TEST REPORT

Report Number: 14954500-E8V1

Applicant	:	SRAM LLC 1000 W Fulton Market 4th Floor Chicago, IL 60607, United States
Model	:	12300
Brand	:	SRAM
FCC ID	:	C9O-HKB1
IC	:	10161A-HKB1
EUT Description	:	BICYCLE HEAD UNIT
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 3 ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue:
2023-11-09

Prepared by:
UL VERIFICATION SERVICES
47173 Benicia Street
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ACCREDITED
CERT #0751.05

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2023-11-09	Initial Issue	

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TABLE OF CONTENTS

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SRAM LLC 1000 W Fulton Market 4th Floor Chicago, IL 60607, United States
EUT DESCRIPTION:	Bicycle Head Unit
MODEL:	12300
BRAND:	SRAM
SERIAL NUMBER:	Radiated: 00416GA23270005 and 00416GA23270009 Conducted: 00413PA232960044 and 00413PA232960035
SAMPLE RECEIPT DATE:	2023-09-22 and 2023-09-28
DATE TESTED:	2023-10-18 to 2023-10-31

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC 47 CFR Part 15 Subpart C	Complies
ISED RSS-247 Issue 3	Complies
ISED RSS-GEN Issue 5 + A1 + A2	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, any agency of the Federal Government, or any agency of the U.S. government.

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Approved & Released For
UL Verification Services Inc. By:

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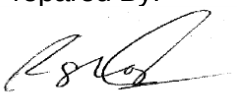
Prepared By:



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2. TEST RESULTS SUMMARY

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.
Below is a list of the data provided by the customer:
1) Antenna gain and type (see section 6.3)

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Compliant	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Compliant	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	Compliant	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Compliant	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant	None

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC 47 CFR Part 2, FCC 47 CFR 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 + A2, and RSS-247 Issue 3.

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	US0104	2324A	550739
☒	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	US0104	2324A	550739

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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%.

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5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Bicycle Head Unit.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak and average conducted output powers as follows:

Frequency Range (MHz)	Mode	Peak		Average	
		Output Power (dBm)	Output Power (mW)	Output Power (dBm)	Output Power (mW)
2405 - 2475	AIREA	6.87	4.86	6.76	4.74

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The Right Nordic Radio utilizes a PIFA antenna, with a maximum gain of 2.23 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed, and the test utility software used during testing was FVIN: H-2.0.

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6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at 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 X(Flatbed) orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

The worst-case data rate provided by the client was 250kbps.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
Laptop	Lenovo	ThinkPad P15s Gen 2	PF-2YV2K6	DoC
Laptop AC/DC Adapter	Lenovo	ADLX65Y	8SSA10R16875C1SG09PRSHT	DoC

I/O CABLES (CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	2-Prong	Un-shielded	1	AC Mains to LT AC/DC Adapter
2	DC	1	DC	Un-shielded	1.5	AC/DC Adapter to Laptop
3	USB	1	USB A to USB C	Un-shielded	1	Laptop to EUT
4	SMA	1	SMA	Un-shielded	0.1	EUT to Spectrum Analyzer
5	AC	1	3-Prong	Un-shielded	1.5	AC Mains to Spectrum Analyzer

I/O CABLES (RADIATED TEST EMISSIONS)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	2-Prong	Un-shielded	1	AC Mains to LT AC/DC Adapter
2	DC	1	DC	Un-shielded	1.5	AC/DC Adapter to Laptop
3	USB	1	USB A to USB C	Un-shielded	1	Laptop to EUT
4	AC	1	3-Prong	Un-shielded	1.5	AC Mains to Spectrum Analyzer

TEST SETUP

For the purposes of testing, the EUT is connected to a laptop via USB A to USB C for radiated emissions above 1GHz. The EUT is normally powered by a Li-Ion battery at 3.85V. The laptop is used for setting up purposes and was used during testing.

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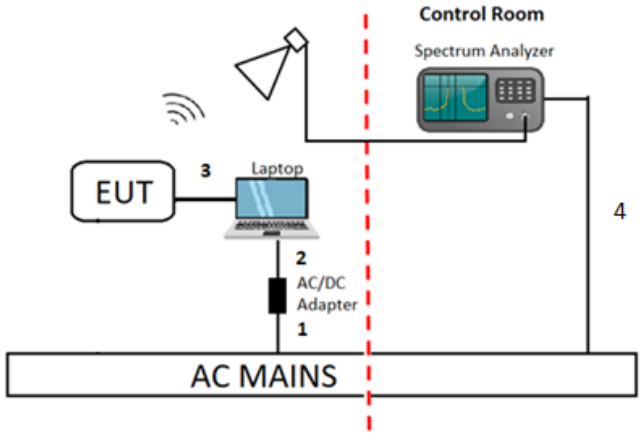
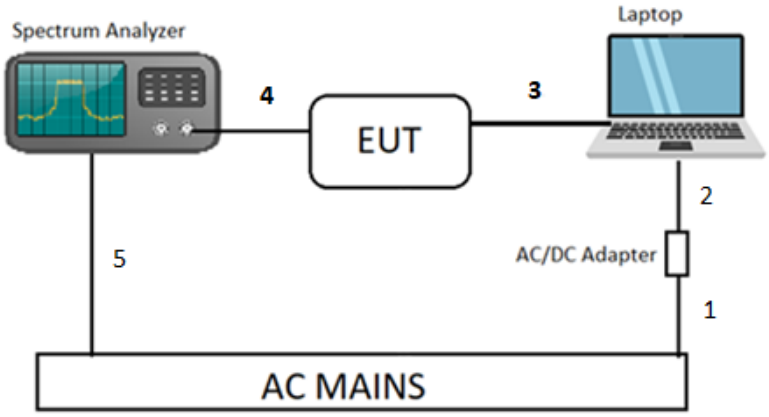
SETUP DIAGRAMS

Radiated Configuration



Conducted Configuration



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7. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW ≥ DTS BW

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 Section 6.10

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

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

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8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Broadband Hybrid, 30MHz to 1GHz	Sunol Sciences Corp.	JB3	232075	2024-03-31	2023-03-13
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	223083	2023-10-31	2022-10-25
RF Filter Box, 1-18GHz	UL-FR1	n/a	197920	2024-05-31	2023-05-17
EMI TEST RECEIVER, with B8 option	Rohde & Schwarz	ESW44	191429	2024-02-29	2023-02-15
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	225688 (chamber K)	2024-02-29	2023-02-14
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	199659	2023-12-06	2022-12-06
Amplifier 18-26.5GHz, +5Vdc, -54dBm P1dB	AMPLICAL	AMP18G26.5-60	234683	2024-03-29	2023-03-18
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	170015	2024-07-31	2022-07-28
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	170013	2024-07-31	2022-07-28
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent Technologies	N9030A	80396	2024-01-31	2023-01-27
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90754	2024-01-31	2023-01-24
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	81319	2024-01-25	2023-01-25
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236193	Verified	Verified
AC Line Conducted					
LISN	Fischer Custom Communications, Inc	FCC-LISN-50/250-25-2-01-480V	175765	2024-01-31	2023-01-27
EMI TEST RECEIVER	Rohde & Schwarz	ESR	171646	2024-02-29	2023-02-20
Transient Limiter	TE	TBFL1	207996	2024-08-31	2023-08-10
UL TEST SOFTWARE LIST					
Radiated Software	UL	UL EMC	Ver 2023-01-18, 2023-03-03, 2023-05-01		
Antenna Port Software	UL	UL RF	Ver 2022-08-16		
AC Line Conducted Software	UL	UL EMC	Rev 9.5, 2022-02-17		

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.

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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

9.1.1. RIGHT NORDIC RADIO

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						
IEEE802154 AIREA	87.80	87.80	1.000	100.00	0.00	0.010

IEEE802154 (250kbps)

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9.2. 99% BANDWIDTH

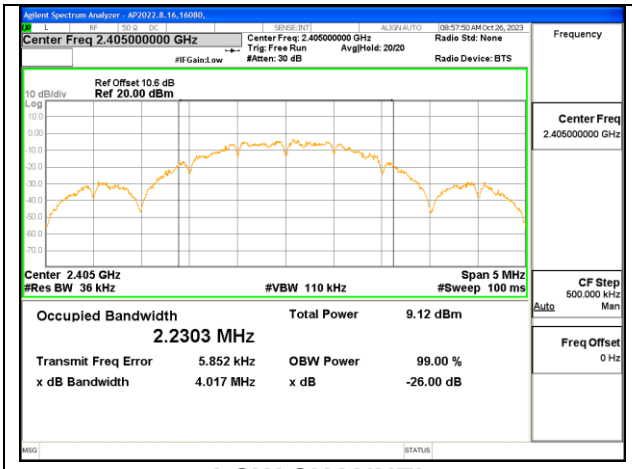
LIMITS

None; for reporting purposes only.

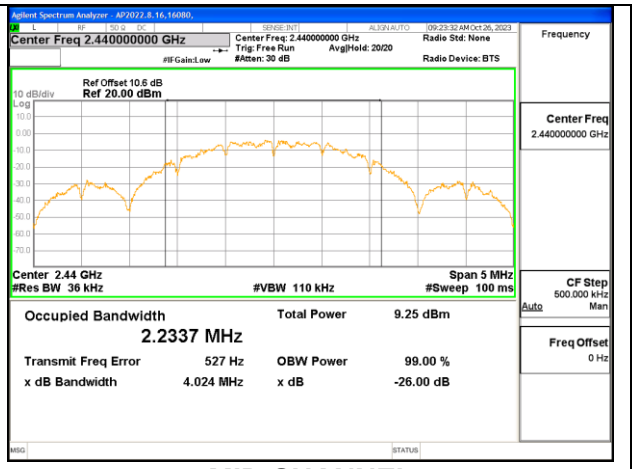
RESULTS

9.2.1. RIGHT NORDIC RADIO

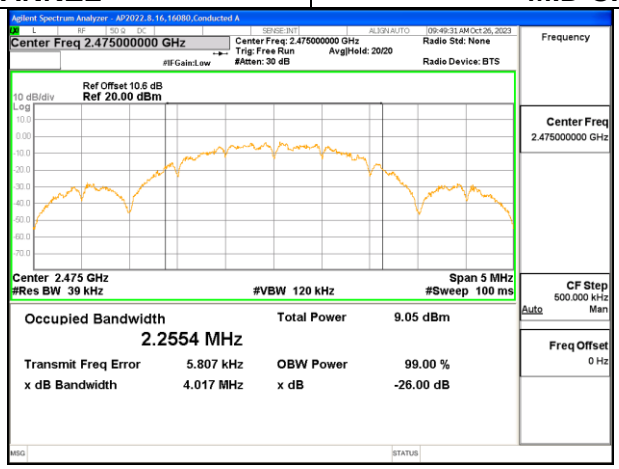
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.2303
Middle	2440	2.2337
High	2475	2.2554



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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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

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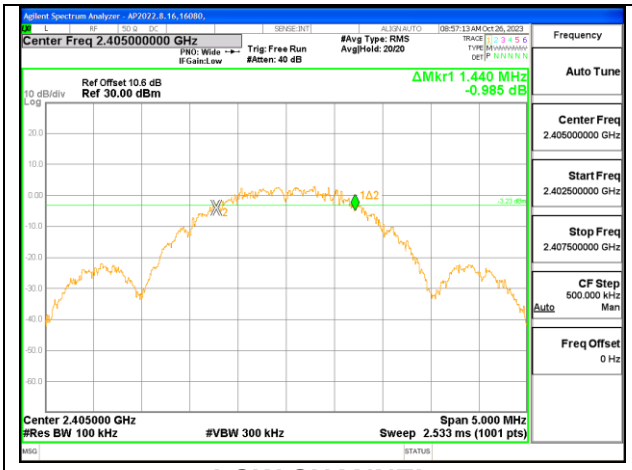
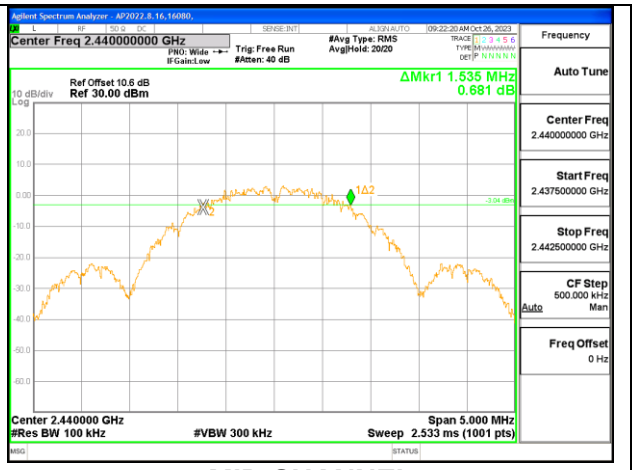
9.3.1. RIGHT NORDIC RADIO

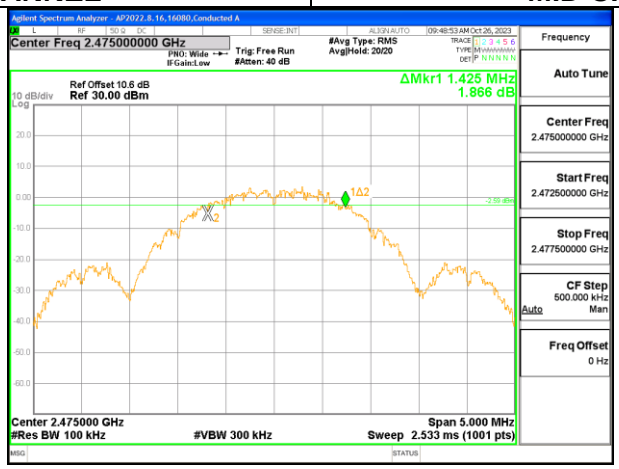
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.440	0.5
Middle	2440	1.535	0.5
High	2475	1.425	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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

RESULTS

9.4.1. RIGHT NORDIC RADIO

Tested By:	PV 27966
Date:	2023-10-26

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2405	6.79	30	-23.21
Middle	2440	6.87	30	-23.13
High	2475	6.85	30	-23.15

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9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

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

RESULTS

9.5.1. RIGHT NORDIC RADIO

Tested By:	PV 27966
Date:	2023-10-26

Channel	Frequency (MHz)	AV power (dBm)
Low	2405	6.68
Middle	2440	6.76
High	2475	6.74

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9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

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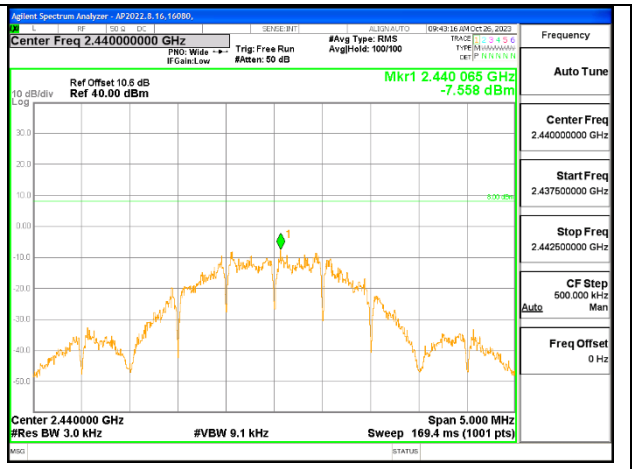
9.6.1. RIGHT NORDIC RADIO

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2405	-8.557	8	-16.56
Middle	2440	-7.558	8	-15.56
High	2475	-6.603	8	-14.60

LOW CHANNEL



MID CHANNEL

HIGH CHANNEL

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9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

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

RESULTS

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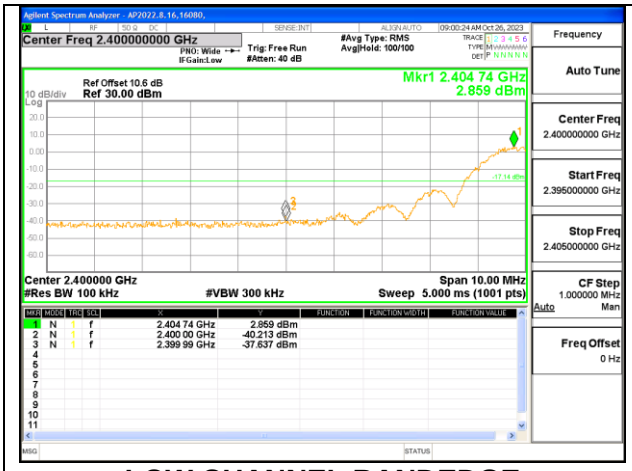
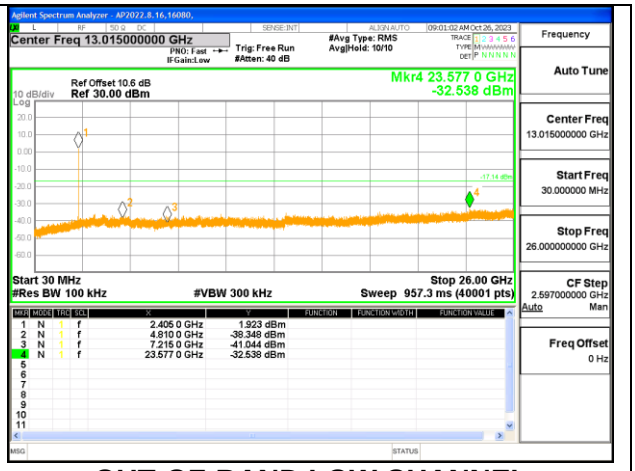
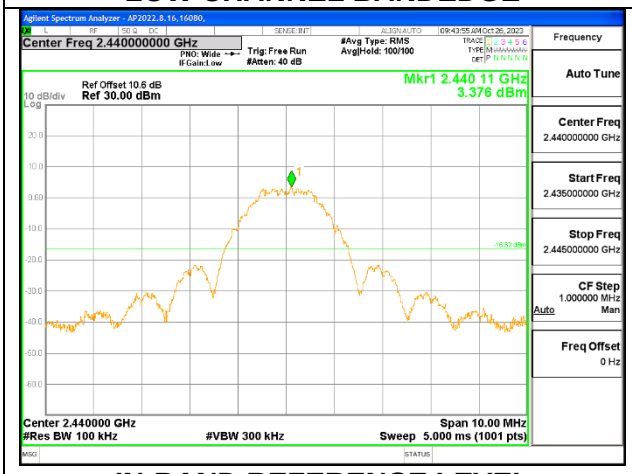
9.7.1. RIGHT NORDIC RADIO



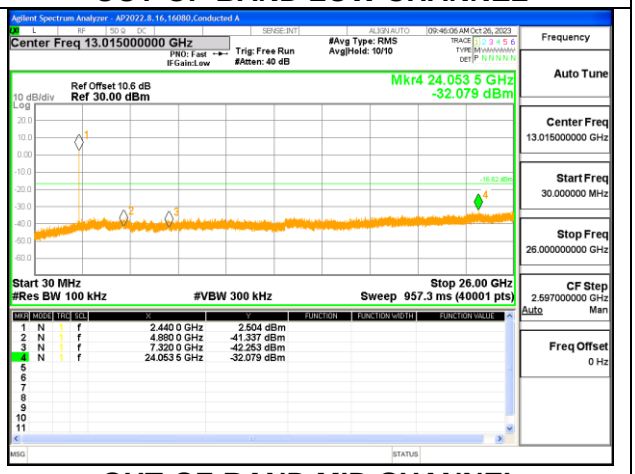
LOW CHANNEL BANDEDGE



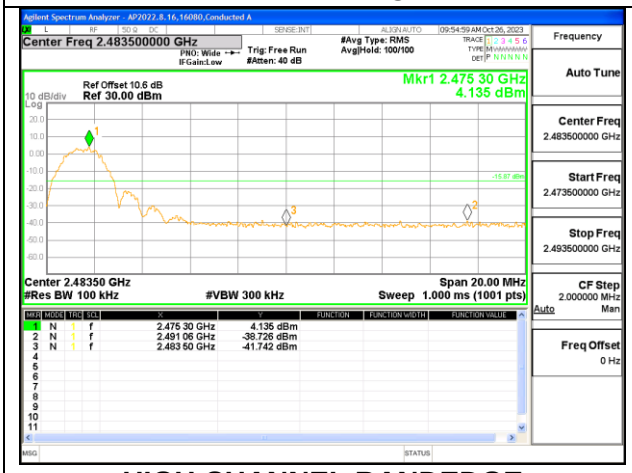
OUT-OF-BAND LOW CHANNEL



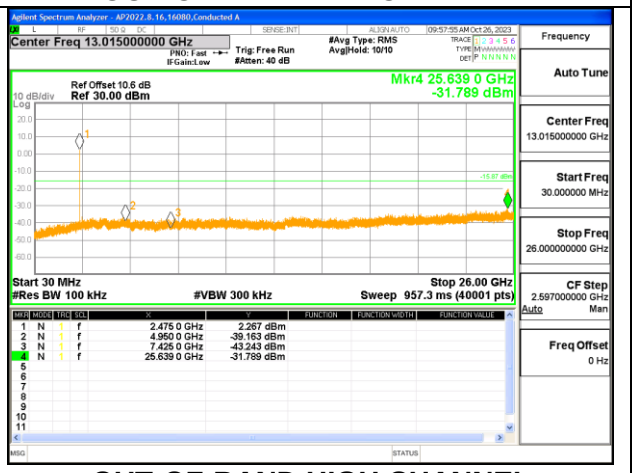
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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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.

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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.

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.

Based 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.

NOTE: The limits in FCC 47 CFR, 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.

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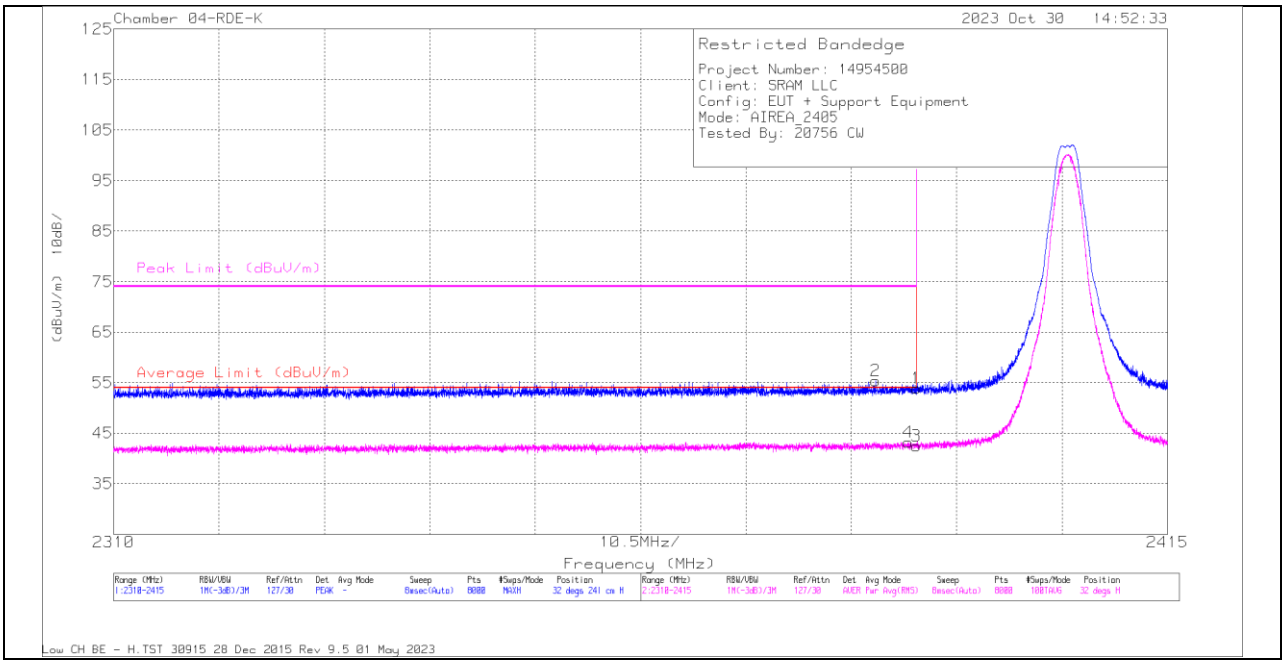
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. RIGHT NORDIC RADIO

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2390	56.59	Pk	31.8	-34.5	53.89	-	-	74	-20.11	32	241	H
2	2385.94	58.1	Pk	31.8	-34.5	55.4	-	-	74	-18.6	32	241	H
3	2390	45.13	RMS	31.8	-34.5	42.43	54	-11.57	-	-	32	241	H
4	2389.169	45.97	RMS	31.8	-34.5	43.27	54	-10.73	-	-	32	241	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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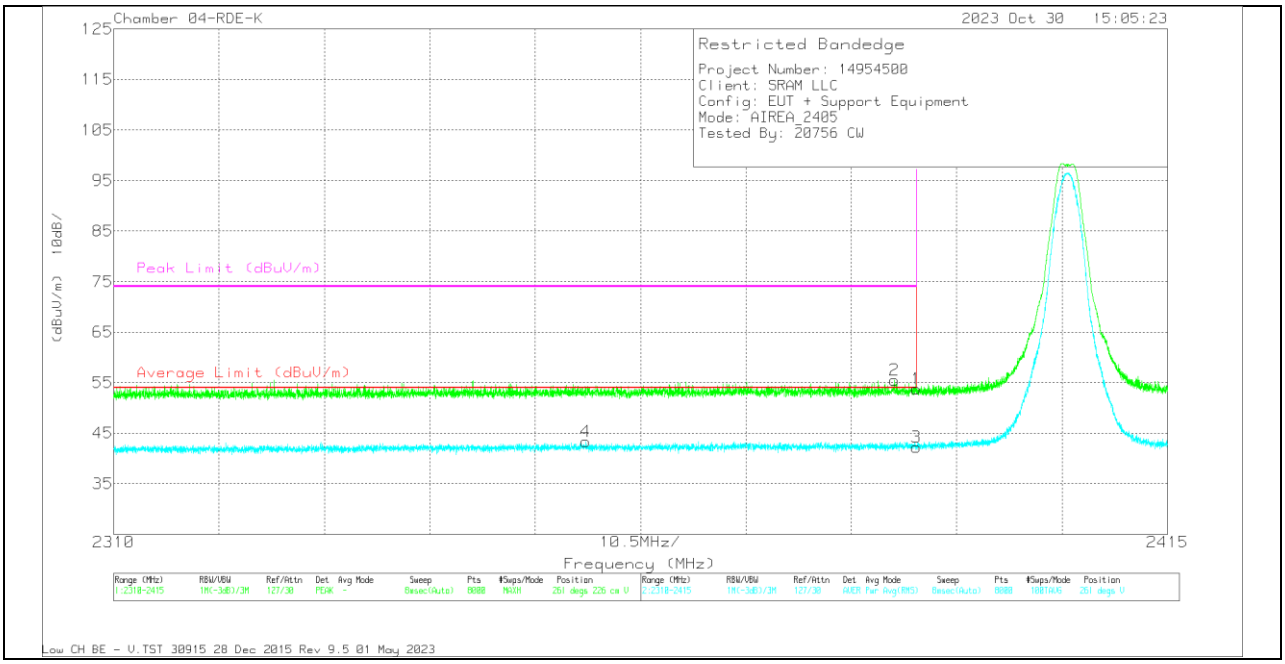
VERTICAL RESULT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2390	56.5	Pk	31.8	-34.5	53.8	-	-	74	-20.2	261	226	V
2	2387.777	58.24	Pk	31.8	-34.5	55.54	-	-	74	-18.46	261	226	V
3	2390	44.9	RMS	31.8	-34.5	42.2	54	-11.8	-	-	261	226	V
4	2357.021	46.37	RMS	31.6	-34.6	43.37	54	-10.63	-	-	261	226	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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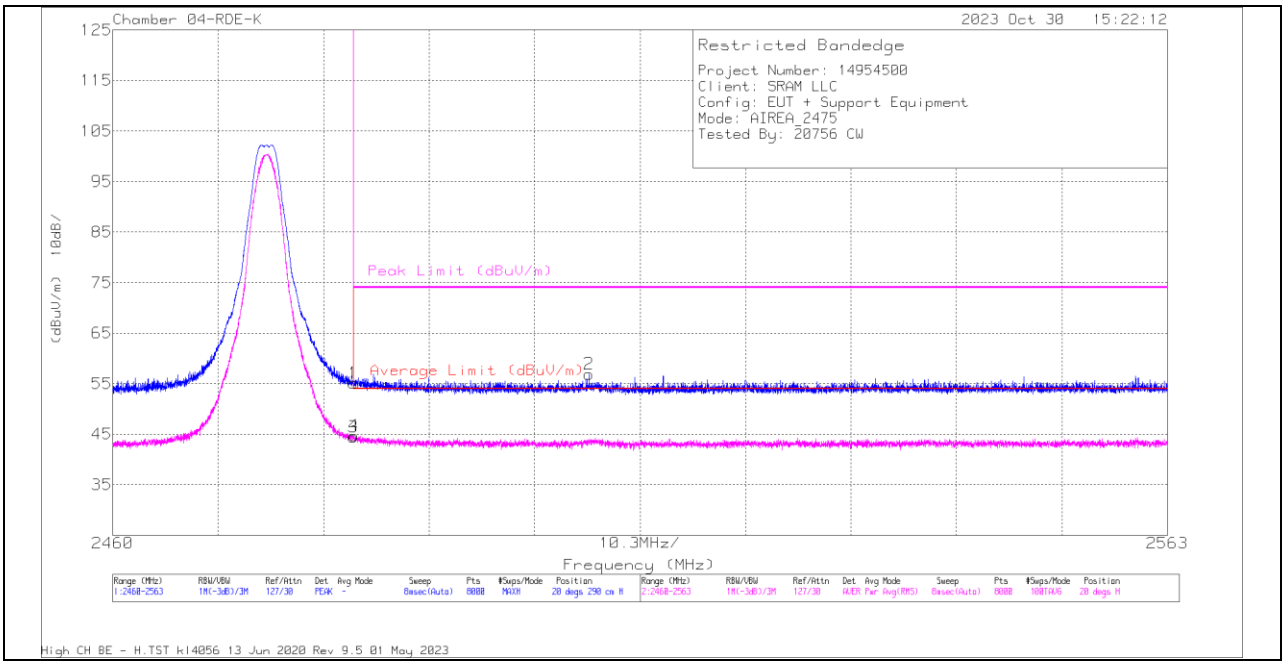
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2483.5	56.99	Pk	32.2	-34.1	55.09	-	-	74	-18.91	20	290	H
2	2506.512	58.63	Pk	32.2	-33.9	56.93	-	-	74	-17.07	20	290	H
3	2483.5	46.33	RMS	32.2	-34.1	44.43	54	-9.57	-	-	20	290	H
4	2483.578	46.57	RMS	32.2	-34.1	44.67	54	-9.33	-	-	20	290	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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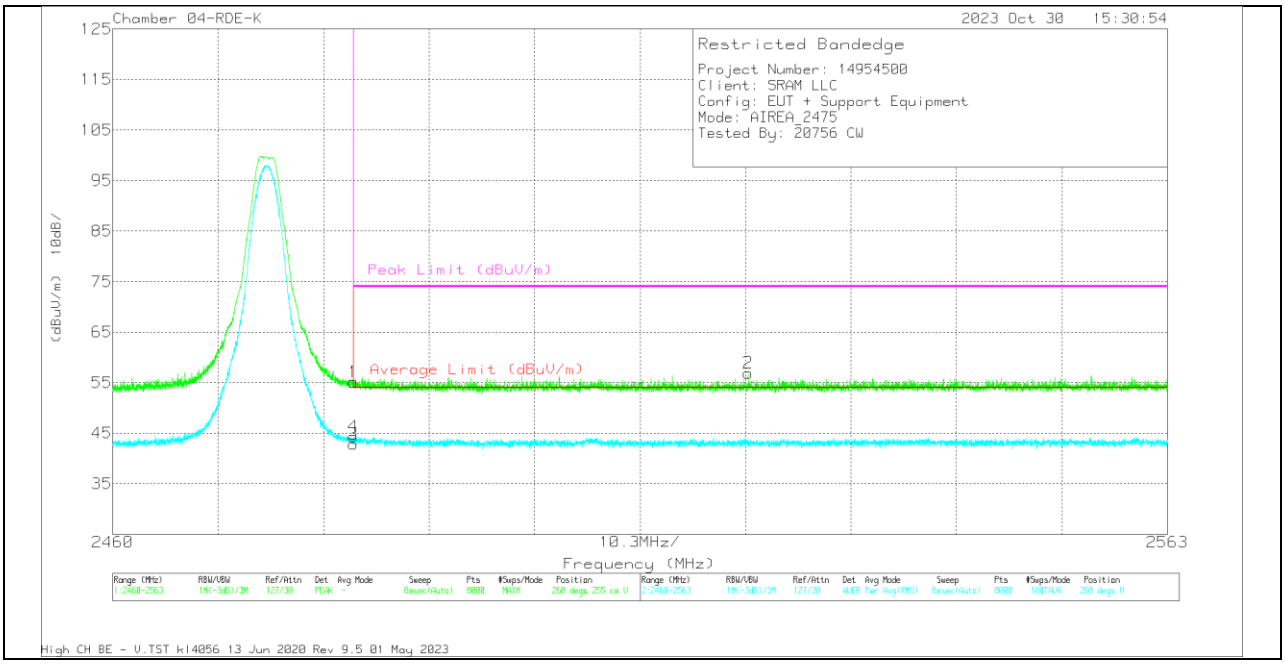
VERTICAL RESULT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2483.5	57	Pk	32.2	-34.1	55.1	-	-	74	-18.9	268	255	V
2	2522.067	58.63	Pk	32.2	-33.9	56.93	-	-	74	-17.07	268	255	V
3	2483.5	44.76	RMS	32.2	-34.1	42.86	54	-11.14	-	-	268	255	V
4	2483.513	46.23	RMS	32.2	-34.1	44.33	54	-9.67	-	-	268	255	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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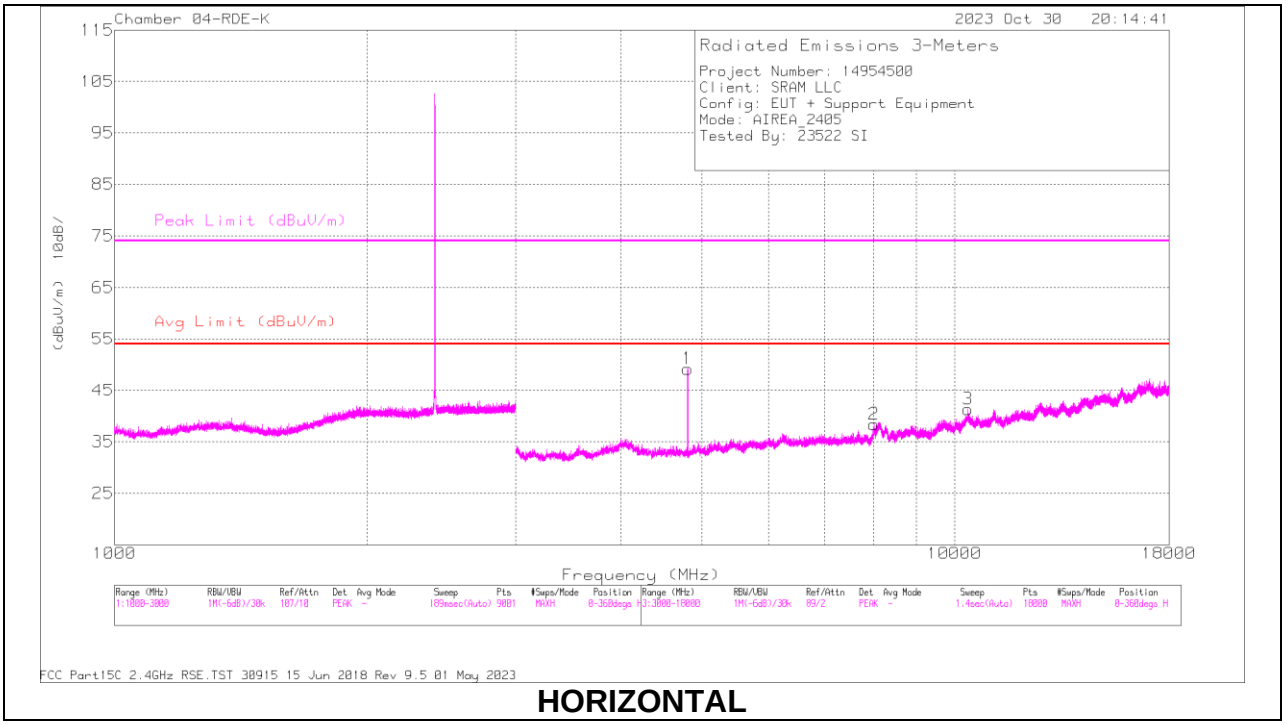
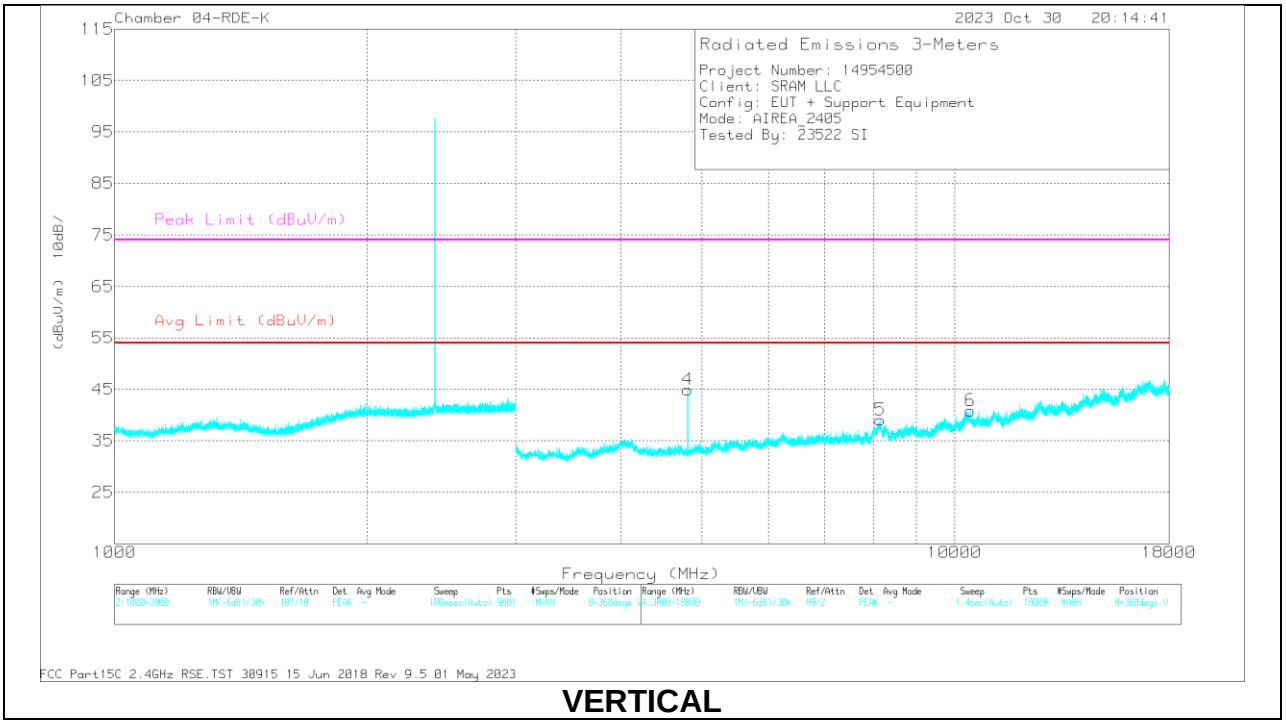
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4810.09	58.28	PK2	33.7	-39.8	52.18	-	-	74	-21.82	157	102	H
	* 4810.04	55.4	MAv1	33.7	-39.8	49.3	54	-4.7	-	-	157	102	H
2	* 8016.848	47.96	PK2	35.9	-36.4	47.46	-	-	74	-26.54	309	246	H
	* 8015.582	36.62	MAv1	35.9	-36.4	36.12	54	-17.88	-	-	309	246	H
3	10369.092	47.84	PK2	37.7	-35.4	50.14	-	-	-	-	93	161	H
4	* 4809.944	54.97	PK2	33.7	-39.8	48.87	-	-	74	-25.13	211	103	V
	* 4810.017	50.79	MAv1	33.7	-39.8	44.69	54	-9.31	-	-	211	103	V
5	* 8154.4	48.75	PK2	35.9	-36.9	47.75	-	-	74	-26.25	58	324	V
	* 8152.529	37.79	MAv1	35.9	-37	36.69	54	-17.31	-	-	58	324	V
6	10443.661	47.16	PK2	37.8	-35.6	49.36	-	-	-	-	195	374	V

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

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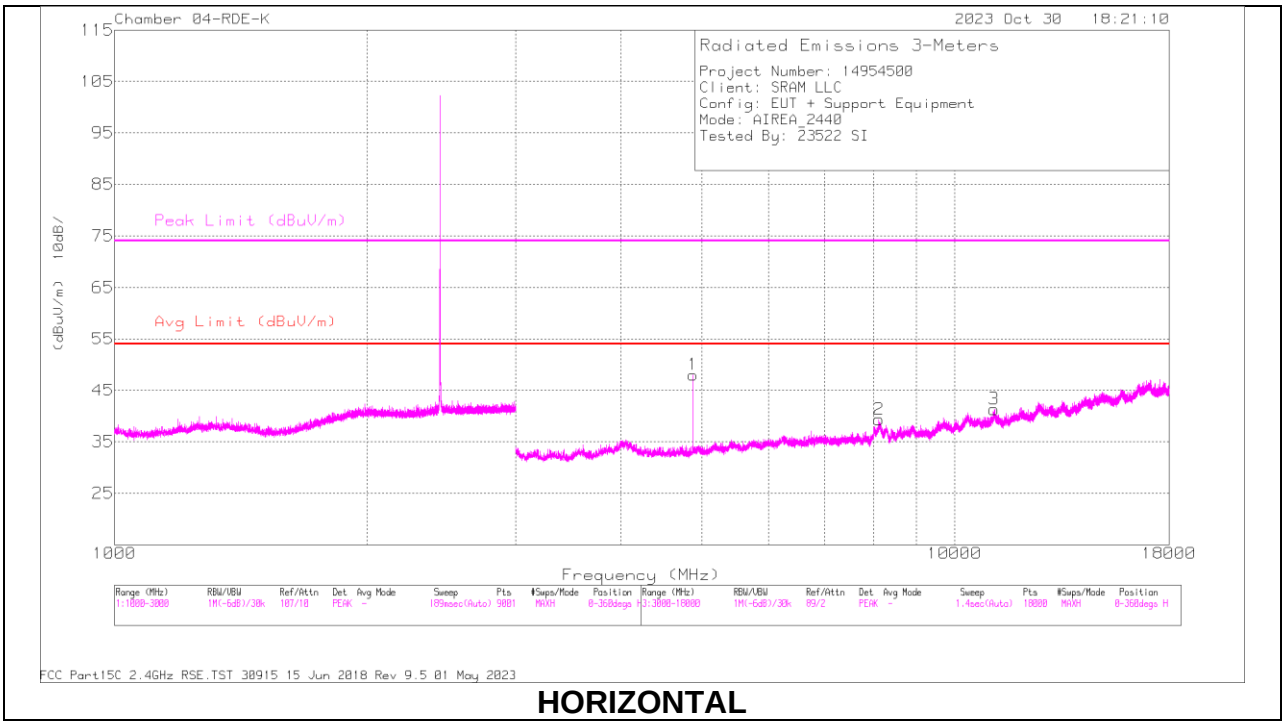
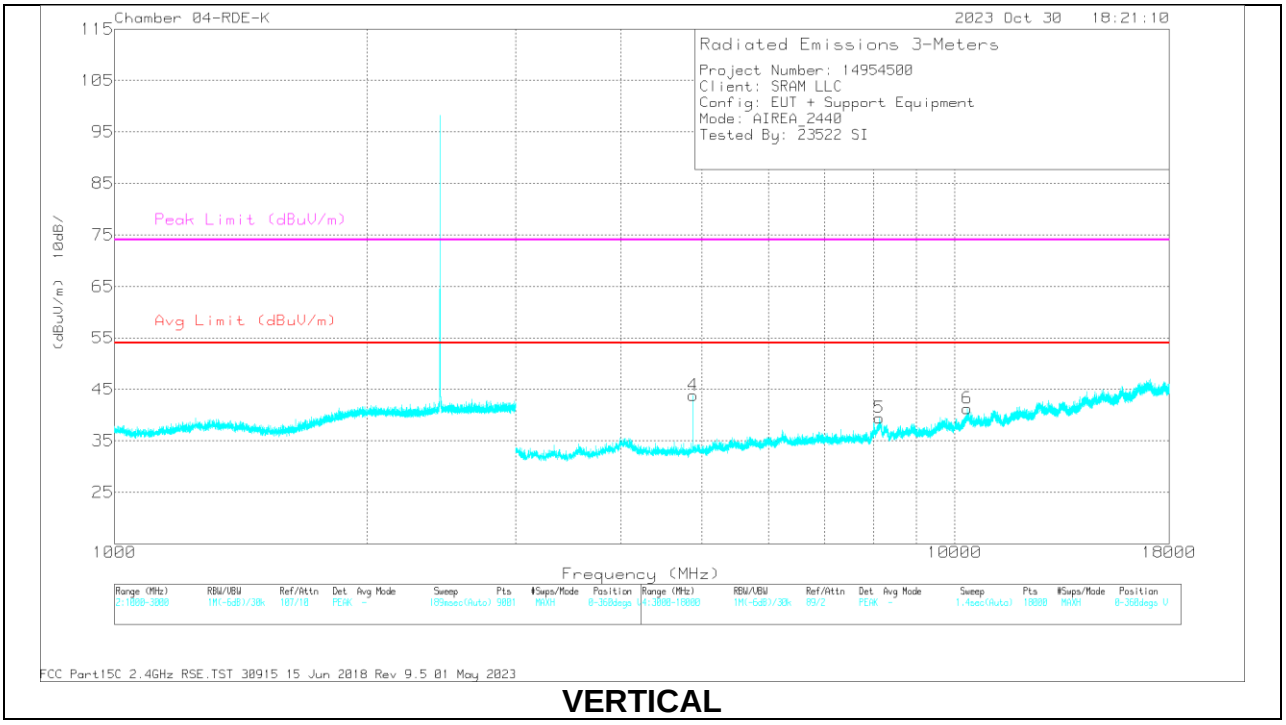
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4880.065	57.82	PK2	33.7	-39.9	51.62	-	-	74	-22.38	157	103	H
	* 4880.022	54.47	MAv1	33.7	-39.9	48.27	54	-5.73	-	-	157	103	H
2	* 8121.341	48.8	PK2	35.9	-36.9	47.8	-	-	74	-26.2	136	106	H
	* 8122.905	37.31	MAv1	35.9	-36.8	36.41	54	-17.59	-	-	136	106	H
3	* 11137.626	47.78	PK2	38	-35.2	50.58	-	-	74	-23.42	311	329	H
	* 11138.766	36.21	MAv1	38	-35.1	39.11	54	-14.89	-	-	311	329	H
4	* 4880.035	54.73	PK2	33.7	-39.9	48.53	-	-	74	-25.47	337	104	V
	* 4880.005	49.92	MAv1	33.7	-39.9	43.72	54	-10.28	-	-	337	104	V
5	* 8127.404	49.43	PK2	35.9	-36.9	48.43	-	-	74	-25.57	259	256	V
	* 8129.329	37.77	MAv1	35.9	-36.8	36.87	54	-17.13	-	-	259	256	V
6	10350.34	48.53	PK2	37.7	-35.7	50.53	-	-	-	-	105	132	V

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

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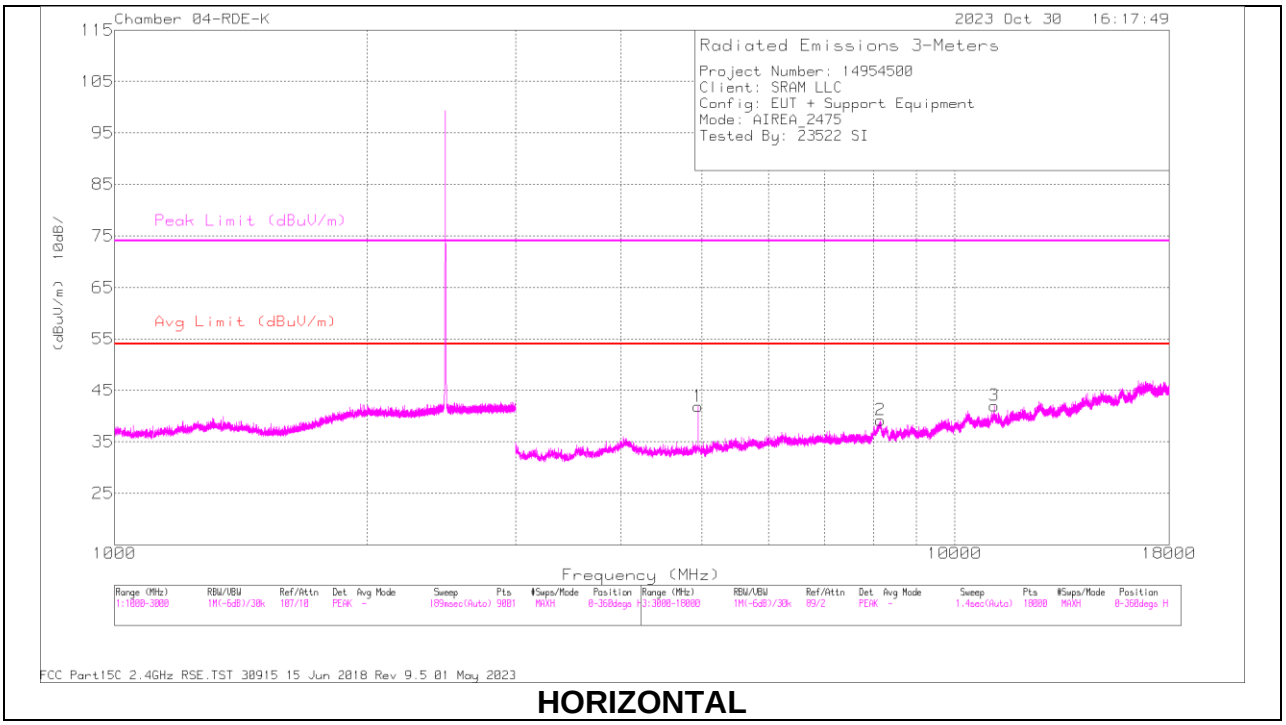
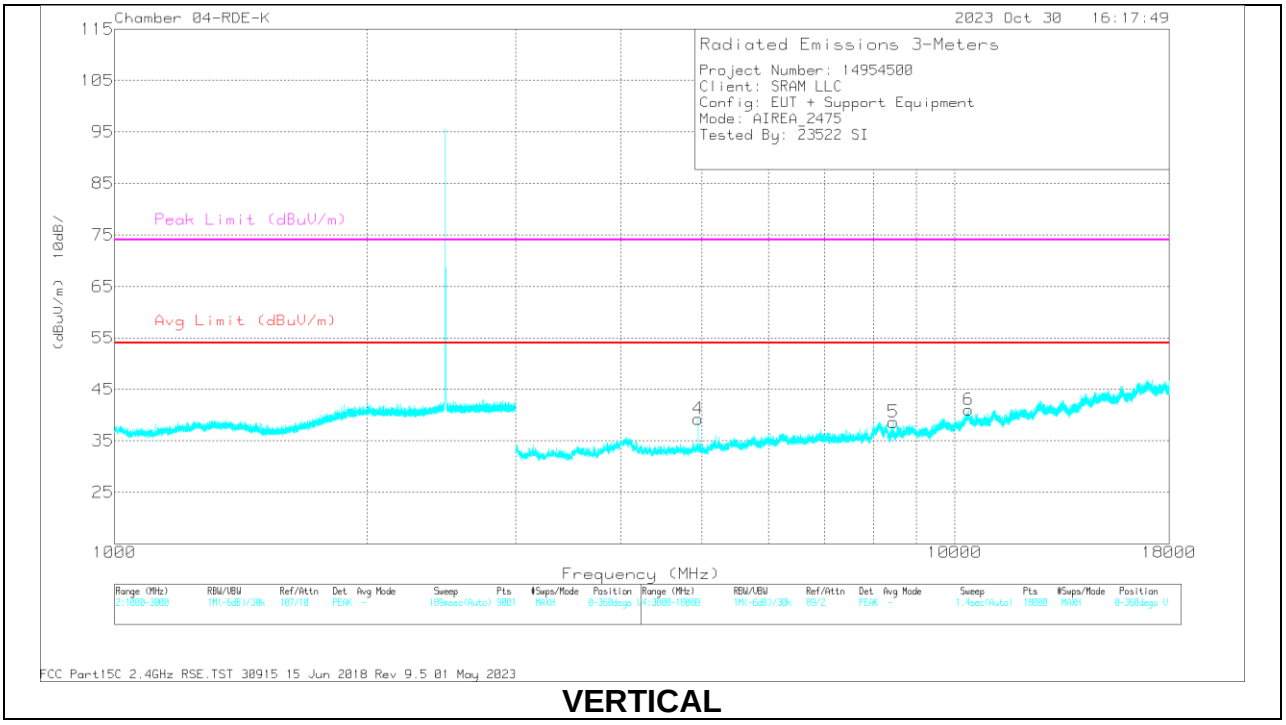
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4949.117	56.34	PK2	33.7	-39.8	50.24	-	-	74	-23.76	159	250	H
	* 4949.117	48.42	MAv1	33.7	-39.8	42.32	54	-11.68	-	-	159	250	H
2	* 8160.352	49.28	PK2	35.9	-36.9	48.28	-	-	74	-25.72	341	367	H
	* 8158.566	37.68	MAv1	35.9	-37	36.58	54	-17.42	-	-	341	367	H
3	* 11143.155	47.75	PK2	38	-35.1	50.65	-	-	74	-23.35	3	375	H
	* 11144.308	36.32	MAv1	38	-35.1	39.22	54	-14.78	-	-	3	375	H
4	* 4950.889	55.29	PK2	33.7	-39.8	49.19	-	-	74	-24.81	8	275	V
	* 4950.954	46.87	MAv1	33.7	-39.8	40.77	54	-13.23	-	-	8	275	V
5	* 8457.442	46.72	PK2	35.8	-36.4	46.12	-	-	74	-27.88	333	266	V
	* 8455.738	35.56	MAv1	35.8	-36.5	34.86	54	-19.14	-	-	333	266	V
6	10386.866	47.8	PK2	37.7	-35.4	50.1	-	-	-	-	235	301	V

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

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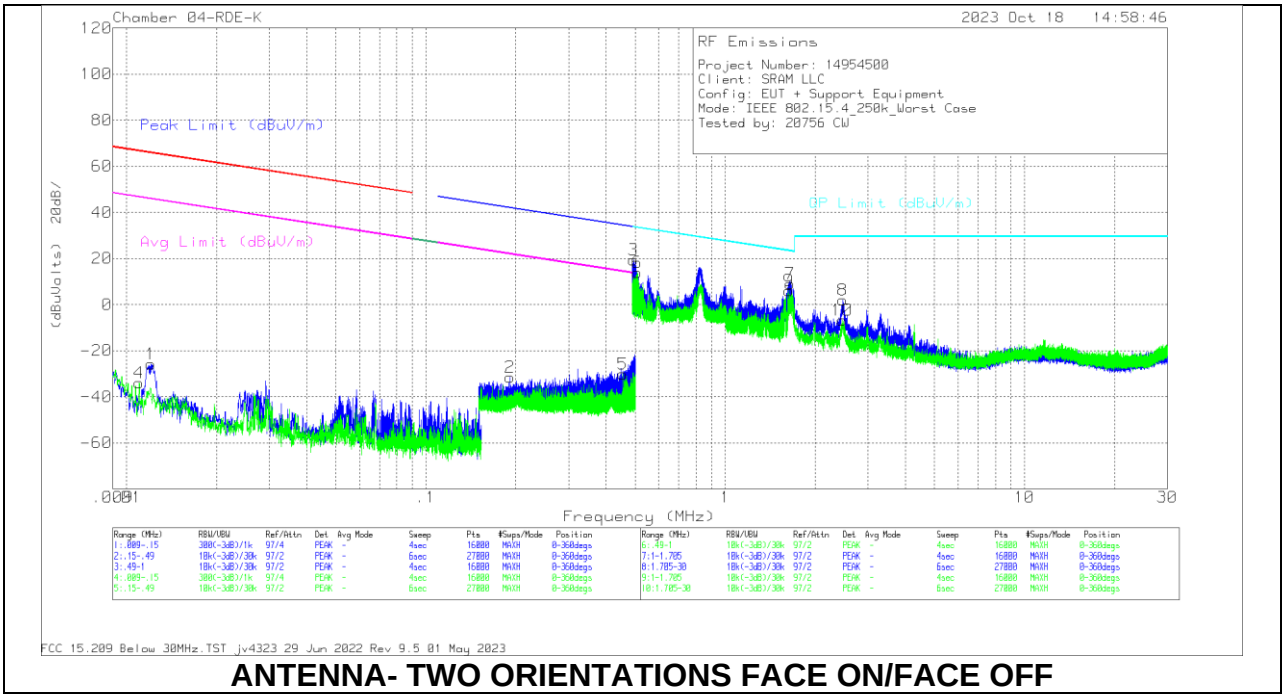
10.3. WORST CASE BELOW 30 MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Amp/Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	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	.0121	25.09	Pk	60.1	-31.1	-80	-25.91	65.93	-91.84	45.93	-71.84	-	-	-	-	0-360
2	.1913	24.36	Pk	56.3	-32.1	-80	-31.44	-	-	-	-	41.99	-73.43	21.99	-53.43	0-360
4	.011	16.78	Pk	60.3	-31	-80	-33.92	66.73	-100.65	46.73	-80.65	-	-	-	-	0-360
5	.4556	25.91	Pk	56.2	-32.3	-80	-30.19	-	-	-	-	34.43	-64.62	14.43	-44.62	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Amp/Cbl (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.4942	35.35	Pk	56.2	-32.2	-40	19.35	33.73	-14.38	0-360
6	.5086	29.9	Pk	56.2	-32.2	-40	13.9	33.48	-19.58	0-360
7	1.6475	37.71	Pk	43.4	-32.1	-40	9.01	23.3	-14.29	0-360
8	2.4711	33.7	Pk	40.2	-31.9	-40	2	29.5	-27.5	0-360
9	1.6348	34.6	Pk	43.5	-32	-40	6.1	23.36	-17.26	0-360
10	2.4575	24.75	Pk	40.3	-31.9	-40	-6.85	29.5	-36.35	0-360

Pk - Peak detector

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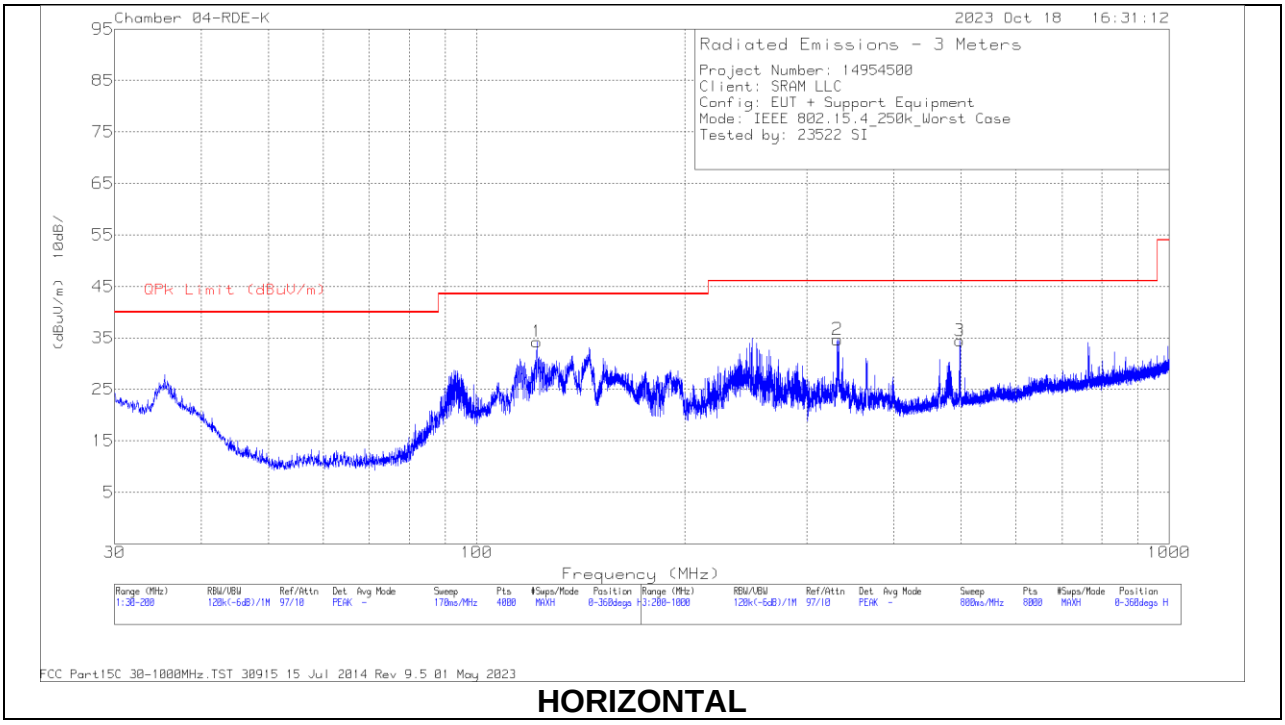
10.4. WORST CASE BELOW 1 GHz

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



HORIZONTAL

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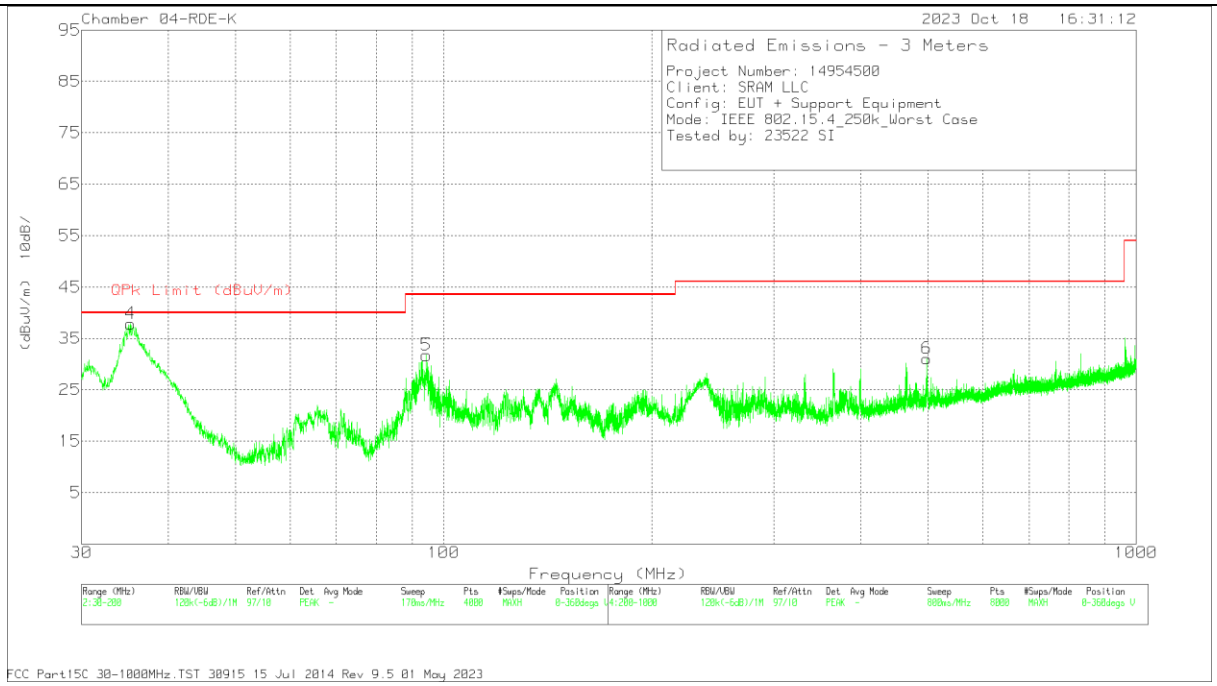

VERTICAL

Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	232075 ACF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 122.164	44.85	Pk	19.9	-30.5	34.25	43.52	-9.27	0-360	199	H
4	35.3139	46.24	Pk	22.9	-31.3	37.84	40	-2.16	0-360	100	V
	35.5283	38.21	Qp	22.7	-31.3	29.61	40	-10.39	314	199	V
5	94.4042	47.51	Pk	14.8	-30.6	31.71	43.52	-11.81	0-360	100	V
2	* 331.817	44.36	Pk	19.8	-29.5	34.66	46.02	-11.36	0-360	299	H
3	498.539	39.67	Pk	23.6	-28.8	34.47	46.02	-11.55	0-360	99	H
6	498.339	36.18	Pk	23.6	-28.7	31.08	46.02	-14.94	0-360	99	V

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

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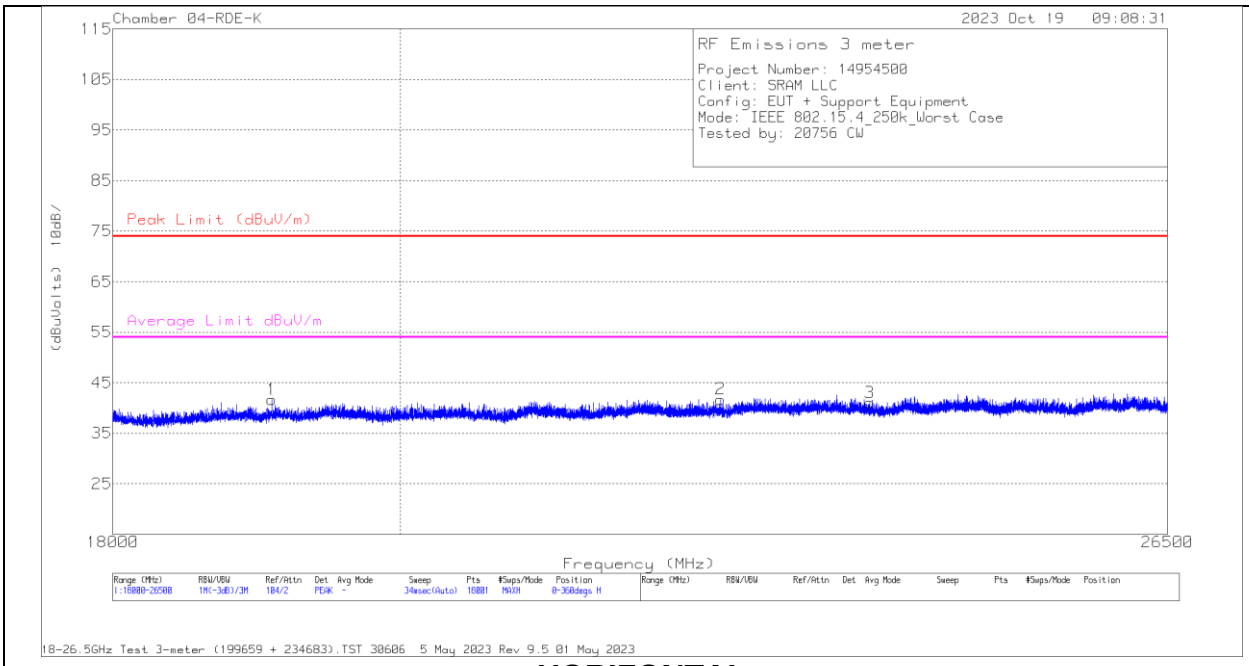
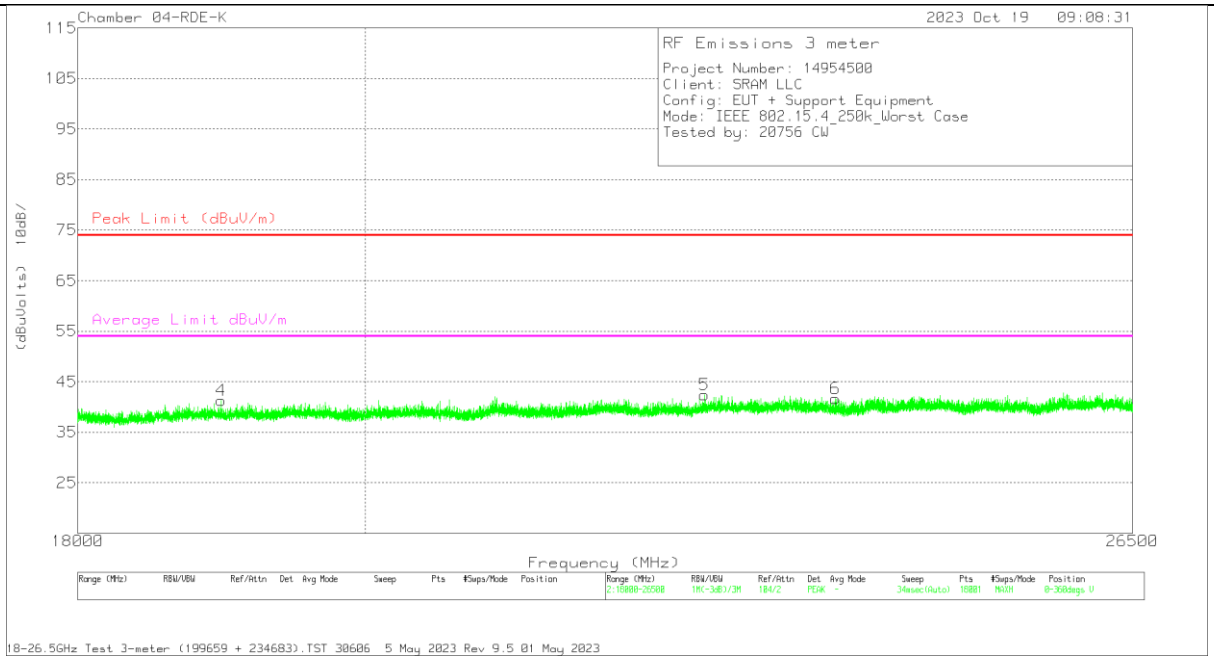
10.5. WORST CASE 18-26 GHz

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



HORIZONTAL



VERTICAL

18 – 26GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Horn ACF (dB/m)	234683 Amp/Cbl (dB)	Cables (dB)	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 19081.388	53.19	Pk	32.6	-62.5	18.4	41.69	74	-32.31	54	-12.31	0-360	200	H
2	* 22496.498	51.22	Pk	33.3	-62.6	19.8	41.72	74	-32.28	54	-12.28	0-360	200	H
3	* 23756.858	49.66	Pk	33.6	-62.6	20.4	41.06	74	-32.94	54	-12.94	0-360	101	H
4	* 18970.416	53.04	Pk	32.5	-62.5	18.3	41.34	74	-32.66	54	-12.66	0-360	101	V
5	* 22649.97	51.83	Pk	33.3	-62.6	19.9	42.43	74	-31.57	54	-11.57	0-360	200	V
6	* 23762.525	50.26	Pk	33.6	-62.6	20.4	41.66	74	-32.34	54	-12.34	0-360	200	V

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

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
ISED RSS-GEN, Section 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

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

RESULTS

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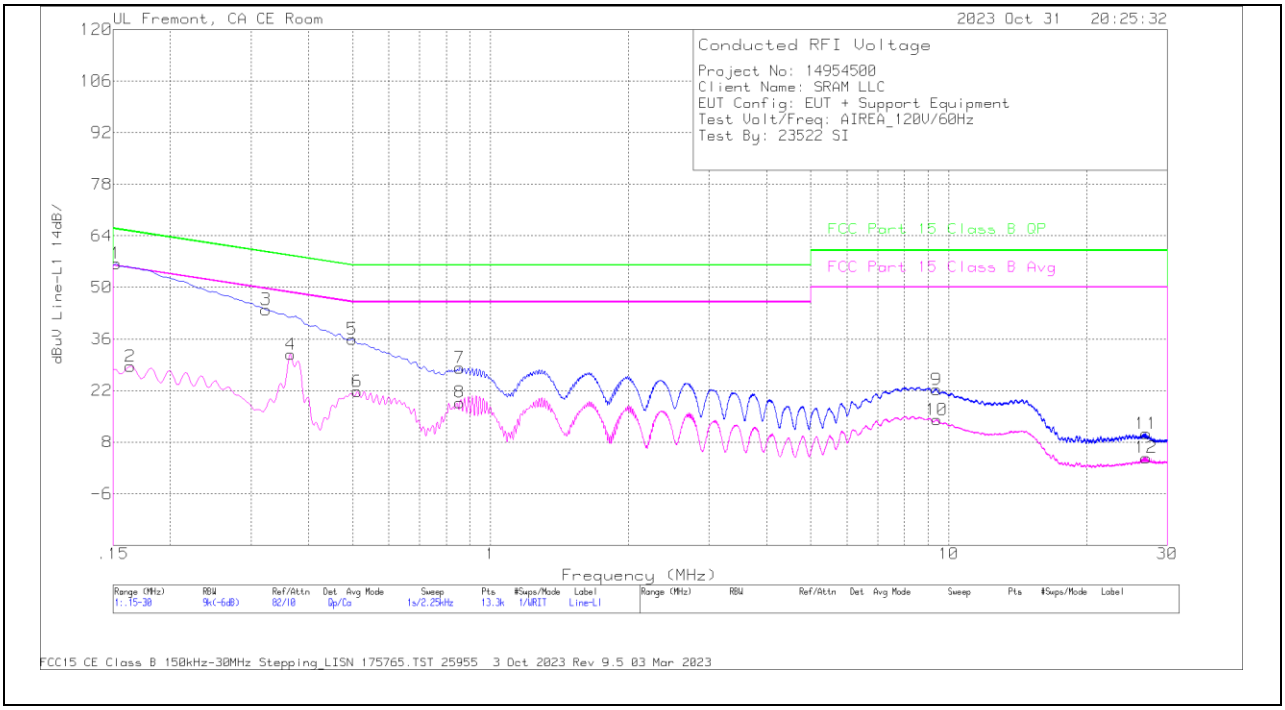
11.1. AC Power Line Norm

LINE 1 RESULTS



Trace Markers

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trns Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.1523	46.99	Qp	0	0	9.5	56.49	65.88	-9.39	-	-
2	.1635	19.08	Ca	0	0	9.5	28.58	-	-	55.28	-26.7
3	.3233	34.49	Qp	0	.1	9.4	43.99	59.62	-15.63	-	-
4	.366	22.4	Ca	0	0	9.4	31.8	-	-	48.59	-16.79
5	.4988	26.63	Qp	0	0	9.3	35.93	56.02	-20.09	-	-
6	.5123	12.43	Ca	0	0	9.3	21.73	-	-	46	-24.27
7	.8565	18.79	Qp	0	.1	9.3	28.19	56	-27.81	-	-
8	.8565	9.36	Ca	0	.1	9.3	18.76	-	-	46	-27.24
9	9.4065	12.63	Qp	0	.2	9.4	22.23	60	-37.77	-	-
10	9.4223	4.47	Ca	0	.2	9.4	14.07	-	-	50	-35.93
11	26.9723	.19	Qp	.3	.3	9.5	10.29	60	-49.71	-	-
12	26.9723	-6.33	Ca	.3	.3	9.5	3.77	-	-	50	-46.23

Qp - Quasi-Peak detector
Ca - CISPR average detection

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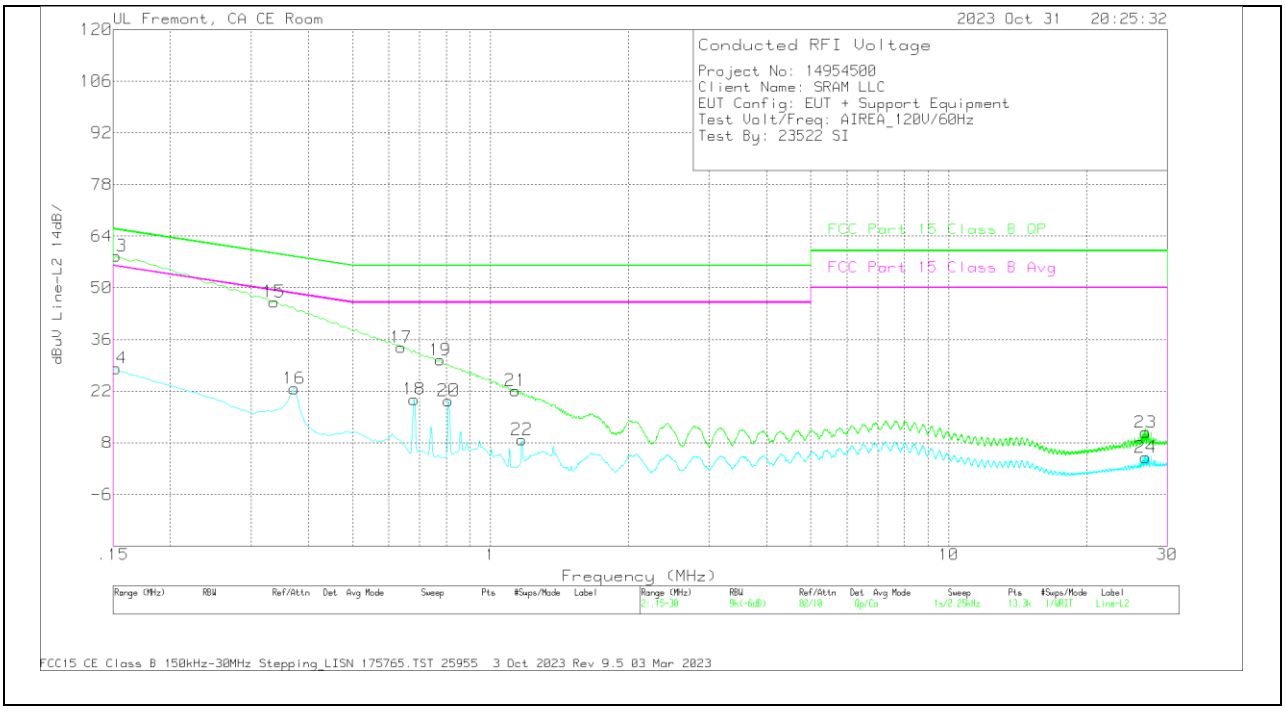
LINE 2 RESULTS



Trace Markers

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trns Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.1523	49.15	Qp	0	0	9.5	58.65	65.88	-7.23	-	-
14	.1523	18.66	Ca	0	0	9.5	28.16	-	-	55.88	-27.72
15	.3368	36.68	Qp	0	.1	9.4	46.18	59.28	-13.1	-	-
16	.3728	13.2	Ca	0	.1	9.4	22.7	-	-	48.44	-25.74
17	.6383	24.36	Qp	0	.1	9.4	33.86	56	-22.14	-	-
18	.681	10.49	Ca	0	0	9.3	19.79	-	-	46	-26.21
19	.7755	21.15	Qp	0	0	9.3	30.45	56	-25.55	-	-
20	.8093	10.11	Ca	0	0	9.3	19.41	-	-	46	-26.59
21	1.1333	12.53	Qp	0	.2	9.4	22.13	56	-33.87	-	-
22	1.1693	-.78	Ca	0	.2	9.4	8.82	-	-	46	-37.18
23	26.8913	.81	Qp	.3	.3	9.4	10.81	60	-49.19	-	-
24	26.8913	-5.97	Ca	.3	.3	9.4	4.03	-	-	50	-45.97

Qp - Quasi-Peak detector
Ca - CISPR average detection

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