

## FCC PART 15C TEST REPORT FOR CERTIFICATION

On Behalf of

SHARP Corporation

Electronic paper display

EP-C251

FCC ID: APYBSC0005

SHARP

Prepared for : SHARP Corporation  
1 Takumi-cho, Sakai-ku Sakai City Osaka 590-8522 Japan

Prepared By : Audix Technology (Shenzhen) Co., Ltd.  
No. 6, Kefeng Road, Science & Technology Park,  
Nanshan District , Shenzhen, Guangdong, China

Tel: (0755) 26639496



Report Number : ACS-F23208  
Date of Test : Oct.18~Nov.04, 2023  
Date of Report : Nov.28, 2023

**TABLE OF CONTENTS**

<u>Description</u>	<u>Page</u>
<b>1. SUMMARY OF STANDARDS AND RESULTS.....</b>	<b>5</b>
1.1. Description of Standards and Results .....	5
<b>2. GENERAL INFORMATION.....</b>	<b>6</b>
2.1. Description of Equipment Under Test .....	6
2.2. Feature of Equipment Under Test.....	7
2.3. Tested Supporting System Details .....	8
2.4. Block Diagram of connection between EUT and simulators.....	8
2.5. Test information.....	8
2.6. Test Facility .....	10
2.7. Measurement Uncertainty (95% confidence levels, k=2).....	10
<b>3. POWER LINE CONDUCTED EMISSION TEST .....</b>	<b>11</b>
3.1. Test Equipments.....	11
3.2. Block Diagram of Test Setup.....	11
3.3. Power Line Conducted Emission Test Limits.....	11
3.4. Configuration of EUT on Test .....	11
3.5. Operating Condition of EUT.....	12
3.6. Test Procedure .....	12
3.7. Power Line Conducted Emission Test Results .....	12
<b>4. RADIATED EMISSION TEST .....</b>	<b>15</b>
4.1. Test Equipments.....	15
4.2. Block Diagram of Test Setup.....	16
4.3. Radiated Emission Limits Standard:.....	17
4.4. EUT Configuration on Test .....	17
4.5. Operating Condition of EUT.....	17
4.6. Test Procedure .....	18
4.7. Radiated Emission Test Results.....	18
<b>5. CONDUCTED SPURIOUS EMISSIONS.....</b>	<b>46</b>
5.1. Test Equipments.....	46
5.2. Block Diagram of Test Setup.....	46
5.3. Limit.....	46
5.4. Test Procedure .....	46
5.5. Test result.....	46
<b>6. 20 DB &amp; 99% BANDWIDTH TEST .....</b>	<b>53</b>
6.1. Test Equipments.....	53
6.2. Limit.....	53
6.3. Test Procedure .....	53
6.4. Test Results.....	54
<b>7. CARRIER FREQUENCY SEPARATION TEST.....</b>	<b>56</b>
7.1. Test Equipments.....	56
7.2. Limit.....	56
7.3. Test Procedure .....	56
7.4. Test Results.....	56
<b>8. NUMBER OF HOPPING FREQUENCY TEST.....</b>	<b>57</b>
8.1. Test Equipments.....	57
8.2. Limit.....	57

8.3.	Test Procedure .....	57
8.4.	Test Results .....	57
<b>9.</b>	<b>DWELL TIME .....</b>	<b>58</b>
9.1.	Test Equipments.....	58
9.2.	Limit.....	58
9.3.	Test Procedure .....	58
9.4.	Test Results .....	58
<b>10.</b>	<b>MAXIMUM PEAK OUTPUT POWER TEST.....</b>	<b>61</b>
10.1.	Test Equipments.....	61
10.2.	Limit.....	61
10.3.	Test Procedure .....	61
10.4.	Test Results .....	61
<b>11.</b>	<b>BAND EDGE COMPLIANCE TEST .....</b>	<b>63</b>
11.1.	Test Equipments.....	63
11.2.	Limit.....	63
11.3.	Test Produce.....	63
11.4.	Test Results .....	64
<b>12.</b>	<b>ANTENNA REQUIREMENT .....</b>	<b>73</b>
12.1.	Standard Applicable.....	73
12.2.	Antenna Connected Construction .....	73
<b>13.</b>	<b>DEVIATION TO TEST SPECIFICATIONS.....</b>	<b>74</b>

- Appendix A. Setup Photographs
- Appendix B. General Appearance of the EUT
- Appendix C. Inside Configuration of the EUT

### TEST REPORT

Applicant : SHARP Corporation  
 Manufacturer : SHARP Corporation  
 Product : Electronic paper display  
 FCC ID : APYBSC0005  
 (A) Model No. : EP-C251  
 (B) Brand : SHARP  
 (C) Test Voltage : AC 120V/60Hz

Tested for comply with:  
FCC CFR47 Part 15 Subpart C

Test procedure used:  
ANSI C63.10: 2020

The device described above is tested by Audix Technology (Shenzhen) Co., Ltd. to confirm comply with all the FCC Part 15 Subpart C requirements. The test results are contained in this test report and Audix Technology (Shenzhen) Co., Ltd. is assumed full responsibility for the accuracy and completeness of these tests. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements. This report contains data that are not covered by the NVLAP accreditation.

This Report is made under FCC Part 2.1074. No modifications were required during testing to bring this product into compliance.

This report applies to single evaluation of one sample of above mentioned product and shall not be reproduced in part without written approval of Audix Technology (Shenzhen) Co., Ltd..

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Date of Test : Oct.18~Nov.04, 2023 Report of date: Nov.28, 2023

Prepared by : Mia Zhao Reviewed by : Thomas Chen  
 Mia Zhao / Assistant Thomas Chen / Assistant Manager



Approved & Authorized Signer : Sunny Lu  
Sunny Lu / Manager

# 1. SUMMARY OF STANDARDS AND RESULTS

## 1.1. Description of Standards and Results

The EUT has been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	Standard	Results
Power Line Conducted Emission Test	FCC Part 15: 15.207 ANSI C63.10: 2020	PASS
Radiated Emission Test	FCC Part 15 15.209 FCC Part 15 15.205 FCC Part 15 15.247(d) ANSI C63.10: 2020	PASS
Conducted Spurious Emissions	FCC Part 15: 15.247(d) ANSI C63.10 2020	PASS
Carrier Frequency Separation Test	FCC Part 15: 15.247(a)(1) ANSI C63.10: 2020	PASS
20dB & 99% Bandwidth Test	FCC Part 15: 15.215(c) ANSI C63.10: 2020	PASS
Number Of Hopping Frequency Test	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10: 2020	PASS
Dwell Time Test	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10: 2020	PASS
Maximum Peak Output Power Test	FCC Part 15 15.247(b)(1) ANSI C63.10: 2020	PASS
Band Edge Compliance Test	FCC Part 15 15.247(d) ANSI C63.10: 2020	PASS
Antenna requirement	FCC Part 15: 15.203	PASS

Note: Measurement uncertainty affection to the result is not considered, the EUT is technically compliant with standard requirements.

## 2. GENERAL INFORMATION

### 2.1. Description of Equipment Under Test

Applicant	SHARP Corporation
Applicant Address	1 Takumi-cho, Sakai-ku Sakai City Osaka 590-8522 Japan
Manufacturer	SHARP Corporation
Manufacturer Address	1 Takumi-cho, Sakai-ku Sakai City Osaka 590-8522 Japan
Factory	TPV Electronics (Fujian)Co.,Ltd.
Factory Address	Rongqiao Economic and Technological Development Zone, Fuqing City, Fujian Province
Product	Electronic paper display
Model No.	EP-C251
FCC ID	APYBSC0005
Brand	SHARP
Power Adapter	Manufacturer: DELTA ELECTRONICS, INC. M/N:ADP-100XB B Input: AC 100-240V 2.0A 50-60Hz Output: 5.0V $\overline{\text{---}}$ 3A, 15.0W / 9.0V $\overline{\text{---}}$ 3A 12.0V $\overline{\text{---}}$ 3A / 15.0V $\overline{\text{---}}$ 3A 20.0V $\overline{\text{---}}$ 5.0A, 100.0W DC Cable: Unshielded, Undetachable, 1.5m
Sample Type	Prototype production
Date of Receipt	Jun.21, 2023
Date of Test	Oct.18~Nov.04, 2023
Remark: This report only for BDR+EDR.	

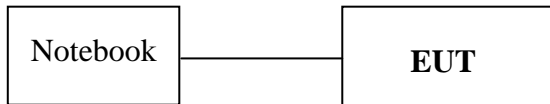
2.2. Feature of Equipment Under Test

<b>Product Feature &amp; Specification</b>	
Product	Electronic paper display
Model No.	EP-C251
Radio	IEEE802.11 a/b/g/n/ac
Power Source	DC 15/20V
<b>Bluetooth</b>	
Radio	BDR +EDR; BLE
Frequency Range	2402-2480MHz
Type of Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Data Rate	1Mbps, 2Mbps, 3Mbps
Quantity of Channels	79/40
Channel Separation	1MHz/2MHz
<b>2.4GHz Wi-Fi</b>	
Support Modes	802.11b/g/n20
Frequency Range	2412-2462MHz
Type of Modulation	802.11b(DSSS): CCK, QPSK, BPSK; 802.11g/n(OFDM): 64QAM,16QAM, QPSK, BPSK
Data Rate	802.11b: 1/2/5.5/11 Mbps; 802.11g: 6/9/12/18/24/36/48/54 Mbps; 802.11n: up to 75Mbps
Channel Separation	5MHz
<b>5GHz Wi-Fi</b>	
Support Modes	802.11a/n20/n40/ac20/ac40/ac80
Frequency Range	5180-5240MHz, 5260-5320MHz, 5500-5700MHz, 5745-5825MHz
Type of Modulation	802.11a/n (OFDM): QPSK, BPSK, 16QAM, 64QAM 802.11ac (OFDM): QPSK, BPSK, 16QAM, 64QAM,256QAM
Data Rate	802.11a: 6/9/12/18/24/36/48/54 Mbps; 802.11n: up to 150Mbps; 802.11ac: up to 433Mbps
Channel Separation	5MHz
<b>Antenna System</b>	
Type of Antenna	shrapnel Antenna
Antenna Number	1
Antenna Peak Gain	Bluetooth Peak Gain: 2.69dBi. DTS/DSS Band Peak Gain: 2.69dBi. U-NII-1 Band Peak Gain: 1.87dBi. U-NII-2A Band Peak Gain: 2.28dBi. U-NII-2C Band Peak Gain: 2.28dBi. U-NII-3 Band Peak Gain: 2.22dBi.

### 2.3. Tested Supporting System Details

No.	Description	ACS No.	Manufacturer	Model	Serial Number
1.	Notebook	N/A	ACER	ZOW	N/A
Power Cord(3C): Unshielded, Detachable, 1.8m Power Adapter: Manufacturer: Lite-On, M/N: PA-1900-32 Data Cable: Unshielded, Undetectable, 4.0m(Bond one ferrite core)					

### 2.4. Block Diagram of connection between EUT and simulators



**(EUT: Electronic paper display)**

### 2.5. Test information

A special software (Ampak RFTestTool, VER:7.0) was used to control EUT work in TX mode

Tested mode, Packet Type, peak output power information			
Mode	Packet Type	Output power(dBm) P max	Output Power(dBm) P low
GFSK	DH1	7.447	4.429
	DH3		
	DH5		
8DPSK	3-DH1	7.046	4.303
	3-DH3		
	3-DH5		

Note:  $\pi/4$ DQPSK mode has been verified to have the lowest power, so the final test were performed with GFSK and 8DPSK mode, the worse-case packet type were:

GFSK Mode: DH5

8DPSK Mode: 3DH5



Item		Modulation	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge	GFSK	1Mbps	00/78
		8-DPSK	3Mbps	00/78
	Radiated Spurious Emission	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
Conducted Test Case	20dB Bandwidth	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
	Carrier Frequency Separation	GFSK	1Mbps	39
		8-DPSK	3Mbps	39
	Time of Occupancy	GFSK	1Mbps	39
		8-DPSK	3Mbps	39
	Number of Hopping Channels	GFSK	1Mbps	39
		8-DPSK	3Mbps	39
	Maximum Peak Output Power	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78
	Band Edges	GFSK	1Mbps	00/78
		8-DPSK	3Mbps	00/78
	Spurious Emission	GFSK	1Mbps	00/39/78
		8-DPSK	3Mbps	00/39/78

2.6. Test Facility

Site Description

Name of Firm

: Audix Technology (Shenzhen) Co., Ltd.  
 No. 6, Kefeng Road, Science & Technology Park,  
 Nanshan District , Shenzhen, Guangdong, China

EMC Lab.

: Certificated by ISED, Canada  
 Company Number: 5183A  
 CAB identifier: CN0034  
 Valid Date: Mar.31, 2024

Certificated by FCC, USA  
 Designation No.: CN5022  
 Valid Date: Mar.31, 2024

Accredited by NVLAP, USA  
 NVLAP Code: 200372-0  
 Valid Date: Mar.31, 2024

2.7. Measurement Uncertainty (95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Conduction emission test in No. 1 Conduction	$\pm 2.6\text{dB}(150\text{KHz to } 30\text{MHz})$
Uncertainty for Radiation Emission test in 3m chamber	$\pm 3.8\text{dB}(30\sim 200\text{MHz, Polarization: H})$
	$\pm 3.8\text{dB}(30\sim 200\text{MHz, Polarization: V})$
	$\pm 4.0\text{dB}(200\text{M}\sim 1\text{GHz, Polarization: H})$
	$\pm 4.0\text{dB}(200\text{M}\sim 1\text{GHz, Polarization: V})$
Uncertainty for Radiation Emission test in 3m chamber(1GHz-18GHz)	$\pm 4.0\text{dB}(1\sim 6\text{GHz, Distance: } 3\text{m})$
	$\pm 4.0\text{dB}(6\sim 18\text{GHz, Distance: } 3\text{m})$
Uncertainty for Radiated Spurious Emission test in RF chamber	$\pm 3.7\text{dB}(30\text{MHz}\sim 1000\text{MHz})$
	$\pm 3.3\text{dB}(1\sim 26.5\text{GHz})$
Uncertainty for Conduction Spurious emission test	$\pm 2.0\text{dB}$
Uncertainty for Output power test	$\pm 0.8\text{dB}$
Uncertainty for Bandwidth test	$\pm 4.6\%$
Uncertainty for DC power test	$\pm 0.1\%$
Uncertainty for test site temperature and humidity	$\pm 0.6^\circ\text{C}$
	$\pm 3\%$

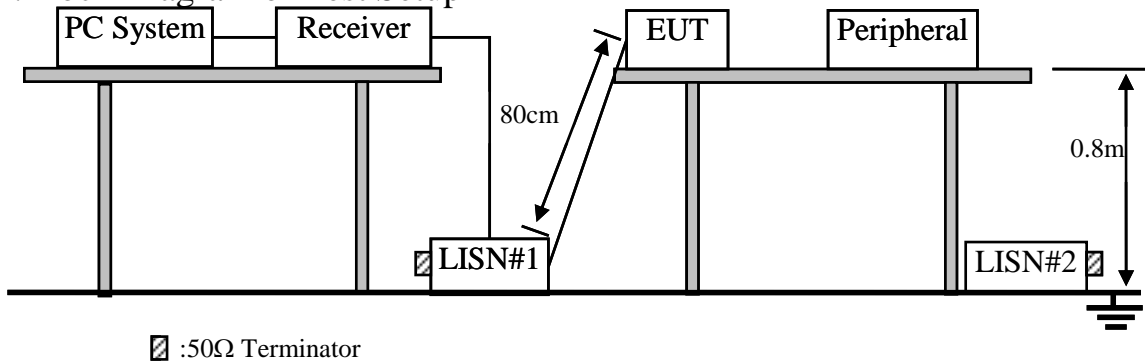
### 3. POWER LINE CONDUCTED EMISSION TEST

#### 3.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	1# Shielding Room	AUDIX	N/A	N/A	Nov.09,22	3 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100842	Apr.01,23	1 Year
3.	L.I.S.N.#1	Rohde & Schwarz	ENV216	102160	Jun.25,23	1 Year
4.	RF Cable	Eastsheep	RG223	190424	Sep.15,23	1Year
5.	Test Software	AUDIX	e3	6.100913a	N/A	N/A

Note: N/A means Not applicable.

#### 3.2. Block Diagram of Test Setup



#### 3.3. Power Line Conducted Emission Test Limits

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. \* Decreasing linearly with logarithm of frequency.

2. The lower limits shall apply at the transition frequencies.

3. Emission Level (dBμV) = Factor (L.I.S.N.) (dB) + Cable Loss (dB)+Reading (Receiver) (dBμV)

#### 3.4. Configuration of EUT on Test

The following equipment are installed on Power Line Conducted Emission Test to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

##### 3.4.1. Electronic paper display (EUT)

Model No. : EP-C251

##### 3.4.2. Support Equipment: As Tested Supporting System Details, in Section 2.3.

### 3.5. Operating Condition of EUT

- 3.5.1. Setup the EUT as shown as Section 3.2.
- 3.5.2. Turn on the power of EUT.
- 3.5.3. PC run test software to control EUT work in Tx mode.

### 3.6. Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power Via Adapter connected to the power mains through a line impedance stabilization network (L.I.S.N. #1). This provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs). The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10 on Conducted Emission Test.

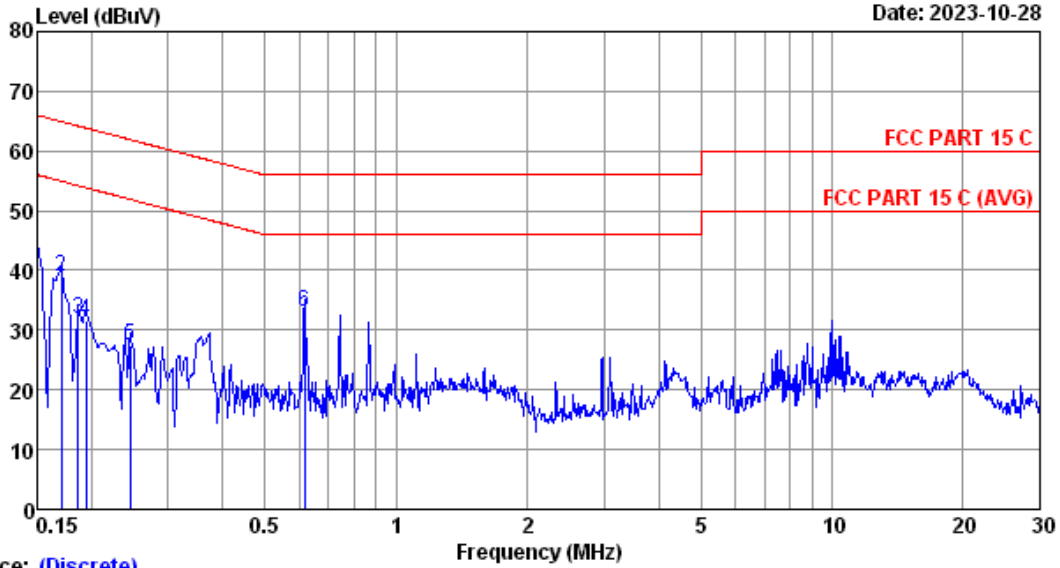
The bandwidth of test receiver (R & S ESCI) is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

### 3.7. Power Line Conducted Emission Test Results

**PASS.** (All emissions not reported below are too low against the prescribed limits.)

Data: 1 File: E:\1#CE\2023 Report Data\T\TPVA\1Z2310044-RF\C251-FCC.EM6 (8) Date: 2023-10-28

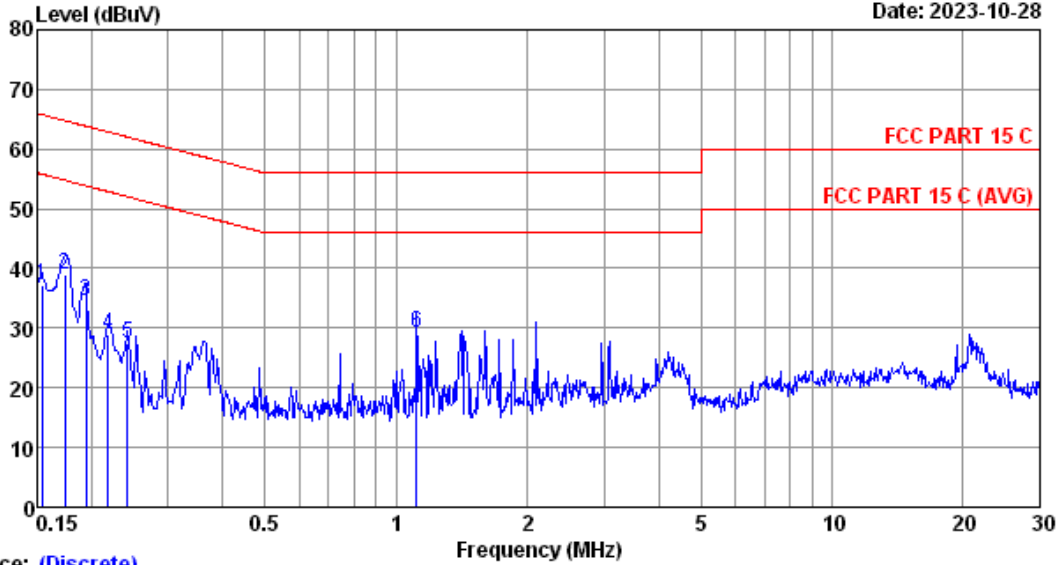


Trace: (Discrete)  
 Site no :1# CE Data No :1  
 Dis./Lisn :2023 ENV216-N  
 Limit :FCC PART 15 C  
 Env./Ins. :21.6°C/52% Engineer :Sucy  
 Power Rating :AC 120V/60Hz  
 Test Mode :BT3.0 TX Mode

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.150	9.69	0.01	32.47	42.17	66.00	23.83	QP
2	0.170	9.69	0.01	29.41	39.11	64.94	25.83	QP
3	0.186	9.70	0.01	22.19	31.90	64.20	32.30	QP
4	0.194	9.70	0.01	21.98	31.69	63.84	32.15	QP
5	0.246	9.70	0.01	17.84	27.55	61.91	34.36	QP
6	0.617	9.74	0.01	23.39	33.14	56.00	22.86	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.  
 2.If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

Data: 2 File: E:\1#CE\2023 Report Data\TPVA1Z2310044-RF\C251-FCC.EM6 (8) Date: 2023-10-28



Trace: (Discrete)

Site no :1# CE Data No :2  
 Dis./Lisn :2023 ENV216-L  
 Limit :FCC PART 15 C  
 Env./Ins. :21.6°C/52% Engineer :Sucy  
 Power Rating :AC 120V/60Hz  
 Test Mode :BT3.0 TX Mode

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.154	9.62	0.01	27.67	37.30	65.78	28.48	QP
2	0.174	9.62	0.01	29.45	39.08	64.77	25.69	QP
3	0.194	9.62	0.01	24.95	34.58	63.84	29.26	QP
4	0.219	9.62	0.01	19.21	28.84	62.88	34.04	QP
5	0.242	9.61	0.01	17.81	27.43	62.04	34.61	QP
6	1.111	9.57	0.01	19.77	29.35	56.00	26.65	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.  
 2.If the average limit is met when using a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

## 4. RADIATED EMISSION TEST

### 4.1. Test Equipments

Frequency range: 30~1000MHz

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3m Chamber(NSA)	AUDIX	N/A	N/A	Aug.11,22	3Year
2.	3m Chamber(SE)	AUDIX	N/A	N/A	Sep.16,22	3 Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	103670	Jun.25,23	1 Year
4.	Tri-log-Broadband Antenna	SCHWARZBECK	VULB 9168	429	Oct.10,23	1 Year
5.	NSA Cable	HUBER+SUHNER	CFD400NL-LW	No.3+190411	Sep.20,23	1 Year
6.	Coaxial Switch	Anritsu	MP59B	6201397223	Apr.02,23	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESR3	101931	Apr.01,23	1 Year
8.	Broadband Amplifier	SCHWARZBECK	BBV9744	00259	Jun.25,23	1 Year
9.	Test Software	AUDIX	e3	6.100913a	N/A	N/A

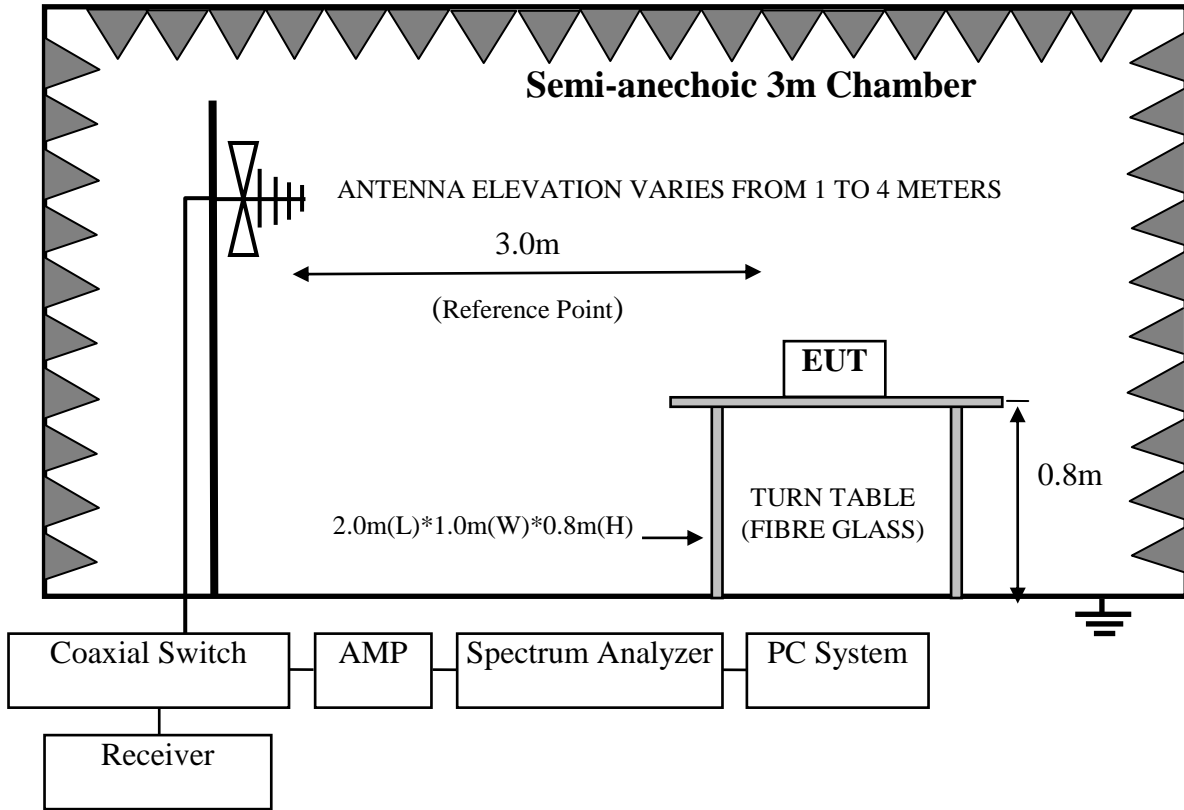
Note: N/A means Not applicable.

Frequency range: above 1000MHz

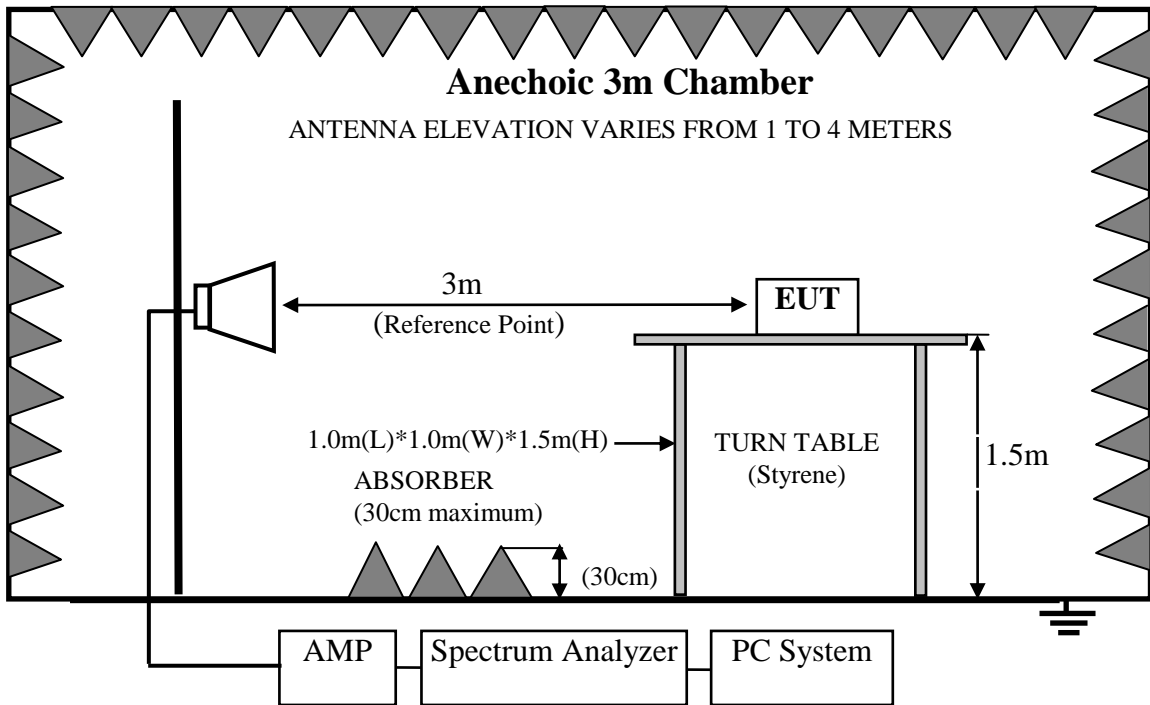
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3mChamber(Svswr)	AUDIX	N/A	N/A	Aug.09,22	3Year
2.	3mChamber(SE)	AUDIX	N/A	N/A	Sep.16,22	3Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.01,23	1 Year
4.	Amplifier	Agilent	83017A	MY53270084	Sep.20,23	1 Year
5.	RF Cable	EMCI	EMC104-SM-S M-15000	190407	Jun.25,23	1 Year
6.	Test Software	AUDIX	e3	6.100913a	N/A	N/A
7.	Horn Antenna	ETC	MCTD 1209	DRH15F03006	Aug.23,23	1 Year

Note: N/A means Not applicable.

4.2. Block Diagram of Test Setup  
For frequency range 30MHz-1000MHz



For frequency range above 1GHz





4.3.Radiated Emission Limits Standard:

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000MHz	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

- Remark :
- (1) Emission Level (dBμV/m) = Reading (Receiver) (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB)  
Emission Level (dBμV/m) = Reading (Spectrum) (dBμV) + Antenna Factor (dB/m) – Amp Factor (dB) + Cable Loss (dB)(above 1000MHz)
  - (2) The smaller limits shall apply at the cross point between two frequency bands.
  - (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.
  - (4) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

4.4.EUT Configuration on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

4.4.1. Electronic paper display (EUT)

Model Number : EP-C251

4.5.Operating Condition of EUT

- 4.5.1. Setup the EUT and simulator as shown as Section 4.2.
- 4.5.2. Turn on the power of all equipments.
- 4.5.3. Let EUT work in Tx mode.

#### 4.6. Test Procedure

##### **Frequency below 30MHz:**

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2020 regulation.

##### **Frequency Above 30MHz:**

EUT and its simulators are placed on a turn table, which is 0.8 meter high above ground for frequency 30MHz~1000MHz, 1.5 meter high above ground for frequency above 1GHz and put the absorbing with 2.4m(L)\*2.4m(W)\*0.3m(H) on the ground . The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna for frequency 30MHz~1000MHz, and the Horn antenna is used as receiving antenna for frequency above 1GHz. Both horizontal and vertical polarization of the antenna is set on Test. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.10 on radiated emission Test

The bandwidth of the EMI test receiver (R&S ESR3) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's RBW is set at 1MHz and VBW is set at 3MHz for peak emissions measurement above 1GHz

This device is pulse Modulated, a duty cycle factor was used to calculated average level based measured peak level.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

#### 4.7. Radiated Emission Test Results

##### **PASS.**

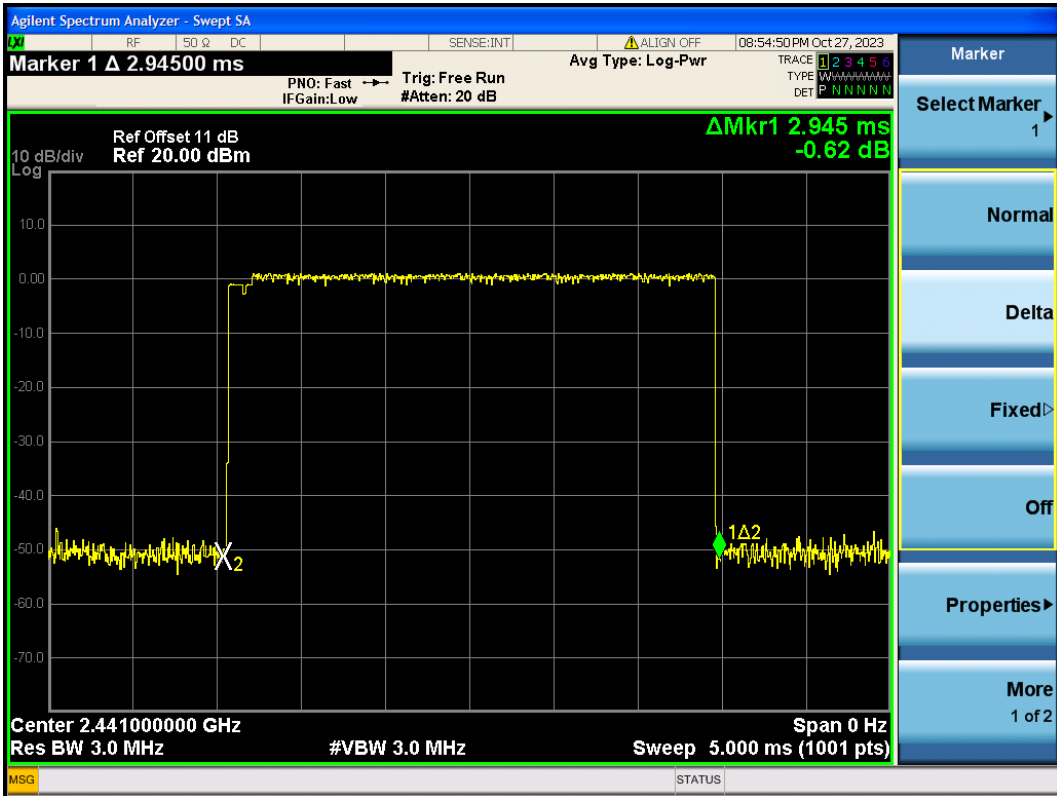
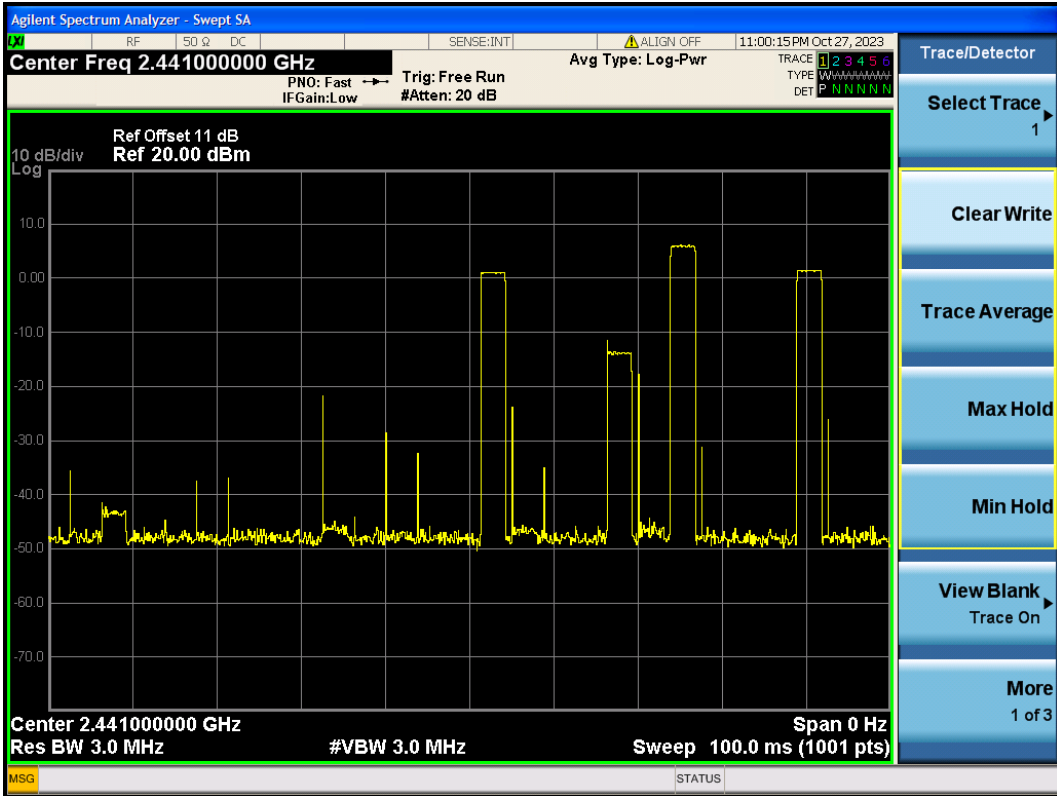
All the emissions from 30MHz to 25GHz were comply with the 15.209 Limit.

Note 1: The duty cycle factor for calculate average level is -30.618dB, and average limit is 20dB below peak limit, so if peak measured level comply with average limit, the average level was deemed to comply with average limit.

Note 2: The emissions (9kHz~30MHz) not reported for there is no emission be found.

Duty cycle factor =  $20\log(\text{Dwell time}/100\text{ms}) = -30.618\text{dB}$

Dwell Time =  $2.945 * 1\text{ms}$

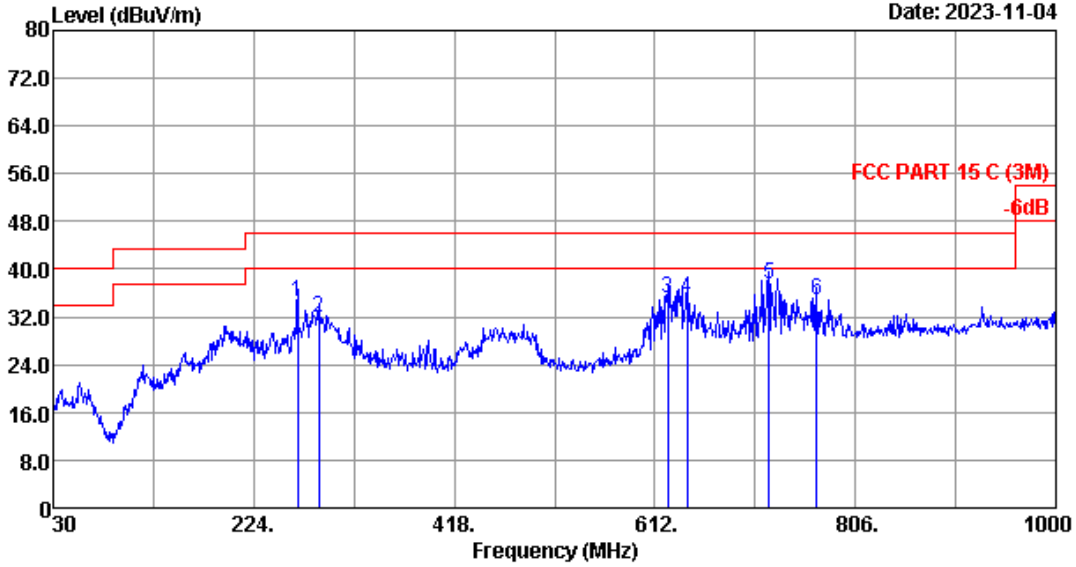


Frequency: 30MHz~1GHz

Data: 1

File: E:\2023 Report Data\T\TPVA122310044-FCC-RF.EM6 (8)

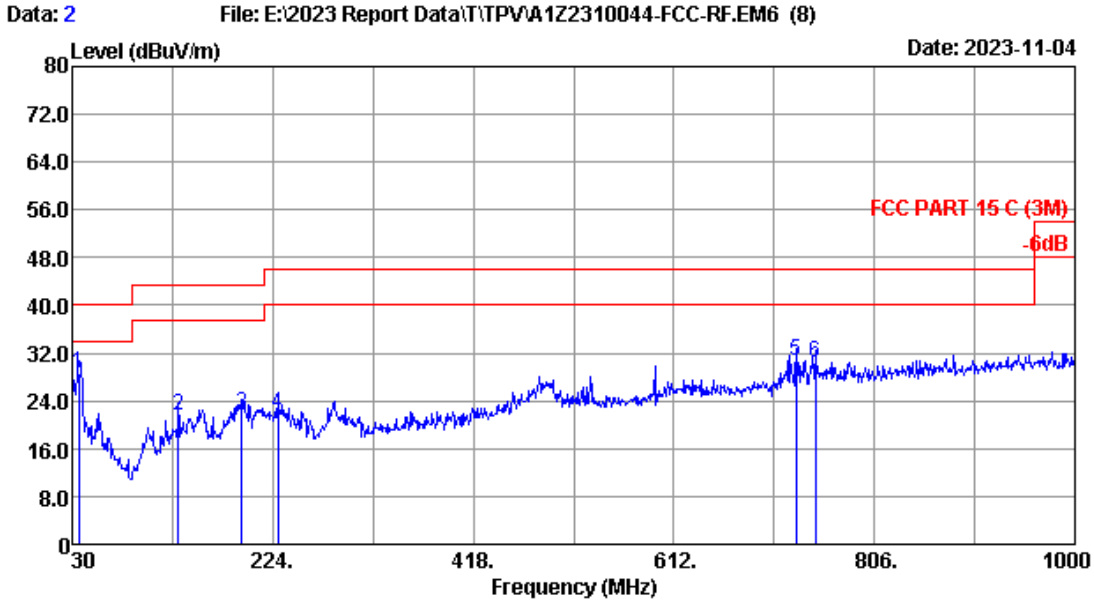
Date: 2023-11-04



Site no. : 3m Chamber Data no. : 1  
 Dis. / Ant. : 3m 2023 VULB 9168-429 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15 C (3M)  
 Env. / Ins. : 23.6\*C55% Engineer : Abel  
 Test Mode : BT3.0 TX Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Emission				Remark
				Reading (dBuV)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	
1	266.680	18.40	1.36	43.87	34.53	46.00	11.47	QP
2	287.050	19.14	1.40	40.41	31.91	46.00	14.09	QP
3	624.610	26.21	2.10	36.48	35.14	46.00	10.86	QP
4	643.040	26.34	2.14	36.25	35.12	46.00	10.88	QP
5	722.580	27.05	2.25	37.75	37.64	46.00	8.36	QP
6	768.170	28.10	2.33	33.60	34.80	46.00	11.20	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 2  
 Dis. / Ant. : 3m 2023 VULB 9168-429 Ant. pol. : VERTICAL  
 Limit : FCC PART 15 C (3M)  
 Env. / Ins. : 23.6°C55% Engineer : Abel  
 Test Mode : BT3.0 TX Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	36.790	19.06	0.54	39.38	28.69	40.00	11.31	QP
2	132.820	18.40	0.97	32.11	21.64	43.50	21.86	QP
3	193.930	16.61	1.14	33.53	21.84	43.50	21.66	QP
4	228.850	16.26	1.29	33.59	21.93	46.00	24.07	QP
5	730.340	27.41	2.26	30.33	30.62	46.00	15.38	QP
6	748.770	28.40	2.30	28.98	30.38	46.00	15.62	QP

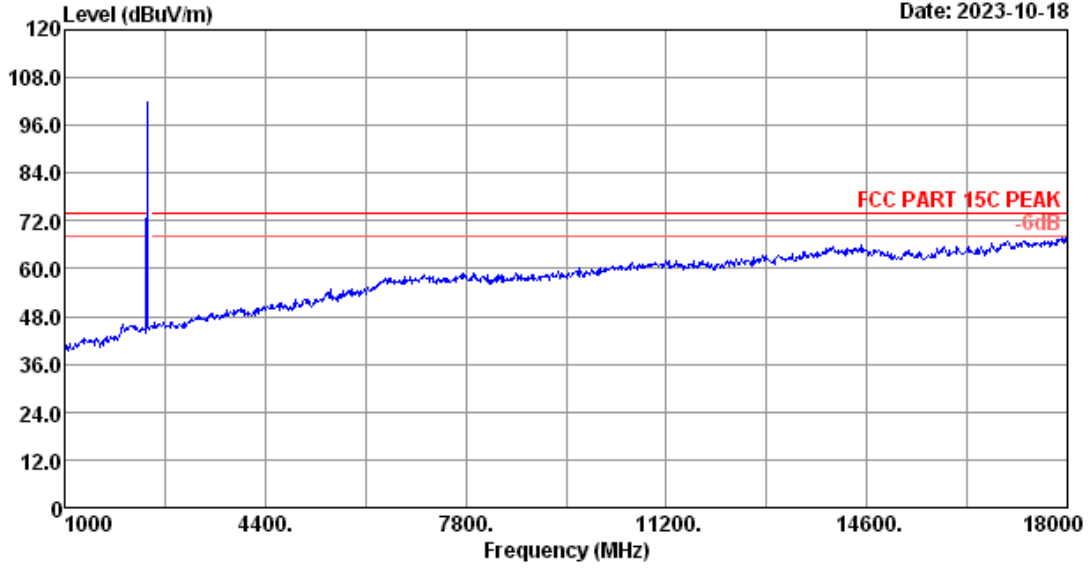
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Frequency: 1GHz~18GHz

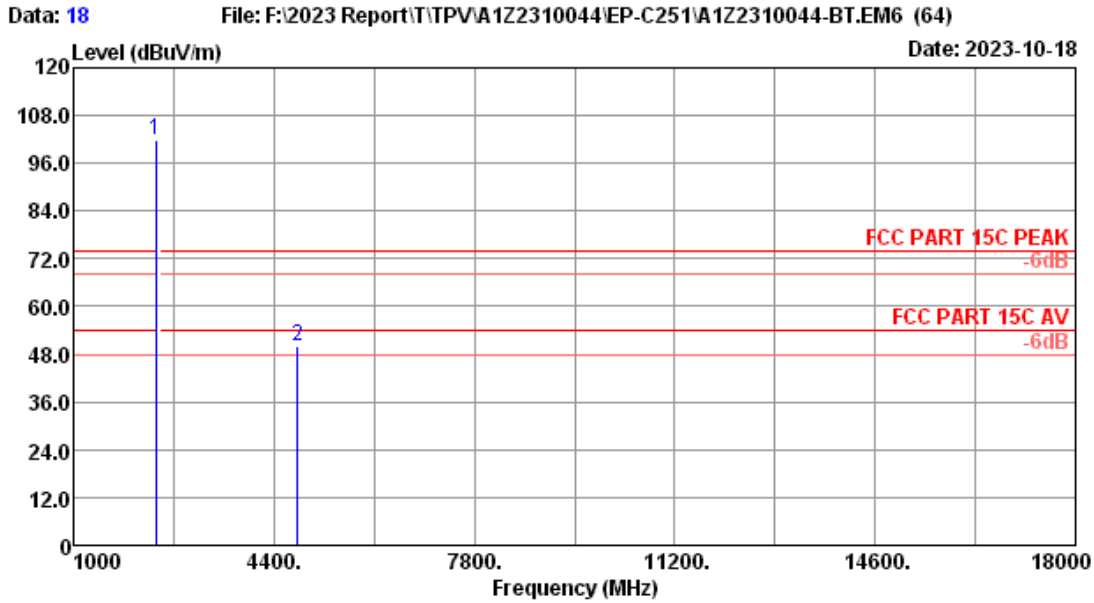
Data: 17

File: F:\2023 Report\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64)

Date: 2023-10-18



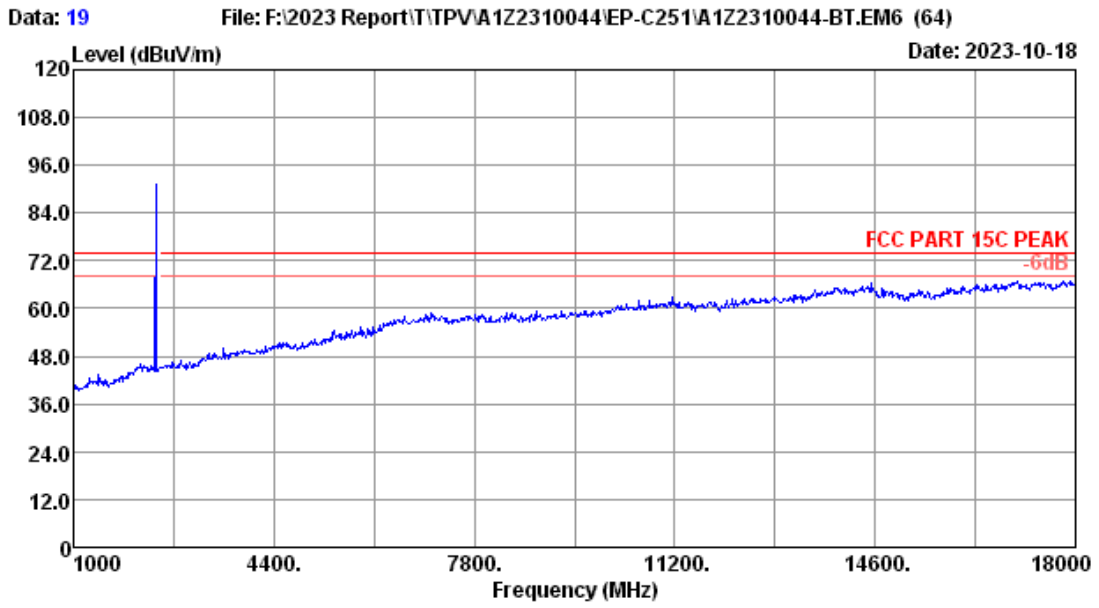
Site no.	: 3m Chamber	Data no.	: 17
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT GFSK 2402 MHz TX		



Site no. : 3m Chamber Data no. : 18  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT GFSK 2402 MHz TX

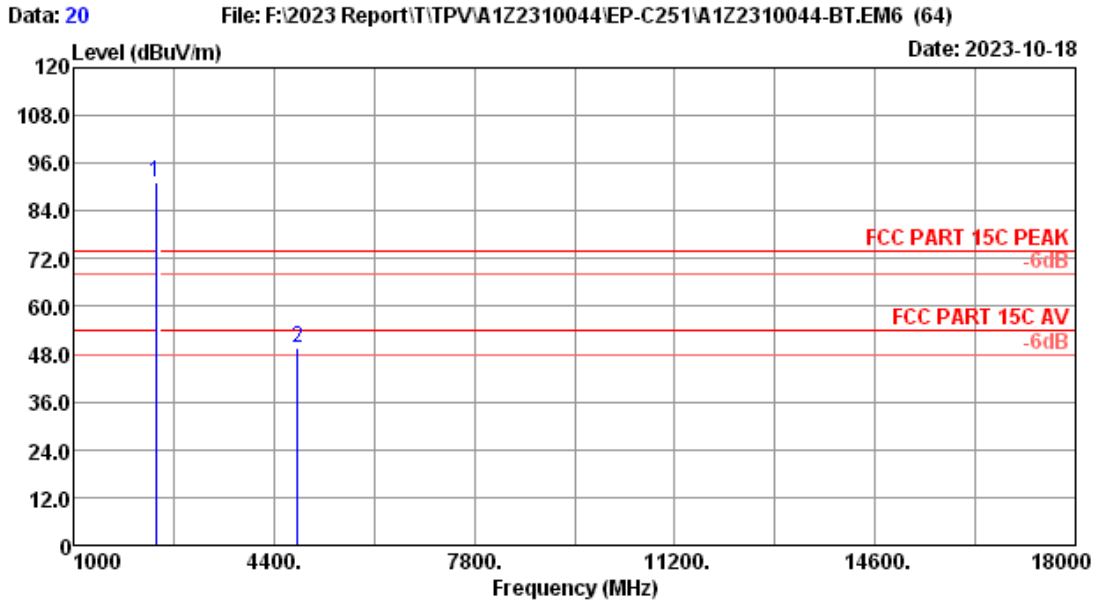
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	103.58	34.36	101.69	-----	-----	Peak
2	4804.00	31.20	6.50	45.99	33.68	50.01	74.00	23.99	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



Site no.	: 3m Chamber	Data no.	: 19
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT GFSK 2402 MHz TX		

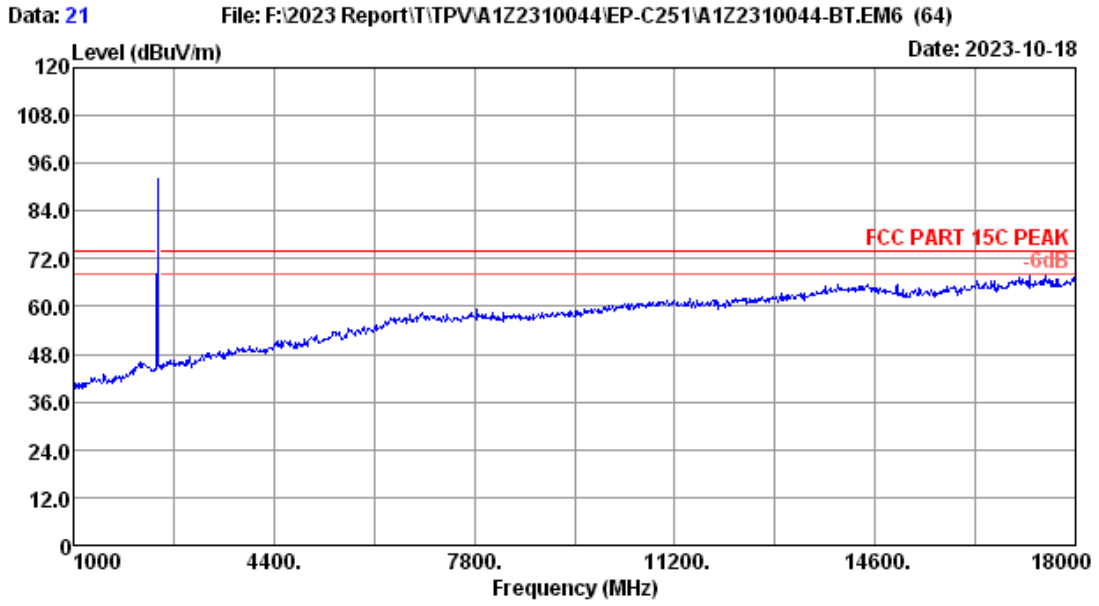




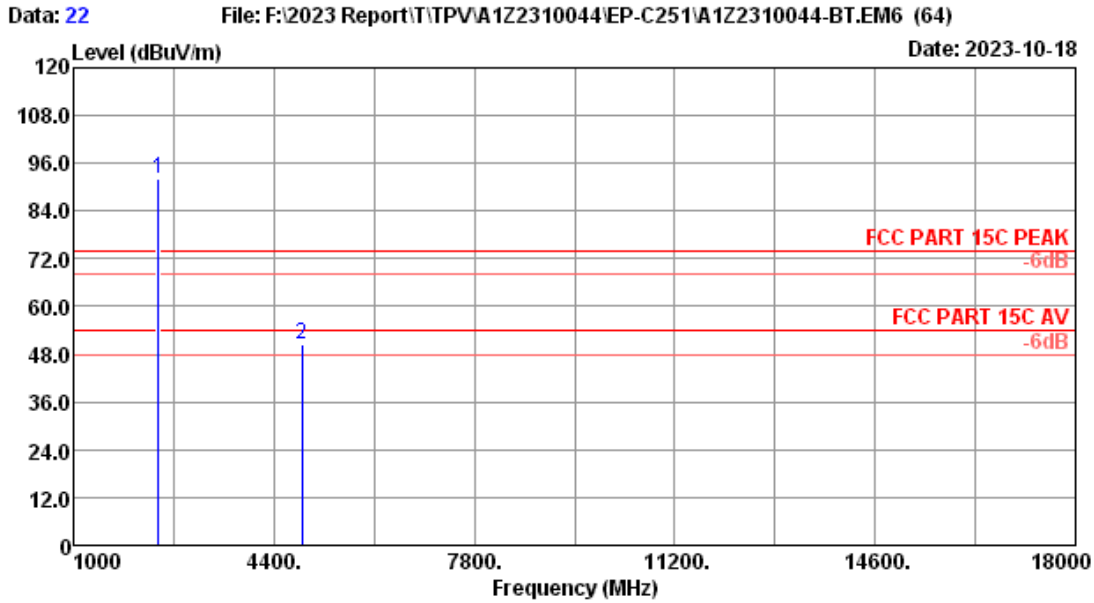
Site no. : 3m Chamber Data no. : 20  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT GFSK 2402 MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	93.07	34.36	91.18	-----	-----	Peak
2	4804.00	31.20	6.50	45.62	33.68	49.64	74.00	24.36	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



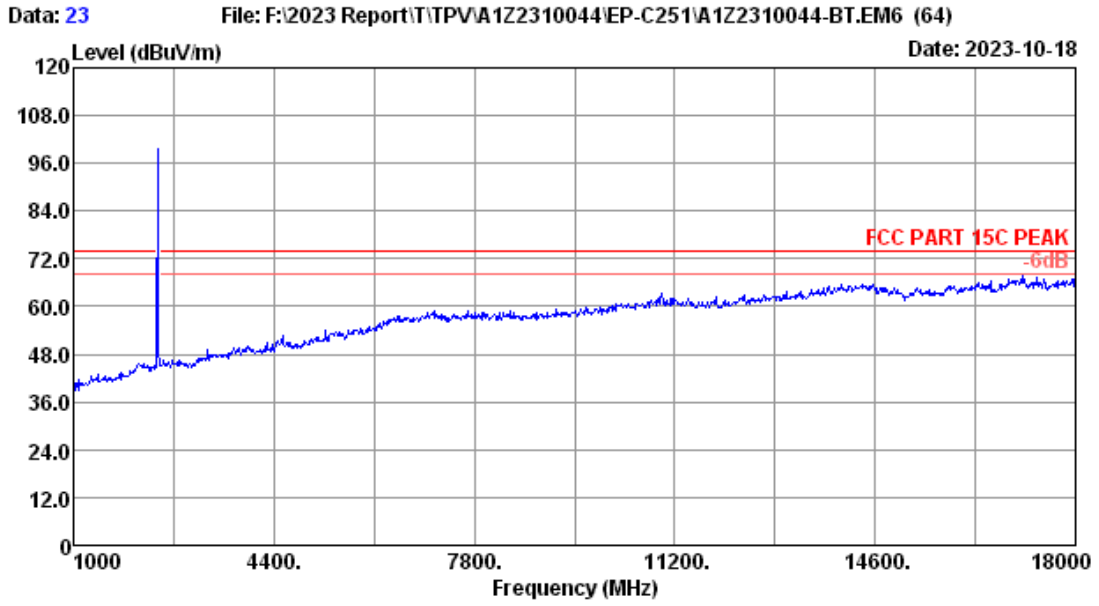
Site no.	: 3m Chamber	Data no.	: 21
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT GFSK 2441 MHz TX		



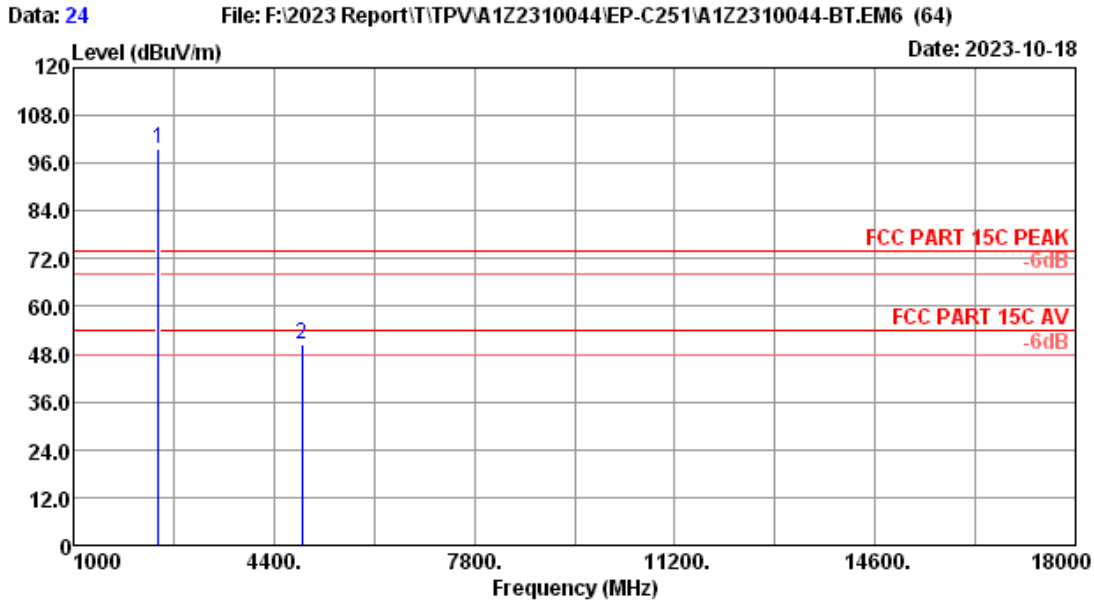
Site no. : 3m Chamber Data no. : 22  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT GFSK 2441 MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2441.00	27.76	4.90	93.96	34.35	92.27	-----	-----	Peak
2	4882.00	31.46	6.54	46.03	33.69	50.34	74.00	23.66	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



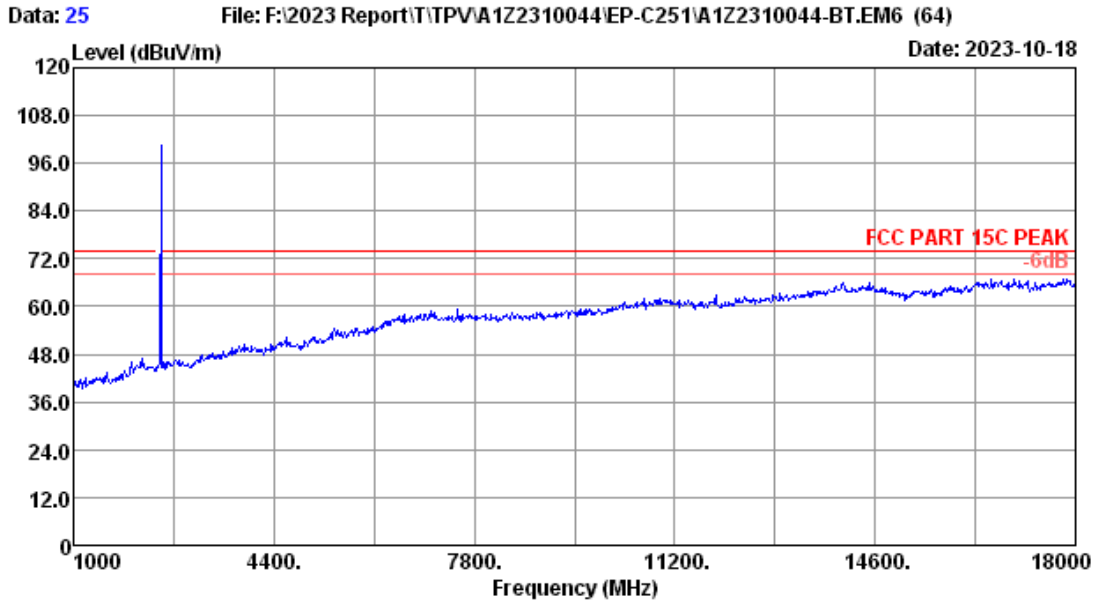
Site no.	: 3m Chamber	Data no.	: 23
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT GFSK 2441 MHz TX		



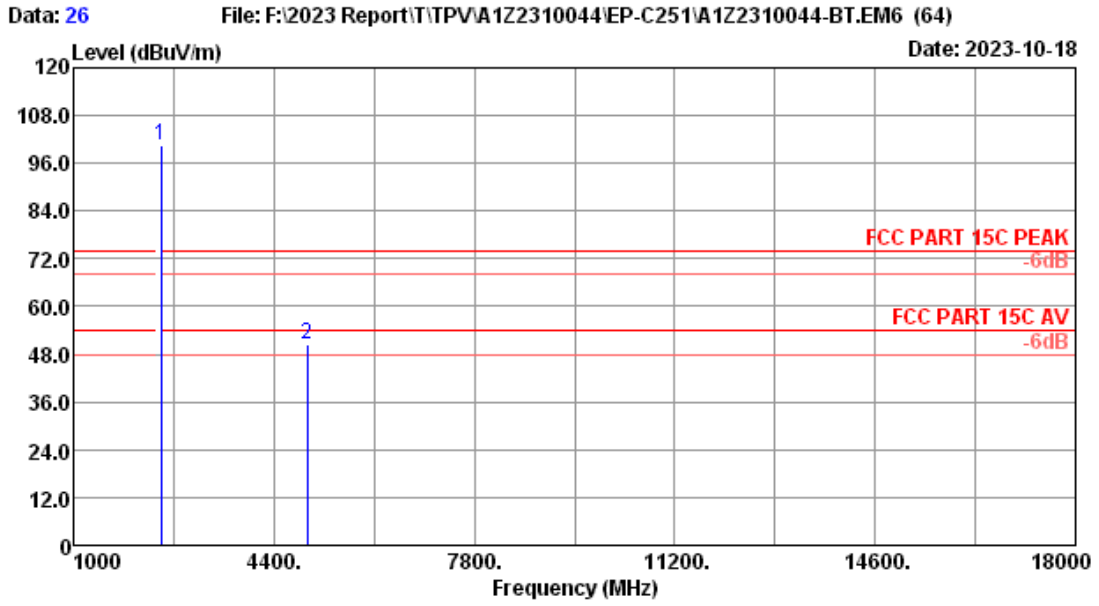
Site no. : 3m Chamber Data no. : 24  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT GFSK 2441 MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBUV)	Amp factor (dB)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	2442.00	27.77	4.90	101.41	34.35	99.73	-----	-----	Peak
2	4882.00	31.46	6.54	46.23	33.69	50.54	74.00	23.46	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



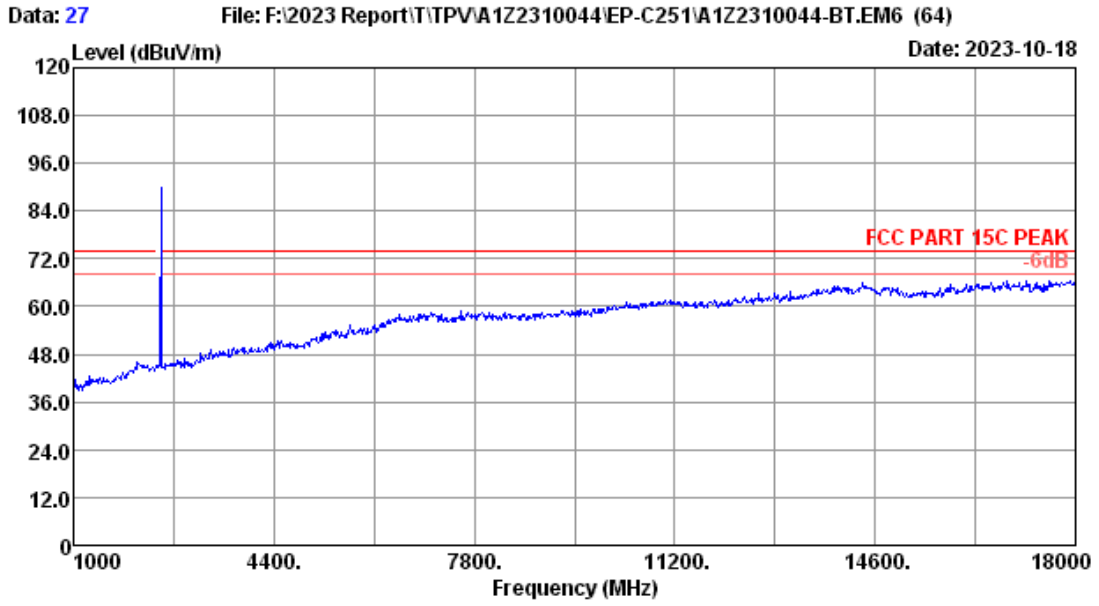
Site no.	: 3m Chamber	Data no.	: 25
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT GFSK 2480 MHz TX		



Site no. : 3m Chamber Data no. : 26  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT GFSK 2480 MHz TX

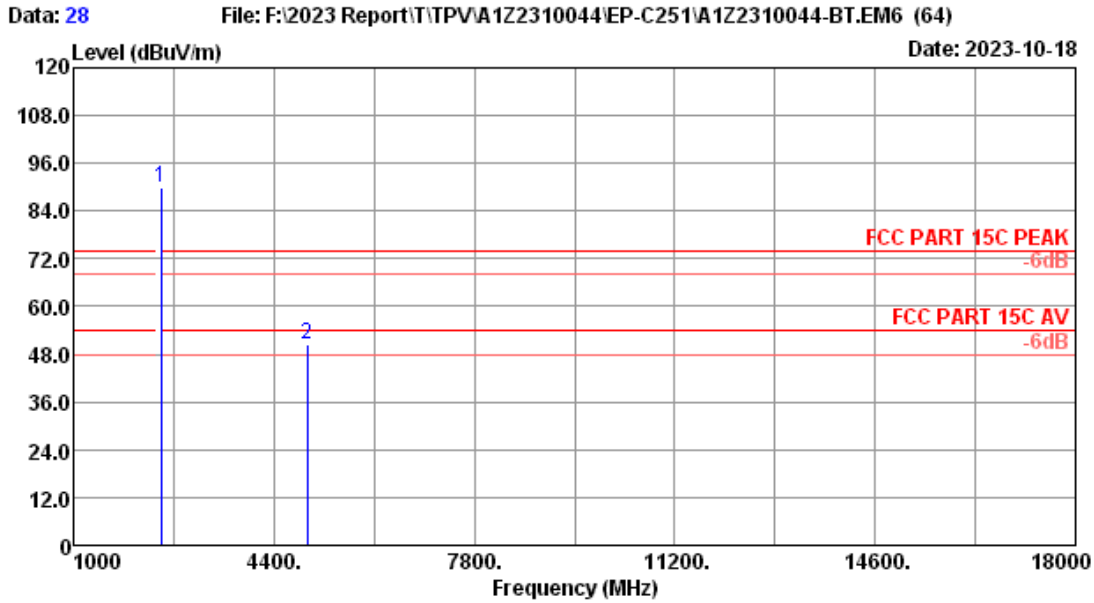
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	102.07	34.35	100.45	-----	-----	Peak
2	4960.00	31.98	6.58	45.59	33.69	50.46	74.00	23.54	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



Site no.	: 3m Chamber	Data no.	: 27
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT GFSK 2480 MHz TX		

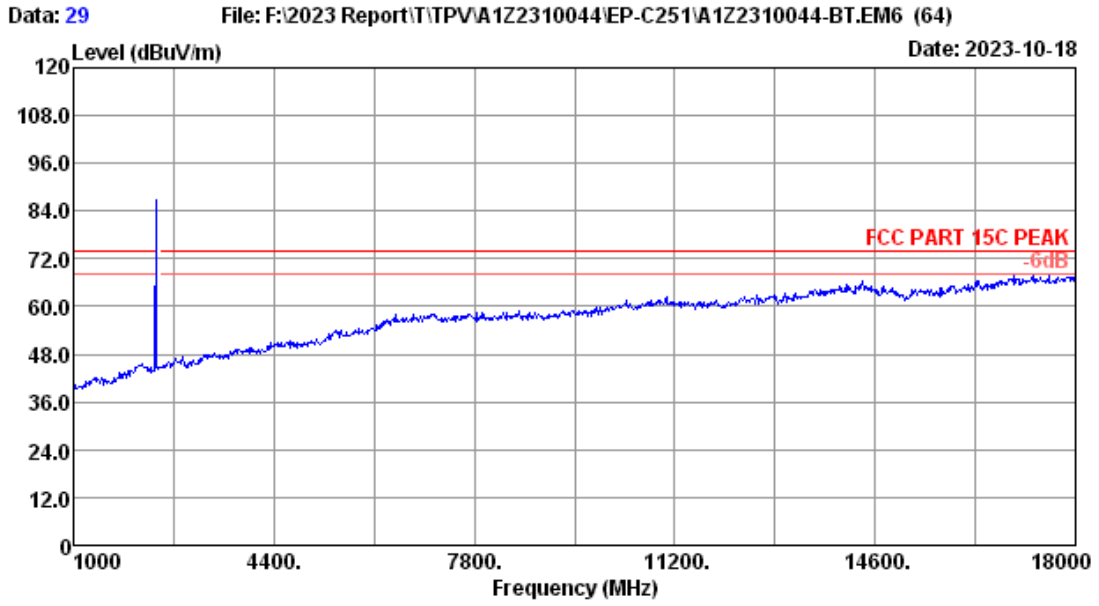




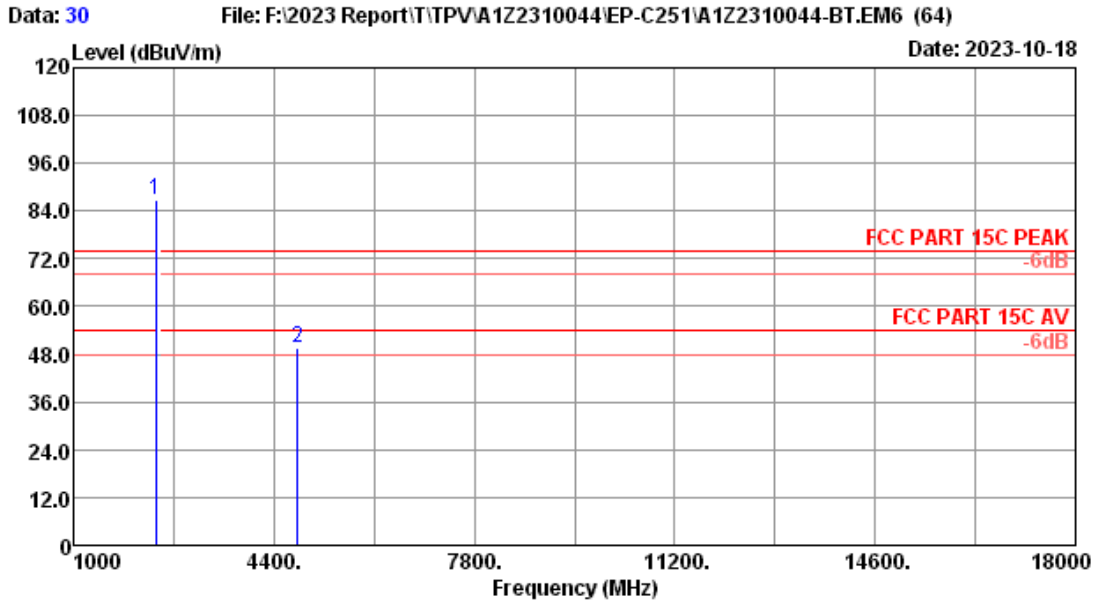
Site no. : 3m Chamber Data no. : 28  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT GFSK 2480 MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	91.44	34.35	89.82	-----	-----	Peak
2	4960.00	31.98	6.58	45.75	33.69	50.62	74.00	23.38	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



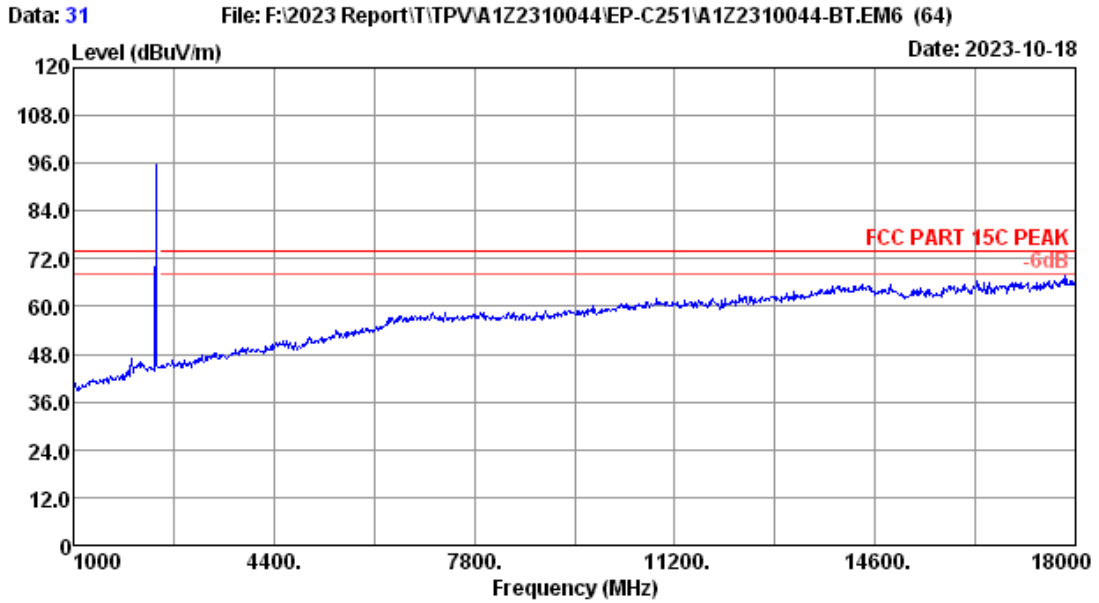
Site no.	: 3m Chamber	Data no.	: 29
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT3.0 8-DPSK 2402MHz TX		



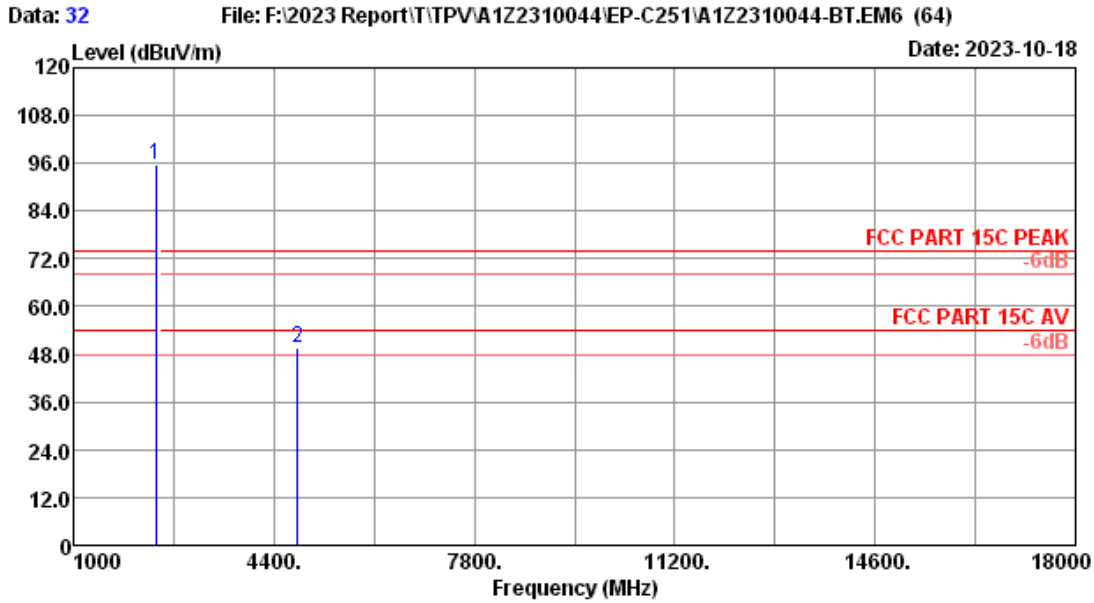
Site no. : 3m Chamber Data no. : 30  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT3.0 8-DPSK 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	88.70	34.36	86.81	-----	-----	Peak
2	4804.00	31.20	6.50	45.48	33.68	49.50	74.00	24.50	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



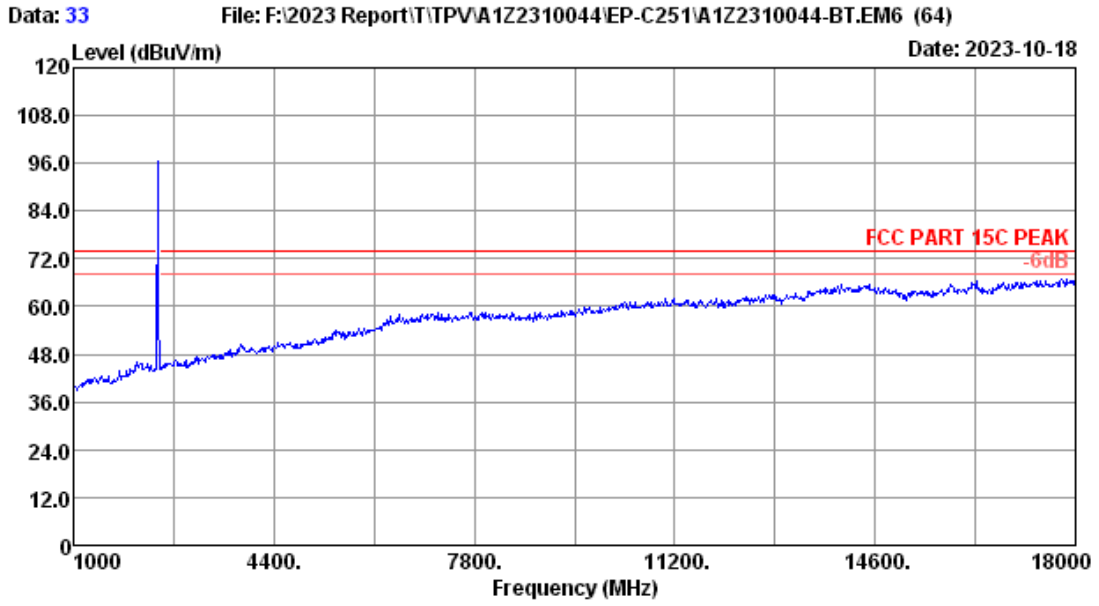
Site no.	: 3m Chamber	Data no.	: 31
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT3.0 8-DPSK 2402MHz TX		



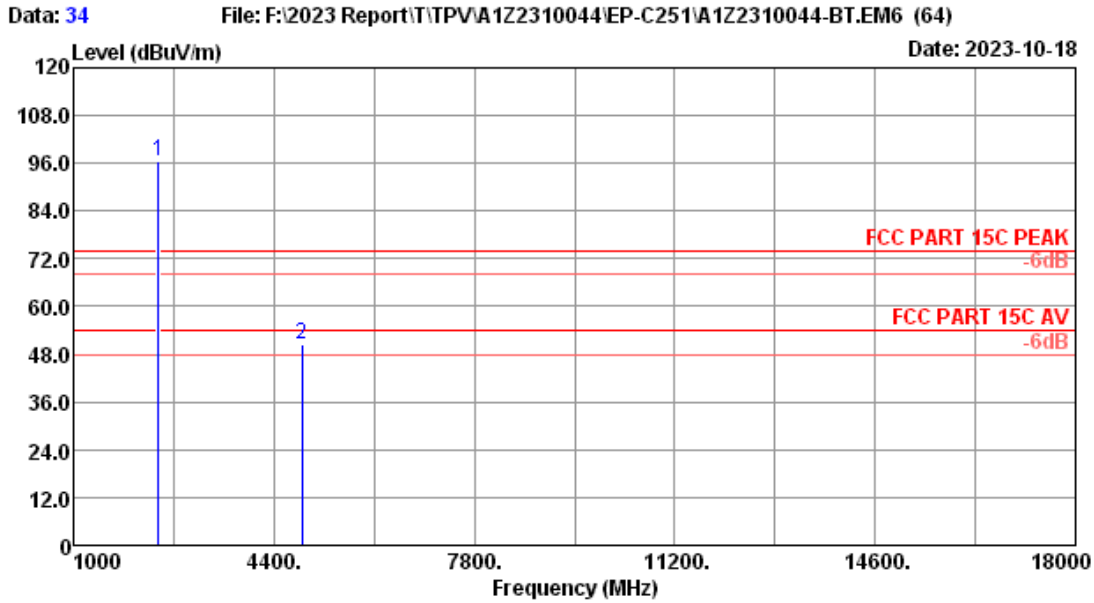
Site no. : 3m Chamber Data no. : 32  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT3.0 8-DPSK 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	97.59	34.36	95.70	-----	-----	Peak
2	4804.00	31.20	6.50	45.63	33.68	49.65	74.00	24.35	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



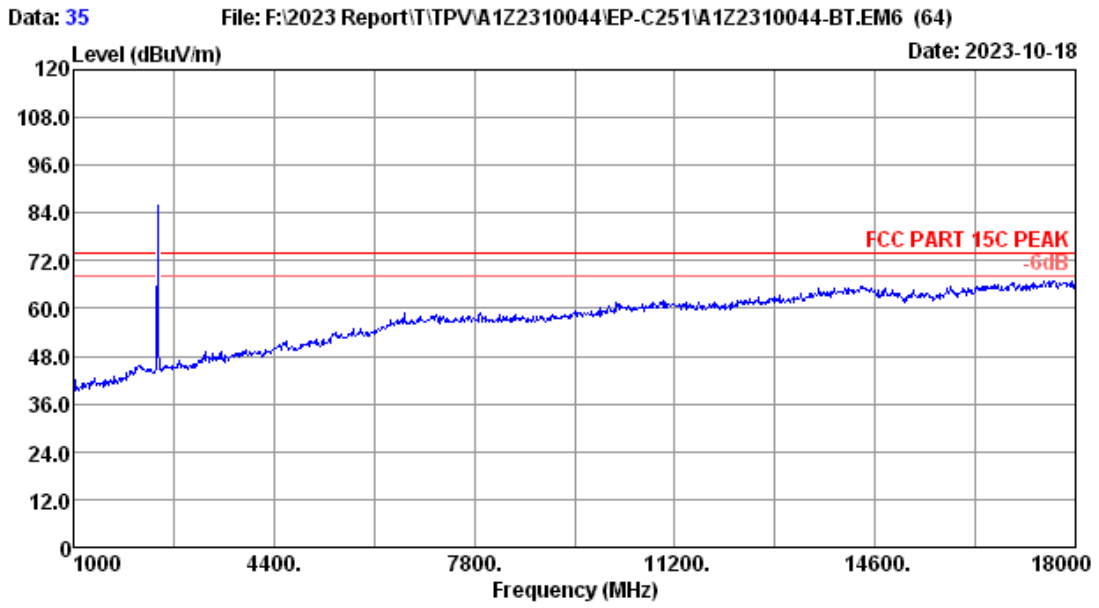
Site no.	: 3m Chamber	Data no.	: 33
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT3.0 8-DPSK 2441MHz TX		



Site no. : 3m Chamber Data no. : 34  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT3.0 8-DPSK 2441MHz TX

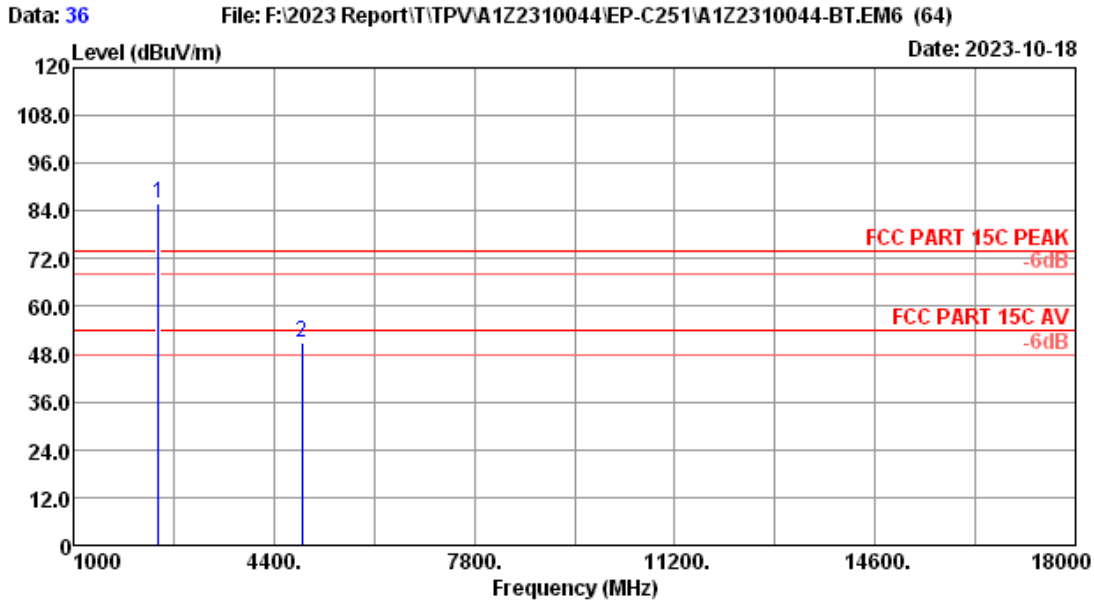
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2441.00	27.76	4.90	98.36	34.35	96.67	72.00	24.67	Peak
2	4882.00	31.46	6.54	46.25	33.69	50.56	50.56	23.44	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



Site no.	: 3m Chamber	Data no.	: 35
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT3.0 8-DPSK 2441MHz TX		

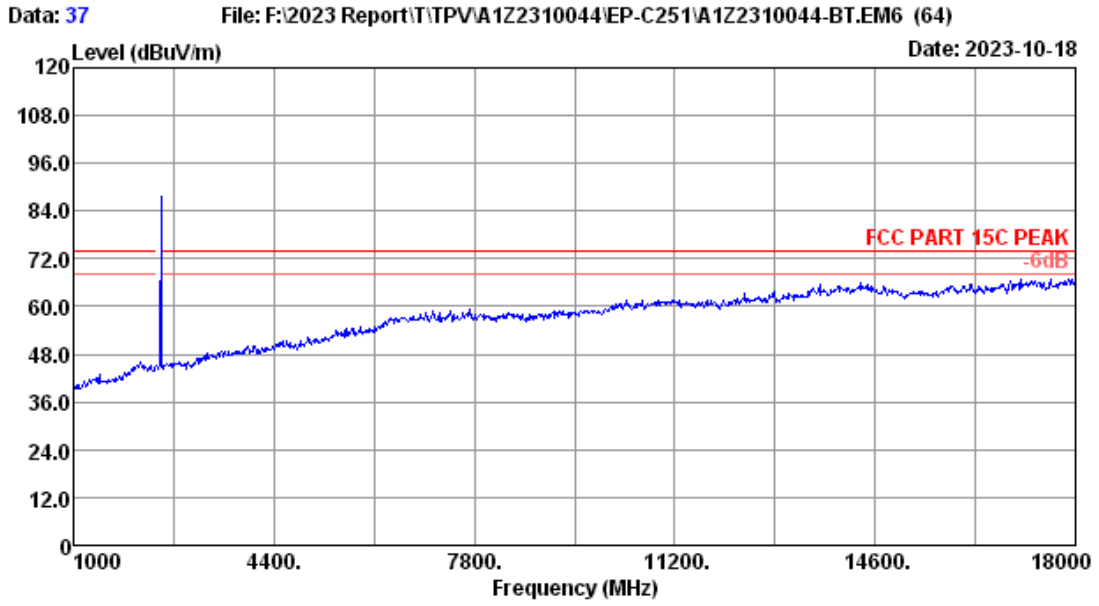




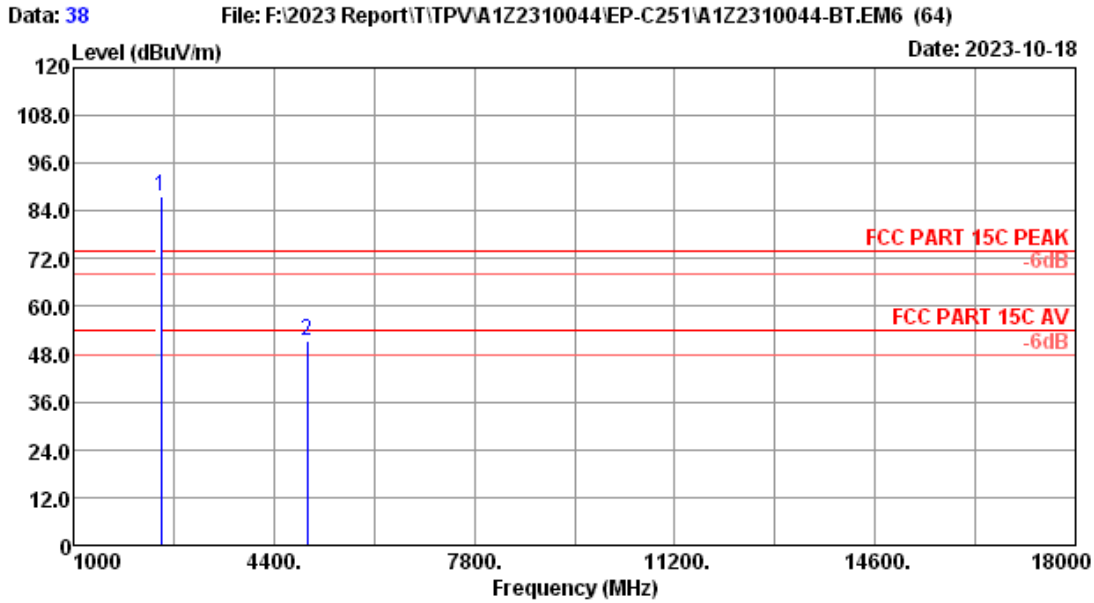
Site no. : 3m Chamber Data no. : 36  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT3.0 8-DPSK 2441MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2441.00	27.76	4.90	87.79	34.35	86.10	-----	-----	Peak
2	4882.00	31.46	6.54	46.44	33.69	50.75	74.00	23.25	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



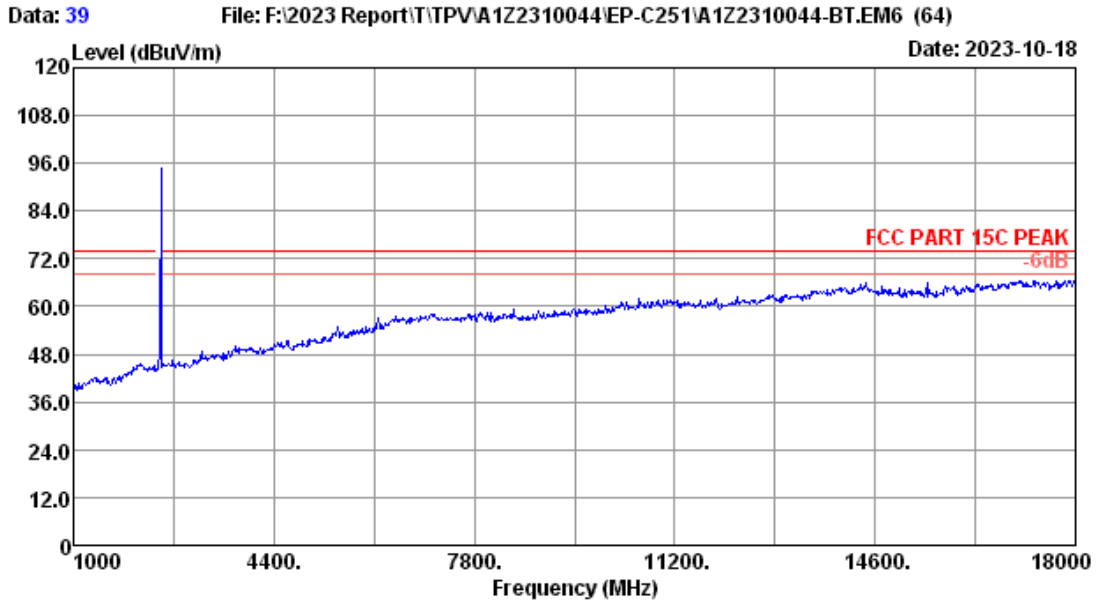
Site no.	: 3m Chamber	Data no.	: 37
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT3.0 8-DPSK 2480MHz TX		



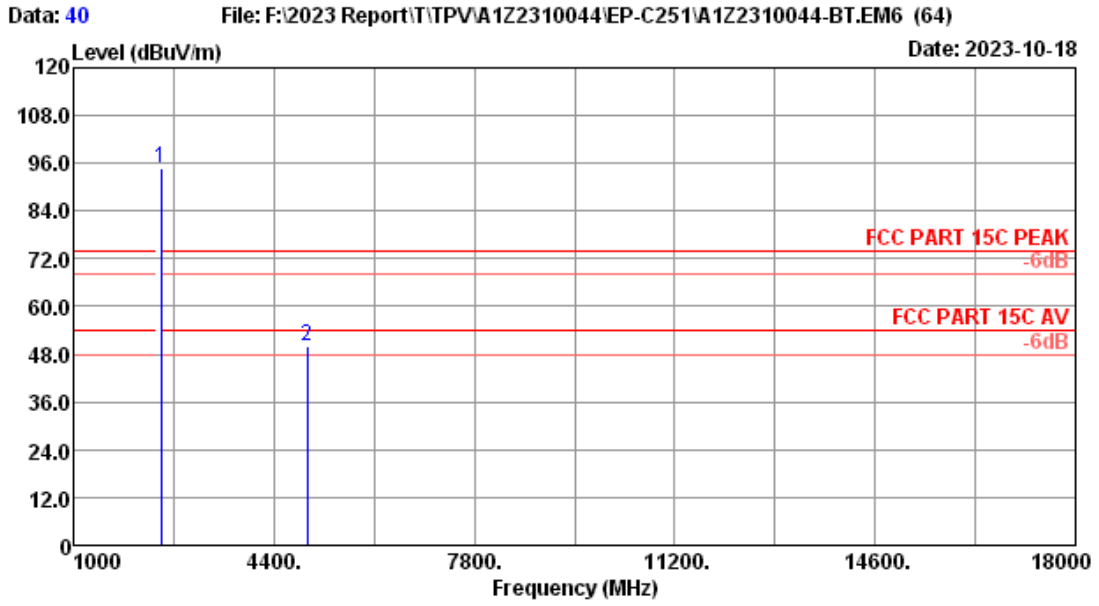
Site no. : 3m Chamber Data no. : 38  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT3.0 8-DPSK 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	89.51	34.35	87.89	-----	-----	Peak
2	4960.00	31.98	6.58	46.55	33.69	51.42	74.00	22.58	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.



Site no.	: 3m Chamber	Data no.	: 39
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BT3.0 8-DPSK 2480MHz TX		



Site no. : 3m Chamber Data no. : 40  
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL  
 Limit : FCC PART 15C PEAK  
 Env. / Ins. : 21.0°C/51.1% Engineer : nier  
 Test Mode : BT3.0 8-DPSK 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	96.20	34.35	94.58	72.00	22.58	Peak
2	4960.00	31.98	6.58	45.21	33.69	50.08	50.08	23.92	Peak

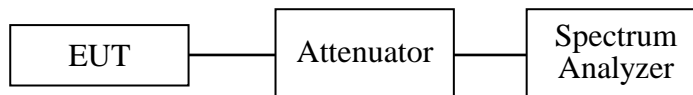
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.  
 2. The emission levels that are 20dB below the official limit are not reported.

## 5. CONDUCTED SPURIOUS EMISSIONS

### 5.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.01,23	1 Year
2.	RF Cable	HUBER+SUHNER	SUCOFLEX-106	505238/6	Apr.02,23	1 Year

### 5.2. Block Diagram of Test Setup



### 5.3. Limit

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30dB instead of 20dB.

### 5.4. Test Procedure

Use the test method described in ANSI C63.10 clause 7.8.8:

The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz and measure all the emissions With peak detector.

Note: The cable loss and attenuator loss were offset into spectrum analyzer as an amplitude offset.

### 5.5. Test result

**PASS** (The testing data was attached in the next pages.)

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-11-03~04	Pressure: 102.3±1.0 kpa	Humidity: 53.6±3.0%
Tested by: Jason	Test site: RF site	Temperature: 25.5±0.6 °C

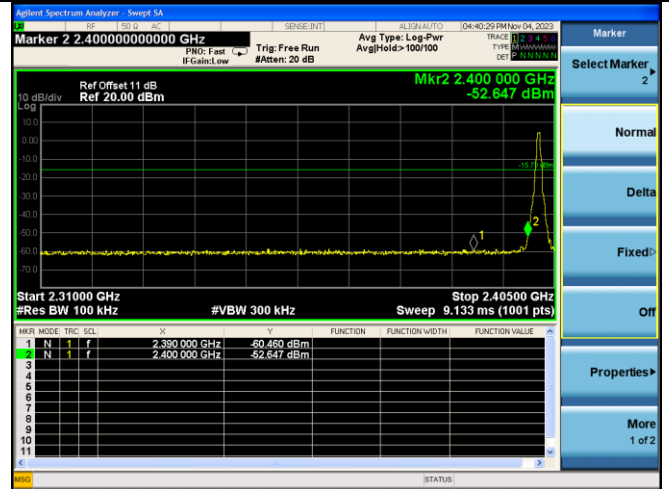
Hopping off

GFSK

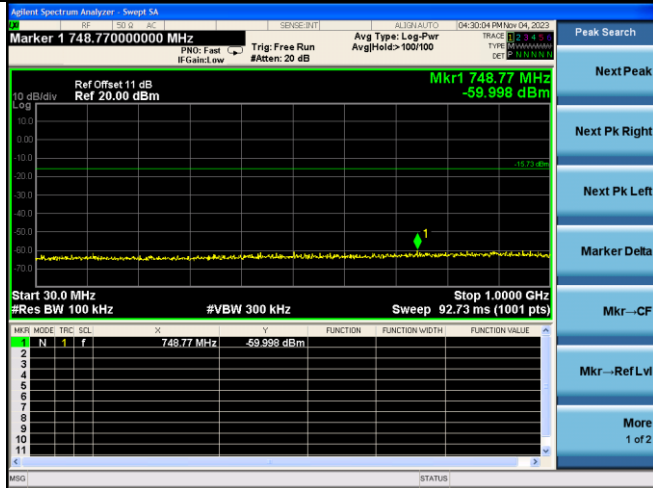
2402MHz



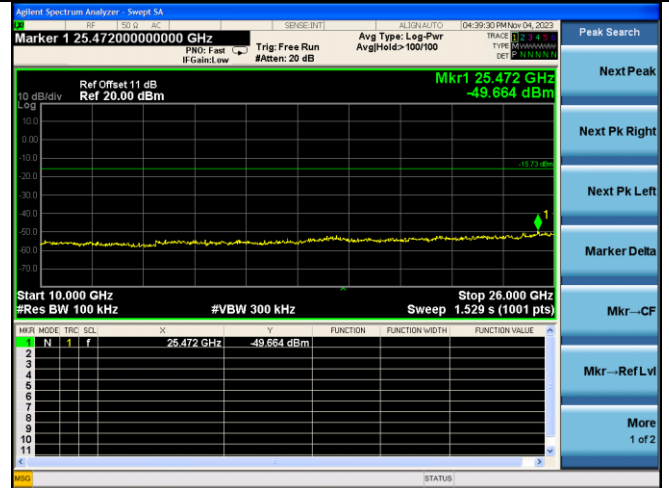
2402MHz(2.3GHz – 2.4GHz)



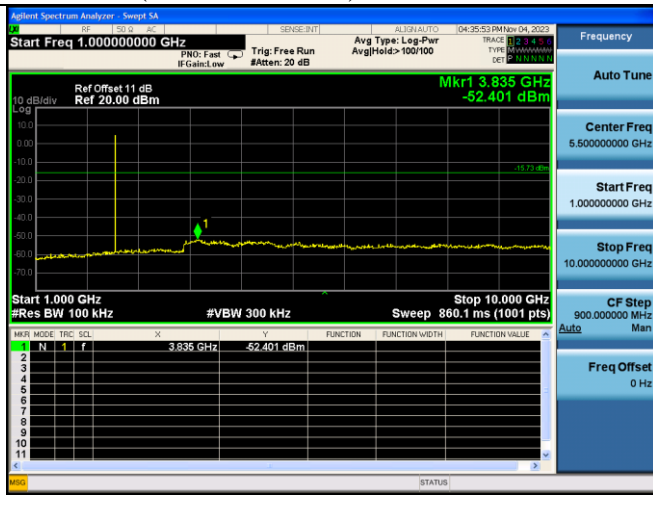
2402MHz(30MHz – 1GHz)



2402MHz(10GHz – 26GHz)



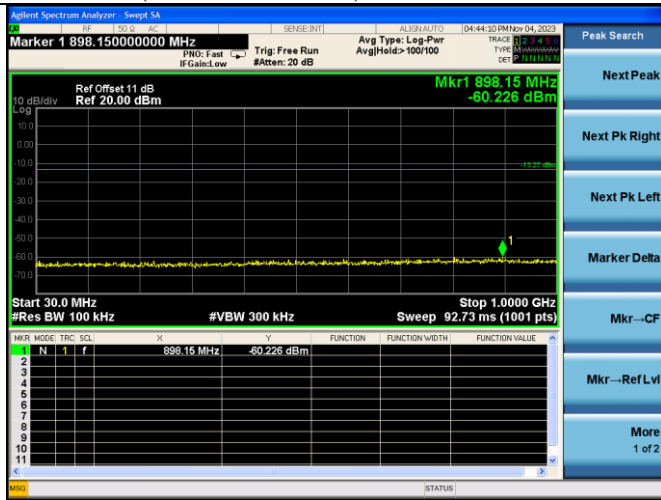
2402MHz(1GHz – 10GHz)



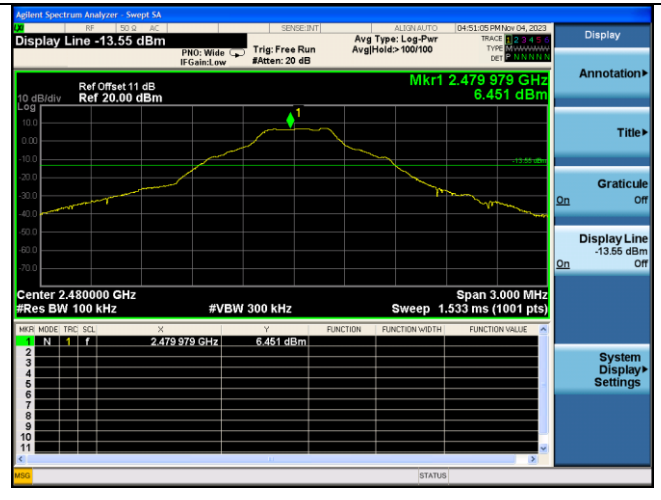
2441MHz



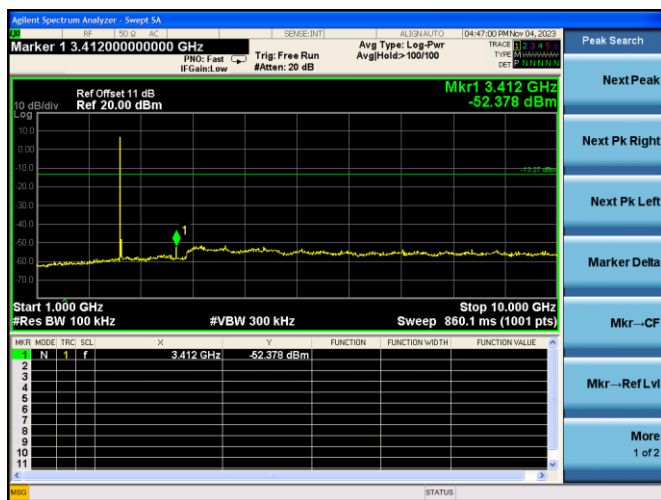
2441MHz(30MHz – 1GHz)



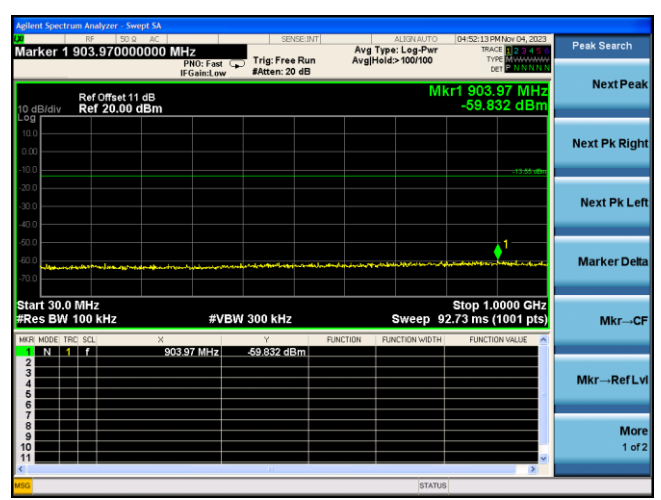
2480MHz



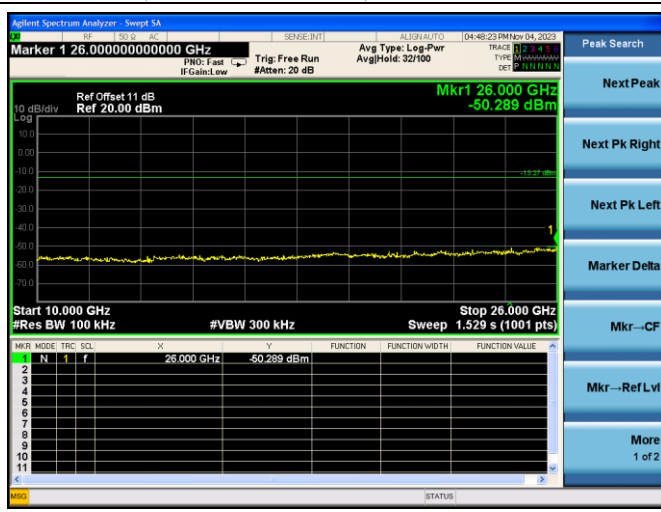
2441MHz(1GHz – 10GHz)



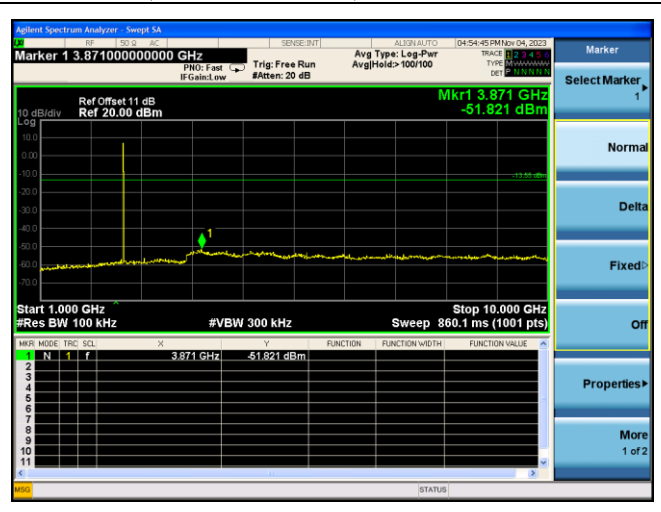
2480MHz(30MHz – 1GHz)



2441MHz(10GHz – 26GHz)

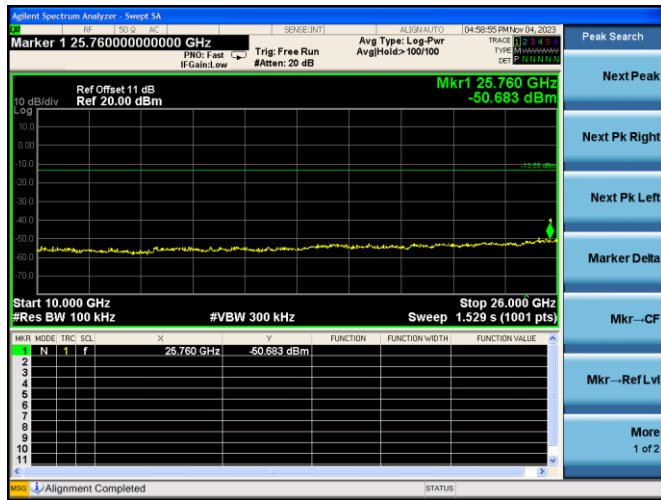


2480MHz(1GHz – 10GHz)

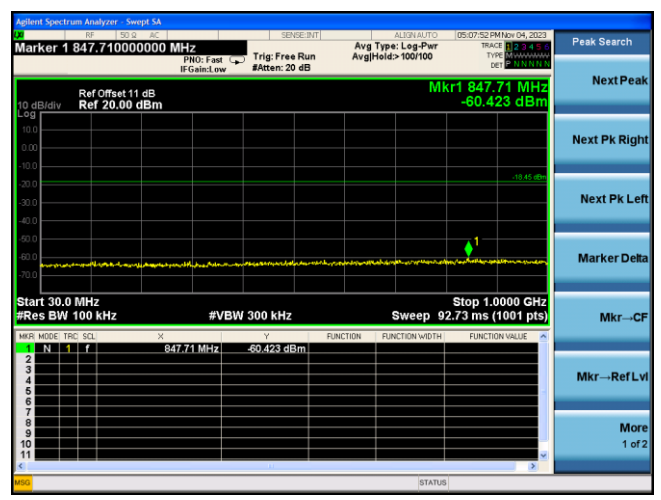




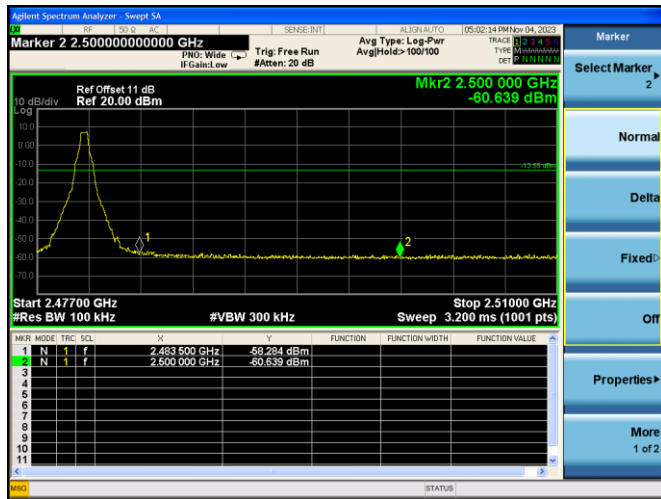
2480MHz(10GHz – 26GHz)



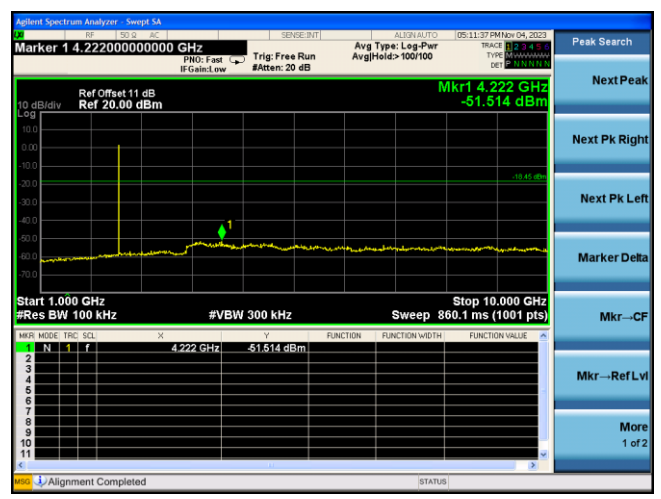
2402MHz(30MHz – 1GHz)



2480MHz(2.4GHz – 2.5GHz)

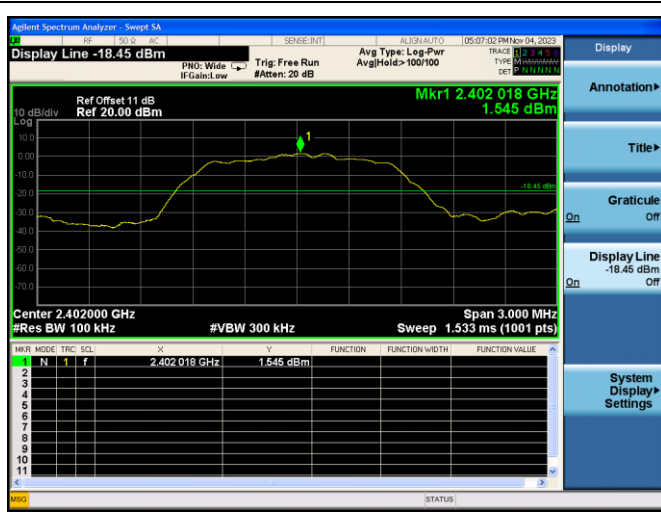


2402MHz(1GHz – 10GHz)

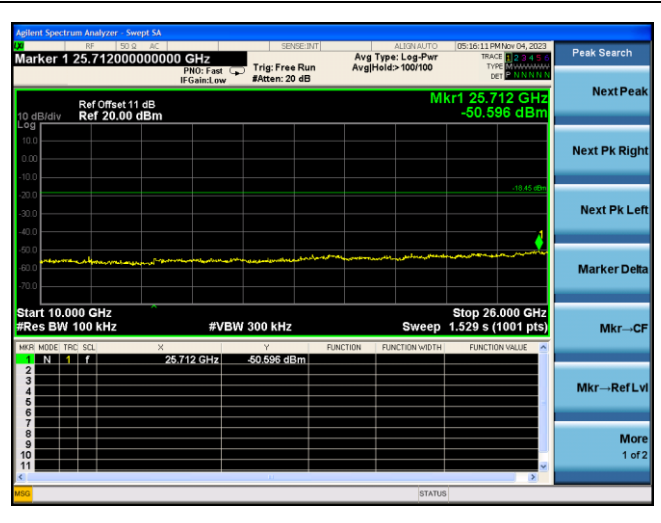


8-DPSK

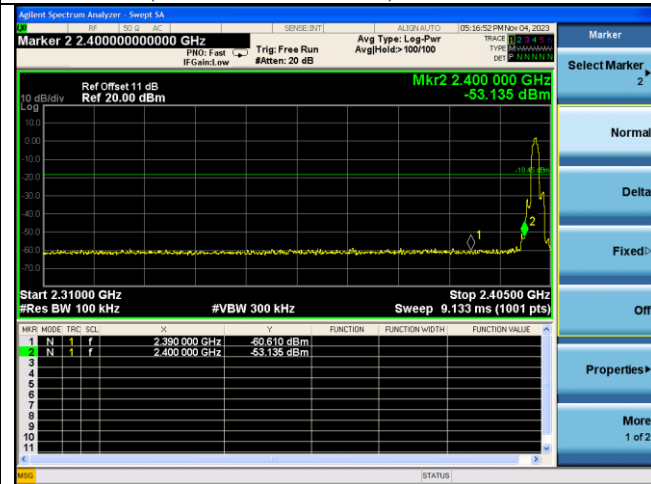
2402MHz



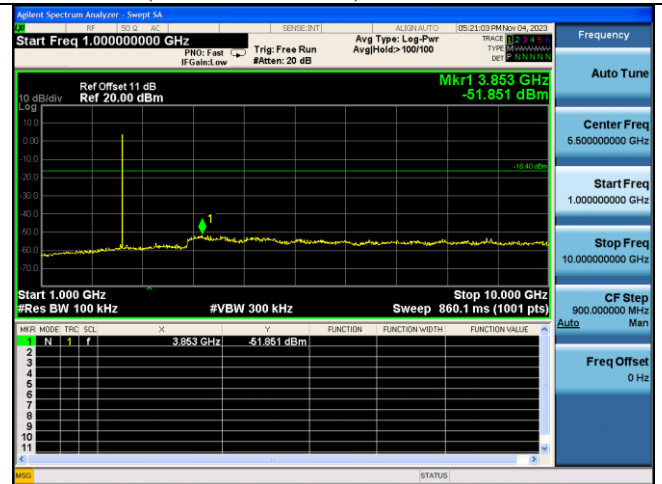
2402MHz(10GHz – 26GHz)



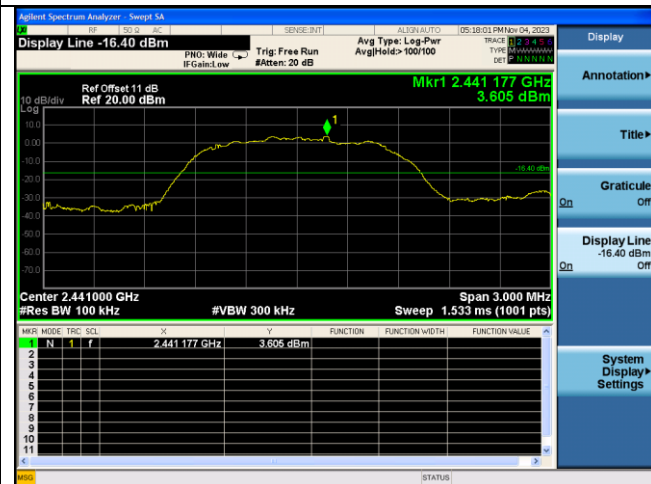
2402MHz(2.3GHz – 2.4GHz)



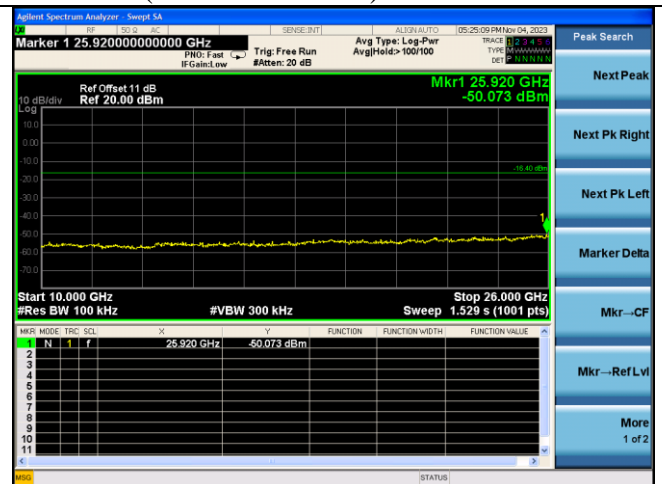
2441MHz(1GHz – 10GHz)



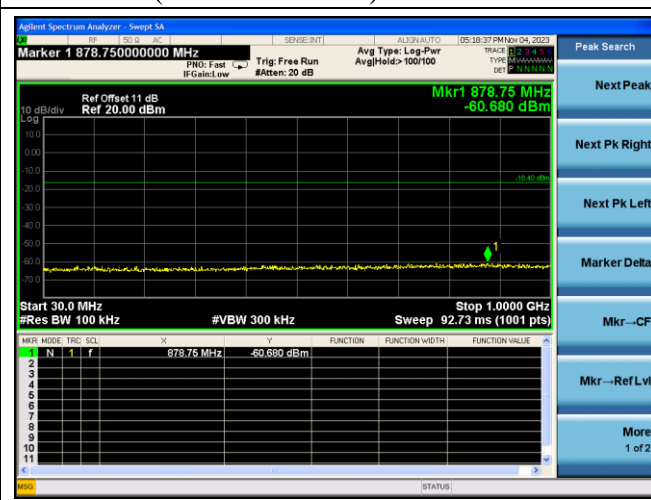
2441MHz



2441MHz(10GHz – 26GHz)



2441MHz (30MHz – 1GHz)



2480MHz

