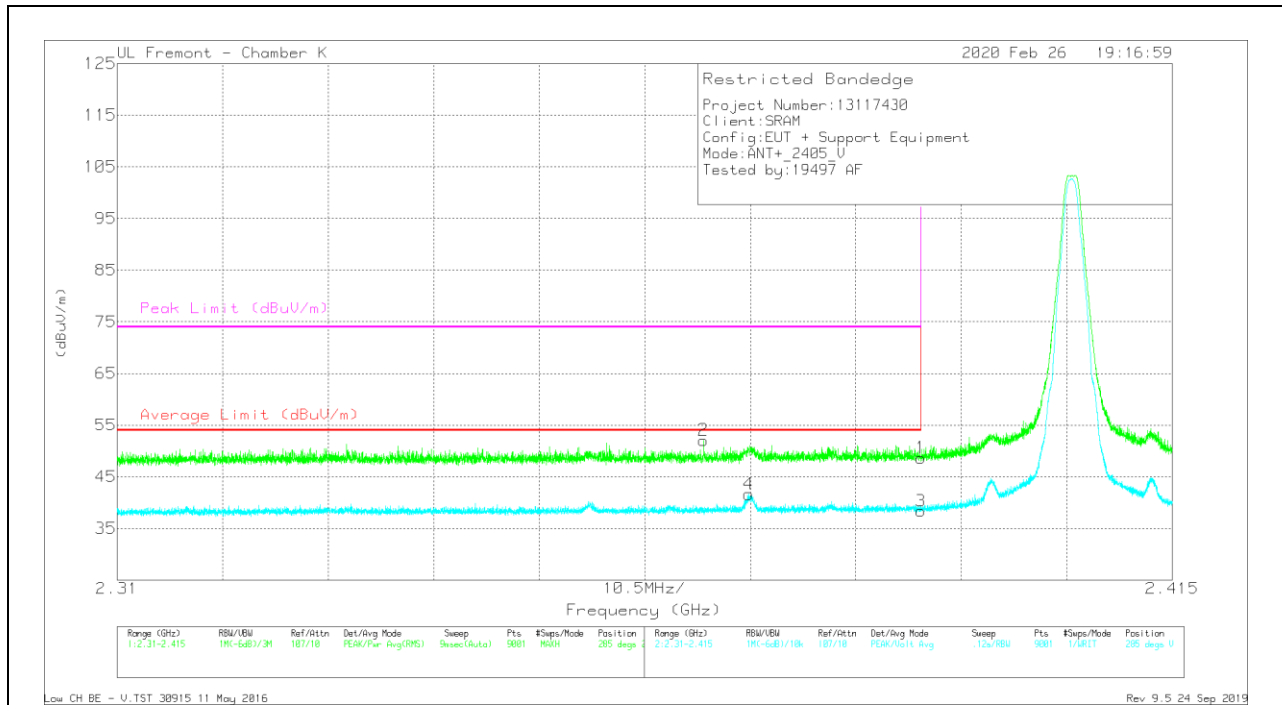
### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Filtr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	43.41	Pk	31.9	-24.7	0	50.61	-	-	74	-23.39	181	193	H
2	* 2.36923	45.05	Pk	31.9	-24.6	0	52.35	-	-	74	-21.65	181	193	H
3	* 2.38999	31.96	AVG	31.9	-24.7	-59.64	-9.03	54	-63.03	-	-	181	193	H
4	* 2.36923	33.63	AVG	31.9	-24.6	-59.64	-7.29	54	-61.29	-	-	181	193	H

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

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

### VERTICAL RESULT



### Trace Markers

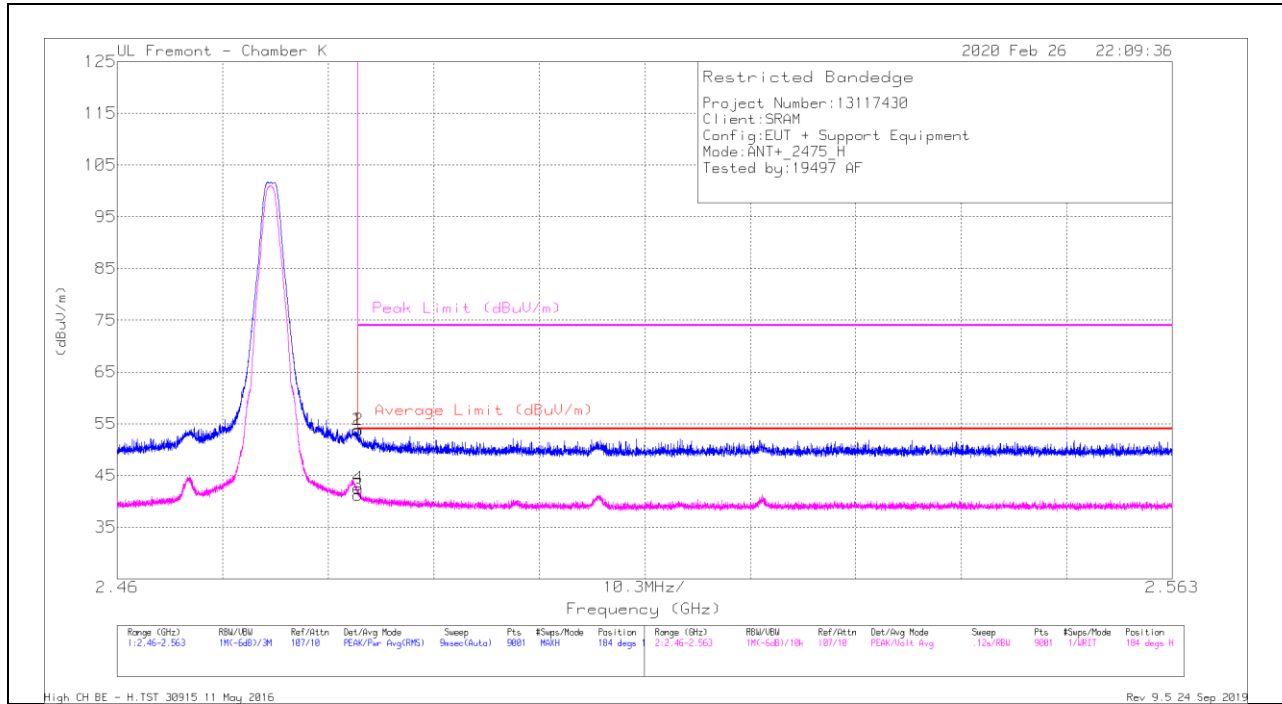
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cb/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	41.46	Pk	31.9	-24.7	0	48.66	-	-	74	-25.34	285	230	V
2	* 2.36835	44.87	Pk	31.8	-24.6	0	52.07	-	-	74	-21.93	285	230	V
3	* 2.38999	31.15	AVG	31.9	-24.7	-59.64	-10.98	54	-69.65	-	-	285	230	V
4	* 2.36835	34.32	AVG	31.9	-24.6	-59.64	-7.57	54	-61.57	-	-	285	230	V

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

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

## BANDEDGE (HIGH CHANNEL)

### HORIZONTAL RESULT



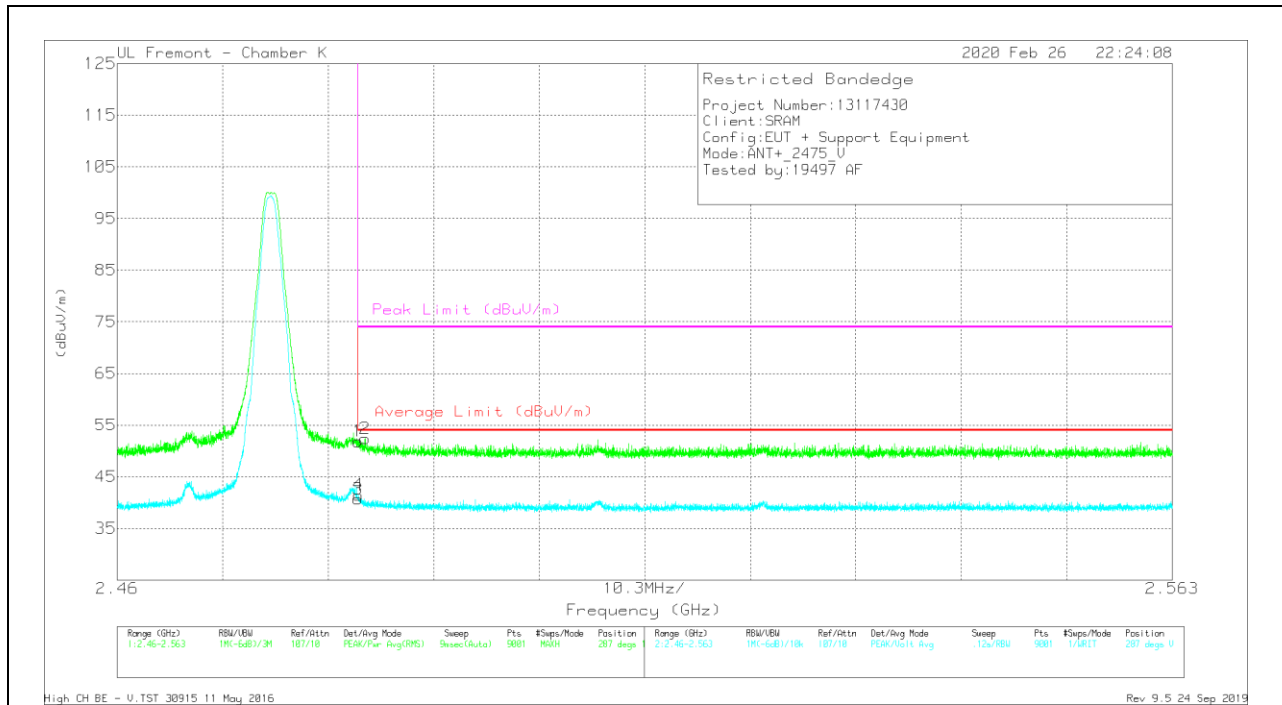
### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cb/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	45.89	Pk	32.5	-24.6	0	53.79	-	-	74	-20.21	184	159	H
2	* 2.48352	45.91	Pk	32.5	-24.6	0	53.81	-	-	74	-20.19	184	159	H
3	* 2.48351	33.31	AVG	32.5	-24.6	-59.64	-5.85	54	-59.85	-	-	184	159	H
4	* 2.48352	34.68	AVG	32.5	-24.6	-59.64	-5.83	54	-59.83	-	-	184	159	H

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

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

### VERTICAL RESULT



### Trace Markers

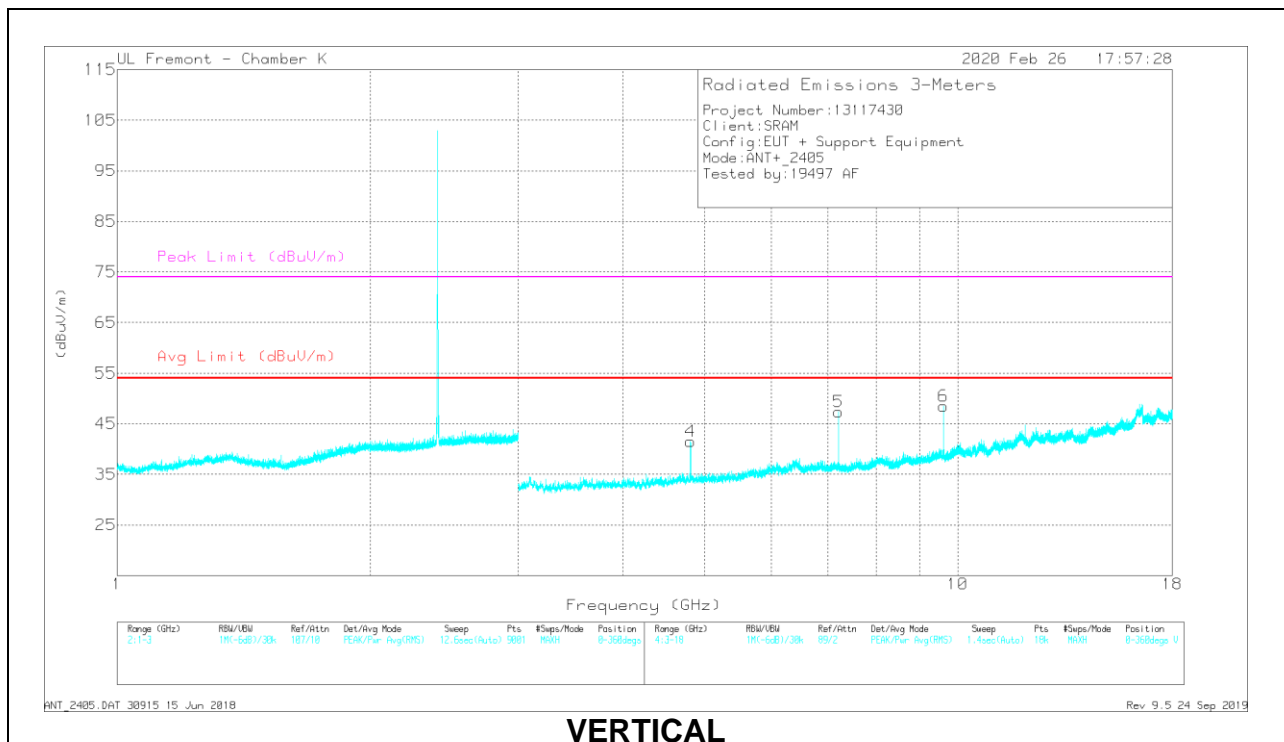
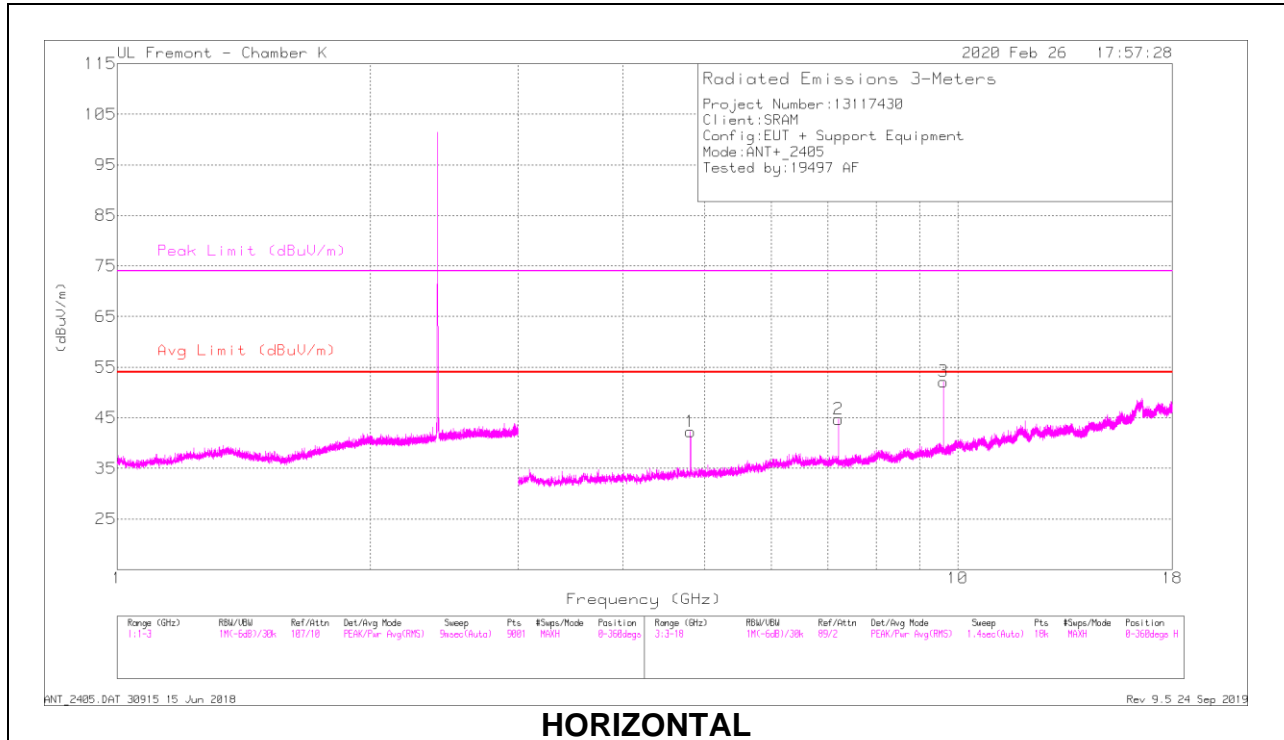
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cb/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	43.97	Pk	32.5	-24.6	0	51.87	-	-	74	-22.13	287	174	V
2	* 2.48419	44.48	PK	32.5	-24.6	0	52.38	-	-	74	-21.62	287	174	V
3	* 2.48351	32.78	AVG	32.5	-24.6	-59.64	-7.77	54	-61.77	-	-	287	174	V
4	* 2.48419	33.57	AVG	32.5	-24.6	-59.64	-7.26	54	-61.26	-	-	287	174	V

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

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

## HARMONICS AND SPURIOUS EMISSIONS

### LOW CHANNEL RESULTS





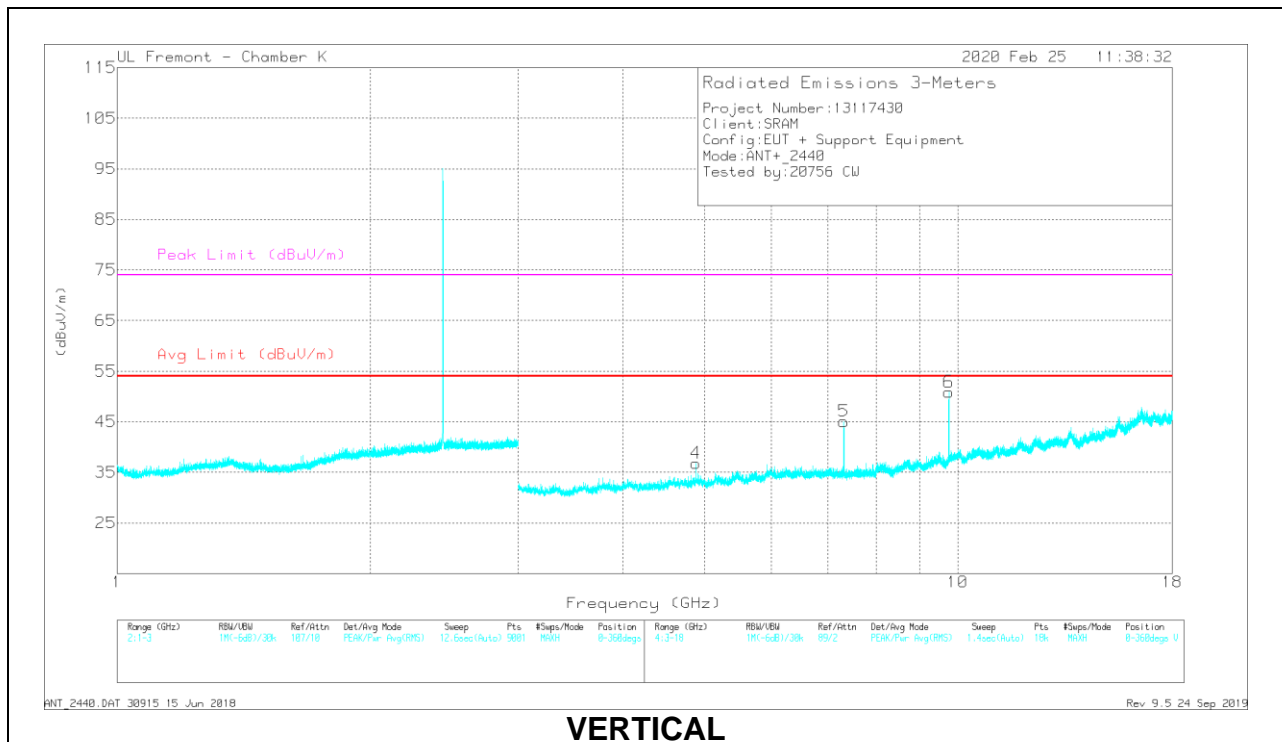
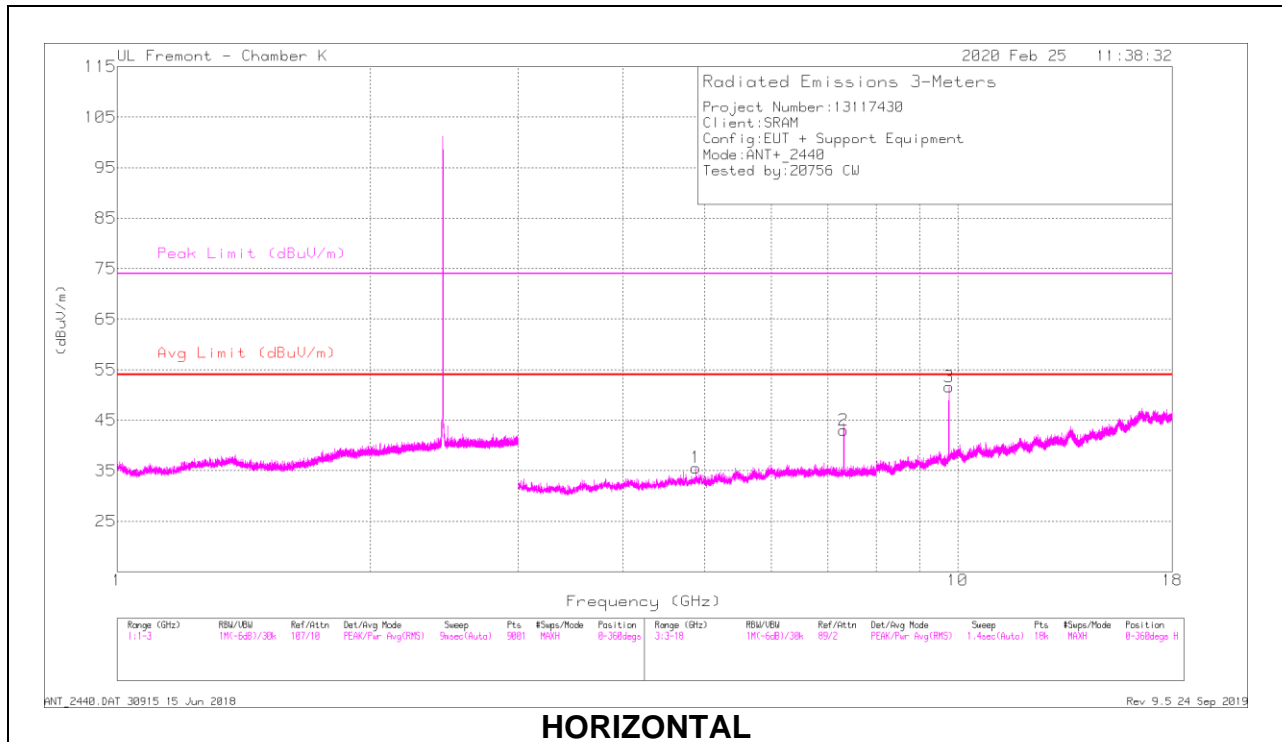
**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cb/Filtr/P ad (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	* 4.81014	43.74	PKFH	34.1	-29.2	0	48.64	-	-	74	-25.36	173	193	H
	* 4.81014	37.42	AVG	34.1	-29.2	-59.64	-11	54	-65	-	-	173	193	H
2	7.21384	40.98	PKFH	35.7	-25.2	0	51.48	-	-	-	-	207	206	H
	7.21384	34.38	AVG	35.7	-25.2	-59.64	-14.76	-	-	-	-	207	206	H
3	9.61872	40.9	PKFH	37.1	-22.2	0	55.8	-	-	-	-	203	98	H
	9.61872	36	AVG	37.1	-22.2	-59.64	-3.84	-	-	-	-	203	98	H
4	* 4.80952	43.63	PKFH	34.1	-29.2	0	48.53	-	-	74	-25.47	93	237	V
	* 4.80952	37.34	AVG	34.1	-29.2	-59.64	-11.11	54	-65.11	-	-	93	237	V
5	7.2142	43.84	PKFH	35.7	-25.2	0	54.34	-	-	-	-	45	189	V
	7.2142	38.71	AVG	35.7	-25.2	-59.64	-5.3	-	-	-	-	45	189	V
6	9.61878	38.94	PKFH	37.1	-22.2	0	53.84	-	-	-	-	116	140	V
	9.61878	33.45	AVG	37.1	-22.2	-59.64	-5.8	-	-	-	-	116	140	V

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

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

### MID CHANNEL RESULTS



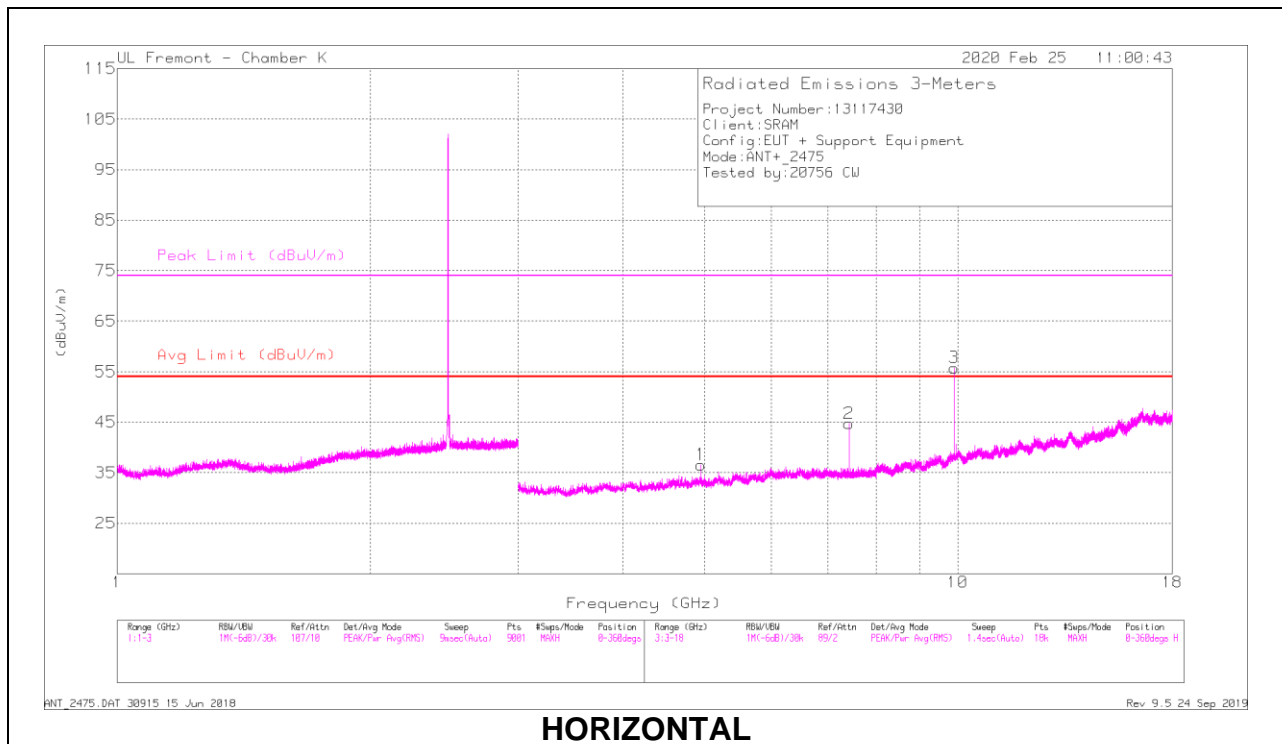
**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb/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	* 4.87948	39.91	PKFH	34.1	-31	0	43.01	-	-	74	-30.99	37	175	H
	4.87948	32.02	AVG	34.1	-31	-59.64	-24.52	54	-72.88	-	-	37	175	H
2	* 7.31889	38.44	PKFH	35.5	-27.1	0	46.84	-	-	74	-27.16	63	144	H
	7.31889	32.3	AVG	35.5	-27.1	-59.64	-18.94	54	-67.3	-	-	63	144	H
3	9.76136	45.07	PKFH	36.9	-23.5	0	58.47	-	-	-	-	185	181	H
	9.76136	39.92	AVG	36.9	-23.5	-59.64	-6.32	-	-	-	-	185	181	H
4	* 4.88125	39.24	PKFH	34.1	-31	0	42.34	-	-	74	-31.66	52	175	V
	4.88125	30.25	AVG	34.1	-31	-59.64	-26.29	54	-80.29	-	-	52	175	V
5	* 7.32105	42.58	PKFH	35.5	-27.1	0	50.98	-	-	74	-23.02	102	211	V
	7.32105	37.3	AVG	35.5	-27.1	-59.64	-13.94	54	-67.94	-	-	102	211	V
6	9.75868	45.68	PKFH	36.9	-23.5	0	59.08	-	-	-	-	90	147	V
	9.75868	41.31	AVG	36.9	-23.5	-59.64	-4.93	-	-	-	-	90	147	V

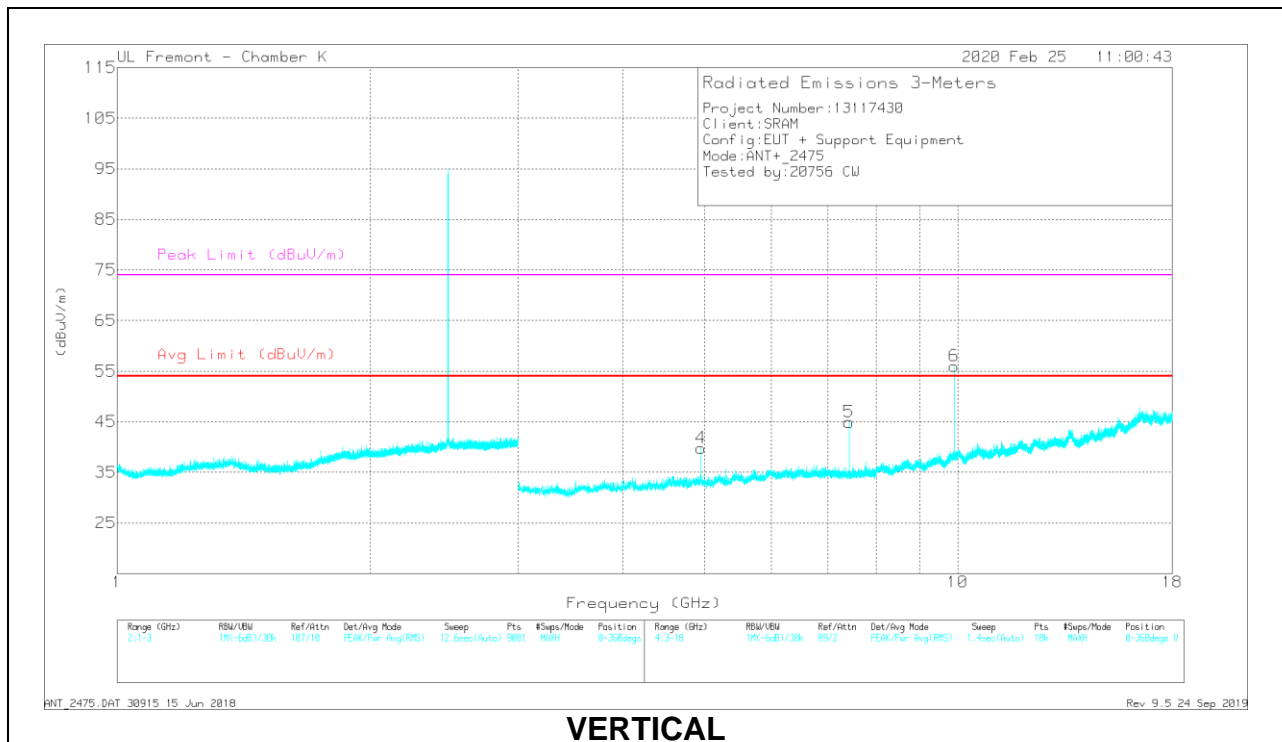
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

**RADIATED EMISSIONS**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb/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	* 4.94931	42.7	PKFH	34.1	-30	0	46.8	-	-	74	-27.2	206	206	H
	4.94931	34.47	AVG	34.1	-30	-59.64	-21.07	54	-75.07	-	-	206	206	H
2	* 7.42427	38.47	PKFH	35.5	-27.1	0	46.87	-	-	74	-27.13	214	232	H
	7.42427	27.27	AVG	35.5	-27.1	-59.64	-23.97	54	-77.97	-	-	214	232	H
3	9.89873	46.5	PKFH	37	-24.5	0	59	-	-	-	-	161	121	H
	9.89873	38.41	AVG	37	-24.5	-59.64	-8.73	-	-	-	-	161	121	H
4	* 4.9495	43.13	PKFH	34.1	-30	0	47.23	-	-	74	-26.77	49	197	V
	4.9495	34.31	AVG	34.1	-30	-59.64	-21.23	54	-75.23	-	-	49	197	V
5	* 7.42406	41.62	PKFH	35.5	-27.1	0	50.02	-	-	74	-23.98	123	133	V
	7.42406	32.03	AVG	35.5	-27.1	-59.64	-19.21	54	-73.21	-	-	123	133	V
6	9.89872	45.99	PKFH	37	-24.5	0	58.49	-	-	-	-	91	375	V
	9.89872	37.65	AVG	37	-24.5	-59.64	-9.49	-	-	-	-	91	375	V

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

PK: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64

## 9.2. FUNDAMENTAL FREQUENCY RADIATED EMISSION

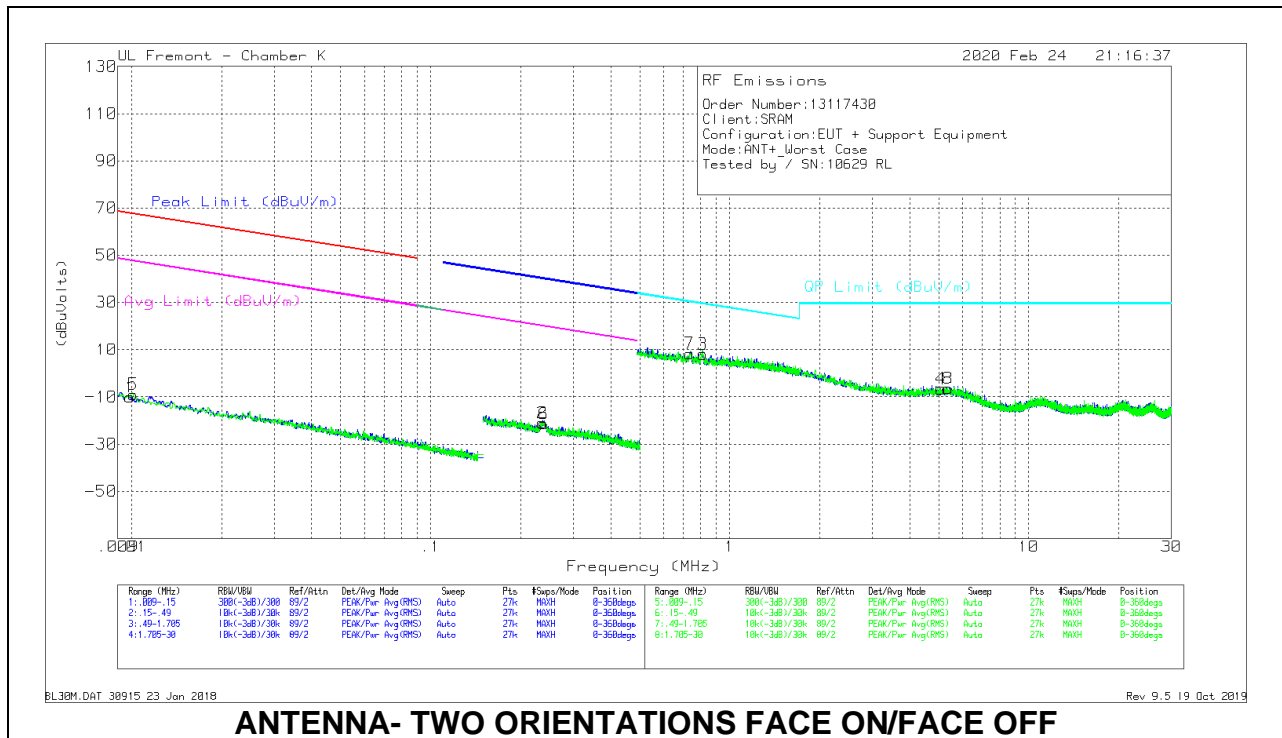
<b>Tested By:</b>	19497 AF
<b>Date:</b>	02/24/2020

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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
2.405	95.6	PKFH	31.9	-24.7	0	102.8	-	-	114	-11.2	186	195	H
	95.6	AVG	31.9	-24.7	-59.64	43.16	94	-50.84	-	-	186	195	H
	96.56	PKFH	31.9	-24.7	0	103.76	-	-	114	-10.24	285	196	V
	96.56	AVG	31.9	-24.7	-59.64	44.12	94	-49.88	-	-	285	196	V
2.440	95.68	PKFH	32.1	-25.5	0	102.28	-	-	114	-11.72	187	143	H
	95.68	AVG	32.1	-25.5	-59.64	42.64	94	-51.36	-	-	187	143	H
	94.5	PKFH	32.1	-25.5	0	101.1	-	-	114	-12.9	284	164	V
	94.5	AVG	32.1	-25.5	-59.64	41.46	94	-52.54	-	-	284	164	V
2.475	94.8	PKFH	32.3	-25.5	0	101.6	-	-	114	-12.4	190	208	H
	94.8	AVG	32.3	-25.5	-59.64	41.96	94	-49.04	-	-	190	208	H
	92.67	PKFH	32.3	-25.5	0	99.47	-	-	114	-14.53	284	122	V
	92.67	AVG	32.3	-25.5	-59.64	39.83	94	-54.17	-	-	284	122	V

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak  
 AVG = Peak Reading + Duty Cycle Correction Factor  
 Duty Cycle Correction Factor = -59.64 d

### 9.3. WORST CASE BELOW 30 MHz

#### SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)



#### Below 30 MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	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)
1	.00988	54.33	Pk	15.5	0	-80	-10.17	67.69	-77.86	47.69	-57.86	-	-	-	-	0-360
2	.23603	44.77	Pk	14	.1	-80	-21.13	-	-	-	-	40.16	-61.29	20.16	-41.29	0-360
5	.01013	55.55	Pk	15.4	0	-80	-9.05	67.47	-76.52	47.47	-56.52	-	-	-	-	0-360
6	.23889	44.5	Pk	14	.1	-80	-21.4	-	-	-	-	40.05	-61.45	20.05	-41.45	0-360

Pk - Peak detector

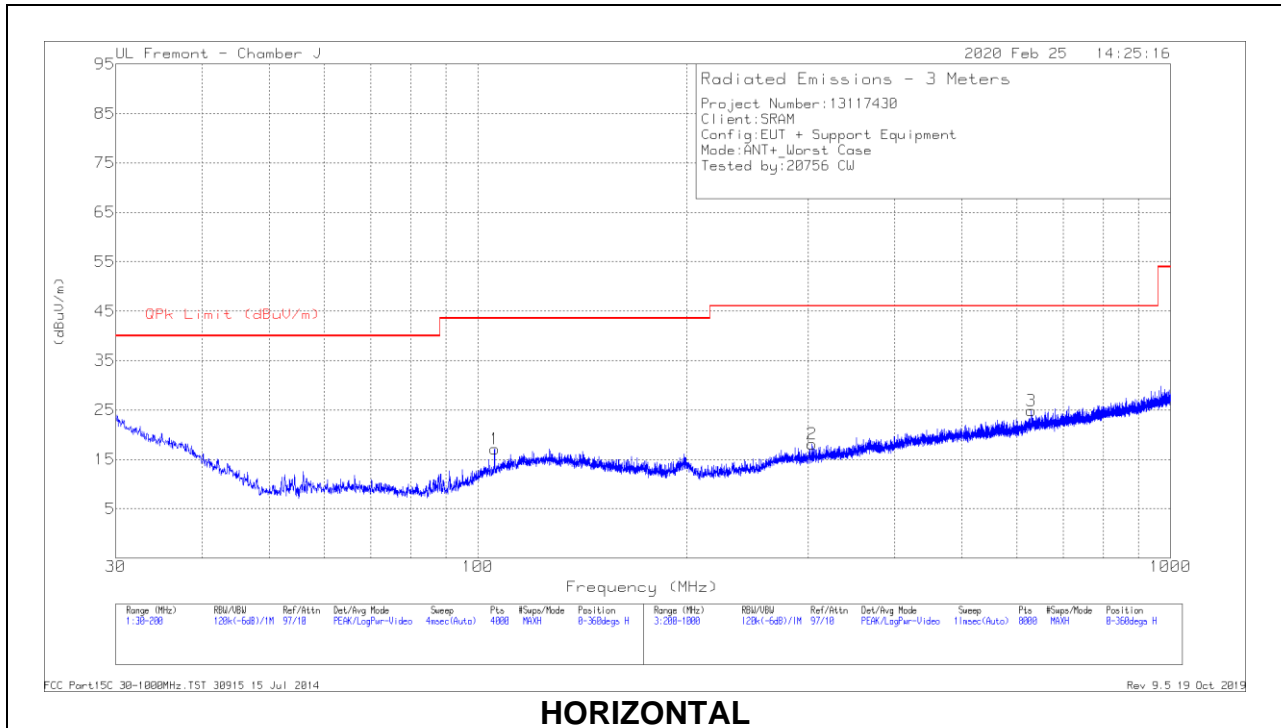
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.81339	33.88	Pk	14.1	.1	-40	8.08	29.41	-21.33	0-360
4	5.07799	18.34	Pk	14.9	.2	-40	-6.56	29.5	-36.06	0-360
7	.73451	34.05	Pk	14.1	.1	-40	8.25	30.29	-22.04	0-360
8	5.36252	18.27	Pk	14.9	.3	-40	-6.53	29.5	-36.03	0-360

Pk - Peak detector

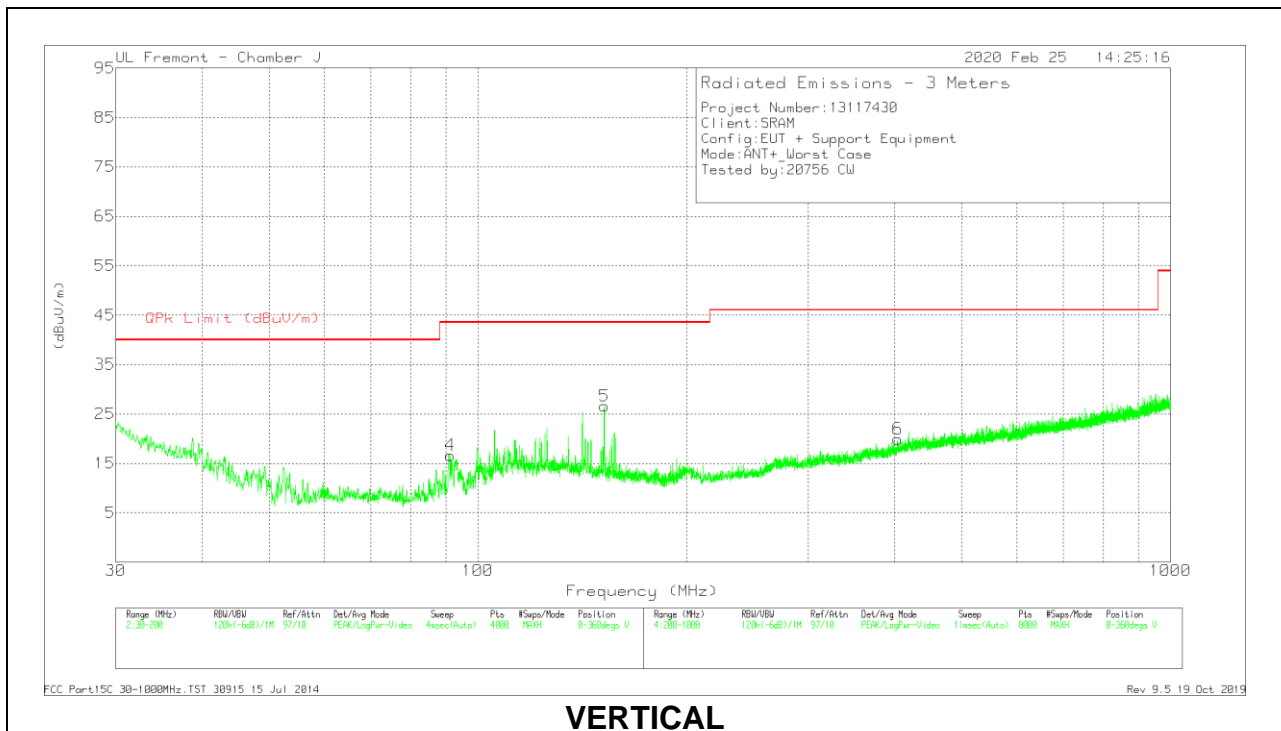
**Note:** The Limits in CRF 47, Part 15, Subpart C, Paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels ( as reported in the table) using the free space impedance 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.

### 9.4. 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	AF T899 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	105.7121	30.38	Pk	17.7	-31	17.08	43.52	-26.44	0-360	398	H
4	91.3009	33.85	Pk	13.9	-31.1	16.65	43.52	-26.87	0-360	100	V
5	152.1186	29.35	Pk	18.3	-30.7	16.95	43.52	-26.57	336	387	V
	152.1186	21.74	Qp	18.3	-30.7	9.34	43.52	-34.18	336	387	V
2	303.9135	28.87	Pk	19.4	-30.1	18.17	46.02	-27.85	0-360	101	H
3	629.9559	28.59	Pk	25.4	-29.2	24.79	46.02	-21.23	0-360	198	H
6	* 404.1265	28.15	Pk	21.6	-29.8	19.95	46.02	-26.07	0-360	198	V

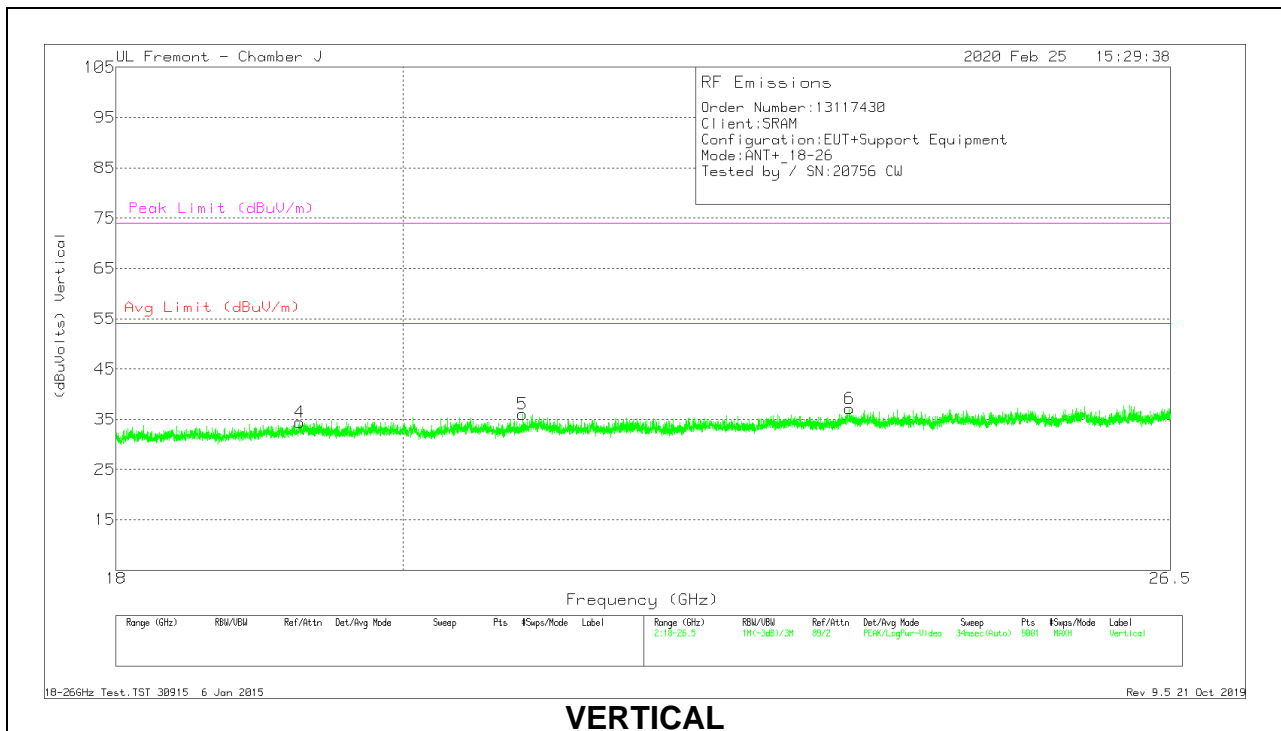
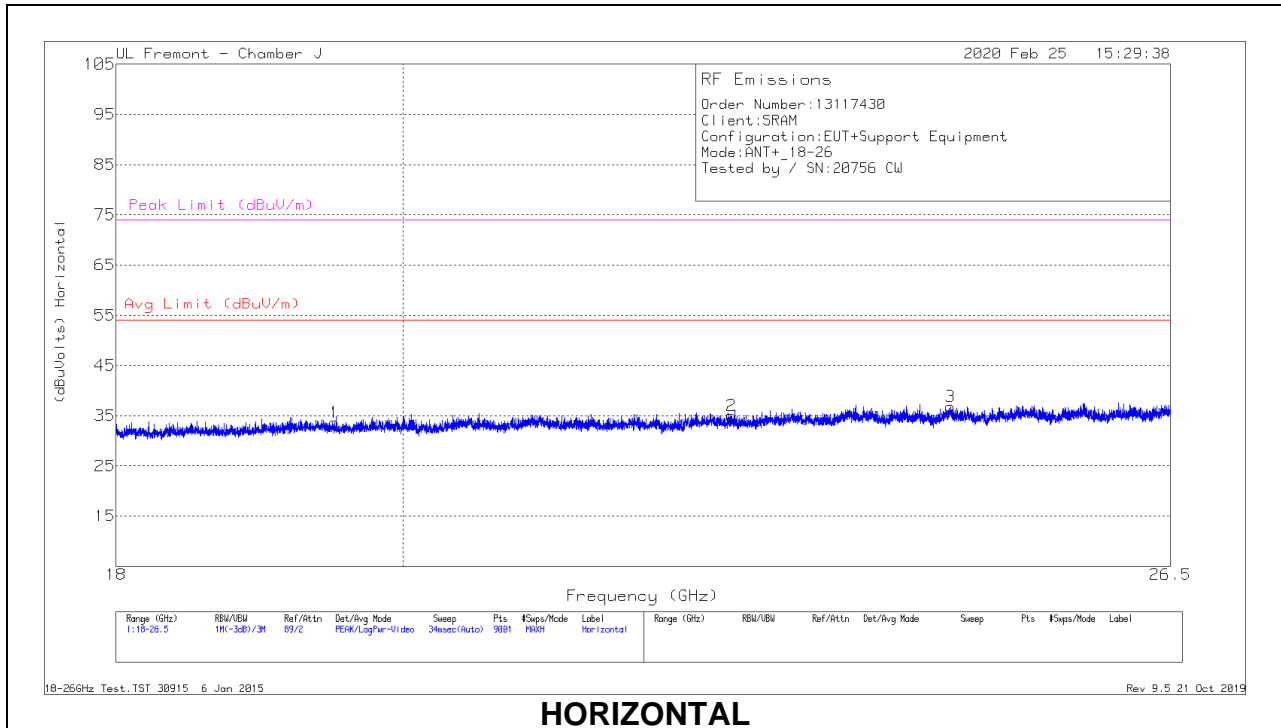
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

### 9.5. 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 (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.50261	67.5	Pk	32.8	-57.2	-9.5	33.6	54	-20.4	74	-40.4
2	22.55789	68.36	Pk	33.6	-57.5	-9.5	34.96	54	-19.04	74	-39.04
3	24.44489	68.01	Pk	34.3	-56	-9.5	36.81	54	-17.19	74	-37.19
4	19.25328	68.58	Pk	32.7	-57.4	-9.5	34.38	54	-19.62	74	-39.62
5	20.89378	69.5	Pk	33.2	-57.2	-9.5	36	54	-18	74	-38
6	23.55616	69.34	Pk	34.2	-56.9	-9.5	37.14	54	-16.86	74	-36.86

Pk - Peak detector