

# TEST REPORT

**Report Number:** 14954500-E1V1

**Applicant :** SRAM LLC  
1000 W Fulton Market 4<sup>th</sup> 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:**  
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## REPORT REVISION HISTORY

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

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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:** 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:** 2023-09-29 to 2023-10-20

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 3	Complies
ISED RSS-GEN Issue 5 + A1 + A2	Complies

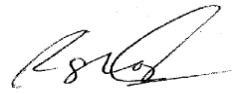
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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, or any agency of the U.S. government.

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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	Per ANSI C63.10, Section 11.6.
See Comment	RSS-GEN 6.7	20dB BW/99% OBW	Reporting purposes only	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	RSS-247 (5.1) (b)	Hopping Frequency Separation		None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Number of Hopping Channels		None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Average Time of Occupancy		None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power		None.
See Comment		Average Power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	RSS-247 (5.5)	Conducted Spurious Emissions		None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions		None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions		None.

### 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
<input checked="" type="checkbox"/>	Building 1: 47173 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	550739
<input type="checkbox"/>	Building 2: 47266 Benicia Street Fremont, CA 94538, U.S.A	US0104	2324A	550739
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd Fremont, CA 94538, U.S.A	US0104	2324A	550739



## 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 <sub>Lab</sub>
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 a Bicycle Head Unit.

### 6.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	6.35	4.32
2402 - 2480	Enhanced DQPSK	7.35	5.43
2402 - 2480	Enhanced 8PSK	7.84	6.08

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The Qualcomm Radio utilizes a PIFA antenna, with a maximum gain of 2.08 dBi.

### 6.4. SOFTWARE AND FIRMWARE

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

## 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.

Worst-case data rates as provided by the client were:

GFSK mode: DH5  
8PSK mode: 3-DH5

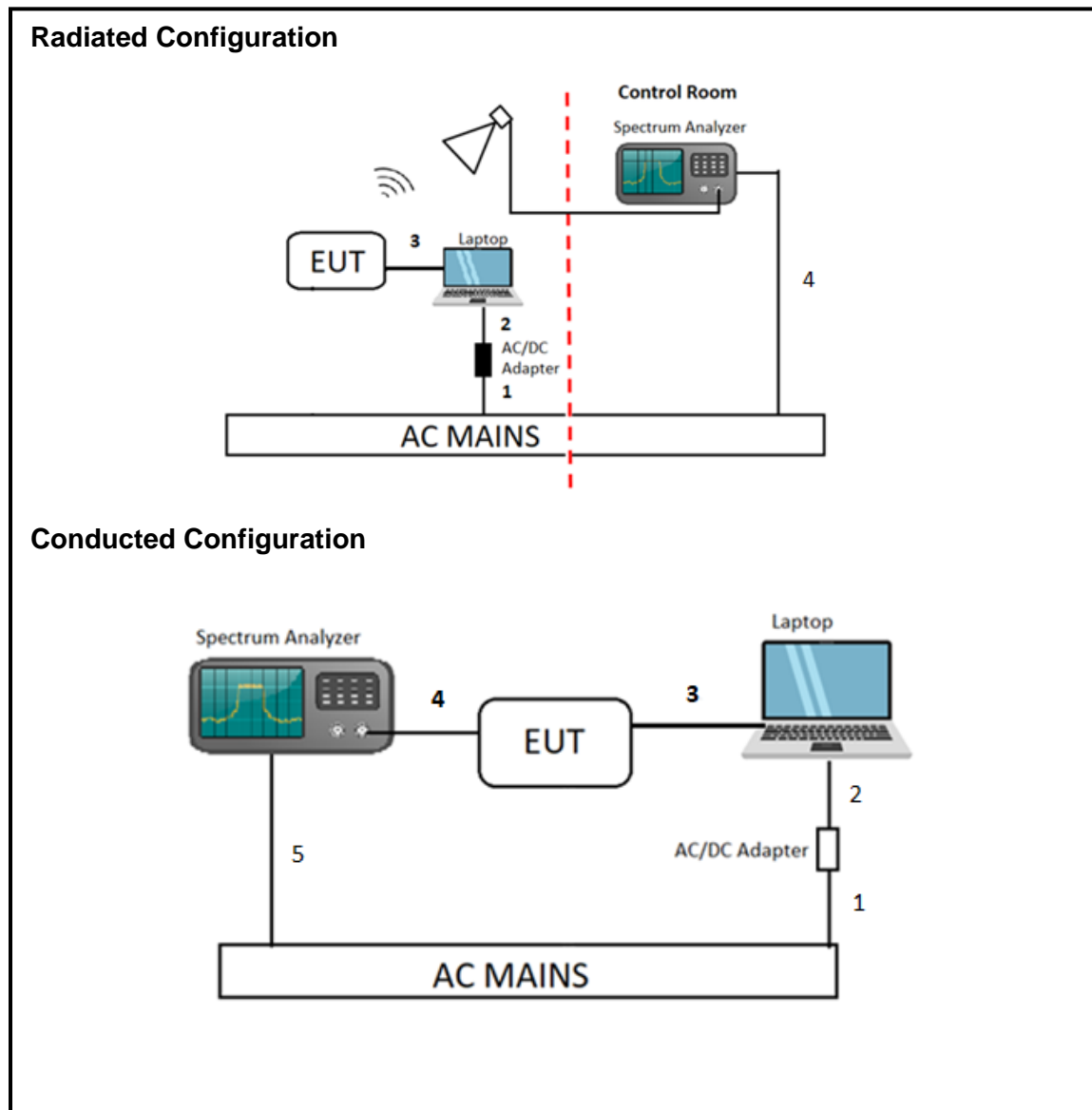
## 6.6. DESCRIPTION OF TEST SETUP

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.

**SETUP DIAGRAMS**



## 7. 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.

## 8. 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

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

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

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

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

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



## 9. ANTENNA PORT TEST RESULTS

### 9.1. 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

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
Bluetooth GFSK	85.00	85.00	1.000	100.00	0.00	0.010
Bluetooth 8PSK	89.20	89.20	1.000	100.00	0.00	0.010

#### DUTY CYCLE PLOTS



## **9.2. 20 dB AND 99% BANDWIDTH**

### **LIMITS**

None; for reporting purposes only.

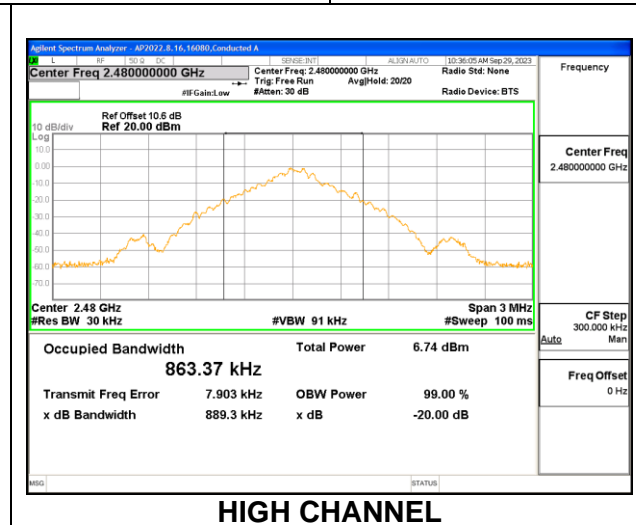
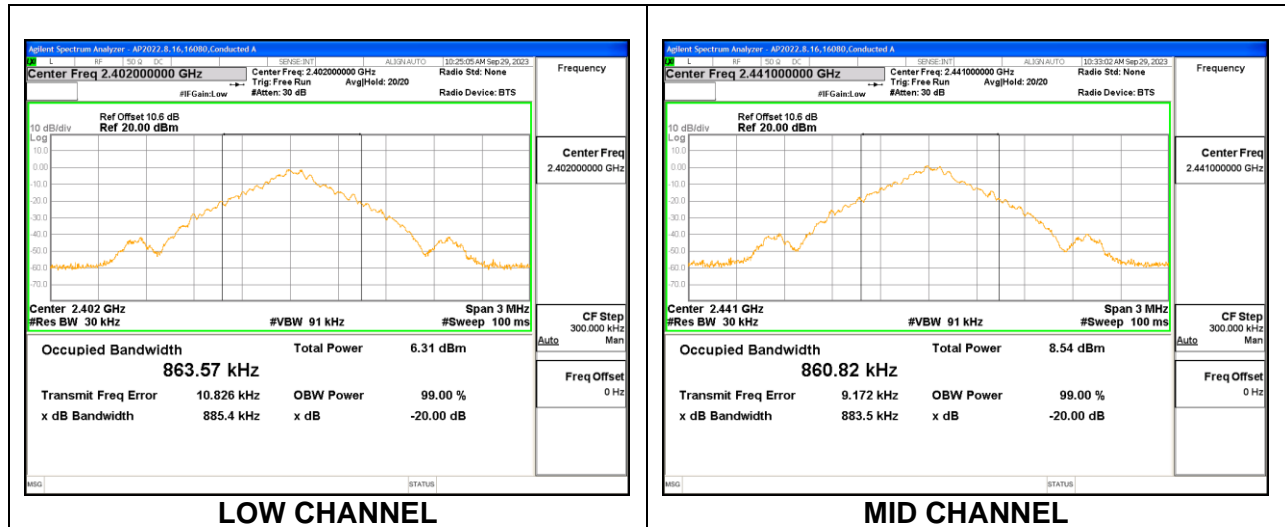
### **TEST PROCEDURE**

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**

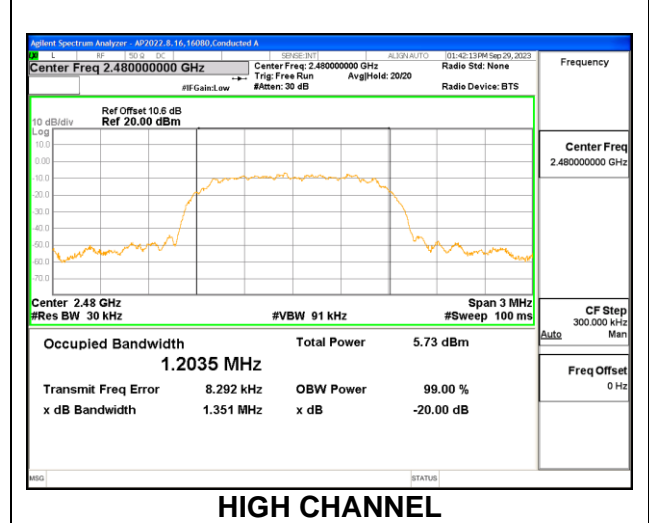
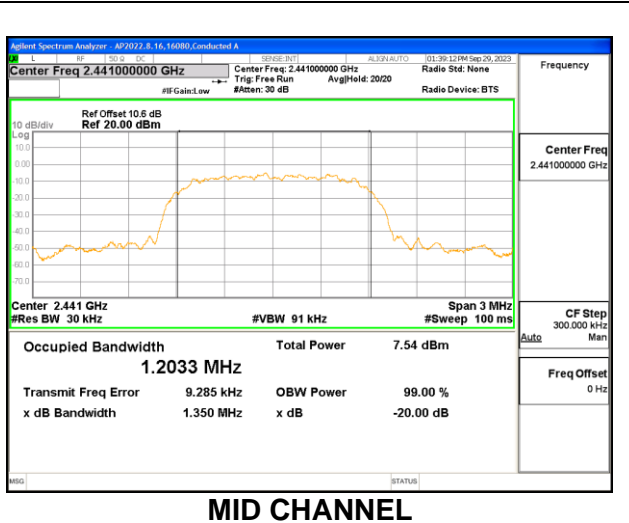
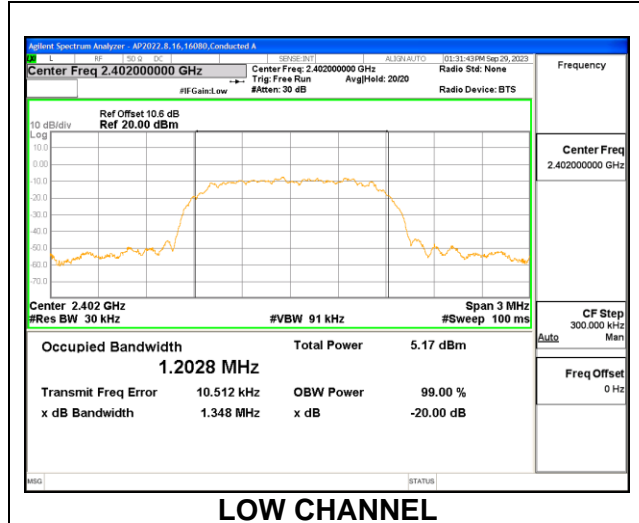
### 9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	885.4	863.57
Mid	2441	883.5	860.82
High	2480	889.3	863.37



### 9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.348	1.2028
Mid	2441	1.350	1.2033
High	2480	1.351	1.2035



### **9.3. HOPPING FREQUENCY SEPARATION**

#### **LIMITS**

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

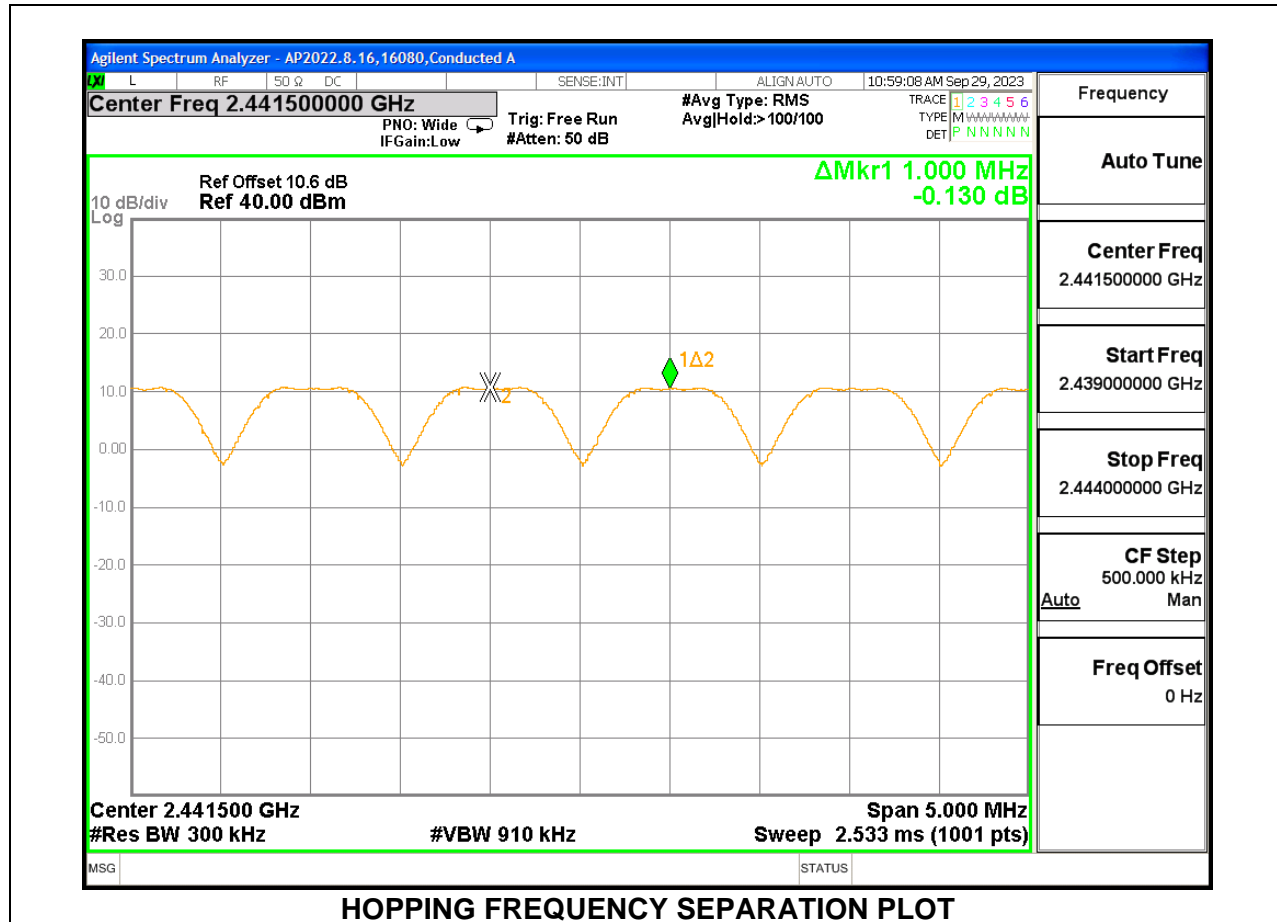
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### **TEST PROCEDURE**

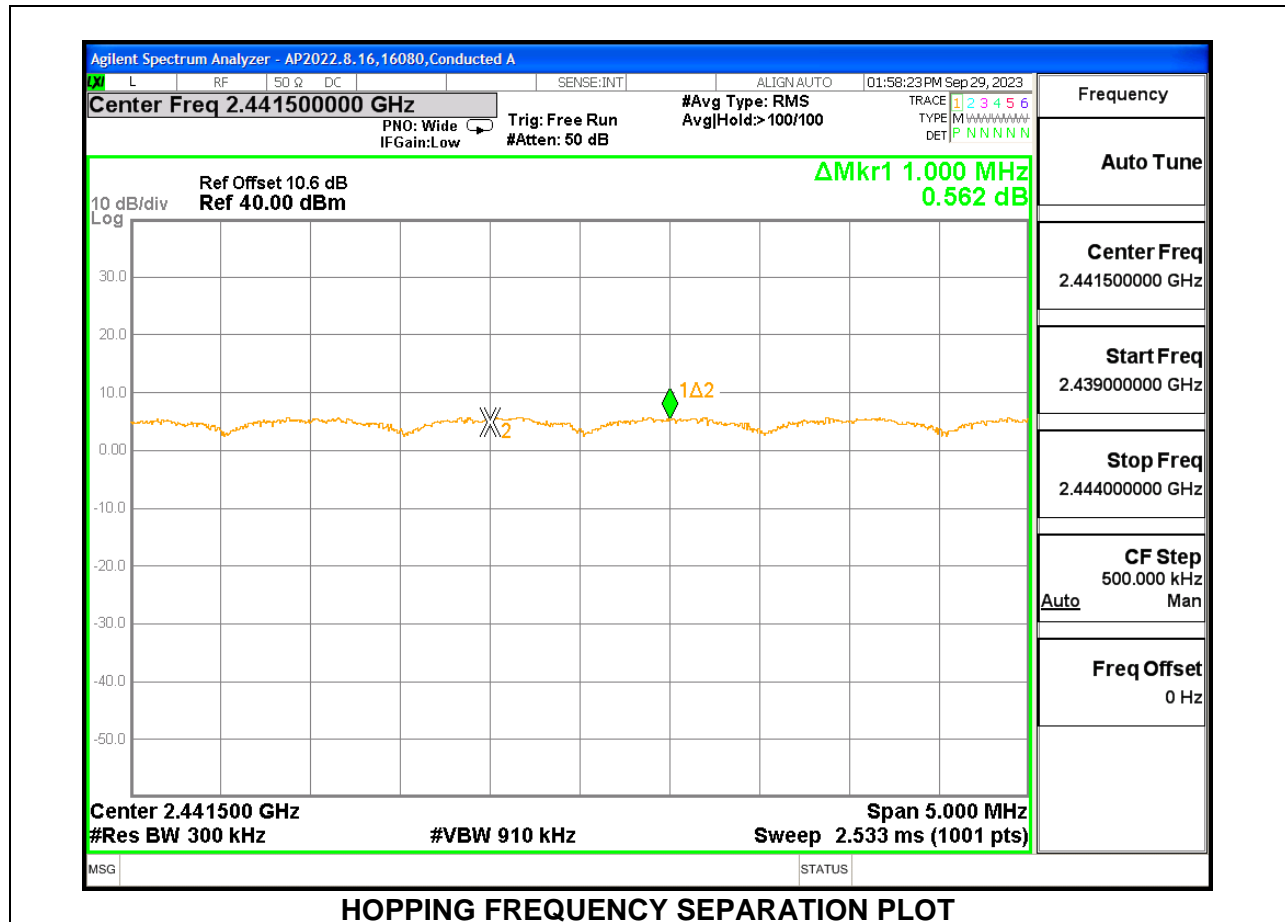
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to  $VBW \geq RBW$ . The sweep time is coupled.

#### **RESULTS**

### 9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



### 9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



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## **9.4. NUMBER OF HOPPING CHANNELS**

### **LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

### **TEST PROCEDURE**

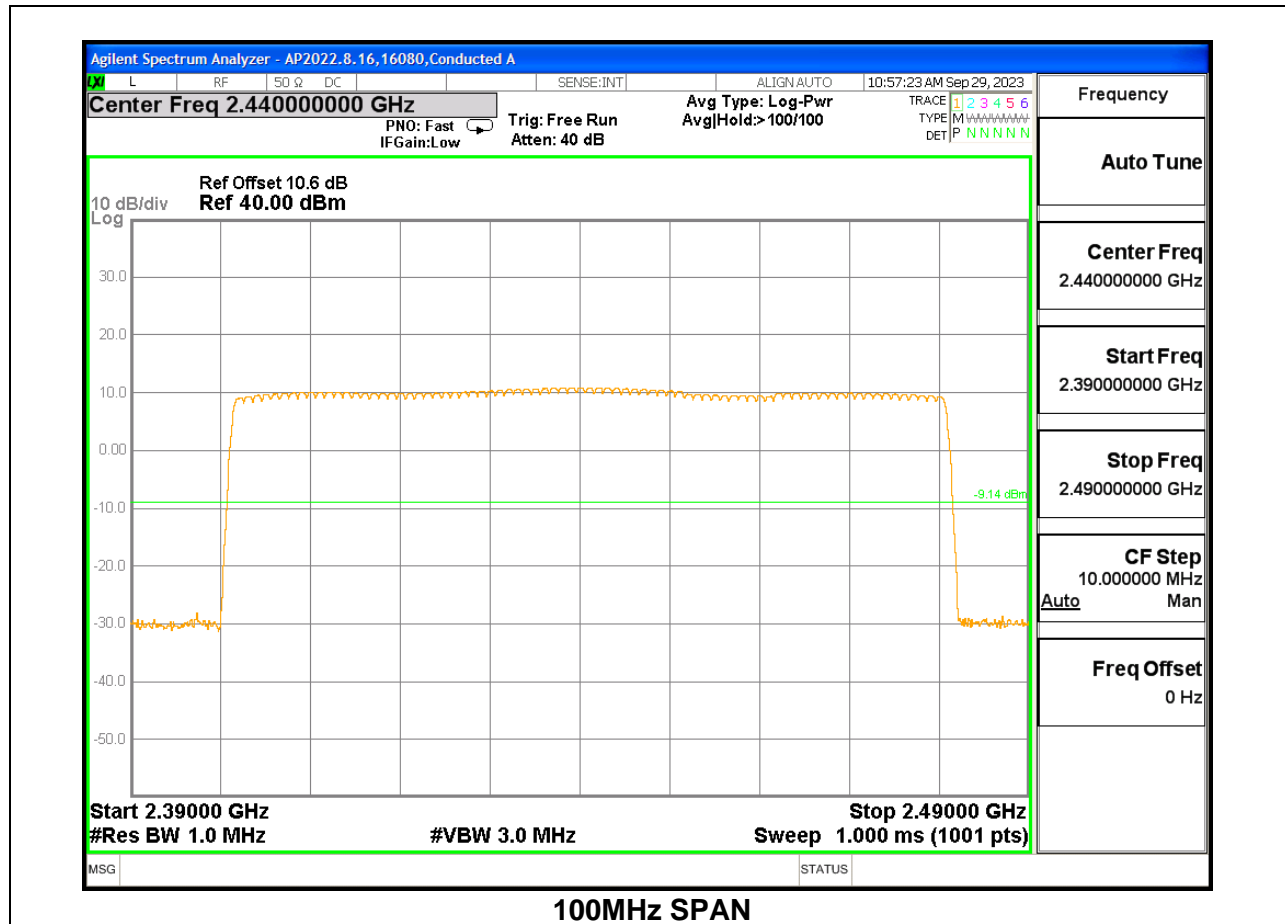
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

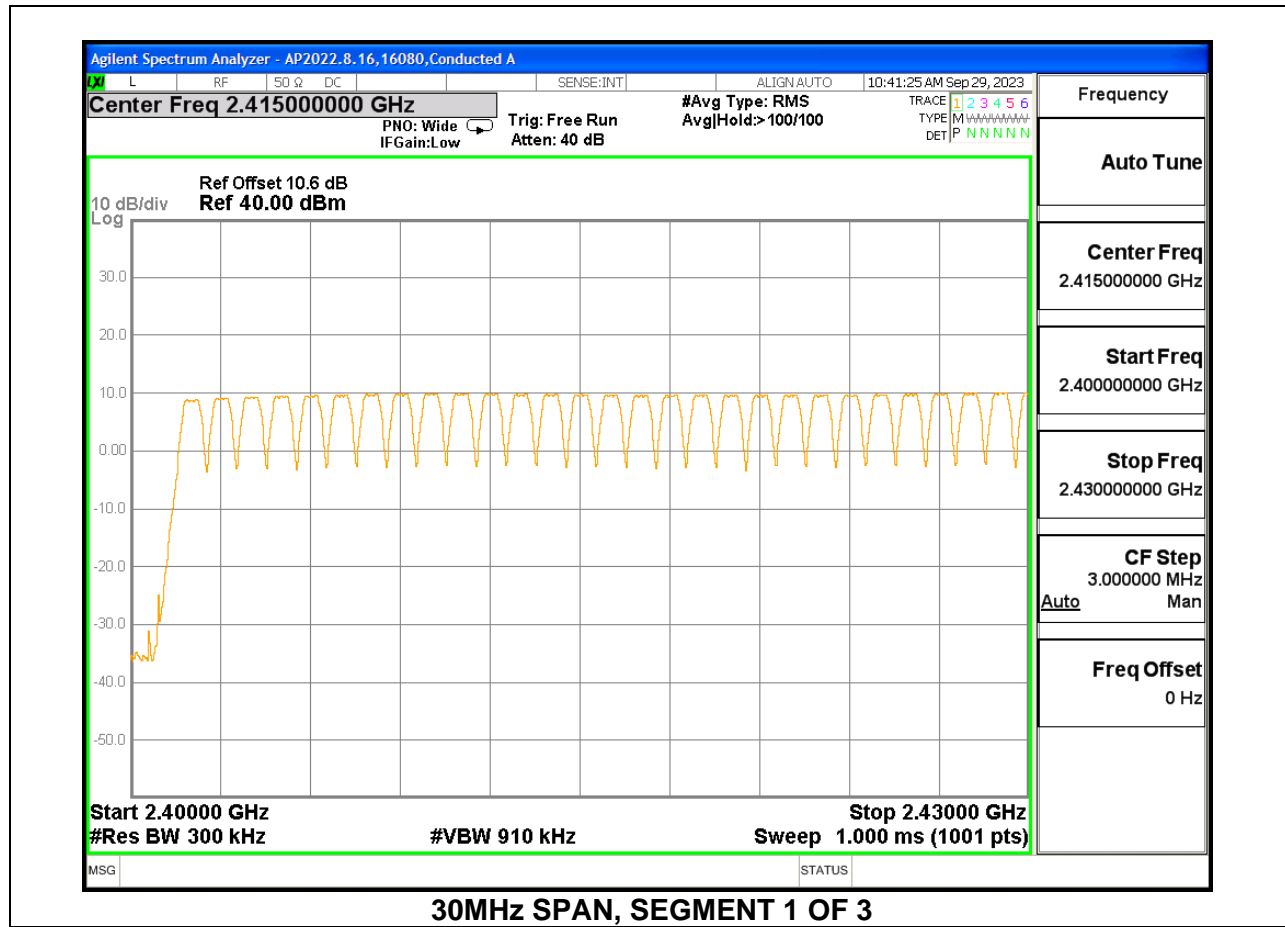
### **RESULTS**

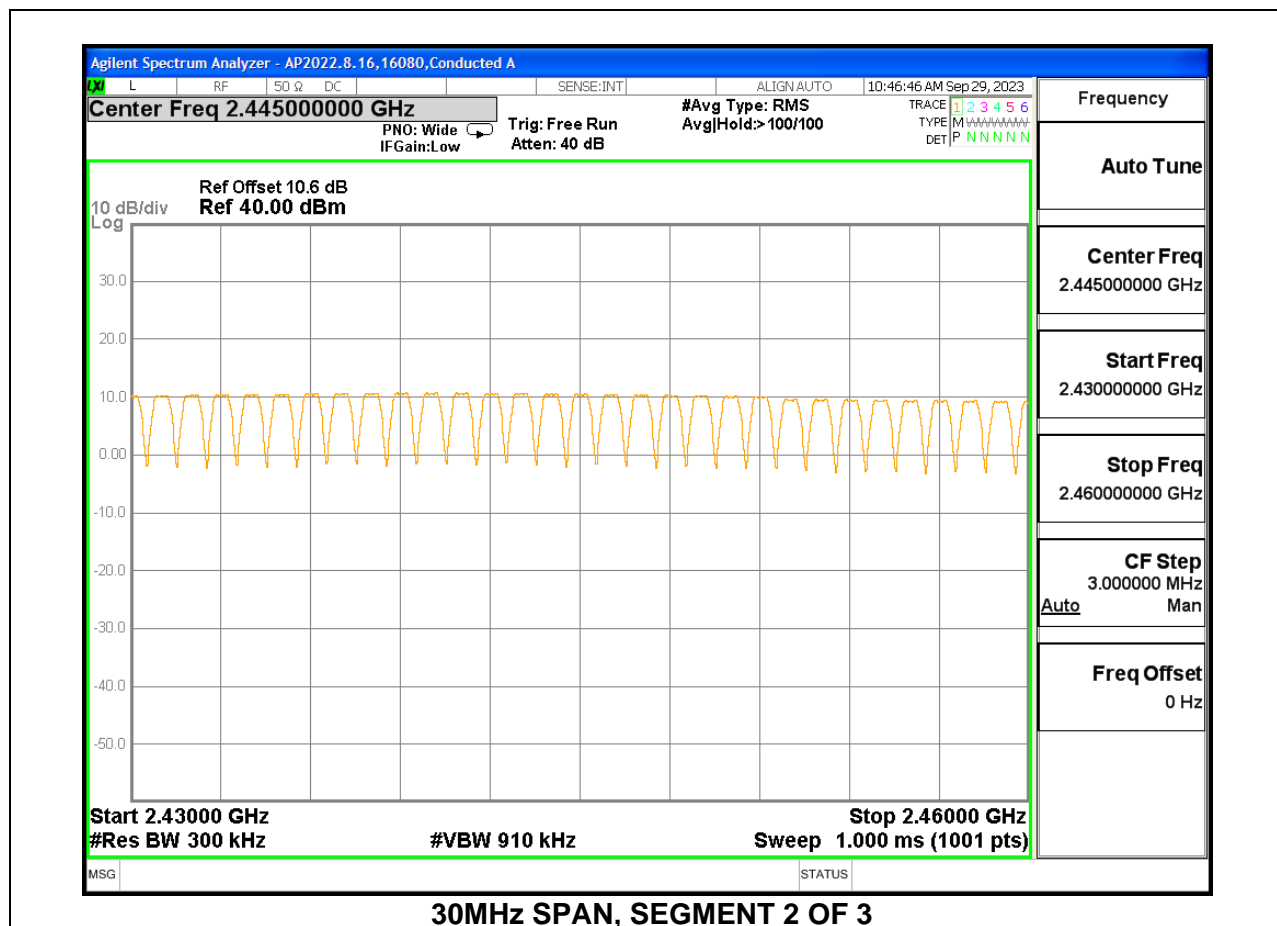
Normal Mode: 79 Channels Observed

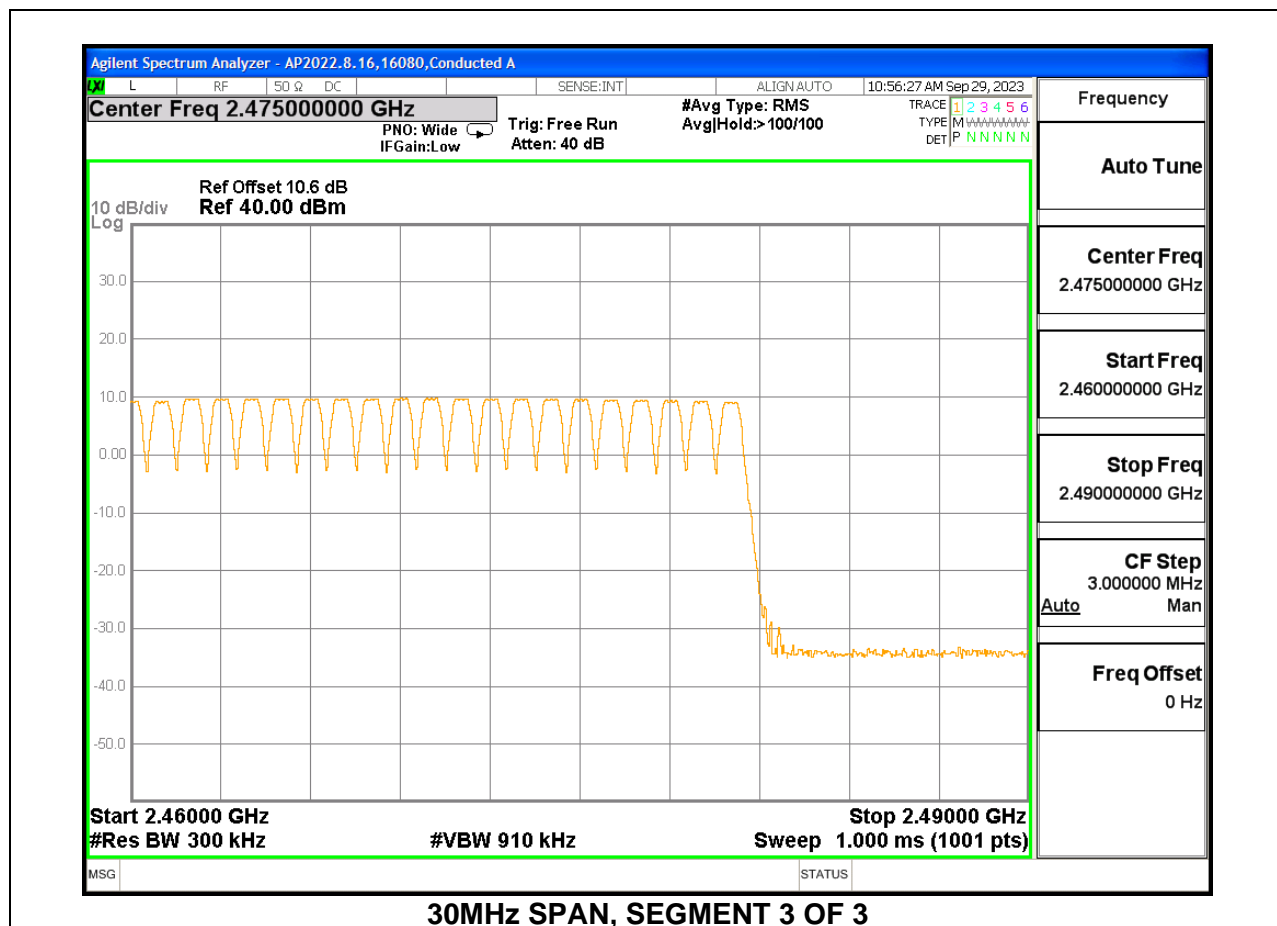


### 9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

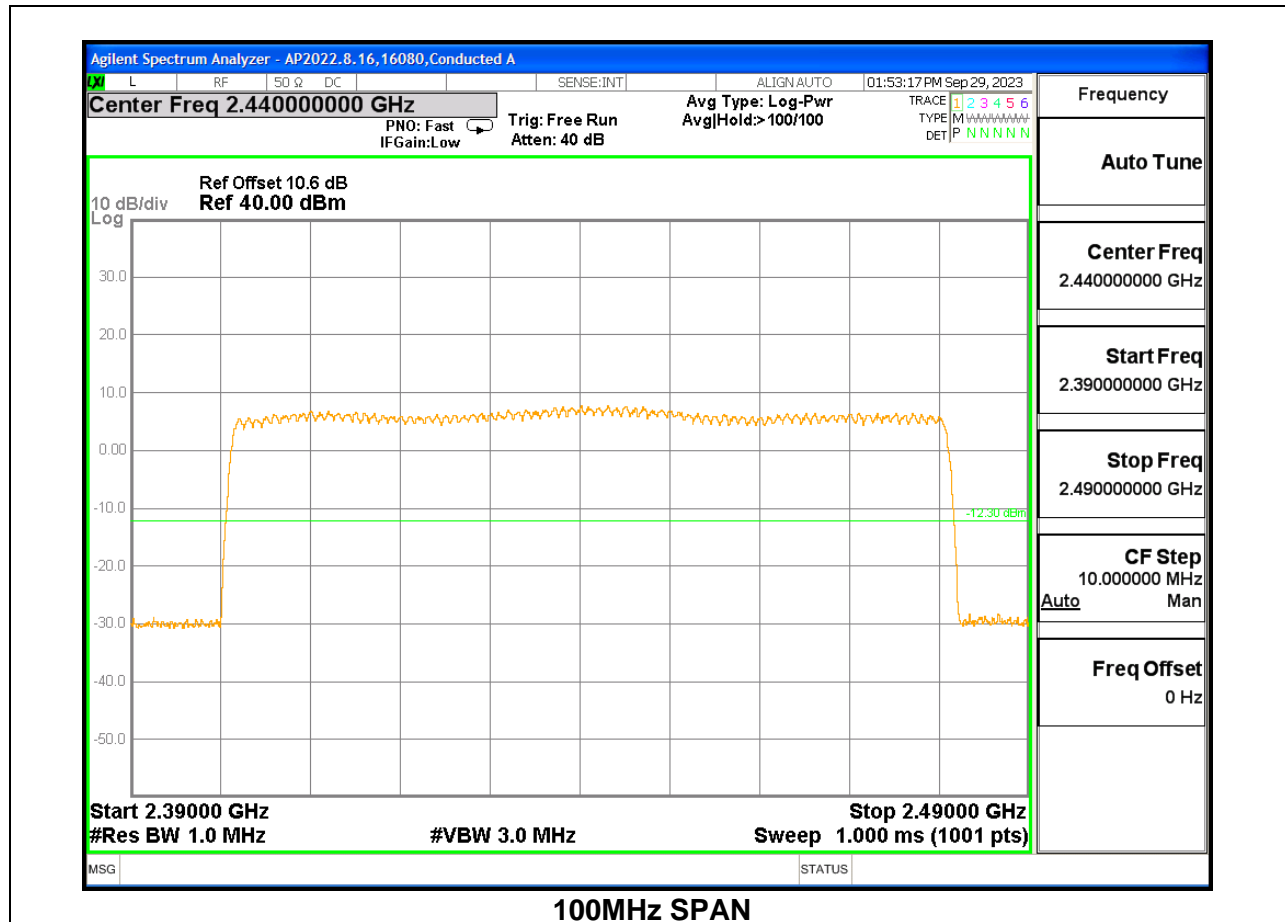


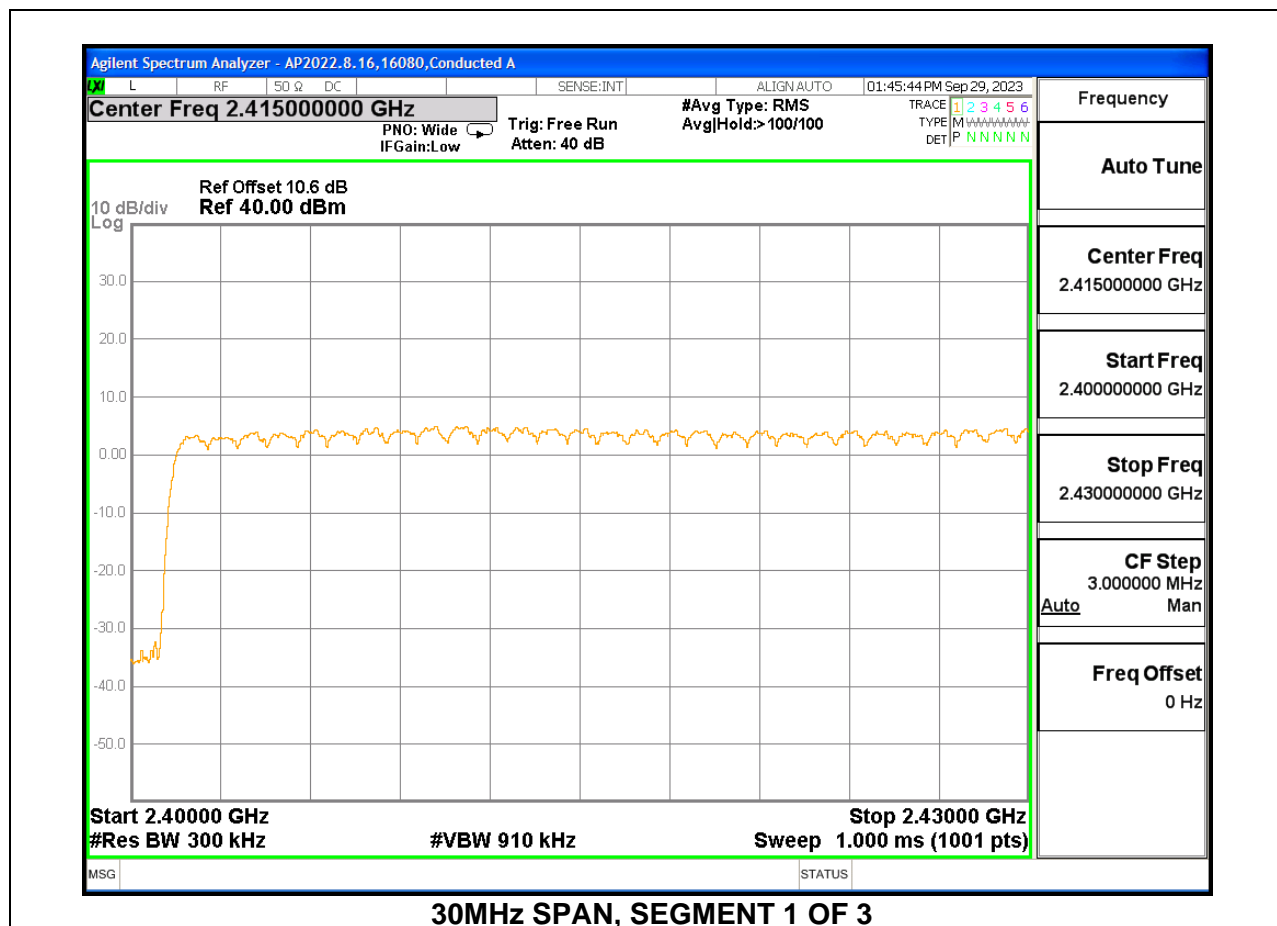


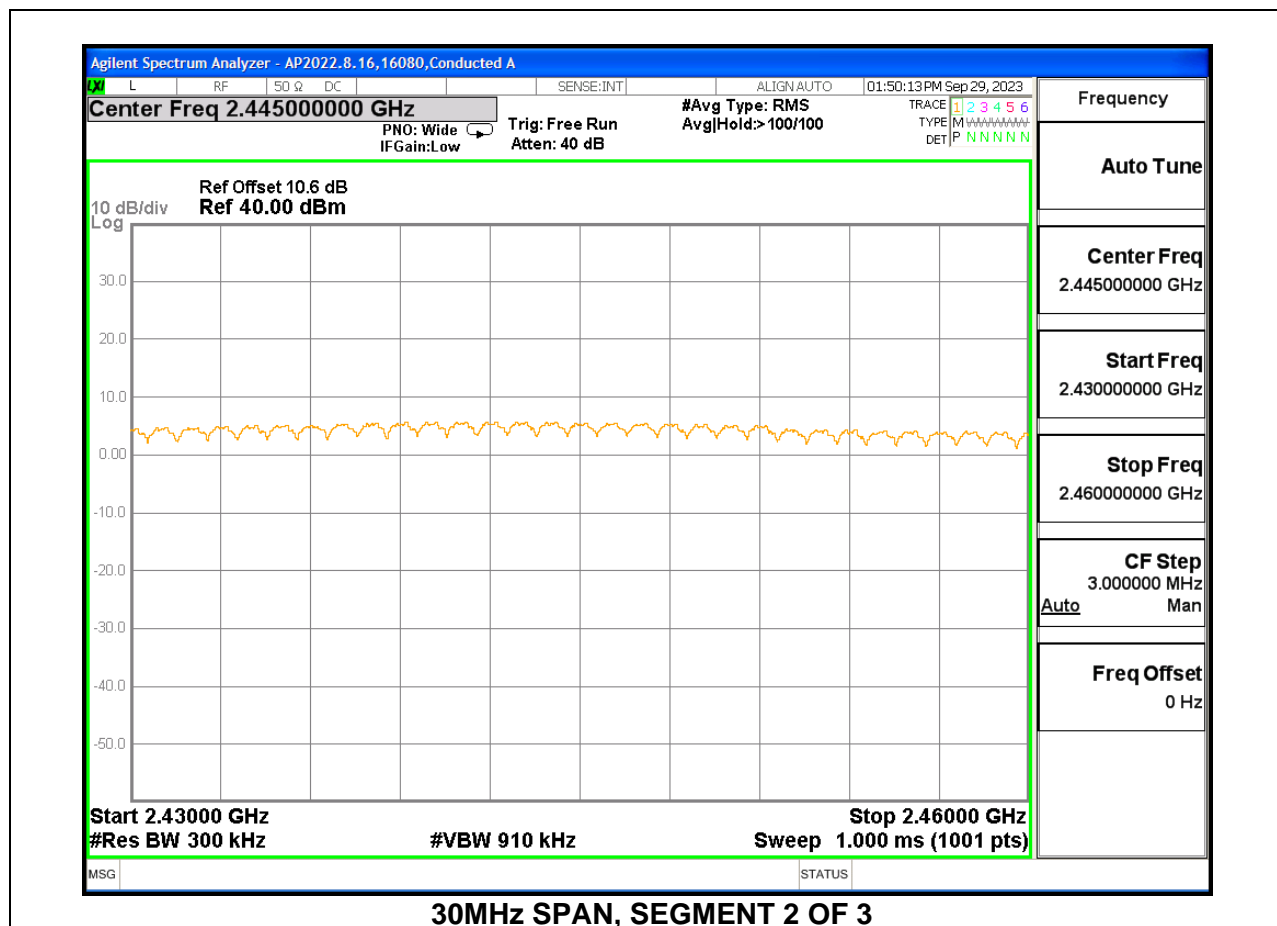


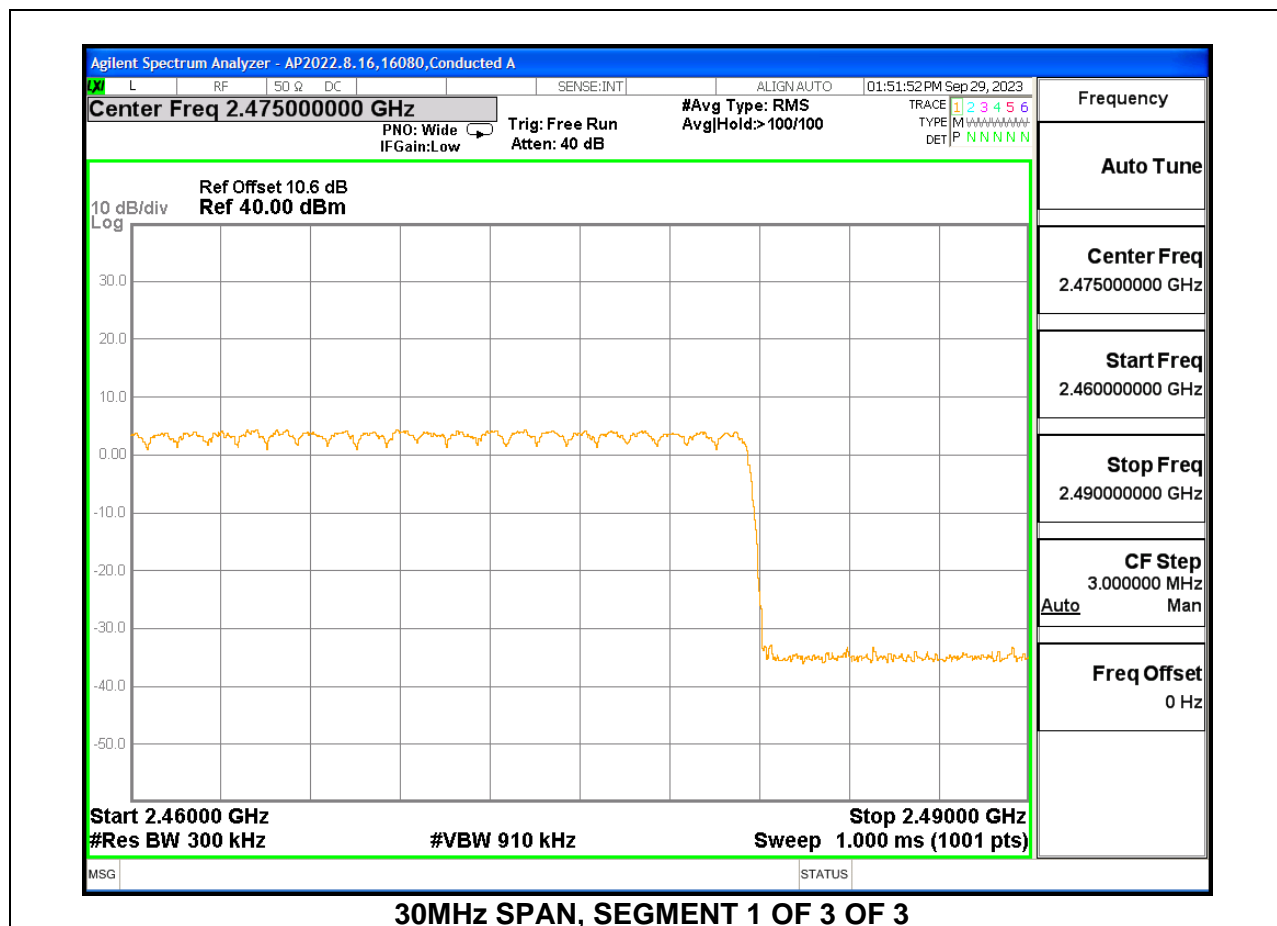


### 9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION











## **9.5. AVERAGE TIME OF OCCUPANCY**

### **LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

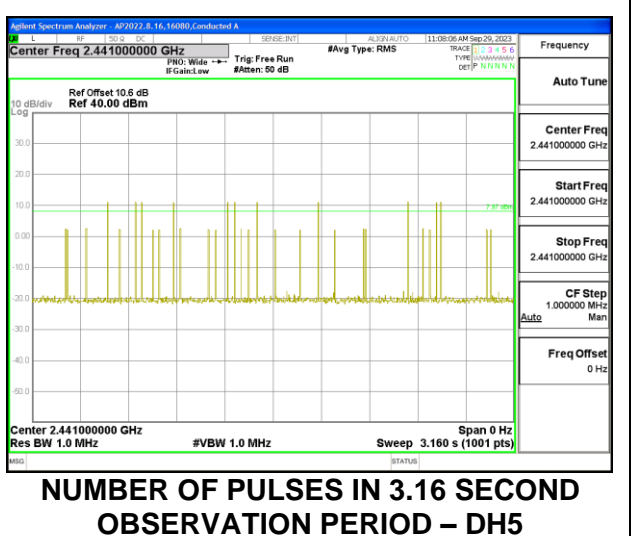
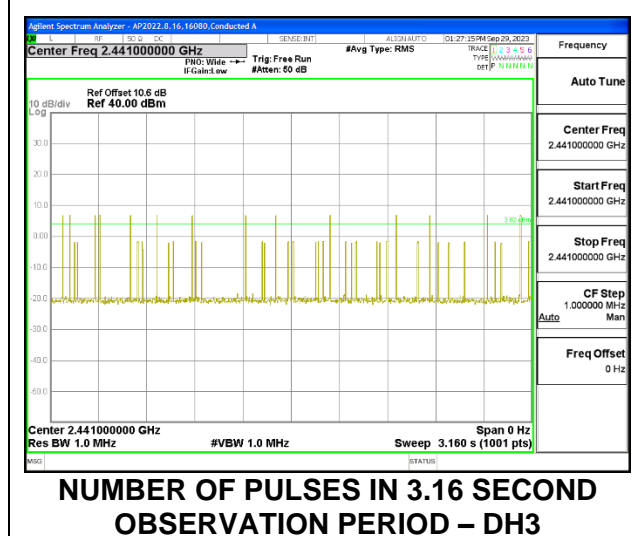
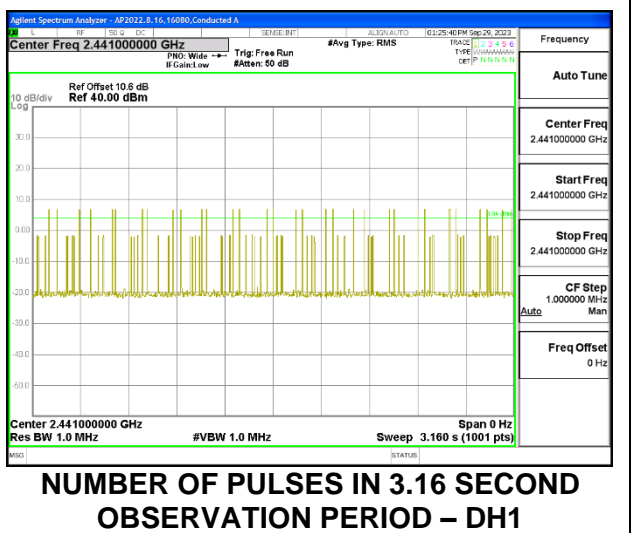
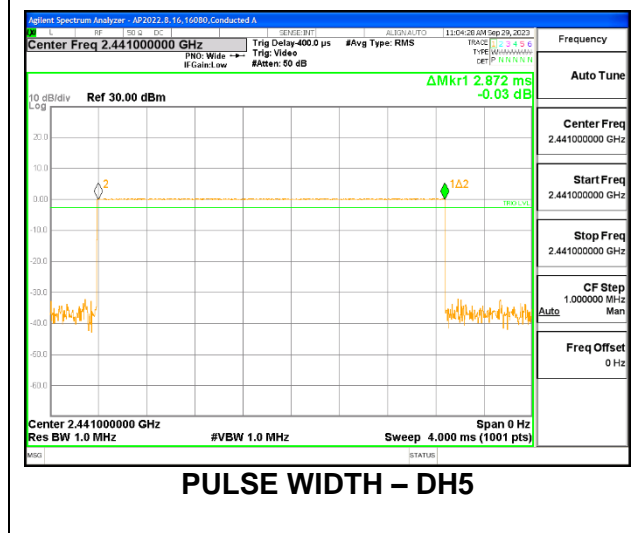
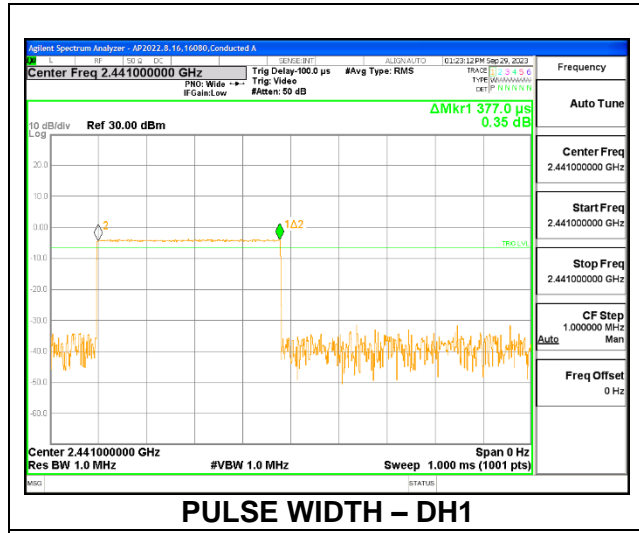
The average time of occupancy in the specified 3.16 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to  $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$ .

### **RESULTS**

### 9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

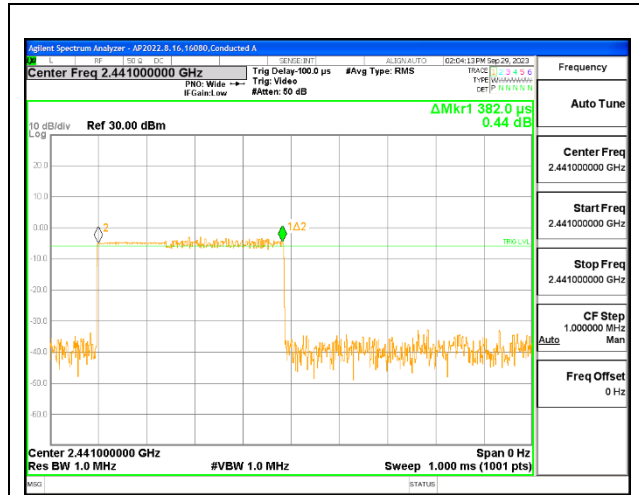
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
<b>GFSK Normal Mode</b>					
DH1	0.377	29	0.1093	0.4	-0.2907
DH3	1.630	14	0.2282	0.4	-0.1718
DH5	2.872	11	0.3159	0.4	-0.0841
<b>GFSK AFH Mode</b>					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.377	7.25	0.02733	0.4	-0.3727
DH3	1.630	3.50	0.05705	0.4	-0.3430
DH5	2.872	2.75	0.07898	0.4	-0.3210



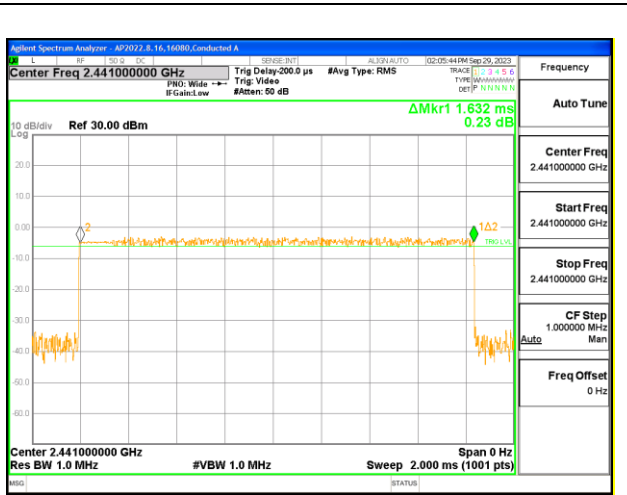
### 9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.382	32	0.12224	0.4	-0.2778
3DH3	1.632	14	0.22848	0.4	-0.1715
3DH5	2.876	11	0.31636	0.4	-0.0836

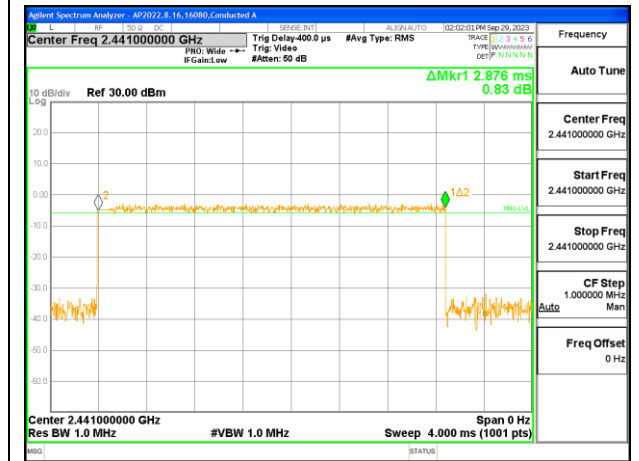
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



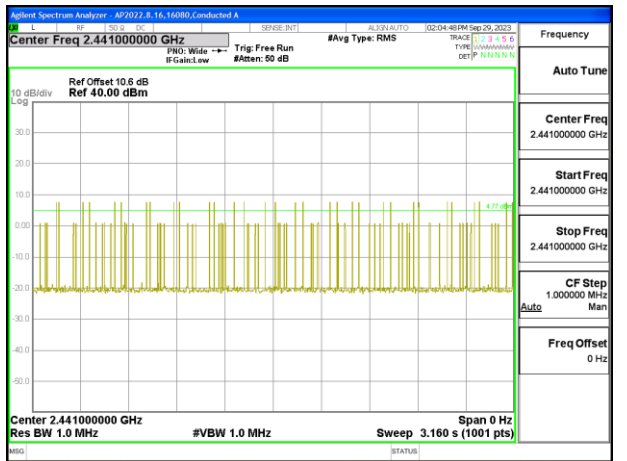
**PULSE WIDTH – 3DH1**



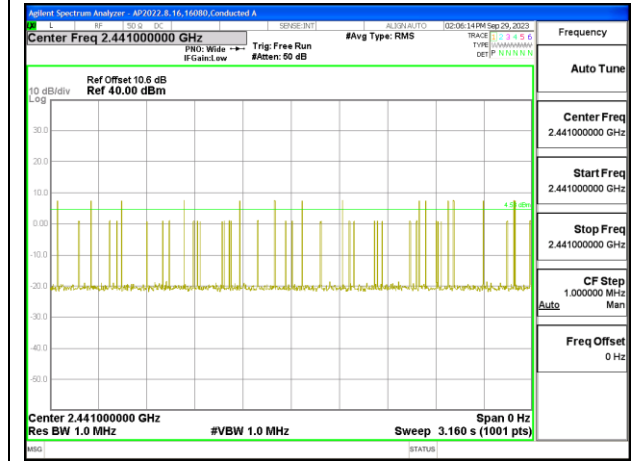
**PULSE WIDTH – 3DH3**



**PULSE WIDTH – 3DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH5**

## **9.6. OUTPUT POWER**

### **LIMITS**

§15.247 (b) (1)

RSS-247 (5.4) (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

### **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**

### 9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	16080 ZS
Date:	2023-09-29

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.14	21	-16.86
Middle	2441	6.35	21	-14.65
High	2480	4.66	21	-16.34

### 9.6.2. BLUETOOTH BASIC DATA RATE DQPSK MODULATION

Tested By:	16080 ZS
Date:	2023-09-29

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.22	21	-15.78
Middle	2441	7.35	21	-13.65
High	2480	5.91	21	-15.09

### 9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	16080 ZS
Date:	2023-09-29

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.47	21	-15.53
Middle	2441	7.84	21	-13.16
High	2480	5.98	21	-15.02

## **9.7. AVERAGE POWER**

### **LIMITS**

None; for reporting purposes only

### **TEST PROCEDURE**

Measurements perform using a wideband gated RF 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**



### 9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	16080 ZS
Date	2023-09-29

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.73
Middle	2441	6.01
High	2480	4.28

### 9.7.2. BLUETOOTH BASIC DATA RATE DQPSK MODULATION

Tested By:	16080 ZS
Date	2023-09-29

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	2.61
Middle	2441	4.89
High	2480	3.17

### 9.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	16080 ZS
Date	2023-09-29

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	2.63
Middle	2441	4.91
High	2480	3.18

## **9.8. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

RSS-247 5.5

Limit = -20 dBc

### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

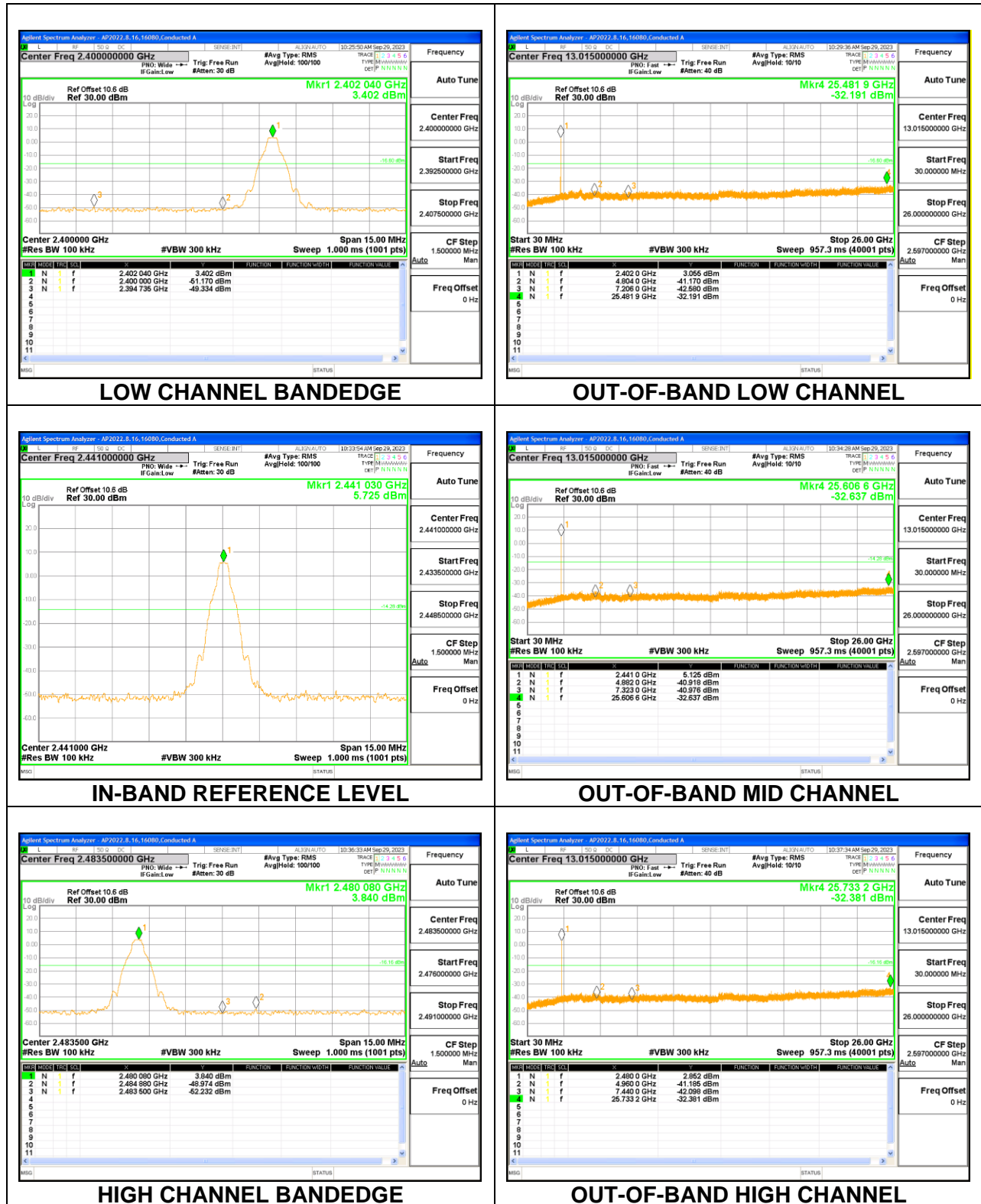
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

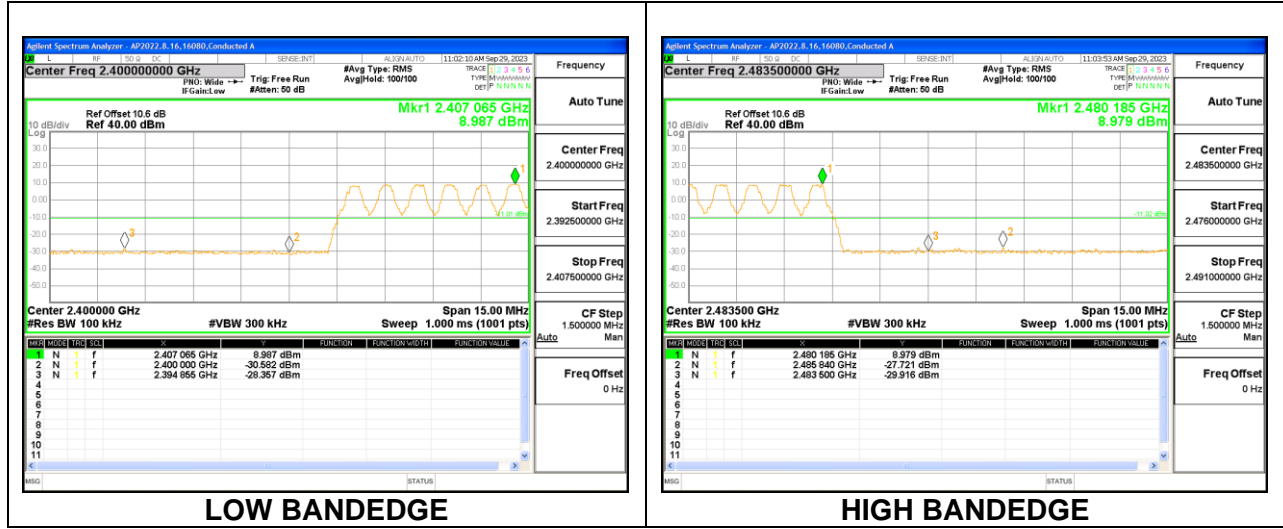
### **RESULTS**

## 9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

### Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING

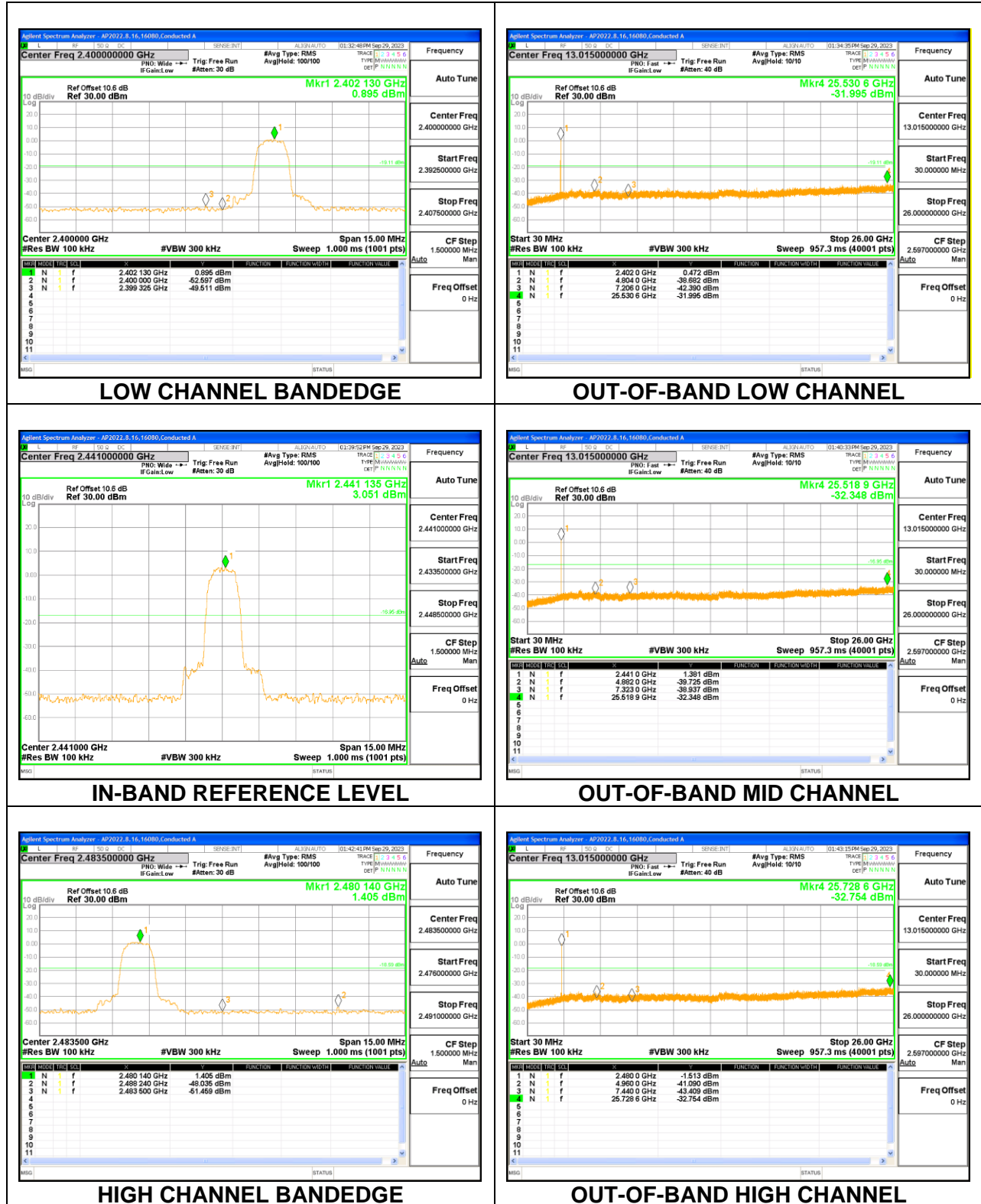


**Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

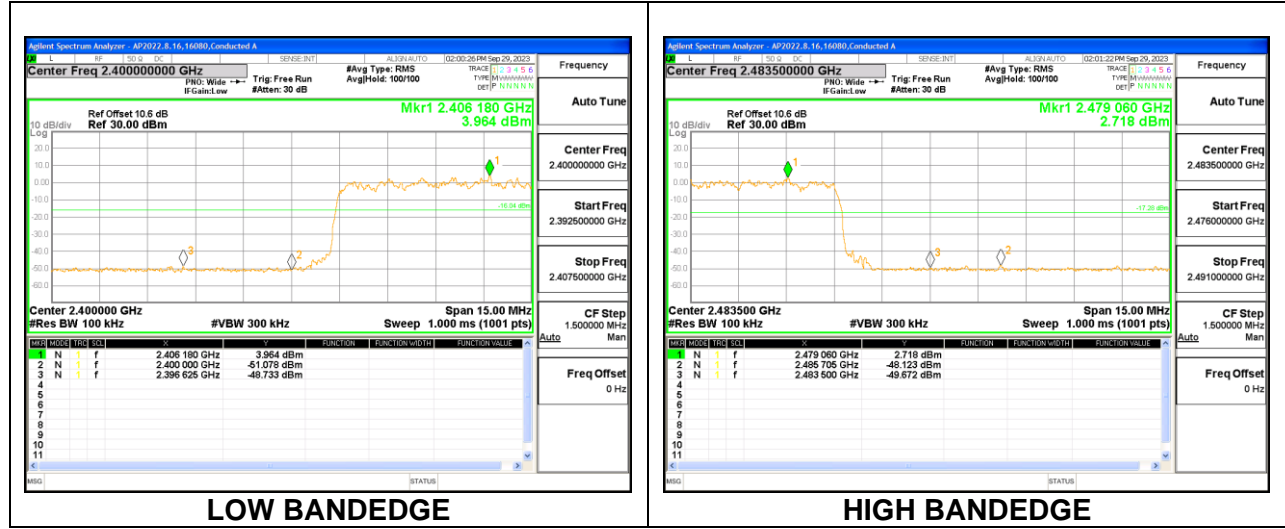


## 9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



**Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 10. RADIATED TEST RESULTS

### 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 1 MHz resolution bandwidth with 1/T 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.

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.

#### **KDB 558074 D01 15.247 Meas Guidance v05r02**

Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

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.

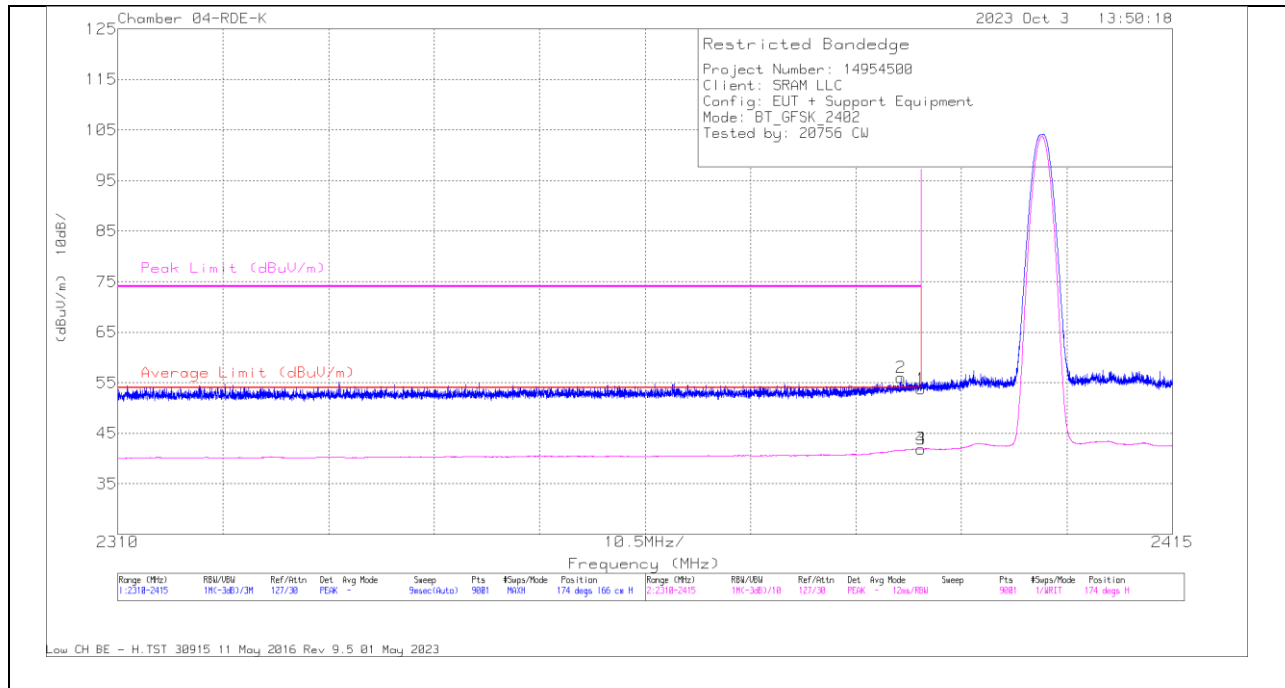


## 10.1. TRANSMITTER ABOVE 1 GHz

### 10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT

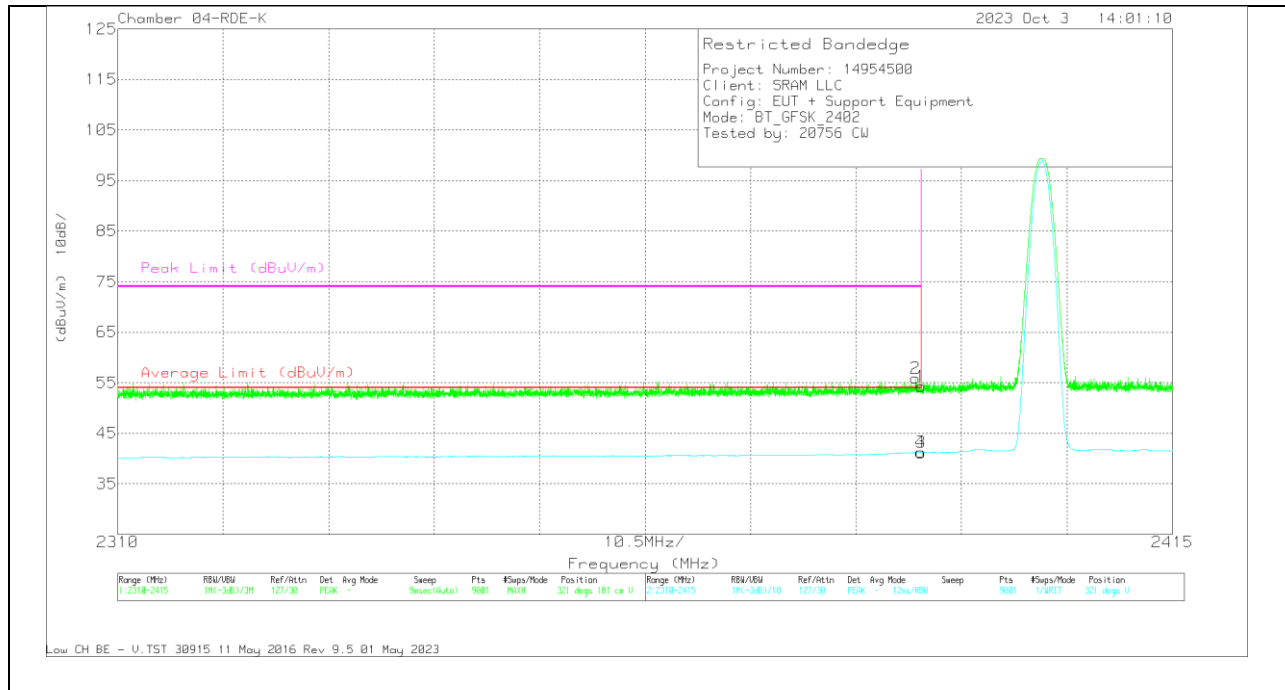


#### Trace Markers

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	56.46	Pk	31.8	-34.5	53.76	-	-	74	-20.24	174	166	H
2	* 2387.959	58.68	Pk	31.8	-34.5	55.98	-	-	74	-18.02	174	166	H
3	* 2390	44.61	VA1T	31.8	-34.5	41.91	54	-12.09	-	-	174	166	H
4	* 2389.989	44.61	VA1T	31.8	-34.5	41.91	54	-12.09	-	-	174	166	H

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average  $V_B=1/T_{on}$  where:  $T_{on}$  is transmitting duration

### VERTICAL RESULT



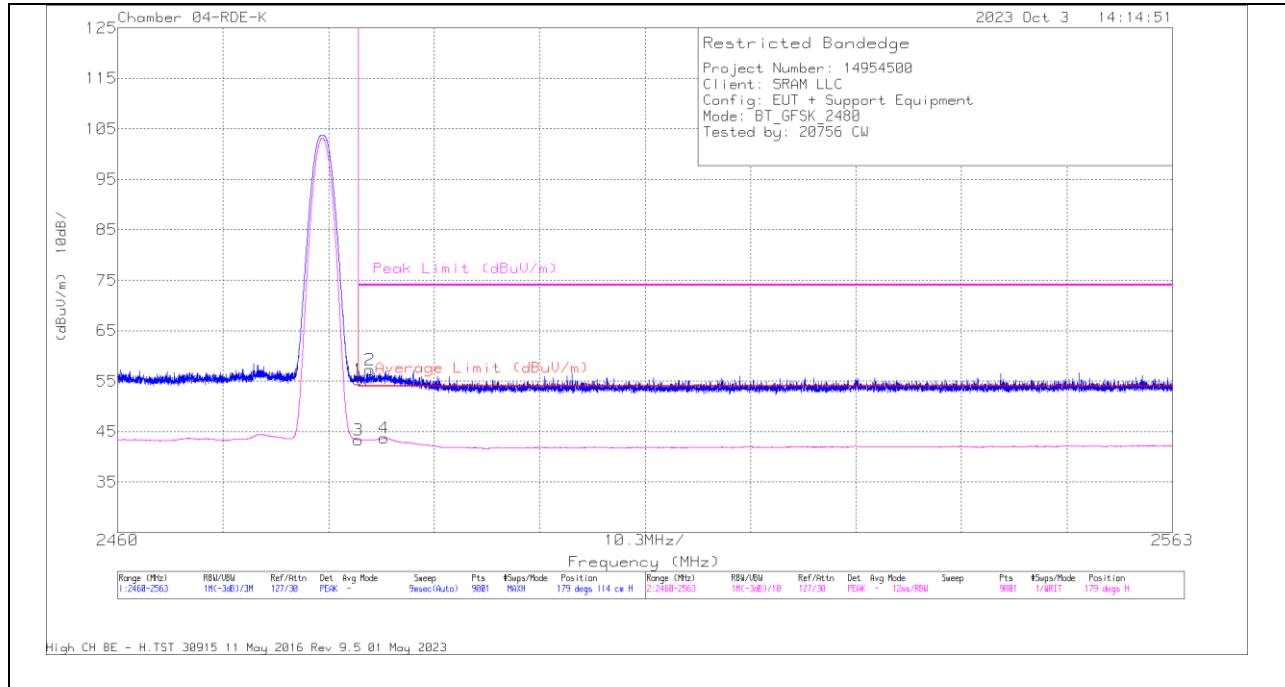
### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223093 ACF 3m (dBm)	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	57.01	Pk	31.8	-34.5	54.31	-	-	74	-19.69	321	181	V
2	* 2389.394	58.58	Pk	31.8	-34.5	55.88	-	-	74	-18.12	321	181	V
3	* 2390	43.87	VA1T	31.8	-34.5	41.17	54	-12.83	-	-	321	181	V
4	* 2389.919	43.89	VA1T	31.8	-34.5	41.19	54	-12.81	-	-	321	181	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**

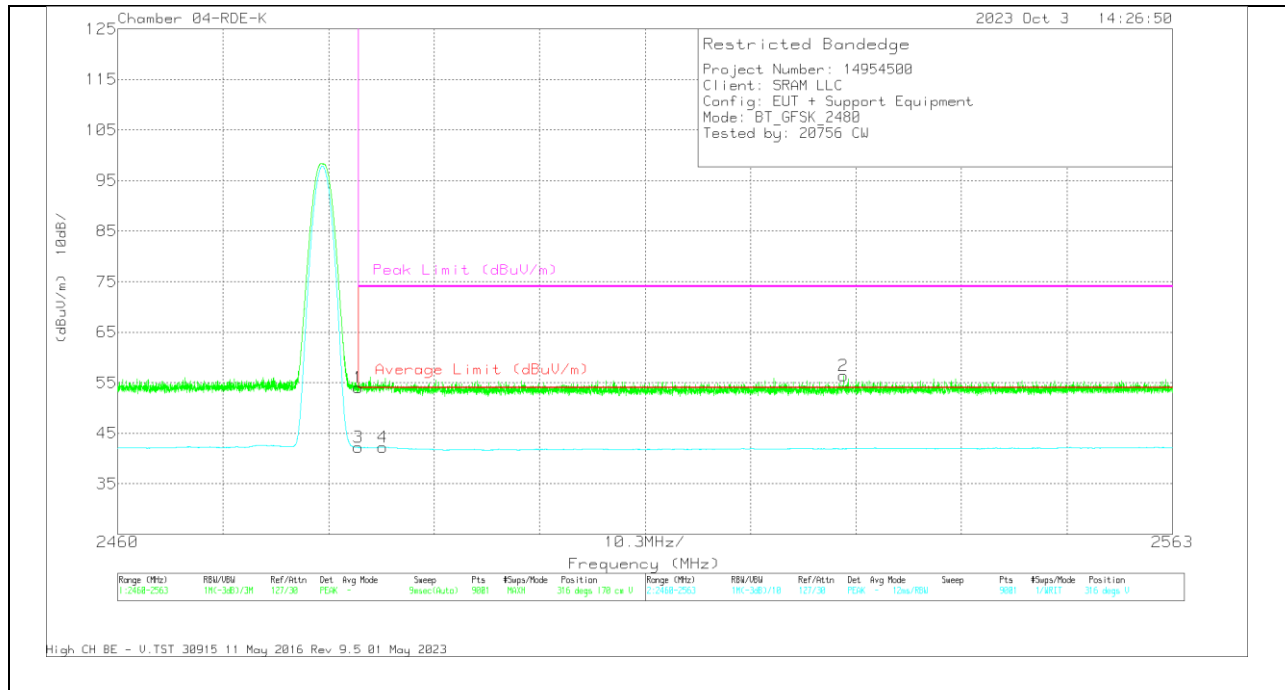


**Trace Markers**

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	57.18	Pk	32.2	-34.1	55.28	-	-	74	-18.72	179	114	H
2	* 2484.627	59.17	Pk	32.2	-34.1	57.27	-	-	74	-16.73	179	114	H
3	* 2483.5	45.27	VA1T	32.2	-34.1	43.37	54	-10.63	-	-	179	114	H
4	* 2486.024	45.57	VA1T	32.2	-34.1	43.67	54	-10.33	-	-	179	114	H

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

### VERTICAL RESULT



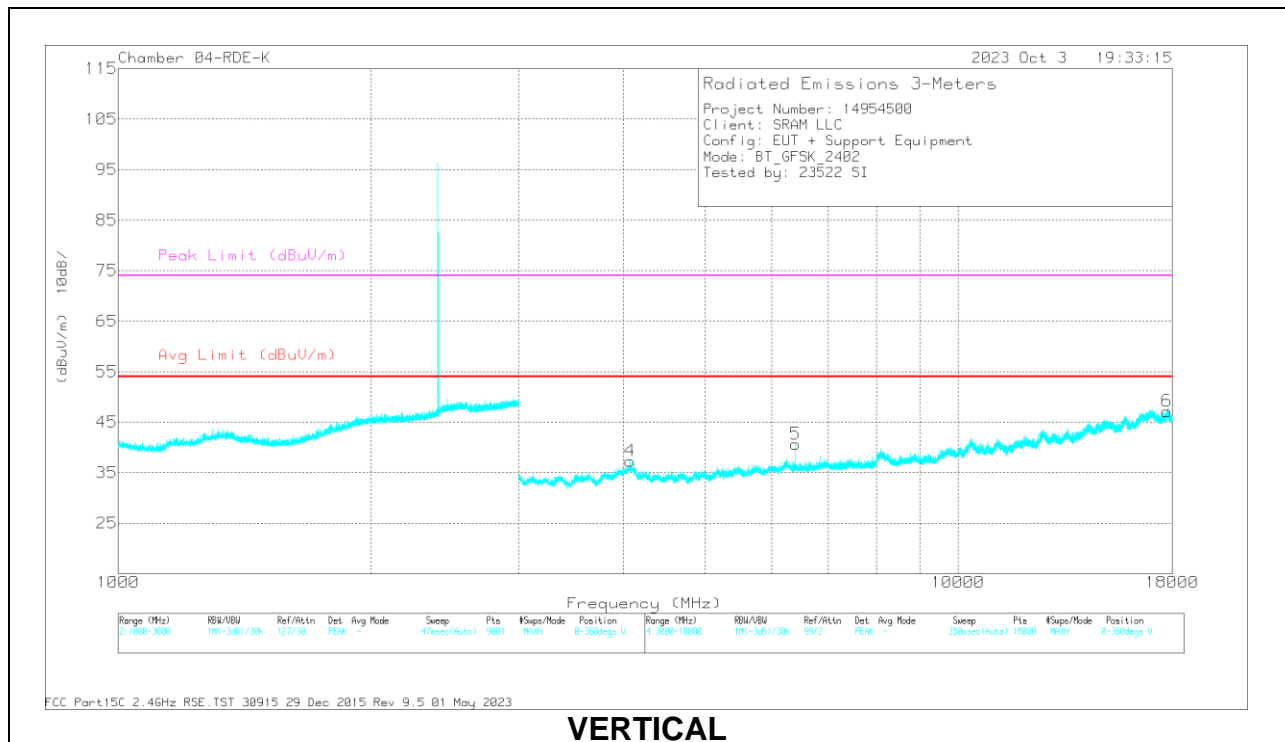
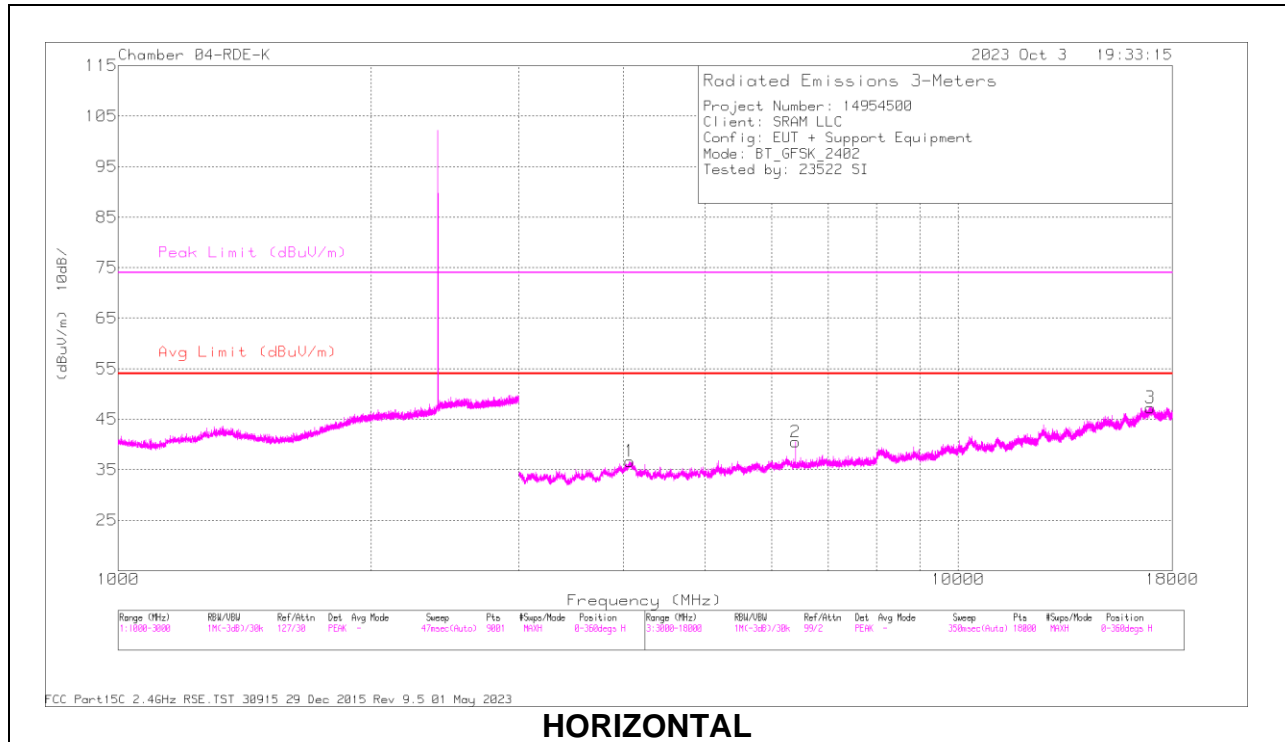
### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223093 ACF 3m (dBm)	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	55.92	Pk	32.2	-34.1	54.02	-	-	74	-19.98	316	170	V
2	2530.861	58.2	Pk	32.2	-34	56.4	-	-	74	-17.6	316	170	V
3	* 2483.5	44.06	VA1T	32.2	-34.1	42.16	54	-11.84	-	-	316	170	V
4	* 2485.863	44.15	VA1T	32.2	-34.1	42.25	54	-11.75	-	-	316	170	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL RESULTS



### RADIATED EMISSIONS

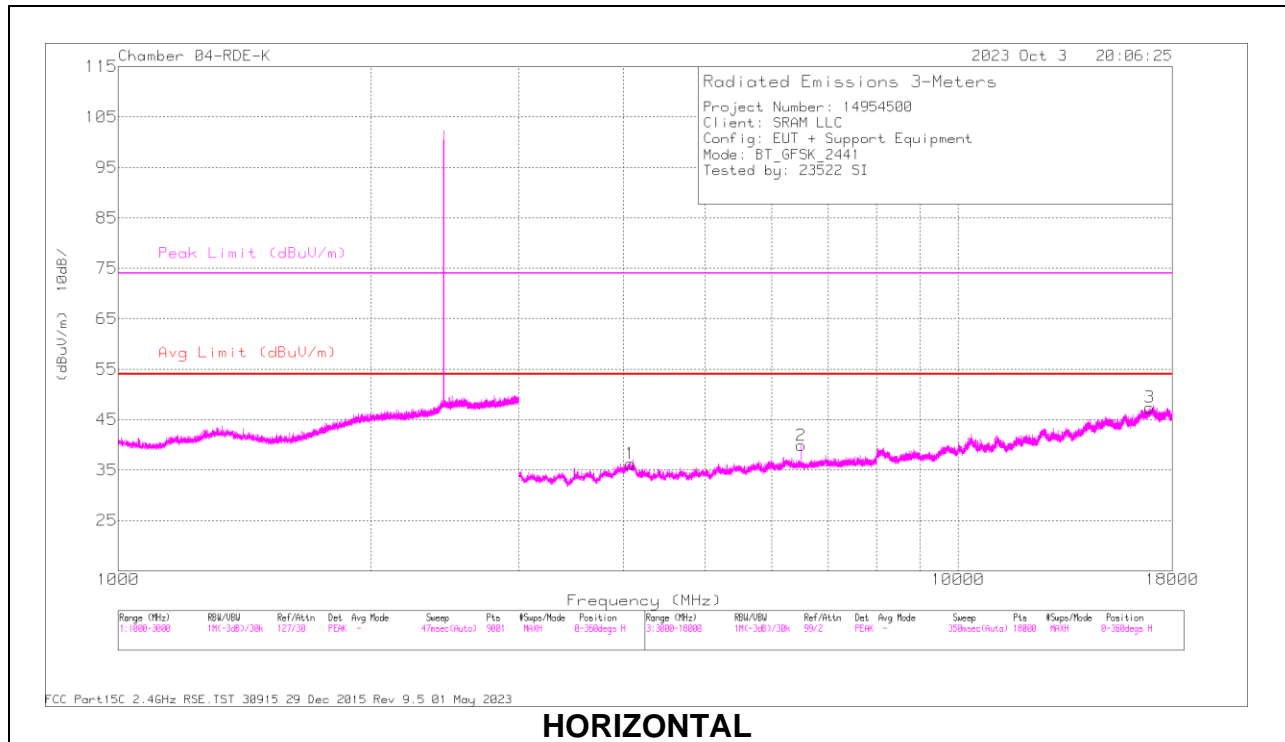
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4065.219	50.84	PKFH	35.2	-41.2	44.84	-	-	74	-29.16	10	365	H
	* 4065.258	37.72	VA1T	35.2	-41.2	31.72	54	-22.28	-	-	10	365	H
2	6405.298	50.38	PKFH	35.4	-38.4	47.38	-	-	74	-26.62	167	133	H
	6405.248	43.02	VA1T	35.4	-38.4	40.02	54	-13.98	-	-	167	133	H
3	16942.887	44.44	PKFH	41.7	-31.7	54.44	-	-	74	-19.56	359	302	H
	16941.271	30.67	VA1T	41.7	-31.6	40.77	54	-13.23	-	-	359	302	H
4	* 4070.908	50.53	PKFH	35.2	-41.2	44.53	-	-	74	-29.47	321	341	V
	* 4069.39	37.72	VA1T	35.2	-41.3	31.62	54	-22.38	-	-	321	341	V
	6405.48	49.53	PKFH	35.4	-38.4	46.53	-	-	74	-27.47	24	116	V
5	6405.292	40.61	VA1T	35.4	-38.4	37.61	54	-16.39	-	-	24	116	V
	* 17731.692	43.58	PKFH	40.6	-29.7	54.48	-	-	74	-19.52	192	380	V
	* 17734.26	29.81	VA1T	40.6	-29.7	40.71	54	-13.29	-	-	192	380	V

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

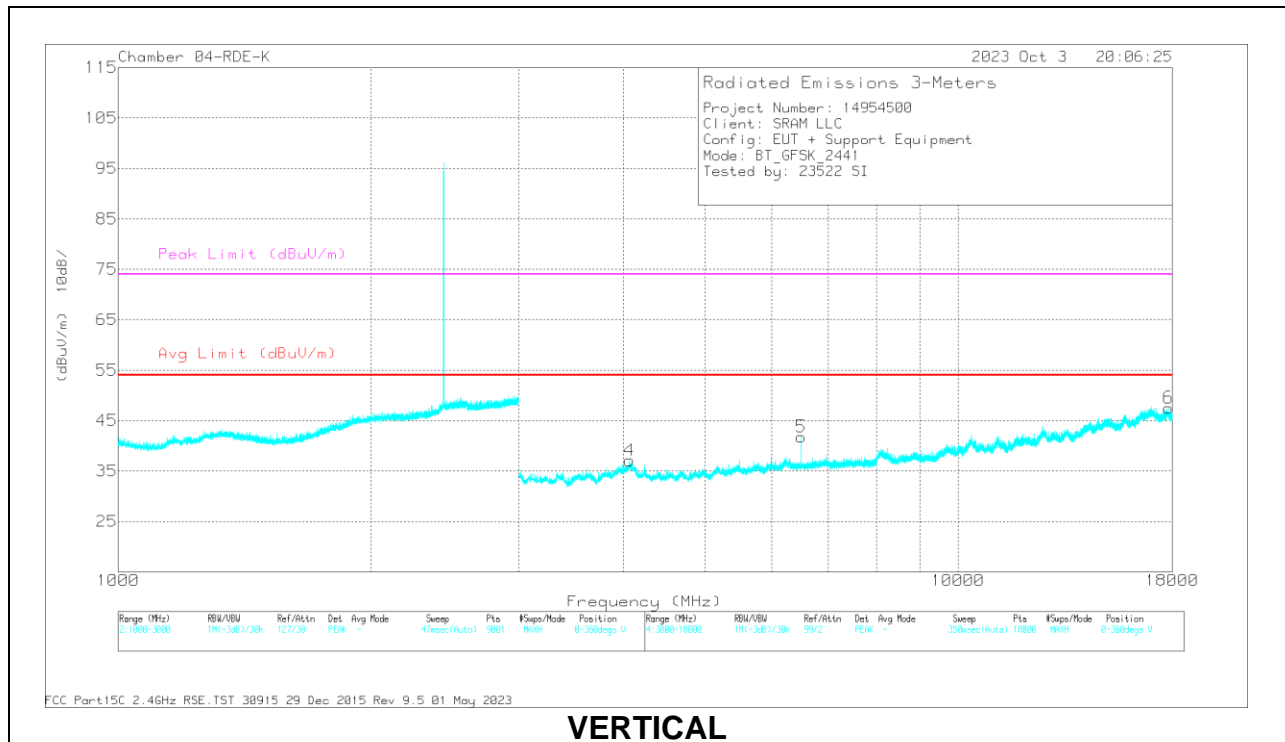
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

### MID CHANNEL RESULTS



### HORIZONTAL



### VERTICAL

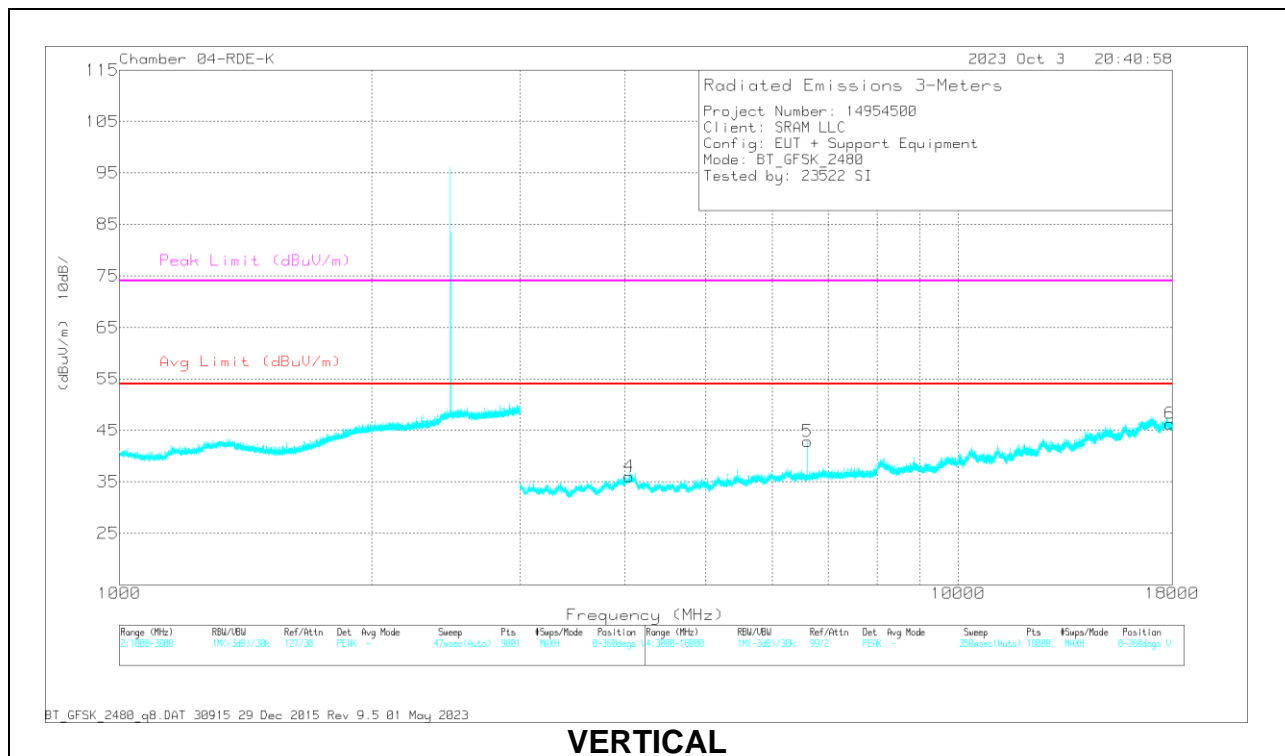
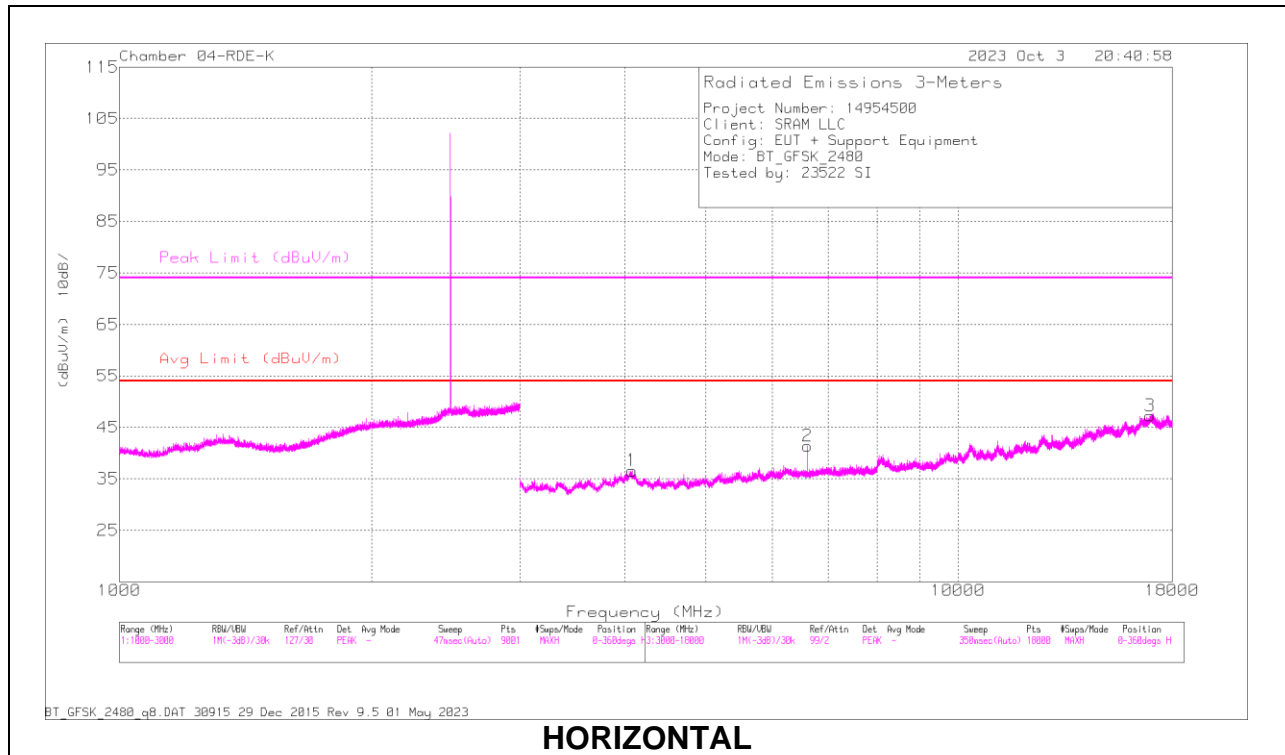
**RADIATED EMISSIONS**

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	* 4074.974	50.98	PKFH	35.1	-41.3	44.78	-	-	74	-29.22	213	287	H
	* 4075.024	37.45	VA1T	35.1	-41.3	31.25	54	-22.75	-	-	213	287	H
2	6509.274	50.6	PKFH	35.5	-38.2	47.9	-	-	74	-26.1	160	125	H
	6509.306	42.51	VA1T	35.5	-38.2	39.81	54	-14.19	-	-	160	125	H
3	16922.634	44.45	PKFH	41.7	-31.6	54.55	-	-	74	-19.45	341	288	H
	16921.139	30.8	VA1T	41.7	-31.5	41	54	-13	-	-	341	288	H
4	* 4063.556	50.92	PKFH	35.2	-41.2	44.92	-	-	74	-29.08	3	169	V
	* 4062.053	37.61	VA1T	35.2	-41.3	31.51	54	-22.49	-	-	3	169	V
	6509.572	50.5	PKFH	35.5	-38.2	47.8	-	-	74	-26.2	356	111	V
5	6509.252	42.34	VA1T	35.5	-38.2	39.64	54	-14.36	-	-	356	111	V
	* 17812.129	44.03	PKFH	40.5	-30.1	54.43	-	-	74	-19.57	6	361	V
	* 17812.402	30.31	VA1T	40.5	-30.1	40.71	54	-13.29	-	-	6	361	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration



### HIGH CHANNEL RESULTS



**RADIATED EMISSIONS**

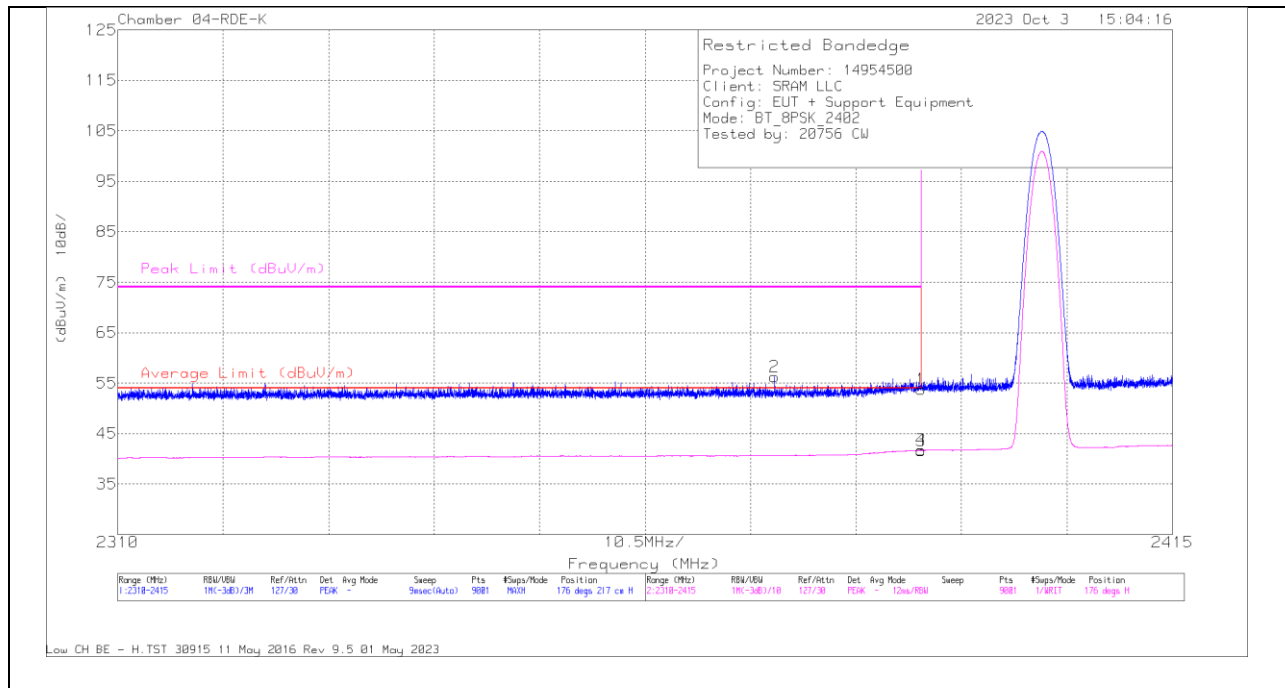
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4083.078	50.08	PKFH	35.1	-41.3	43.88	-	-	74	-30.12	279	214	H
	* 4082.228	36.74	VA1T	35.1	-41.3	30.54	54	-23.46	-	-	279	214	H
2	6613.515	50.7	PKFH	35.5	-38.1	48.1	-	-	74	-25.9	161	107	H
	6613.284	42.1	VA1T	35.5	-38.2	39.4	54	-14.6	-	-	161	107	H
3	16927.788	44.73	PKFH	41.7	-31.6	54.83	-	-	74	-19.17	48	217	H
	16926.51	30.76	VA1T	41.7	-31.6	40.86	54	-13.14	-	-	48	217	H
4	* 4050.974	51.26	PKFH	35.2	-41.3	45.16	-	-	74	-28.84	345	377	V
	* 4053.331	37.41	VA1T	35.2	-41.3	31.31	54	-22.69	-	-	345	377	V
	6612.99	50.64	PKFH	35.5	-38.2	47.94	-	-	74	-26.06	5	110	V
5	6613.292	43.75	VA1T	35.5	-38.2	41.05	54	-12.95	-	-	5	110	V
	* 17878.087	42.8	PKFH	40.6	-30.1	53.3	-	-	74	-20.7	339	242	V
	* 17879.415	29.69	VA1T	40.6	-30.1	40.19	54	-13.81	-	-	339	242	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

## 10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### BANDEDGE (LOW CHANNEL)

### HORIZONTAL RESULT



### Trace Markers

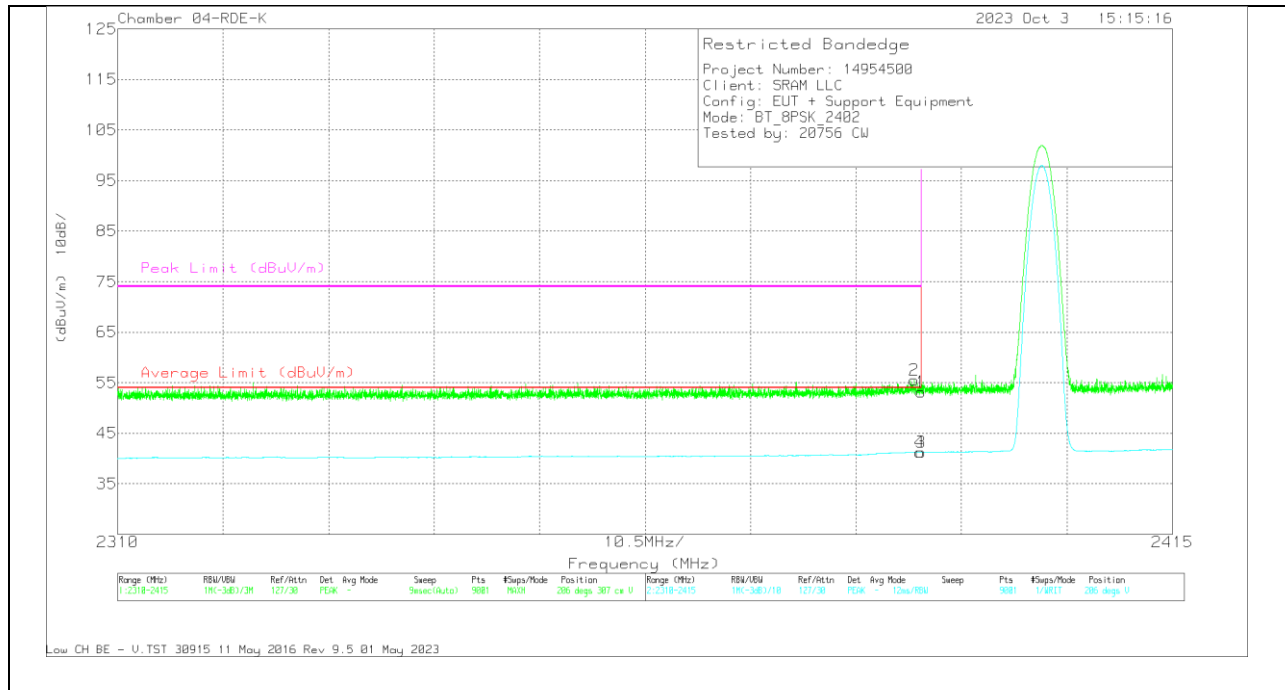
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dBm)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2390	56.42	Pk	31.8	-34.5	53.72	-	-	74	-20.28	176	217	H
2	* 2375.382	59.12	Pk	31.7	-34.6	56.22	-	-	74	-17.78	176	217	H
3	* 2390	44.36	VA1T	31.8	-34.5	41.66	54	-12.34	-	-	176	217	H
4	* 2389.966	44.37	VA1T	31.8	-34.5	41.67	54	-12.33	-	-	176	217	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

### VERTICAL RESULT



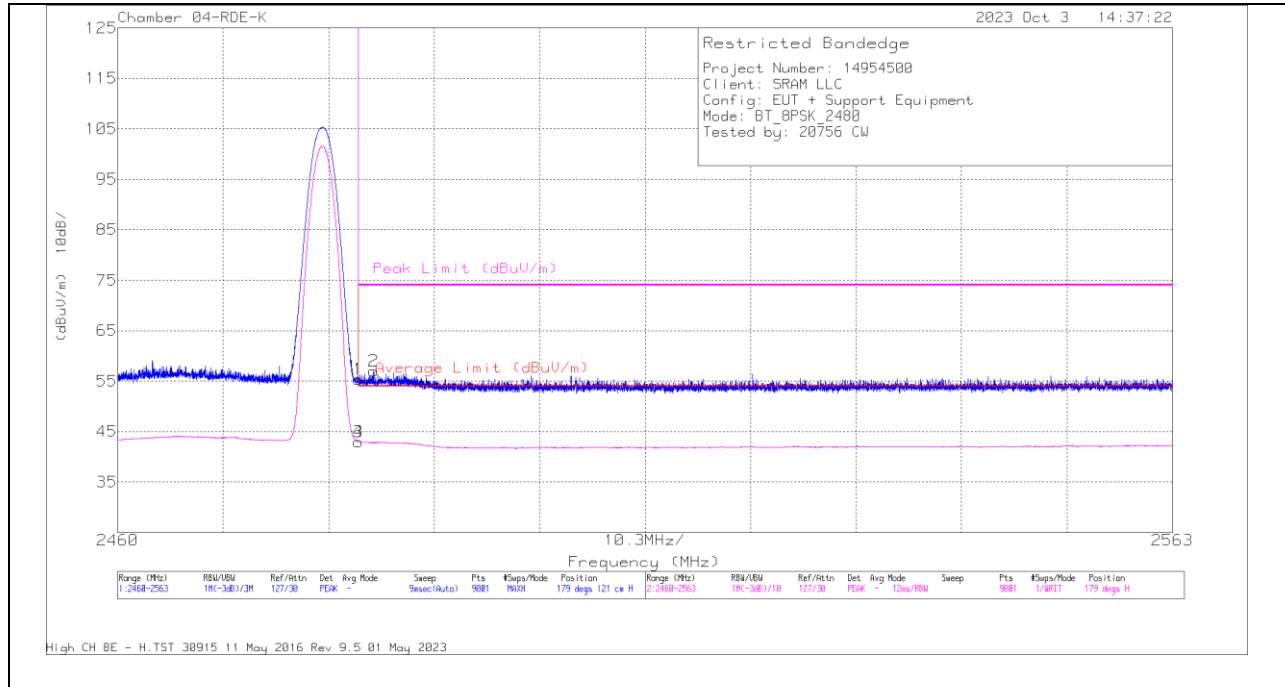
### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223093 ACF 3m (dBm)	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	55.81	Pk	31.8	-34.5	53.11	-	-	74	-20.89	206	307	V
2	* 2389.266	58.16	Pk	31.8	-34.5	55.46	-	-	74	-18.54	206	307	V
3	* 2390	43.94	VA1T	31.8	-34.5	41.24	54	-12.76	-	-	206	307	V
4	* 2389.861	43.97	VA1T	31.8	-34.5	41.27	54	-12.73	-	-	206	307	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

**BANDEDGE (HIGH CHANNEL)**

**HORIZONTAL RESULT**

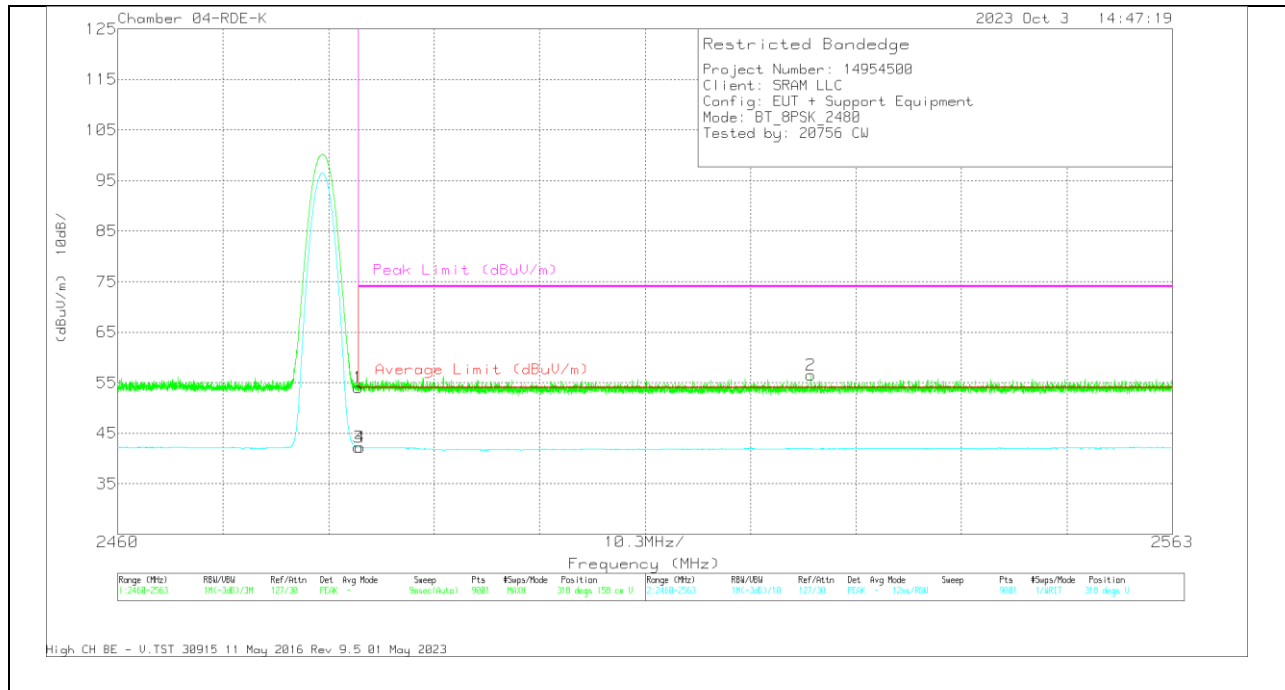


**Trace Markers**

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	57.24	Pk	32.2	-34.1	55.34	-	-	74	-18.66	179	121	H
2	* 2484.994	58.91	Pk	32.2	-34.1	57.01	-	-	74	-16.99	179	121	H
3	* 2483.5	44.9	VA1T	32.2	-34.1	43	54	-11	-	-	179	121	H
4	* 2483.506	44.88	VA1T	32.2	-34.1	42.98	54	-11.02	-	-	179	121	H

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

### VERTICAL RESULT



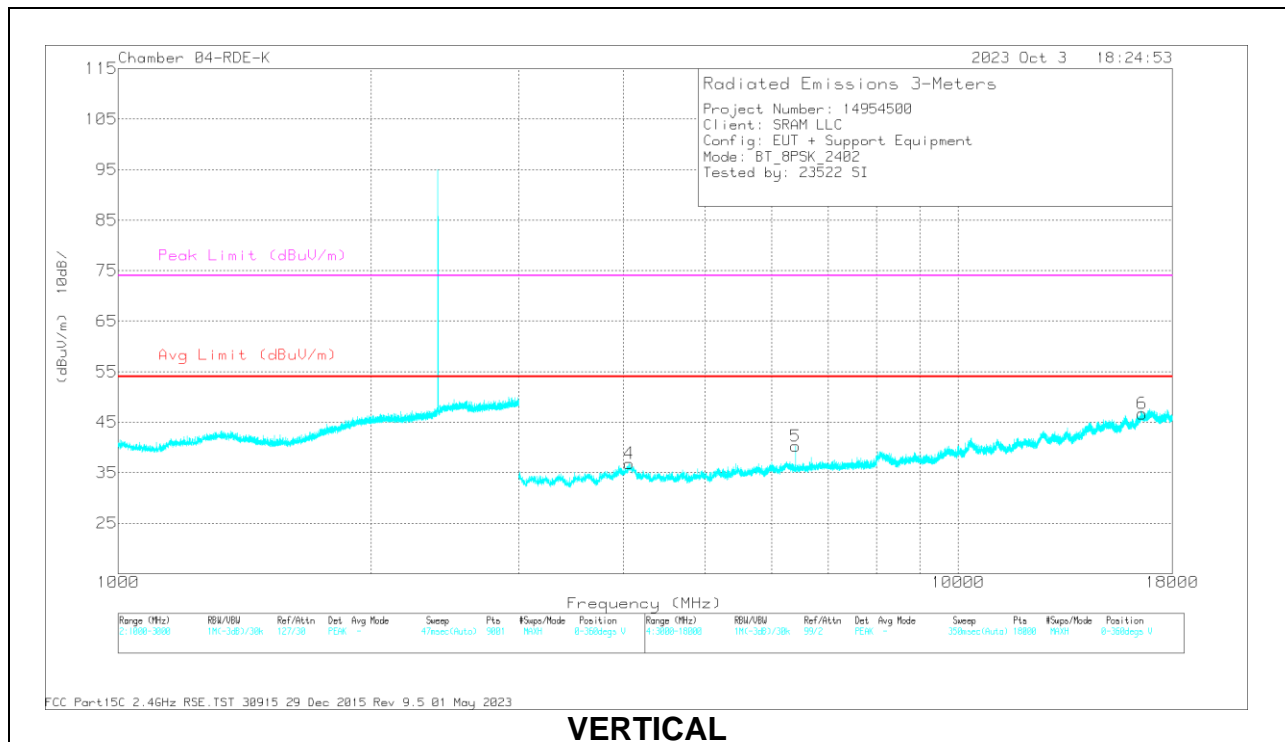
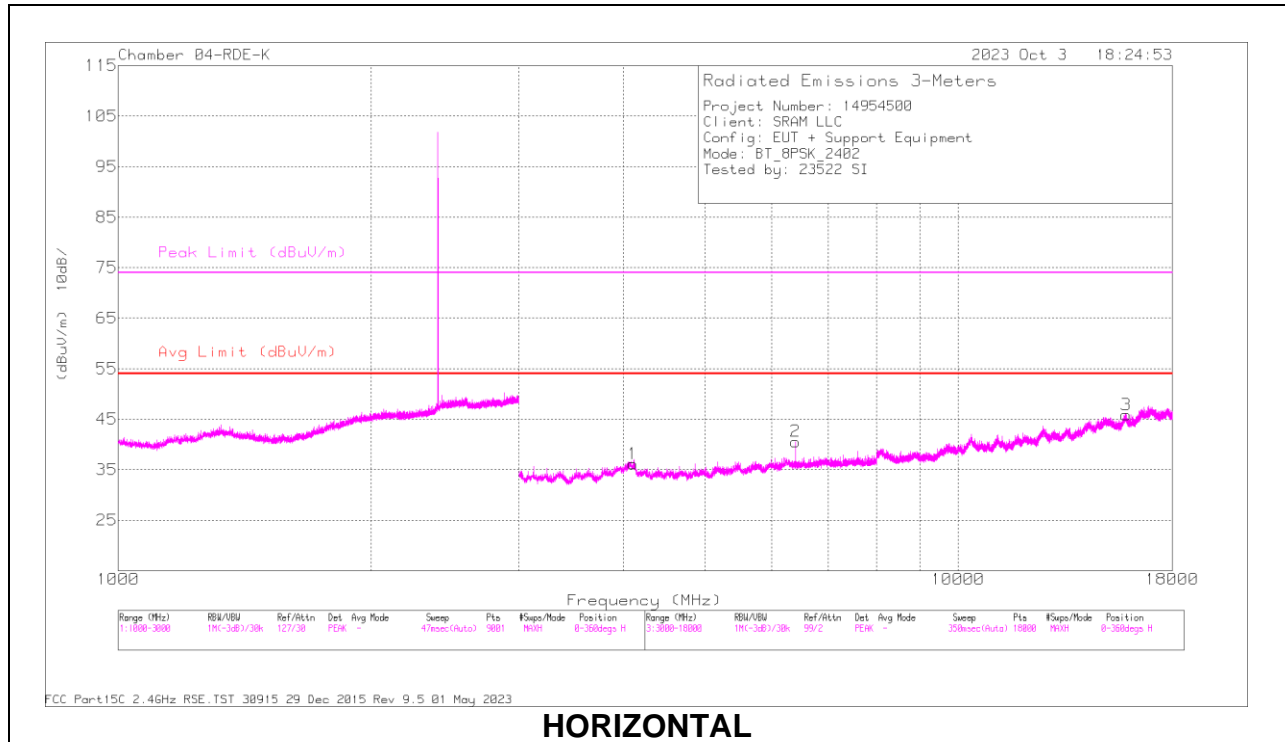
### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223093 ACF 3m (dBm)	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	55.96	Pk	32.2	-34.1	54.06	-	-	74	-19.94	318	158	V
2	2527.703	58.31	Pk	32.2	-34	56.51	-	-	74	-17.49	318	158	V
3	* 2483.5	44.09	VA1T	32.2	-34.1	42.19	54	-11.81	-	-	318	158	V
4	* 2483.655	44.12	VA1T	32.2	-34.1	42.22	54	-11.78	-	-	318	158	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 Pk - Peak detector  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

# HARMONICS AND SPURIOUS EMISSIONS

## LOW CHANNEL RESULTS



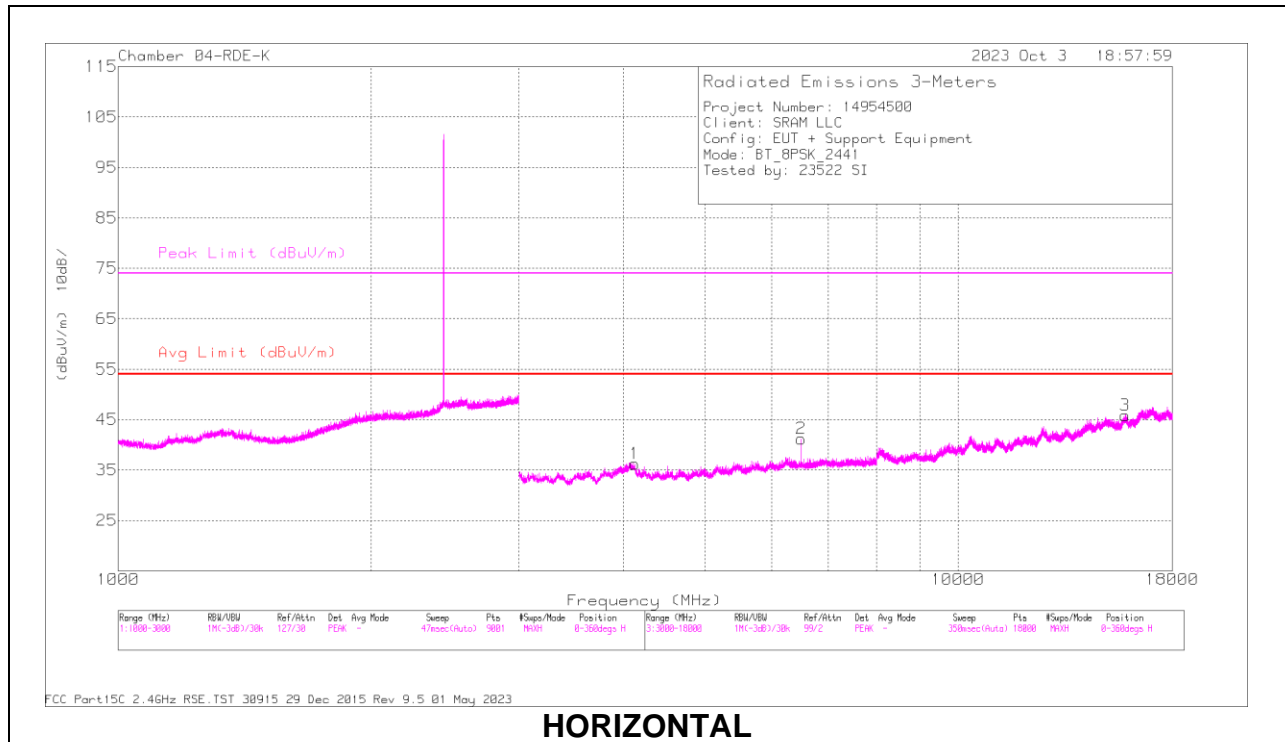
**RADIATED EMISSIONS**

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	* 4099.939	50.8	PKFH	35	-41.2	44.6	-	-	74	-29.4	8	255	H
	* 4099.203	37.29	VA1T	35	-41.2	31.09	54	-22.91	-	-	8	255	H
2	6405.45	50.55	PKFH	35.4	-38.4	47.55	-	-	74	-26.45	207	115	H
	6405.279	42.24	VA1T	35.4	-38.4	39.24	54	-14.76	-	-	207	115	H
3	* 15856.58	45.53	PKFH	40.2	-31.9	53.83	-	-	74	-20.17	359	185	H
	* 15857.178	31.51	VA1T	40.2	-31.9	39.81	54	-14.19	-	-	359	185	H
4	* 4060.543	51.25	PKFH	35.2	-41.4	45.05	-	-	74	-28.95	14	293	V
	* 4060.408	37.49	VA1T	35.2	-41.3	31.39	54	-22.61	-	-	14	293	V
	6404.94	50.32	PKFH	35.4	-38.4	47.32	-	-	74	-26.68	191	103	V
5	6405.278	42.14	VA1T	35.4	-38.4	39.14	54	-14.86	-	-	191	103	V
	16573.404	43.54	PKFH	41.2	-31.6	53.14	-	-	74	-20.86	312	131	V
6	16574.092	30.66	VA1T	41.2	-31.6	40.26	54	-13.74	-	-	312	131	V

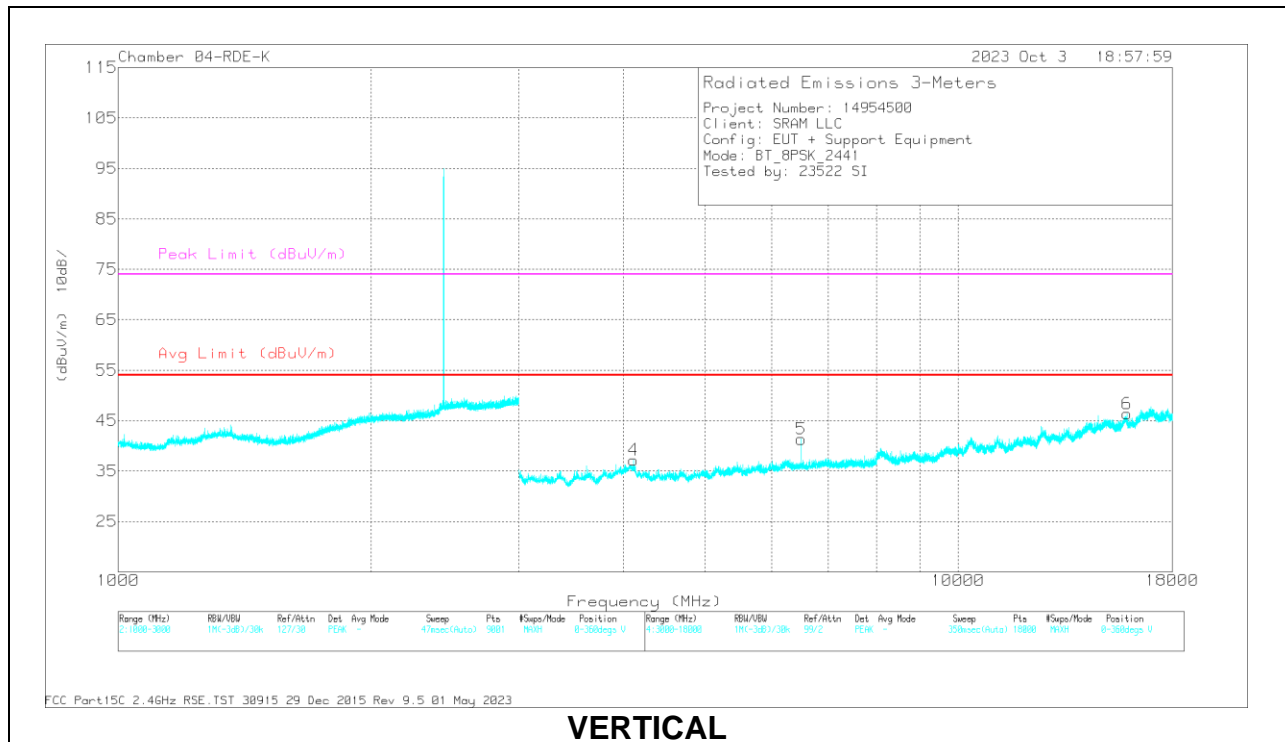
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration



### MID CHANNEL RESULTS



**HORIZONTAL**



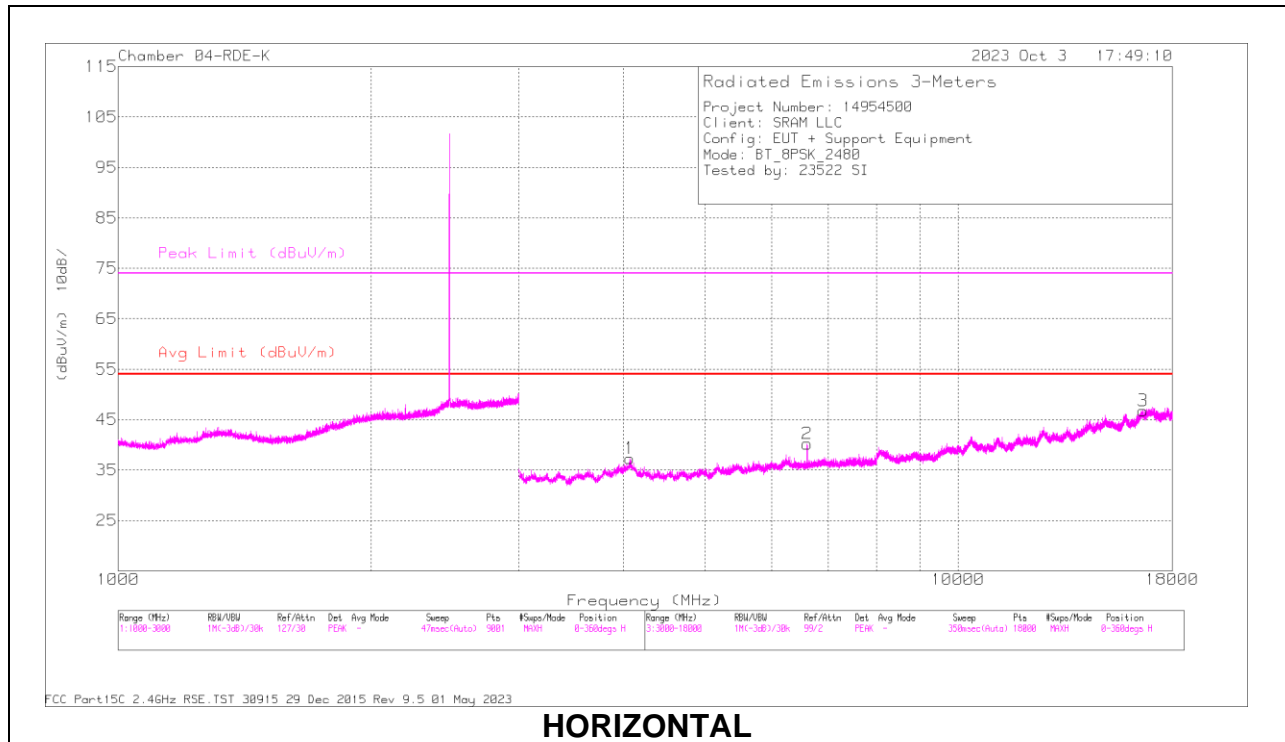
**VERTICAL**

**RADIATED EMISSIONS**

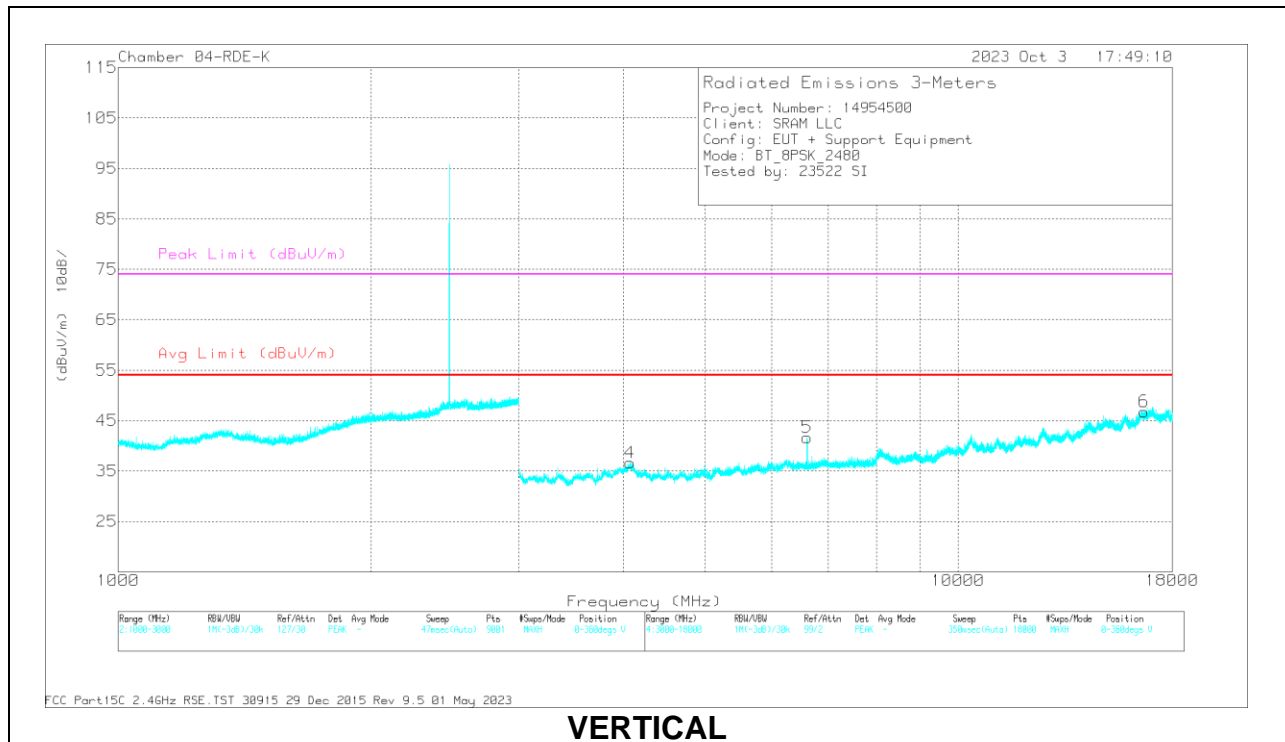
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	223083 ACF 3m (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4120.756	50.06	PKFH	34.9	-41	43.96	-	-	74	-30.04	355	320	H
	* 4120.69	37.03	VA1T	34.9	-41	30.93	54	-23.07	-	-	355	320	H
2	6508.757	49.41	PKFH	35.5	-38.2	46.71	-	-	74	-27.29	173	124	H
	6509.255	41.24	VA1T	35.5	-38.2	38.54	54	-15.46	-	-	173	124	H
3	* 15812.104	44.61	PKFH	40.2	-31.9	52.91	-	-	74	-21.09	255	301	H
	* 15809.784	31.54	VA1T	40.2	-31.9	39.84	54	-14.16	-	-	255	301	H
4	* 4109.757	50.9	PKFH	34.9	-41	44.8	-	-	74	-29.2	308	320	V
	* 4109.218	37.27	VA1T	34.9	-41.1	31.07	54	-22.93	-	-	308	320	V
5	6509.188	50.32	PKFH	35.5	-38.2	47.62	-	-	74	-26.38	201	129	V
	6509.264	41.57	VA1T	35.5	-38.2	38.87	54	-15.13	-	-	201	129	V
6	* 15891.447	45.64	PKFH	40.2	-32.1	53.74	-	-	74	-20.26	167	264	V
	* 15889.684	31.46	VA1T	40.2	-32.1	39.56	54	-14.44	-	-	167	264	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

### HIGH CHANNEL RESULTS



**HORIZONTAL**



**VERTICAL**

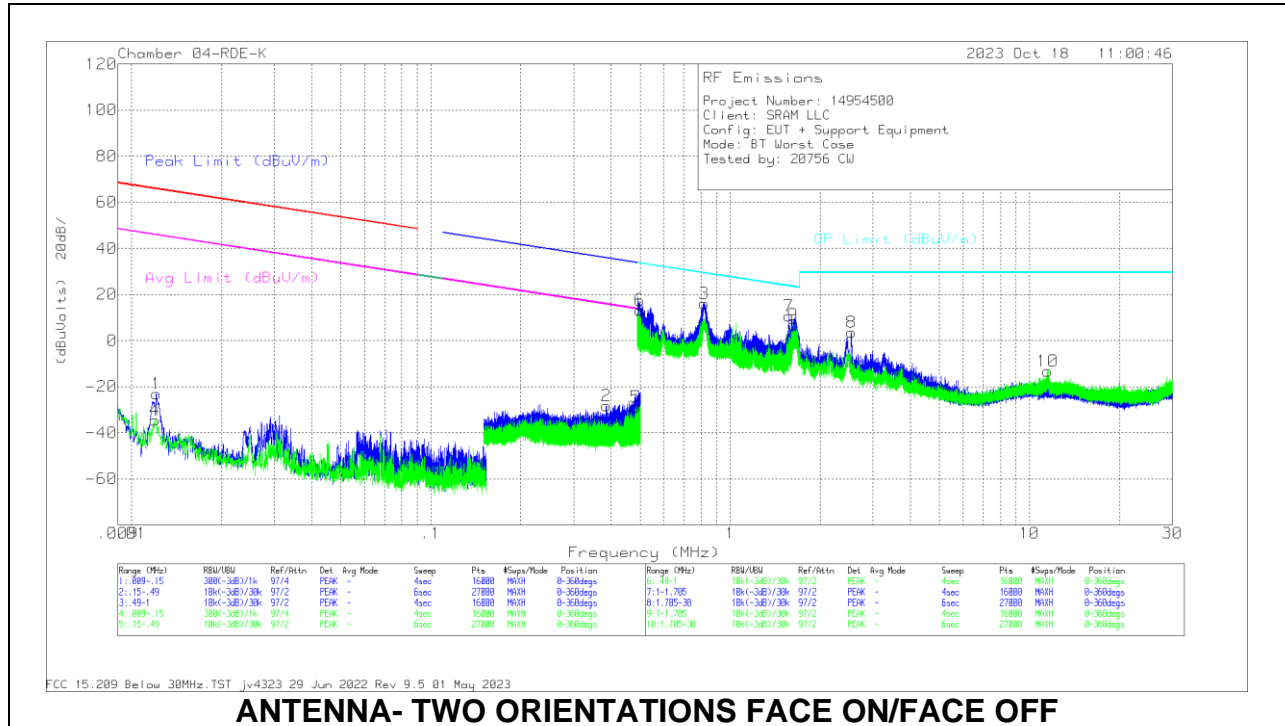
**RADIATED EMISSIONS**

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	* 4069.682	50.7	PKFH	35.2	-41.3	44.6	-	-	74	-29.4	359	286	H
	* 4066.097	37.64	VA1T	35.2	-41.3	31.54	54	-22.46	-	-	359	286	H
2	6613.095	49.55	PKFH	35.5	-38.2	46.85	-	-	74	-27.15	182	146	H
	6613.24	40.43	VA1T	35.5	-38.2	37.73	54	-16.27	-	-	182	146	H
3	16612.79	44.14	PKFH	41.3	-31.4	54.04	-	-	74	-19.96	112	156	H
	16612.506	30.12	VA1T	41.3	-31.4	40.02	54	-13.98	-	-	112	156	H
4	* 4070.685	51.39	PKFH	35.2	-41.2	45.39	-	-	74	-28.61	7	294	V
	* 4067.915	37.53	VA1T	35.2	-41.4	31.33	54	-22.67	-	-	7	294	V
	6613.338	50.48	PKFH	35.5	-38.2	47.78	-	-	74	-26.22	28	164	V
5	6613.319	43.07	VA1T	35.5	-38.2	40.37	54	-13.63	-	-	28	164	V
	16664.436	43.98	PKFH	41.5	-31.6	53.88	-	-	74	-20.12	207	375	V
	16665.93	30.32	VA1T	41.5	-31.6	40.22	54	-13.78	-	-	207	375	V

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band  
 PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak  
 VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmitting duration

## 10.2. 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	27.96	Pk	60.1	-31.1	-80	-23.04	65.92	-88.96	45.92	-68.96	-	-	-	-	0-360
2	.387	27.55	Pk	56.3	-32.1	-80	-28.25	-	-	-	-	35.85	-64.1	15.85	-44.1	0-360
4	.012	16.42	Pk	60.1	-31.1	-80	-34.58	66.01	-100.59	46.01	-80.59	-	-	-	-	0-360
5	.4835	27.16	Pk	56.2	-32.2	-80	-28.84	-	-	-	-	33.92	-62.76	13.92	-42.76	0-360

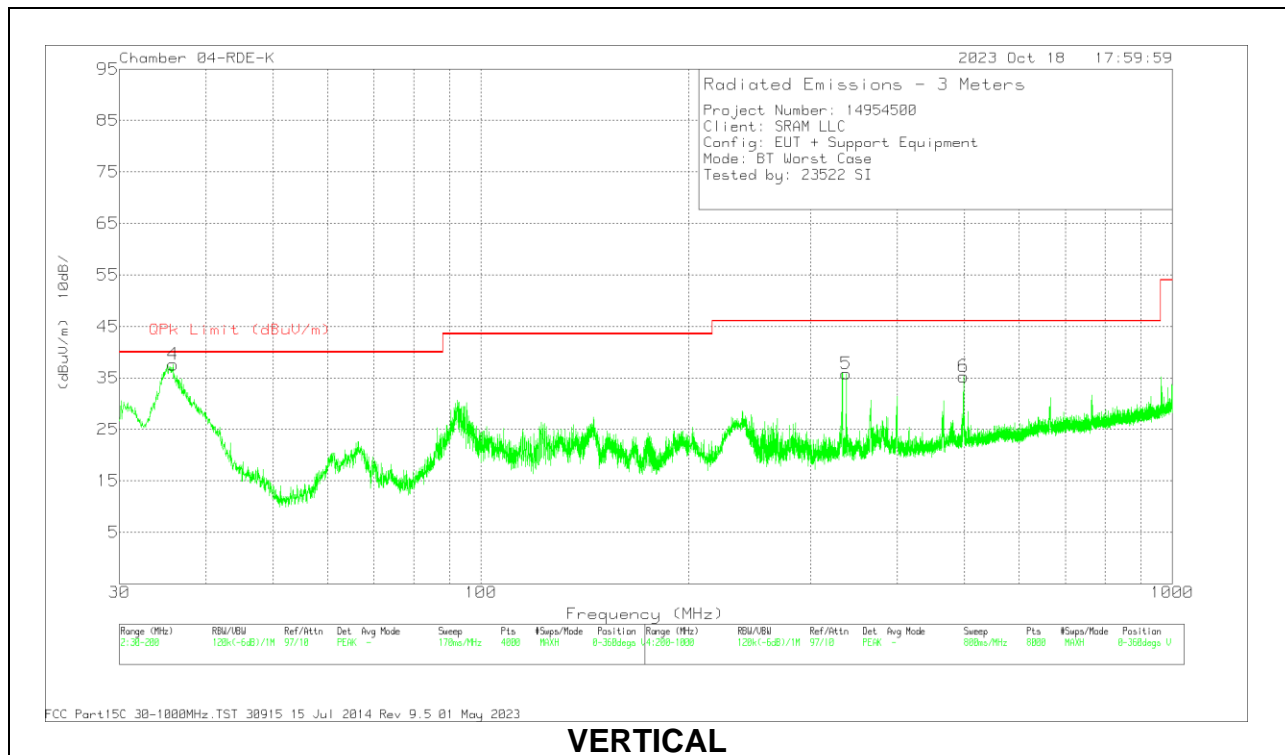
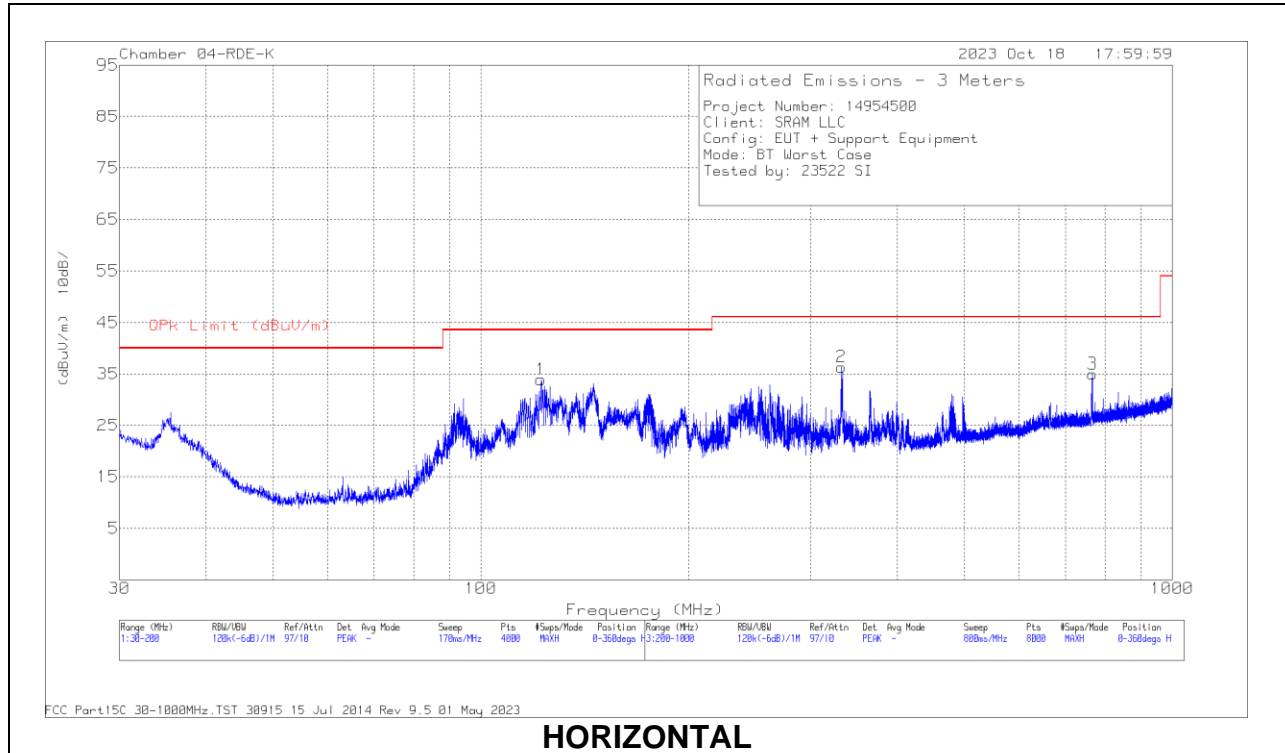
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna E(ACF)	Amp/Cbl (dB)	Dist Corr 30m 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.8185	31.81	Pk	56.4	-32.2	-40	16.01	29.36	-13.35	0-360
6	.4986	29.15	Pk	56.2	-32.1	-40	13.25	33.65	-20.4	0-360
7	1.5711	38.65	Pk	43.8	-31.9	-40	10.55	23.71	-13.16	0-360
8	2.5403	35.55	Pk	40	-32	-40	3.55	29.5	-25.95	0-360
9	1.6228	35.35	Pk	43.6	-32	-40	6.95	23.43	-16.48	0-360
10	11.4692	23.74	Pk	34.7	-31.7	-40	-13.26	29.5	-42.76	0-360

Pk - Peak detector

### 10.3. WORST CASE BELOW 1 GHz

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



### 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	* 122.121	44.5	Pk	19.9	-30.5	33.9	43.52	-9.62	0-360	199	H
4	35.8665	46.4	Pk	22.5	-31.3	37.6	40	-2.4	0-360	101	V
	35.6953	42.35	Qp	22.6	-31.3	33.65	40	-6.35	0-227	108	V
2	* 332.317	45.92	Pk	19.8	-29.4	36.32	46.02	-9.7	0-360	299	H
3	766.574	35.65	Pk	26.6	-27.3	34.95	46.02	-11.07	0-360	101	H
5	337.518	45.32	Pk	19.8	-29.3	35.82	46.02	-10.2	0-360	199	V
6	499.039	40.49	Pk	23.6	-28.8	35.29	46.02	-10.73	0-360	99	V

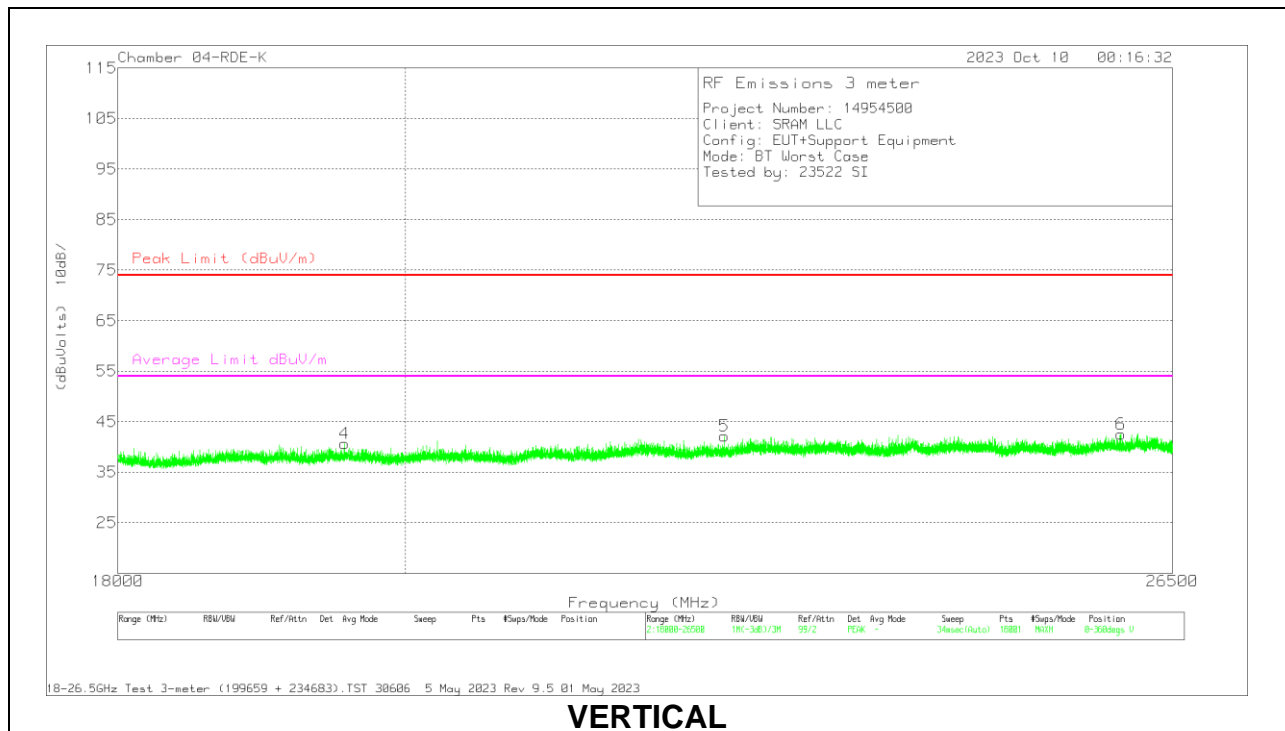
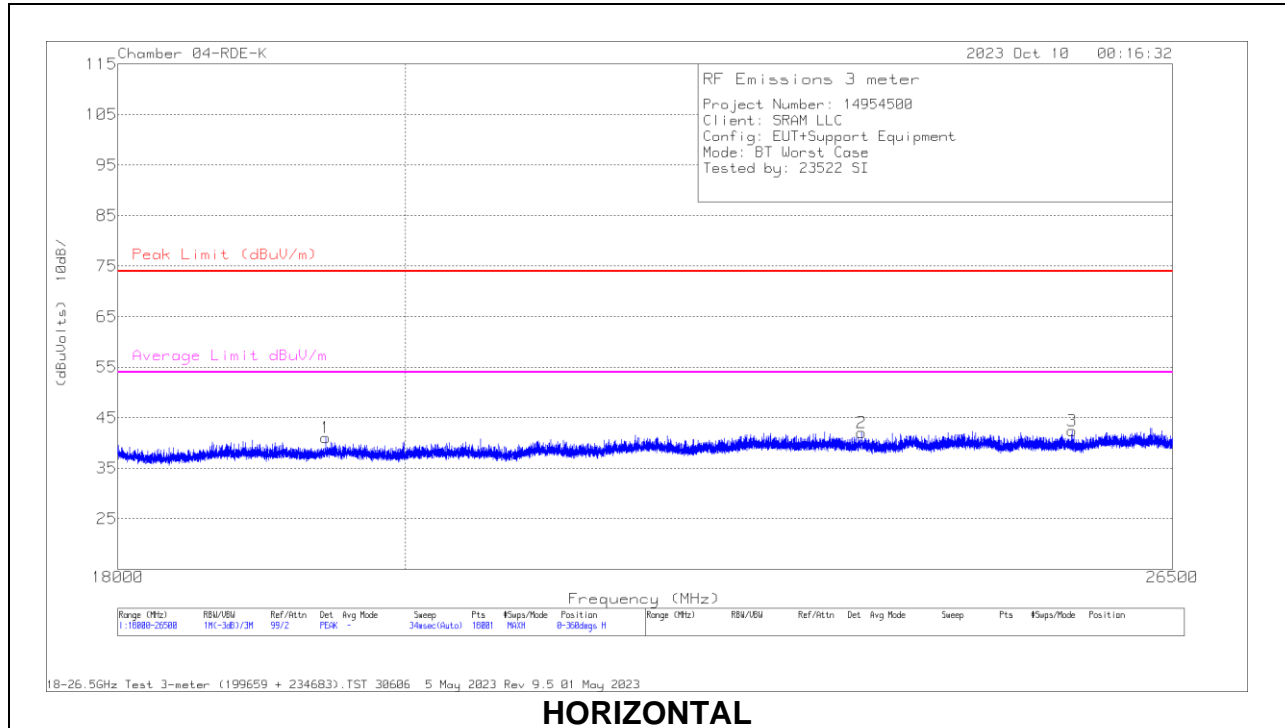
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

### 10.4. WORST CASE 18-26 GHz

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





## 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	*19426.11	52.83	Pk	32.5	-62.8	18.5	41.03	74	-32.97	54	-12.97	0-360	200	H
2	*23644.47	50.83	Pk	33.6	-62.7	20.3	42.03	74	-31.97	54	-11.97	0-360	200	H
3	*25545.635	49.13	Pk	34.1	-62	21.2	42.43	74	-31.57	54	-11.57	0-360	101	H
4	*19560.221	52.06	Pk	32.7	-62.7	18.6	40.66	74	-33.34	54	-13.34	0-360	199	V
5	*22482.331	51.69	Pk	33.3	-62.6	19.8	42.19	74	-31.81	54	-11.81	0-360	199	V
6	*26006.052	48.48	Pk	34.3	-61.6	21.4	42.58	74	-31.42	54	-11.42	0-360	101	V

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

## 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.

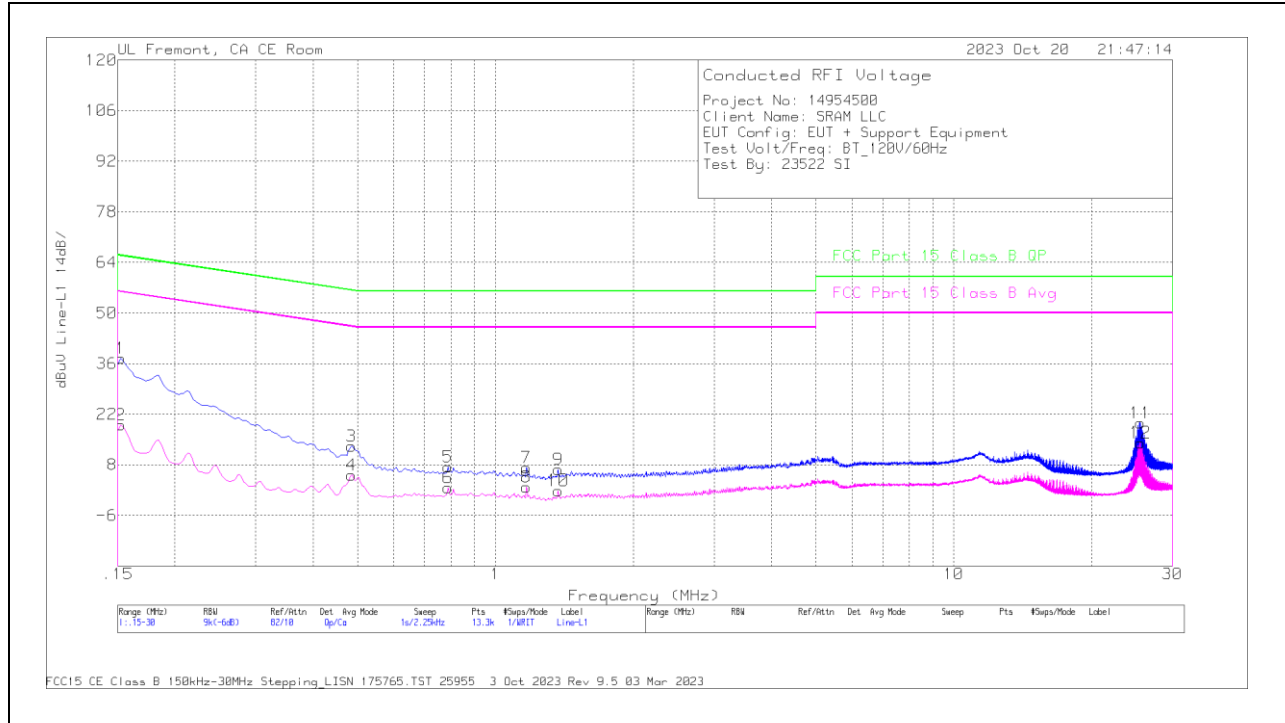
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

### RESULTS

# AC Power Line Norm

## LINE 1 RESULTS

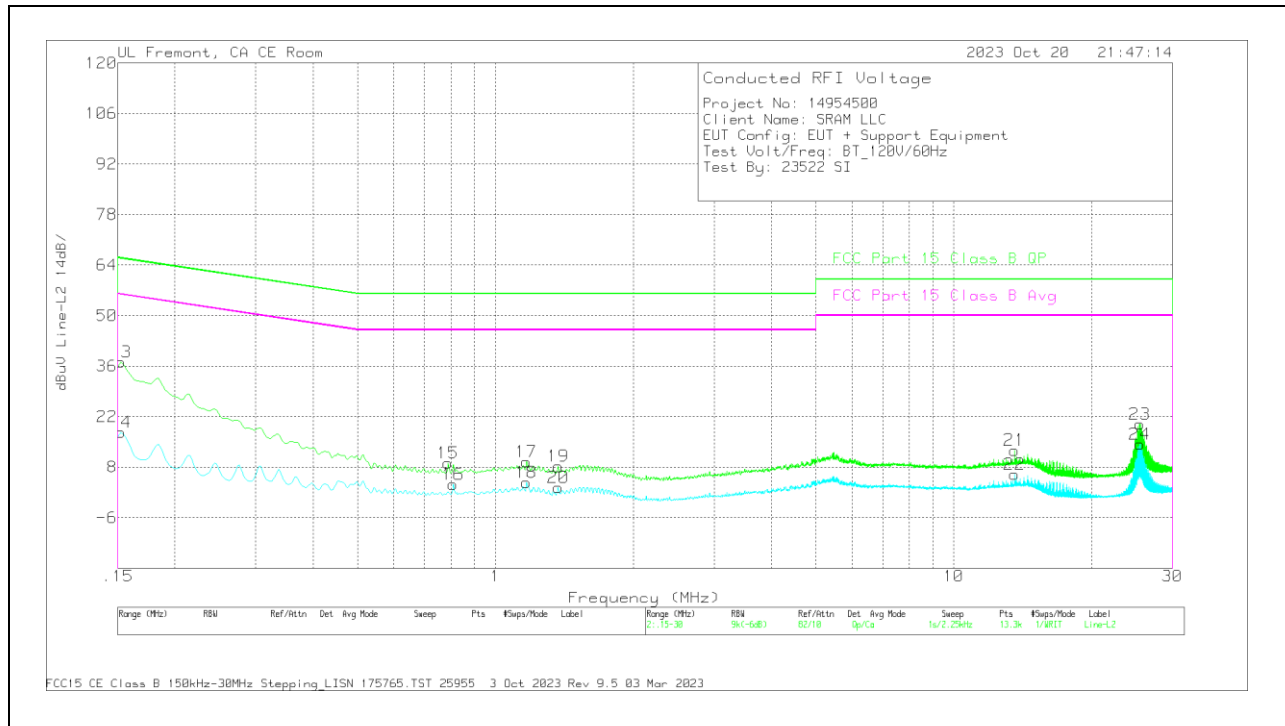


### Trace Markers

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Tms Limiter (dB)	Corrected Reading dBuV	FCC Part 15 Class B QP	QP Margin (dB)	FCC Part 15 Class B Avg	Av(CISPR)M argin (dB)
1	.1523	27.92	Qp	0	0	9.5	37.42	65.88	-28.46	-	-
2	.1523	9.5	Ca	0	0	9.5	19	-	-	55.88	-36.88
3	.4853	3.89	Qp	0	0	9.3	13.19	56.25	-43.06	-	-
4	.4853	-4.12	Ca	0	0	9.3	5.18	-	-	46.25	-41.07
5	.789	-2	Qp	0	.1	9.3	7.4	56	-48.6	-	-
6	.789	-7.79	Ca	0	.1	9.3	1.61	-	-	46	-44.39
7	1.1693	-2.21	Qp	0	.1	9.4	7.29	56	-48.71	-	-
8	1.1693	-7.69	Ca	0	.1	9.4	1.81	-	-	46	-44.19
9	1.3695	-2.71	Qp	0	.1	9.3	6.69	56	-49.31	-	-
10	1.3695	-8.51	Ca	0	.1	9.3	.89	-	-	46	-45.11
11	25.53	9.61	Qp	.2	.3	9.5	19.61	60	-40.39	-	-
12	25.53	4.1	Ca	.2	.3	9.5	14.1	-	-	50	-35.9

Qp - Quasi-Peak detector  
 Ca - CISPR average detection

### LINE 2 RESULTS



#### Trace Markers

Range 2: Line-L2 .15 - 30MHz												
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN (dB)	Cbl (dB)	Trms 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	27.6	Qp	0	0	9.5	37.1	65.88	-28.78	-	-	
14	.1523	8.2	Ca	0	0	9.5	17.7	-	-	55.88	-38.18	
15	.789	-.2	Qp	0	0	9.3	9.1	56	-46.9	-	-	
16	.8093	-6.12	Ca	0	0	9.3	3.18	-	-	46	-42.82	
17	1.1693	-.06	Qp	0	.2	9.4	9.54	56	-46.46	-	-	
18	1.1693	-5.81	Ca	0	.2	9.4	3.79	-	-	46	-42.21	
19	1.3695	-1.2	Qp	0	.1	9.3	8.2	56	-47.8	-	-	
20	1.3695	-6.99	Ca	0	.1	9.3	2.41	-	-	46	-43.59	
21	13.56	2.91	Qp	.1	.2	9.5	12.71	60	-47.29	-	-	
22	13.56	-3.78	Ca	.1	.2	9.5	6.02	-	-	50	-43.98	
23	25.4648	10.01	Qp	.2	.3	9.4	19.91	60	-40.09	-	-	
24	25.4648	4.52	Ca	.2	.3	9.4	14.42	-	-	50	-35.58	

Qp - Quasi-Peak detector  
 Ca - CISPR average detection