



# CTC Laboratories, Inc.

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## TEST REPORT

**Report No.** ..... : **CTC20231447E11**

**FCC ID**..... : **A5M-MD80**

**Applicant** ..... : **Lenovo (Beijing) Limited**

Address..... : 201-H2-6, Floor 2, Building 2, No.6 Shangdi West Road, Haidian District, Beijing China

Manufacturer..... : Lenovo (Beijing) Limited

Address..... : 201-H2-6, Floor 2, Building 2, No.6 Shangdi West Road, Haidian District, Beijing China

**Product Name** ..... : **Lenovo Wireless Transmitter**

Trade Mark ..... : Lenovo

Model/Type reference..... : Lenovo MD80

Listed Model(s) ..... : /

**Standard** ..... : **FCC CFR Title 47 Part 15 Subpart C Section 15.247**

Date of receipt of test sample..... : Jun. 29, 2023

Date of testing..... : Jun. 29, 2023 to Aug. 4, 2023

Date of issue..... : Aug. 5, 2023

**Result**..... : **PASS**

Compiled by:

(Printed name+signature) Jim Jiang

Supervised by:

(Printed name+signature) Eric Zhang

Approved by:

(Printed name+signature) Totti Zhao

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Table of Contents

Page

- 1. TEST SUMMARY ..... 3
  - 1.1. TEST STANDARDS..... 3
  - 1.2. REPORT VERSION ..... 3
  - 1.3. TEST DESCRIPTION..... 3
  - 1.4. TEST FACILITY ..... 4
  - 1.5. MEASUREMENT UNCERTAINTY ..... 5
  - 1.6. ENVIRONMENTAL CONDITIONS..... 5
- 2. GENERAL INFORMATION ..... 6
  - 2.1. CLIENT INFORMATION ..... 6
  - 2.2. GENERAL DESCRIPTION OF EUT ..... 6
  - 2.3. ACCESSORY EQUIPMENT INFORMATION ..... 7
  - 2.4. OPERATION STATE ..... 8
  - 2.5. MEASUREMENT INSTRUMENTS LIST ..... 9
- 3. TEST ITEM AND RESULTS ..... 10
  - 3.1. CONDUCTED EMISSION..... 10
  - 3.2. RADIATED EMISSION ..... 13
  - 3.3. BAND EDGE EMISSIONS (RADIATED) ..... 27
  - 3.4. BAND EDGE AND SPURIOUS EMISSIONS (CONDUCTED) ..... 40
  - 3.5. 20dB BANDWIDTH..... 46
  - 3.6. CHANNEL SEPARATION..... 50
  - 3.7. NUMBER OF HOPPING CHANNEL ..... 52
  - 3.8. DWELL TIME ..... 54
  - 3.9. PEAK OUTPUT POWER ..... 56
  - 3.10. DUTY CYCLE ..... 59
  - 3.11. ANTENNA REQUIREMENT ..... 65



# 1. TEST SUMMARY

## 1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Operation within the bands 902–928MHz, 2400–2483.5MHz, and 5725–5850MHz.

[RSS-247 Issue 2](#): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

[RSS-Gen Issue 5](#): General Requirements for Compliance of Radio Apparatus.

[ANSI C63.10-2013](#): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

## 1.2. Report Version

Revised No.	Date of issue	Description
01	Aug. 5, 2023	Original

## 1.3. Test Description

FCC Part 15 Subpart C (15.247) / RSS-247 Issue 2				
Test Item	Standard Section		Result	Test Engineer
	FCC	IC		
Antenna Requirement	15.203	RSS-Gen 6.8	Pass	Jim Jiang
Conducted Emission	15.207	RSS-Gen 8.8	Pass	Jim Jiang
Restricted Bands	15.205	RSS-Gen 8.10	Pass	Jim Jiang
Hopping Channel Separation	15.247(a)(1)	RSS-247 5.1 (b)	Pass	Jim Jiang
Dwell Time	15.247(a)(iii)	RSS-247 5.1 (d)	Pass	Jim Jiang
Peak Output Power	15.247(b)(1)	RSS-247 5.4 (b)	Pass	Jim Jiang
Number of Hopping Frequency	15.247(a)(iii)	RSS-247 5.1 (d)	Pass	Jim Jiang
Conducted Band Edge and Spurious Emissions	15.247(d)	RSS-247 5.5	Pass	Jim Jiang
Radiated Band Edge and Spurious Emissions	15.205&15.209&15.247(d)	RSS-247 5.5	Pass	Jim Jiang
Radiated Spurious Emission	15.247(d) &15.209	RSS-247 5.5&RSS-Gen 8.9	Pass	Jim Jiang
20dB Bandwidth	15.247(a)	RSS-247 5.1 (b)	Pass	Jim Jiang

Note:

- The measurement uncertainty is not included in the test result.
- N/A: means this test item is not applicable for this device according to the technology characteristic of device.

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## 1.4. Test Facility

### Address of the report laboratory

#### CTC Laboratories, Inc.

Add: 2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China

### Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

#### A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

#### FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 951311, Aug 26, 2017.



## 1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 “Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1” and TR-100028-02 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2” and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.

Test Items	Measurement Uncertainty	Notes
20dB Emission Bandwidth	±0.0196%	(1)
Carrier Frequency Separation	±1.9%	(1)
Number of Hopping Channel	±1.9%	(1)
Time of Occupancy	±0.028%	(1)
Max Peak Conducted Output Power	±0.743 dB	(1)
Band-edge Spurious Emission	±1.328 dB	(1)
Conducted RF Spurious Emission	9kHz-1GHz: ±0.746dB 1GHz-26GHz: ±1.328dB	(1)
Conducted Emissions 9kHz~30MHz	±3.08 dB	(1)
Radiated Emissions 30~1000MHz	±4.51 dB	(1)
Radiated Emissions 1~18GHz	±5.84 dB	(1)
Radiated Emissions 18~40GHz	±6.12 dB	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 1.6. Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15 °C to 35 °C
Relative Humidity:	20 % to 75 %
Air Pressure:	101 kPa



## 2. GENERAL INFORMATION

### 2.1. Client Information

Applicant:	Lenovo (Beijing) Limited
Address:	201-H2-6, Floor 2, Building 2, No.6 Shangdi West Road, Haidian District, Beijing China
Manufacturer:	Lenovo (Beijing) Limited
Address:	201-H2-6, Floor 2, Building 2, No.6 Shangdi West Road, Haidian District, Beijing China

### 2.2. General Description of EUT

Product Name:	Lenovo Wireless Transmitter
Trade Mark:	Lenovo
Model/Type reference:	Lenovo MD80
Listed Model(s):	/
Model Difference:	/
Power Supply:	DC5V 500mA
Hardware Version:	20230513-1840-rv1126-md80-8.0.22
Software Version:	9.VMD80MBV01BSL
<b>Bluetooth 5.2 / BR+EDR</b>	
Modulation:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation Frequency:	2402MHz~2480MHz
Channel Number:	79
Channel Separation:	1MHz
Antenna Type:	FPC Antenna
Antenna Gain:	1.58dBi



### 2.3. Accessory Equipment Information

Equipment Information			
Name	Model	S/N	Manufacturer
Notebook	ThinkPad T460s	/	Lenovo
Cable Information			
Name	Shielded Type	Ferrite Core	Length
/	/	/	/
Test Software Information			
Name	Version	/	/
adb tool	/	/	/



### 2.4. Operation State

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT EDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
<b>00</b>	<b>2402</b>
01	2403
:	:
38	2440
<b>39</b>	<b>2441</b>
40	2442
:	:
77	2479
<b>78</b>	<b>2480</b>

Note: The display in grey were the channel selected for testing.

Test Mode:

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.





## 2.5. Measurement Instruments List

Tonscend RF Test System					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	MXA Signal Analyzer	Keysight	N9020A	MY46471737	Dec. 16, 2023
2	Spectrum Analyzer	R&S	FSU26	100105	Dec. 16, 2023
3	Spectrum Analyzer	R&S	FSV40-N	101331	Mar. 14, 2024
4	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 16, 2023
5	PSG Analog Signal Generator	Agilent	E8257D	MY46521908	Dec. 16, 2023
6	Power Sensor	Keysight	U2021XA	MY55130004	Mar. 14, 2024
7	Power Sensor	Keysight	U2021XA	MY55130006	Mar. 14, 2024
8	Wideband Radio Communication Tester	R&S	CMW500	102414	Dec. 16, 2023
9	High and low temperature box	ESPEC	MT3035	/	Mar. 24, 2024
10	JS1120 RF Test System	TONSCEND	v2.6	/	/

Radiated Emission (3m chamber 2)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-1013	Dec. 07, 2024
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-648	Dec. 07, 2024
3	Spectrum Analyzer	R&S	FSU26	100105	Dec. 16, 2023
4	Spectrum Analyzer	R&S	FSV40-N	101331	Mar. 14, 2024
5	Pre-Amplifier	SONOMA	310	186194	Dec. 16, 2023
6	Low Noise Pre-Amplifier	EMCI	EMC051835	980075	Dec. 16, 2023
7	Test Receiver	R&S	ESC17	100967	Dec. 16, 2023
8	3m chamber 2	Frankonia	EE025	/	Oct. 23, 2024

Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	LISN	R&S	ENV216	101112	Dec. 16, 2023
2	LISN	R&S	ENV216	101113	Dec. 16, 2023
3	EMI Test Receiver	R&S	ESCS30	100353	Dec. 16, 2023
4	ISN CAT6	Schwarzbeck	NTFM 8158	CAT6-8158-0046	Dec. 16, 2023
5	ISN CAT5	Schwarzbeck	NTFM 8158	CAT5-8158-0046	Dec. 16, 2023

Note: 1. The Cal. Interval was one year.

2. The Cal. Interval was three years of the antenna.

3. The cable loss has been calculated in test result which connection between each test instruments.

### 3. TEST ITEM AND RESULTS

#### 3.1. Conducted Emission

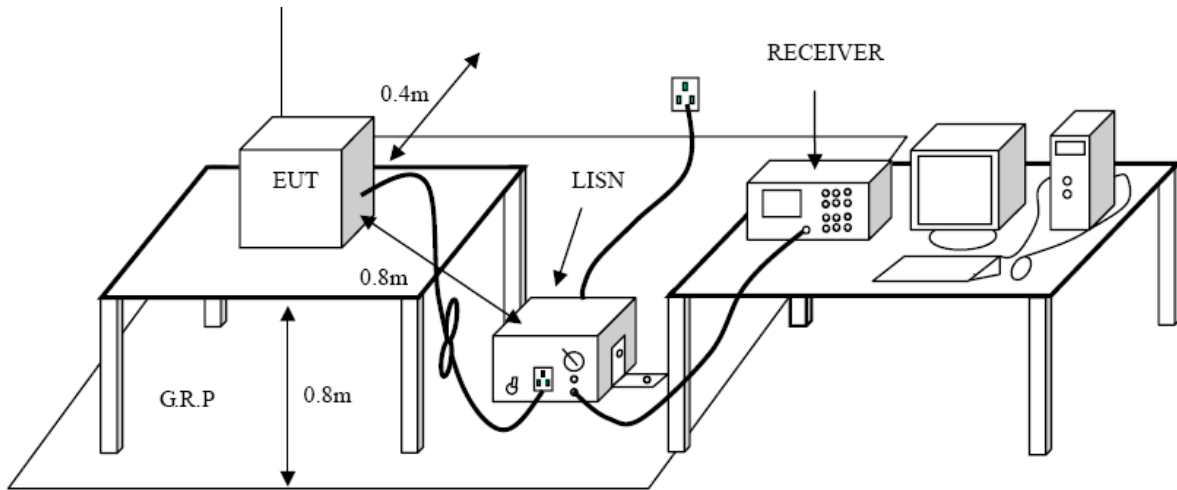
**Limit**

FCC CFR Title 47 Part 15 Subpart C Section 15.207 / RSS-Gen 8.8

Frequency (MHz)	Conducted Limit (dB $\mu$ V)	
	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 Configuration**



**Test Procedure**

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm / 50  $\mu$ H coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

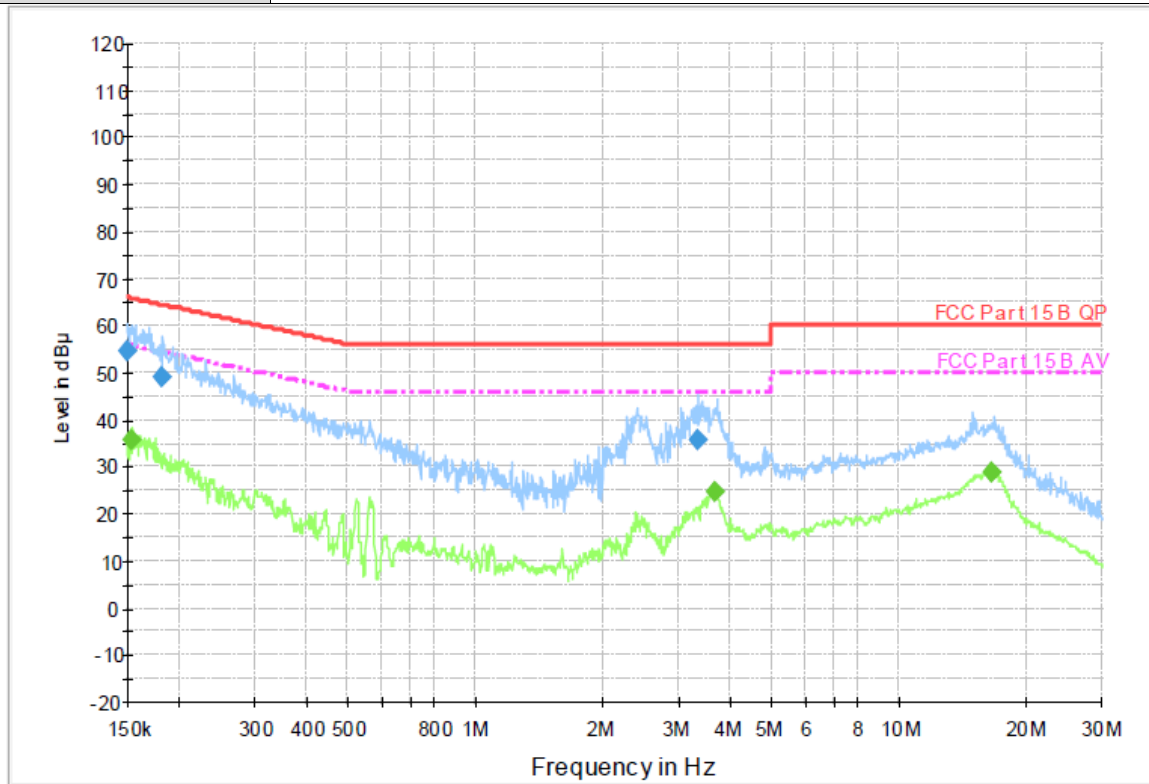
**Test Mode**

Please refer to the clause 2.4.



**Test Result**

<b>Test Voltage:</b>	AC 120V/60Hz
<b>Terminal:</b>	Line
<b>Remark:</b>	Only worse case is reported



**Final Measurement Detector 1**

Frequency (MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.150000	54.8	1000.00	9.000	On	L1	9.7	11.2	66.0	
0.181680	49.1	1000.00	9.000	On	L1	9.7	15.3	64.4	
3.335700	35.7	1000.00	9.000	On	L1	9.7	20.3	56.0	

**Final Measurement Detector 2**

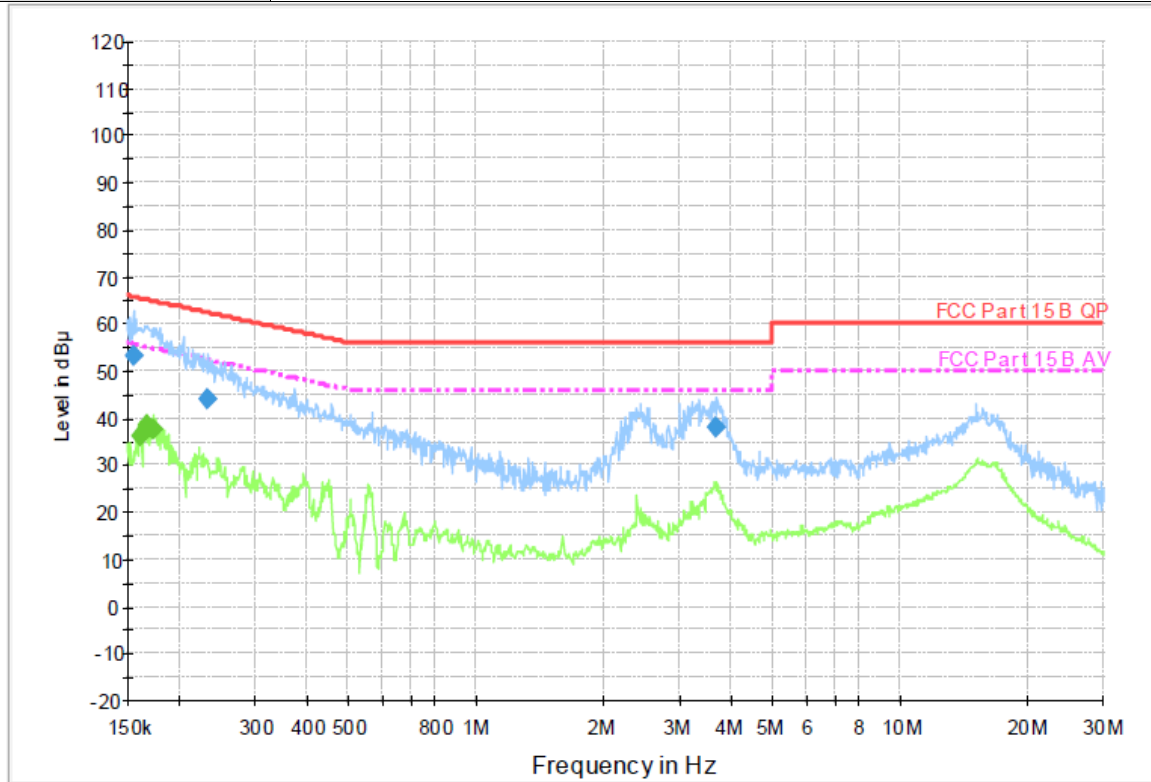
Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.154250	35.8	1000.00	9.000	On	L1	9.7	20.0	55.8	
3.641900	24.6	1000.00	9.000	On	L1	9.7	21.4	46.0	
16.403550	28.9	1000.00	9.000	On	L1	9.8	21.1	50.0	

Emission Level = Read Level + Correct Factor





<b>Test Voltage:</b>	AC 120V/60Hz
<b>Terminal:</b>	Neutral
<b>Remark:</b>	Only worse case is reported



**Final Measurement Detector 1**

Frequency (MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.154870	53.4	1000.00	9.000	On	N	10.0	12.3	65.7	
0.232700	44.0	1000.00	9.000	On	N	10.0	18.4	62.4	
3.671090	38.2	1000.00	9.000	On	N	10.0	17.8	56.0	

**Final Measurement Detector 2**

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.160530	36.3	1000.00	9.000	On	N	10.0	19.1	55.4	
0.167070	38.5	1000.00	9.000	On	N	10.0	16.6	55.1	
0.171810	37.5	1000.00	9.000	On	N	10.0	17.4	54.9	

Emission Level = Read Level + Correct Factor

### 3.2. Radiated Emission

#### Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.209 / RSS-Gen 8.9

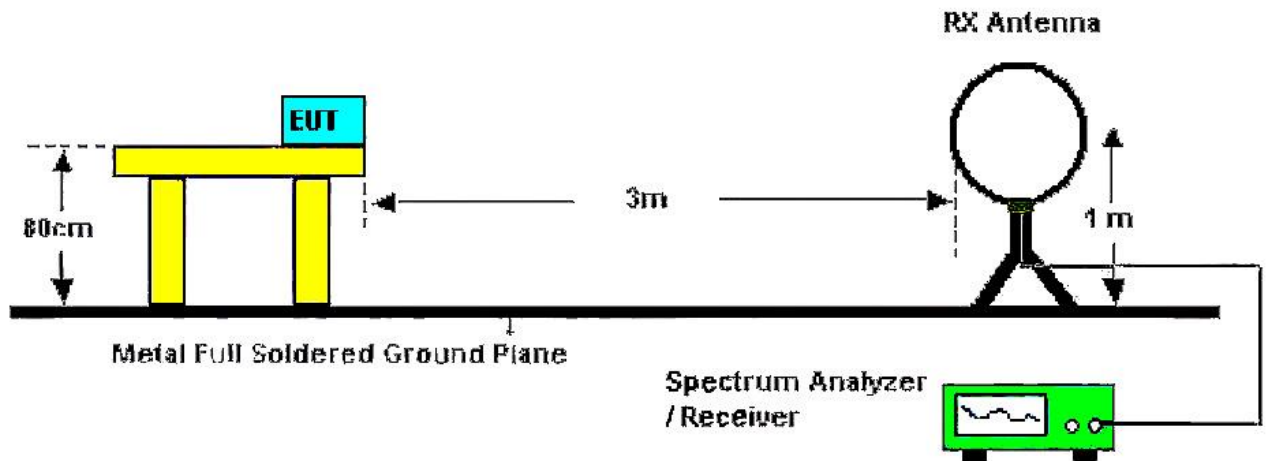
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Frequency Range (MHz)	dBµV/m (at 3 meters)	
	Peak	Average
Above 1000	74	54

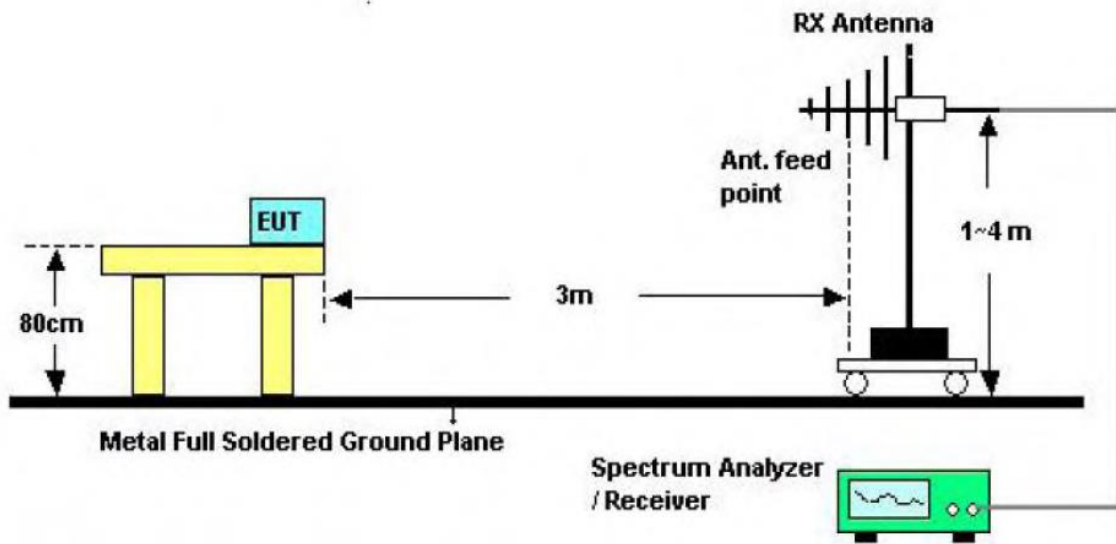
Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBµV/m)=20log Emission Level (µV/m).

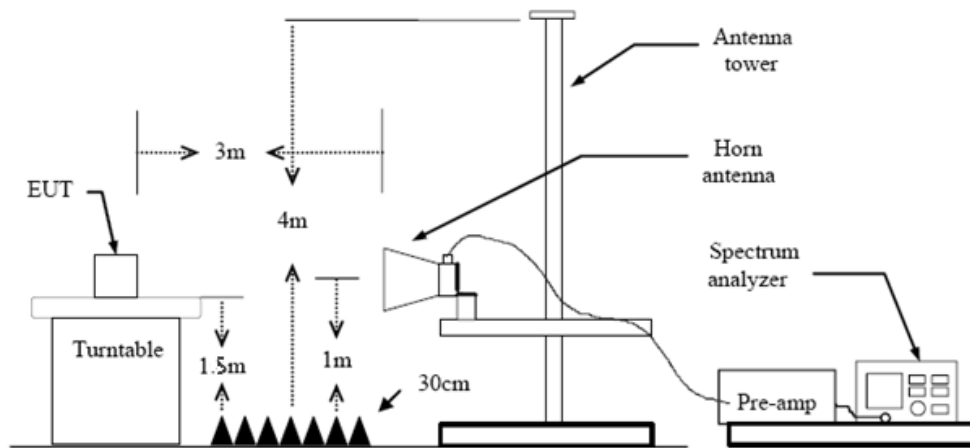
#### Test Configuration



Below 30MHz Test Setup



30-1000MHz Test Setup



Above 1GHz Test Setup

**Test Procedure**

1. The EUT was setup and tested according to ANSI C63.10:2013.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Below 1 GHz:  
 RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;  
 If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
  - (3) From 1 GHz to 10<sup>th</sup> harmonic:  
 RBW=1MHz, VBW=3MHz Peak detector for Peak value.



RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then 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. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

### **Test Mode**

Please refer to the clause 2.4.

### **Test Result**

#### **9 kHz~30 MHz**

From 9 kHz to 30 MHz: The conclusion is PASS.

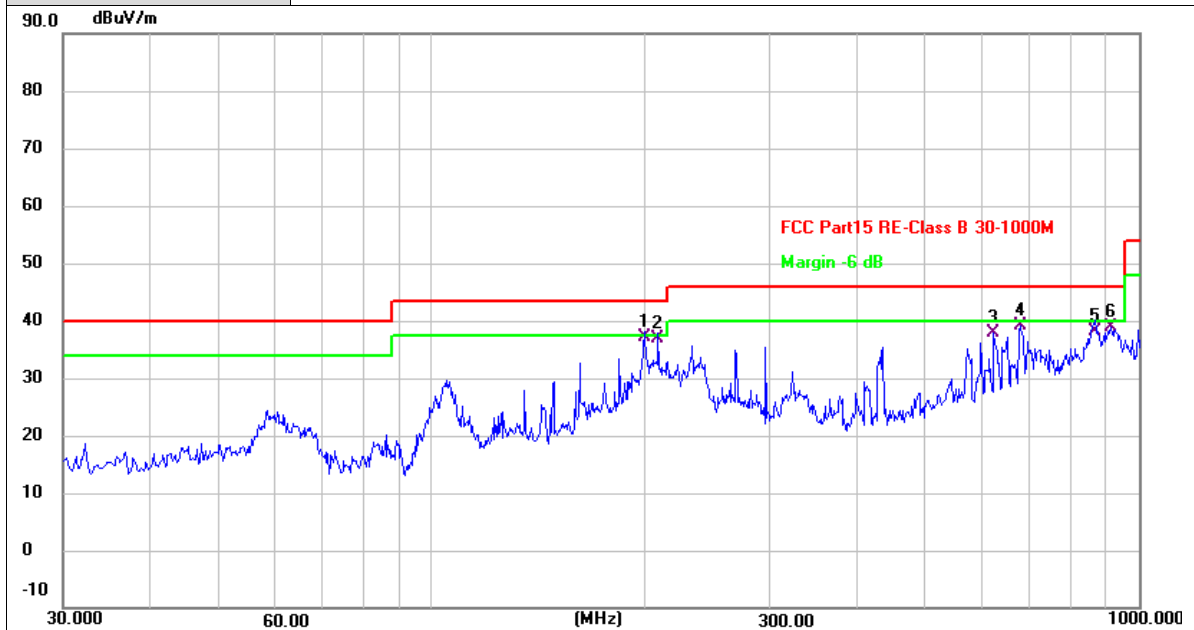
Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.





30MHz-1GHz

Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2402MHz
Remark:	Only worse case is reported.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	199.7500	53.12	-16.09	37.03	43.50	-6.47	QP
2	208.8033	52.61	-15.82	36.79	43.50	-6.71	QP
3	623.9633	44.40	-6.42	37.98	46.00	-8.02	QP
4	681.1933	44.97	-5.76	39.21	46.00	-6.79	QP
5	868.7264	41.14	-3.08	38.06	46.00	-7.94	QP
6	913.9932	41.28	-2.50	38.78	46.00	-7.22	QP

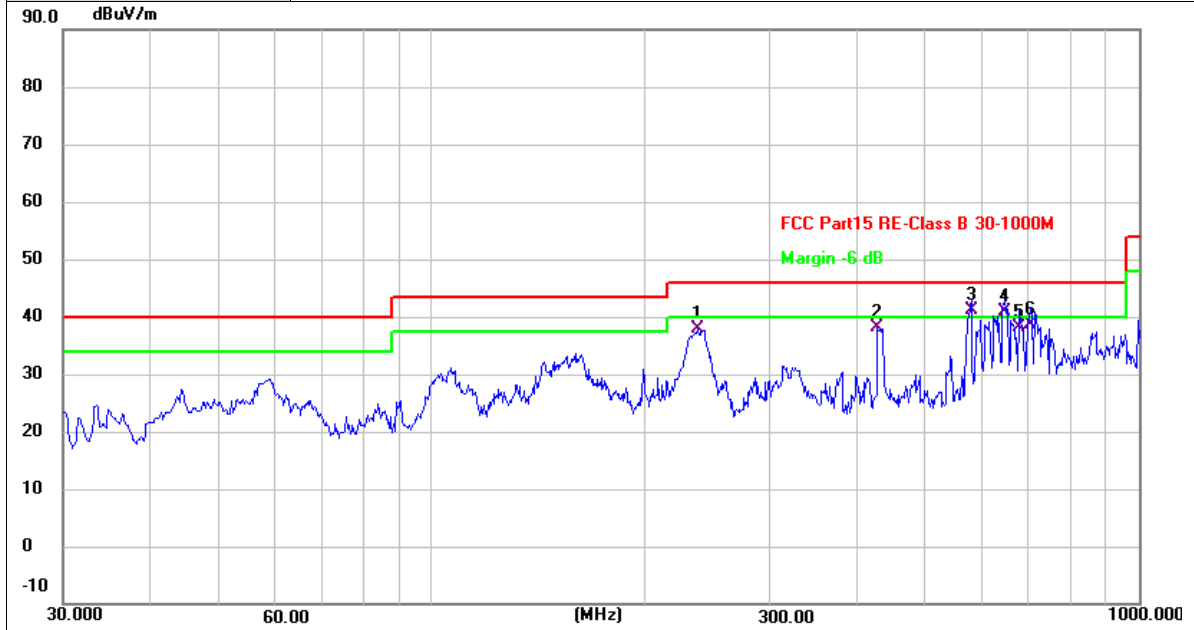
Remarks:

- 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2. Margin value = Level -Limit value





Ant. Pol.	Vertical
Test Mode:	TX GFSK Mode 2402MHz
Remark:	Only worse case is reported.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	238.2264	52.85	-14.98	37.87	46.00	-8.13	QP
2	427.7000	48.59	-10.54	38.05	46.00	-7.95	QP
3 *	579.9900	48.30	-7.19	41.11	46.00	-4.89	QP
4 !	645.9500	47.12	-6.15	40.97	46.00	-5.03	QP
5	677.9600	43.86	-5.79	38.07	46.00	-7.93	QP
6	703.1800	44.03	-5.50	38.53	46.00	-7.47	QP

Remarks:

- 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2. Margin value = Level -Limit value



## Above 1GHz

<b>Ant. Pol.</b>	Horizontal																														
<b>Test Mode:</b>	TX GFSK Mode 2402MHz																														
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.																														
<table border="1"> <thead> <tr> <th>No.</th> <th>Frequency (MHz)</th> <th>Reading (dBuV)</th> <th>Factor (dB/m)</th> <th>Level (dBuV/m)</th> <th>Limit (dBuV/m)</th> <th>Margin (dB)</th> <th>Detector</th> </tr> </thead> <tbody> <tr> <td>1 *</td> <td>4803.895</td> <td>28.30</td> <td>2.56</td> <td>30.86</td> <td>54.00</td> <td>-23.14</td> <td>AVG</td> </tr> <tr> <td>2</td> <td>4804.008</td> <td>40.74</td> <td>2.56</td> <td>43.30</td> <td>74.00</td> <td>-30.70</td> <td>peak</td> </tr> </tbody> </table>								No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1 *	4803.895	28.30	2.56	30.86	54.00	-23.14	AVG	2	4804.008	40.74	2.56	43.30	74.00	-30.70	peak
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4803.895	28.30	2.56	30.86	54.00	-23.14	AVG																								
2	4804.008	40.74	2.56	43.30	74.00	-30.70	peak																								
<b>Remarks:</b> 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value																															

<b>Ant. Pol.</b>	Vertical																														
<b>Test Mode:</b>	TX GFSK Mode 2402MHz																														
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.																														
<table border="1"> <thead> <tr> <th>No.</th> <th>Frequency (MHz)</th> <th>Reading (dBuV)</th> <th>Factor (dB/m)</th> <th>Level (dBuV/m)</th> <th>Limit (dBuV/m)</th> <th>Margin (dB)</th> <th>Detector</th> </tr> </thead> <tbody> <tr> <td>1 *</td> <td>4803.989</td> <td>29.07</td> <td>2.56</td> <td>31.63</td> <td>54.00</td> <td>-22.37</td> <td>AVG</td> </tr> <tr> <td>2</td> <td>4804.012</td> <td>41.45</td> <td>2.56</td> <td>44.01</td> <td>74.00</td> <td>-29.99</td> <td>peak</td> </tr> </tbody> </table>								No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1 *	4803.989	29.07	2.56	31.63	54.00	-22.37	AVG	2	4804.012	41.45	2.56	44.01	74.00	-29.99	peak
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4803.989	29.07	2.56	31.63	54.00	-22.37	AVG																								
2	4804.012	41.45	2.56	44.01	74.00	-29.99	peak																								
<b>Remarks:</b> 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value																															



<b>Ant. Pol.</b>	Horizontal
<b>Test Mode:</b>	TX GFSK Mode 2441MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.919	40.09	2.79	42.88	74.00	-31.12	peak
2 *	4882.214	28.95	2.79	31.74	54.00	-22.26	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

<b>Ant. Pol.</b>	Vertical
<b>Test Mode:</b>	TX GFSK Mode 2441MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4881.825	28.31	2.79	31.10	54.00	-22.90	AVG
2	4882.257	40.68	2.79	43.47	74.00	-30.53	peak

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value



<b>Ant. Pol.</b>	Horizontal
<b>Test Mode:</b>	TX GFSK Mode 2480MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.922	39.03	3.04	42.07	74.00	-31.93	peak
2 *	4960.011	28.54	3.04	31.58	54.00	-22.42	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

<b>Ant. Pol.</b>	Vertical
<b>Test Mode:</b>	TX GFSK Mode 2480MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.940	39.99	3.04	43.03	74.00	-30.97	peak
2 *	4960.014	27.17	3.04	30.21	54.00	-23.79	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value



<b>Ant. Pol.</b>	Horizontal																														
<b>Test Mode:</b>	TX $\pi/4$ -DQPSK Mode 2402MHz																														
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.																														
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4803.889	28.50	2.56	31.06	54.00	-22.94	AVG																								
2	4804.252	40.70	2.56	43.26	74.00	-30.74	peak																								
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value																															

<b>Ant. Pol.</b>	Vertical																														
<b>Test Mode:</b>	TX $\pi/4$ -DQPSK Mode 2402MHz																														
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.																														
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4804.080	29.12	2.56	31.68	54.00	-22.32	AVG																								
2	4804.140	40.49	2.56	43.05	74.00	-30.95	peak																								
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value																															



<b>Ant. Pol.</b>	Horizontal
<b>Test Mode:</b>	TX $\pi/4$ -DQPSK Mode 2441MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4882.012	40.59	2.79	43.38	74.00	-30.62	peak
2 *	4882.085	28.73	2.79	31.52	54.00	-22.48	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

<b>Ant. Pol.</b>	Vertical
<b>Test Mode:</b>	TX $\pi/4$ -DQPSK Mode 2441MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4882.023	27.51	2.79	30.30	54.00	-23.70	AVG
2	4882.072	40.72	2.79	43.51	74.00	-30.49	peak

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value



<b>Ant. Pol.</b>	Horizontal
<b>Test Mode:</b>	TX $\pi/4$ -DQPSK Mode 2480MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4959.947	27.65	3.04	30.69	54.00	-23.31	AVG
2	4960.114	39.50	3.04	42.54	74.00	-31.46	peak

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

<b>Ant. Pol.</b>	Vertical
<b>Test Mode:</b>	TX $\pi/4$ -DQPSK Mode 2480MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.990	39.72	3.04	42.76	74.00	-31.24	peak
2 *	4960.150	27.21	3.04	30.25	54.00	-23.75	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value



<b>Ant. Pol.</b>	Horizontal																														
<b>Test Mode:</b>	TX 8-DPSK Mode 2402MHz																														
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.																														
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1	4803.986	40.85	2.56	43.41	74.00	-30.59	peak																								
2 *	4804.125	27.63	2.56	30.19	54.00	-23.81	AVG																								
<b>Remarks:</b> 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value																															

<b>Ant. Pol.</b>	Vertical																														
<b>Test Mode:</b>	TX 8-DPSK Mode 2402MHz																														
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.																														
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4803.860	27.89	2.56	30.45	54.00	-23.55	AVG																								
2	4804.047	40.55	2.56	43.11	74.00	-30.89	peak																								
<b>Remarks:</b> 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value																															





<b>Ant. Pol.</b>	Horizontal
<b>Test Mode:</b>	TX 8-DPSK Mode 2441MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4882.020	28.51	2.79	31.30	54.00	-22.70	AVG
2	4882.055	40.96	2.79	43.75	74.00	-30.25	peak

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

<b>Ant. Pol.</b>	Vertical
<b>Test Mode:</b>	TX 8-DPSK Mode 2441MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4881.863	27.41	2.79	30.20	54.00	-23.80	AVG
2	4882.014	40.62	2.79	43.41	74.00	-30.59	peak

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value



<b>Ant. Pol.</b>	Horizontal
<b>Test Mode:</b>	TX 8-DPSK Mode 2480MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.824	40.55	3.04	43.59	74.00	-30.41	peak
2 *	4960.022	28.97	3.04	32.01	54.00	-21.99	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

<b>Ant. Pol.</b>	Vertical
<b>Test Mode:</b>	TX 8-DPSK Mode 2480MHz
<b>Remark:</b>	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4960.027	40.55	3.04	43.59	74.00	-30.41	peak
2 *	4960.036	27.14	3.04	30.18	54.00	-23.82	AVG

Remarks:

1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2. Margin value = Level -Limit value

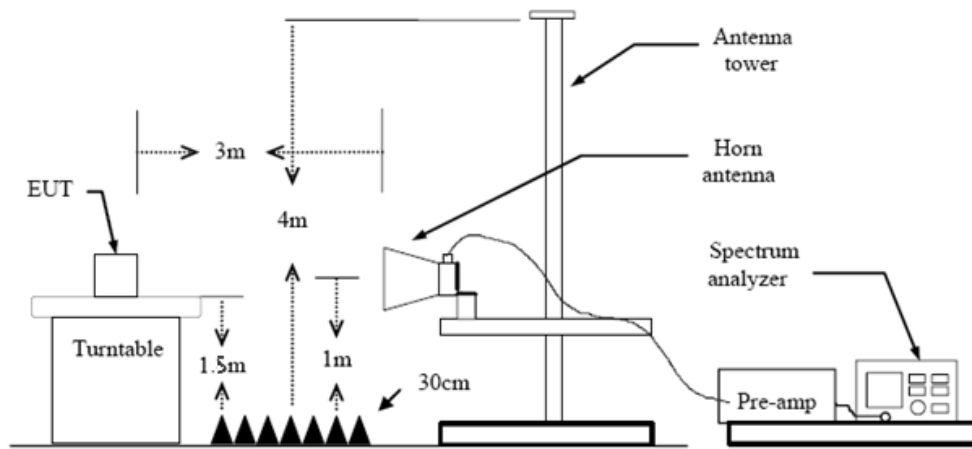
### 3.3. Band Edge Emissions (Radiated)

#### Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d) / RSS-247 5.5

Restricted Frequency Band (MHz)	(dB $\mu$ V/m) (at 3m)	
	Peak	Average
2310 ~ 2390	74	54
2483.5 ~ 2500	74	54

#### Test Configuration



#### Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:  
 RBW=1MHz, VBW=3MHz Peak detector for Peak value.  
 RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

Note 1: For measurements, above 1 GHz the resolution bandwidth is set to 1 MHz, then 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. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

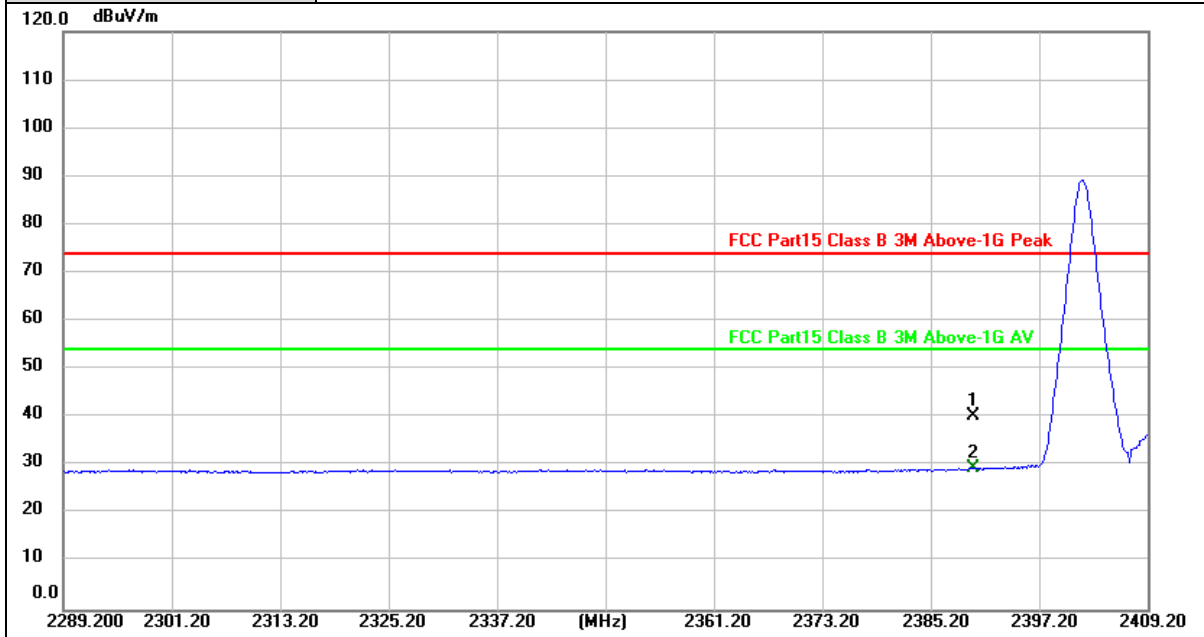
#### Test Mode

Please refer to the clause 2.4.



**Test Result**

Ant. Pol.	Horizontal
Test Mode:	GFSK Mode 2402MHz



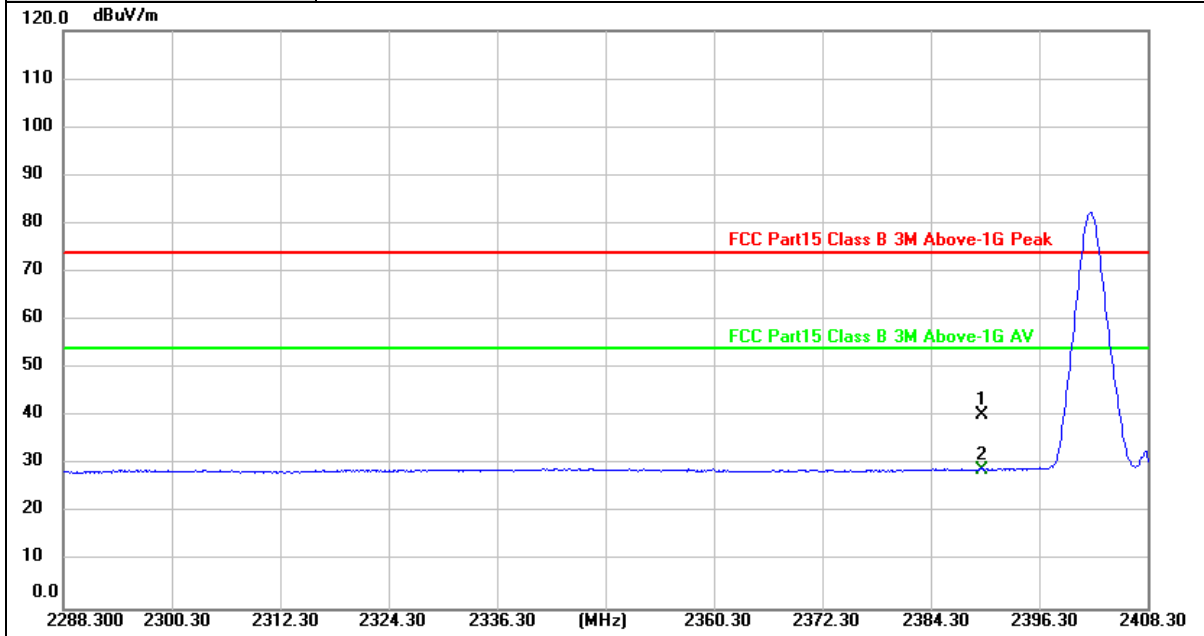
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	48.04	-7.72	40.32	74.00	-33.68	peak
2 *	2390.000	37.31	-7.72	29.59	54.00	-24.41	AVG

Remarks:

- 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2.Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	GFSK Mode 2402MHz



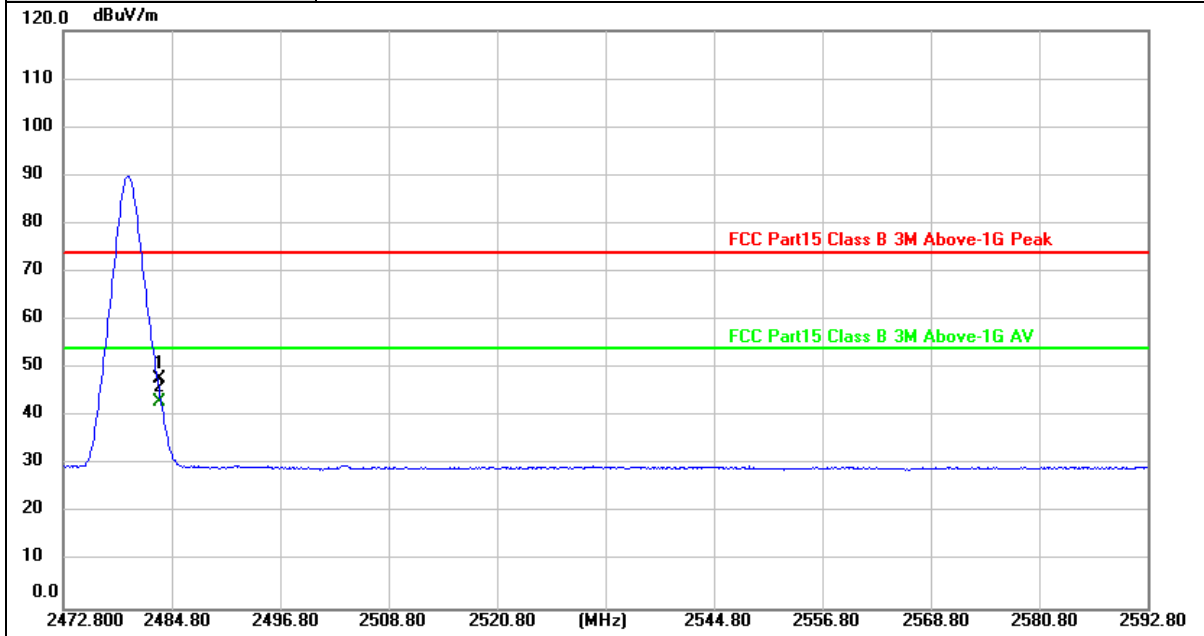
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	48.22	-7.72	40.50	74.00	-33.50	peak
2 *	2390.000	36.81	-7.72	29.09	54.00	-24.91	AVG

Remarks:

- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value



Ant. Pol.	Horizontal
Test Mode:	GFSK Mode 2480MHz



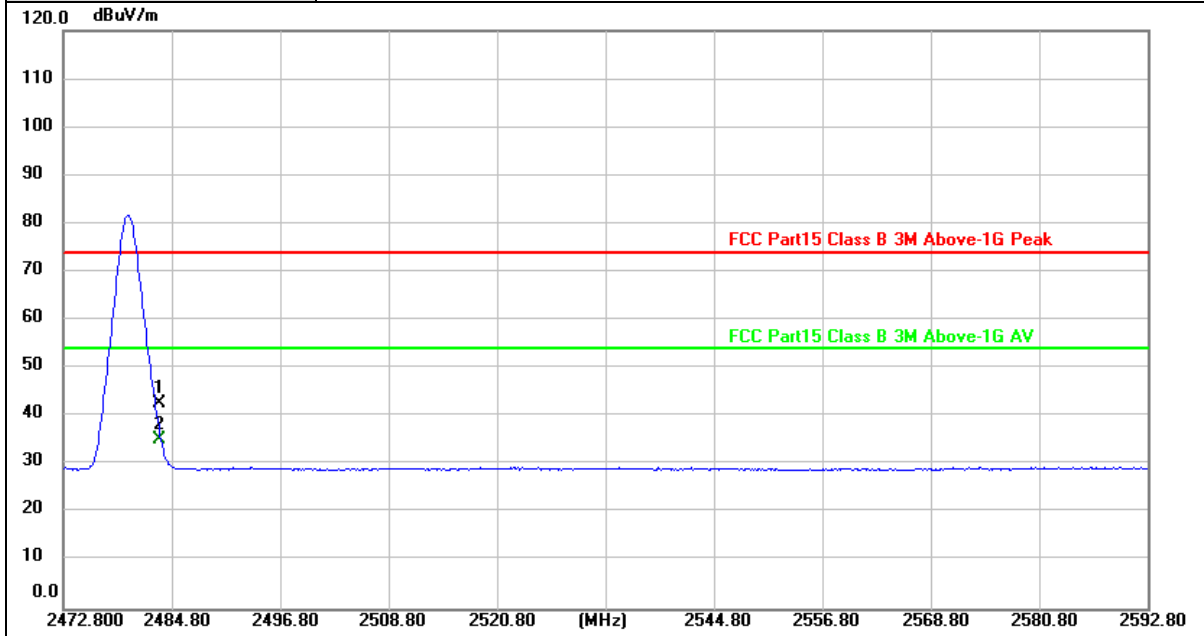
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	55.18	-7.32	47.86	74.00	-26.14	peak
2 *	2483.500	50.49	-7.32	43.17	54.00	-10.83	AVG

Remarks:

- 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2. Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	GFSK Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	50.14	-7.32	42.82	74.00	-31.18	peak
2 *	2483.500	42.63	-7.32	35.31	54.00	-18.69	AVG

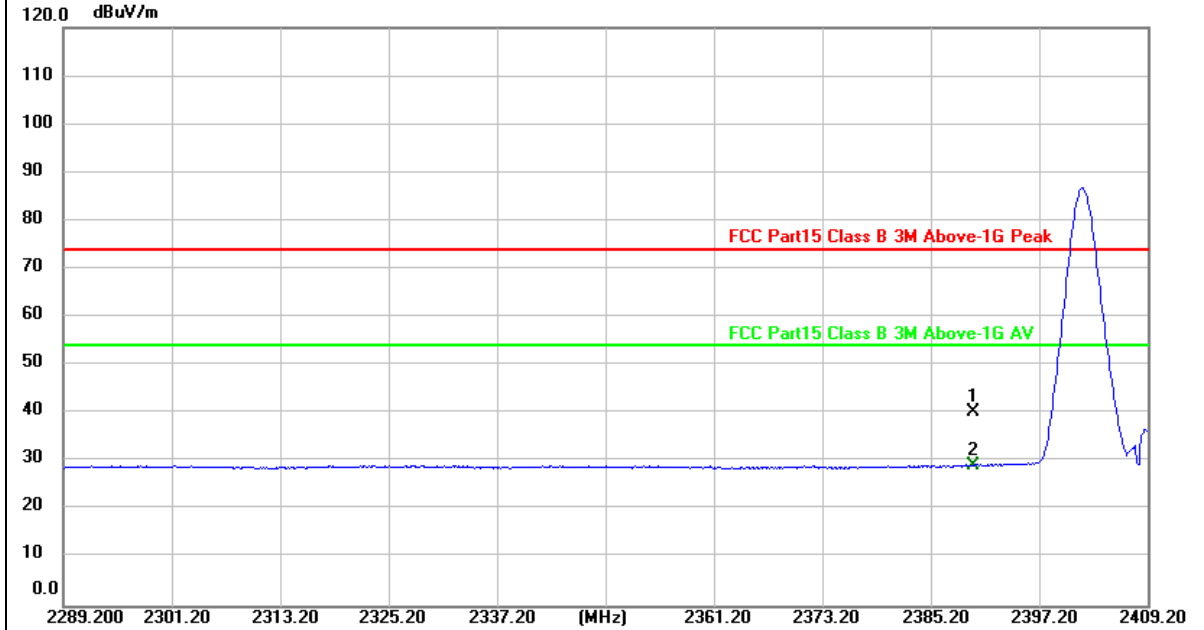
Remarks:

- 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2.Margin value = Level -Limit value





Ant. Pol.	Horizontal
Test Mode:	$\pi/4$ -DQPSK Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	48.15	-7.72	40.43	74.00	-33.57	peak
2 *	2390.000	37.09	-7.72	29.37	54.00	-24.63	AVG

Remarks:

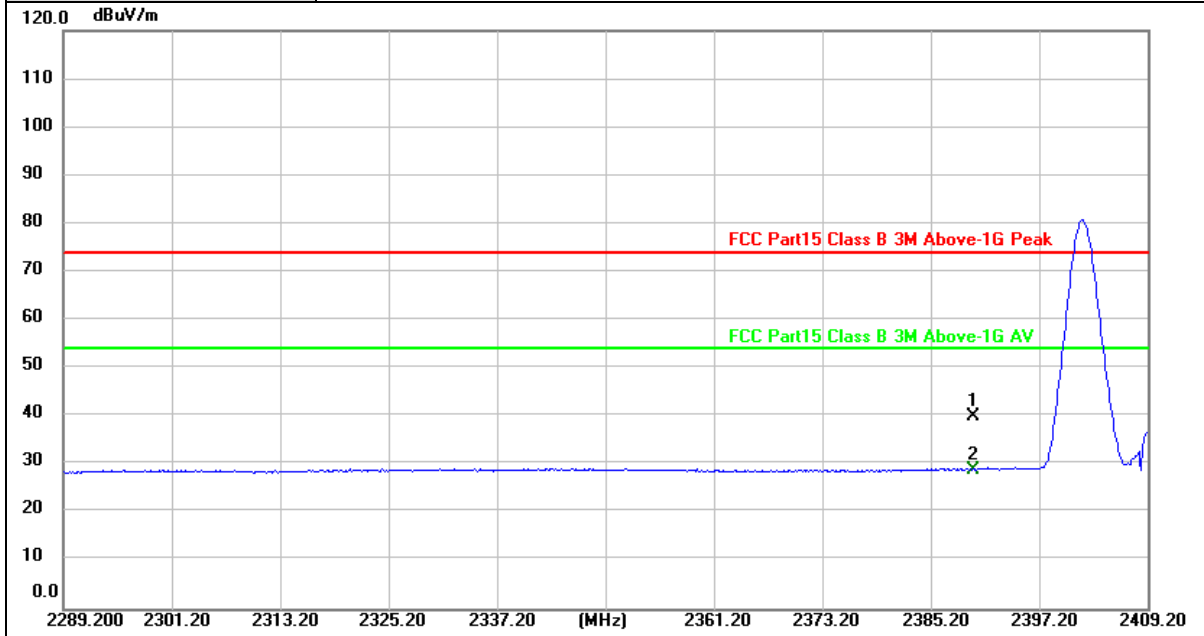
- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value







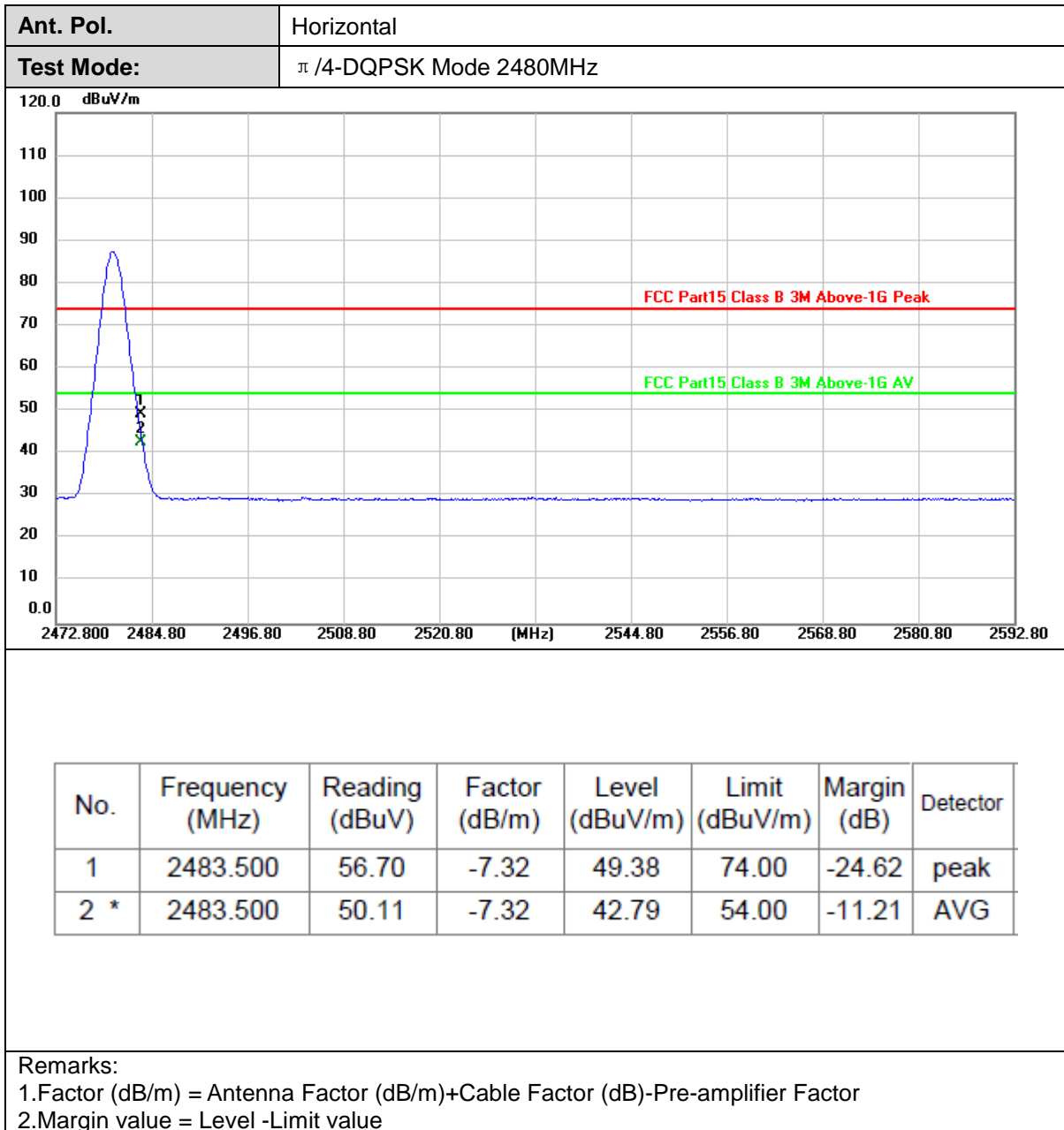
Ant. Pol.	Vertical
Test Mode:	$\pi/4$ -DQPSK Mode 2402MHz

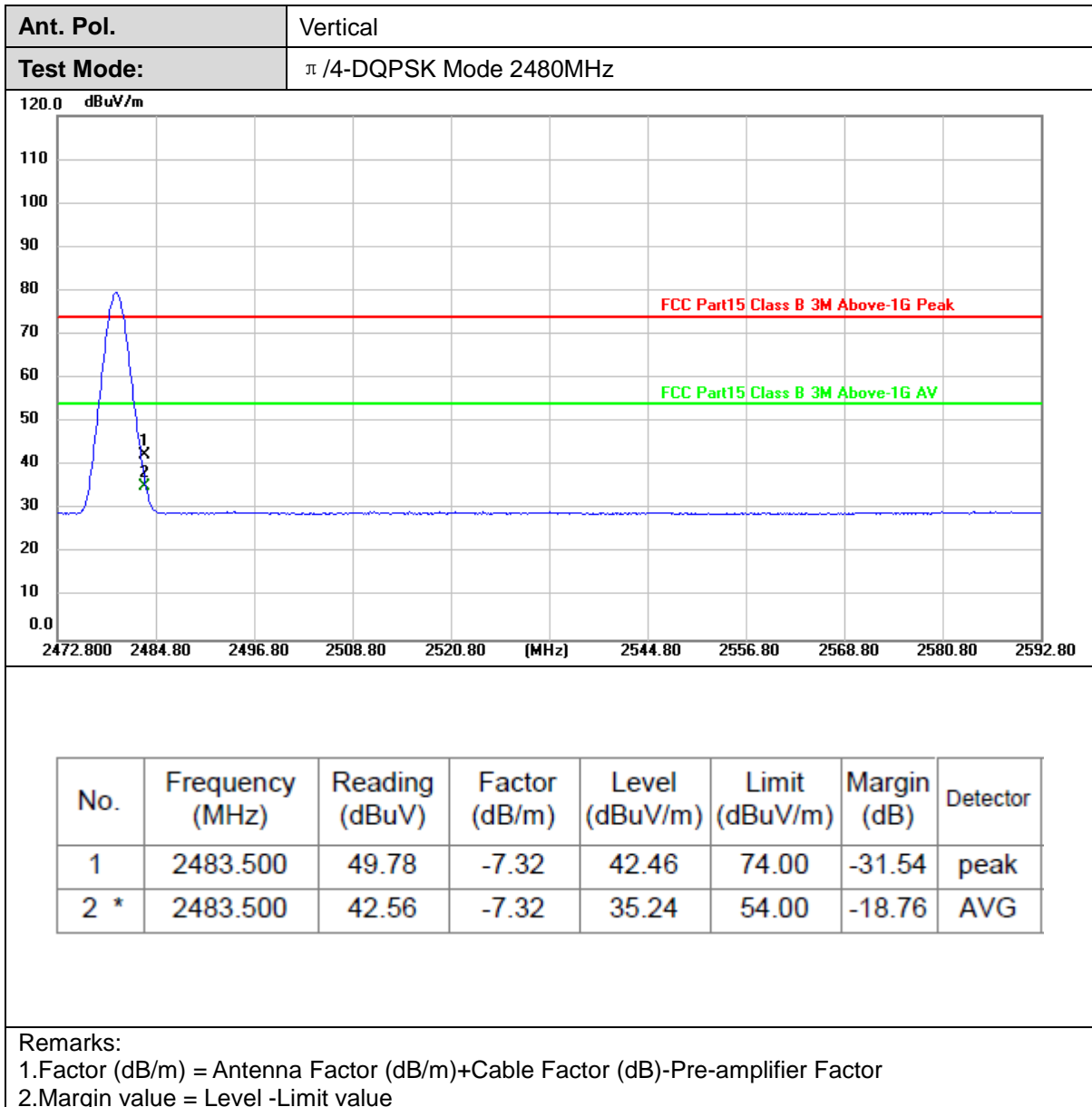


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	47.70	-7.72	39.98	74.00	-34.02	peak
2 *	2390.000	36.79	-7.72	29.07	54.00	-24.93	AVG

Remarks:

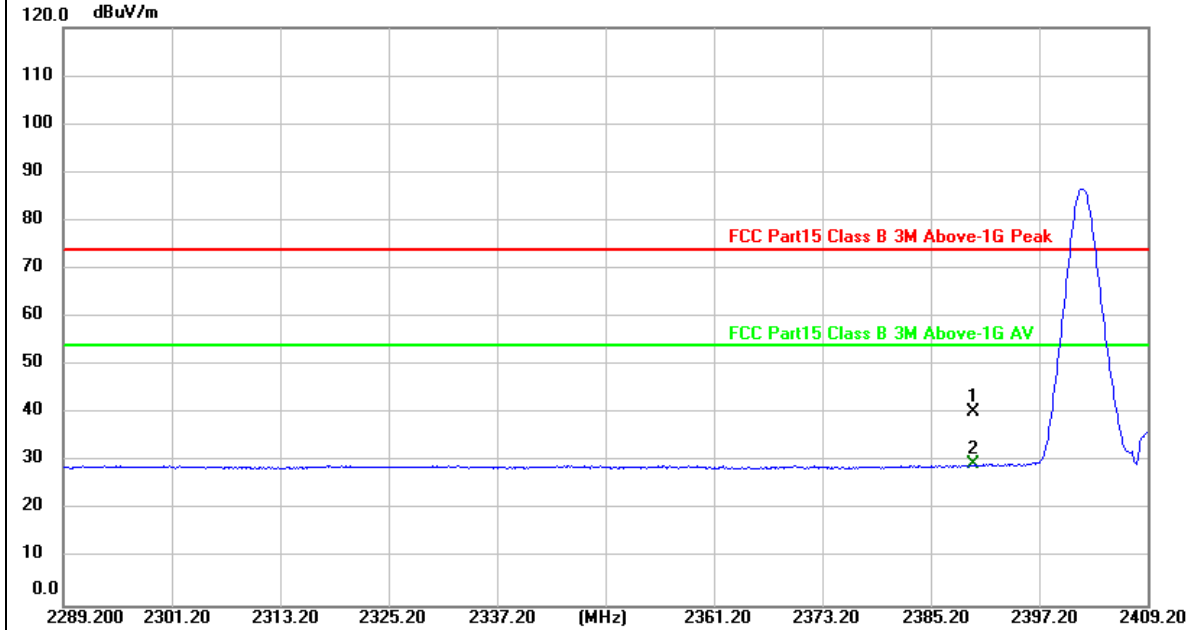
- 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2. Margin value = Level -Limit value







Ant. Pol.	Horizontal
Test Mode:	8-DPSK Mode 2402MHz



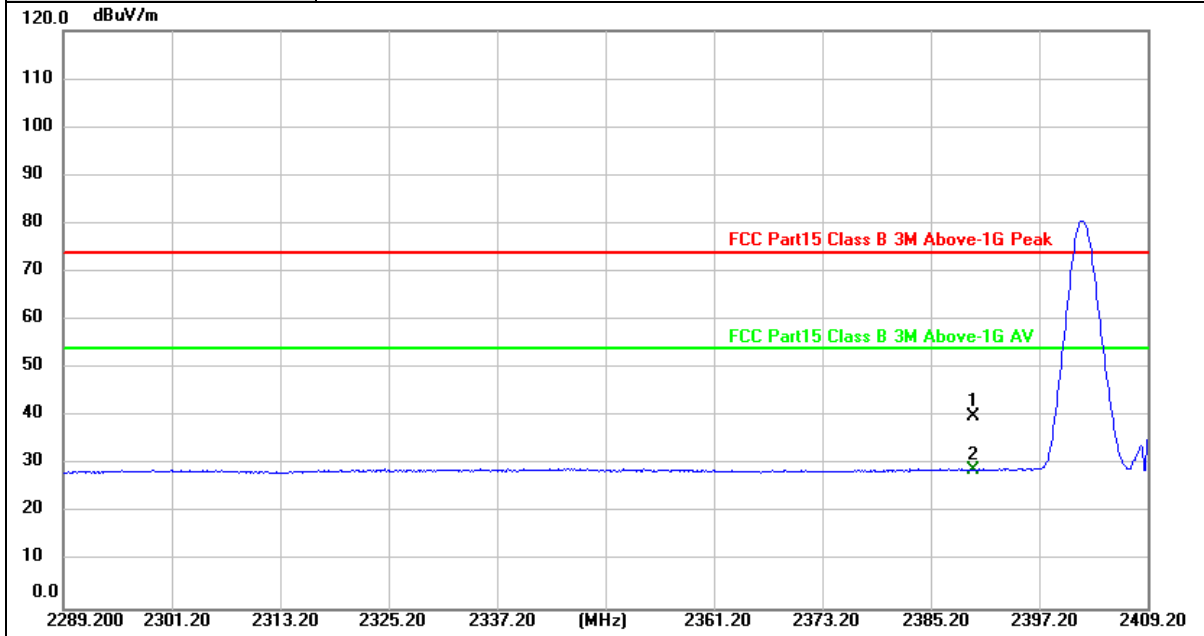
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	47.98	-7.72	40.26	74.00	-33.74	peak
2 *	2390.000	37.17	-7.72	29.45	54.00	-24.55	AVG

Remarks:

- 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2.Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	8-DPSK Mode 2402MHz

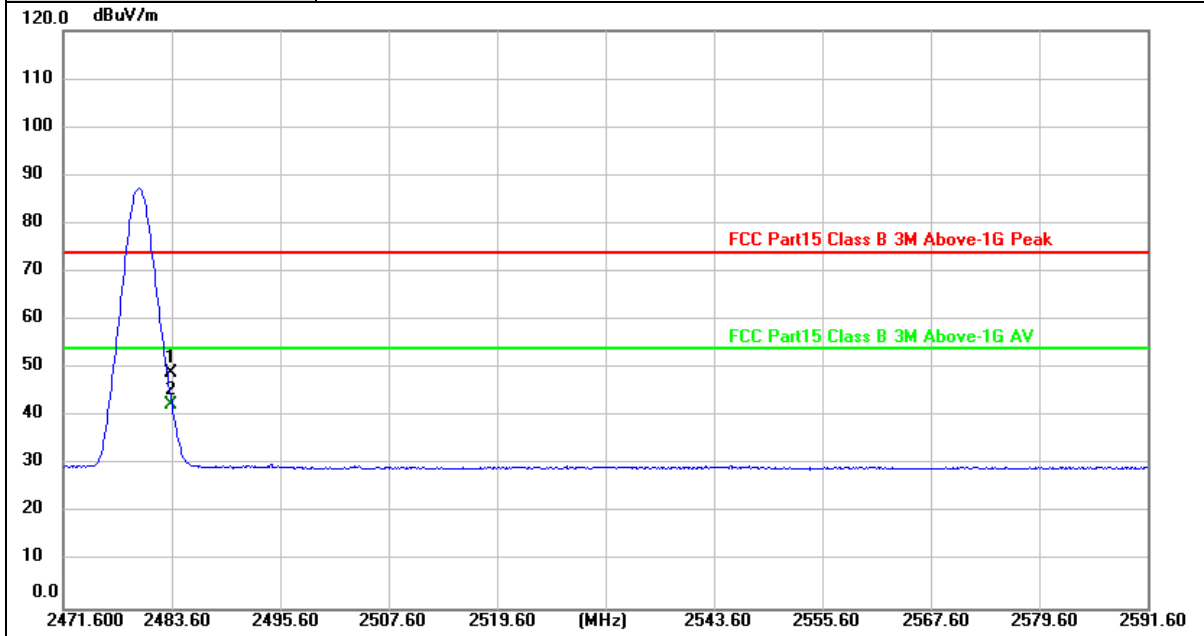


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	47.78	-7.72	40.06	74.00	-33.94	peak
2 *	2390.000	36.67	-7.72	28.95	54.00	-25.05	AVG

Remarks:  
 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor  
 2. Margin value = Level -Limit value



Ant. Pol.	Horizontal
Test Mode:	8-DPSK Mode 2480MHz



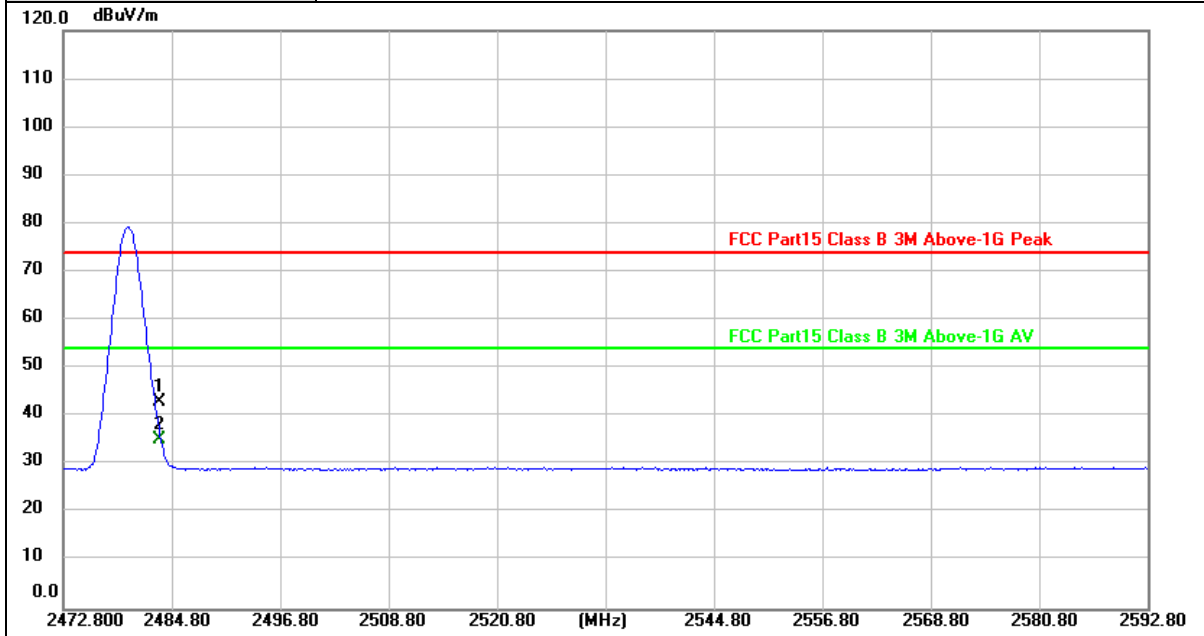
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	56.25	-7.32	48.93	74.00	-25.07	peak
2 *	2483.500	49.92	-7.32	42.60	54.00	-11.40	AVG

Remarks:

- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	8-DPSK Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	50.28	-7.32	42.96	74.00	-31.04	peak
2 *	2483.500	42.47	-7.32	35.15	54.00	-18.85	AVG

Remarks:

- 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2.Margin value = Level -Limit value



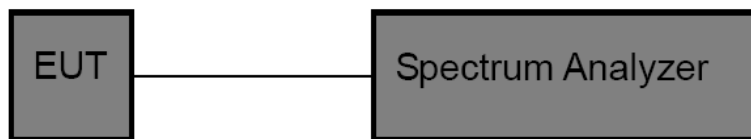
### 3.4. Band Edge and Spurious Emissions (Conducted)

#### Limit

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d) / RSS-247 5.5**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

#### Test Configuration



#### Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:  
RBW = 100 kHz, VBW  $\geq$  RBW, scan up through 10<sup>th</sup> harmonic.  
Sweep = auto, Detector function = peak, Trace = max hold.
4. Measure and record the results in the test report.

#### Test Mode

Please refer to the clause 2.4.



**Test Result**

## Non-Hopping

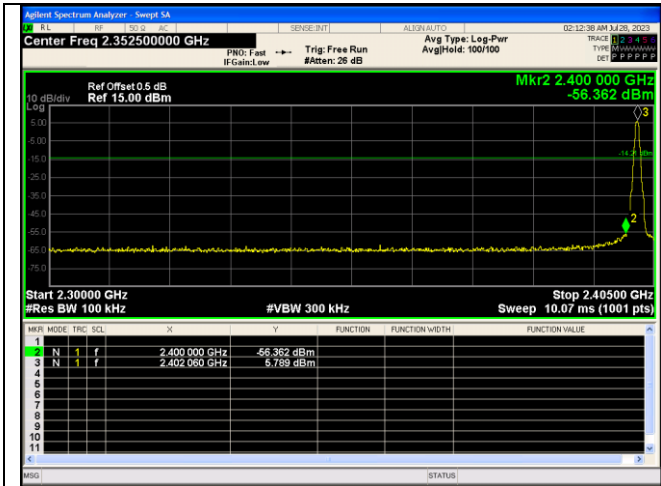
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Result	
GFSK	DH5	0	2400.00	-56.362	-14.21	PASS	
			24939.4	-51.266	-14.21	PASS	
		78	39	23856.3	-51.913	-13.8	PASS
			78	2483.50	-61.713	-14.79	PASS
				24811.5	-51.871	-14.79	PASS
$\pi/4$ DQPSK	2-DH5	0	2400.00	-51.812	-13.1	PASS	
			24887.6	-51.461	-13.1	PASS	
		78	39	23608.5	-51.300	-13.51	PASS
			78	2483.50	-62.468	-15.3	PASS
				23584.8	-51.509	-15.3	PASS
8DPSK	3-DH5	0	2400.00	-51.313	-13.09	PASS	
			23338.2	-51.985	-13.09	PASS	
		78	39	23596.7	-51.584	-13.46	PASS
			78	2483.50	-62.022	-15.48	PASS
				23466.2	-52.220	-15.48	PASS

## Hopping

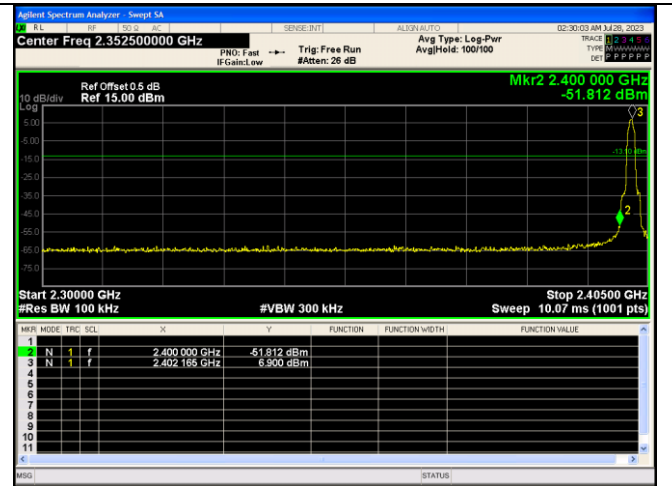
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Result
GFSK	DH5	Hopping	2400.00	-58.085	-15.22	PASS
			2483.50	-62.421	-15.13	PASS
$\pi/4$ DQPSK	2-DH5		2400.00	-54.263	-13.80	PASS
			2483.50	-63.379	-15.12	PASS
8DPSK	3-DH5		2400.00	-54.798	-13.99	PASS
			2483.50	-61.375	-14.93	PASS



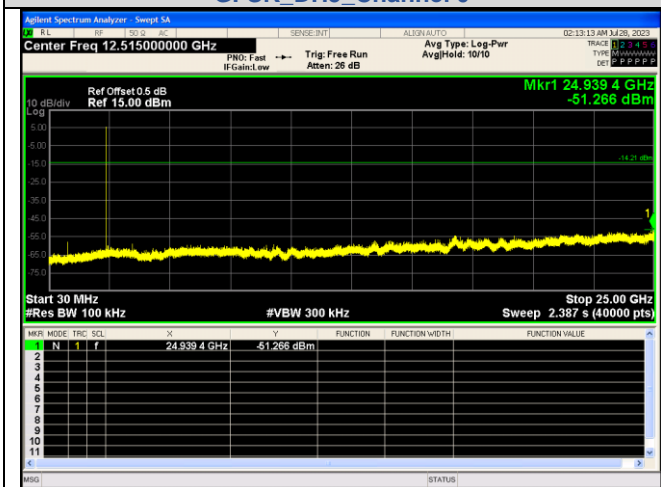
Test plot as follows:



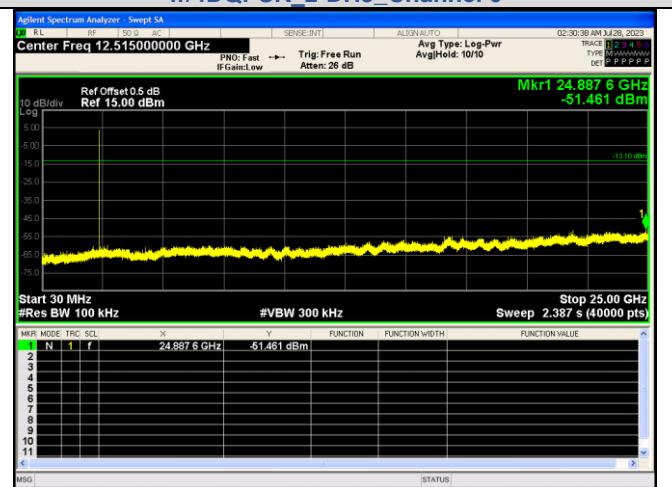
Out Of Band Emission  
GFSK DH5 Channel 0



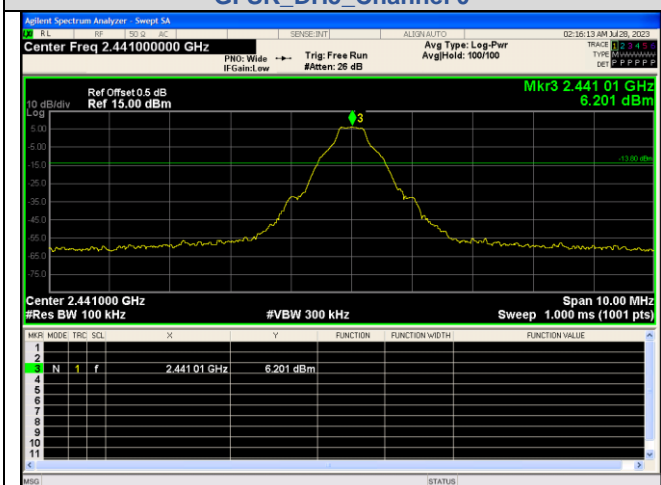
Out Of Band Emission  
 $\pi/4$ DQPSK 2-DH5 Channel 0



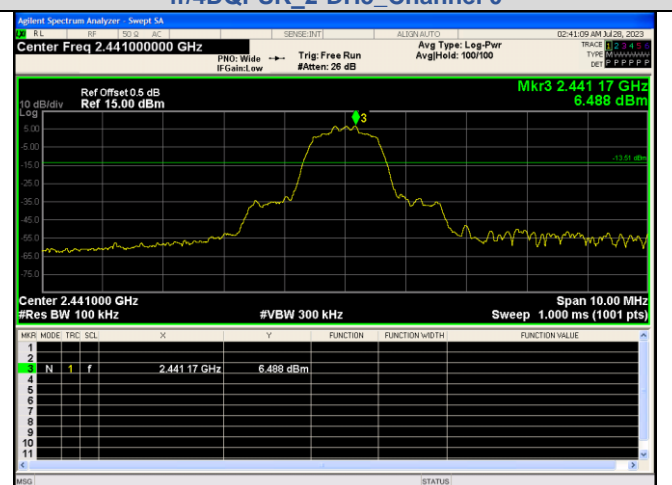
Spurious Emission  
GFSK DH5 Channel 0



Spurious Emission  
 $\pi/4$ DQPSK 2-DH5 Channel 0



Out Of Band Emission  
GFSK DH5 Channel 39



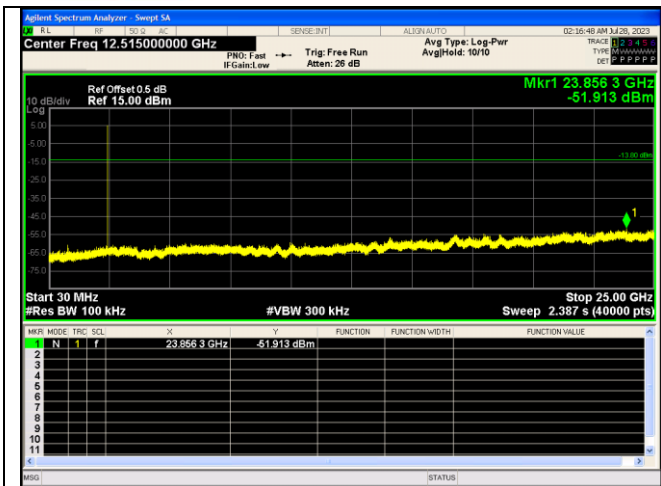
Out Of Band Emission  
 $\pi/4$ DQPSK 2-DH5 Channel 39

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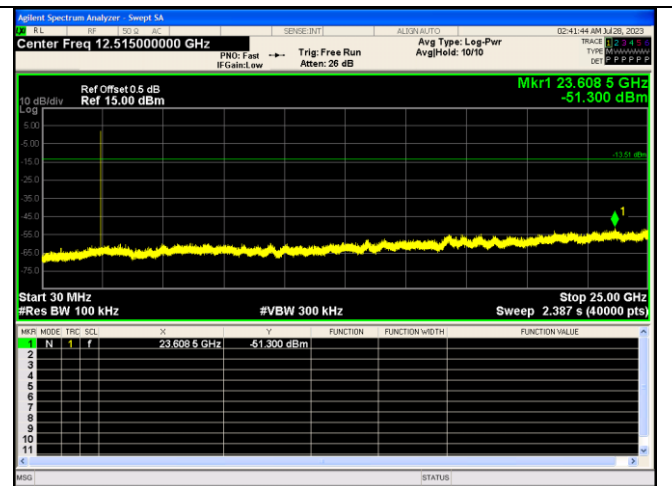
2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China  
Tel.: (86)755-27521059 Fax: (86)755-27521011 Http://www.sz-ctc.org.cn



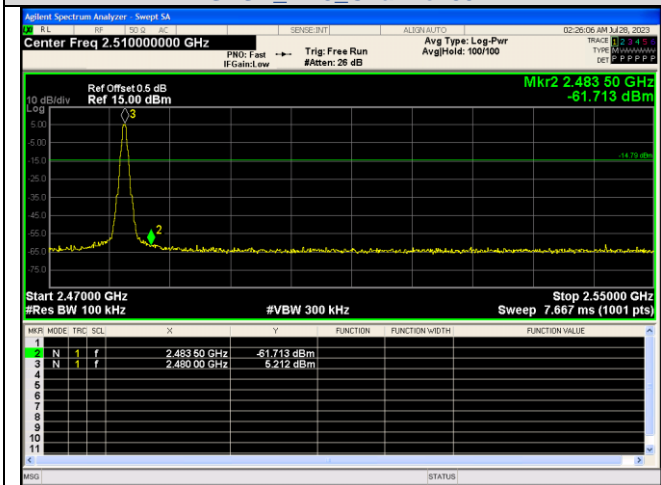
For anti-fake verification, please visit the official website of Certification and Accreditation Administration of the People's Republic of China : <http://yz.cnca.cn>



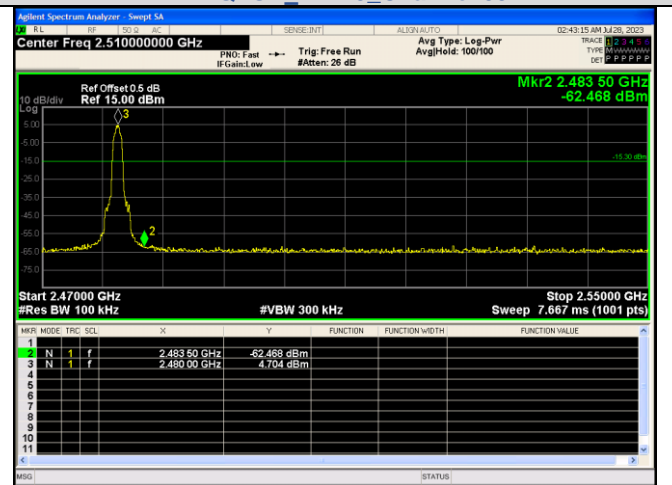
Spurious Emissions GFSK\_DH5\_Channel 39



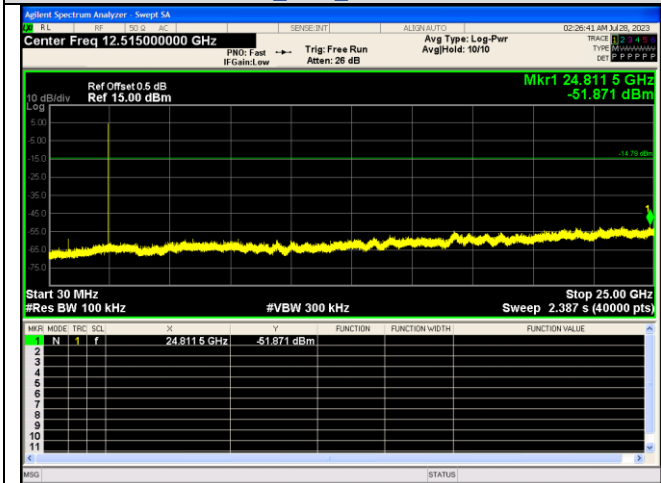
Spurious Emissions pi/4DQPSK\_2-DH5\_Channel 39



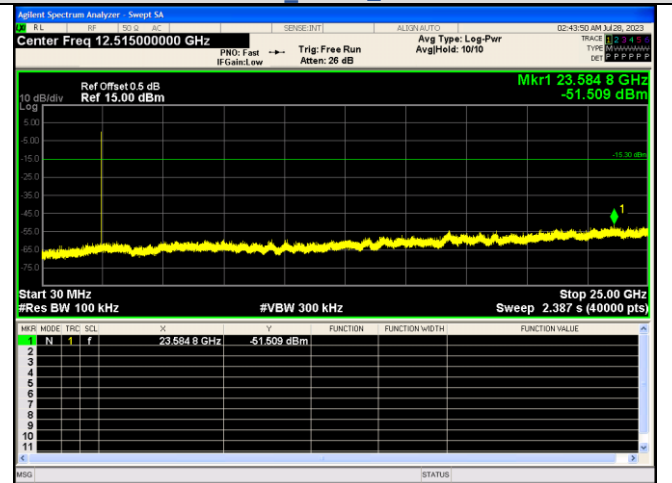
Out Of Band Emission GFSK\_DH5\_Channel 78



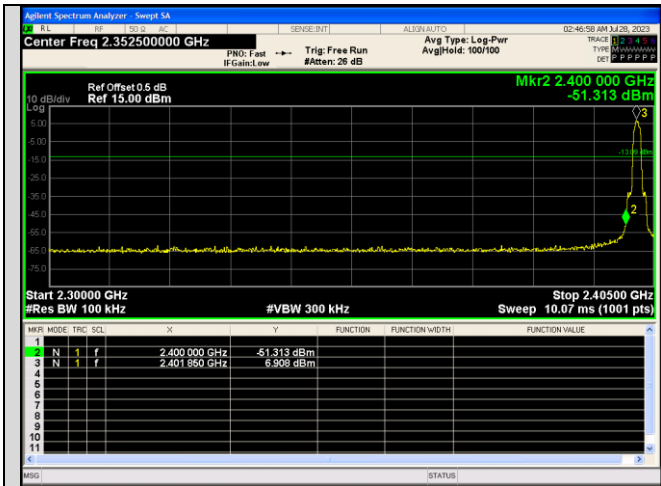
Out Of Band Emission pi/4DQPSK\_2-DH5\_Channel 78



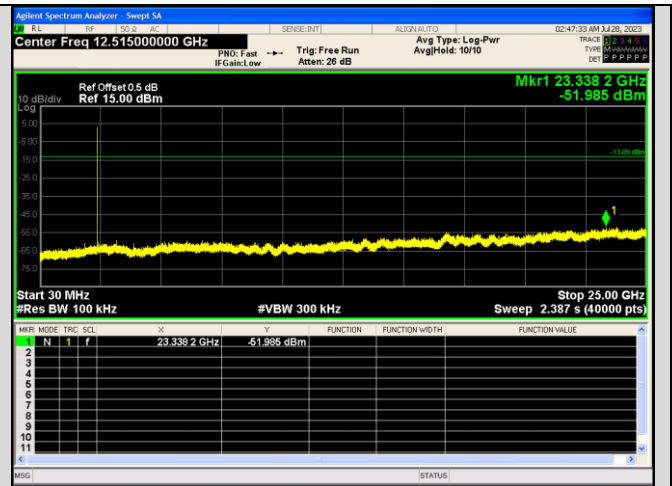
Spurious Emission GFSK\_DH5\_Channel 78



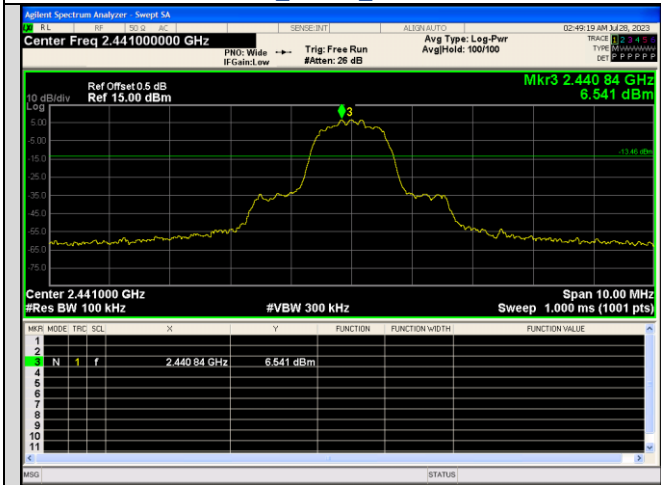
Spurious Emission pi/4DQPSK\_2-DH5\_Channel 78



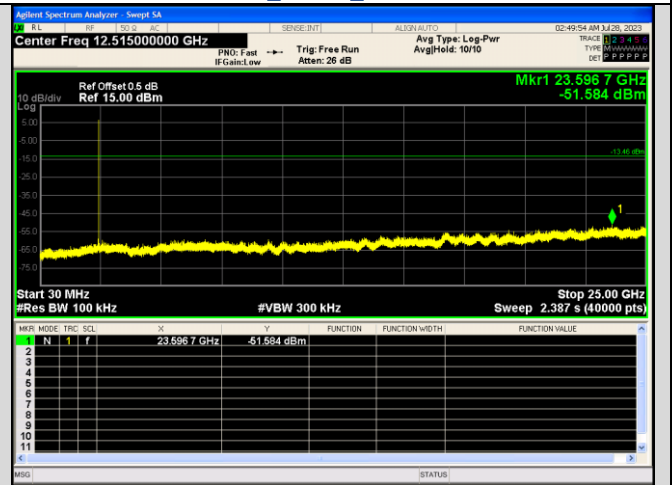
Out Of Band Emission 8DPSK\_3-DH5\_Channel 0



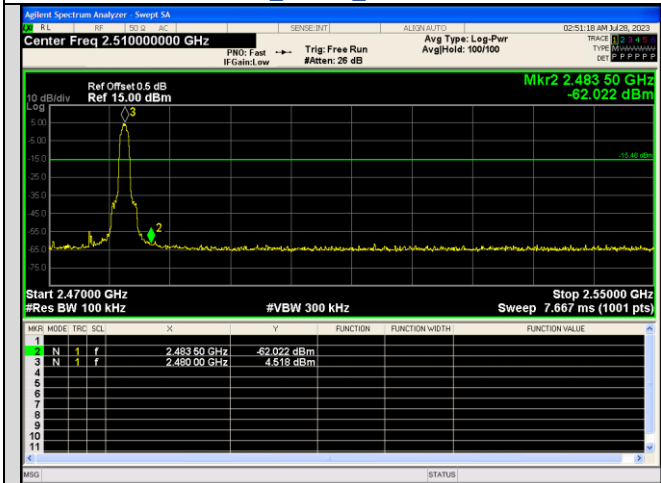
Spurious Emission 8DPSK\_3-DH5\_Channel 0



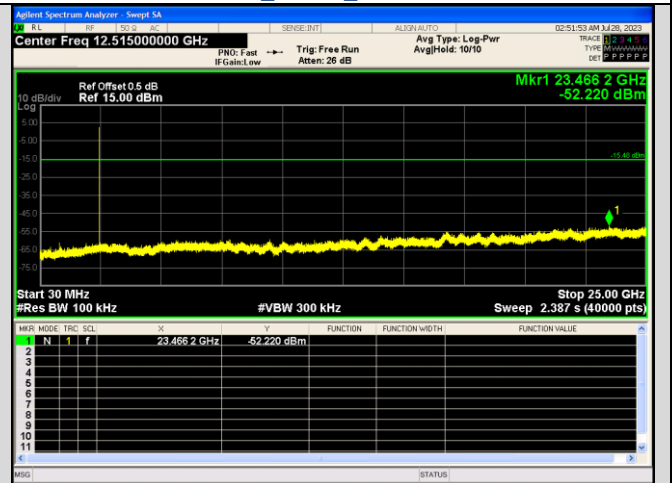
Out Of Band Emission 8DPSK\_3-DH5\_Channel 39



Spurious Emissions 8DPSK\_3-DH5\_Channel 39

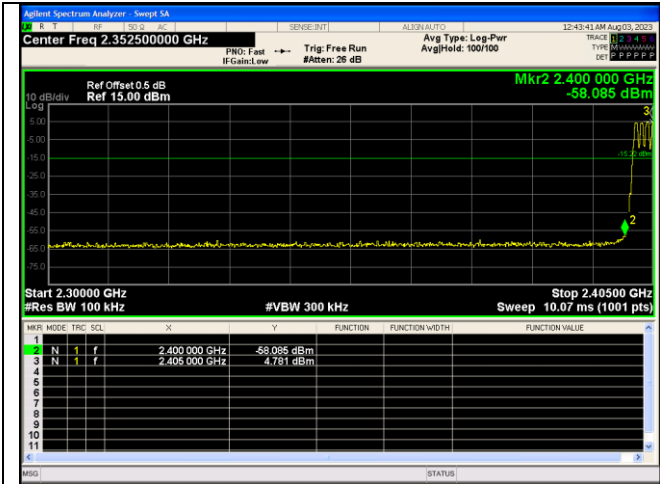


Out Of Band Emission 8DPSK\_3-DH5\_Channel 78

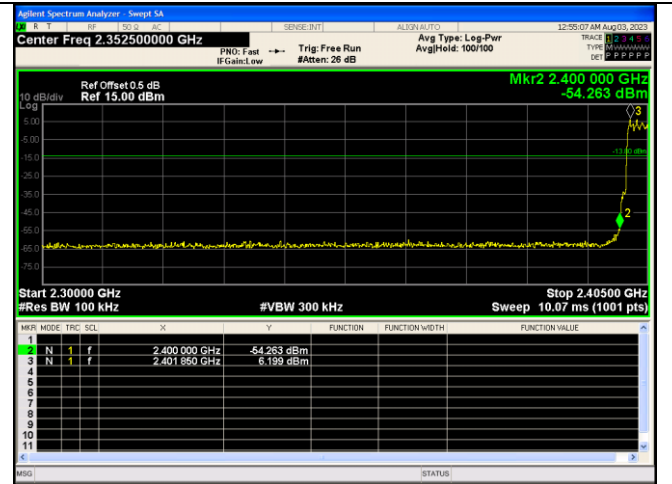


Spurious Emission 8DPSK\_3-DH5\_Channel 78

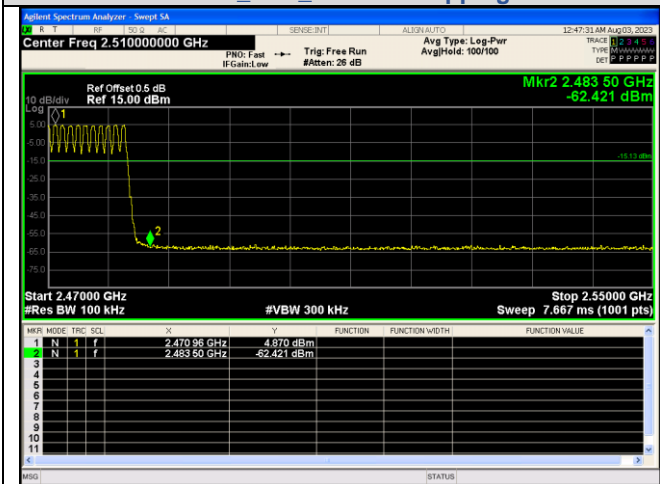




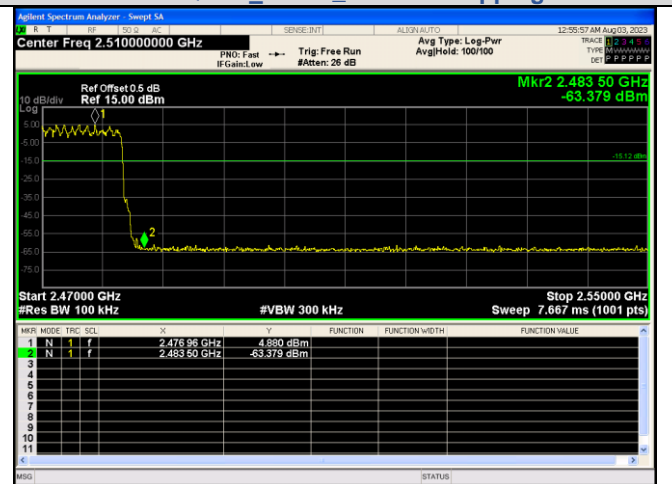
Out Of Band Emission(Left)  
GFSK DH5 Channel Hopping



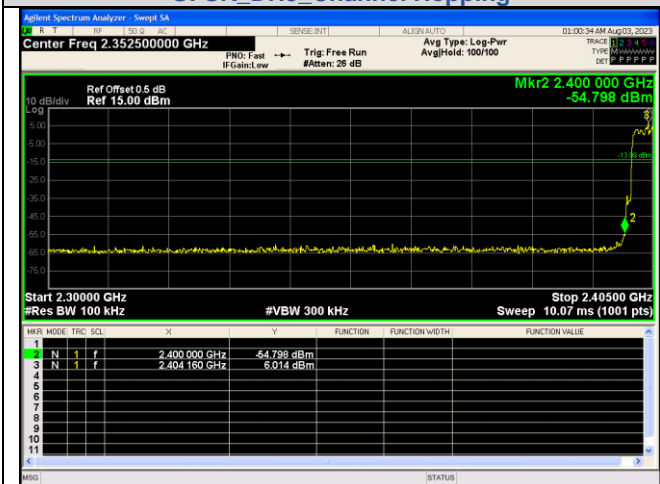
Out Of Band Emission(Left)  
 $\pi/4$ DQPSK 2-DH5 Channel Hopping



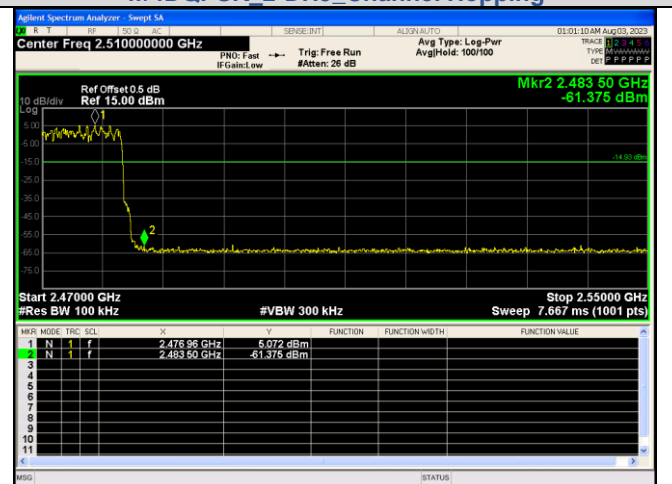
Out Of Band Emission(Right)  
GFSK DH5 Channel Hopping



Out Of Band Emission(Right)  
 $\pi/4$ DQPSK 2-DH5 Channel Hopping



Out Of Band Emission(Left)  
8DPSK 3-DH5 Channel Hopping



Out Of Band Emission(Right)  
8DPSK 3-DH5 Channel Hopping

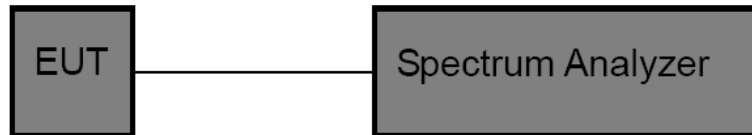


### 3.5. 20dB Bandwidth

#### Limit

N/A

#### Test Configuration



#### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. OCB and 20dB Spectrum Setting:
  - (1) Set RBW = 1% ~ 5% occupied bandwidth.
  - (2) Set the video bandwidth (VBW)  $\geq 3$  RBW.
  - (3) Detector = Peak.
  - (4) Trace mode = Max hold.
  - (5) Sweep = Auto couple.

Note: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

#### Test Mode

Please refer to the clause 2.4.

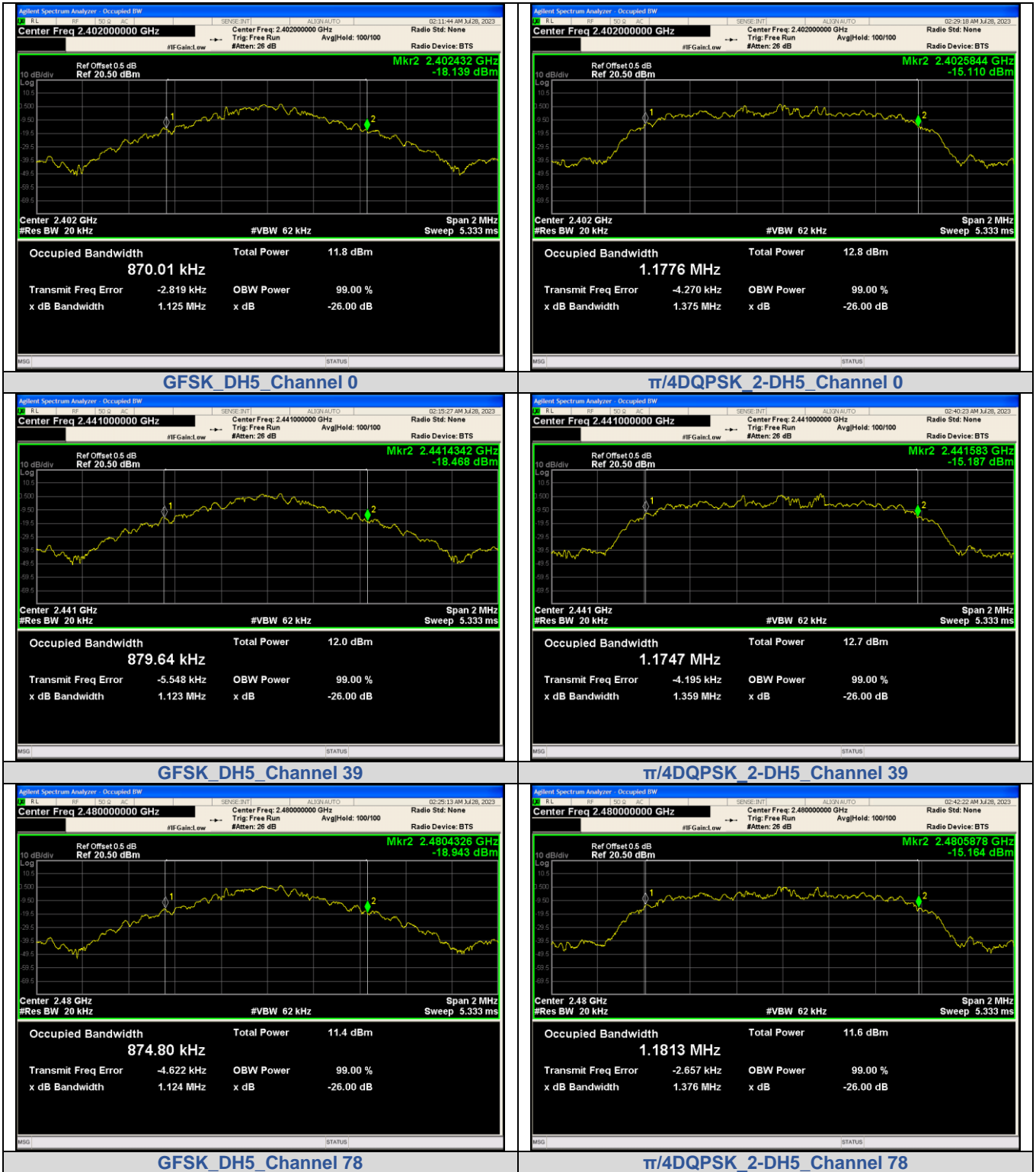
#### Test Result

Modulation	Channel	99% Bandwidth (MHz)	20 dB Bandwidth (MHz)	20dB Bandwidth *2/3 (MHz)
GFSK	0	0.87001	0.9604	0.640
	39	0.87964	0.9564	0.638
	78	0.87480	0.9566	0.638
$\pi/4$ DQPSK	0	1.1776	1.278	0.852
	39	1.1747	1.277	0.851
	78	1.1813	1.276	0.851
8DPSK	0	1.1900	1.293	0.862
	39	1.1822	1.296	0.864
	78	1.1781	1.289	0.859





99% Bandwidth:



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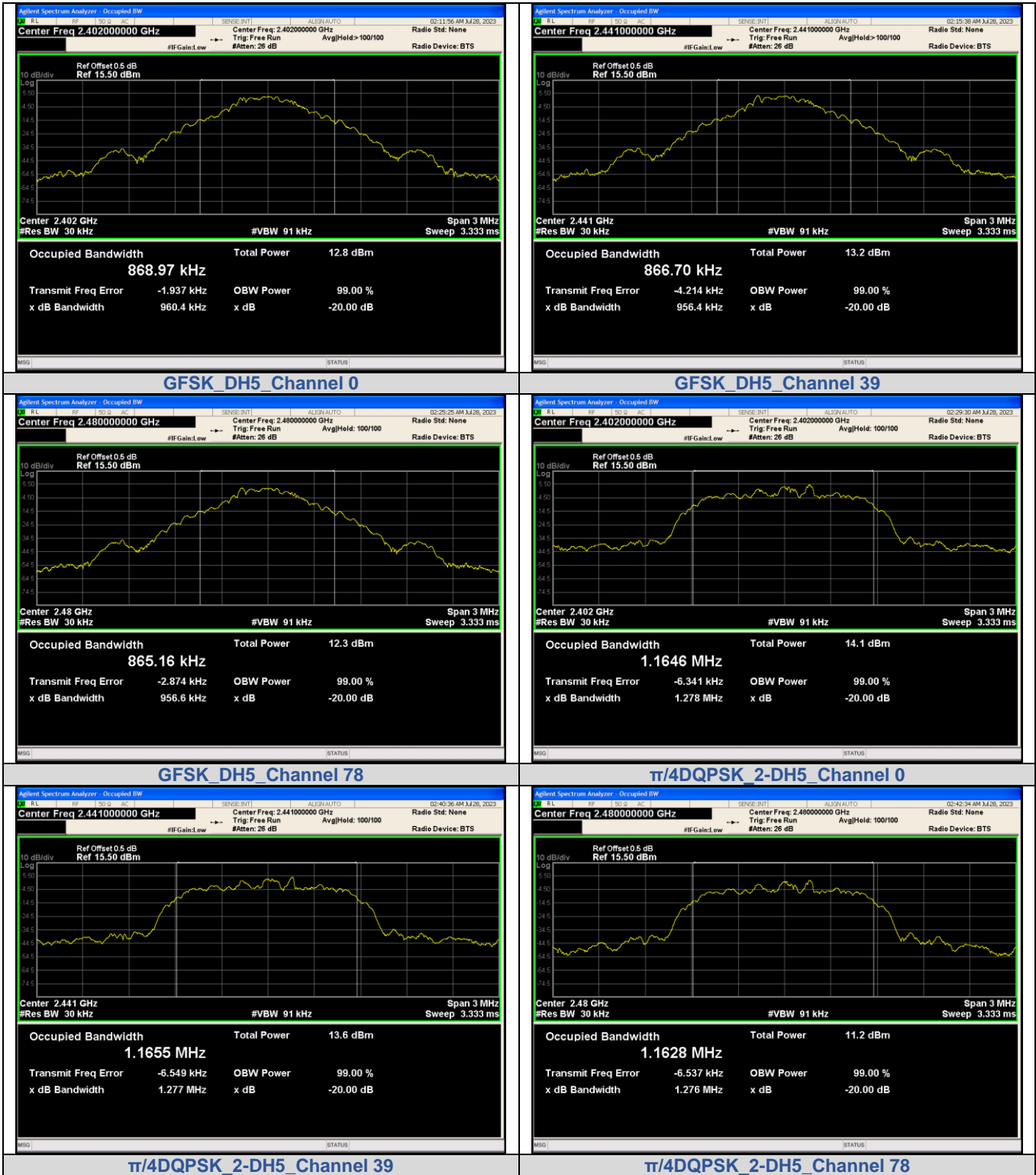
2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China  
Tel.: (86)755-27521059 Fax: (86)755-27521011 Http://www.sz-ctc.org.cn



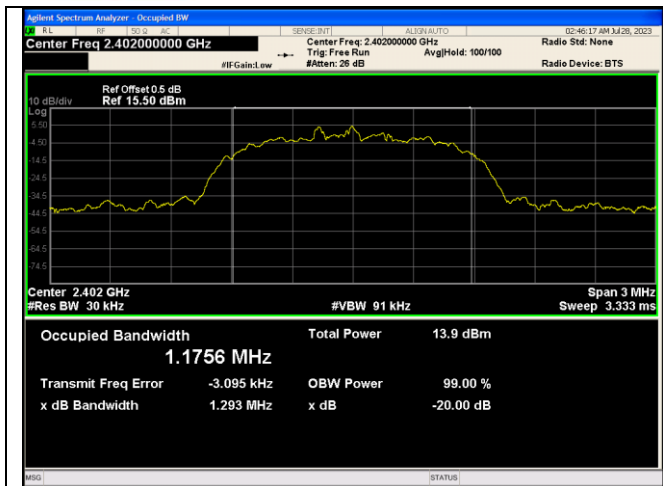
For anti-fake verification, please visit the official website of Certification and Accreditation Administration of the People's Republic of China : <http://yz.cnca.cn>



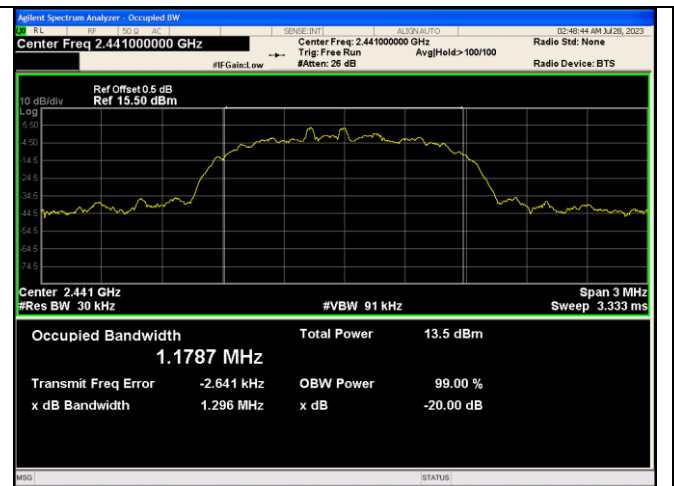
20dB Bandwidth:



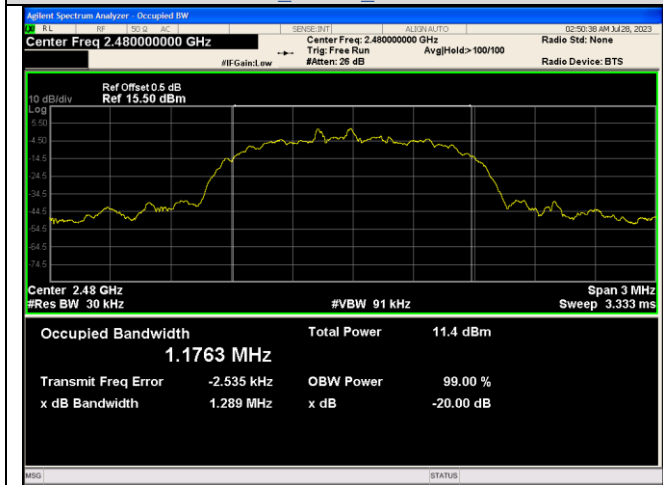




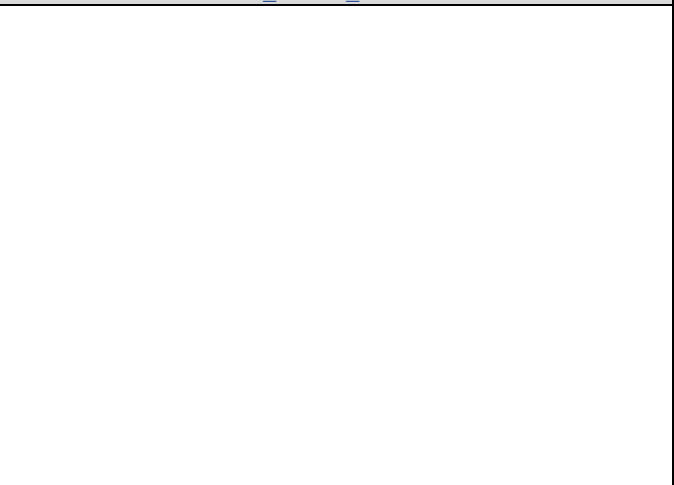
8DPSK 3-DH5 Channel 0



8DPSK\_3-DH5\_Channel 39



8DPSK\_3-DH5\_Channel 78





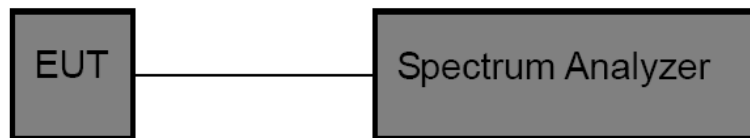
### 3.6. Channel Separation

#### Limit

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1) / RSS-247 5.1 b

Test Item	Limit	Frequency Range (MHz)
Channel Separation	>25kHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

#### Test Configuration



#### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
  - (1) Set RBW = 100 kHz.
  - (2) Set the video bandwidth (VBW)  $\geq 3$  RBW.
  - (3) Detector = Peak.
  - (4) Trace mode = Max hold.
  - (5) Sweep = Auto couple.

#### Test Mode

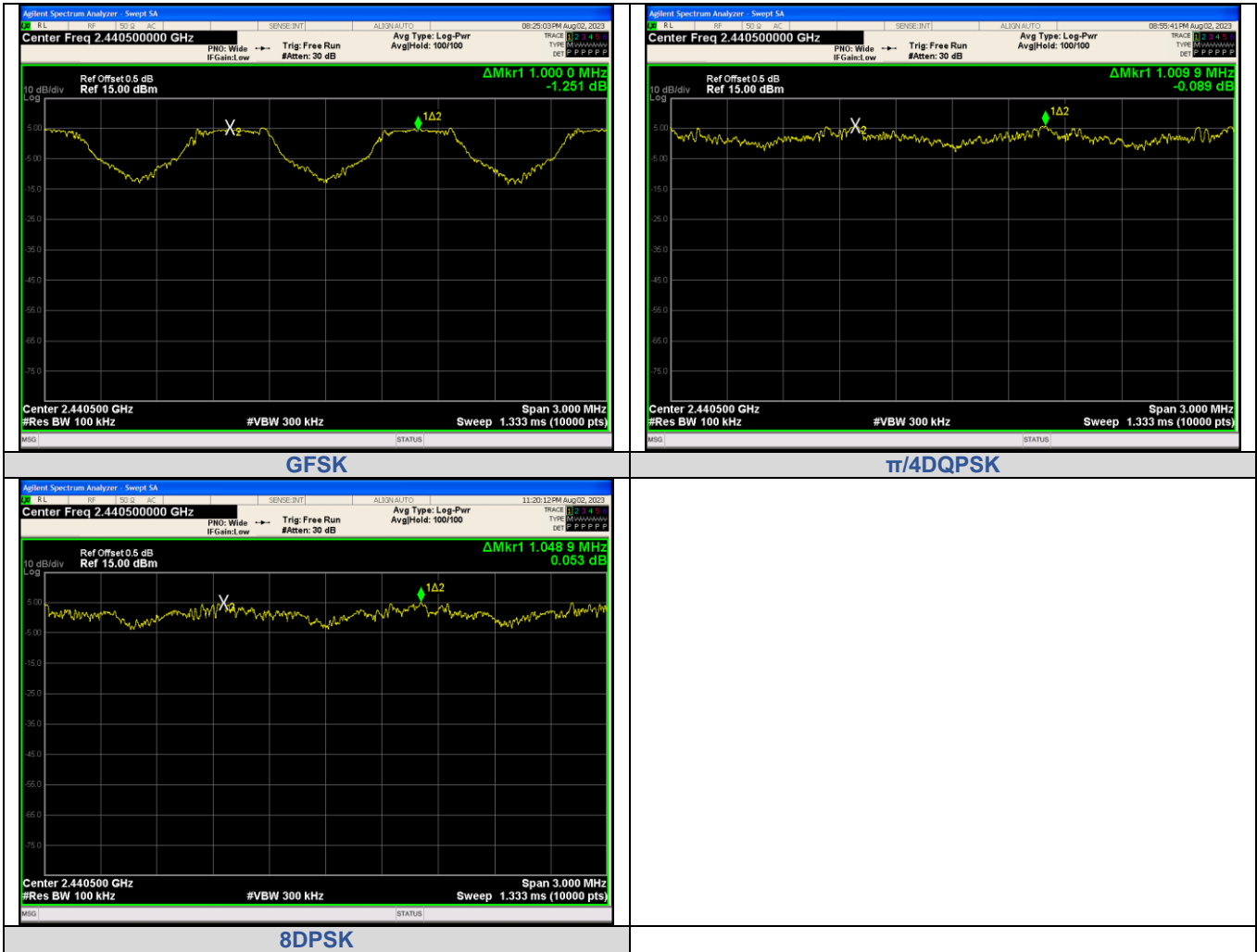
Please refer to the clause 2.4.

#### Test Result

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2439.9901	2441.1632	1	0.638	PASS
$\pi/4$ DQPSK	2-DH5	2439.9844	2440.9943	1.0099	0.851	PASS
8DPSK	3-DH5	2439.9568	2441.0057	1.0489	0.864	PASS



Test plot as follows:





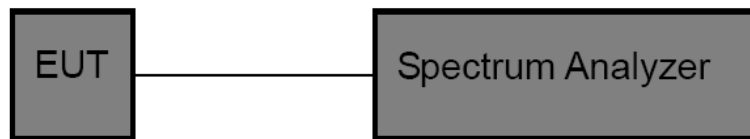
### 3.7. Number of Hopping Channel

#### Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(iii) / RSS-247 5.1 d

Section	Test Item	Limit
15.247 (a)(iii) RSS-247 5.1 d	Number of Hopping Channel	≥15

#### Test Configuration



#### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
  - (1) Peak Detector: RBW=100 kHz, VBW ≥ RBW, Sweep time= Auto.

#### Test Mode

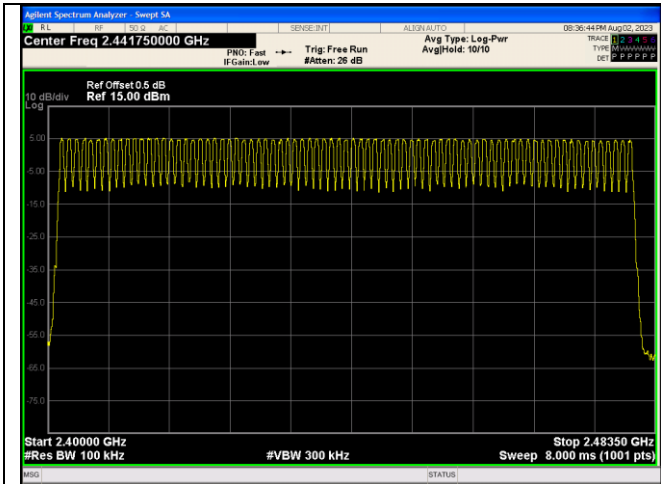
Please refer to the clause 2.4.

#### Test Result

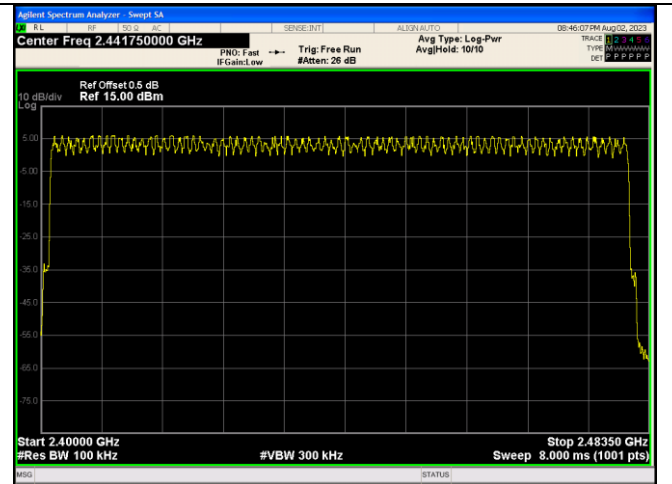
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS



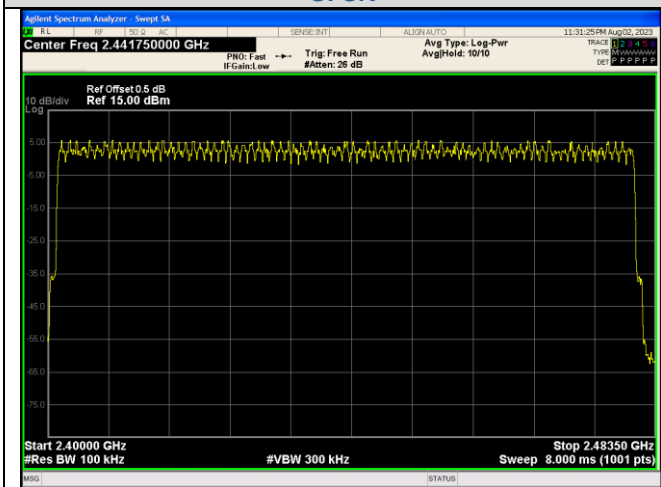
Test plot as follows:



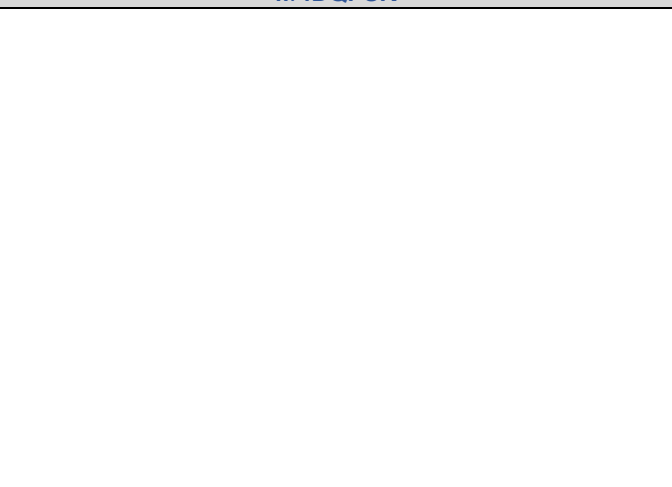
Hopping Plot  
GFSK



Hopping Plot  
 $\pi/4$ DQPSK



Hopping Plot  
8DPSK





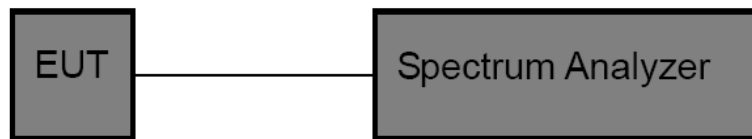
### 3.8. Dwell Time

#### Limit

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(iii) / RSS-247 5.1 d

Section	Test Item	Limit
15.247 (a)(iii) RSS-247 5.1 d	Average Time of Occupancy	0.4 sec

#### Test Configuration



#### Test Procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- Spectrum Setting:
  - Spectrum Setting: RBW=1MHz, VBW $\geq$ RBW.
  - Use video trigger with the trigger level set to enable triggering only on full pulses.
  - Sweep Time is more than once pulse time.
  - Set the center frequency on any frequency would be measure and set the frequency span to zero.
  - Measure the maximum time duration of one single pulse.
  - Set the EUT for packet transmitting.

#### Test Mode

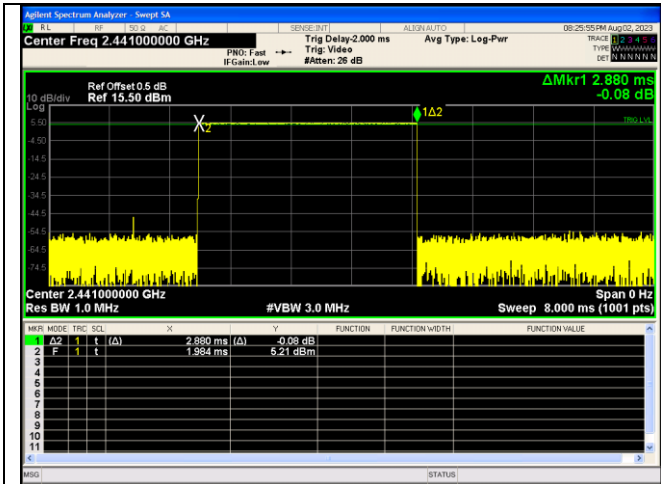
Please refer to the clause 2.4.

#### Test Result

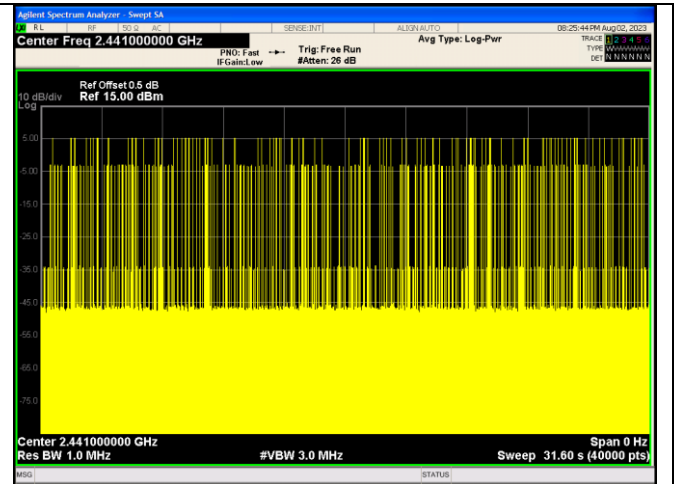
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH39	2.880	109	313.92	< 400	PASS
$\pi/4$ DQPSK	2-DH5	CH39	2.896	110	318.56		PASS
8DPSK	3-DH5	CH39	2.880	111	319.68		PASS



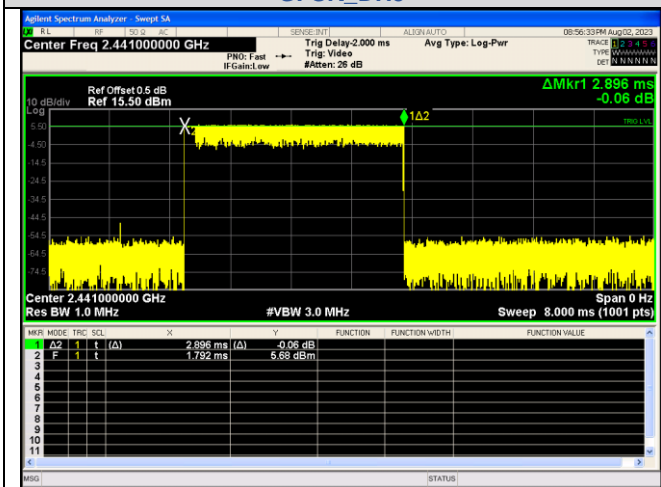
Test plot as follows:



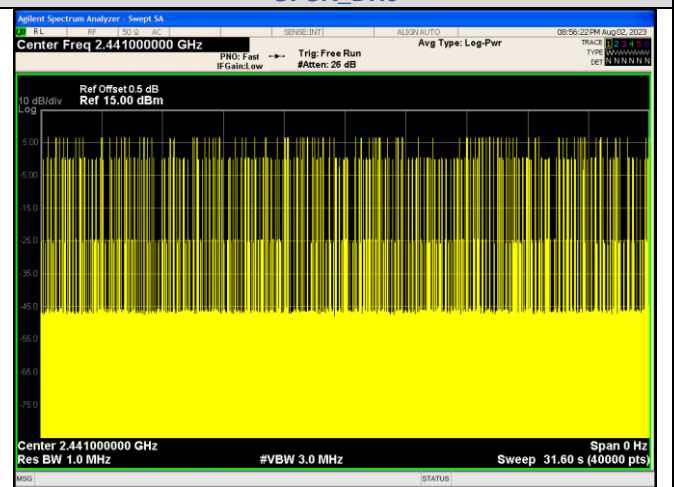
Pulse Width GFSK\_DH5



Number of Pulses in 31.6 seconds GFSK\_DH5



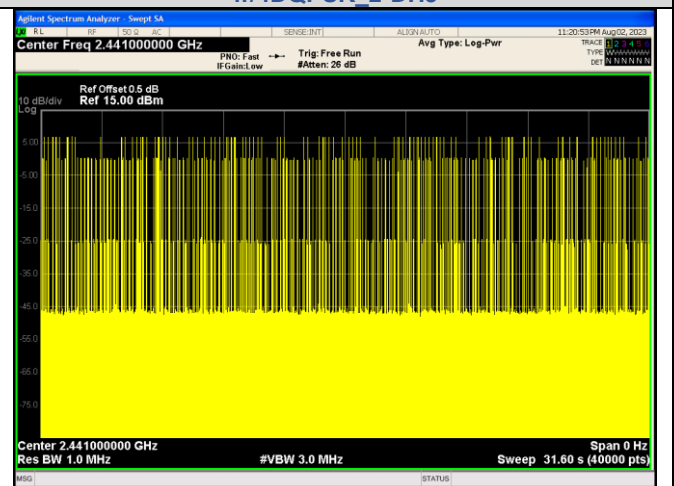
Pulse Width π/4DQPSK\_2-DH5



Number of Pulses in 31.6 seconds π/4DQPSK\_2-DH5



Pulse Width 8DPSK\_3-DH5



Number of Pulses in 31.6 seconds 8DPSK\_3-DH5

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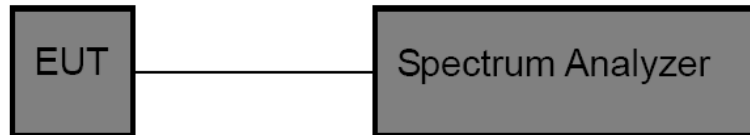
### 3.9. Peak Output Power

#### Limit

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1) / RSS-247 5.4 b

Section	Test Item	Limit	Frequency Range (MHz)
FCC CFR 47 Part 15.247 (b)(1)	Maximum Conducted Output Power	Hopping Channels $\geq 75$ , Power $< 1W(30dBm)$ ; Others $< 125mW(21dBm)$	2400~2483.5
ISED RSS-247 5.4 b	EIRP	4 Watt or 36dBm	2400~2483.5

#### Test Configuration



#### Test Procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- Spectrum Setting:
  - Set RBW  $> 20dB$  Bandwidth.
  - Set VBW  $\geq$  RBW.
  - Detector = Peak.
  - Trace mode = Max hold.
  - Sweep = Auto couple.
  - Span = Approximately five times the 20dB bandwidth, centered on a hopping channel.

#### Test Mode

Please refer to the clause 2.4.

#### Test Result

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	DH5	0	5.743	< 30	PASS
		39	6.119		PASS
		78	5.196		PASS
$\pi/4$ DQPSK	2-DH5	0	8.366		PASS
		39	7.991		PASS
		78	5.530		PASS
8DPSK	3-DH5	0	8.861		PASS
		39	8.501		PASS
		78	6.521		PASS

CTC Laboratories, Inc.

2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China  
Tel.: (86)755-27521059 Fax: (86)755-27521011 Http://www.sz-ctc.org.cn

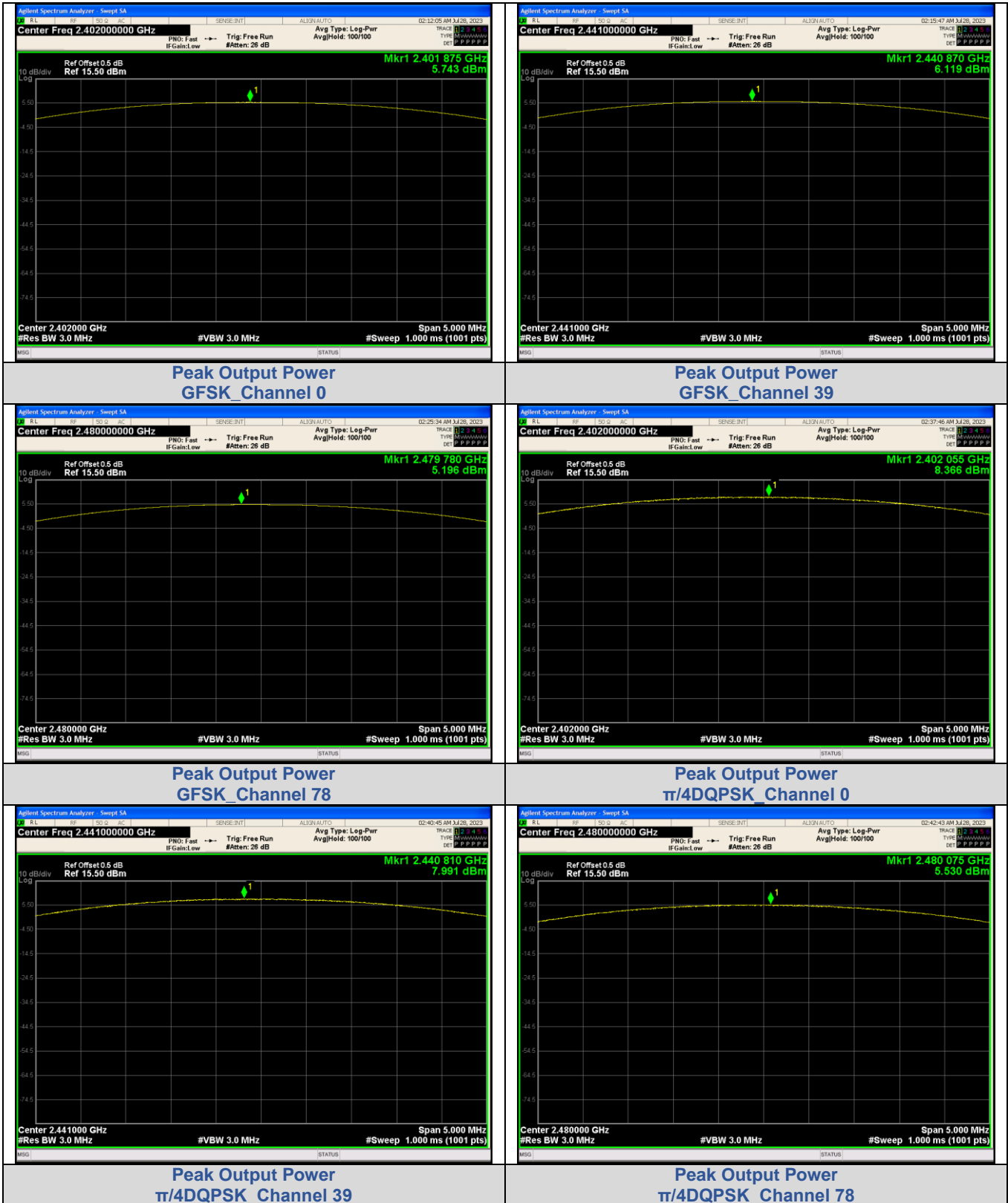


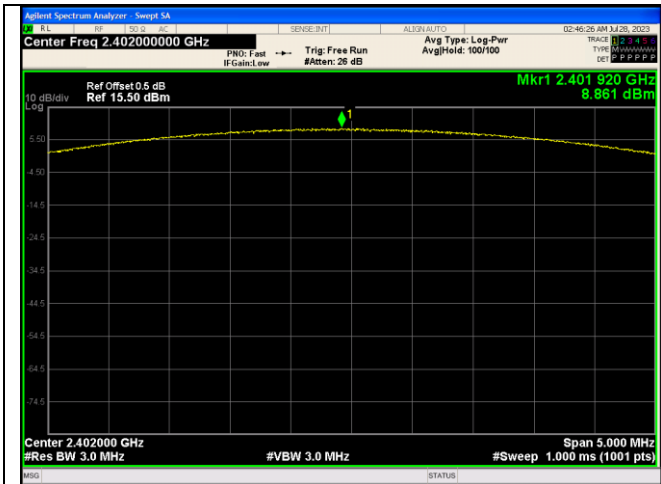
For anti-fake verification, please visit the official website of Certification and Accreditation Administration of the People's Republic of China : <http://yz.cnca.cn>



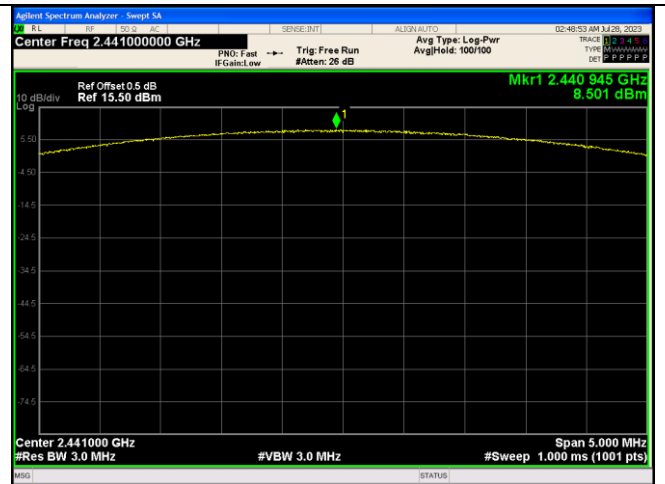


Test plot as follows:

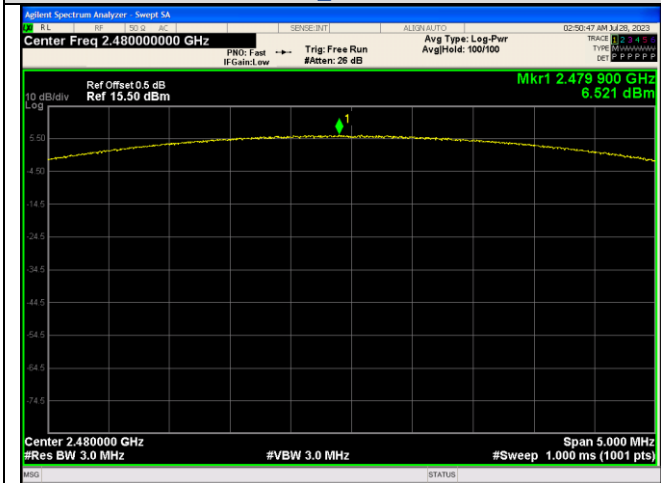




Peak Output Power 8DPSK\_Channel 0



Peak Output Power 8DPSK\_Channel 39



Peak Output Power 8DPSK\_Channel 78



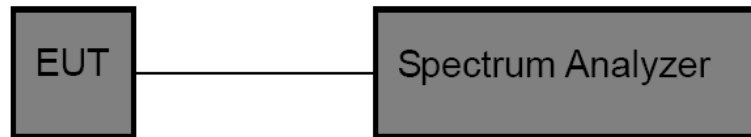


### 3.10. Duty Cycle

#### Limit

None, for report purposes only.

#### Test Configuration



#### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:  
Set analyzer center frequency to test channel center frequency.  
Set the span to 0Hz.  
Set the RBW to 10MHz.  
Set the VBW to 10MHz.  
Detector: Peak.  
Sweep time: Auto.  
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

#### Test Mode

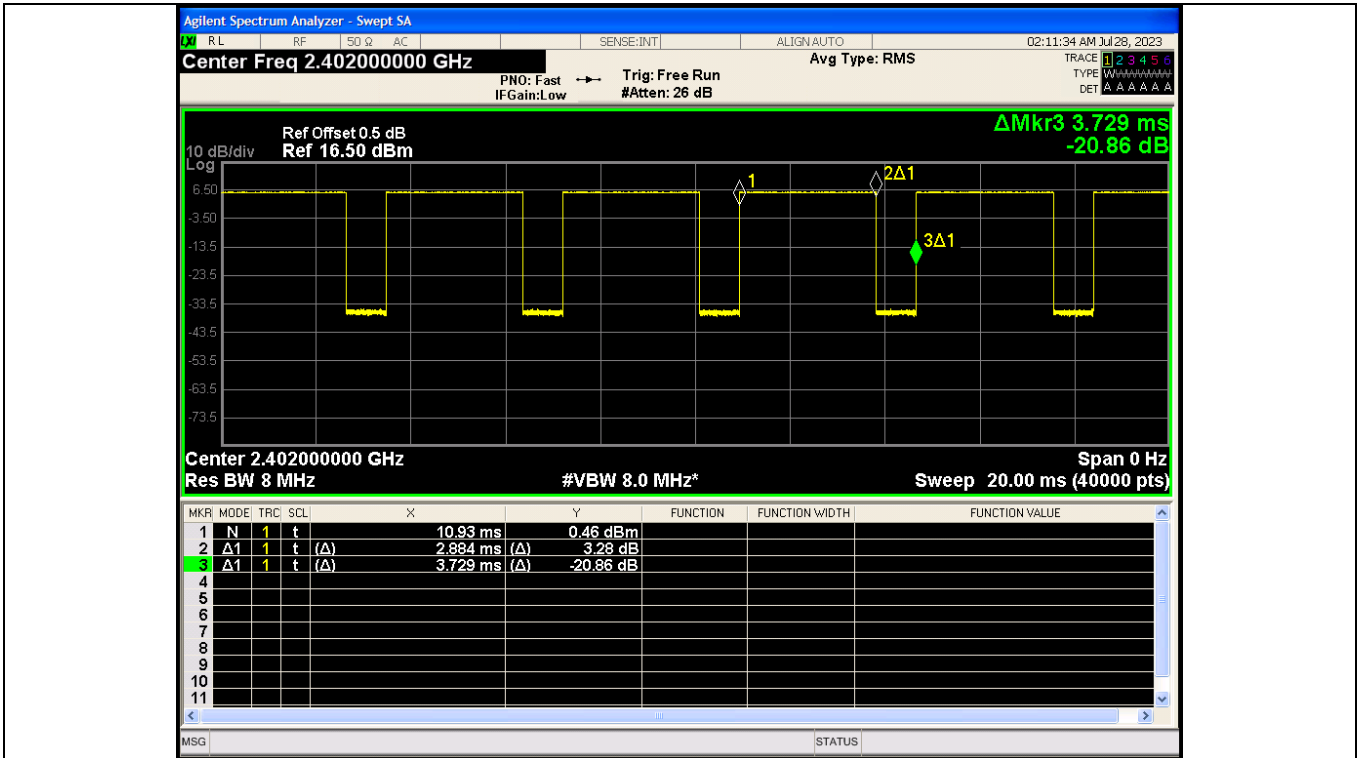
Please refer to the clause 2.4.

#### Test Result

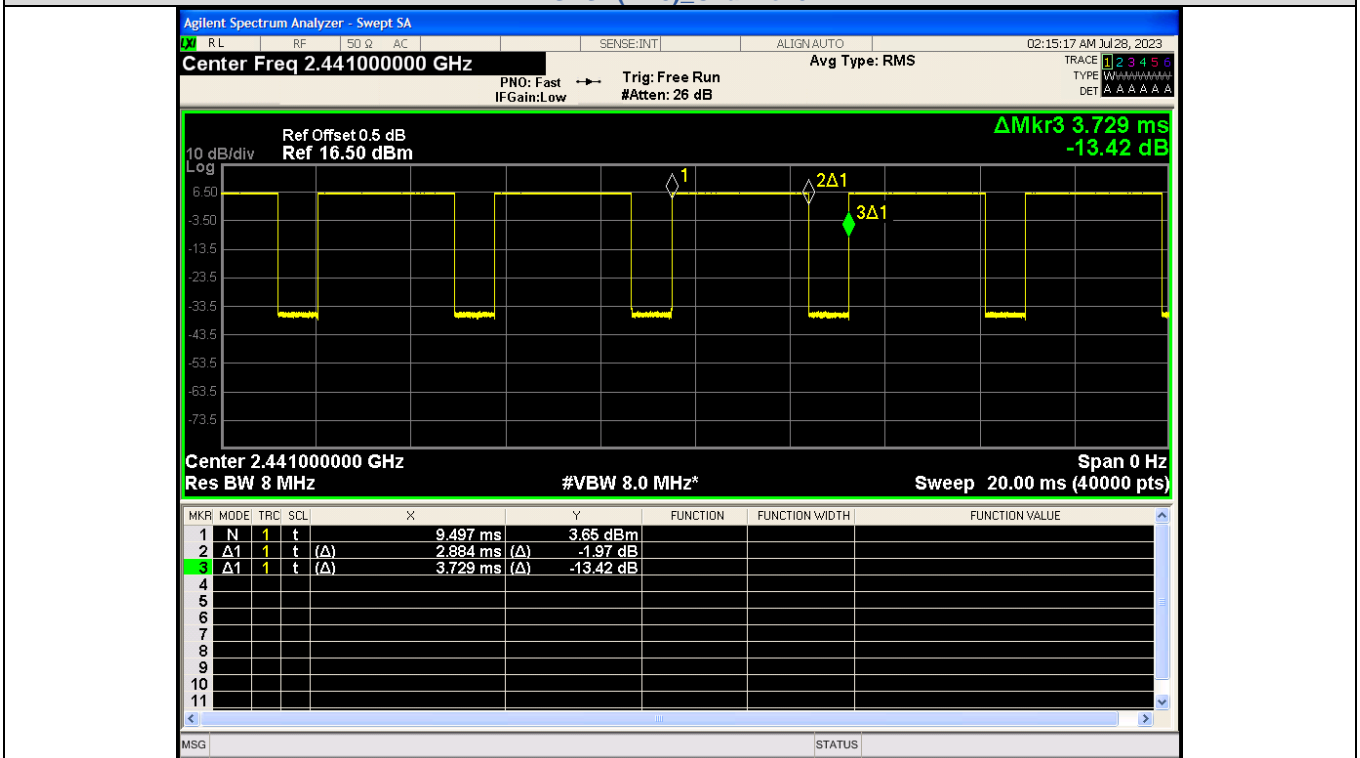
Modulation	Packets	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	1/T Minimum VBW (kHz)	Final Setting for VBW (kHz)
GFSK	DH5	0	2.884	3.729	77.34	0.35	1
		39	2.884	3.729	77.34	0.35	1
		78	2.884	3.729	77.34	0.35	1
$\pi/4$ DQPSK	2-DH5	0	2.880	3.700	77.84	0.35	1
		39	2.880	3.700	77.84	0.35	1
		78	2.900	3.720	77.96	0.34	1
8DPSK	3-DH5	0	2.880	3.700	77.84	0.35	1
		39	2.900	3.720	77.96	0.34	1
		78	2.900	3.720	77.96	0.34	1



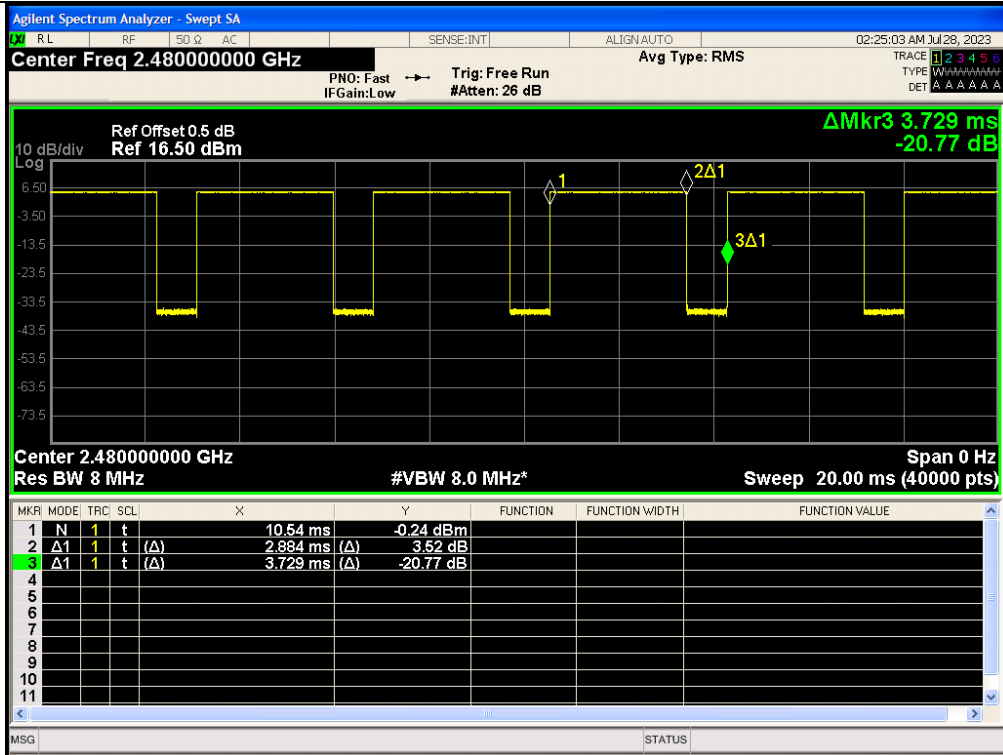
Test plot as follows:



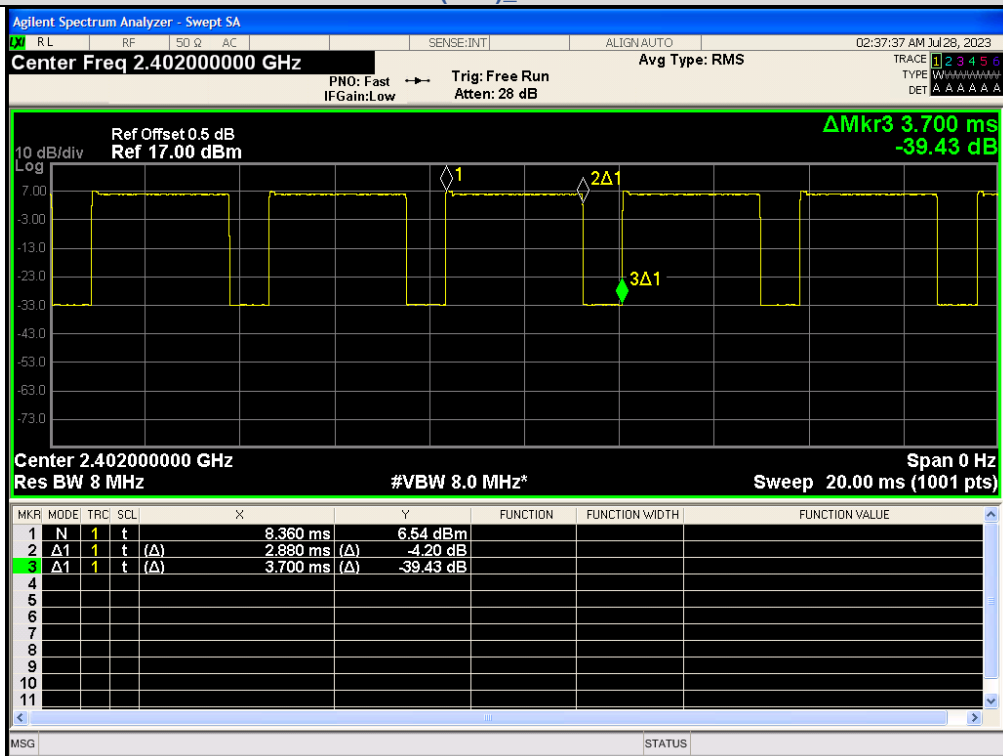
GFSK(DH5) Channel 0



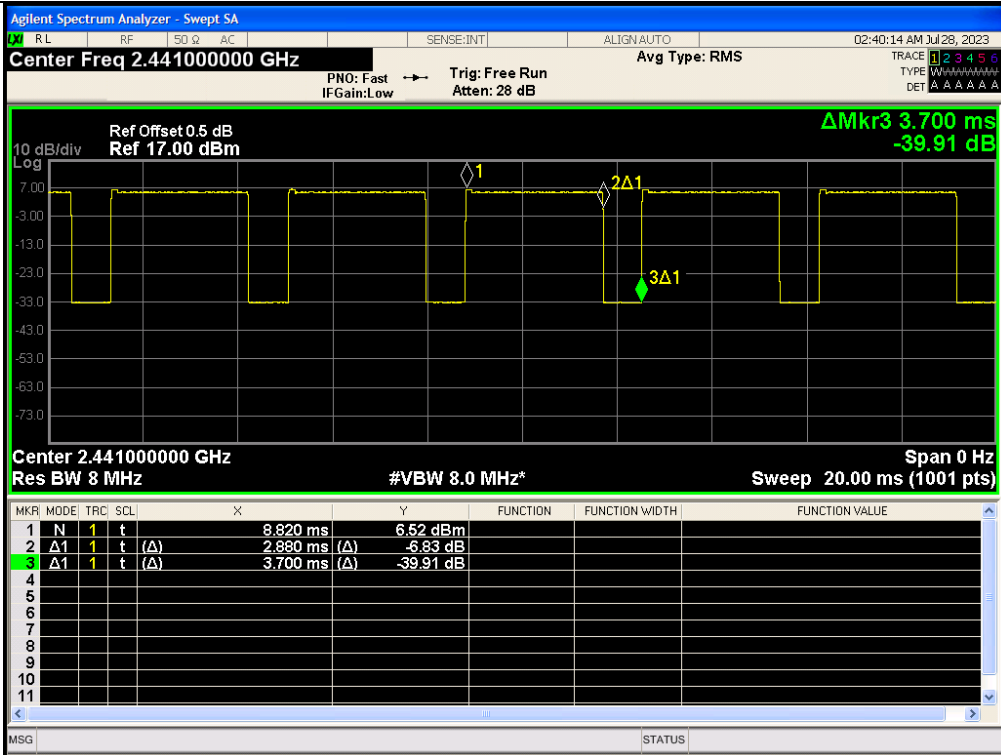
GFSK(DH5) Channel 39



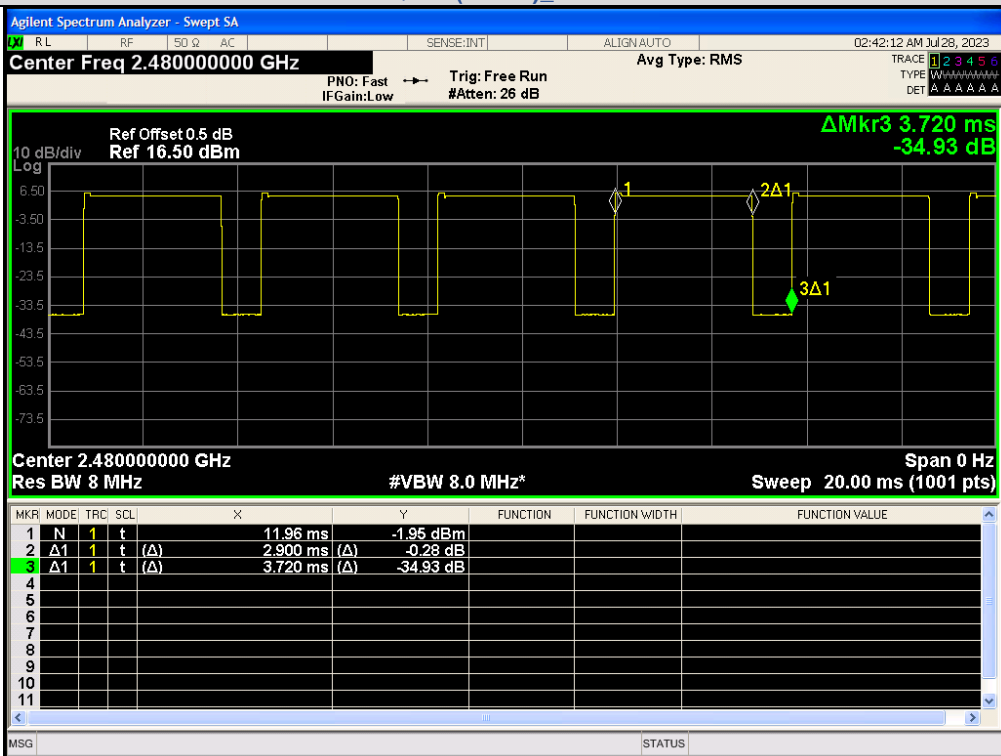
GFSK(DH5)\_Channel 78



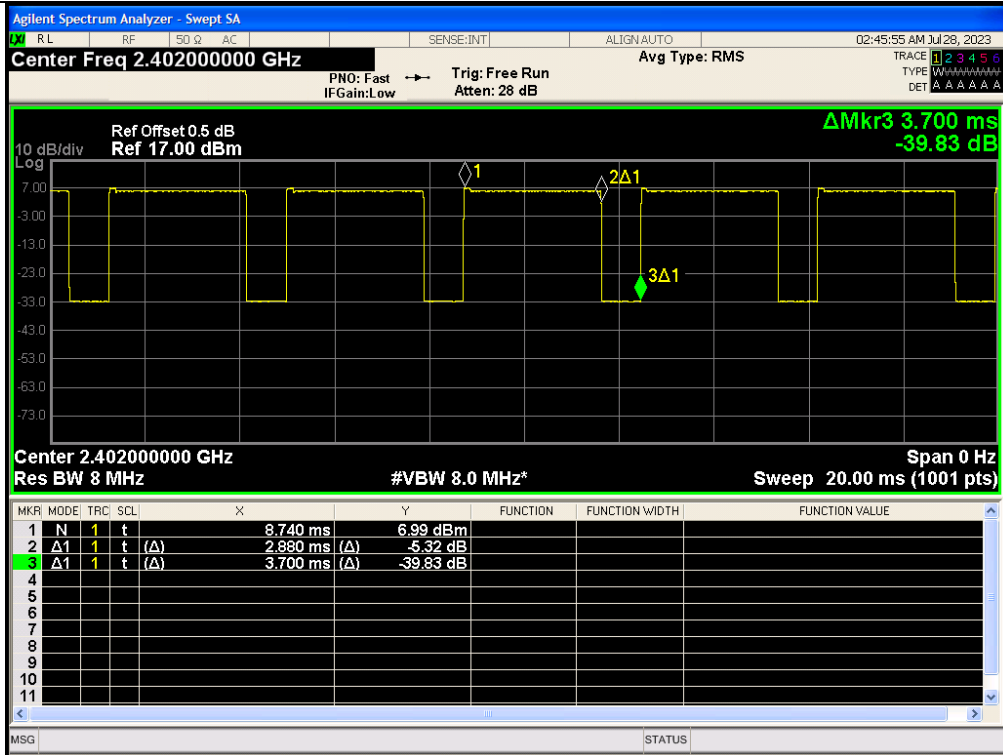
π/4DQPSK(2-DH5)\_Channel 0



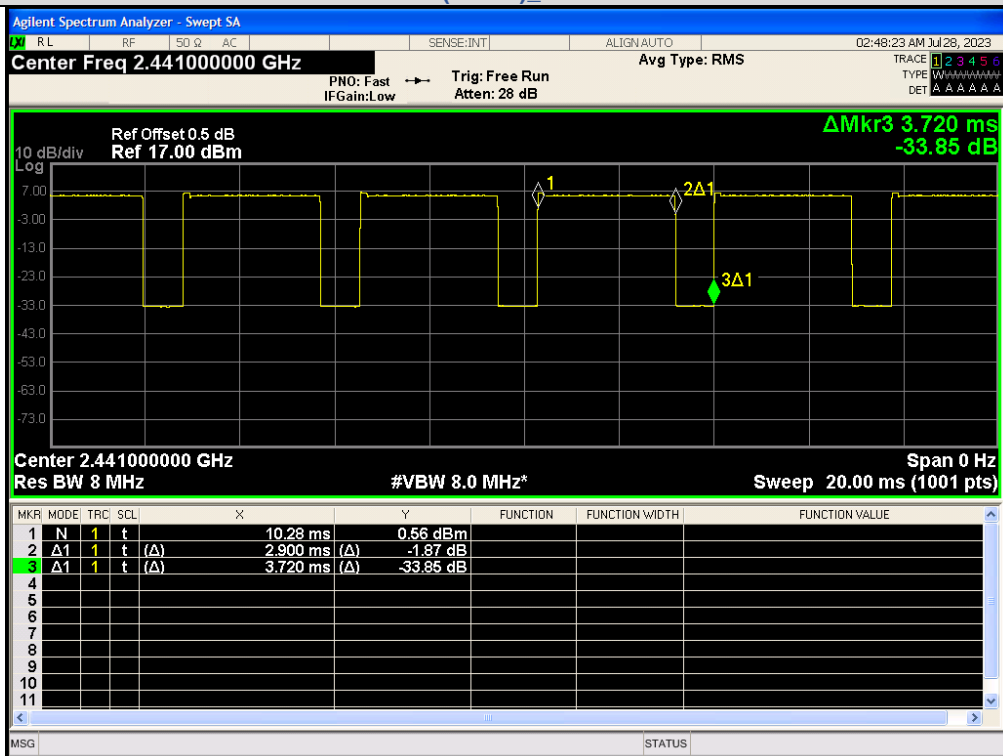
π/4DQPSK(2-DH5)\_Channel 39



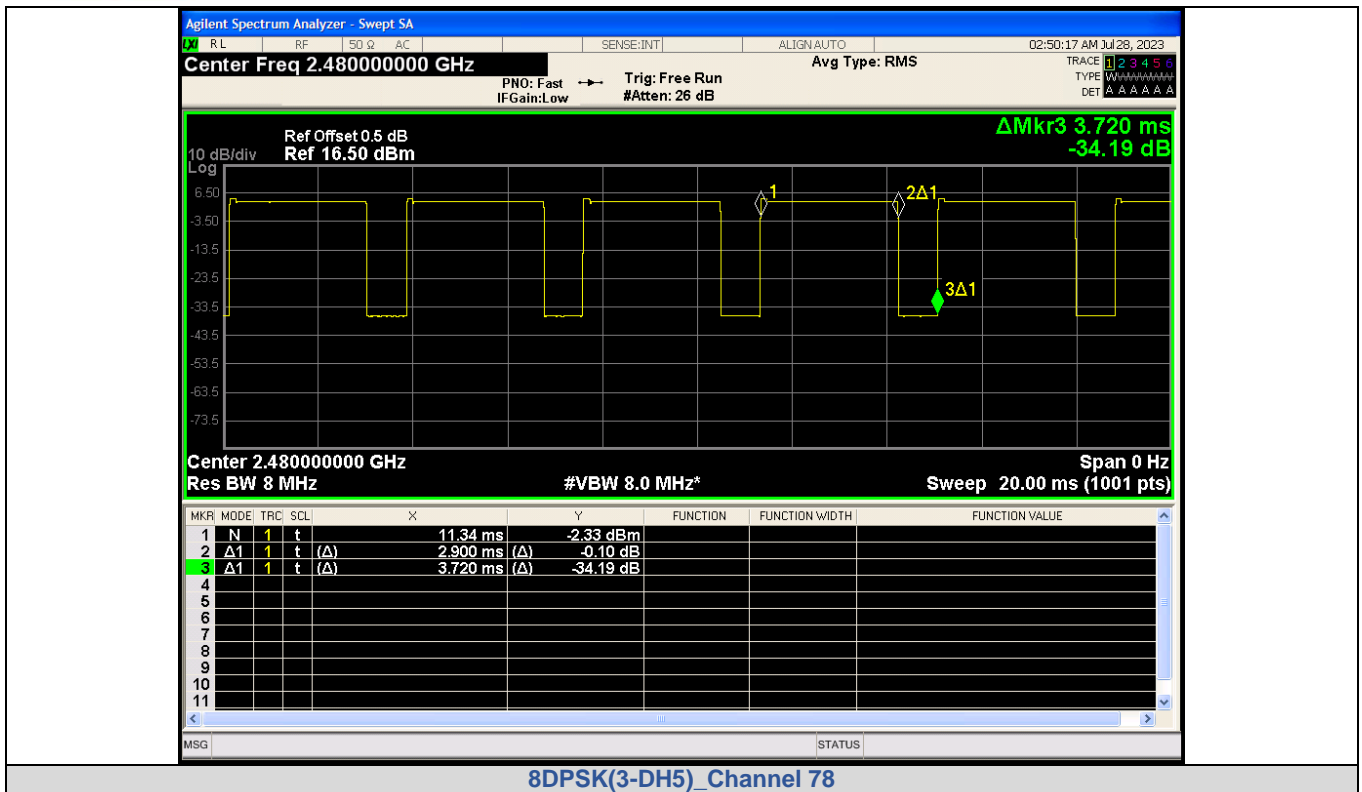
π/4DQPSK(2-DH5)\_Channel 78



8DPSK(3-DH5)\_Channel 0



8DPSK(3-DH5)\_Channel 39







### 3.11. Antenna Requirement

#### Requirement

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.203**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i)**

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

#### Test Result

The directional gain of the antenna is less than 6dBi, please refer to the EUT internal photographs antenna photo.

\*\*\*\*\*THE END\*\*\*\*\*