

November 07, 2022

Xirgo Technologies, LLC  
188 Camino Ruiz  
Camarillo, CA

Dear Ed Gabrelian,

Enclosed is the Wireless test report for compliance testing of the Xirgo Technologies, LLC., Asset Tracking/  
FLEET TPMS as tested to the requirements of Title 47 of the CFR, Part 15 Subpart C for Intentional Radiators.

Thank you for using the services of Eurofins Electrical and Electronic Testing NA, Inc. If you have any  
questions regarding these results or if Eurofins Electrical and Electronic Testing NA, Inc. can be of further  
service to you, please feel free to contact me.



Documentation Department  
Eurofins Electrical and Electronic Testing NA, Inc.

Reference: WIR121141-Xirgo\_FCC\_ISED\_BLE



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## **FCC/ ISED Test Report**

**Applicant name: Xirgo Technologies, LLC**

**Product: Asset Tracking/ FLEET TPMS**

**Report: WIR121141-Xirgo\_FCC\_ISED\_BLE**

**Applicant Address:**

**188 Camino Ruiz  
Camarillo, CA**

**Manufacturer Address:**

**188 Camino Ruiz  
Camarillo, CA**

**Prepared By:  
Eurofins Electrical and Electronic Testing NA, Inc.  
3162 Belick St.  
Santa Clara CA, 95054**

## FCC/ ISED Test Report

**Applicant name: Xirgo Technologies, LLC**

**Product: Asset Tracking/ FLEET TPMS**

**Standard**

**47 CFR FCC Part 15, Subpart C (Section 15.247)**

**558074 D01 15.247 Meas Guidance v05r02**

**ANSI C63.10: 2013**

*Christopher Martin*

Christopher Martin Test Engineer, Wireless Laboratory

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements FCC Rules under normal use and maintenance.

*Gary Chou*

Gary Chou

Wireless Engineering Manager, Wireless Laboratory

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	November 06, 2022	Initial Issue.

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## I. Executive Summary

### A. Executive Summary

47 CFR FCC Part 15, Subpart C (SECTION 15.247) RSS 247 Issue2, RSS Gen Issue5				
FCC/ IC Cluse	ISED	Test Item	Result	Remarks
15.207	RSS Gen 8.8	AC Power Conducted Emission	N/A	Powered by 9-32 Vdc so test is not required.
15.205 &15.209 & 15.247(d)	RSS Gen 8.8	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	RSS 247 5.5C	6dB bandwidth & 99% bandwidth	PASS	Meet the requirement of limit.
15.247(b)	RSS 247 5.2.1 RSS Gen 6.7	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	RSS 247 5.4.4	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	RSS 247 5.2.2	Antenna Requirement	PASS	PCB antenna (without connector) meet the requirement.

**Note:**

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

## II. Equipment Information

### A. Overview

EUT Summary Table

<b>Product:</b>	Asset Tracking/ FLEET TPMS		
<b>Brand:</b>	Xirgo		
<b>Model(s) Tested:</b>	XT4392		
<b>Series Model:</b>	N/A		
<b>Sample Status:</b>	Original		
<b>EUT Specifications:</b>	Primary Power:		8-32 Vdc
	Voltage Frequency:		N/A
	Technology / Type of Modulations:		BLUETOOTH LE: GFSK
	Operating Frequency :		2.402 ~ 2.480GHz
	FCC ID:		GKM-XT4392
	ISED ID:		10281A-XT4392
	Antenna Type:	PCB Antenna	
	Antenna connector:		N/A
	Antenna Gain		2.6 dBi
<b>Analysis:</b>	The results obtained relate only to the item(s) tested.		
<b>Environmental Test Conditions:</b>	Temperature: 20.3° C		
	Relative Humidity: 47.5%		
	Barometric Pressure: 860-1060 mbar		
<b>Evaluated by:</b>	Christopher Martin		
<b>Issue Date(s):</b>	November 06, 2022		

NOTE: The following modules can be chosen to be configured in the EUT.

	Model No.	FCC ID	Note
-	-	-	-

-	-	-	-
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**FCC/IC RF Testing Units Setting**

Model	Hardware (FW) Rev.	Firmware (FW) Rev.	FW operation verification and Instruction
XT4392	XT4392-001	XT4392-01	Verify by Spectrum Analyzer & Laptop

**DESCRIPTION OF TEST MODES**

Power Setting :

Channel	Frequency(MHz)	Power Setting
0	2402	Default
19	2440	Default
39	2480	Default

40 channels are provided for Bluetooth LE:

Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454		
13	2428	27	2456		



## B. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
B	wideband radio communication tester	ROHDE& SCHARZ	CMW500	1201.0002K50	-	Bluetooth Tester

Note: (Describe the outline of a simulator, if used for the tests, as a note under the table.)

Insert Cable Connections to/from EUT provided by test team.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
	-	-	-	-	0	-

Note: The core(s) is(are) originally attached to the cable(s).

## General Description of Applied Standards

## C. References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

- 47 CFR FCC Part 15, Subpart C (Section 15.247)
- 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10:2013
- RSS 247 Issue2
- RSS Gen Issue5

## D. Test Site

All testing was performed at Eurofins Electrical and Electronic Testing NA, Inc., 3162 Belick St. Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Eurofins Electrical and Electronic Testing NA, Inc. has been accredited by the American Association for Laboratory Accreditation (A2LA) (Certificate #: 0591.02) in accordance with ISO/IEC 17025:2017.

Eurofins Electrical and Electronic Testing NA, Inc. is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

## E. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

**Uncertainty Calculations Summary**

**F. Modifications****a) Modifications to EUT**

No modifications were made to the EUT.

**b) Modifications to Test Standard**

No modifications were made to the test standard.

**G. Disposition of EUT**

The test sample including all support equipment (if any), submitted to the Electromagnetic Compatibility Lab for testing was returned to ROKU upon completion of testing.

### III. Electromagnetic Compatibility Criteria for Intentional Radiators

#### Radiated Emission and Bandage Measurement

Limits of Radiated Emission and Bandage Measurement:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

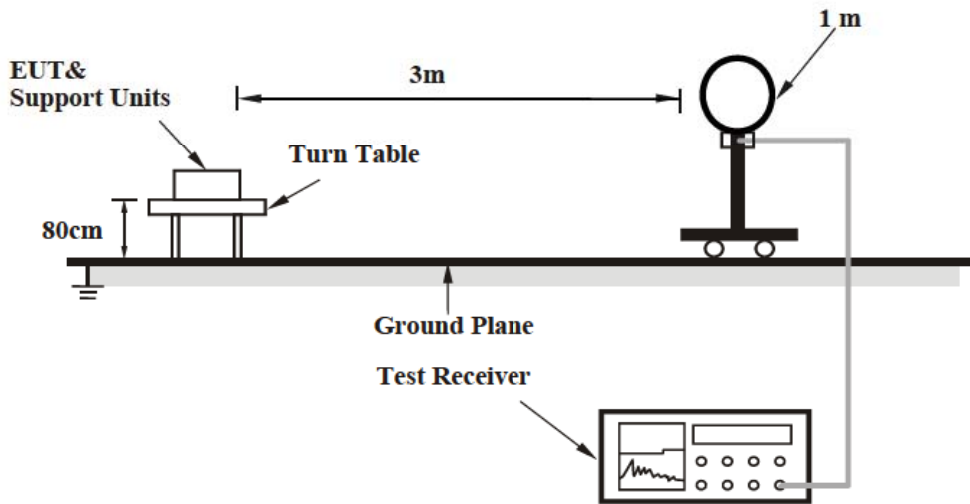
Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

#### Test Procedures:

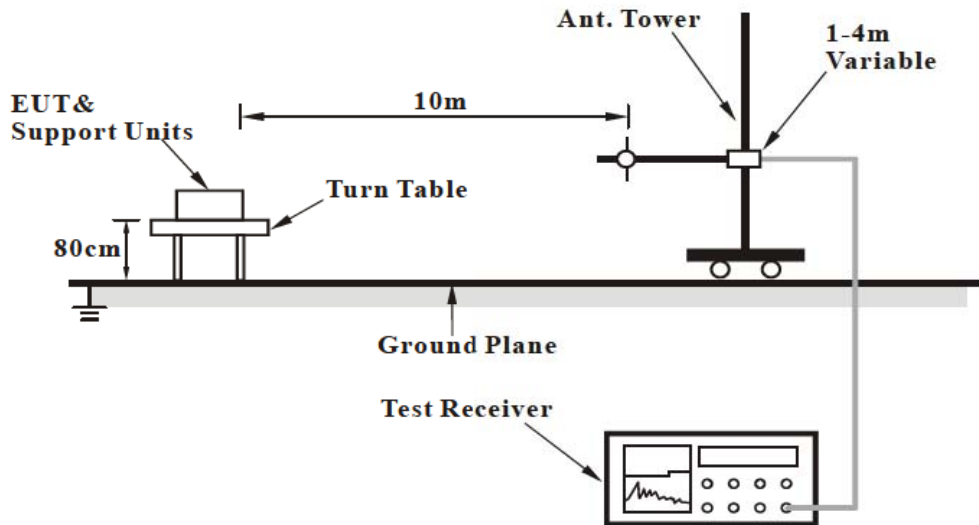
The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

**Test Setup**

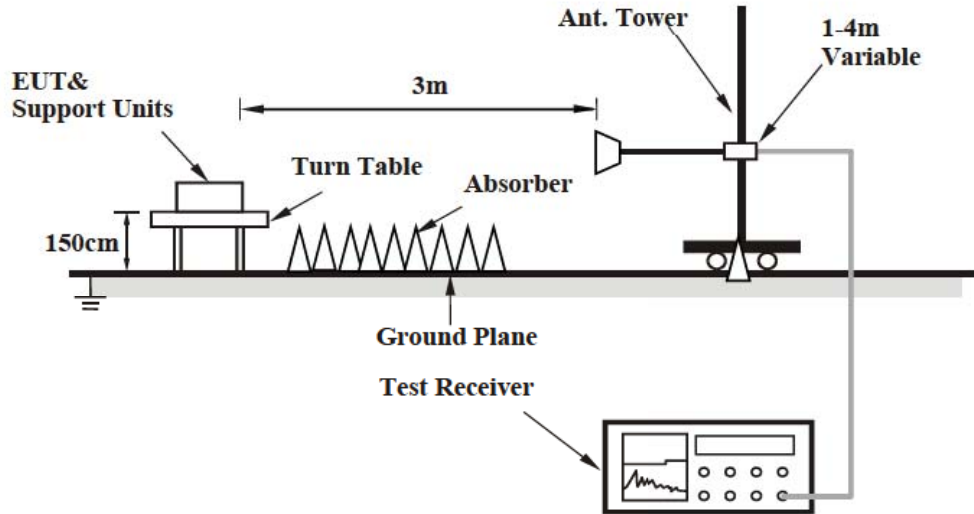
**For Radiated Emission Below 30MHz**



**For Radiated emission 30 MHz to 1GHz**



**For Radiated emission 1GHz to 40GHz**



**Test Results:** The EUT was tested is **compliant** with Radiated Spurious Emissions Requirements.

**Test Equipment List**

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
1S2399	Turntable Controller	SUNOL SCIENCE	SC99V	Not Required	Not Required
1S2486	5 Meter Chamber Control Room	Panashield	5 Meter Control Room	Not Required	Not Required
1S2435	Horn Antenna	ETS-LINDGREN	3117	03/03/2021	03/09/2023
1S4802	Preamplifier	EMC Instrument	EMC118A45SE	Note 1	Note 1
1S2668	Preamplifier	Sonoma Instrument	310N	Note 1	Note 1
1S2600	Antenna	TESEQ GmbH	D-12623	05/ 11/ 2021	05/ 11/ 2023
1S3983	Loop Antenna	ETS-LINDGREN	6512	10/ 14 /2021	10/ 14 /2023

Note 1: Verified by calibrated instrumentation at the time of testing

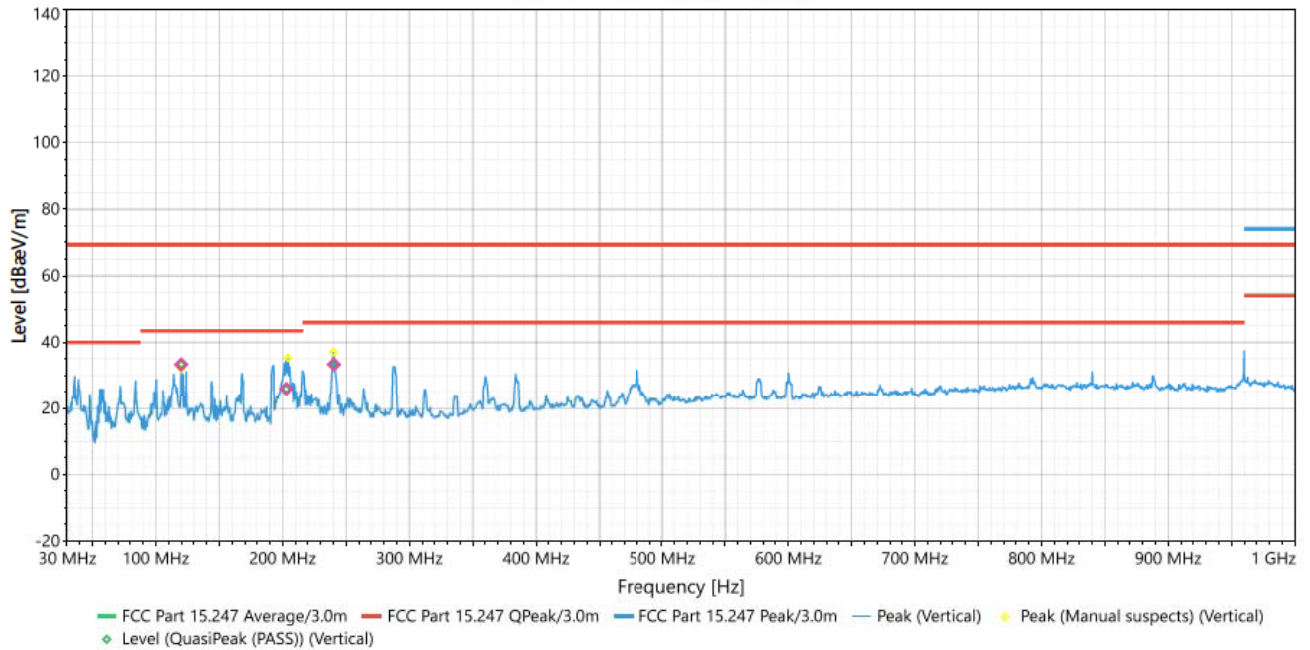
**Test Engineer:** Christopher Martin

**Test Date(s):** 10/07/2022

### Test Data Radiated Emissions (30 MHz~1000 MHz)

EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	30MHz-1GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2440 MHz		

#1 - 30MHz-1GHz (Vertical)



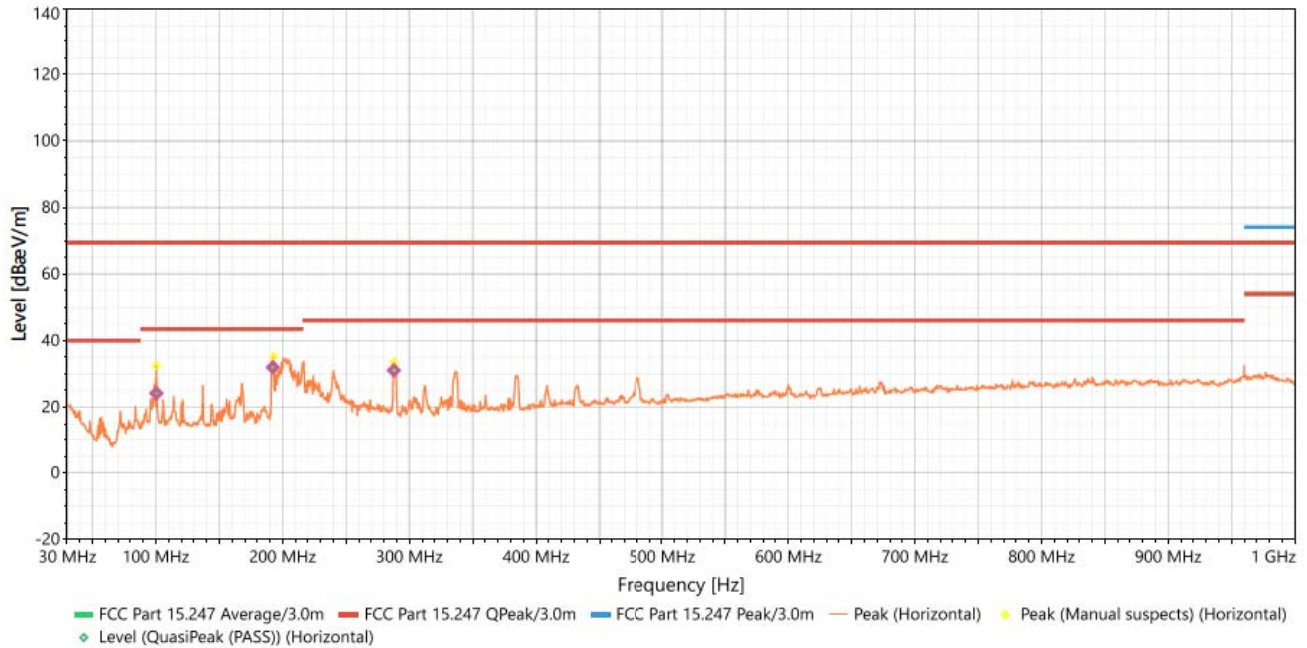
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level Peak [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (cm)	Angle (Deg)	Factor [dB(1/m)]	Pass/Fail
1	120.01	Vertical	33.32	43.5	-10.18	1	225	-12.27	Pass
2	202.94	Vertical	25.909	43.5	-17.591	1.01	95	-14.39	Pass
3	240.47	Vertical	33.332	46	-12.668	1.06	322	-12.59	Pass

**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	30MHz-1GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2440 MHz		

#2 - 30MHz-1GHz (Horizontal)



Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (cm)	Angle (Deg)	Factor [dB(1/m)]	Pass/Fail
1	100.44	Horizontal	24.184	43.5	-19.316	2.08	293	-14.1	Pass
2	192.33	Horizontal	31.981	43.5	-11.519	2.51	264	-15.21	Pass
3	287.88	Horizontal	31.048	46	-14.952	1.46	84	-10.45	Pass

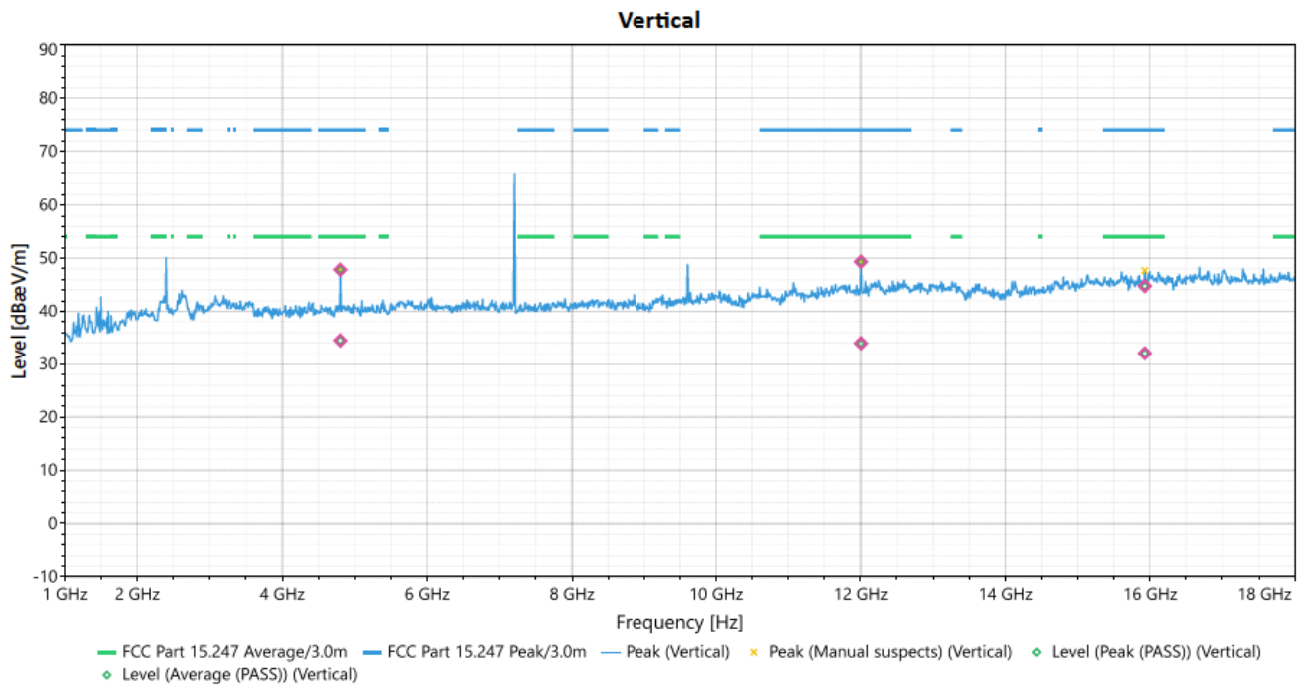
**REMARKS:**

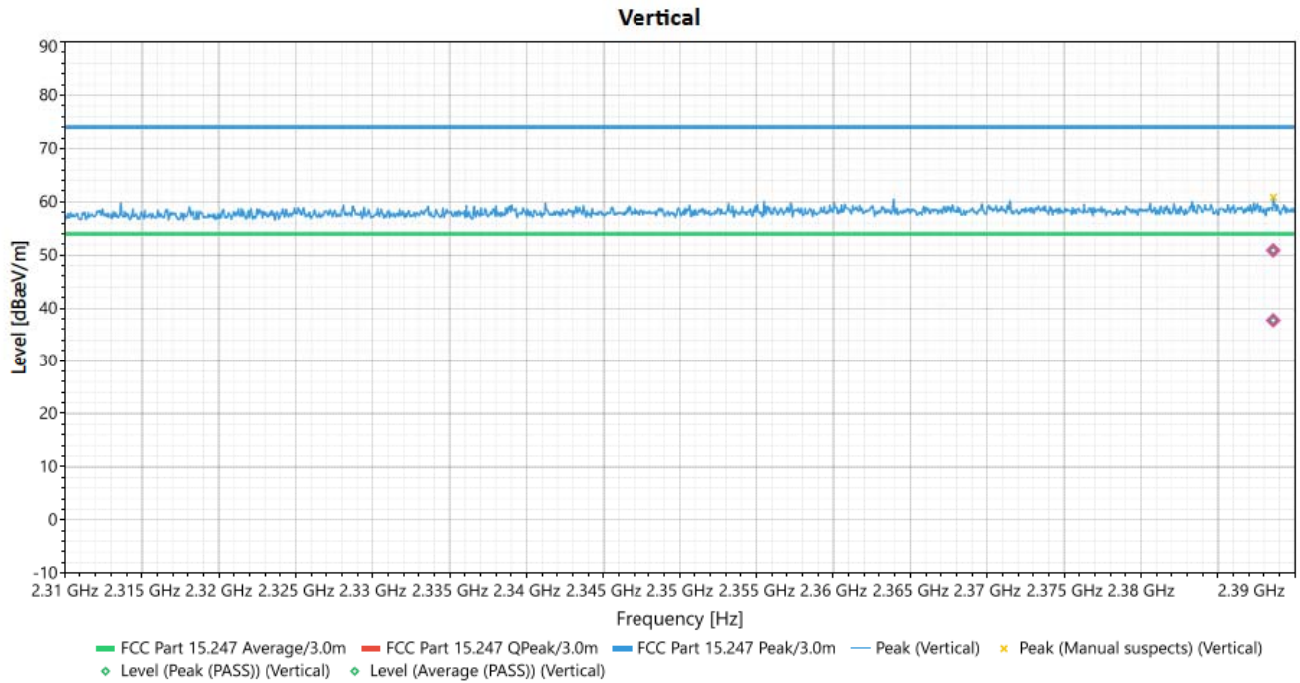
1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.



### Radiated Emissions (Above 1GHz)

EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	1GHz-26GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2402 MHz		



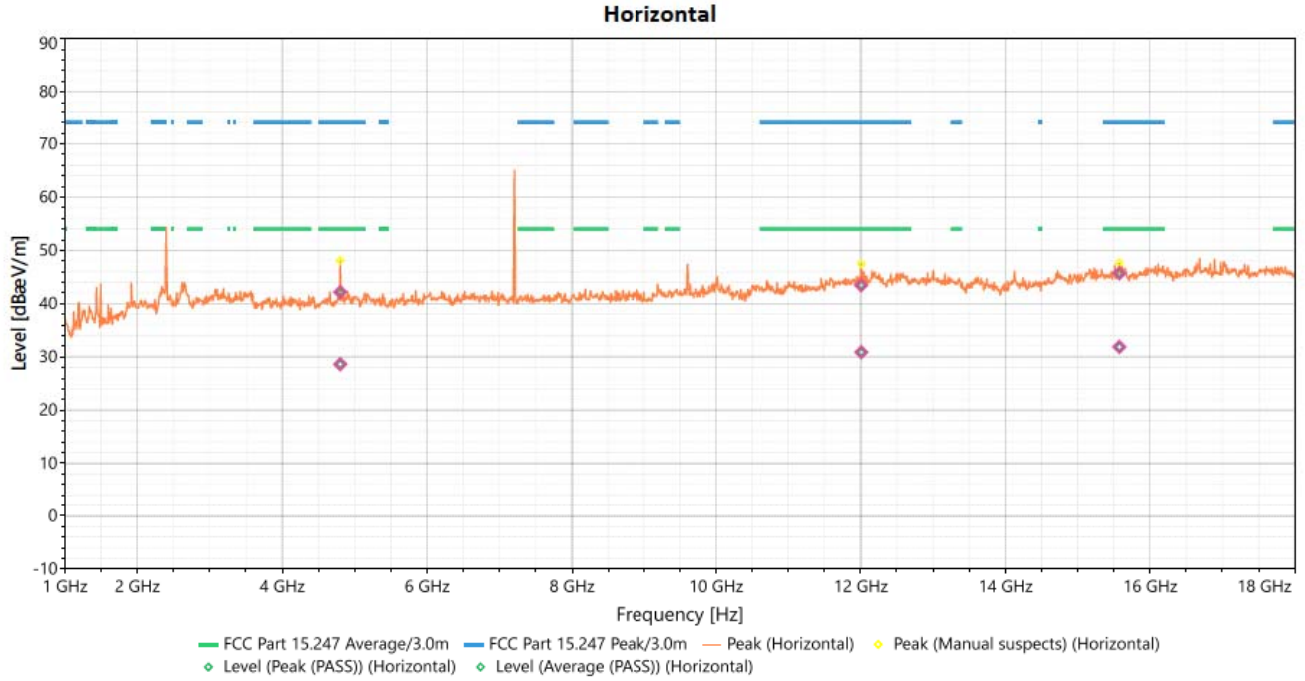


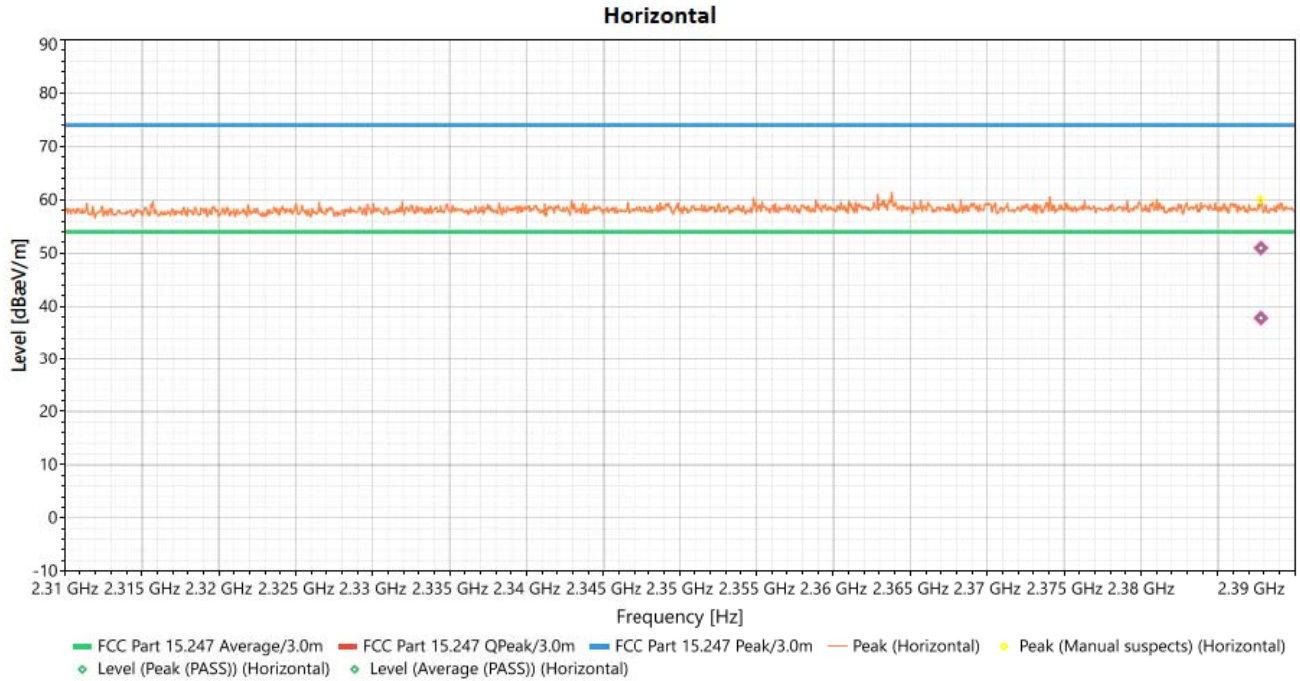
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level Peak [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	4803.65	Vertical	47.807	74	-26.193	1	4	0.49	Peak (PASS)
2	4803.65	Vertical	34.481	54	-19.519	1	4	0.49	Average (PASS)
3	12007.4	Vertical	49.311	74	-24.689	2.39	195	3.61	Peak (PASS)
4	12007.4	Vertical	33.935	54	-20.065	2.39	195	3.61	Average (PASS)
5	15928.025	Vertical	44.741	74	-29.259	1	284	4.55	Peak (PASS)
6	15928.025	Vertical	32.04	54	-21.96	1	284	4.55	Average (PASS)
7	2388.6	Vertical	50.895	74	-23.105	1.84	258	35.81	Peak (PASS)
8	2388.6	Vertical	37.747	54	-16.253	1.84	258	35.81	Average (PASS)

**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	1GHz-26GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2402 MHz		



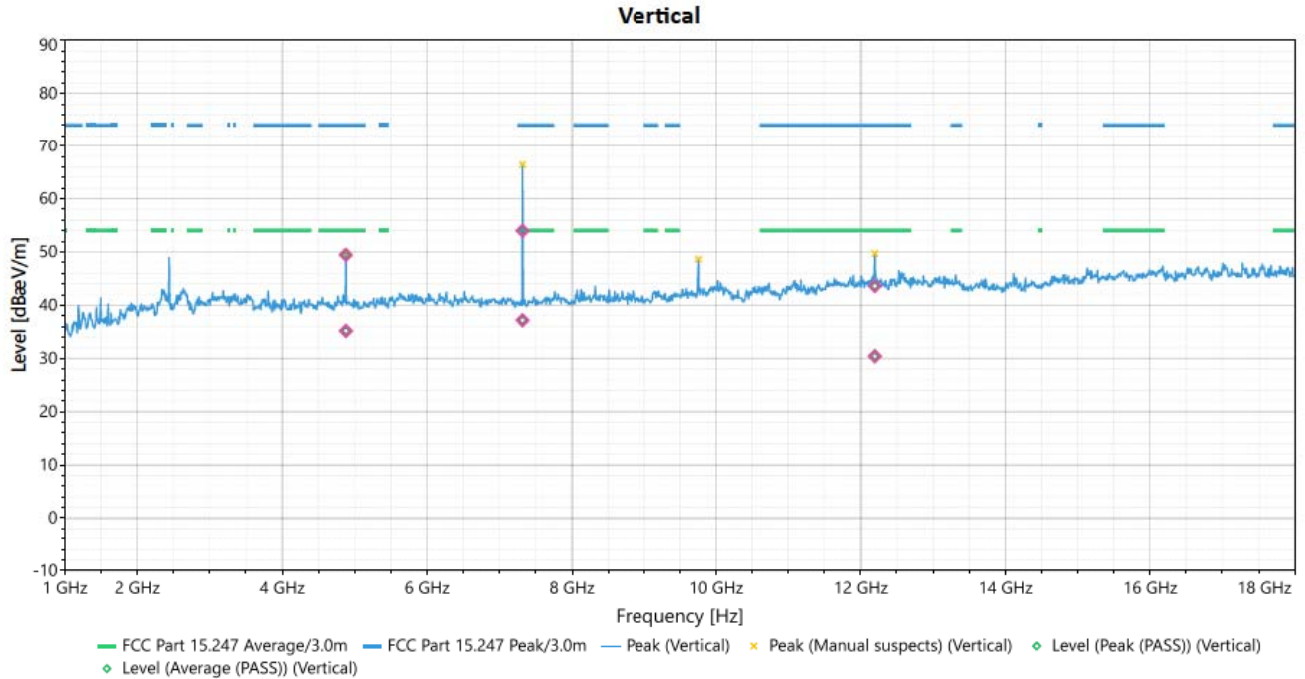


Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	4801.525	Horizontal	42.14	74	-31.86	1.06	121	1.05	Peak (PASS)
2	4801.525	Horizontal	28.618	54	-25.382	1.06	121	1.05	Average (PASS)
3	12009.525	Horizontal	43.456	74	-30.544	1	351	3.8	Peak (PASS)
4	12009.525	Horizontal	30.848	54	-23.152	1	351	3.8	Average (PASS)
5	15575.275	Horizontal	45.662	74	-28.338	1	360	4.5	Peak (PASS)
6	15575.275	Horizontal	31.863	54	-22.137	1	360	4.5	Average (PASS)
7	2387.8	Horizontal	50.959	74	-23.041	1.34	316	35.87	Peak (PASS)
8	2387.8	Horizontal	37.808	54	-16.192	1.34	316	35.87	Average (PASS)

**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

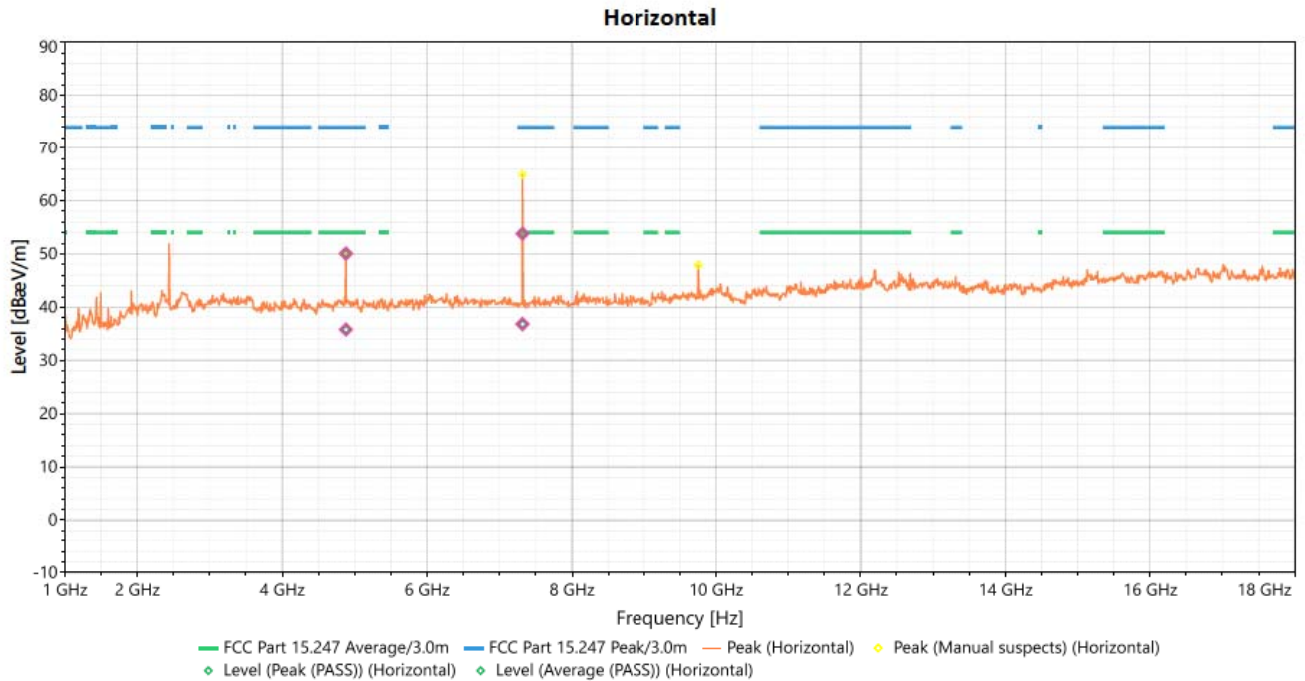
EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	1GHz-26GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2440 MHz		



Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level Peak [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	4880.15	Vertical	49.444	74	-24.556	1	356	0.62	Peak (PASS)
2	4880.15	Vertical	35.17	54	-18.83	1	356	0.62	Average (PASS)
3	7317.525	Vertical	53.966	74	-20.034	1.6	13	2.12	Peak (PASS)
4	7317.525	Vertical	37.163	54	-16.837	1.6	13	2.12	Average (PASS)
5	12196.525	Vertical	43.596	74	-30.404	1.88	164	3.75	Peak (PASS)
6	12196.525	Vertical	30.386	54	-23.614	1.88	164	3.75	Average (PASS)

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	1GHz-26GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2440 MHz		



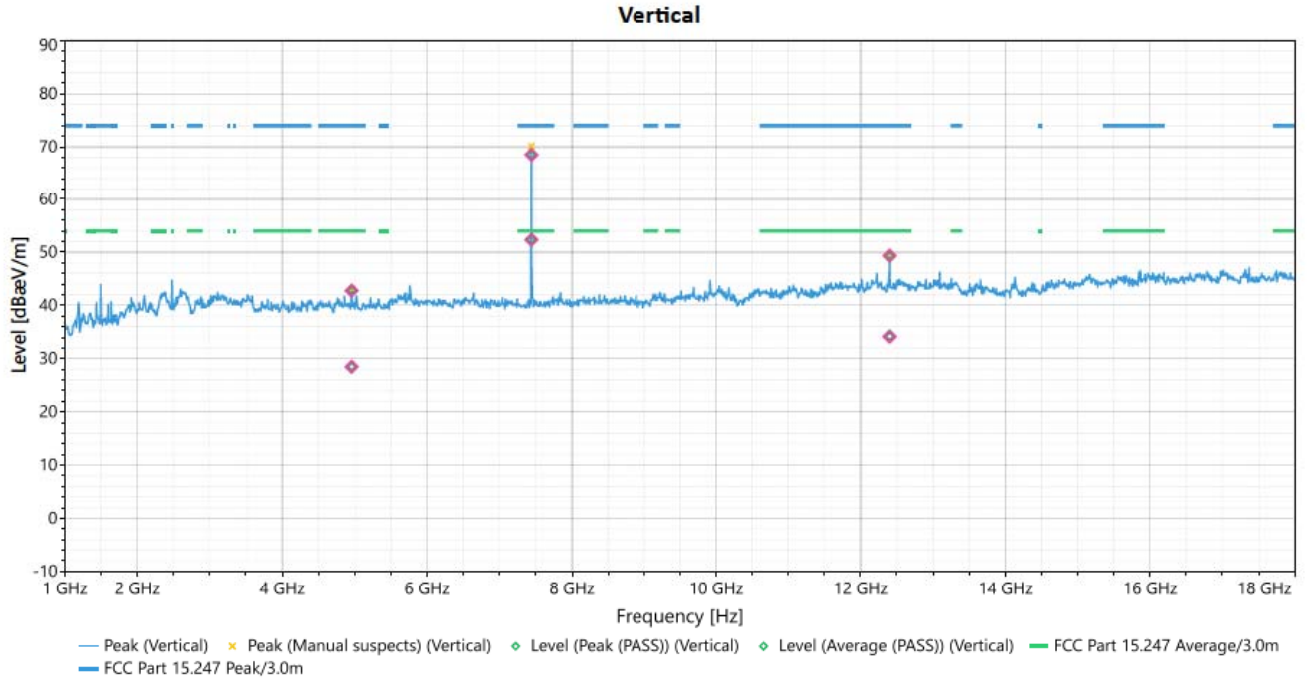
Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (cm)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	4880.15	Horizontal	50.063	74	-23.937	2.86	349	1.06	Peak (PASS)
2	4880.15	Horizontal	35.783	54	-18.217	2.86	349	1.06	Average (PASS)
3	7317.525	Horizontal	53.789	74	-20.211	2.12	46	2.34	Peak (PASS)
4	7317.525	Horizontal	36.805	54	-17.195	2.12	46	2.34	Average (PASS)

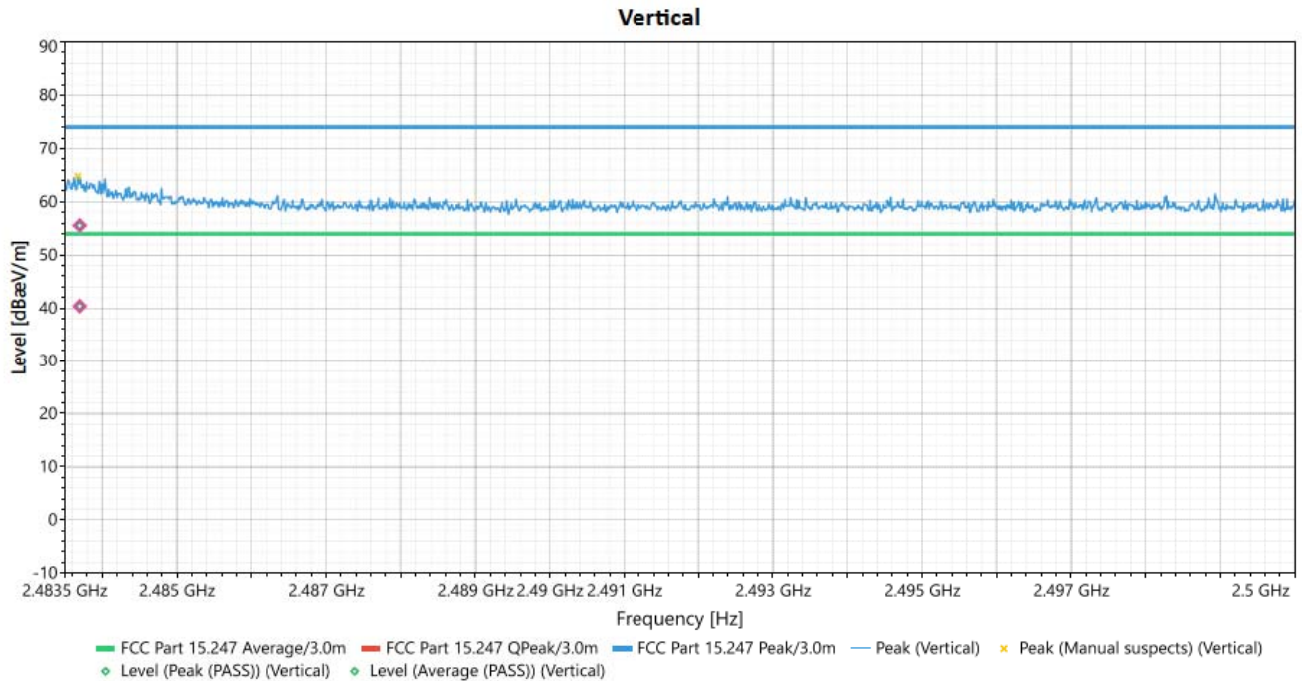
**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition	Measurement Detail
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Input Power	14Vdc	Frequency Range	1GHz-26GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2480 MHz		



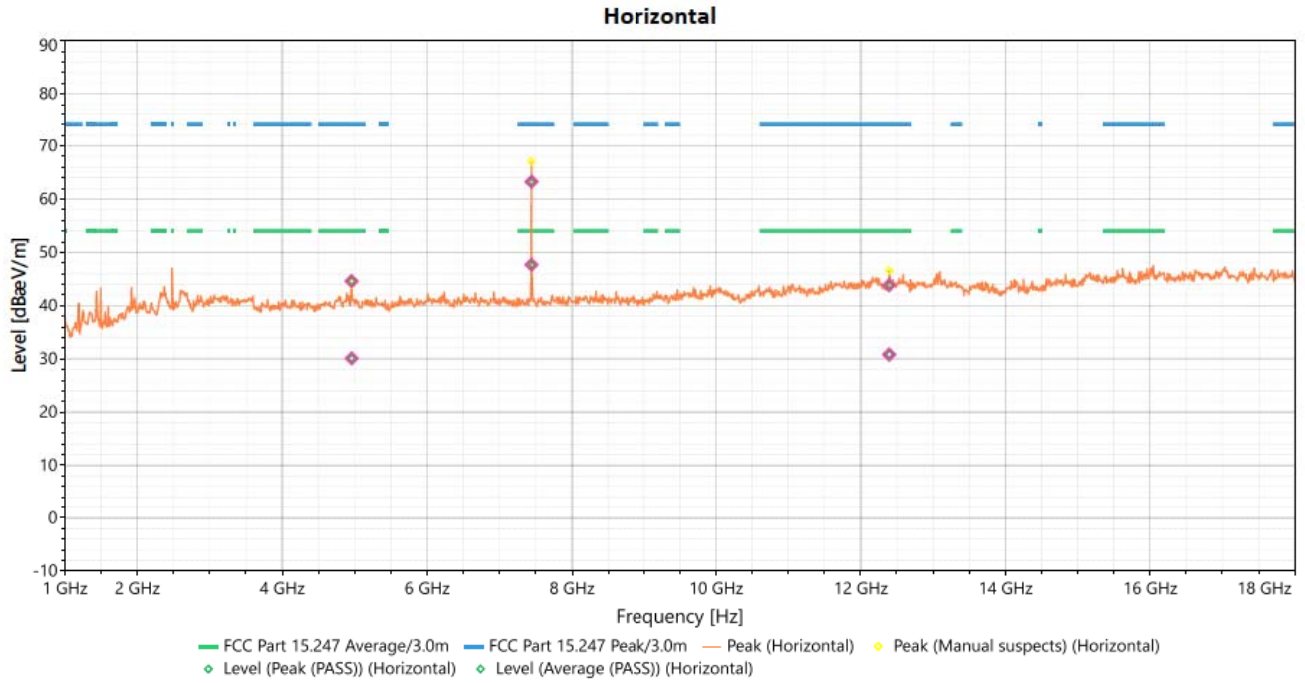


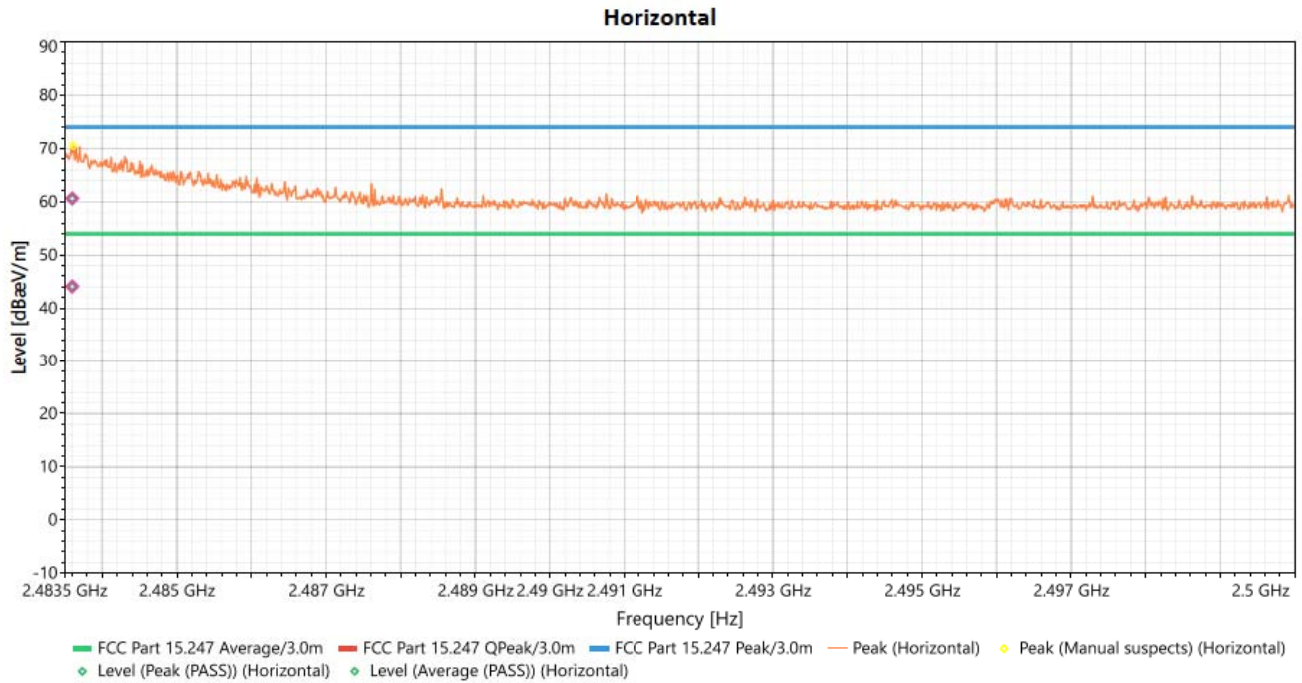
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level Peak [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/ Result
1	4958.775	Vertical	46.891	74	-27.109	2.7	210	0.76	Peak (PASS)
2	4958.775	Vertical	29.981	54	-24.019	2.7	210	0.76	Average (PASS)
3	7438.65	Vertical	49.856	74	-24.144	1.28	210	4.35	Peak (PASS)
4	7438.65	Vertical	36.724	54	-17.276	1.28	210	4.35	Average (PASS)
5	12400.525	Vertical	56.538	74	-17.462	1.61	329	36.21	Peak (PASS)
6	12400.525	Vertical	43.473	54	-10.527	1.61	329	36.21	Average (PASS)
7	2483.7	Vertical	55.571	74	-18.429	3.17	134	36.21	Peak (PASS)
8	2483.7	Vertical	40.393	54	-13.607	3.17	134	36.21	Average (PASS)

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.



EUT Test Condition		Measurement Detail	
Input Power	14Vdc	Frequency Range	1GHz-26GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Test Mode	TX MODE BLE 2480 MHz		





Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (cm)	Angle (Deg)	Factor [dB(1/m)]	Measure Type/Result
1	4958.775	Horizontal	44.591	74	-29.409	1.97	211	1.33	Peak (PASS)
2	4958.775	Horizontal	30.069	54	-23.931	1.97	211	1.33	Average (PASS)
3	7440.775	Horizontal	63.235	74	-10.765	1.94	51	2.37	Peak (PASS)
4	7440.775	Horizontal	47.672	54	-6.328	1.94	51	2.37	Average (PASS)
5	12396.275	Horizontal	43.847	74	-30.153	1	18	3.9	Peak (PASS)
6	12396.275	Horizontal	30.805	54	-23.195	1	18	3.9	Average (PASS)
7	2483.6	Horizontal	60.624	74	-13.376	1.4	198	36.32	Peak (PASS)
8	2483.6	Horizontal	44.094	54	-9.906	1.4	198	36.32	Average (PASS)

**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

## Conducted Emission Measurement

### Limits of Conducted Emission Measurement :

The following standards specified below are covered in the scope of this section of the test report:

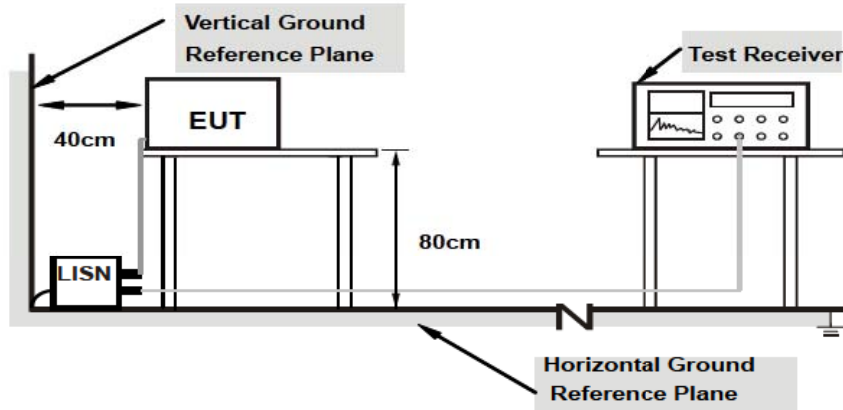
Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

- Note: 1. The lower limit shall apply at the transition frequencies.  
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### Conducted Emissions - Test Procedure

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency ranges from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**Conducted Emissions - Test Setup**



**Note: 1.Support units were connected to second LISN.**

For the actual test configuration, please refer to the attached file (Test Setup Photo)

**Test Results:**

N/A

### 6dB Bandwidth Measurement & 99% Bandwidth Measurement

#### Limits of Conducted Emission Measurement :

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

#### Test Procedure

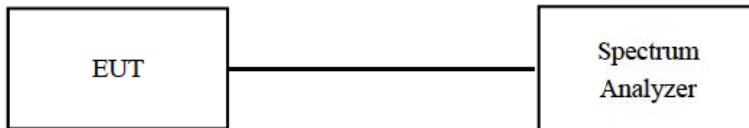
##### 99% Bandwidth Measurement

Refer to ANSI C63.10 section 6.9.3

##### -6dB Bandwidth Measurement

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

#### Conducted Emissions - Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo)

**Test Equipment**

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Test Name: 6dB Bandwidth Measurement & 99% Bandwidth Measurement			Test Date(s): 10/07/2022		
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

**Test Result:**

**DATA RATE:**

**1 MHz**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.6308	1.0457	0.5	PASS
19	2440	0.6294	1.0450	0.5	PASS
39	2480	0.6229	1.0464	0.5	PASS

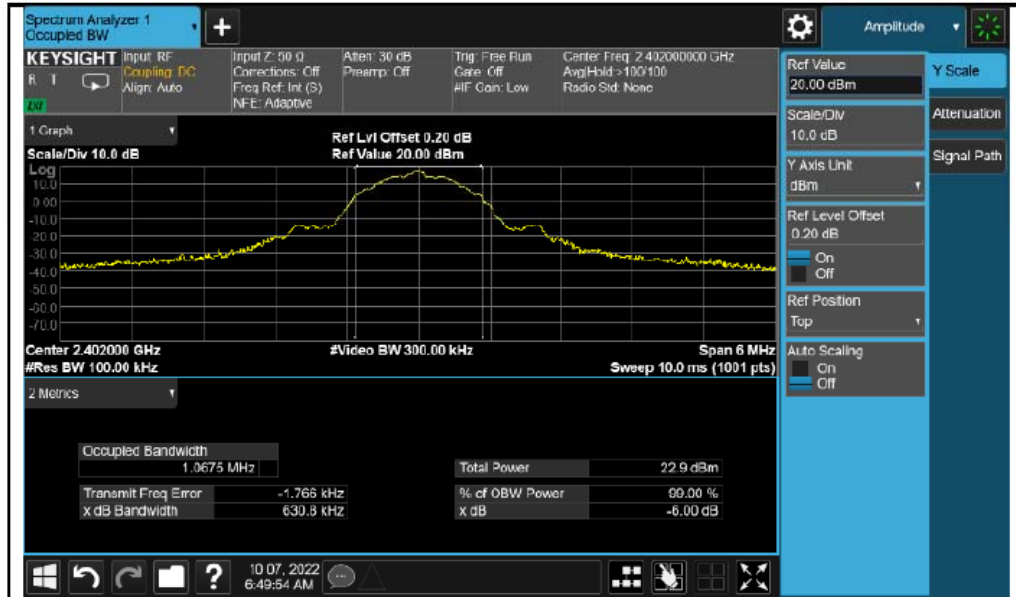
**2 MHz**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	1.089	2.0788	0.5	PASS
19	2440	1.095	2.0821	0.5	PASS
139	2480	1.090	2.0861	0.5	PASS



Test Plots:

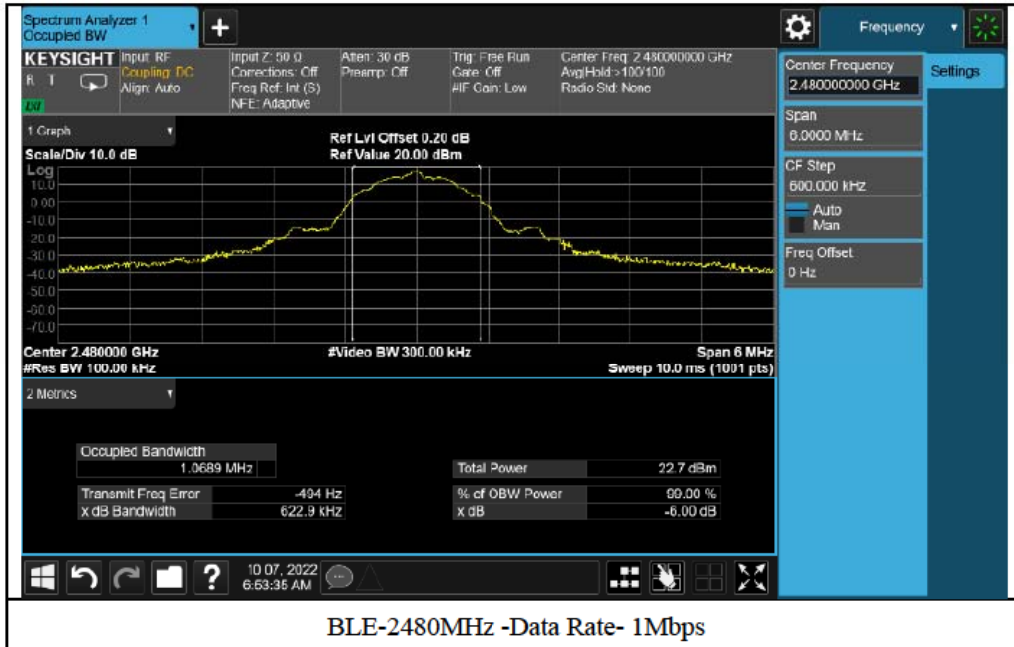
-6dB Bandwidth:



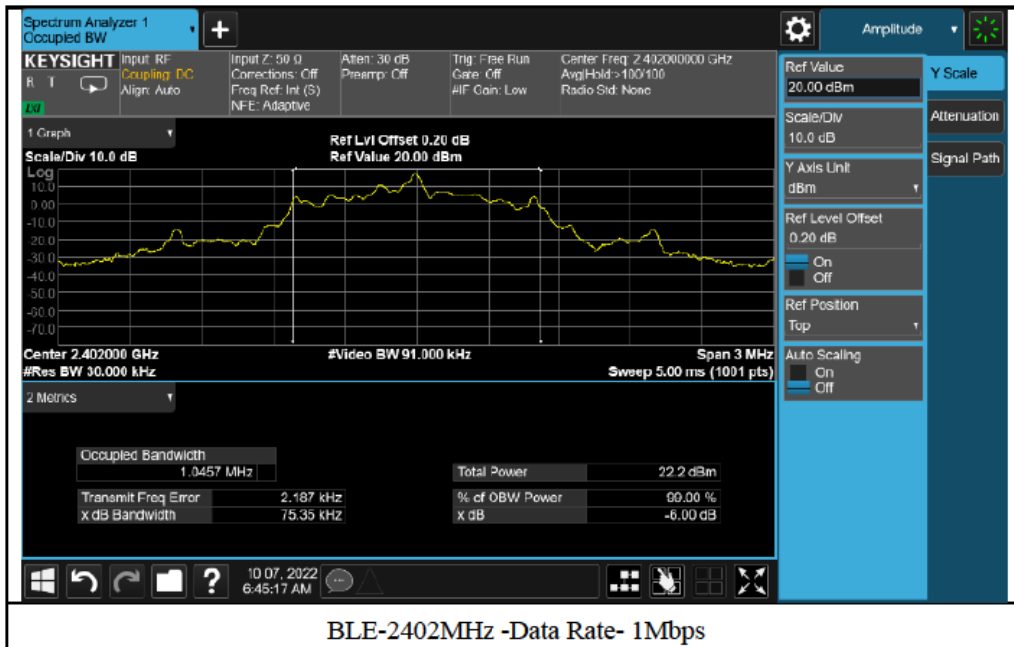
BLE-2402MHz -Data Rate- 1Mbps

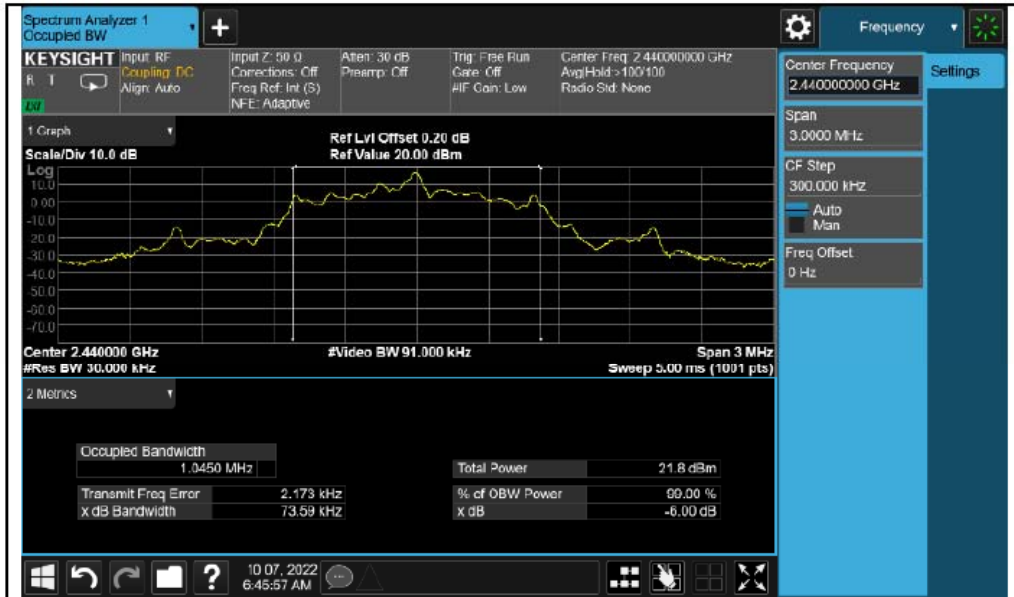


BLE-2440MHz-Data Rate- 1Mbps

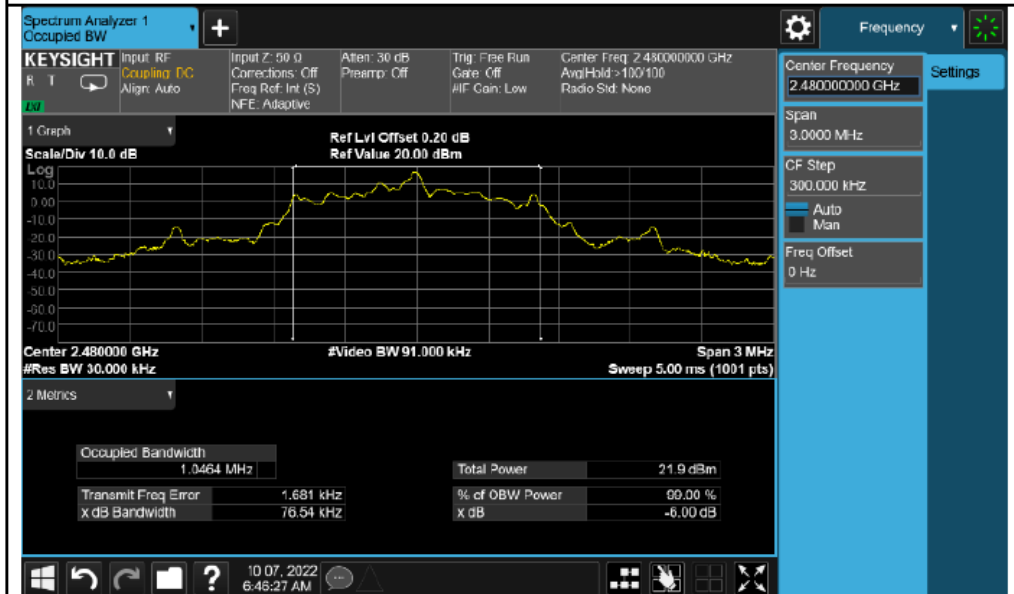


99% Occupied Bandwidth:





BLE-2440MHz-Data Rate- 1Mbps

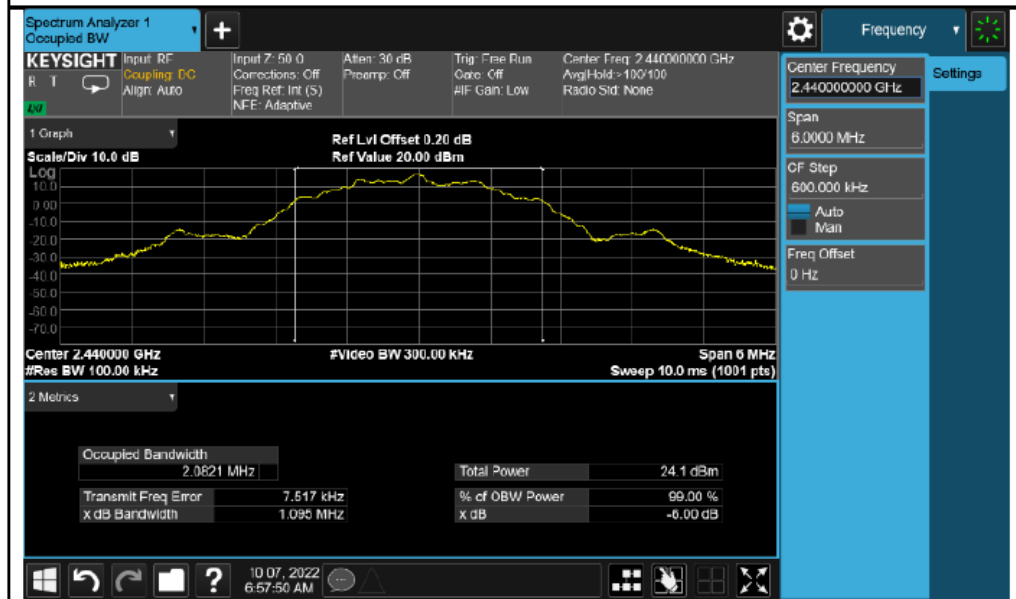


BLE-2480MHz -Data Rate- 1Mbps

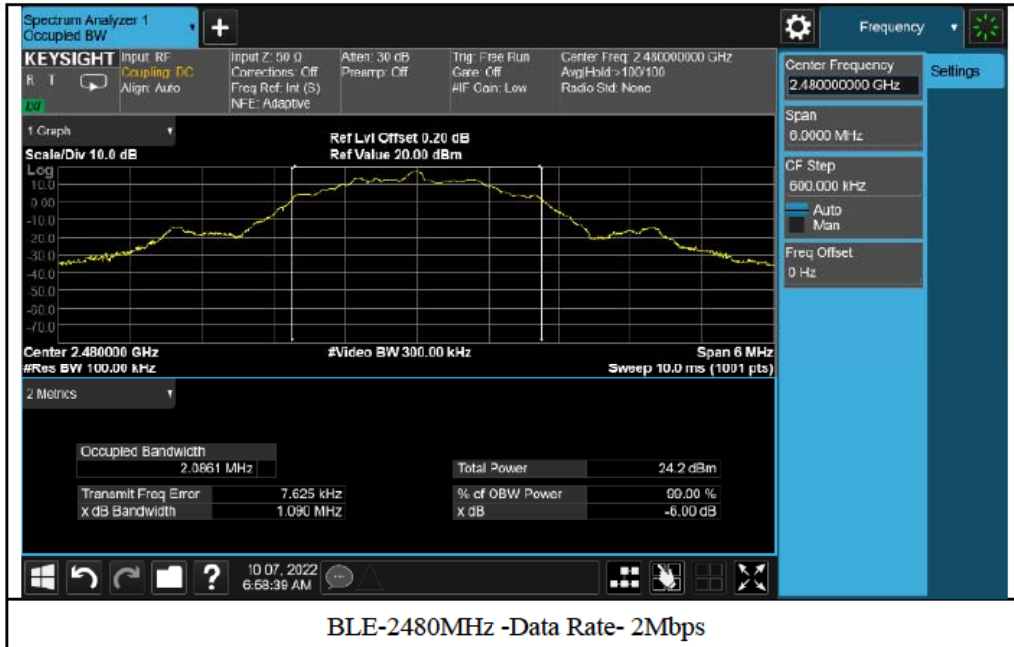
-6dB Bandwidth:



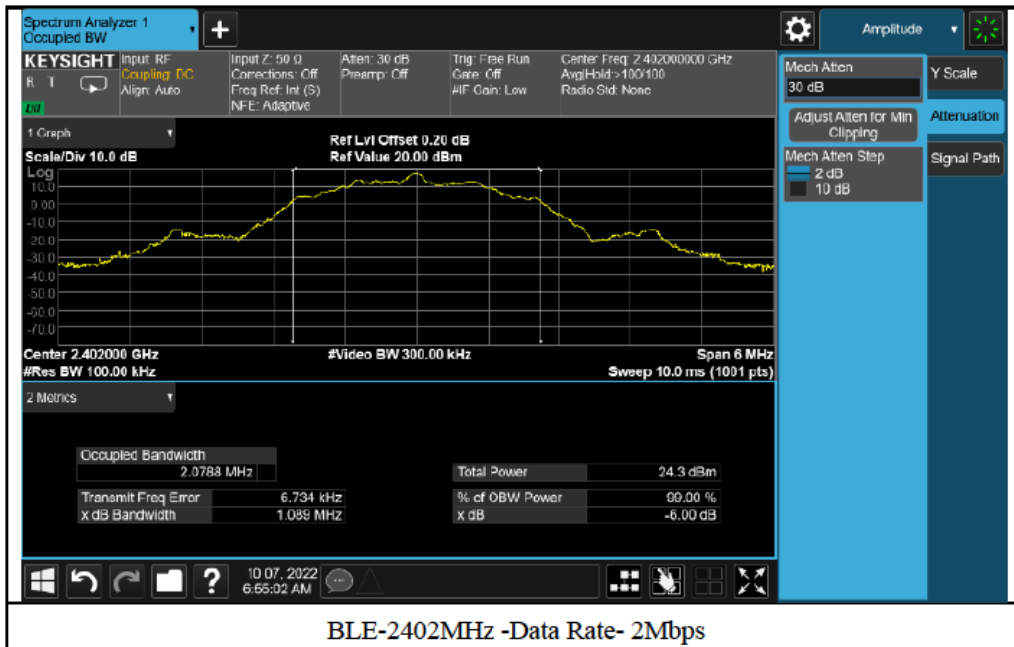
BLE-2402MHz -Data Rate- 2Mbps



BLE-2440MHz-Data Rate- 2Mbps

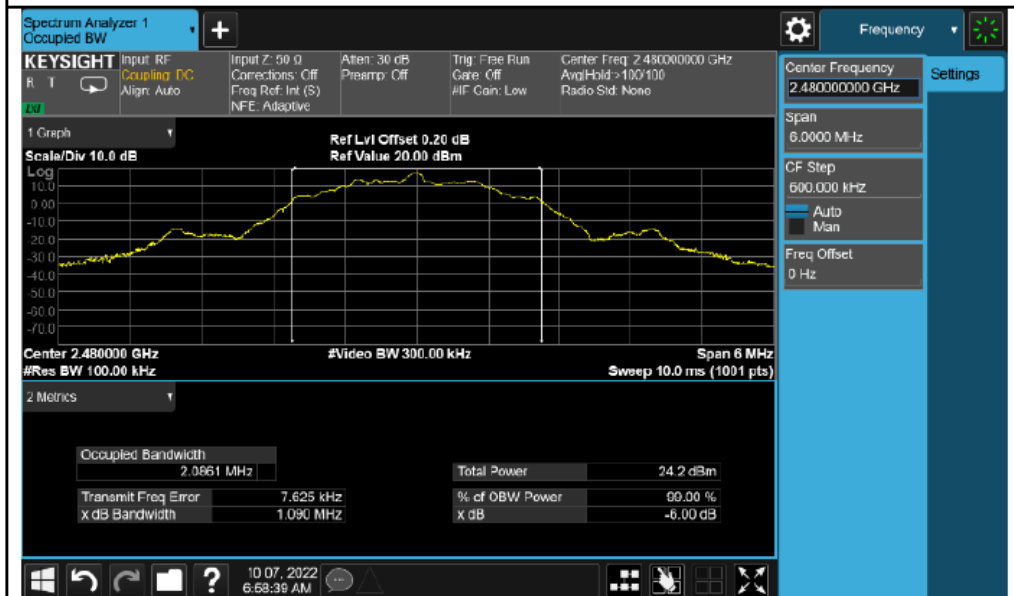


99% Occupied Bandwidth:





BLE-2440MHz-Data Rate- 2Mbps



BLE-2480MHz -Data Rate- 2Mbps

**Conducted Output Power Measurement**

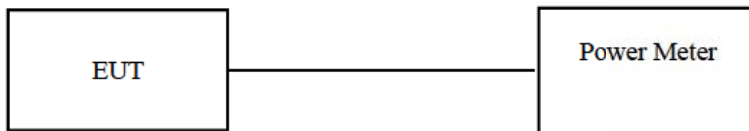
**Limits of Output Power Measurement :**

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

**Test Procedure**

A power meter sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

**Test Setup**



For the actual test configuration, please refer to the attached file (Test Setup Photo)

**Test Equipment**

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

<b>Test Name:</b> Conducted Output Power Measurement			<b>Test Date(s):</b> 10/07/2022		
Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
N/A	Power Meter	ROHDE & SCHWARZ	NRQ6	06/22/2022	06/22/2023

**Test Result:**

Data Rate: 1Mbps (Time-Average Power)

Channel	Frequency (MHz)	Conducted Power (dBm)
37	2402	15.05
17	2440	14.7
39	2480	15.2

Data Rate: 2Mbps (Time-Average Power)

Channel	Frequency (MHz)	Conducted Power (dBm)
37	2402	12.74
17	2440	12.47
39	2480	12.51



**Power Spectral Density Measurement**

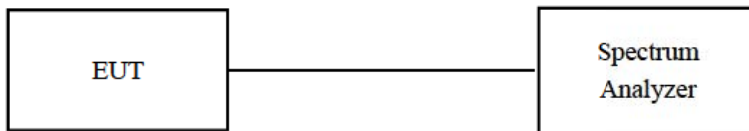
**Limits of Power Spectral Measurement :**

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

**Test Procedure**

A power meter sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

**Test Setup**



For the actual test configuration, please refer to the attached file (Test Setup Photo)

**Test Equipment**

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

<b>Test Name:</b> Power Spectral Density Measurement			<b>Test Date(s):</b> 10/07/2022		
MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

### Test Result:

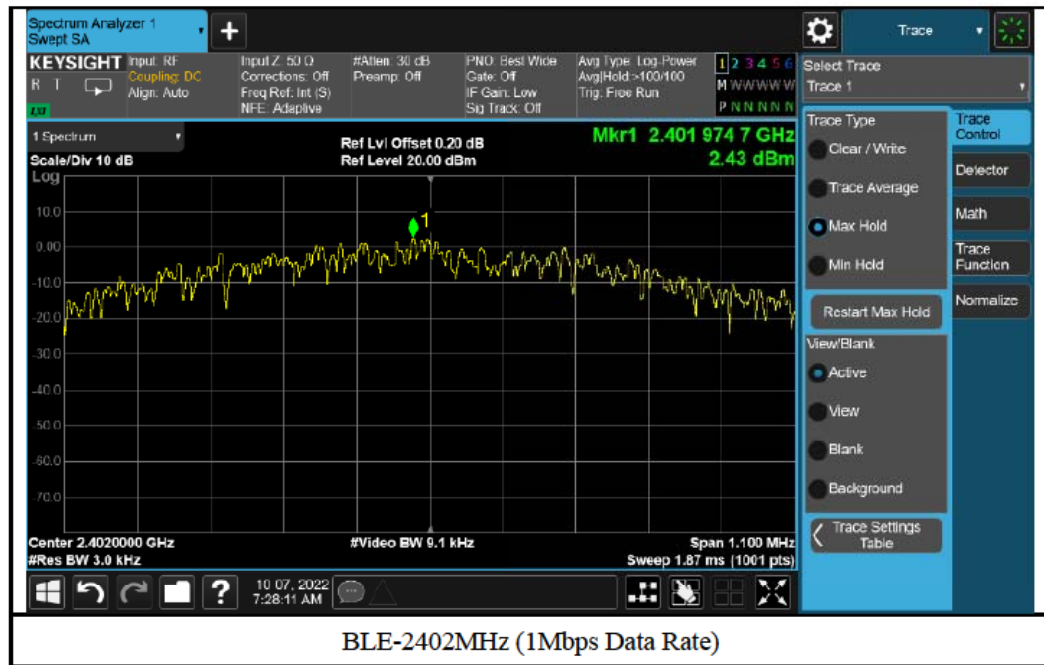
Data Rate: 1Mbps

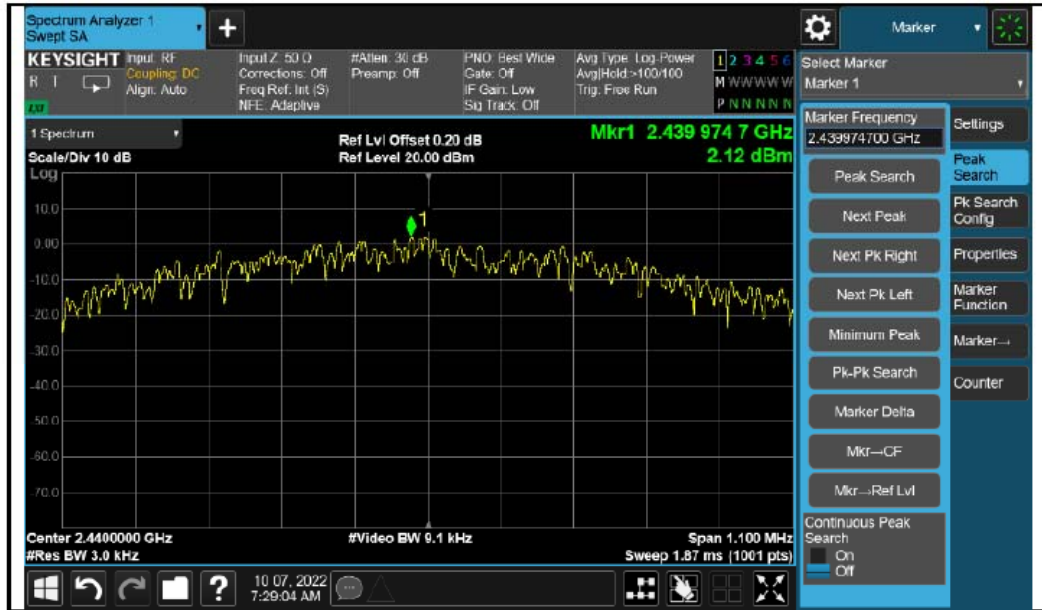
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass/Fail
0	2402	2.43	8	Pass
19	2440	2.12	8	Pass
39	2480	2.17	8	Pass

Data Rate: 2Mbps

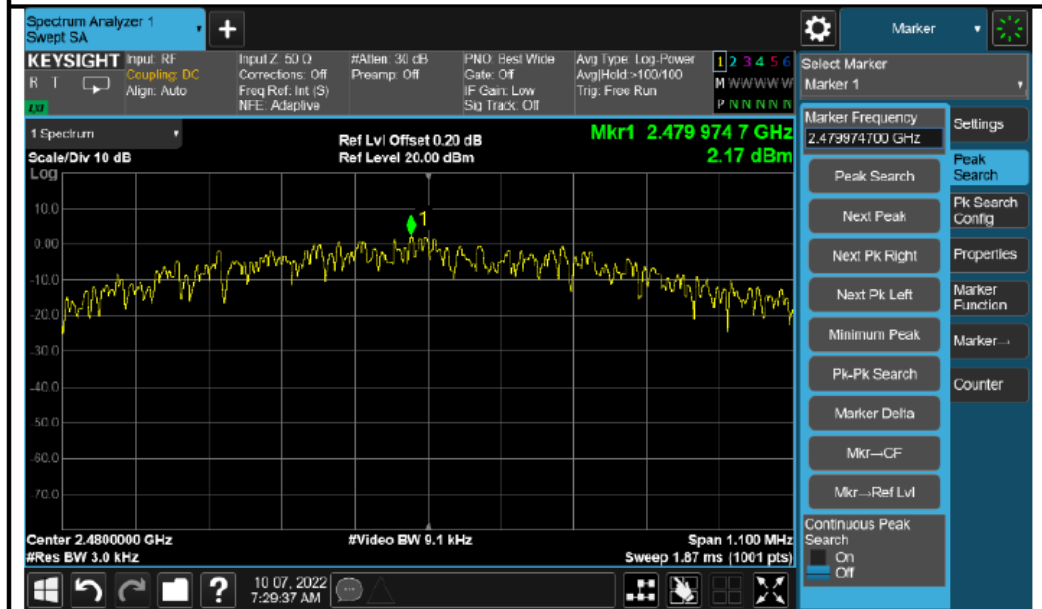
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass/Fail
0	2402	2.22	8	Pass
19	2440	1.89	8	Pass
39	2480	1.92	8	Pass

Test Plots:





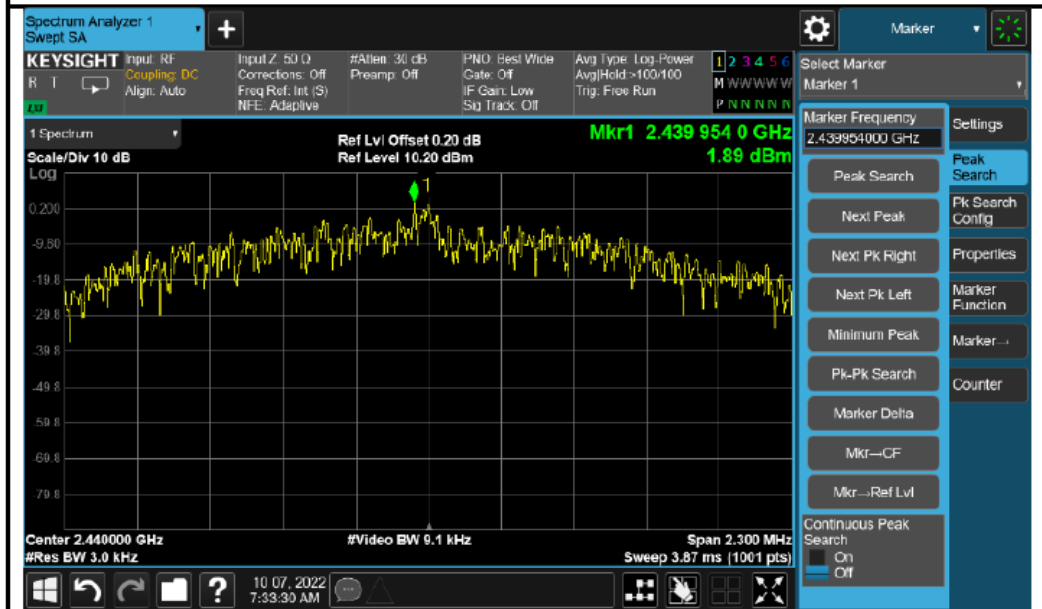
BLE-2440MHz (1Mbps Data Rate)



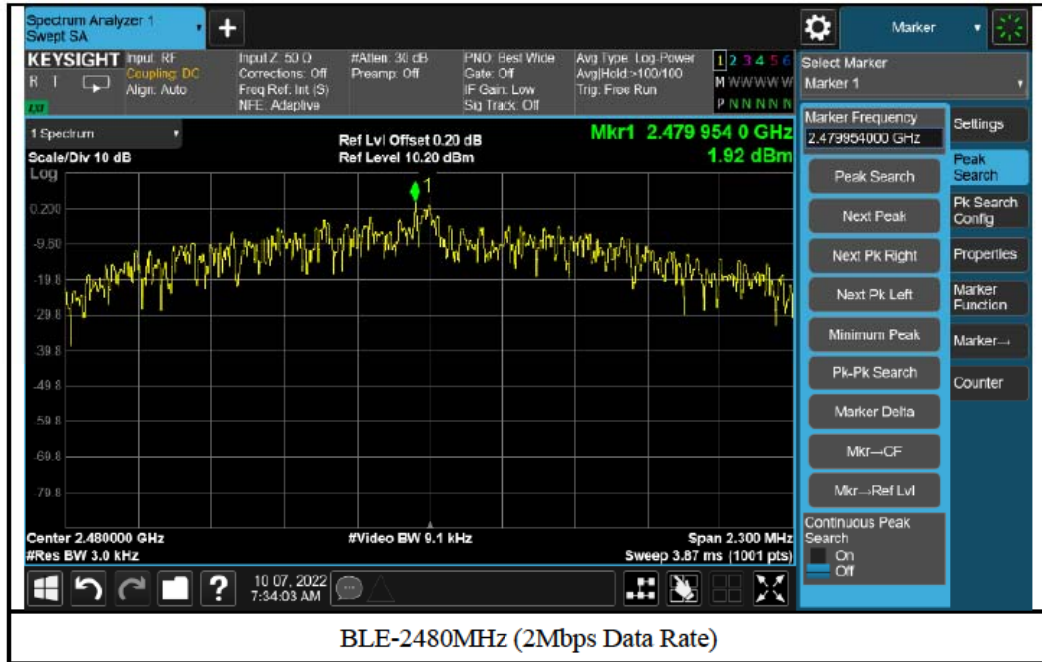
BLE-2480MHz (1Mbps Data Rate)



BLE-2402MHz (2Mbps Data Rate)



BLE-2440MHz (2Mbps Data Rate)



BLE-2480MHz (2Mbps Data Rate)

**Conducted Out of Band Emission Measurement****Limits of Conducted Out of Band Emission Measurement:**

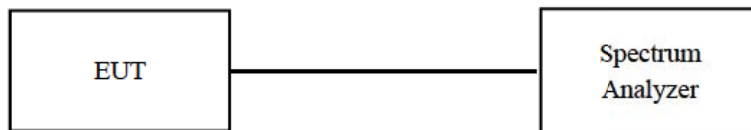
Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth)

**Test Procedure****MEASUREMENT PROCEDURE REF**

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

**MEASUREMENT PROCEDURE OOBE**

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

**Test Setup**

For the actual test configuration, please refer to the attached file (Test Setup Photo)

**Test Equipment**

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

<b>Test Name:</b> Conducted Out of Band Emission Measurement			<b>Test Date(s):</b> 10/07/2022		
<b>MET Asset #</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Last Cal Date</b>	<b>Cal Due Date</b>
1S2003	EMI Test Receiver	Keysight	N9030B	10/08/2021	10/08/2022
Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.					

Test Result:

Data Rate: 1Mbps





Data Rate: 2Mbps



#### **IV. Pictures of test Arrangements**

Please see setup photo file

**END OF REPORT**