

# TEST REPORT

For

**Mobile Phone**

**Model Number: CPH2477**

**FCC ID: R9C-CPH2477**

**Report Number : WT228001826**

Test Laboratory : Shenzhen Academy of Metrology and Quality  
Inspection  
Site Location : NETC Building, No.4 Tongfa Rd., Xili, Nanshan,  
Shenzhen, China  
Tel : 0086-755-86928965  
Fax : 0086-755-86009898-31396  
Web : [www.smq.com.cn](http://www.smq.com.cn)  
E-mail : [emcrf@smq.com.cn](mailto:emcrf@smq.com.cn)

## TEST REPORT DECLARATION


Applicant : Guangdong OPPO Mobile Telecommunications Corp., Ltd.  
Address : NO.18 Haibin Road, Wusha Village, Chang'an Town,  
Dongguan City, Guangdong, China  
Manufacturer : Guangdong OPPO Mobile Telecommunications Corp., Ltd.  
Address : NO.18 Haibin Road, Wusha Village, Chang'an Town,  
Dongguan City, Guangdong, China  
EUT Description : Mobile Phone  
Model No. : CPH2477  
Trade mark : OPPO  
Serial Number : /  
FCC ID : R9C-CPH2477

Test Standards:

### FCC Part 15 Subpart C 15.247 (2020)

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the maximum emissions from the EUT. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results.

The test report is valid for above tested sample only and shall not be reproduced in part without written approval of the laboratory.

Project Engineer:  Date: Aug.25, 2022  
(Zhou Fangai 周芳媛)  
Checked by:  Date: Aug.25, 2022  
(Shi Changda 施昌达)  
Approved by:  Date: Aug.25, 2022  
(Lin Yixiang 林奕翔)

## TABLE OF CONTENTS

<b>TEST REPORT DECLARATION .....</b>	<b>2</b>
<b>1. TEST RESULTS SUMMARY .....</b>	<b>5</b>
<b>2. GENERAL INFORMATION.....</b>	<b>6</b>
2.1. Report Information.....	6
2.2. Laboratory Accreditation and Relationship to Customer .....	6
2.3. Measurement Uncertainty .....	7
<b>3. PRODUCT DESCRIPTION.....</b>	<b>8</b>
3.1. EUT Description.....	8
3.2. Related Submittal(s) / Grant (s) .....	8
3.3. Block Diagram of EUT Configuration .....	8
3.4. Operating Condition of EUT .....	8
3.5. Support Equipment List .....	8
3.6. Test Conditions.....	9
3.7. Special Accessories.....	9
3.8. Equipment Modifications .....	9
3.9. Equipment Requirements.....	9
<b>4. TEST EQUIPMENT USED .....</b>	<b>10</b>
<b>5. CONDUCTED EMISSION TEST .....</b>	<b>11</b>
5.1. Test Standard and Limit .....	11
5.2. Test Procedure .....	11
5.3. Test Arrangement.....	11
5.4. Test Data .....	11
<b>6. RADIATED EMISSION TEST .....</b>	<b>14</b>
6.1. Test Standard and Limit .....	14
6.2. Test Procedure .....	14
6.3. Test Arrangement.....	14
6.4. Test Data .....	14
<b>7. 20DB BANDWIDTH MEASUREMENT .....</b>	<b>25</b>
7.1. Limits of 20dB Bandwidth Measurement .....	25
7.2. Test Procedure .....	25
7.3. Test Setup .....	25
7.4. Test Data .....	25
<b>8. CARRIER FREQUENCY SEPARATION MEASUREMENT.....</b>	<b>28</b>
8.1. Limits of Carrier Frequency Separation Measurement .....	28
8.2. Test Procedure .....	28
8.3. Test Setup .....	28
8.4. Test Data .....	28
<b>9. NUMBER OF HOPPING CHANNEL .....</b>	<b>31</b>
9.1. Limits of Number of Hopping Channel .....	31
9.2. Test Procedure .....	31
9.3. Test Setup .....	31
9.4. Test Data .....	31
<b>10. TIME OF OCCUPANCY .....</b>	<b>33</b>

10.1.	Limits of Time Occupancy.....	33
10.2.	Test Procedure .....	33
10.3.	Test Data .....	33
<b>11.</b>	<b>MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT .....</b>	<b>39</b>
11.1.	Limits of Maximum Conducted Output Power Measurement.....	39
11.2.	Test Procedure .....	39
11.3.	Test Data .....	39
<b>12.</b>	<b>BAND EDGES MEASUREMENT .....</b>	<b>42</b>
12.1.	Limits of Band Edges Measurement .....	42
12.2.	Test Procedure .....	42
12.3.	Test Data .....	42
<b>13.</b>	<b>CONDUCTED SPURIOUS EMISSION.....</b>	<b>51</b>
13.1.	Limits of Band Edges Measurement .....	51
13.2.	Test Procedure .....	51
13.3.	Test Data .....	51
<b>14.</b>	<b>ANTENNA REQUIREMENTS.....</b>	<b>60</b>
14.1.	Antenna Connector .....	60
14.2.	Antenna Gain .....	60

# 1. TEST RESULTS SUMMARY

Table 1 Test Results Summary

Test Items	FCC Rules	Test Results
20dB bandwidth measurement	15.247 (a) (1)	Pass
Carrier frequency separation measurement	15.247 (a) (1)	Pass
Number of hopping channel	15.247 (a) (1) III	Pass
Time of occupancy	15.247 (a) (1) III	Pass
Maximum conducted output power	15.247 (b) (1)	Pass
Band edge compliance measurement	15.247 (d)	Pass
Radiated spurious emission & Radiated restricted band measurement	15.247 (d) / 15.205 & 15.209	Pass
Conducted spurious emission	15.247 (d)	Pass
Conducted emission	15.207	Pass
Antenna requirements	15.203	Pass

Remark: "N/A" means "Not applicable."

## **2. GENERAL INFORMATION**

### **2.1. Report Information**

This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.

The sample/s mentioned in this report is/are supplied by Applicant, SMQ therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

The lab will not be liable for any loss or damage resulting for false, inaccurate, inappropriate or incomplete product information provided by the applicant/manufacturer.

### **2.2. Laboratory Accreditation and Relationship to Customer**

The testing report were performed by the Shenzhen Academy of Metrology and quality Inspection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities located at NETC Building, No.4 Tongfa Rd., Xili, Nanshan, Shenzhen, China. At the time of testing, Laboratory is accredited by the following organizations:

China National Accreditation Service for Conformity Assessment (CNAS) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

The Laboratory is Accredited Testing Laboratory of FCC with Designation number CN1165 and Site registration number 582918.

The Laboratory is registered to perform emission tests with Innovation, Science and Economic Development (ISED), and the registration number is 11177A.

The Laboratory is registered to perform emission tests with VCCI, and the registration number are C-20048, G20076, R-20077, R-20078 and T-20047.

The Laboratory is Accredited Testing Laboratory of American Association for Laboratory Accreditation (A2LA) and certificate number is 3292.01.

### **2.3.Measurement Uncertainty**

Conducted Emission

9 kHz~150 kHz U=3.7dB k=2

150 kHz~30MHz U=3.3dB k=2

Radiated Emission

30MHz~1000MHz U=4.3dB k=2

1GHz~6GHz U=4.6 dB k=2

6GHz~40GHz U=5.1dB k=2

### 3. PRODUCT DESCRIPTION

NOTE: The extreme test conditions for temperature and antenna gain were declared by the manufacturer.

#### 3.1. EUT Description

Description : Mobile Phone  
 Manufacturer : Guangdong OPPO Mobile Telecommunications Corp., Ltd.  
 Model Number : CPH2477  
 Operate Frequency : 2.402GHz~2.480GHz  
 Antenna Designation : Fixed Internal Antenna 1dBi  
 Operating voltage : DC3.6V (Low)/DC3.87V (Nominal)/DC4.45V (Max)  
 Software Version : ColorOS V12.1  
 Hardware Version : 11

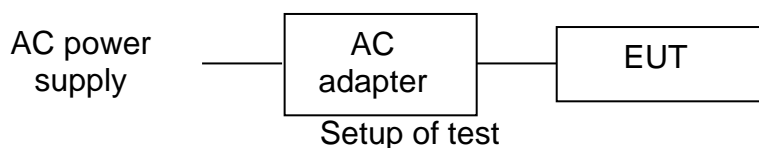
Remark: 1. There are two adapters, only the worst data of OP52YAUH (1#) shown in this report.

2. There are three batteries, only the worst data of BLP915 (1#) shown in this report.

#### 3.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **R9C-CPH2477** filing to comply with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C .

#### 3.3. Block Diagram of EUT Configuration



#### 3.4. Operating Condition of EUT

The transmitter has a maximum peak conducted output power of Basic rate GFSK modulation and EDR mode 8DPSK modulation. Tests were performed with Basic rate GFSK modulation and EDR mode 8DPSK modulation.

#### 3.5. Support Equipment List

Table 2 Support Equipment List

Name	Model No	S/N	Manufacturer
Adapter 1# for EUT	OP52YAUH	---	Jiangsu Chenyang Electron Co., Ltd.
Adapter 2# for EUT	OP52JAUH	---	Huizhou Golden Lake Industrial Co., Ltd.
Rechargeable Li-ion Polymer Battery 1# for EUT	BLP915	---	Chongqing CosMX Battery Co.,Ltd



Rechargeable Li-ion Polymer Battery 2# for EUT	BLP915	---	TWS Technology (Guangzhou) Limited
Rechargeable Li-ion Polymer Battery 3# for EUT	BLP915	---	Sunwoda Electronic CO.,LTD.
USB for EUT	DL122	---	---

### 3.6. Test Conditions

Date of test : Jul.25, 2022- Aug.25, 2022

Date of EUT Receive : Jul.20, 2022

Temperature: 23°C-25°C

Relative Humidity: 46%-58%

### 3.7. Special Accessories

Not available for this EUT intended for grant.

### 3.8. Equipment Modifications

Not available for this EUT intended for grant.

### 3.9. Equipment Requirements

The device is designed according to specifications of SIG. So, it has a full support to Medium access protocol and fully compliant with the KDB558074 standard. The device is compliant Pseudorandom hopping, Equal hopping frequency, receiver bandwidth synchronizes and have same bandwidth with transmitted signal. And the ability to have adaptive hopping when encountering other signals.

#### 4. TEST EQUIPMENT USED

Table 3 Test Equipment

No.	Equipment	Manufacturer	Model No.	Last Cal.	Cal. Interval
SB9058/05	Test Receiver	R&S	ESCI 3	Sep.24,2021	1 Year
SB4357	AMN	R&S	ENN216	Aug.25,2021	1 Year
SB9549	Shielded Room	Albatross	SR	Sep.24,2021	1 Year
SB17366	Test Receiver	R&S	ESR26	Jun.24,2022	1 Year
SB3955	Broadband Antenna	Schwarzbeck	VULB9163	Dec.30,2021	1 Year
SB9555/01	Semi Anechoic Chamber	Albatross	9×6×6(m)	Aug.25,2021	1 Year
SB13956	Test Receiver	R&S	ESR26	Feb.07,2022	1 Year
SB13961	Horn Antenna	R&S	HF907	Mar.22,2022	1 Year
SB8501/09	Test Receiver	R&S	ESU40	Jan.20,2022	1 Year
SB3435	Horn Antenna	R&S	HF906	Dec.03,2021	1 Year
SB9058/03	Pre-Amplifier	R&S	SCU 18	Jan.20,2022	1 Year
SB8501/10	Horn Antenna	R&S	3160-09	Mar.10,2020	3 Years
SB8501/11	Horn Antenna	R&S	3160-09	Mar.09,2020	3 Years
SB8501/12	Horn Antenna	R&S	3160-10	Mar.17,2020	3 Years
SB8501/13	Horn Antenna	R&S	3160-10	Mar.10,2020	3 Years
SB8501/14	Pre-Amplifier	R&S	SCU-03	Jan.20,2022	1 Year
SB8501/15	Pre-Amplifier	R&S	SCU-03	Jan.20,2022	1 Year
SB8501/16	Pre-Amplifier	R&S	SCU 26	Jan.20,2022	1 Year
SB8501/17	Pre-Amplifier	R&S	SCU-18	Jan.18,2022	1 Year
SB9555/02	Fully Anechoic Chamber	Albatross	10.0×5.2×5.4(m)	Aug.25,2021	1 Year
SB20321/0 1	Spectrum Analyzer	R&S	FSV3044	Dec.24, 2021	1 Year

Table 4 Test software

Name	Manufacturer	Version
Bluetooth and WiFi Test System	Shenzhen JS tonscond co.,ltd	2.6.87.0615

## 5. CONDUCTED EMISSION TEST

### 5.1. Test Standard and Limit

#### 5.1.1. Test Standard

FCC Part 15 15.207

#### 5.1.2. Test Limit

Table 5 Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dB $\mu$ V)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

\* Decreasing linearly with logarithm of the frequency

\* The lower limit shall apply at the transition frequency.

### 5.2. Test Procedure

The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI test receiver is used to test the emissions from both sides of AC line.

Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

The bandwidth of EMI test receiver is set at 9 kHz.

### 5.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

### 5.4. Test Data

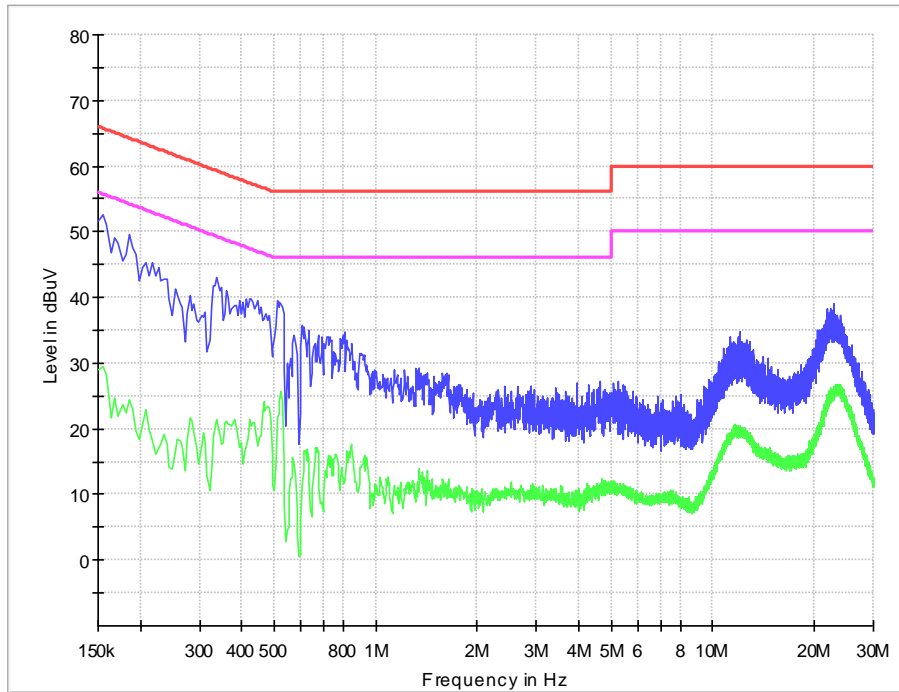
The emissions don't show in below are too low against the limits. Refer to the test curves.

**Table 6 Conducted Emission Test Data**

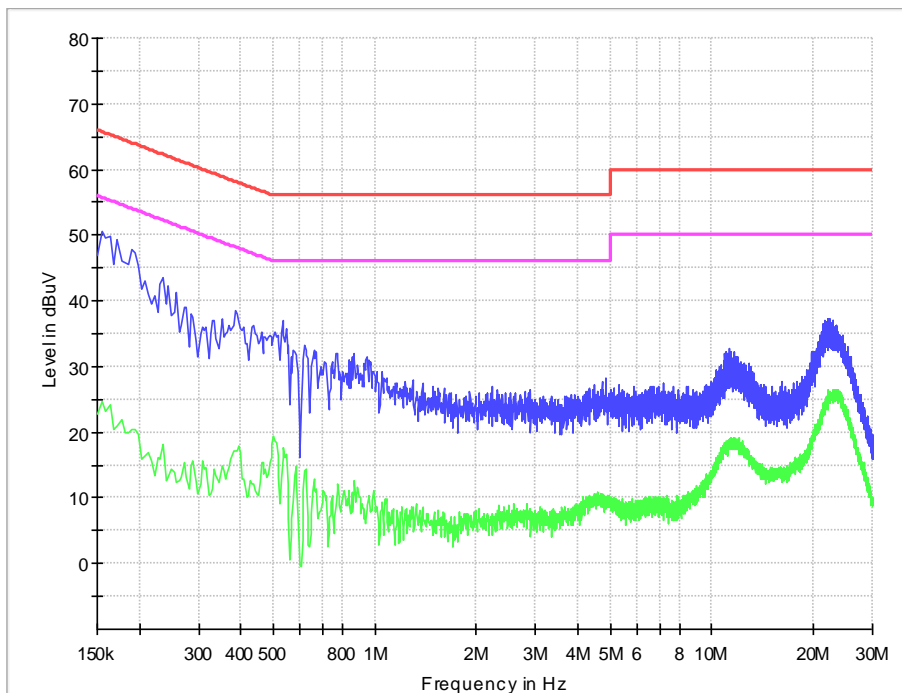
Test mode: Charging and Transmitting								
	Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
			Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V)	Limit (dB $\mu$ V)
Line	0.154	9.7	38.4	48.1	65.8	18.1	27.8	55.8
	0.186	9.7	30.4	40.1	64.2	10.2	19.9	54.2
	0.339	9.7	25.5	35.2	59.2	8.5	18.2	49.2
	0.523	9.8	26.0	35.8	56	13.7	23.5	46
	0.807	9.8	17.3	27.1	56	6.0	15.8	46
	22.884	10.2	22.0	32.2	60	15.9	26.1	50
Neutral	0.154	9.7	34.8	44.5	65.8	14.5	24.2	55.8
	0.190	9.7	28.9	38.6	64.0	9.1	18.8	54.0
	0.379	9.7	21.4	31.1	58.3	6.9	16.6	48.3
	0.501	9.8	20.5	30.3	56	8.4	18.2	46
	11.319	9.9	15.2	25.1	60	8.3	18.2	50
	22.983	10.2	21.0	31.2	60	15.4	25.6	50

- REMARKS: 1. Emission level (dB $\mu$ V) =Read Value (dB $\mu$ V) + Correction Factor (dB)  
 2. Correction Factor (dB) =LISN Factor (dB) + Cable Factor (dB) +Limiter Factor (dB)  
 3. The other emission levels were very low against the limit.

## Line



## Neutral



## 6. RADIATED EMISSION TEST

### 6.1. Test Standard and Limit

#### 6.1.1. Test Standard

FCC Part 15 15.209

#### 6.1.2. Test Limit

Table 7 Radiation Emission Test Limit for FCC (Class B) (9 kHz-1GHz)

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

Table 8 Radiation Emission Test Limit for FCC (Class B) (Above 1G)

Frequency (MHz)	(dBuV/m) (at 3 meters)	
	PEAK	AVERAGE
Above 1000	74	54

\* The lower limit shall apply at the transition frequency.

\* The test distance is 3m.

### 6.2. Test Procedure

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10-2013. The EUT is set to transmit in a continuous mode. Radiated measurements were performed on the frequency range from 30MHz to 25GHz. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 kHz, VBW $\geq$ RBW. All readings above 1 GHz are AV and PK values. RBW=1MHz and 1/T (10Hz) for AV value, RBW=1MHz and VBW $\geq$ RBW for peak value. Measurements were made at 3 meters.

### 6.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

### 6.4. Test Data

The emissions don't show in following result tables are more than 20dB below the limits. Bluetooth basic rate and Bluetooth EDR mode were tested, below only shows worst case

result of Bluetooth basic rate.

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

9 kHz-30MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Table 9 Radiated Emission Test Data 9k Hz-30MHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dBµV/m)	Level (dBµV/m)	Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Note
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--

30MHz-1GHz

Worst case is shown below for 30MHz-1GHz only.

The emissions don't show in following result tables are more than 20dB below the limits.

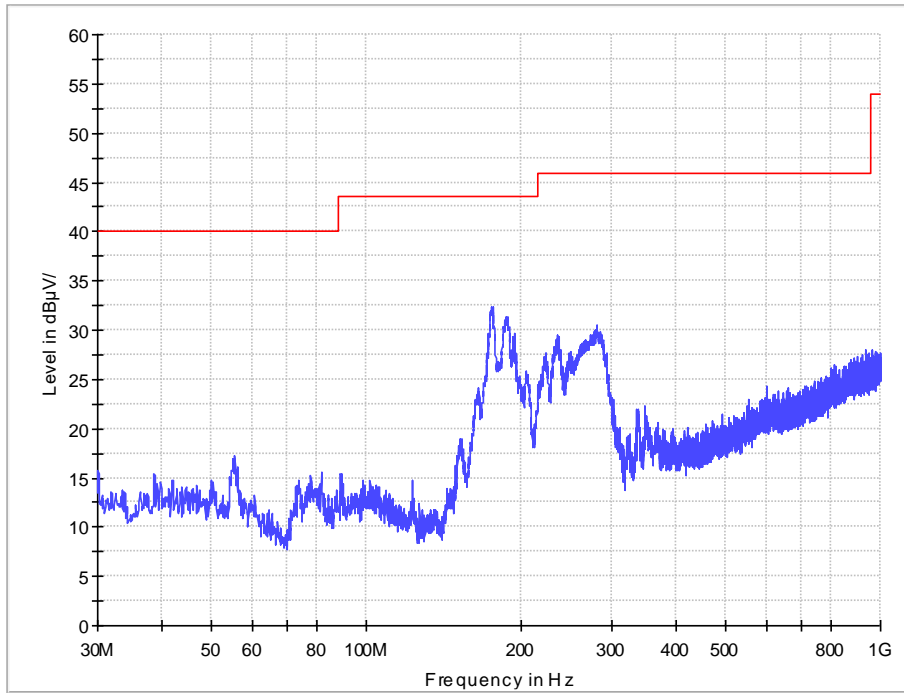
Table 10 Radiated Emission Test Data 30MHz-1GHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dBµV/m)	Level (dBµV/m)	Polarity (Horizontal/ Vertical)	Limit (dBµV/m)	Margin (dB)	Note
30.000	0.6	12.3	11.2	24.1	Vertical	40	15.9	QP
38.439	0.7	12.3	10.8	23.8	Vertical	40	16.2	QP
54.347	0.8	13.3	10.5	24.6	Vertical	40	15.4	QP
65.502	0.9	10.7	11.5	23.1	Vertical	40	16.9	QP
175.985	1.5	9.0	25.2	35.7	Vertical	43.5	7.8	QP
188.013	1.5	9.7	22.2	33.4	Vertical	43.5	10.1	QP
55.511	0.9	13.0	1.4	15.3	Horizontal	40	24.7	QP
152.317	1.4	8.3	6.8	16.5	Horizontal	43.5	27.0	QP
175.500	1.5	9.0	20.3	30.8	Horizontal	43.5	12.7	QP
186.849	1.5	9.7	18.9	30.1	Horizontal	43.5	13.4	QP
193.833	1.7	10.6	15.6	27.9	Horizontal	43.5	15.6	QP
280.745	1.9	12.7	14.7	29.3	Horizontal	46	16.7	QP

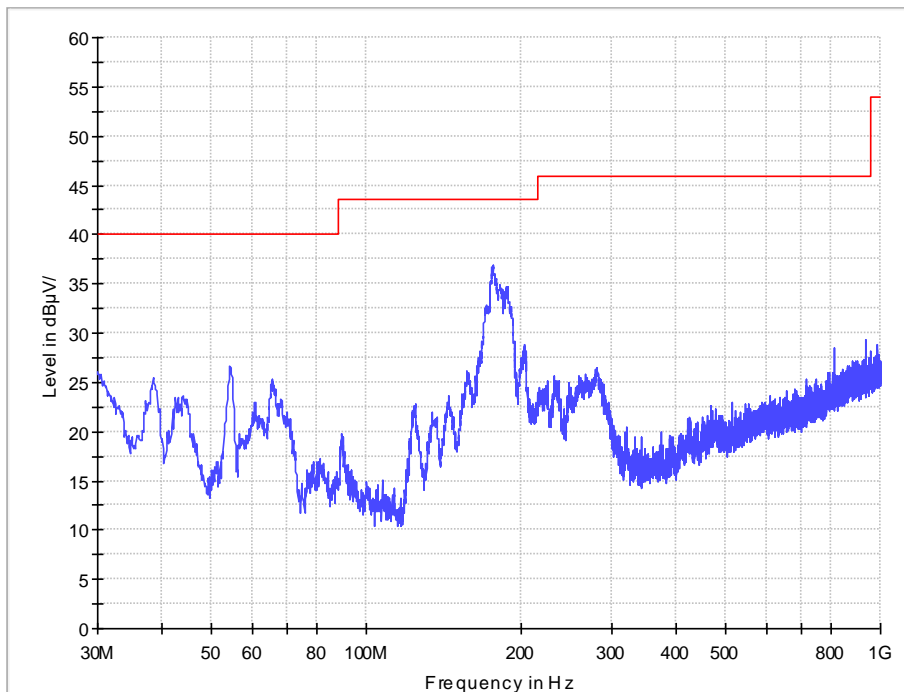
Remark: Emission level (dBµV)=Read Value(dBµV/m) + Antenna Factor(dB)+ Cable Loss +preamp(dB)

30MHz-1GHz

Horizontal



Vertical

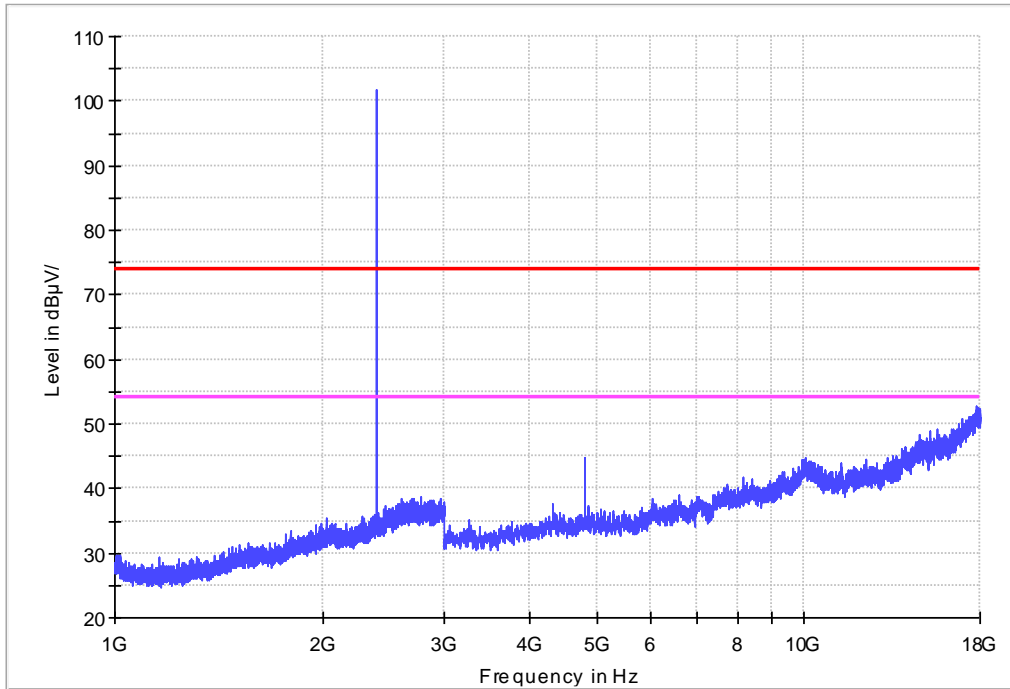




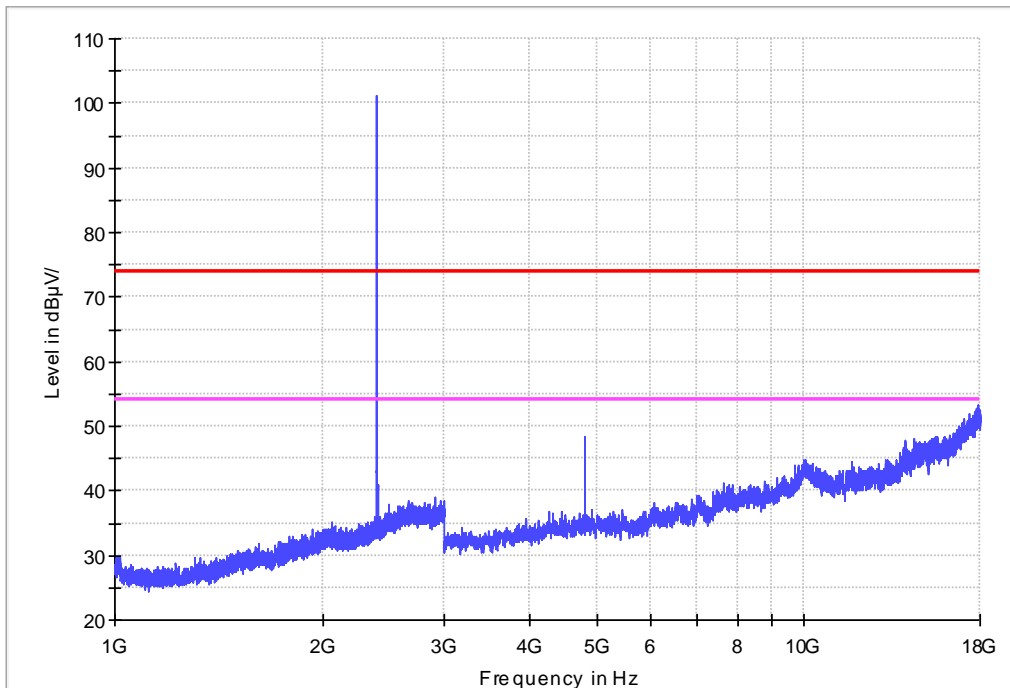
1GHz-18GHz

GFSK CH0

Horizontal



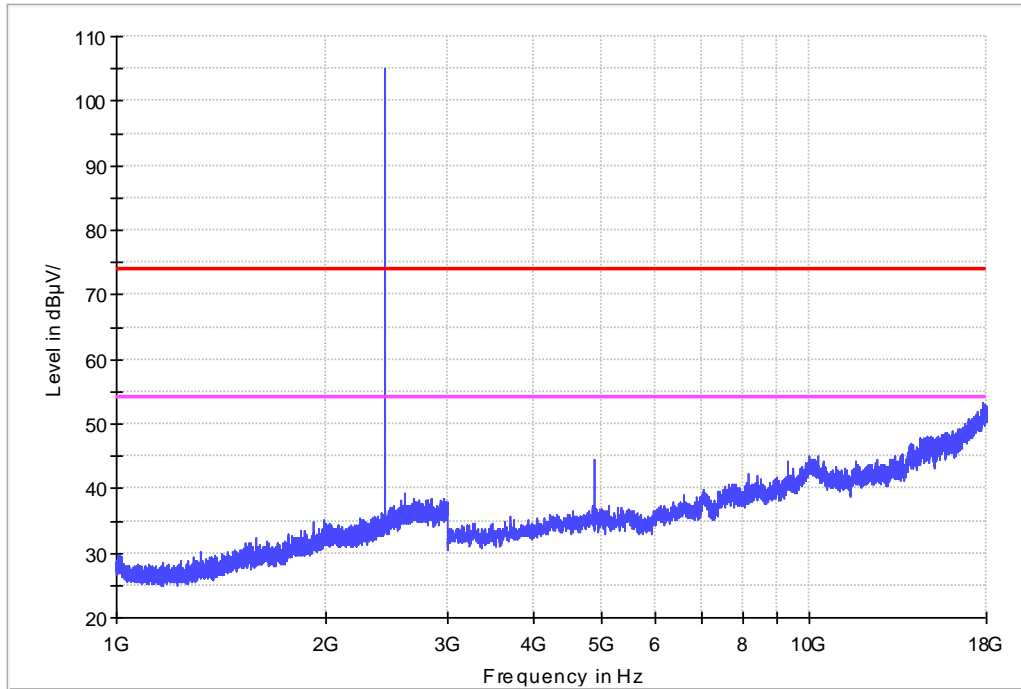
Vertical



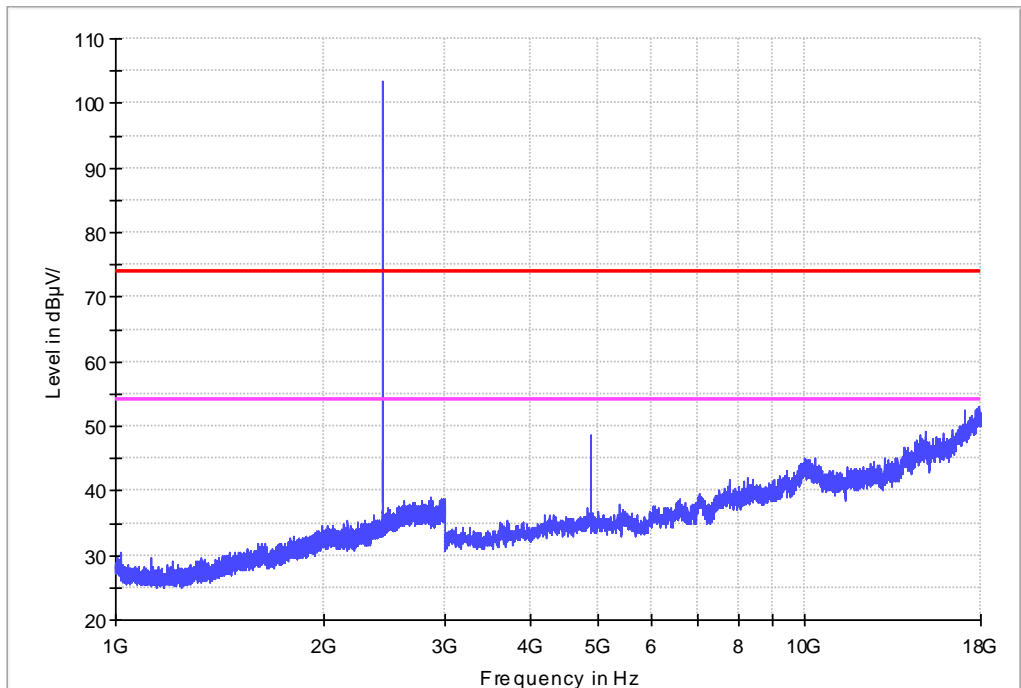
1GHz-18GHz

GFSK CH39

Horizontal



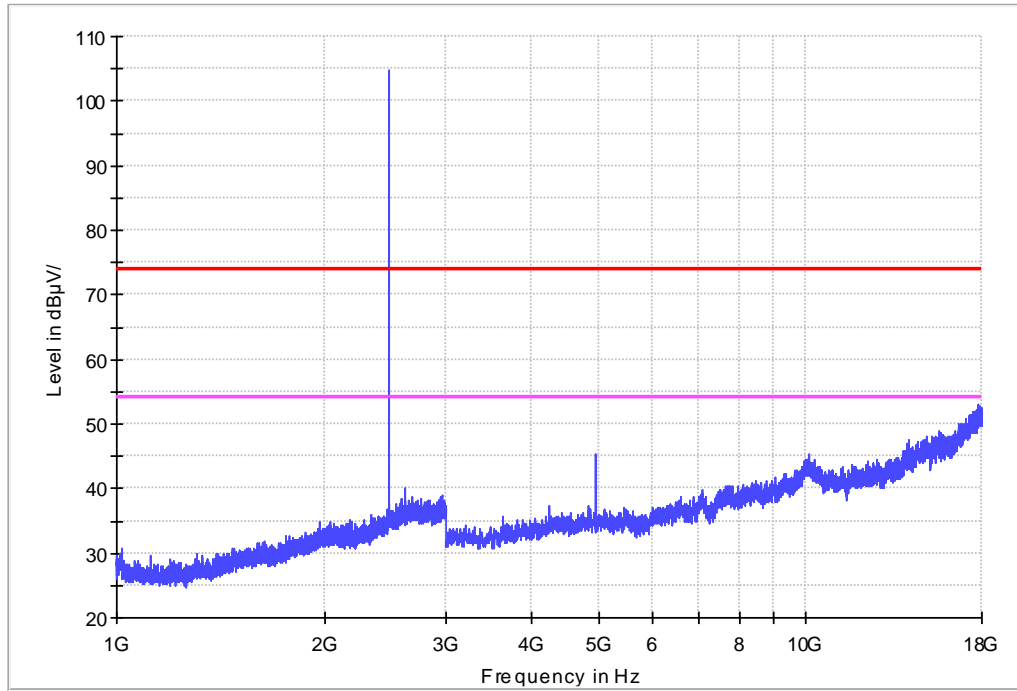
Vertical



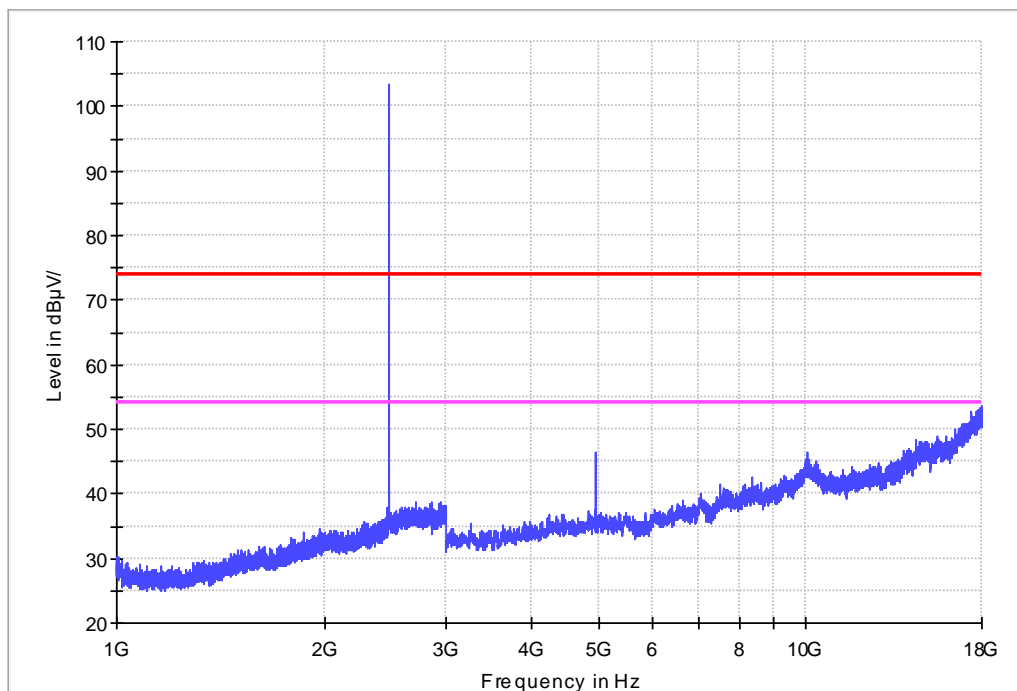
1GHz-18GHz

GFSK CH78

Horizontal



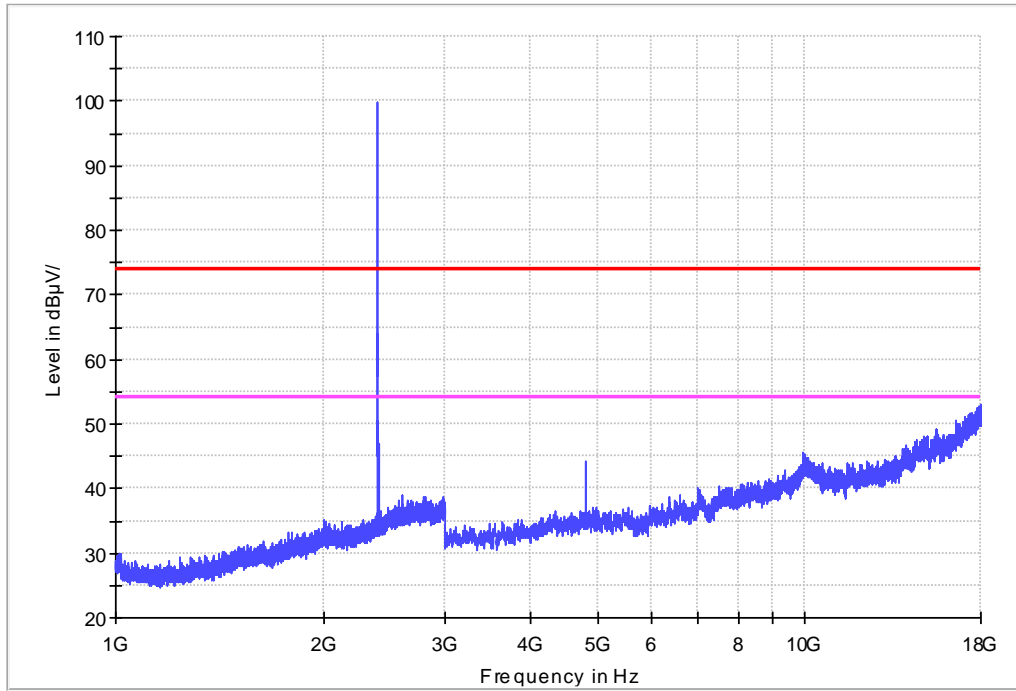
Vertical



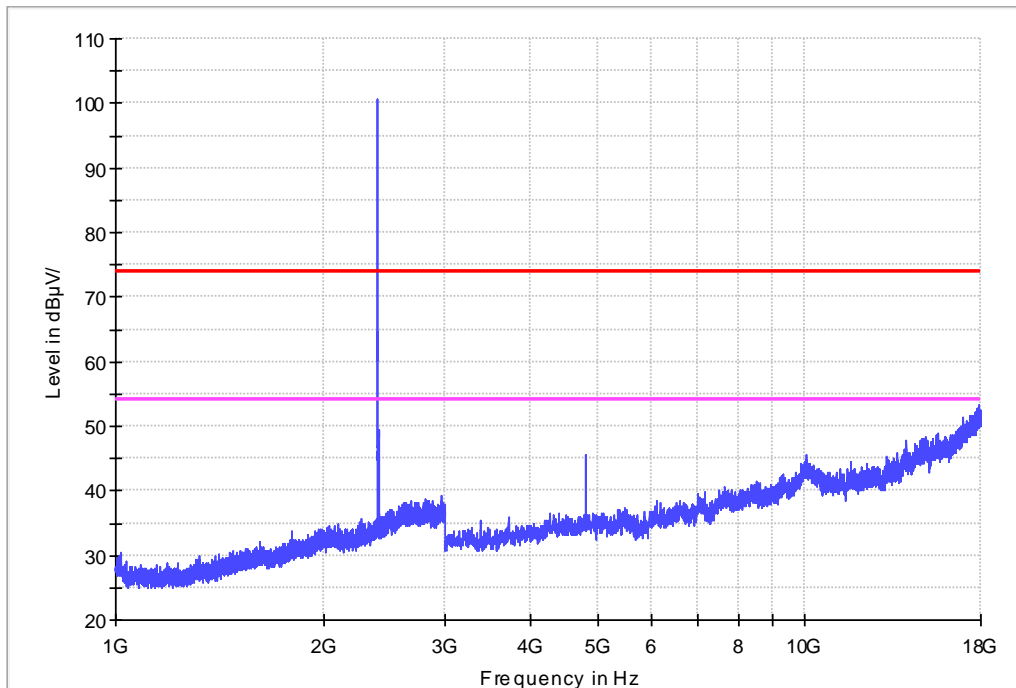
1GHz-18GHz

8PDSK CH0

Horizontal



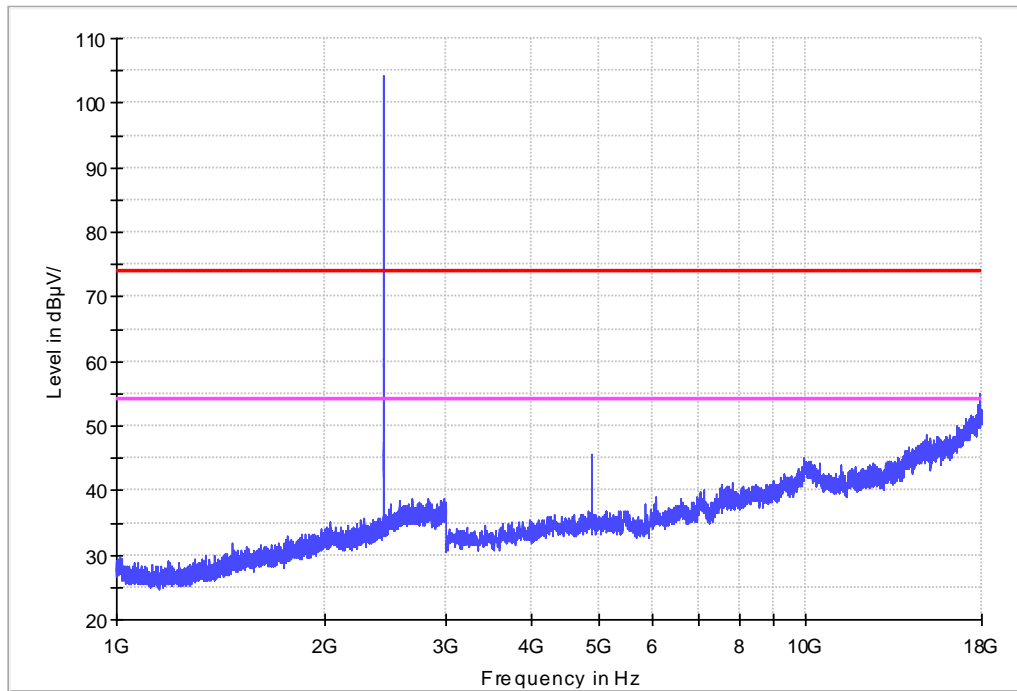
Vertical



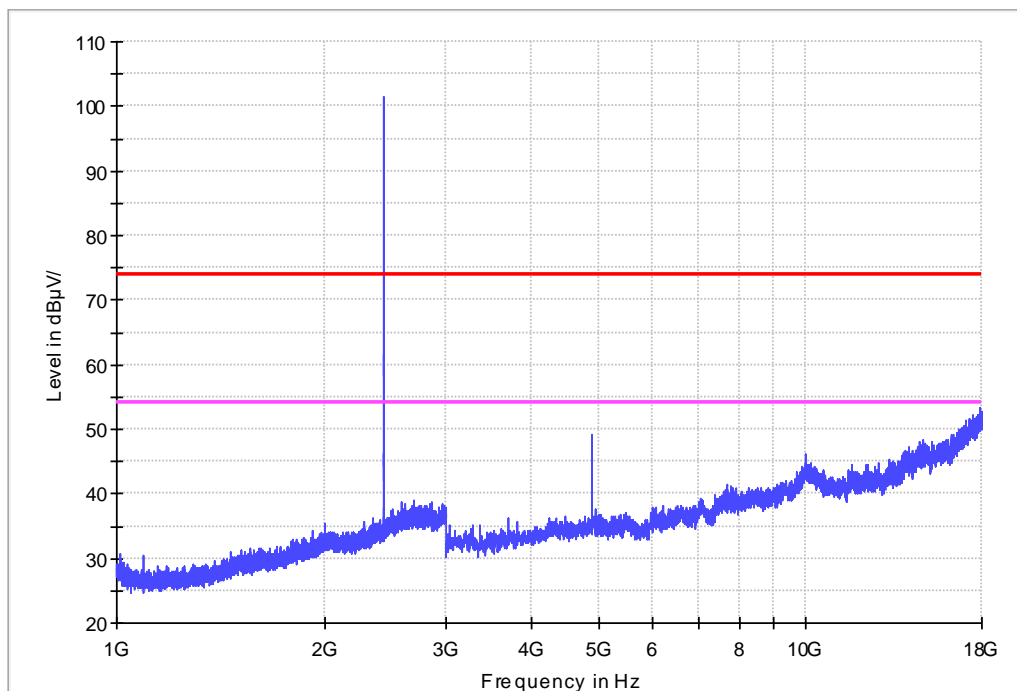
1GHz-18GHz

8PDSK CH39

Horizontal



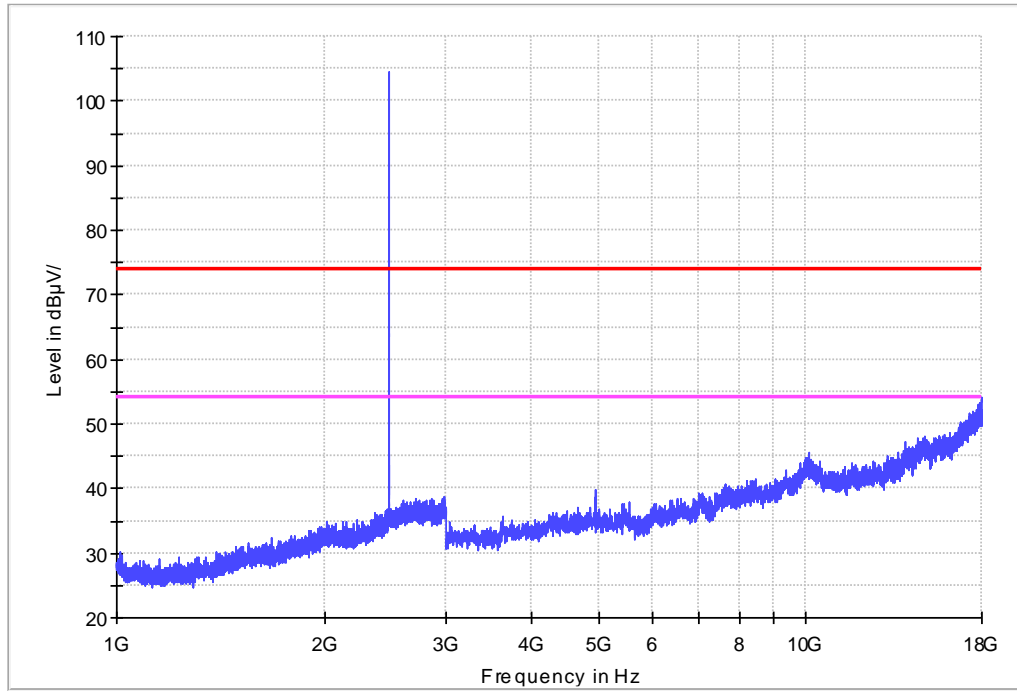
Vertical



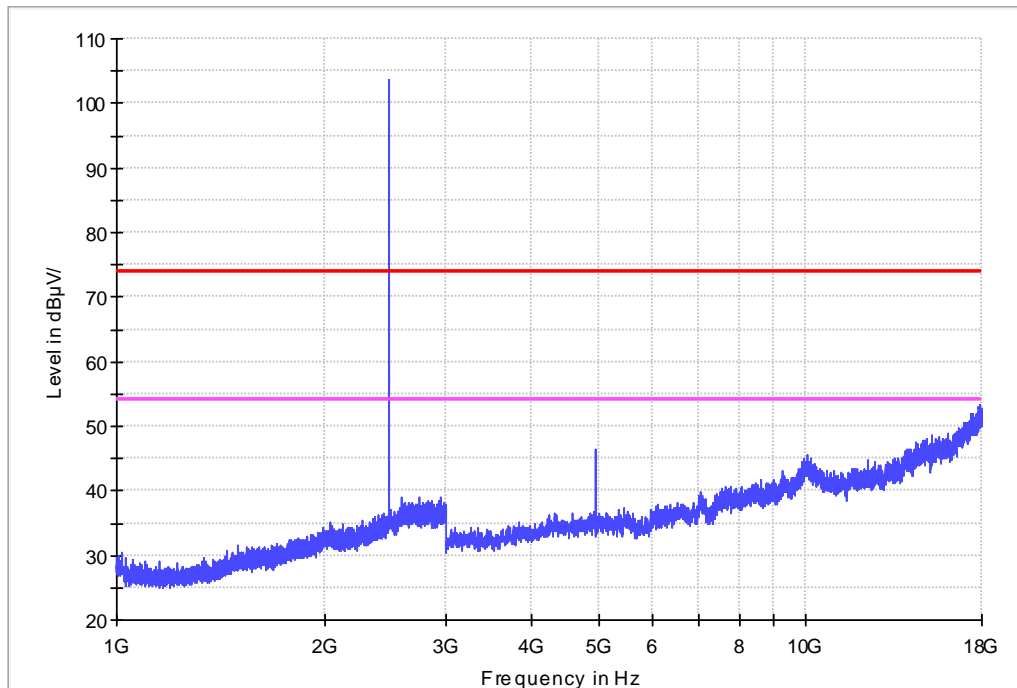
1GHz-18GHz

8PDSK CH78

Horizontal

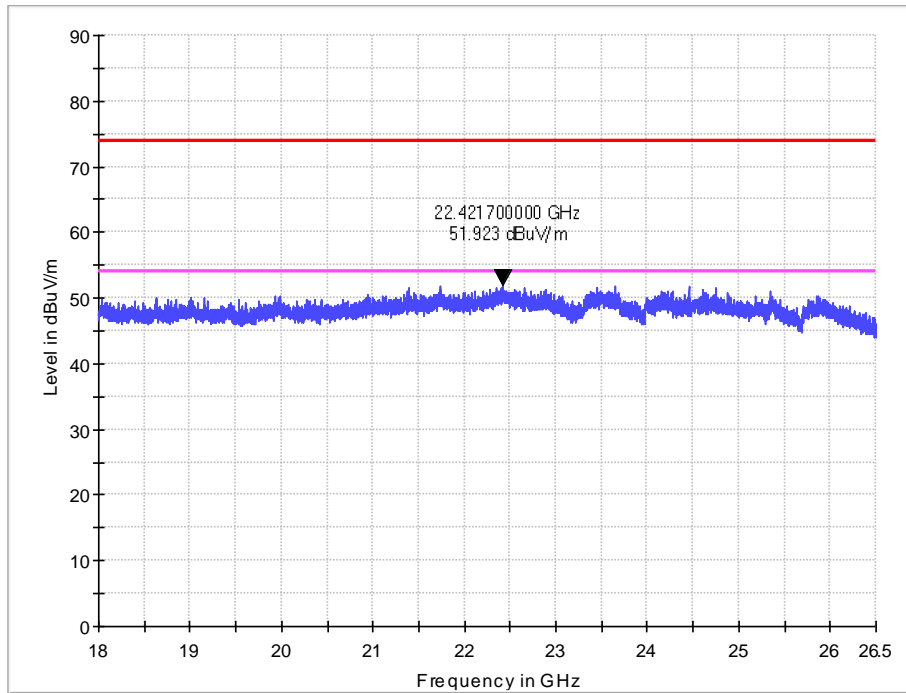


Vertical



## 18-26.5GHz

No Peak found in pre-scan, only worst case result is listed in this report.  
Horizontal



## Vertical

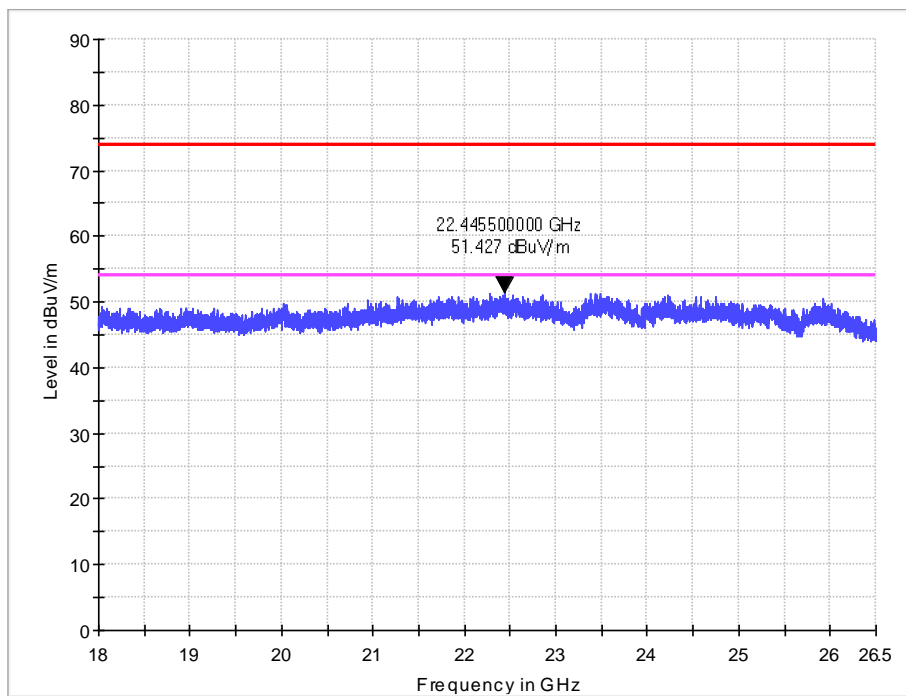


Table 11 Restricted Band Radiated Emission Data

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 -	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.17775	73 - 74.6	1645.5 -	9.3 - 9.5
4.20725 -	74.8 - 75.2	1646.5	
4.20775	108 - 121.94	1660 - 1710	
6.215 - 6.218	123 - 138	1718.8 -	
6.26775 -	149.9 - 150.05	1722.2	
6.26825	156.52475 -	2200 - 2300	
6.31175 -	156.52525	2310 - 2390	
6.31225	156.7 - 156.9	2483.5 - 2500	
8.291 - 8.294	162.0125 - 167.17	2655 - 2900	
8.362 - 8.366	167.72 - 173.2	3260 - 3267	
8.37625 -	240 - 285	3332 - 3339	
8.38675	322 - 335.4	3345.8 - 3358	
8.41425 -		3600 - 4400	
8.41475			
12.29 - 12.293			
12.51975 -			
12.52025			
12.57675 -			
12.57725			
13.36 - 13.41			

Except as shown in table 9 to table 15, all other emission of the above band were less than the limit 20dB.



## 7. 20DB BANDWIDTH MEASUREMENT

### 7.1.Limits of 20dB Bandwidth Measurement

CFR 47 (FCC) part 15.247 (a) (1) and DA 00-705

### 7.2.Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and  $VBW \geq RBW$ . The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

### 7.3.Test Setup

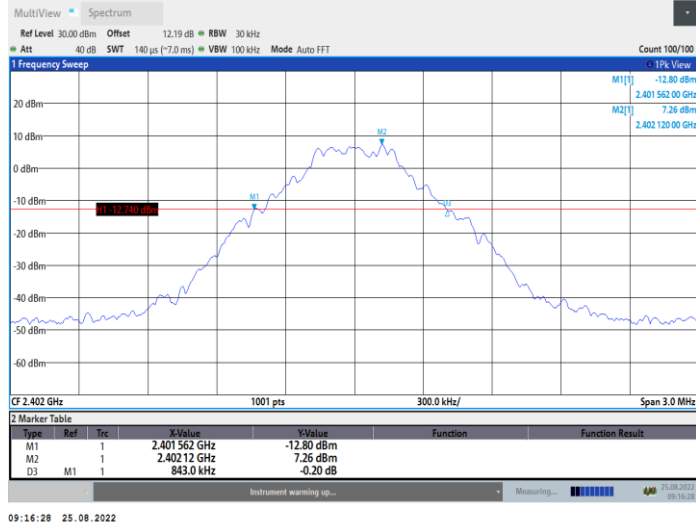


### 7.4.Test Data

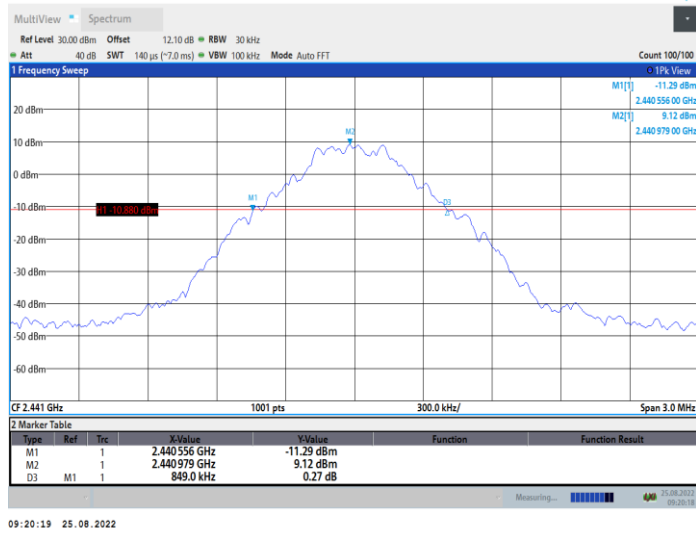
Table 12 20dB Bandwidth Test Data

Test Mode	CHANNEL FREQUENCY (MHz)	Modulation	20dB BANDWIDTH (MHz)	Result
DH1	2402	GFSK	0.84	Pass
	2441		0.85	Pass
	2480		0.84	Pass
3DH1	2402	8DPSK	1.23	Pass
	2441		1.24	Pass
	2480		1.22	Pass

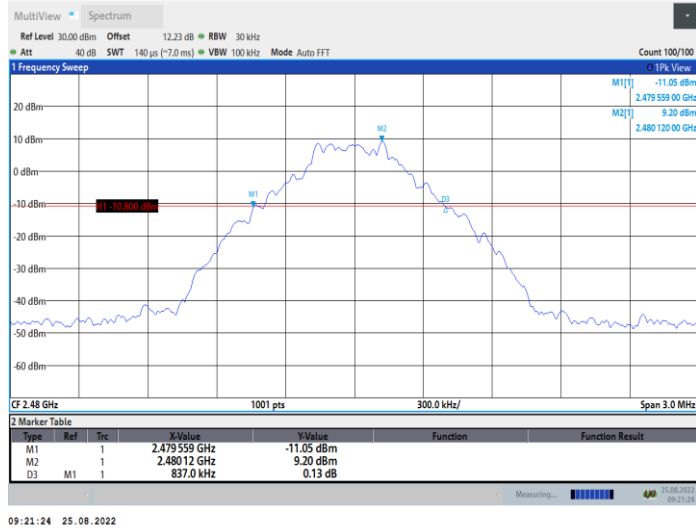
### DH1\_Ant1\_2402



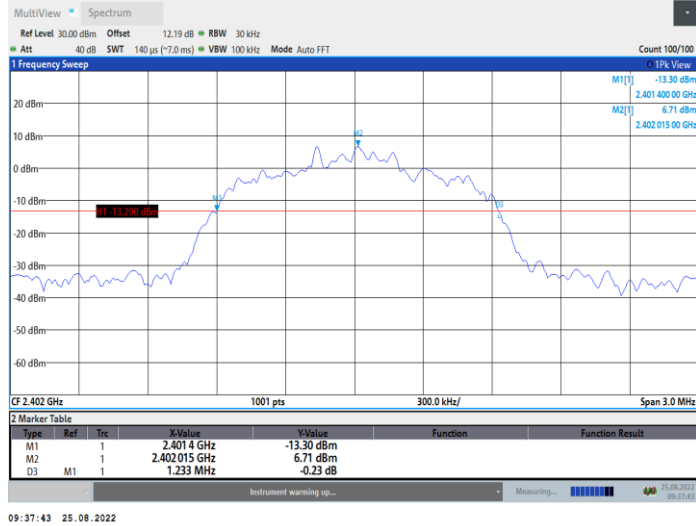
### DH1\_Ant1\_2441



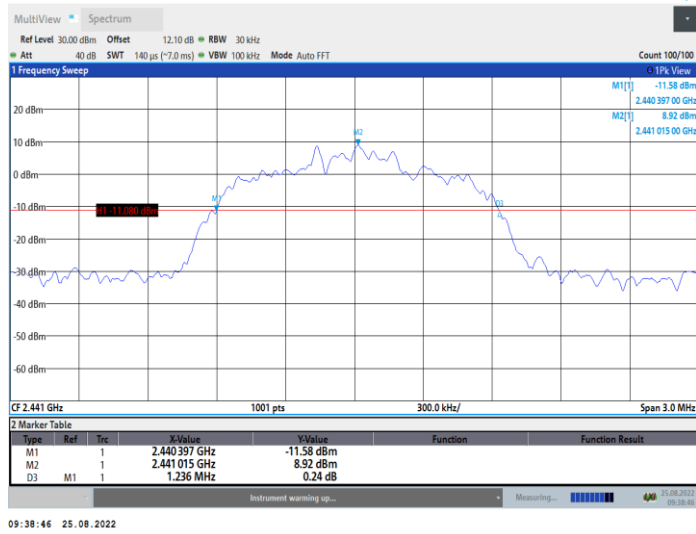
### DH1\_Ant1\_2480



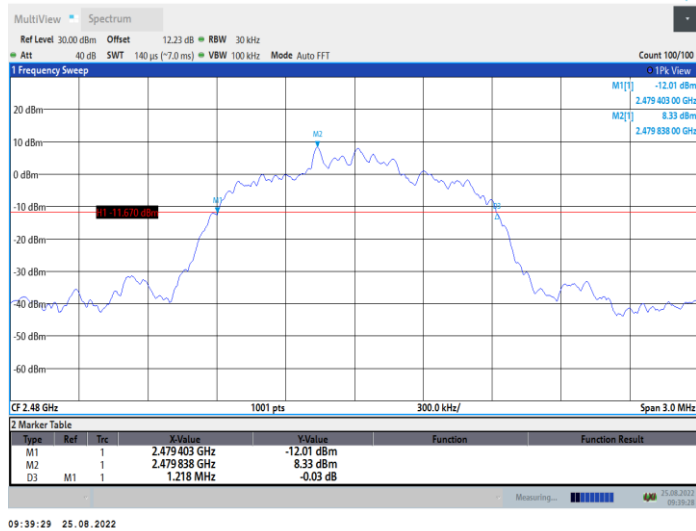
### 3DH1\_Ant1\_2402



### 3DH1\_Ant1\_2441



### 3DH1\_Ant1\_2480



## 8. CARRIER FREQUENCY SEPARATION MEASUREMENT

### 8.1.Limits of Carrier Frequency Separation Measurement

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

### 8.2.Test Procedure

- (a) Connect test port of EUT to spectrum analyzer and universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function, then set the measured frequency number to two adjacent channels separately and test the carrier frequency separation with spectrum analyzer.

### 8.3.Test Setup

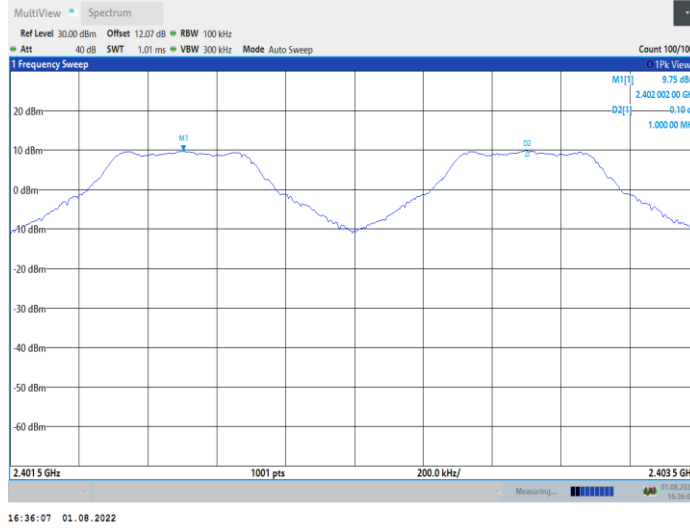


### 8.4.Test Data

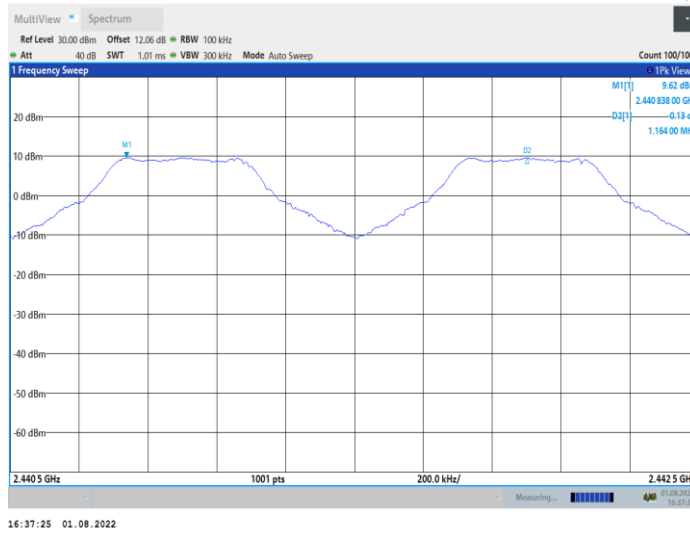
Table 13 Carrier Frequencies Separation

Test Mode	Frequency [MHz]	Frequency [MHz]	Modulation	Frequency separation [MHz]	Limit [MHz]	Result
DH1	2402	2403	GFSK	1	$\geq 0.560$	Pass
	2441	2442		1.164	$\geq 0.567$	Pass
	2478	2479		1.002	$\geq 0.560$	Pass
3DH1	2402	2403	8DPSK	0.996	$\geq 0.820$	Pass
	2441	2442		0.998	$\geq 0.827$	Pass
	2478	2479		1	$\geq 0.813$	Pass

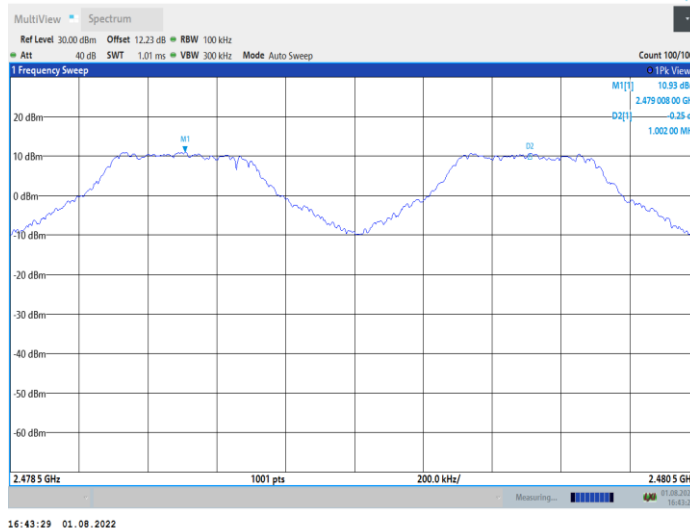
### DH1\_Ant1\_Hop\_2402



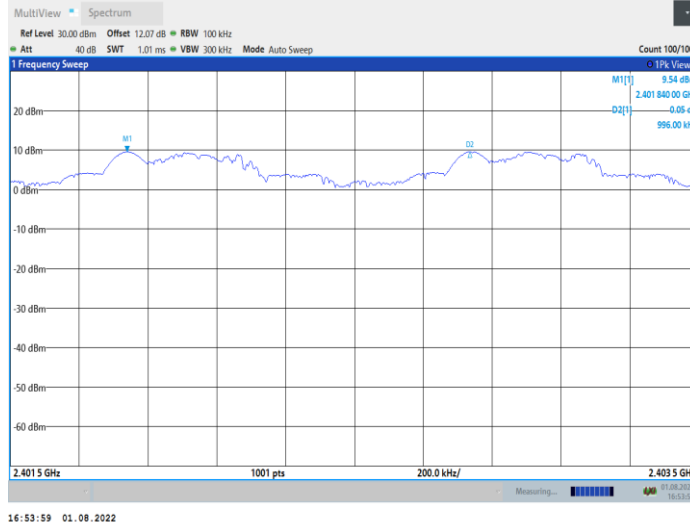
### DH1\_Ant1\_Hop\_2441



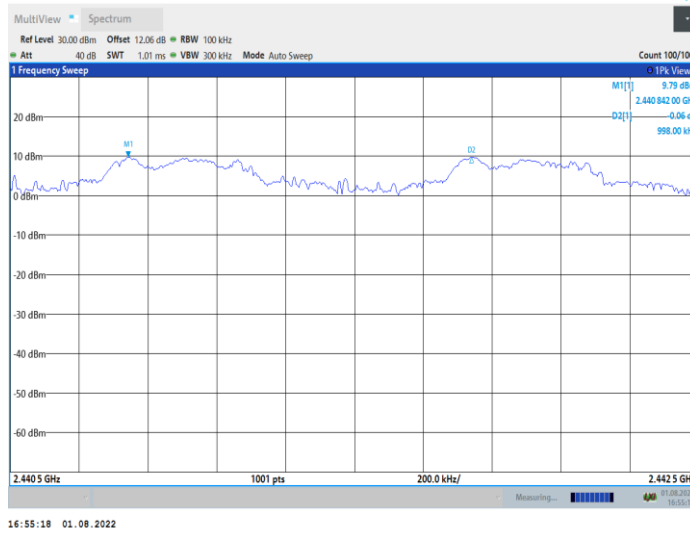
### DH1\_Ant1\_Hop\_2480



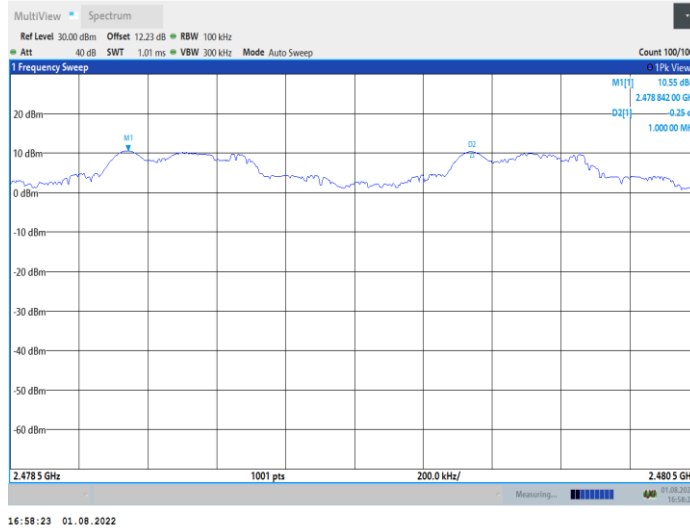
### 3DH1\_Ant1\_Hop\_2402



### 3DH1\_Ant1\_Hop\_2441



### 3DH1\_Ant1\_Hop\_2480



## 9. NUMBER OF HOPPING CHANNEL

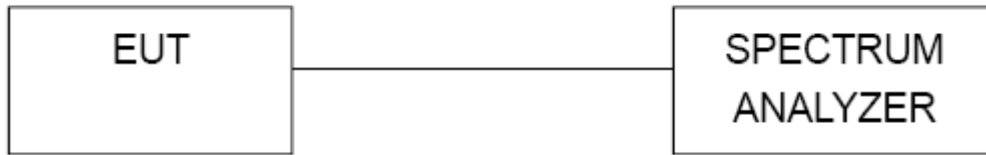
### 9.1.Limits of Number of Hopping Channel

Number of hopping channel should be compliance with the requirements in part15.247 (a) (1) III.

### 9.2.Test Procedure

- (a) Connect test port of EUT to spectrum analyzer.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch on. Frequency hopping function, then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.
- (c) Count the quantity of peaks to get the number of hopping channels.

### 9.3.Test Setup

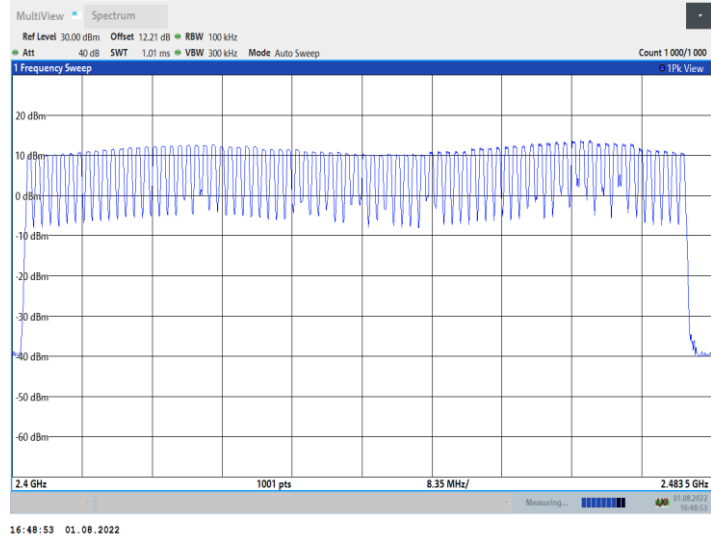


### 9.4.Test Data

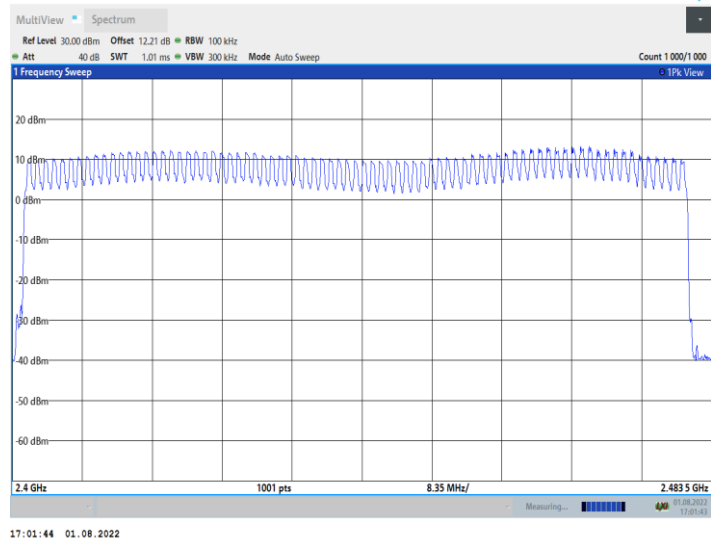
Table 14 Hopping Channel Number Test Data

Test Mode	Hopping Numbers	Modulation	Limit	Result
DH1	79	GFSK	>15	Pass
3DH1	79	8DPSK	>15	Pass

### DH1\_Ant1\_Hop



### 3DH1\_Ant1\_Hop





## 10. TIME OF OCCUPANCY

### 10.1. Limits of Time Occupancy

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 10.2. Test Procedure

- (a) Connect test port of EUT to spectrum analyzer and universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch on frequency hopping function.
- (c) Set the span of spectrum analyzer to 0 Hz, and set the resolution bandwidth to 1 MHz and the video bandwidth to 1 MHz, then get the time domain measured diagram. and set sweep time to 2 times of one burst occupancy time, and measure the time of occupancy of one burst.
- (d) Set the resolution bandwidth to 1 MHz and the video bandwidth to 3 MHz ,and set the sweep time to a period (0.4 seconds multiplied by the number of hopping channels employed), and count the number of the bursts.
- (e) Calculate the time of occupancy in a period with time occupancy of a burst and quantity of bursts.

DH1: Dwell time equal to Pluse time (ms)\*(1600/2/79)\*31.6ms

DH3: Dwell time equal to Pluse time (ms)\*(1600/4/79)\*31.6ms

DH5: Dwell time equal to Pluse time (ms)\*(1600/6/79)\*31.6ms

AFH Mode:

DH1: Dwell time equal to Pluse time (ms)\*(800/2/20)\* (0.4\*20) ms

DH3: Dwell time equal to Pluse time (ms)\*(800/4/20)\* (0.4\*20) ms

DH5: Dwell time equal to Pluse time (ms)\*(800/6/20)\* (0.4\*20) ms

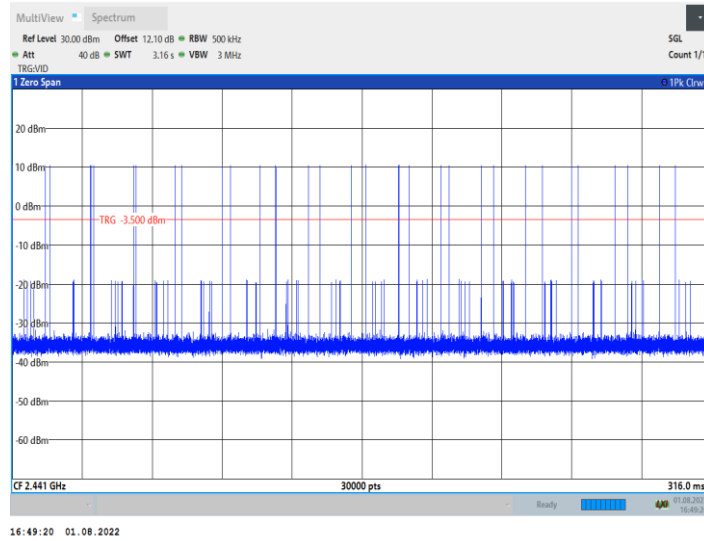
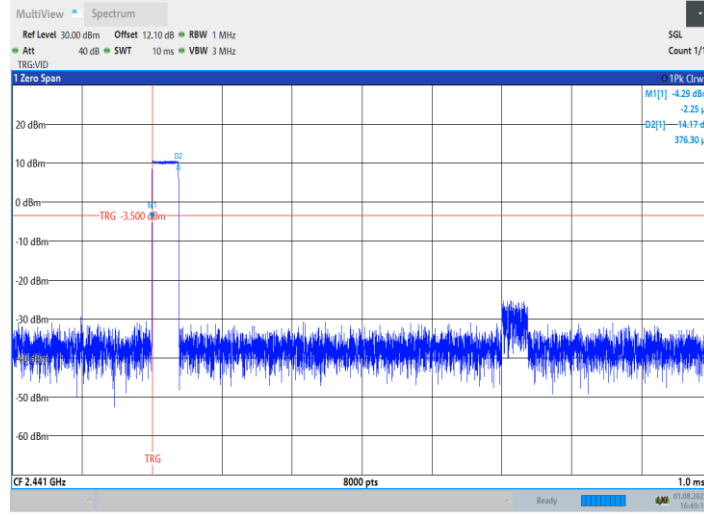
### 10.3. Test Data

GFSK

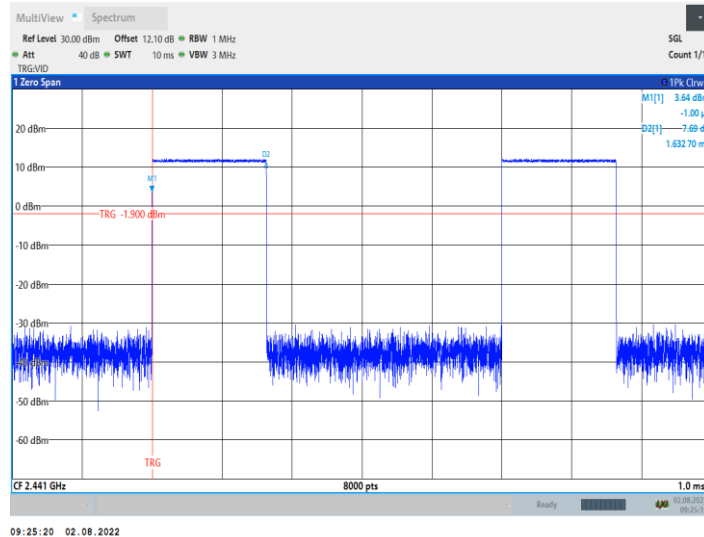
Table 15 Time of Occupancy

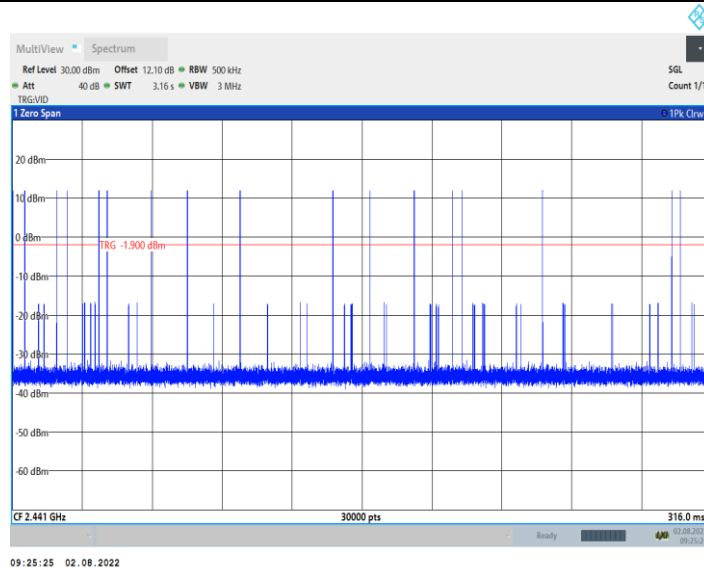
Data Packet	Time of Single Slot [ms]	Numbers of Slots in a period	Time of Occupied in a period [s]	AFH Mode Time of occupied in a period [s]	Limit [s]	Results
DH1	0.38	320	0.1216	0.0608	<= 0.40	Pass
DH3	1.63	170	0.2771	0.13855	<= 0.40	Pass
DH5	2.88	70	0.2016	0.1008	<= 0.40	Pass

### DH1\_Ant1\_Hop

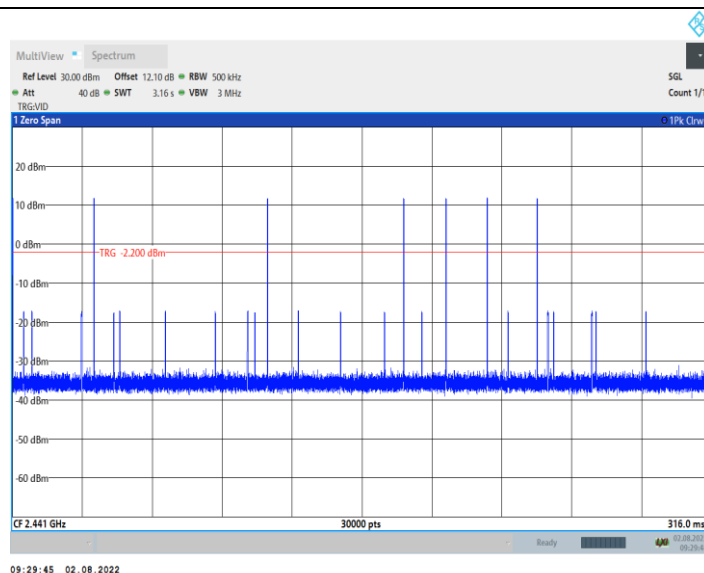
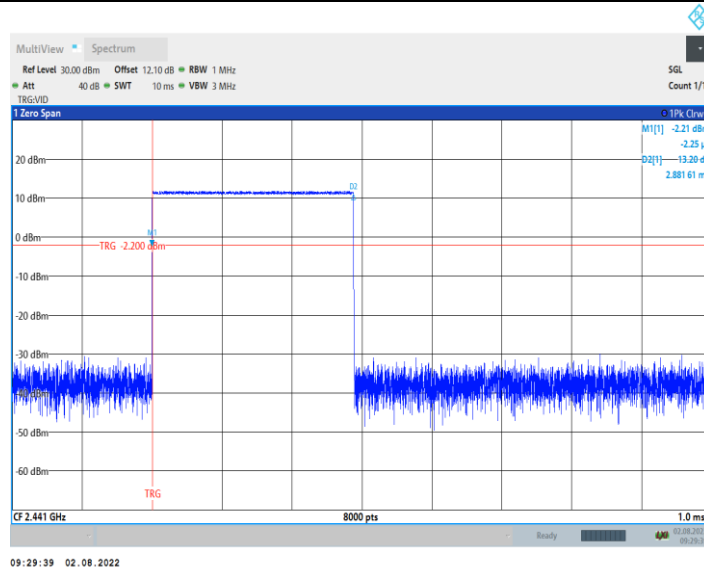


### DH3\_Ant1\_Hop





DH5\_Ant1\_Hop

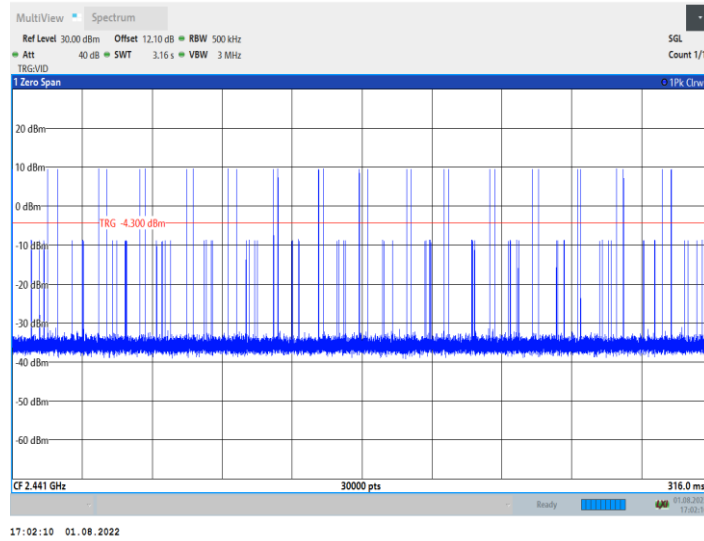
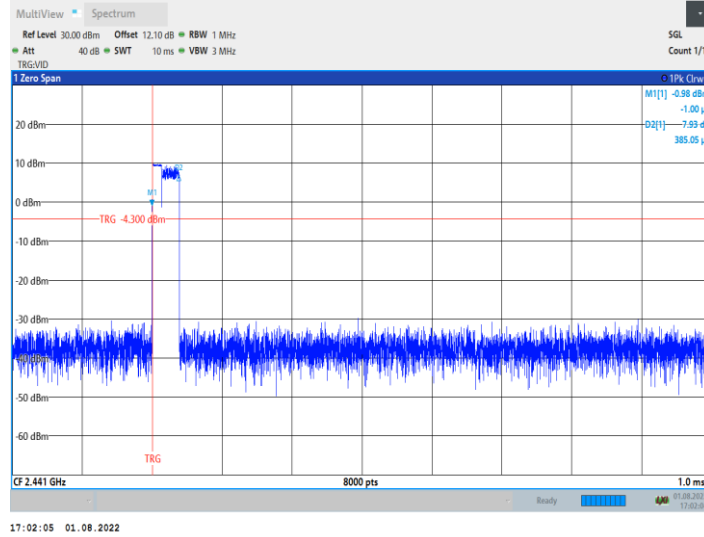


## 8DPSK

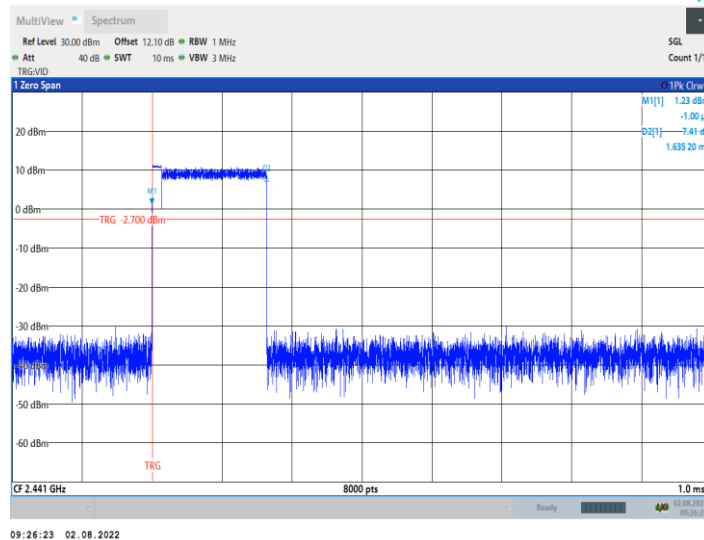
Table 16 Time of Occupancy

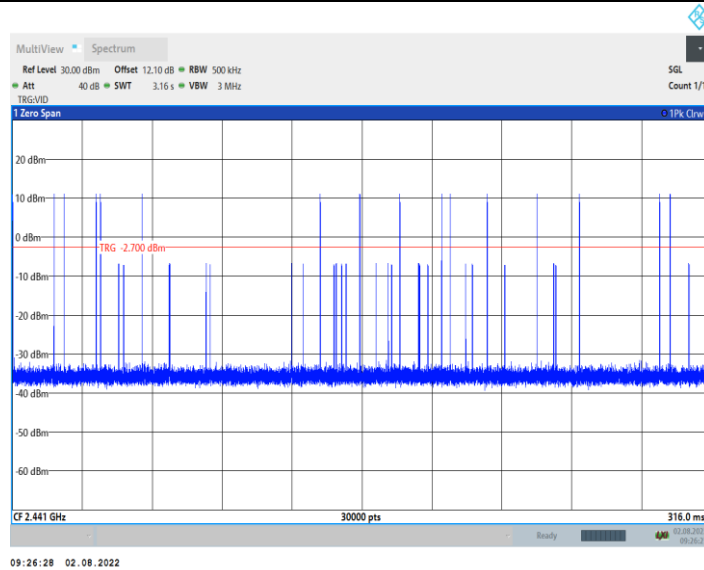
Data Packet	Time of Single Slot [ms]	Numbers of Slots in a period	Time of Occupied in a period [s]	AFH Mode Time of occupied in a period [s]	Limit [s]	Result
3DH1	0.39	320	0.1248	0.0624	$\leq 0.40$	Pass
3DH3	1.64	160	0.2624	0.1312	$\leq 0.40$	Pass
3DH5	2.89	100	0.289	0.1445	$\leq 0.40$	Pass

### 3DH1\_Ant1\_Hop

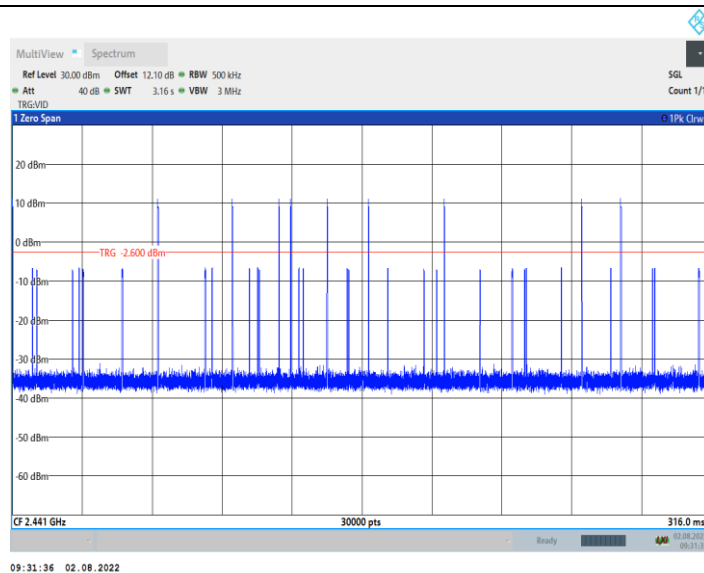
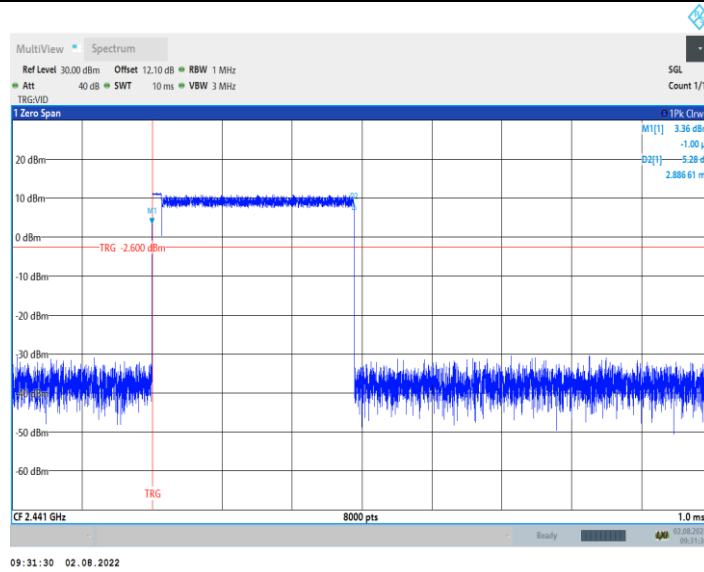


### 3DH3\_Ant1\_Hop





3DH5\_Ant1\_Hop



## 11. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

### 11.1. Limits of Maximum Conducted Output Power Measurement

Compliance with part 15.247 (b) (1) & RSS-247 Clause 5.4(2), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watt.

### 11.2. Test Procedure

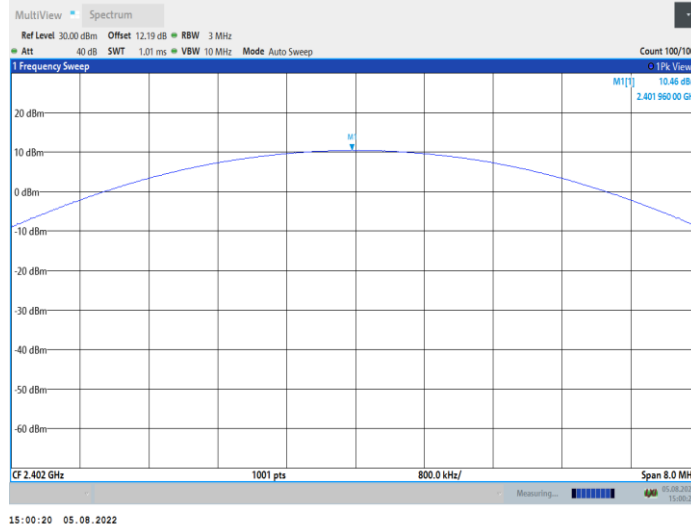
- (a) Connect test port of EUT to universal communication tester.
- (b) Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function.
- (c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted output power separately.

### 11.3. Test Data

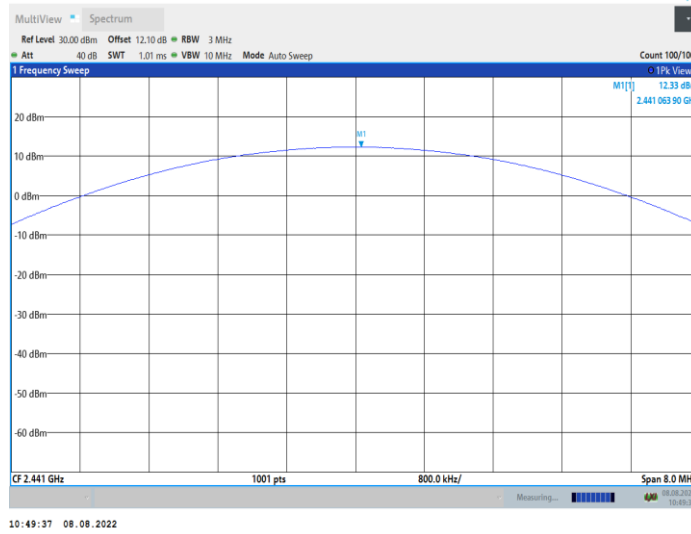
Table 17 Maximum Conducted Output Power Test Data

Test Mode	Center Freq. [MHz]	Modulation	Meas. Level (Cond.) [dBm]	Limit [dBm]	Result
DH1	2402	GFSK	10.46	$\leq 20.97$	Pass
	2441		12.33	$\leq 20.97$	Pass
	2480		12.08	$\leq 20.97$	Pass
3DH1	2402	8DPSK	9.86	$\leq 20.97$	Pass
	2441		9.49	$\leq 20.97$	Pass
	2480		9.43	$\leq 20.97$	Pass

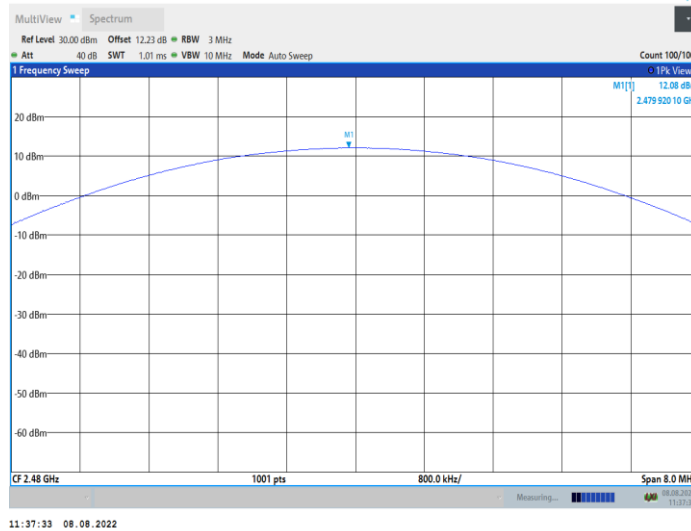
### DH1\_Ant1\_2402



### DH1\_Ant1\_2441

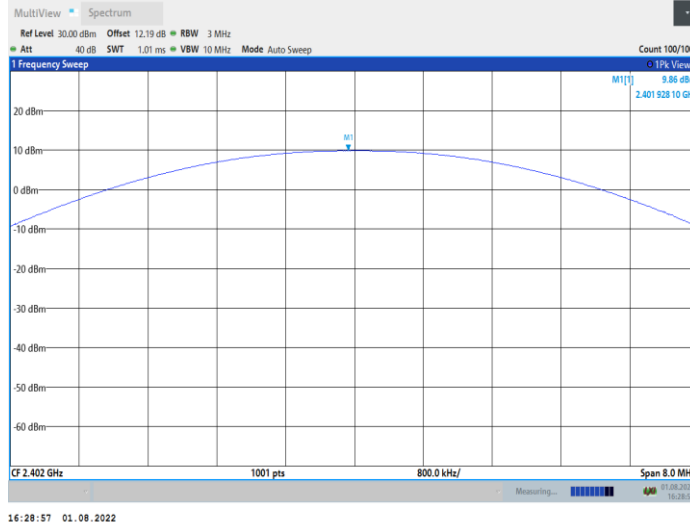


### DH1\_Ant1\_2480

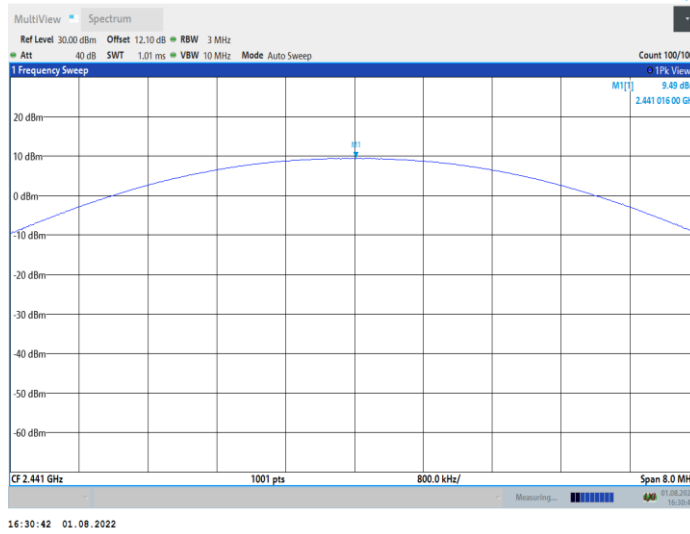




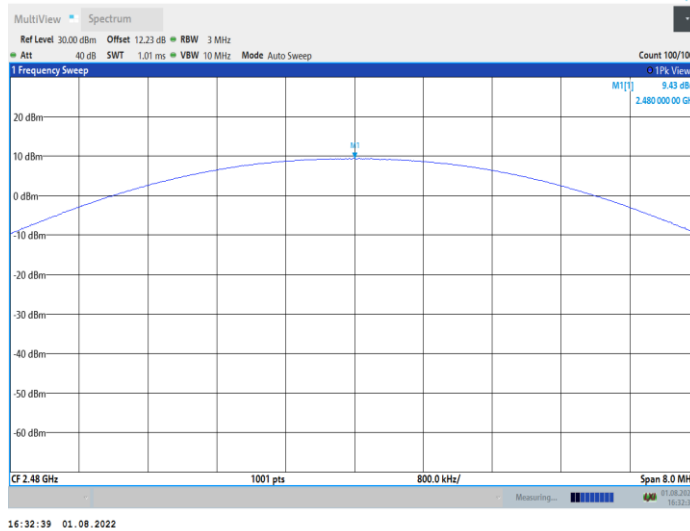
3DH1\_Ant1\_2402



3DH1\_Ant1\_2441



3DH1\_Ant1\_2480



## **12. BAND EDGES MEASUREMENT**

### **12.1.Limits of Band Edges Measurement**

Below –20dB of the highest emission level of operating band (in 100kHz resolution bandwidth).

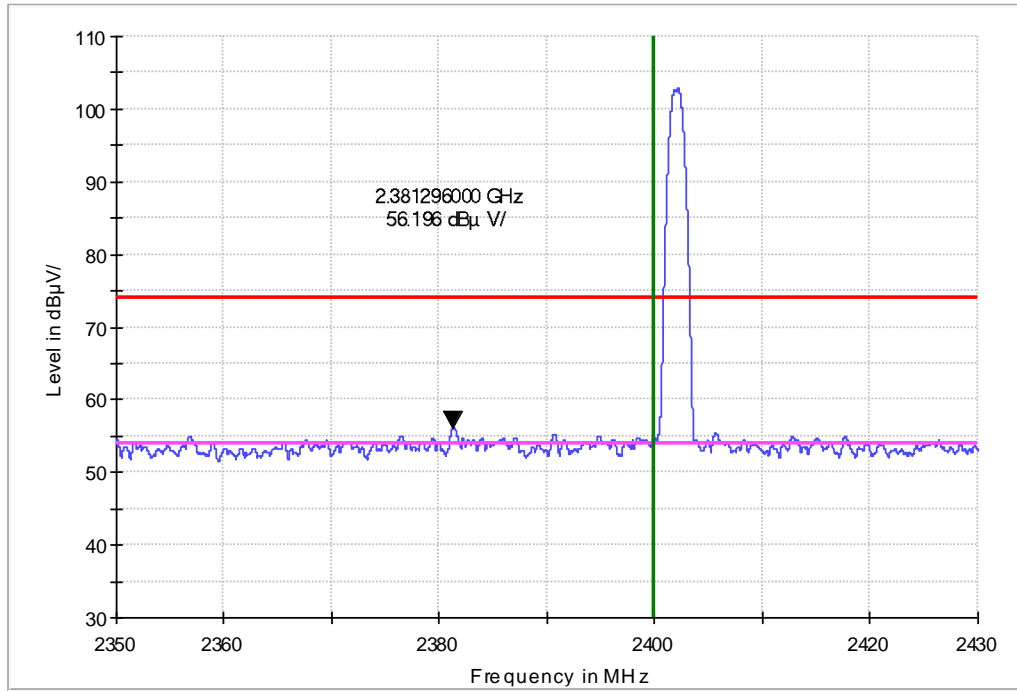
### **12.2.Test Procedure**

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
  - (b) PEAK: RBW=VBW=1MHz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

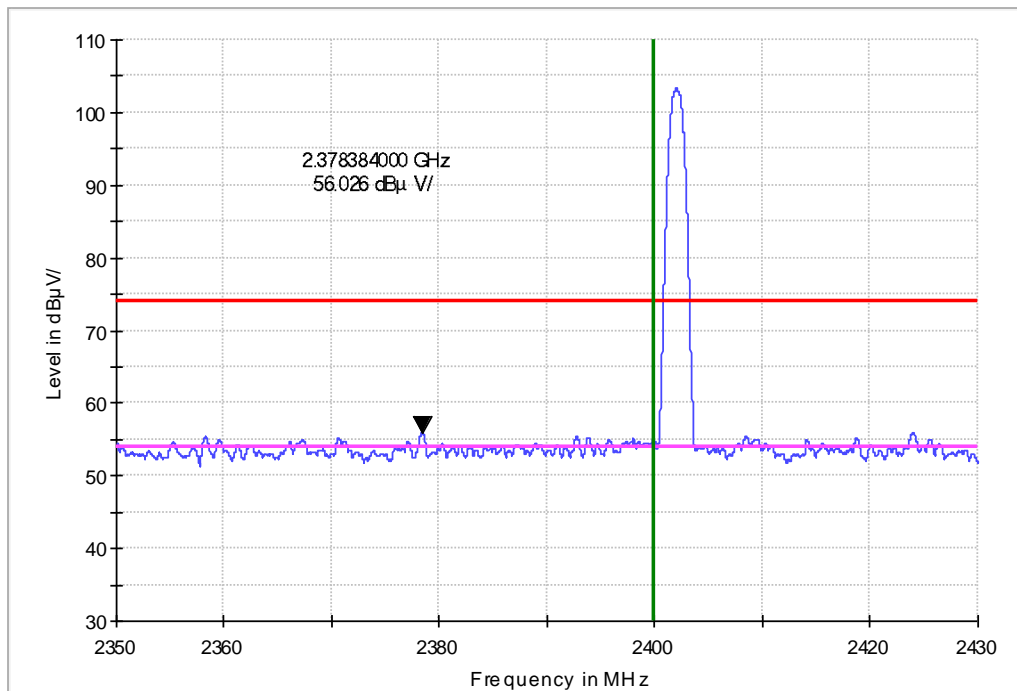
### **12.3.Test Data**

The measured plots are attached on the following. Test data shows compliance with the band edge requirement in part 15.247(d).

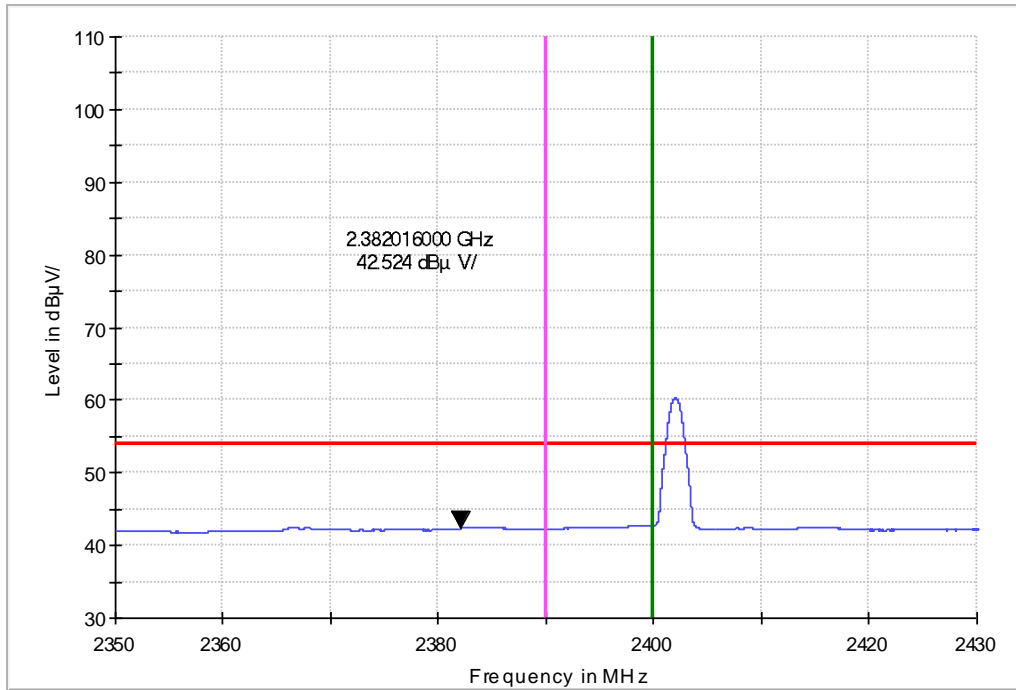
GFSK  
Low edge  
PK  
Horizontal



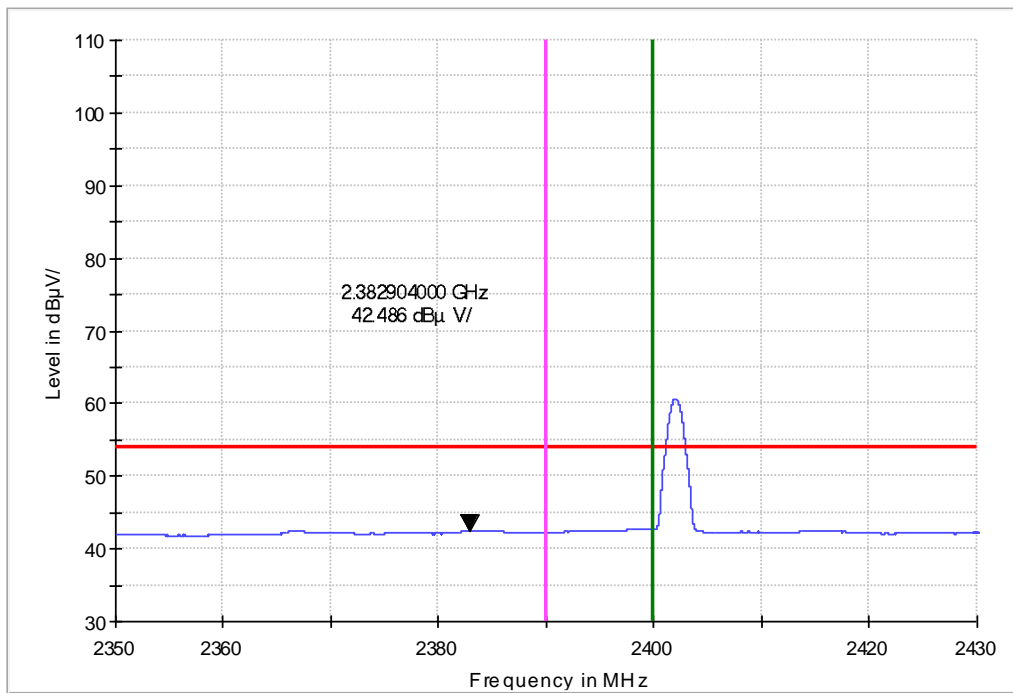
Vertical



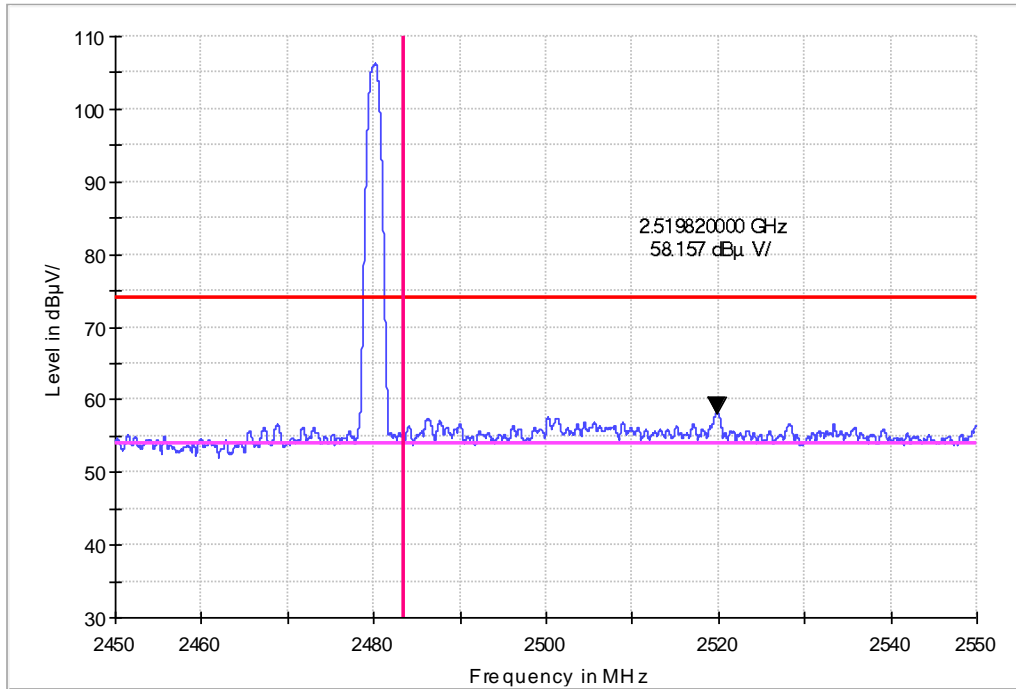
AV  
Horizontal



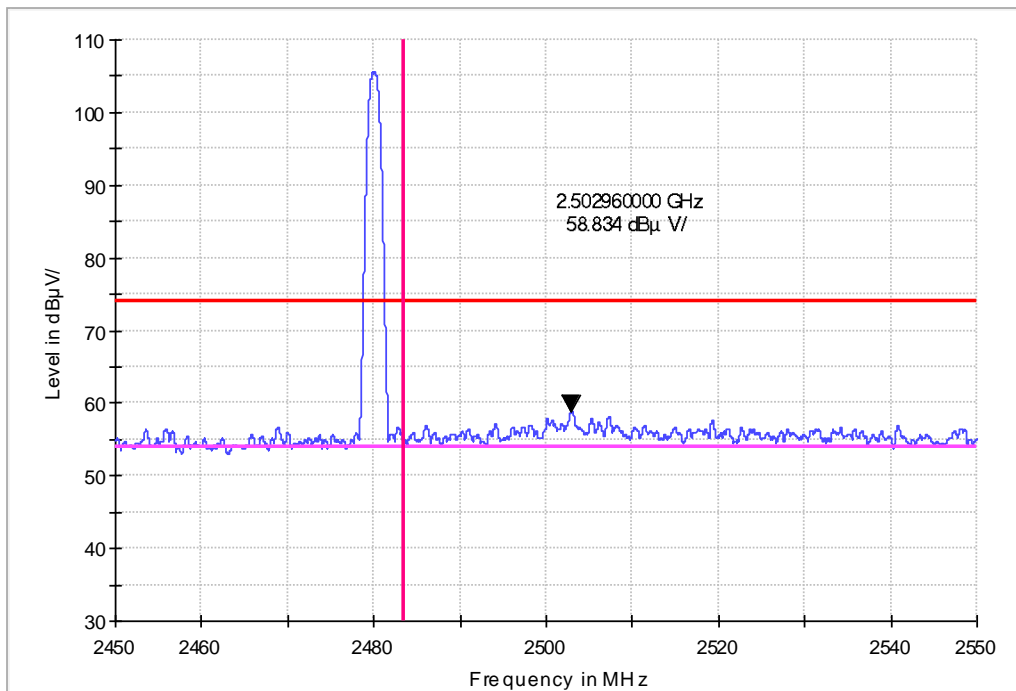
Vertical



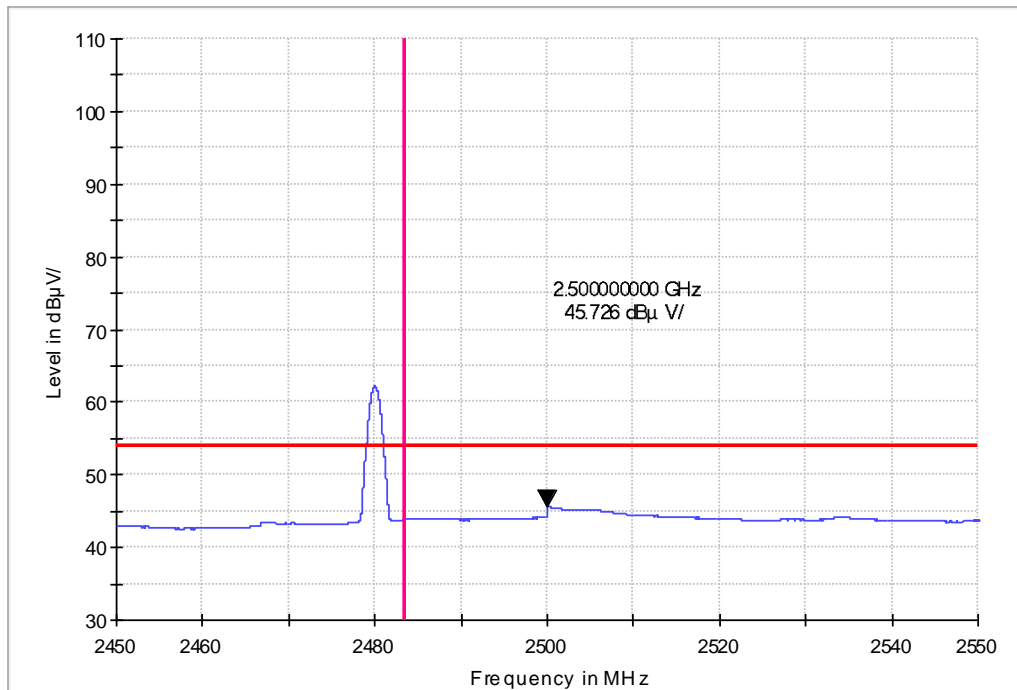
GFSK  
Upper Edge  
PK  
Horizontal



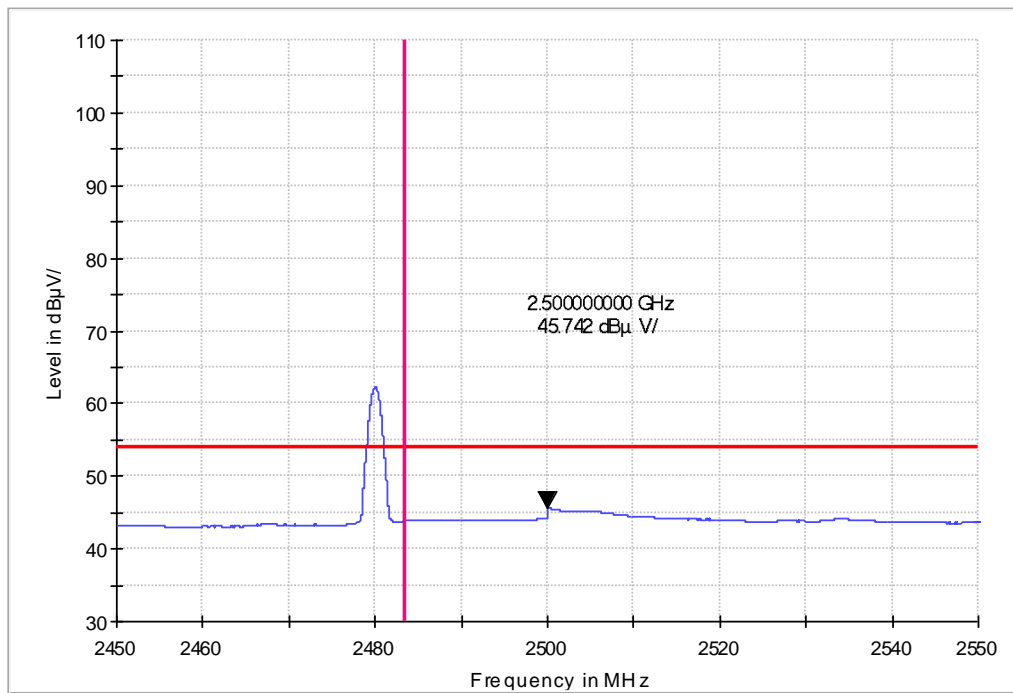
Vertical



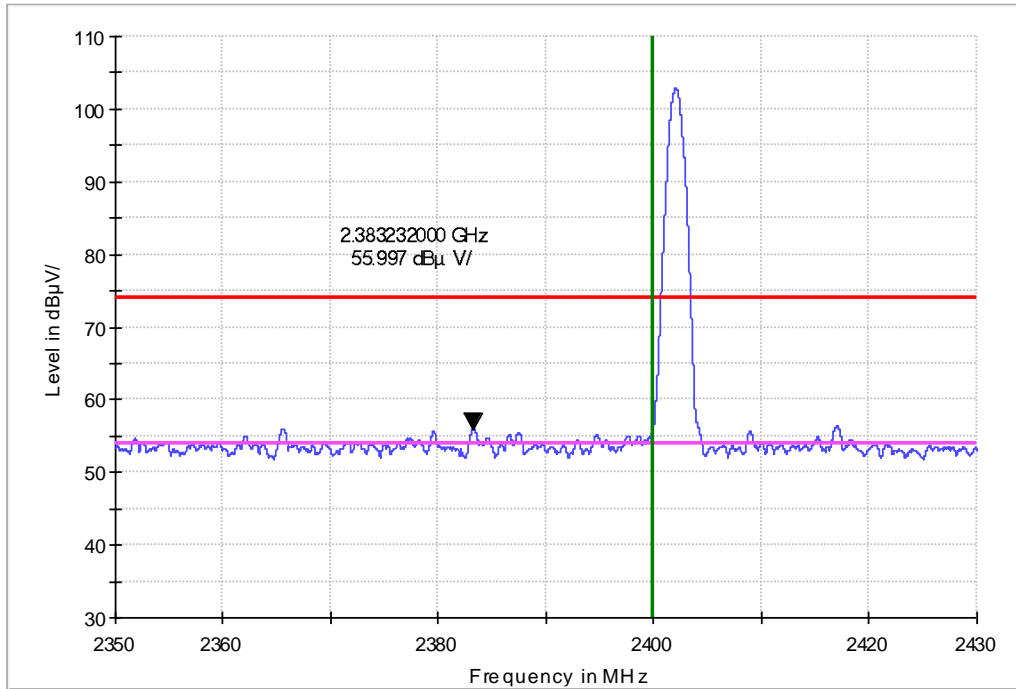
AV  
Horizontal



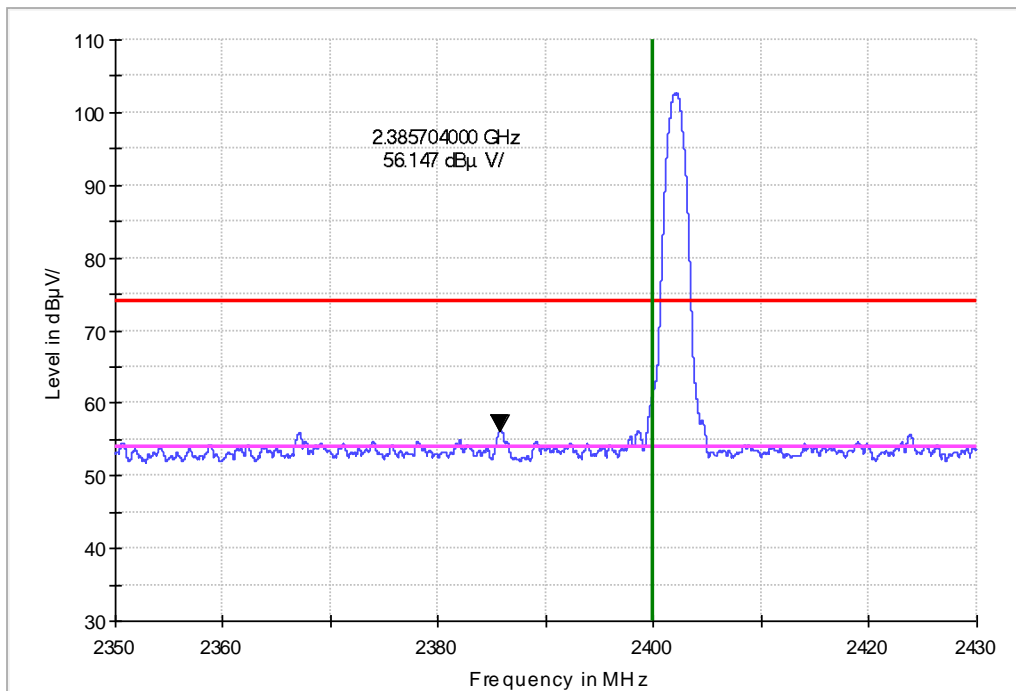
Vertical



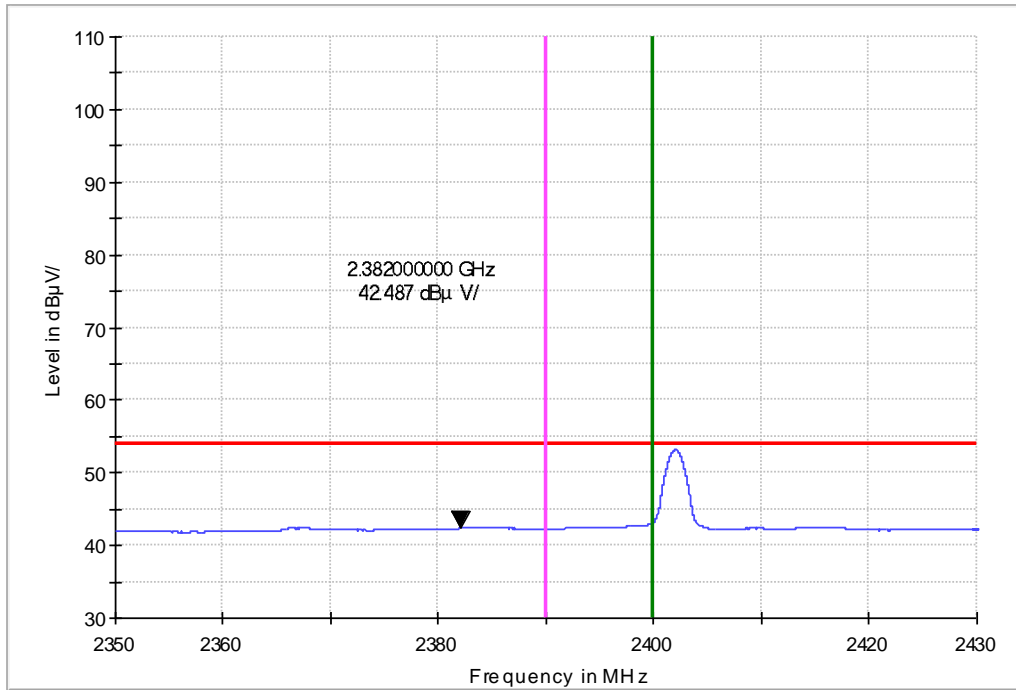
8DPSK  
Low edge  
PK  
Horizontal



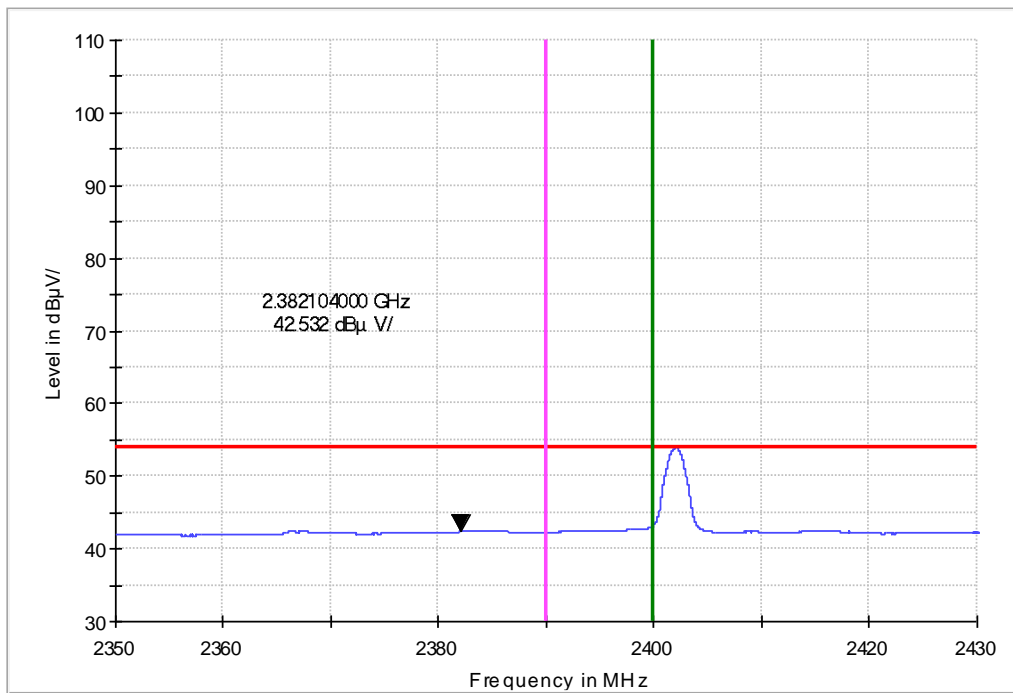
Vertical



AV  
Horizontal

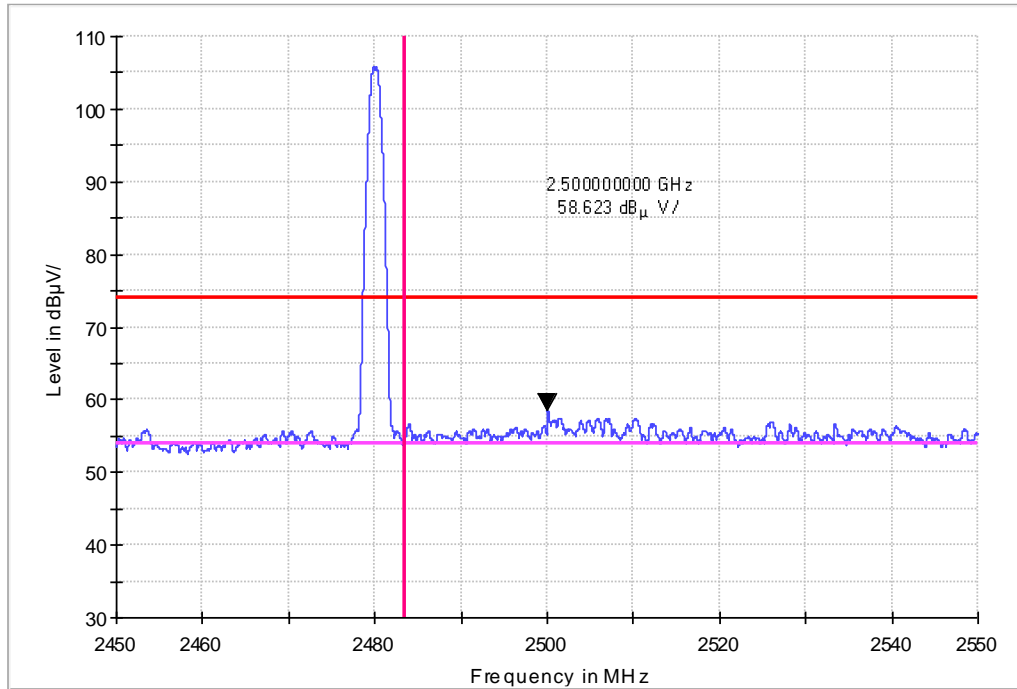


Vertical

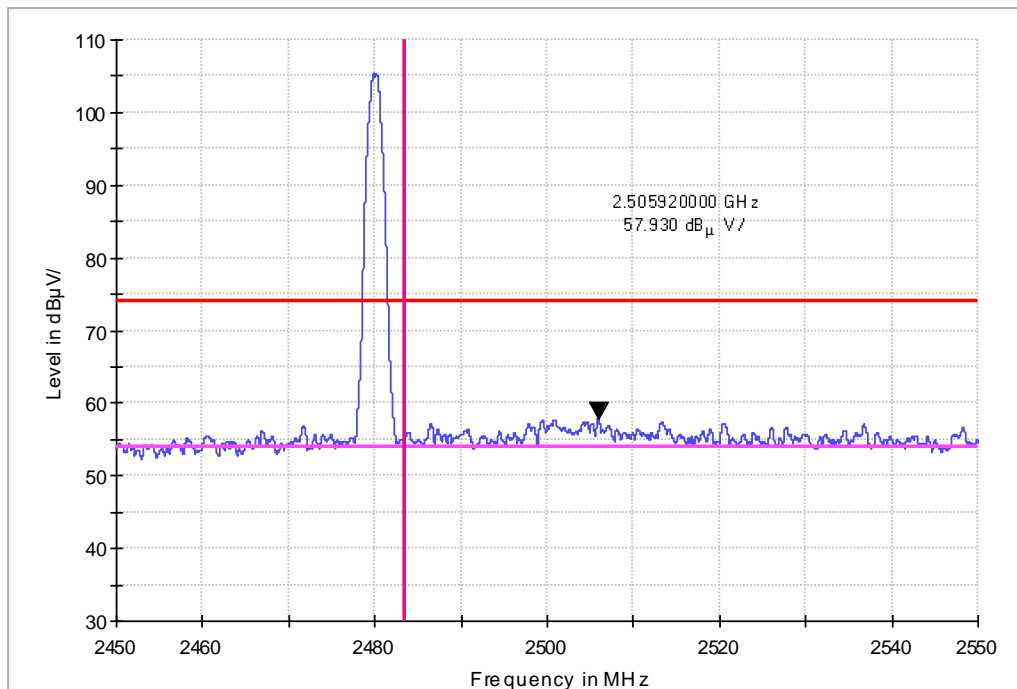




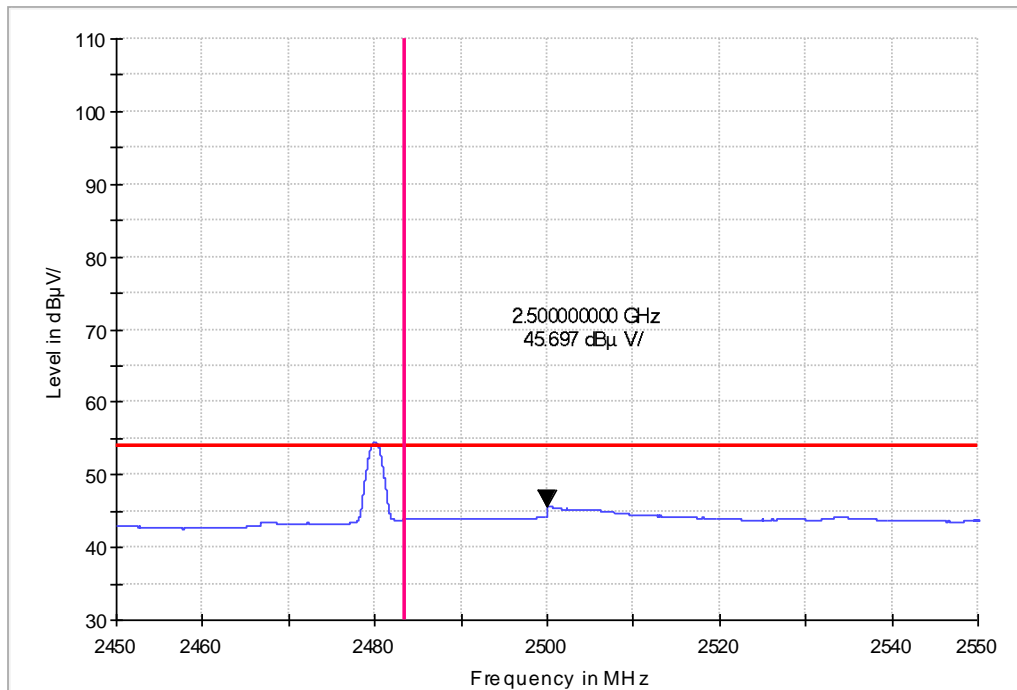
8DPSK  
Upper edge  
PK  
Horizontal



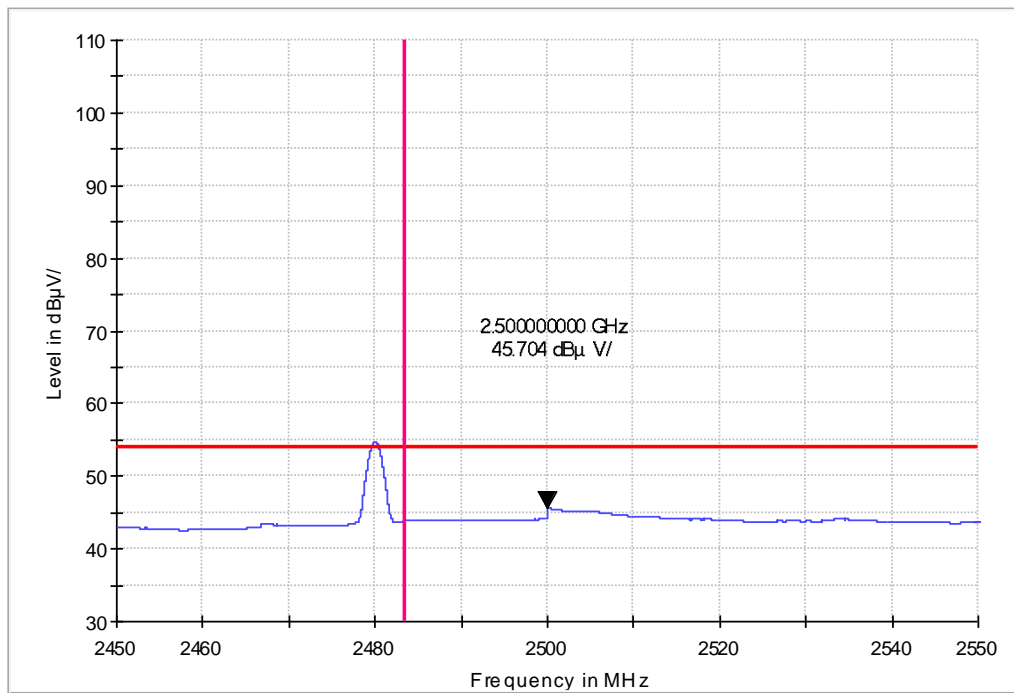
Vertical



AV  
Horizontal



Vertical



## **13. CONDUCTED SPURIOUS EMISSION**

### **13.1.Limits of Band Edges Measurement**

Below –20dB of the highest emission level of operating band (in 100 kHz resolution bandwidth).

### **13.2.Test Procedure**

The transmitter output was connected to the spectrum analyzer.

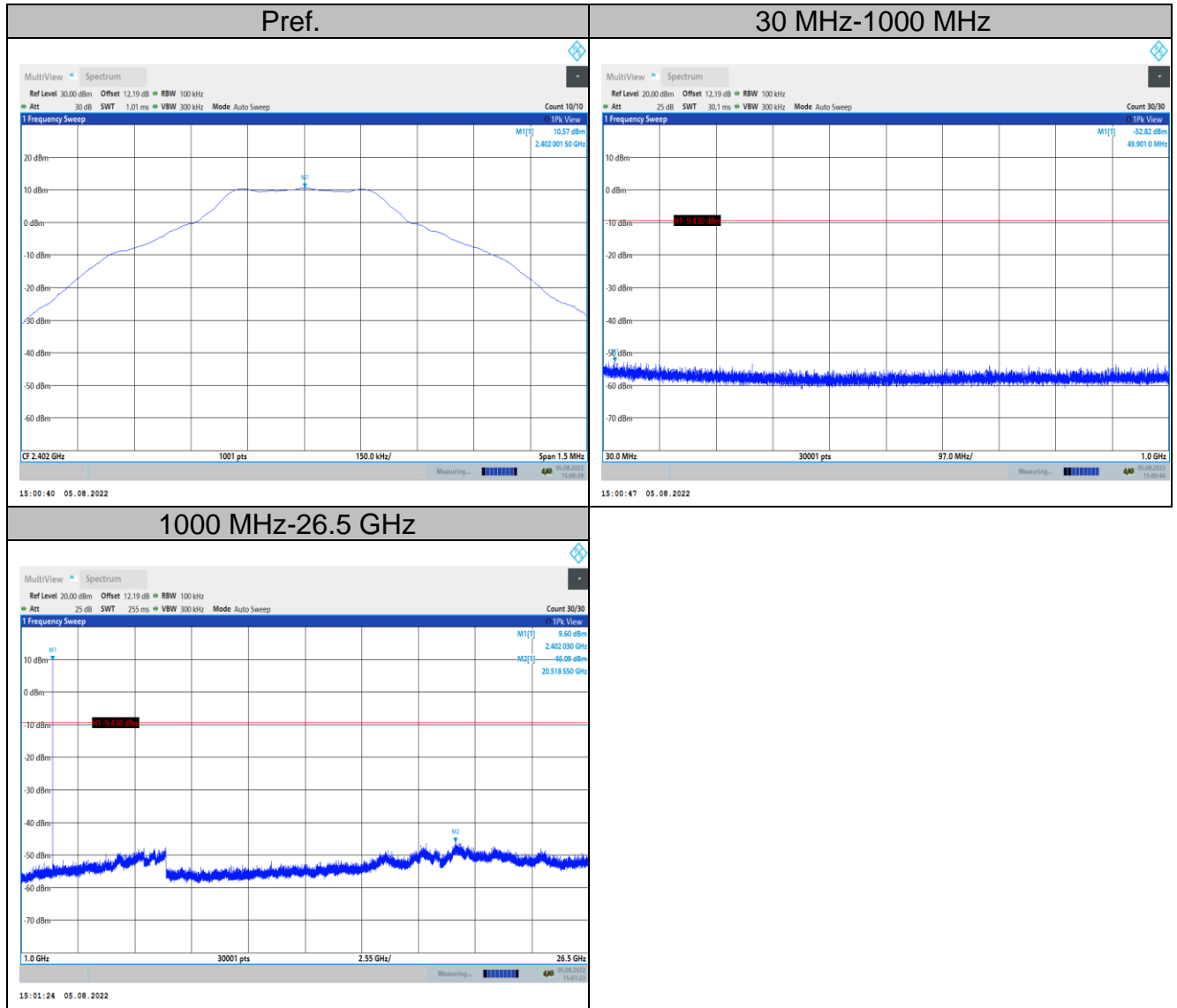
The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

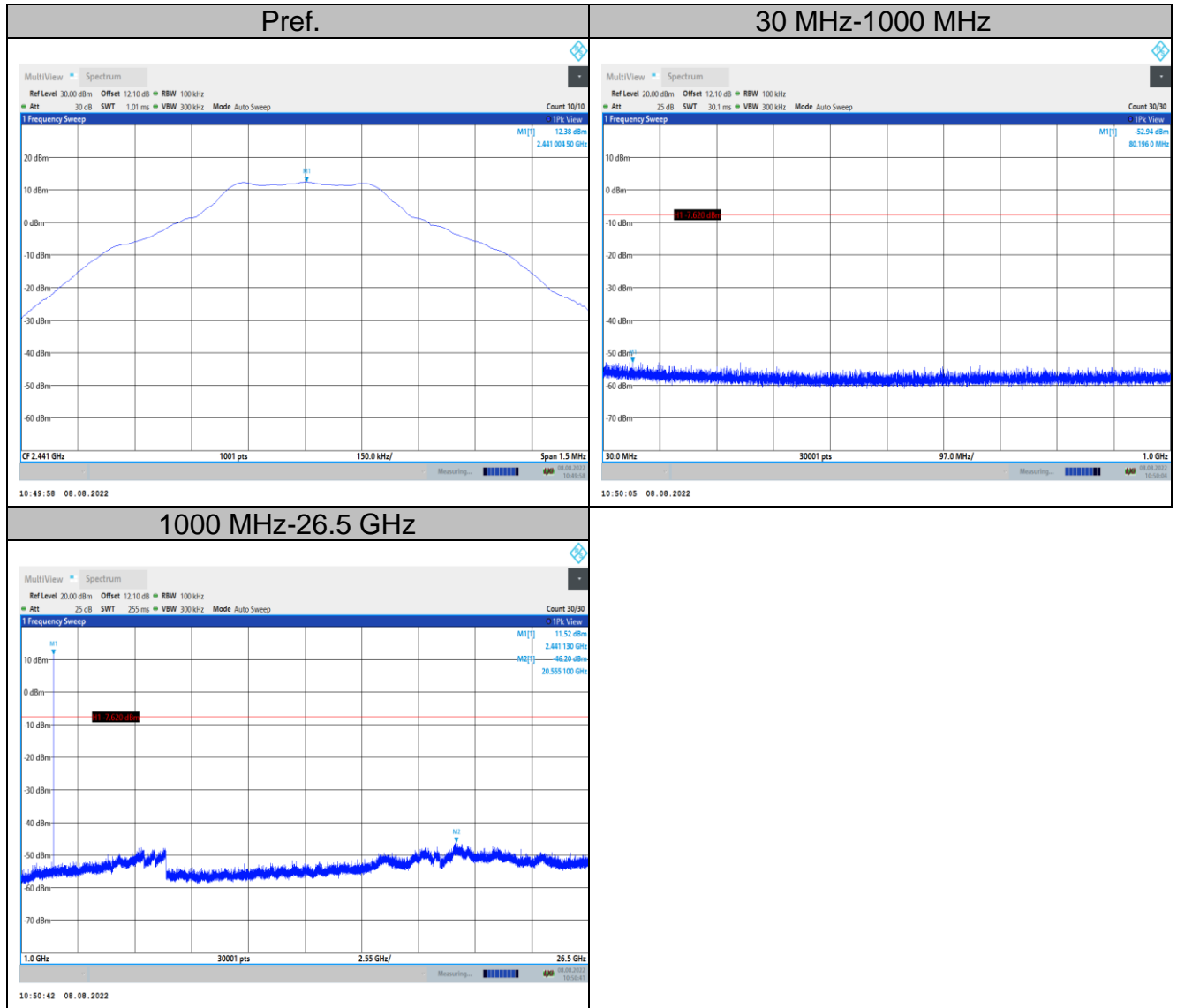
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal

### **13.3.Test Data**

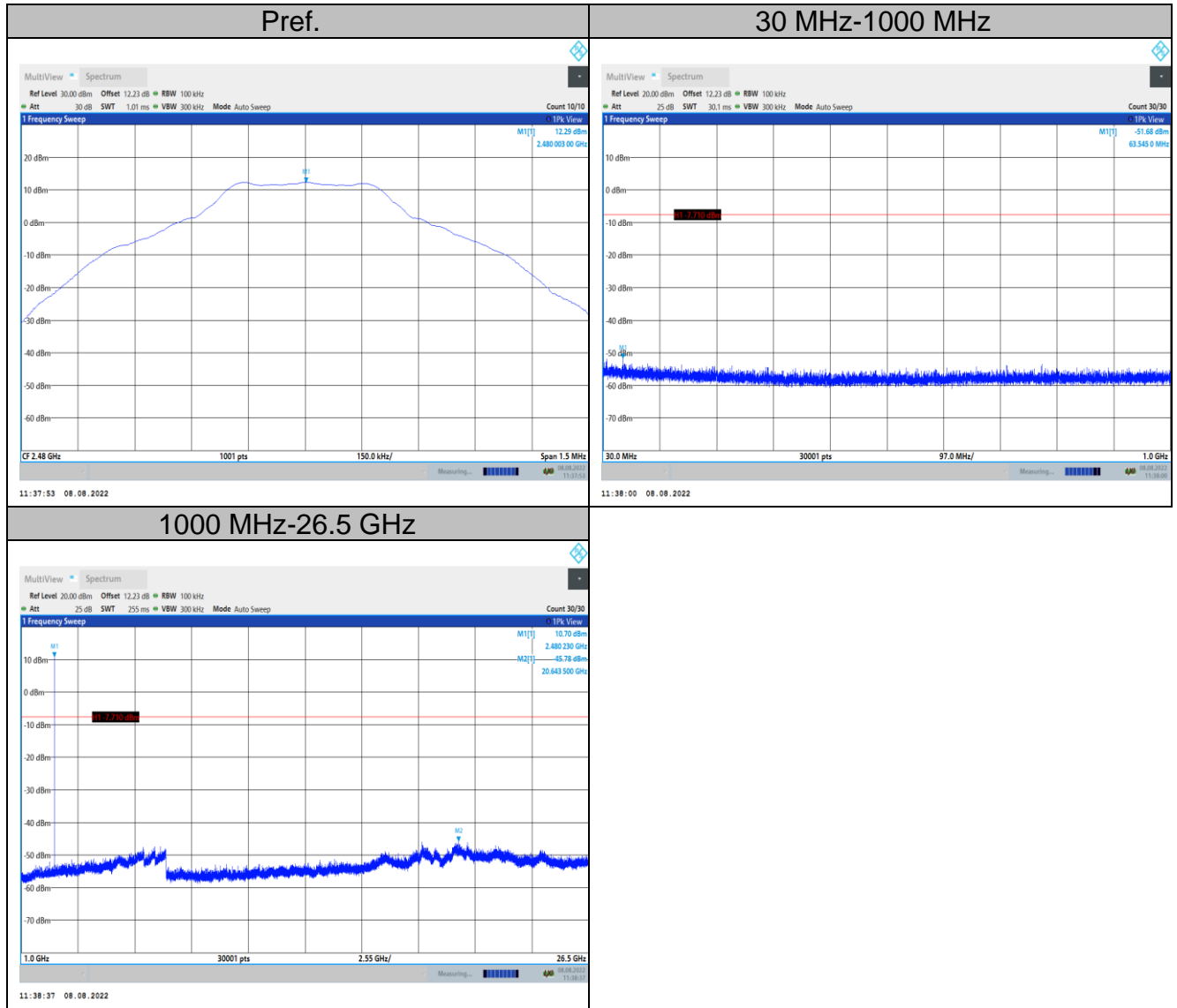
# GFSK Low Channel



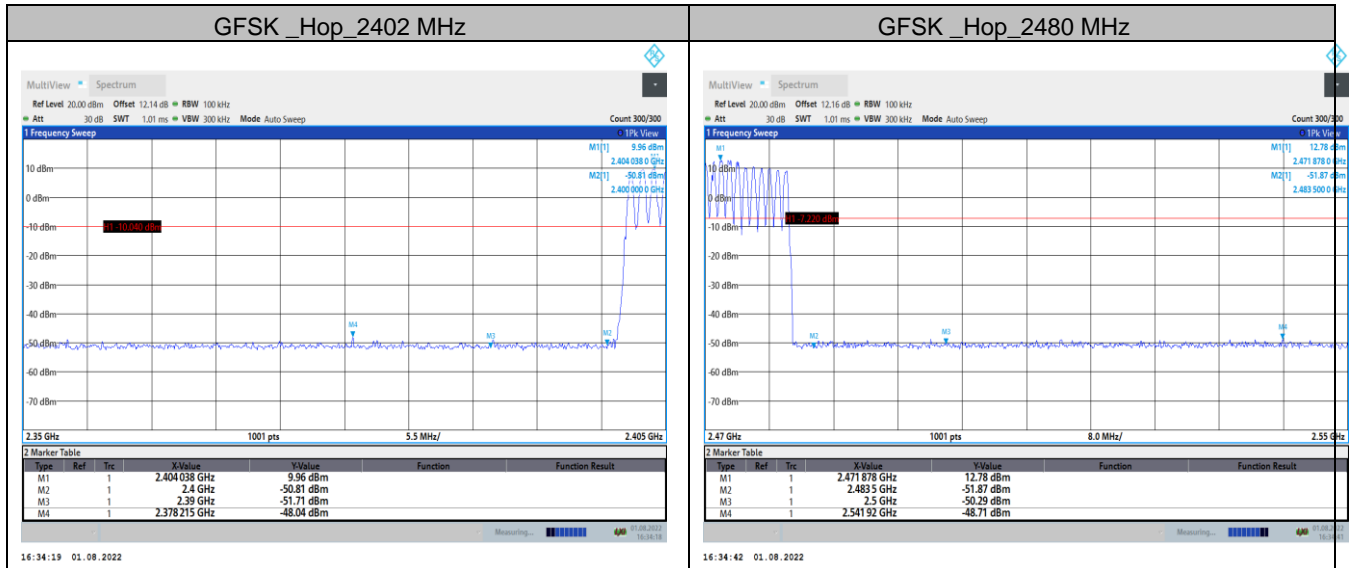
# GFSK Mid Channel



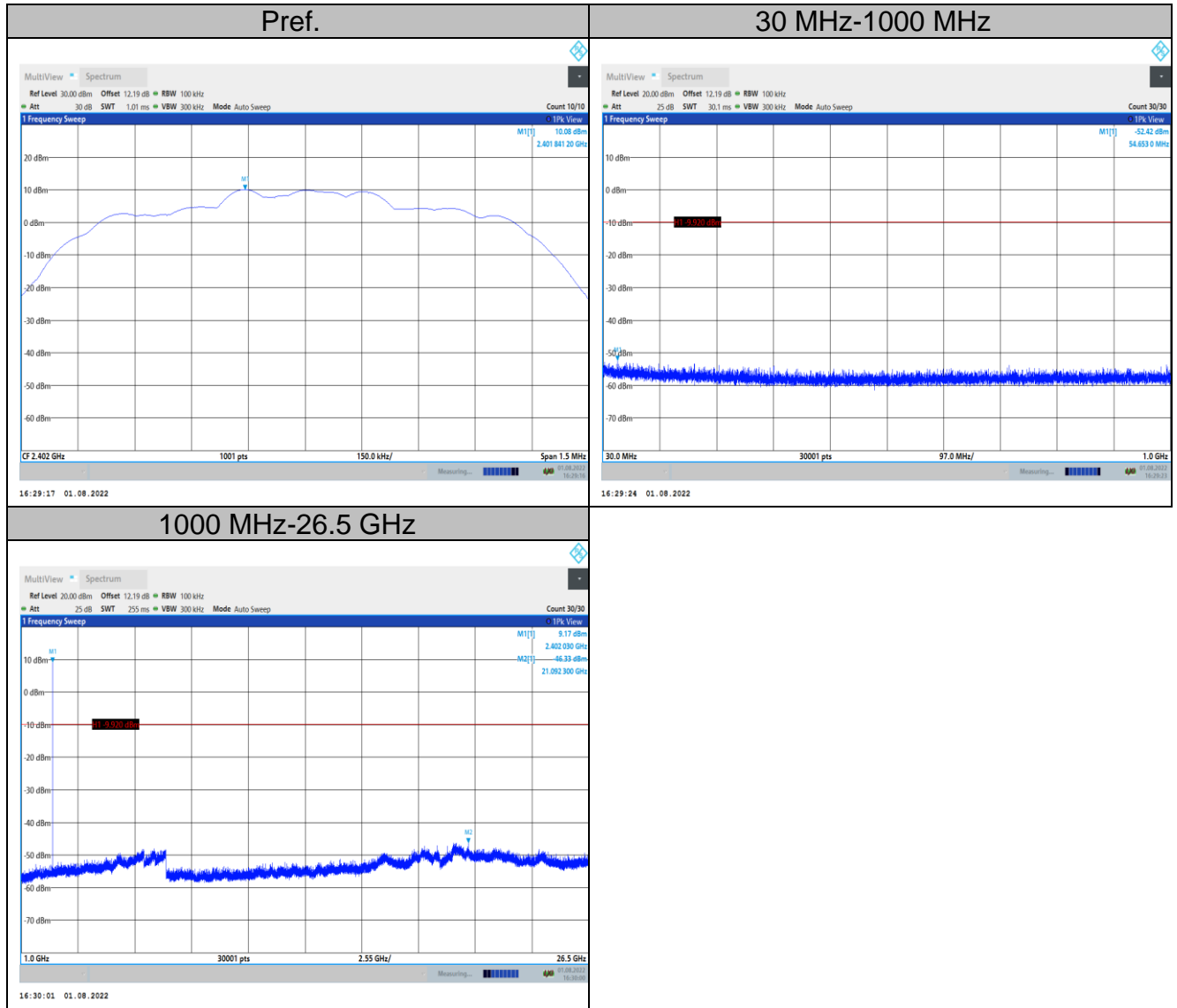
# GFSK High Channel



# GFSK Band Edge Hopping on

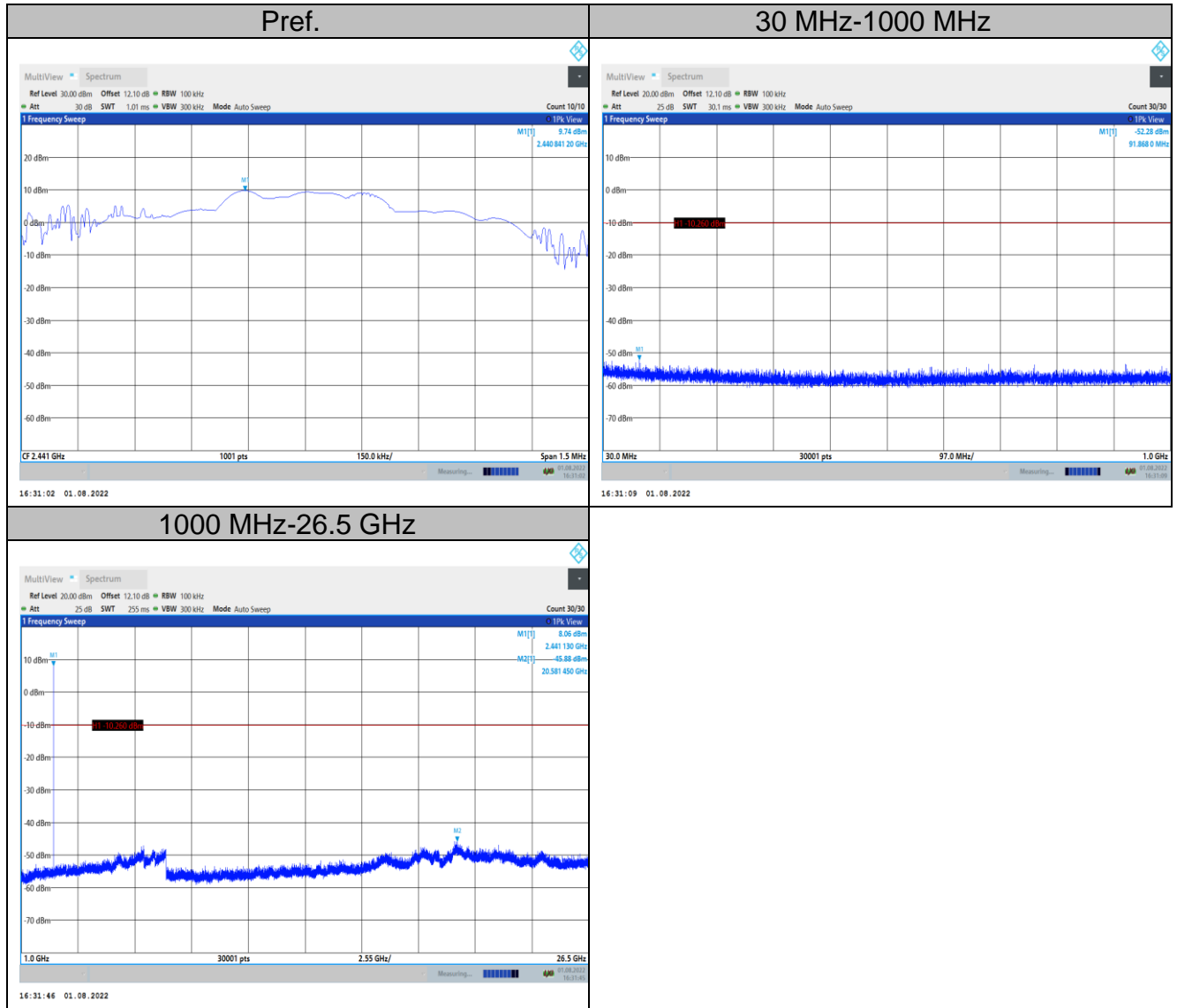


# 8DPSK Low Channel

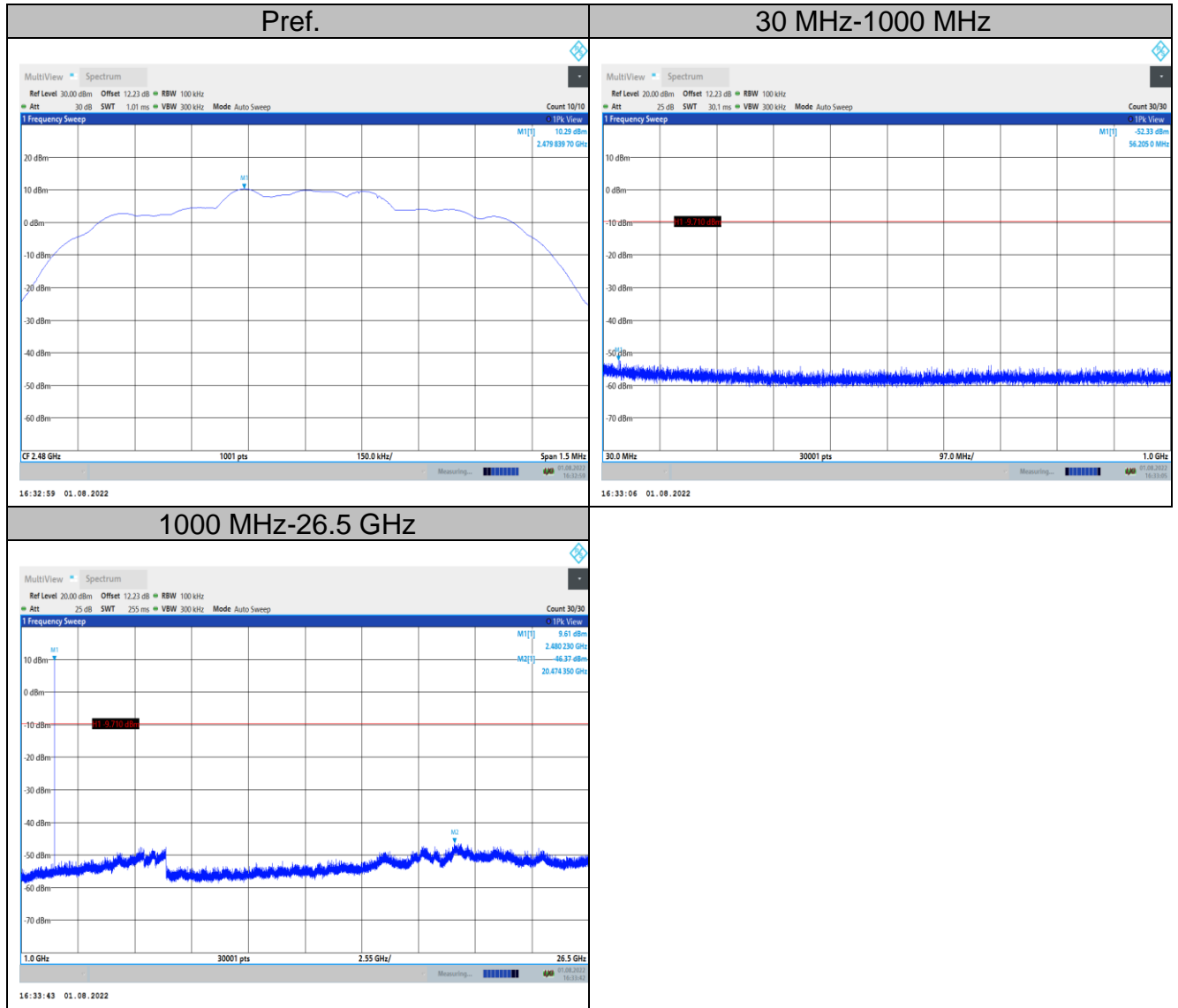




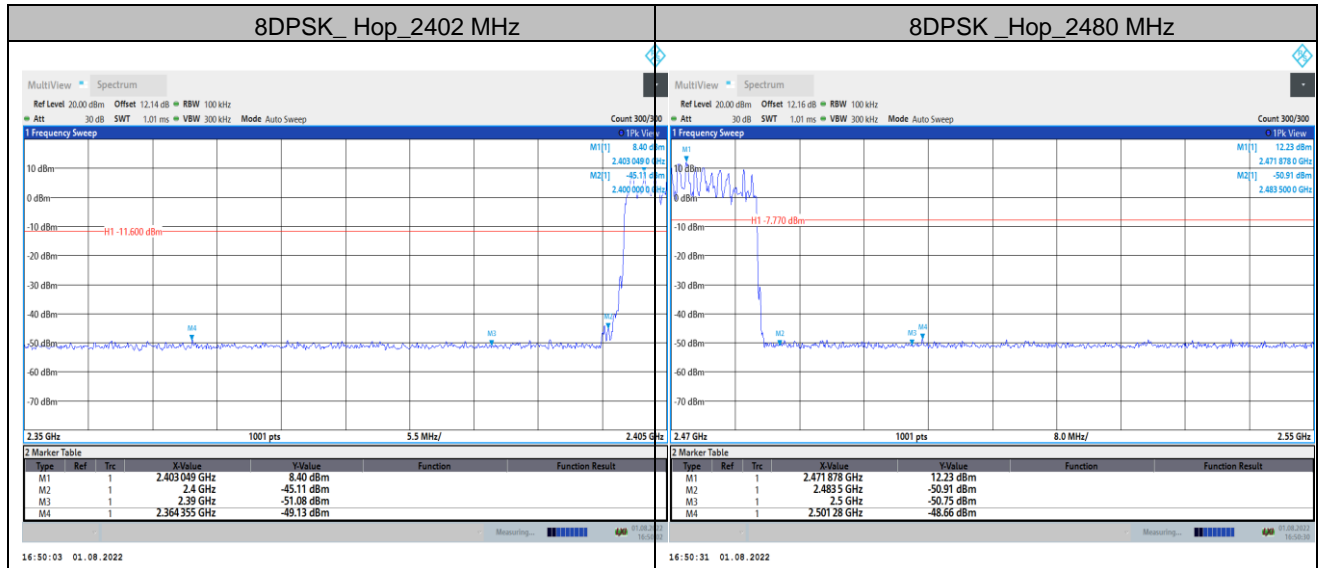
# 8DPSK Mid Channel



# 8DPSK High Channel



# 8DPSK Band Edge Hopping on



## 14. ANTENNA REQUIREMENTS

15.203 requirements:

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 an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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.

15.247(b) (4) requirements:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 14.1. Antenna Connector

Antenna Connector is on the PCB within enclosure and not accessible to user.

### 14.2. Antenna Gain

The antenna gain of EUT is less than 6 dBi.

-----End of Report-----