

FCC TEST REPORT

For

Prolycht directional LED fixture

Model Number: Prolycht Orion 675 FS

FCC ID: 2AXKOORION675FS-C5

Report Number : WT228002492

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
E-mail : emcrf@smq.com.cn

Revision History

No	Date	Remark
V1.0	2022.11.30	Initial issue

TEST REPORT DECLARATION

Applicant : Shenzhen Chromatech Lighting CO LTD
Address : 29 Gaoxin South Ring Road, Building 1, Room 901, Shenzhen, Guangdong, China
Manufacturer : Prolycht Lighting Co., Ltd
Address : Huangtian Road, Shengtao Qianhai Industrial Park, Building #2, 1st floor, Baoan District, Shenzhen, Guangdong, China
EUT Description : Prolycht directional LED fixture
Model No. : Prolycht Orion 675 FS
Trade mark : PROLYCHT
Serial Number : /
FCC ID : 2AXKOORION675FS-C5

Test Standards:

FCC Part 15 Subpart C 15.247

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.

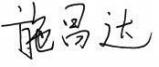
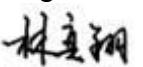
Project Engineer:	 (Zhou Fangai 周芳媛)	Date: Nov.30, 2022
Checked by:	 (Shi Changda 施昌达)	Date: Nov.30, 2022
Approved by:	 (Lin Yixiang 林奕翔)	Date: Nov.30, 2022

TABLE OF CONTENTS

TEST REPORT DECLARATION	3
1. TEST RESULTS SUMMARY	6
2. GENERAL INFORMATION	7
2.1. Report Information.....	7
2.2. Laboratory Accreditation and Relationship to Customer	7
2.3. Measurement Uncertainty	8
3. PRODUCT DESCRIPTION.....	9
3.1. EUT Description.....	9
3.2. Related Submittal(s) / Grant (s)	9
3.3. Block Diagram of EUT Configuration	9
3.4. Operating Condition of EUT	9
3.5. Support Equipment List	9
3.6. Test Conditions.....	9
3.7. Special Accessories.....	10
3.8. Equipment Modifications	10
3.9. Equipment Requirements.....	10
4. TEST EQUIPMENT USED	11
5. CONDUCTED EMISSION TEST	12
5.1. Test Standard and Limit	12
5.2. Test Procedure	12
5.3. Test Arrangement.....	12
5.4. Test Data	12
6. RADIATED EMISSION TEST	15
6.1. Test Standard and Limit	15
6.2. Test Procedure	15
6.3. Test Arrangement.....	15
6.4. Test Data	15
7. 20DB BANDWIDTH MEASUREMENT	26
7.1. Limits of 20dB Bandwidth Measurement.....	26
7.2. Test Procedure	26
7.3. Test Setup	26
7.4. Test Data	26
8. CARRIER FREQUENCY SEPARATION MEASUREMENT.....	28
8.1. Limits of Carrier Frequency Separation Measurement	28
8.2. Test Procedure	28
8.3. Test Setup	28
8.4. Test Data	28
9. NUMBER OF HOPPING CHANNEL	30
9.1. Limits of Number of Hopping Channel.....	30
9.2. Test Procedure	30
9.3. Test Setup	30
9.4. Test Data	30
10. TIME OF OCCUPANCY.....	31

10.1.	Limits of Time Occupancy.....	31
10.2.	Test Procedure	31
10.3.	Test Data	31
11.	MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT	33
11.1.	Limits of Maximum Conducted Output Power Measurement.....	33
11.2.	Test Procedure	33
11.3.	Test Data	33
12.	BAND EDGES MEASUREMENT.....	35
12.1.	Limits of Band Edges Measurement	35
12.2.	Test Procedure	35
12.3.	Test Data	35
13.	CONDUCTED SPURIOUS EMISSION.....	40
13.1.	Limits of Band Edges Measurement	40
13.2.	Test Procedure	40
13.3.	Test Data	40
14.	ANTENNA REQUIREMENTS	45
14.1.	Antenna Connector	45
14.2.	Antenna Gain	45

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.

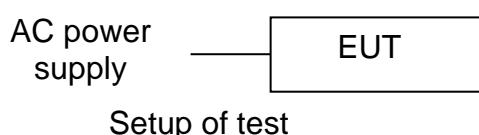
3.1. EUT Description

Description : Prolycht directional LED fixture
Manufacturer : Prolycht Lighting Co., Ltd
Model Number : Prolycht Orion 675 FS
Operate Frequency : 2.402GHz~2.480GHz
Antenna : FPC Antenna 0.99 dBi
Designation :
Operating voltage : DC3.0V(Low)/DC3.3V(Nonimal)/DC3.6V(Max)
Software Version : V1.01.00
Hardware Version : V2.1
Remark: --

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

This submittal(s) (test report) is intended for FCC ID: **2AXK0ORION675FS-C5** 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 GFSK modulation. Tests were performed with GFSK modulation.

3.5. Support Equipment List

Table 2 Support Equipment List

Name	Model No	S/N	Manufacturer
Notebook	HP ProBook 440 G6	---	HP

3.6. Test Conditions

Date of test : Aug.26, 2022- Oct.27, 2022

Date of EUT Receive : Jul.20, 2022

Temperature: 21°C-26°C

Relative Humidity: 48%-54%

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.13,2022	1 Year
SB4357	AMN	R&S	ENN216	Aug.23,2022	1 Year
SB9549	Shielded Room	Albatross	SR	Sep.24,2021	1 Year
SB9549	Shielded Room	Albatross	SR	Sep.06,2022	1 Year
SB15044/01	Test Receiver	R&S	ESW8	Sep.14,2021	1 Year
SB15044/01	Test Receiver	R&S	ESW8	Sep.13,2022	1 Year
SB3345	Loop Antenna	Schwarzbeck	FMZB1516-113	Jan.20,2022	1 Year
SB18856	Broadband Antenna	SCHWARZBECK	VULB9163	Sep.26,2021	1 Year
SB18856	Broadband Antenna	SCHWARZBECK	VULB9163	Sep.07,2022	1 Year
SB18844	Semi Anechoic Chamber	Albatross	9×6×6(m)	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
SB8501/11	Antenna	R&S	3160-09	Mar.09,2020	3 Years
SB8501/16	Pre-Amplifier	R&S	SCU-26	Jan.20,2022	1 Year
SB9555/02	Fully Anechoic Chamber	Albatross	10.0×5.2×5.4(m)	Aug.16,2022	1 Year
SB9060	Spectrum Analyzer	R&S	FSQ40	Apr.26, 2022	1 Year

Table 4 Test software

Name	Manufacturer	Version
Bluetooth and WiFi Test System	Shenzhen JS tonscrend 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 μ 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

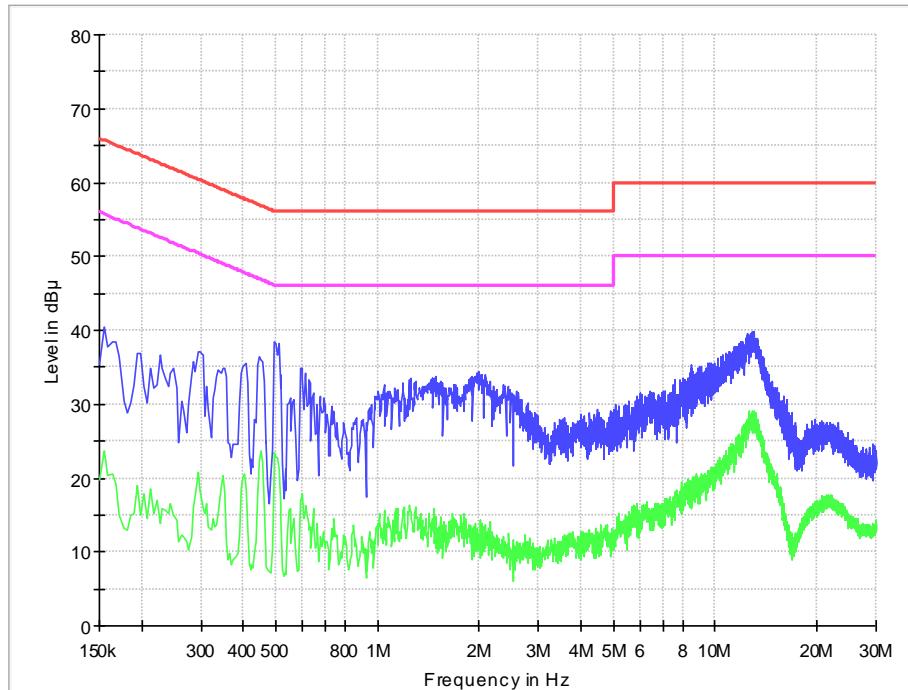
The emissions don't show in below are too low against the limits. Refer to the test curves.

Table 6 Conducted Emission Test Data

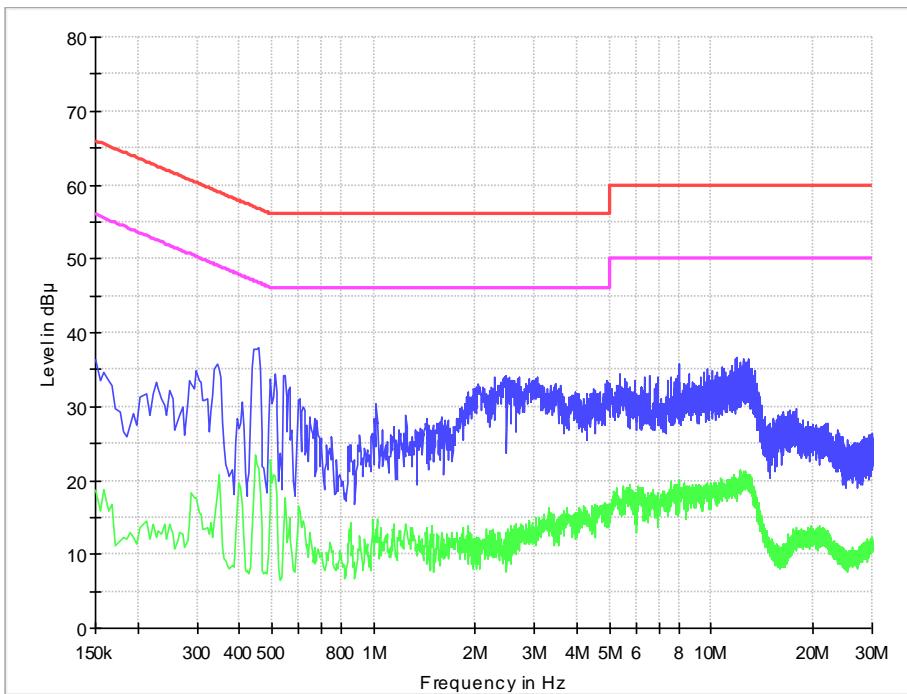
Test mode: Charging and Transmitting								
	Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
			Reading (dB μ V)	Emission Level (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Emission Level (dB μ V)	Limit (dB μ V)
Line	0.699	9.8	36.6	46.4	56	18.6	28.4	46
	1.298	9.8	39.6	49.4	56	27.4	37.2	46
	7.593	10.0	33.8	43.8	56	16.5	26.5	46
	8.241	10.0	30.2	40.2	60	27.8	37.8	50
	10.239	9.9	38.2	48.1	60	34.1	44.0	50
	14.361	9.9	36.4	46.3	60	34.1	44.0	50
Neutral	0.199	9.7	30.4	40.1	63.7	10.4	20.1	53.7
	0.357	9.7	29.3	39.0	58.8	9.0	18.7	48.8
	0.546	9.8	28.4	38.2	56	8.9	18.7	46
	0.708	9.8	36.3	46.1	56	17.1	26.9	46
	1.333	9.8	39.3	49.1	56	26.7	36.5	46
	14.402	9.9	35.1	45.0	60	32.9	42.8	50

REMARKS: 1. Emission level (dB μ V) =Read Value (dB μ 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 (dB μ V/m)	Level (dB μ V/m)	Polarity (H/V)	Limit (dB μ V/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.

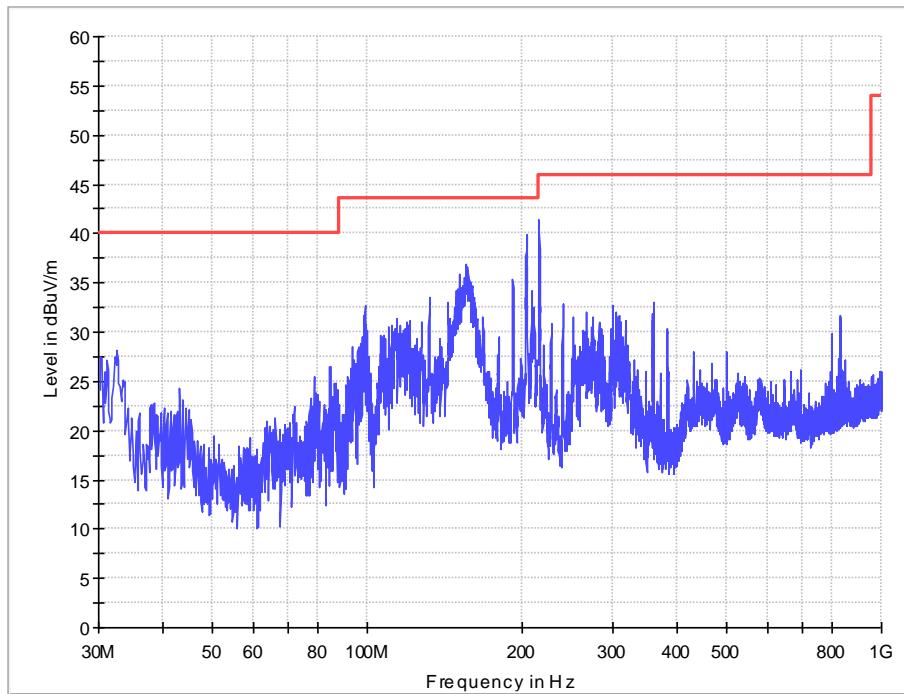
Table 10 Radiated Emission Test Data 30MHz-1GHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dB μ V/m)	Level (dB μ V/m)	Polarity (Horizontal/Vertical)	Limit (dB μ V/m)	Margin (dB)	Note
30.242	0.6	12.3	22.7	35.6	Vertical	40	4.4	QP
31.212	0.6	12.3	25.6	38.5	Vertical	40	1.5	QP
71.588	0.9	8.7	19.4	29.0	Vertical	40	11.0	QP
85.169	1.0	10.3	18.1	29.4	Vertical	40	10.6	QP
119.604	1.3	12.3	22.7	36.3	Vertical	43.5	7.2	QP
151.129	1.4	8.3	31.1	40.8	Vertical	43.5	2.7	QP
32.546	0.7	12.3	14.2	27.2	Horizontal	40	12.8	QP
98.870	1.1	12.8	14.9	28.8	Horizontal	43.5	14.7	QP
131.971	1.3	10.5	19.1	30.9	Horizontal	43.5	12.6	QP
155.736	1.4	8.3	24.3	34.0	Horizontal	43.5	9.5	QP
203.872	1.6	10.6	25.3	37.5	Horizontal	43.5	6.0	QP
215.997	1.7	10.6	27.3	39.6	Horizontal	43.5	3.9	QP

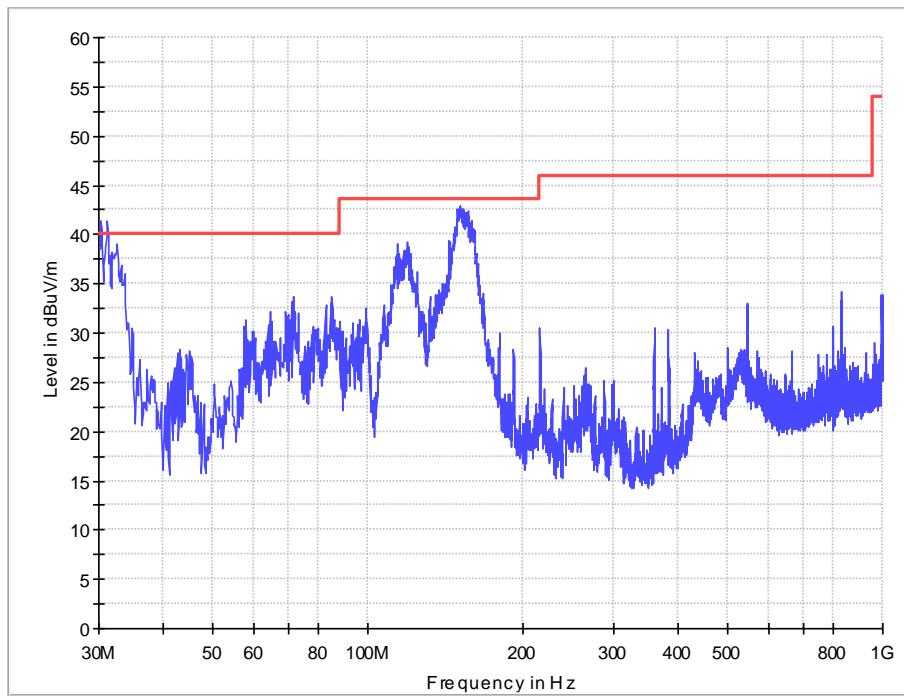
Remark: Emission level (dB μ V)=Read Value(dB μ V/m) + Antenna Factor(dB)+ Cable Loss +preamp(dB)

30MHz-1GHz

Horizontal



Vertical

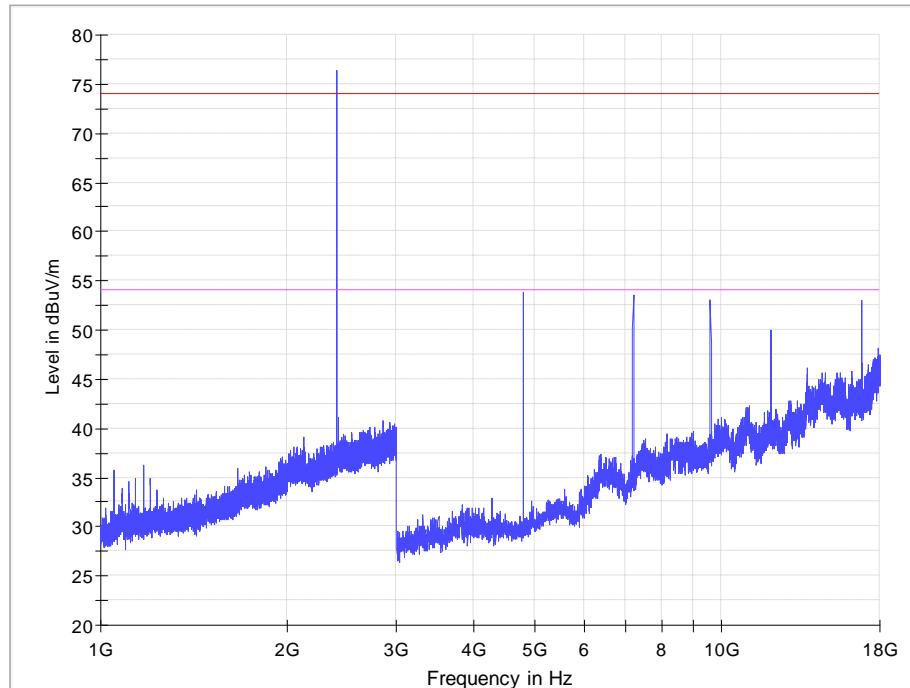


1GHz-18GHz

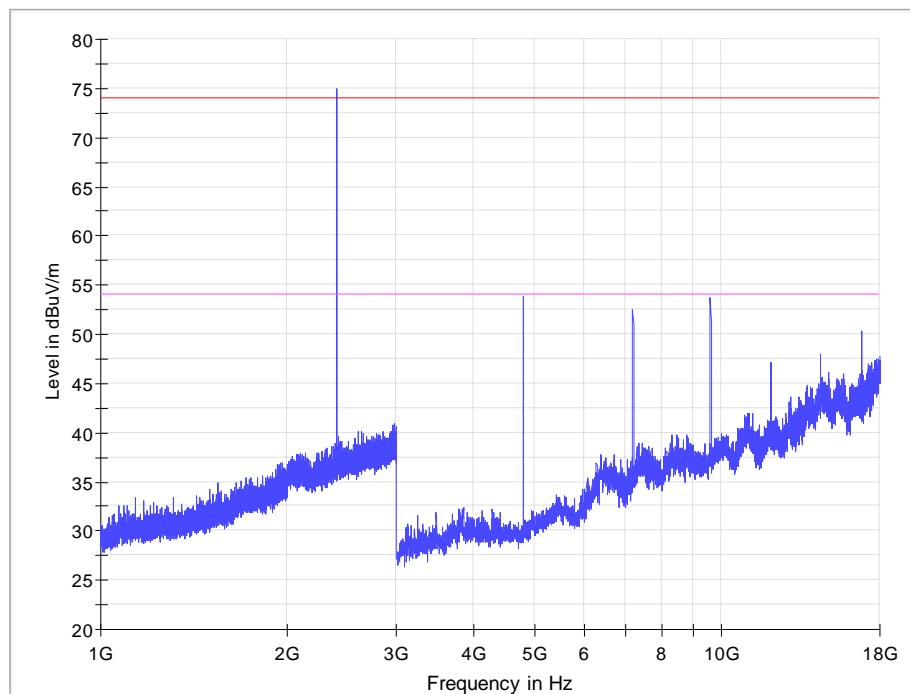
GFSK 2402MHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dB μ V/m)	Level (dB μ V/m)	Polarity	Limits (dB μ V/m)	Margin (dB)	Note
4803.920	-39.4	33.4	70.2	64.2	Vertical	74	9.8	PK
9607.851	-36.5	37.1	63.1	63.7	Vertical	74	10.3	PK
4803.918	-39.4	33.4	70.5	64.5	Horizontal	74	9.5	PK
4803.920	-39.4	33.4	59.8	53.8	Vertical	54	0.2	AV
9607.851	-36.5	37.1	52.9	53.5	Vertical	54	0.5	AV
4803.918	-39.4	33.4	59.9	53.9	Horizontal	54	0.1	AV

Horizontal



Vertical

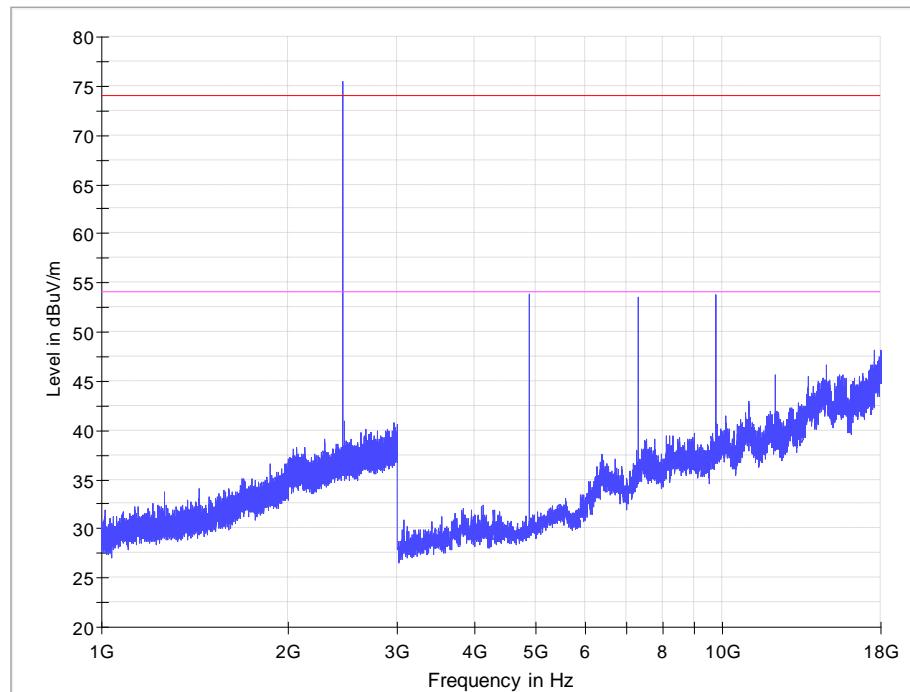


1GHz-18GHz

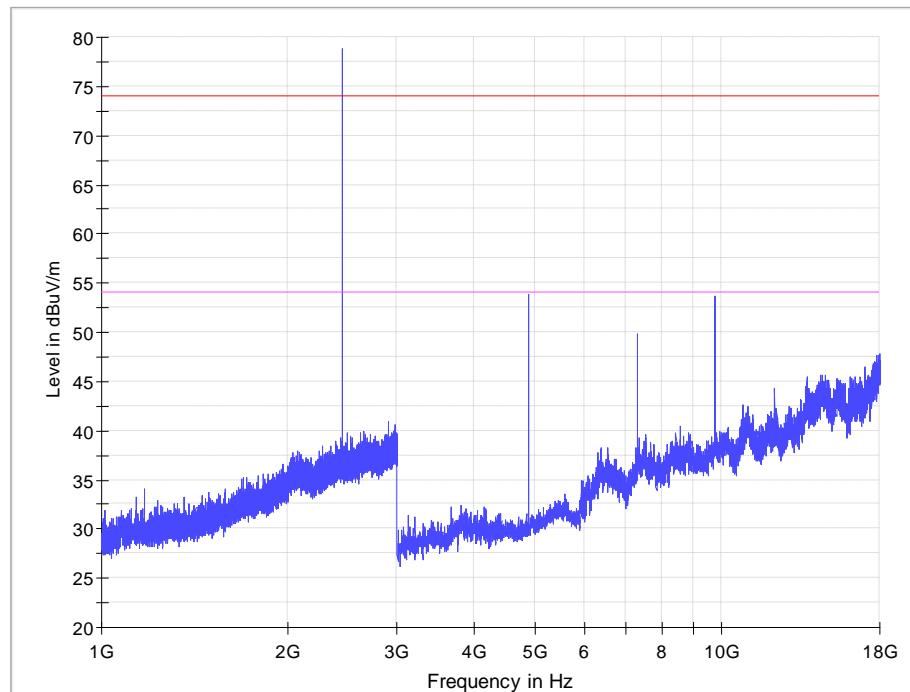
GFSK 2440MHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dB μ V/m)	Level (dB μ V/m)	Polarity	Limits (dB μ V/m)	Margin (dB)	Note
4879.906	-39.4	33.4	70.8	64.8	Horizontal	74	9.2	PK
7320.346	-38.1	35.6	64.1	61.6	Horizontal	74	12.4	PK
9759.780	-35.5	37.1	61.6	63.2	Horizontal	74	10.8	PK
4879.900	-39.4	33.4	70.6	64.6	Vertical	74	9.4	PK
9759.786	-35.5	37.1	62.7	64.3	Vertical	74	9.7	PK
4879.906	-39.4	33.4	59.9	53.9	Horizontal	54	0.1	AV
7320.346	-38.1	35.6	55.0	52.5	Horizontal	54	1.5	AV
9759.780	-35.5	37.1	51.4	53.0	Horizontal	54	1.0	AV
4879.900	-39.4	33.4	59.7	53.7	Vertical	54	0.3	AV
9759.786	-35.5	37.1	52.0	53.6	Vertical	54	0.4	AV

Horizontal



Vertical

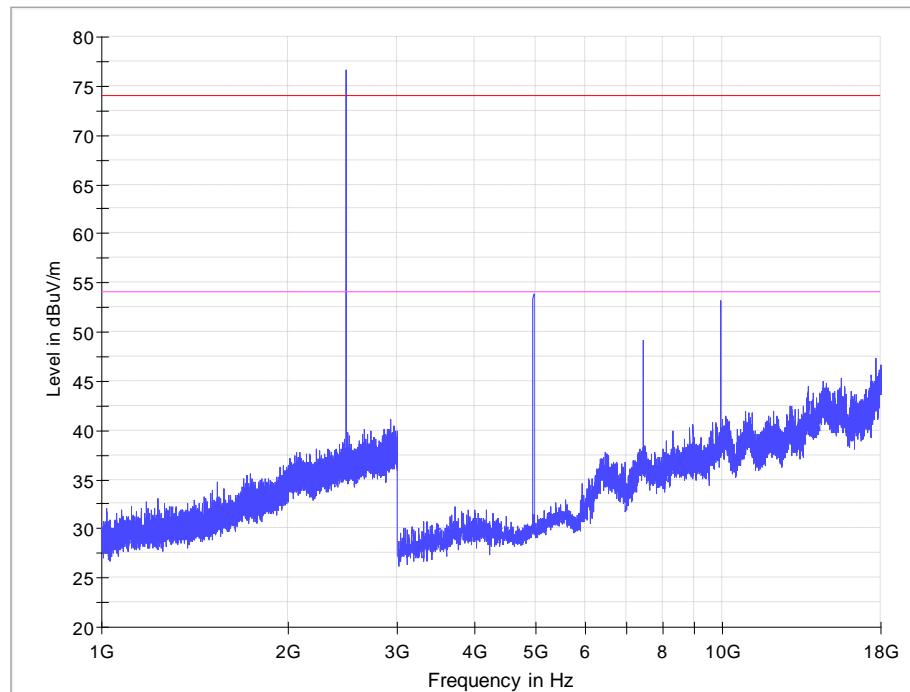


1GHz-18GHz

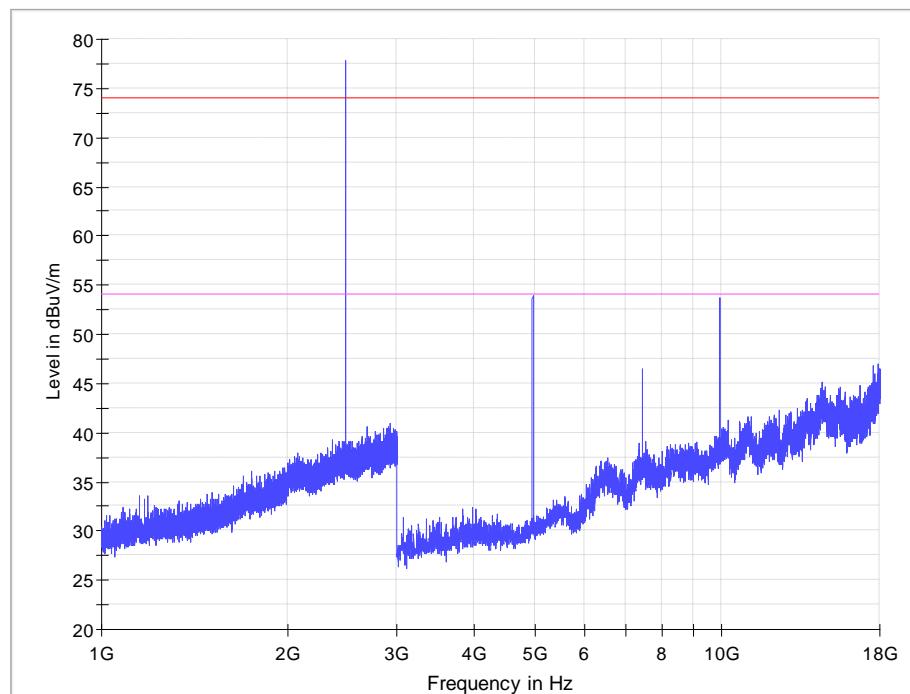
GFSK 2480MHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dB μ V/m)	Level (dB μ V/m)	Polarity	Limits (dB μ V/m)	Margin (dB)	Note
4959.862	-39.5	33.4	70.1	64.0	Vertical	74	10.0	PK
4959.886	-39.5	33.4	70.4	64.3	Horizontal	74	9.7	PK
4959.862	-39.5	33.4	59.8	53.7	Vertical	54	0.3	AV
4959.886	-39.5	33.4	60.0	53.9	Horizontal	54	0.1	AV

Horizontal

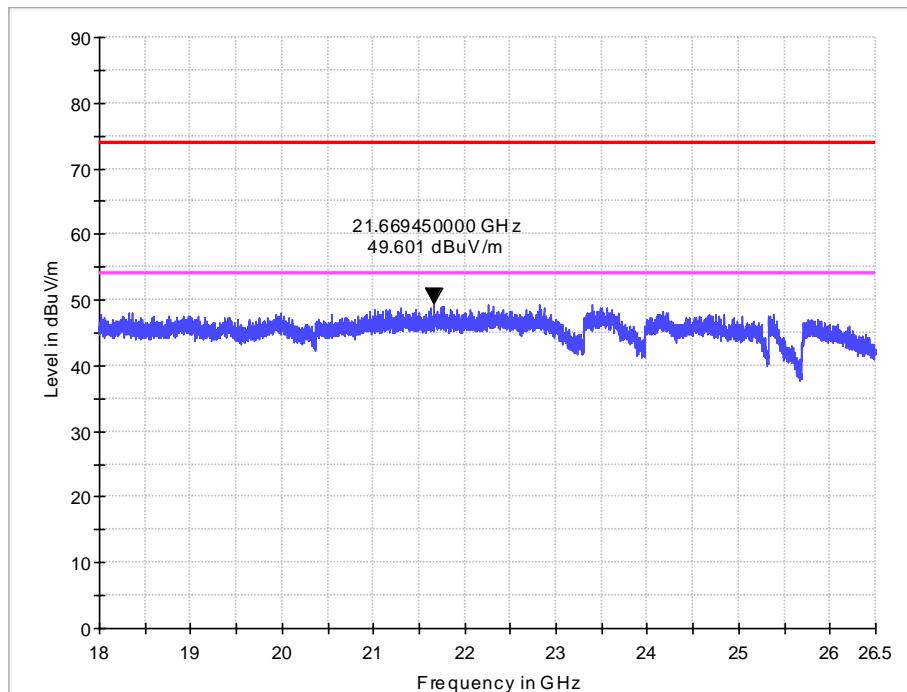


Vertical



18-26.5GHz

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



Vertical

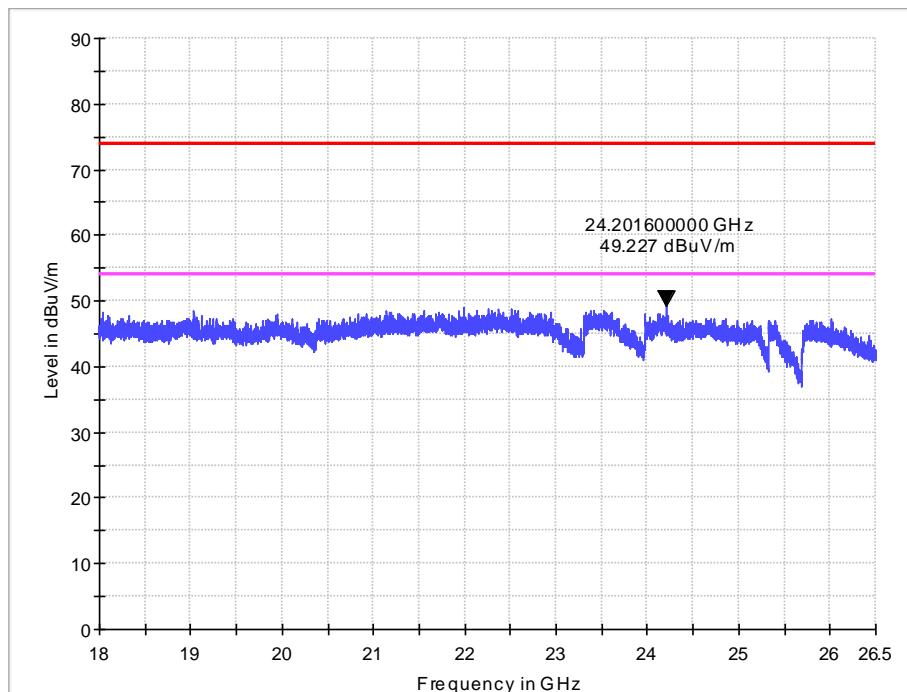


Table 11 Restricted Band Radiated Emission Data

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	-
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

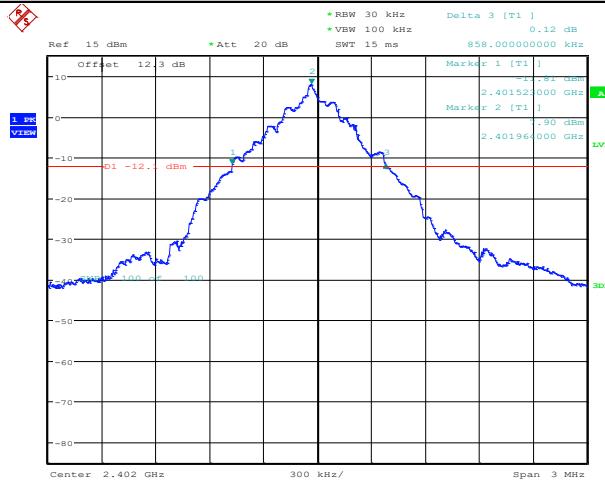


7.4. Test Data

Table 12 20dB Bandwidth Test Data

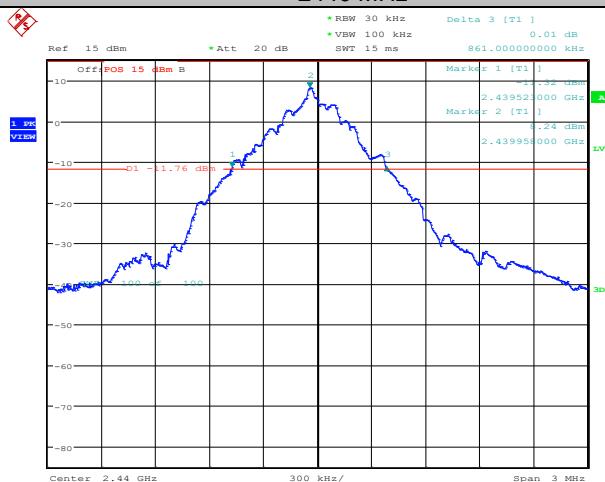
CHANNEL FREQUENCY (MHz)	Modulation	20dB BANDWIDTH (MHz)	Result
2402	GFSK	0.86	Pass
2440		0.86	Pass
2480		0.86	Pass

2402 MHz



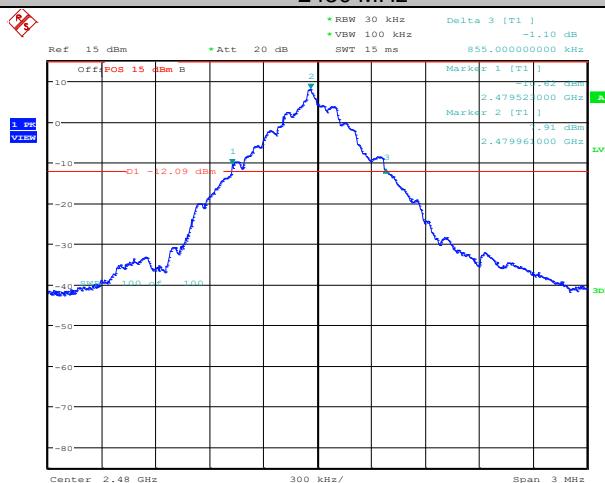
Date: 11.OCT.2022 15:27:50

2440 MHz



Date: 11.OCT.2022 15:37:04

2480 MHz



Date: 11.OCT.2022 15:40:02

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

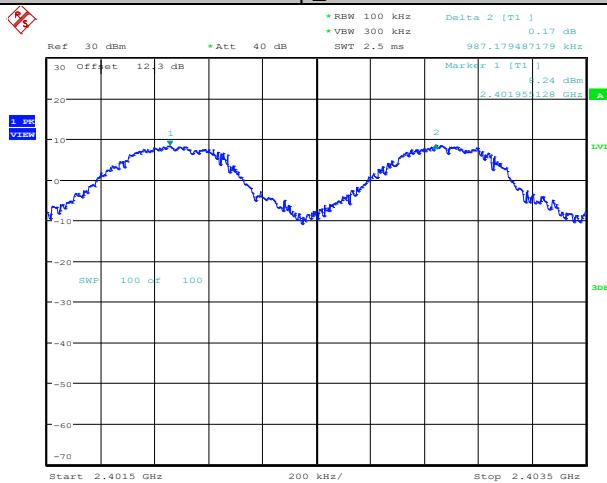


8.4. Test Data

Table 13 Carrier Frequencies Separation

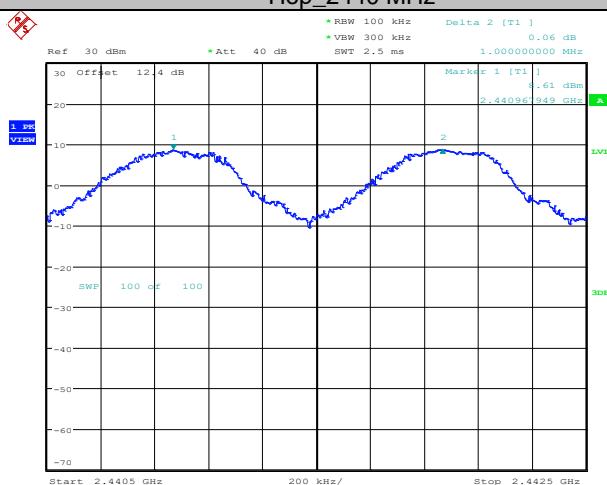
Frequency [MHz]	Frequency [MHz]	Modulation	Frequency separation [MHz]	Limit [MHz]	Result
2402	2403	GFSK	0.987	0.573	Pass
2441	2442		1	0.573	Pass
2479	2480		1.016	0.573	Pass

Hop_2402 MHz



Date: 27.OCT.2022 11:33:41

Hop_2440 MHz



Date: 27.OCT.2022 11:31:01

Hop_2479 MHz



Date: 27.OCT.2022 11:35:16

9. NUMBER OF HOPPING CHANNEL

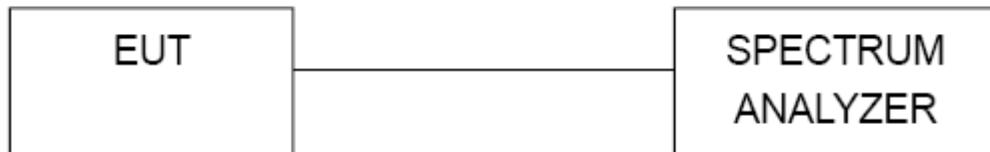
9.1. Limits of Number of Hopping Channel

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

9.2. Test Procedure

- Connect test port of EUT to spectrum analyzer.
- 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.
- Count the quantity of peaks to get the number of hopping channels.

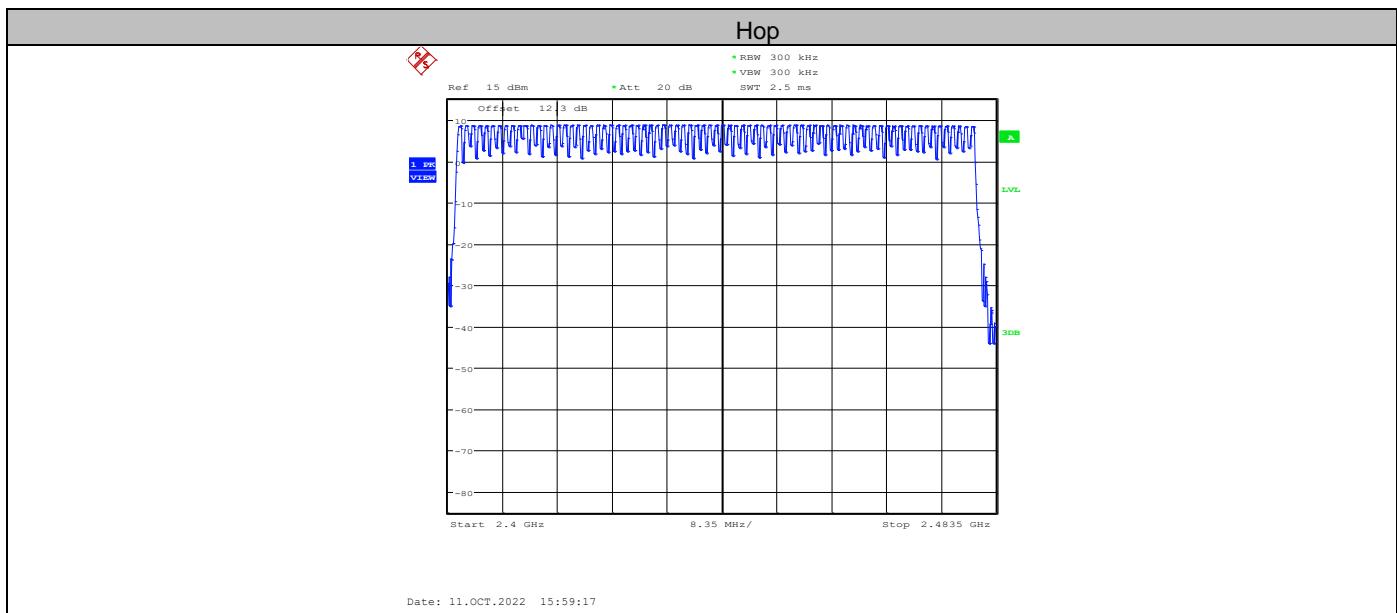
9.3. Test Setup



9.4. Test Data

Table 14 Hopping Channel Number Test Data

Hopping Numbers	Modulation	Limit	Result
79	GFSK	>15	Pass



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

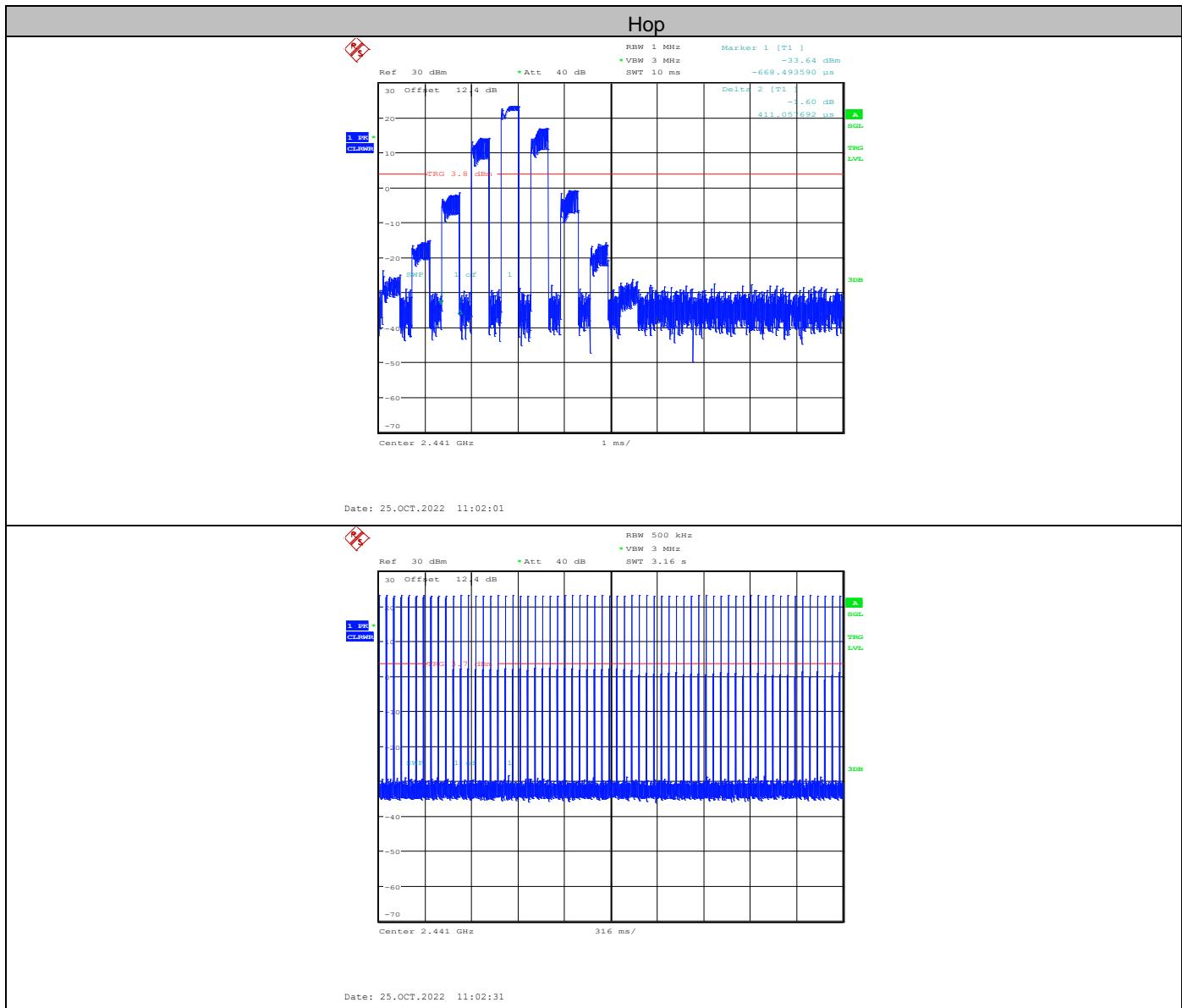
DH3: Dwell time equal to Pluse time (ms)*(800/4/20)*(0.4*20) ms

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

10.3. Test Data

Table 15 Time of Occupancy

Modulation	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
GFSK	0.41	630	0.26	0.13	<= 0.40	Pass



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

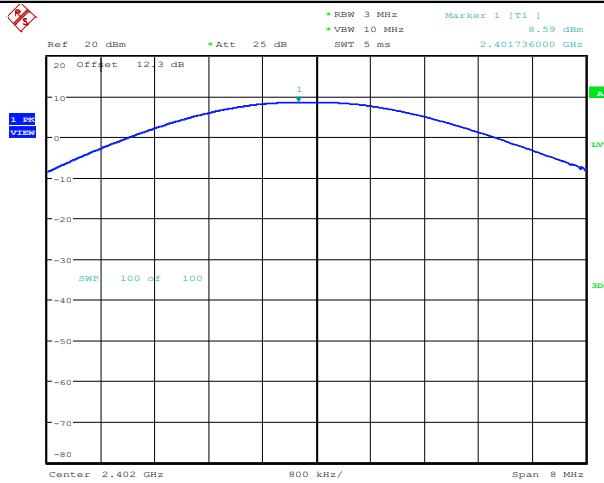
- Connect test port of EUT to universal communication tester.
- Set the EUT to transmit maximum output power at 2.4GHz and switch off frequency hopping function.
- Then set the EUT to transmit at high, middle and low frequency and measure the conducted output power separately.

11.3. Test Data

Table 16 Maximum Conducted Output Power Test Data

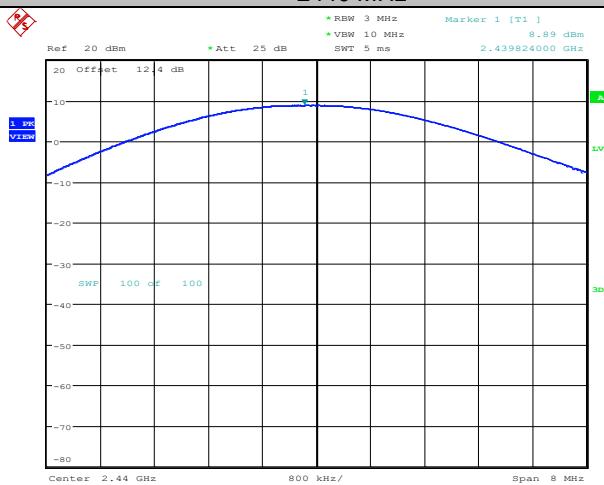
Center Freq. [MHz]	Modulation	Meas. Level (Cond.) [dBm]	Limit [dBm]	Result
2402	GFSK	8.59	≤20.97	Pass
2440		8.89	≤20.97	Pass
2480		8.64	≤20.97	Pass

2402 MHz



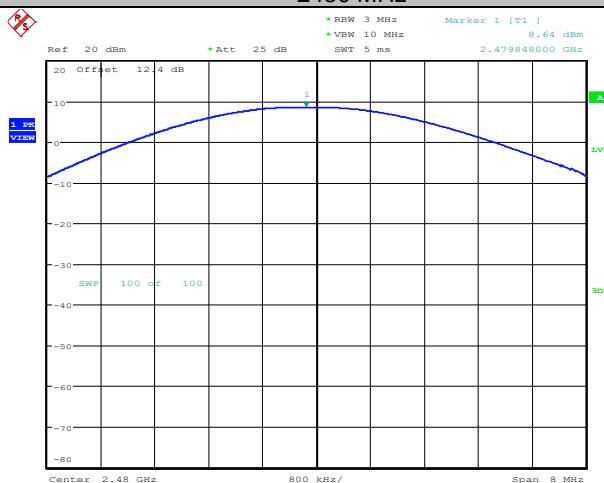
Date: 11.OCT.2022 16:03:31

2440 MHz



Date: 11.OCT.2022 16:03:48

2480 MHz



Date: 11.OCT.2022 16:04:07

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

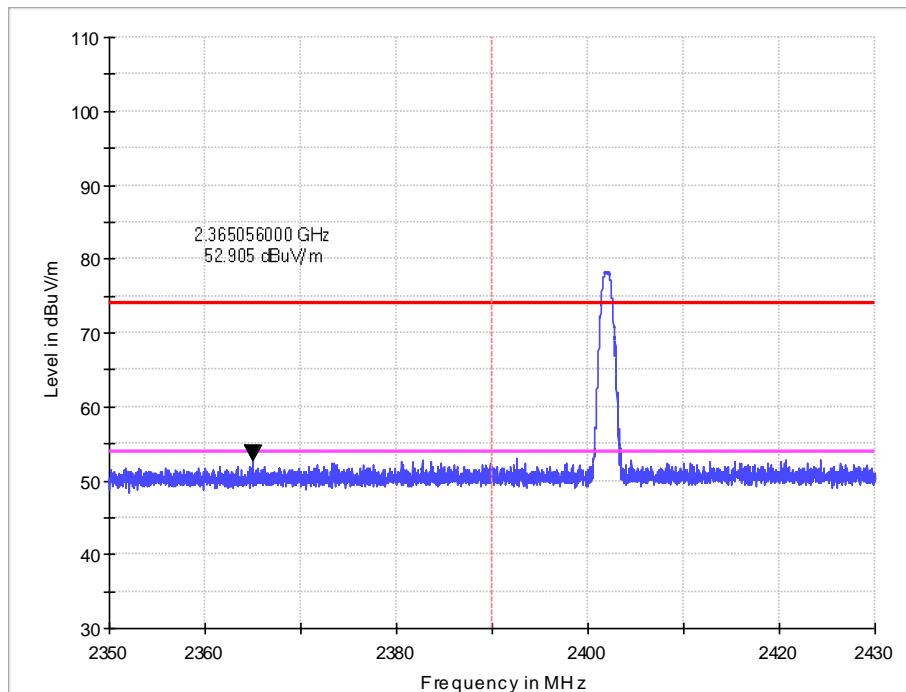
The measured plots are attached on the following. Test data shows compliance with the band edge requirement in part 15.247(d).

GFSK

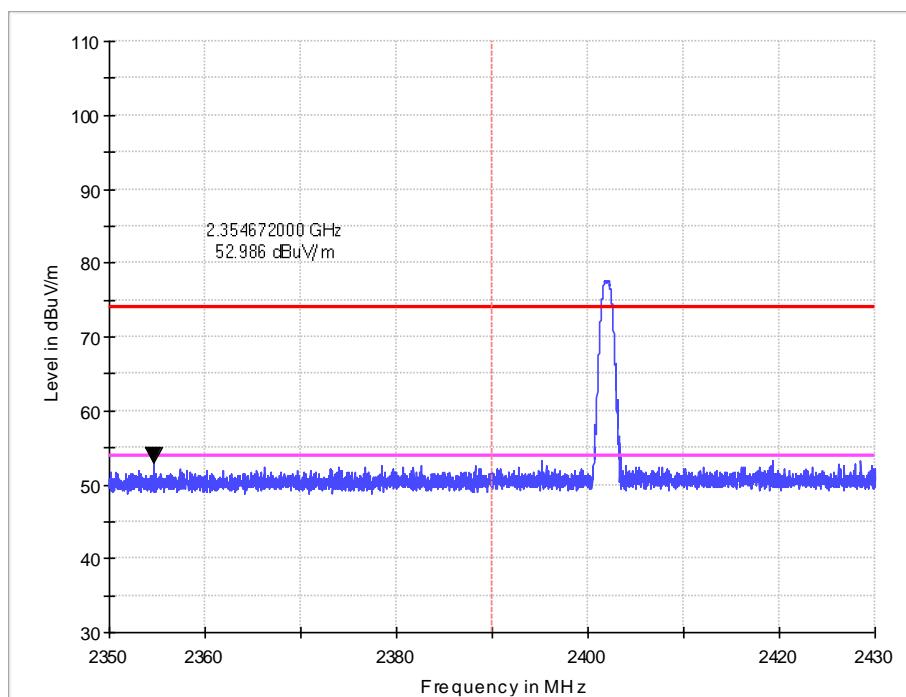
Low edge

PK

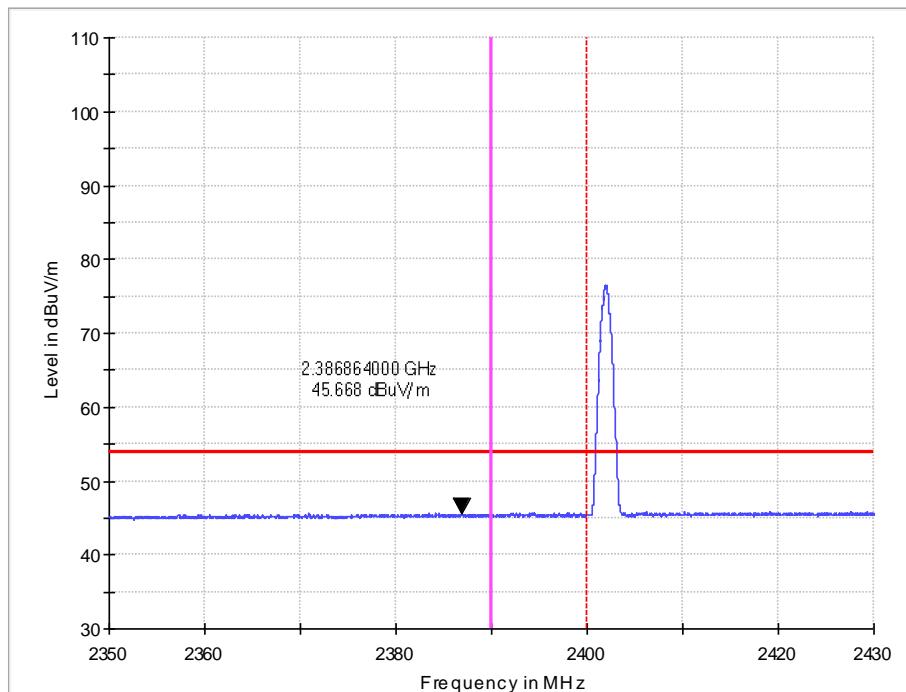
Horizontal



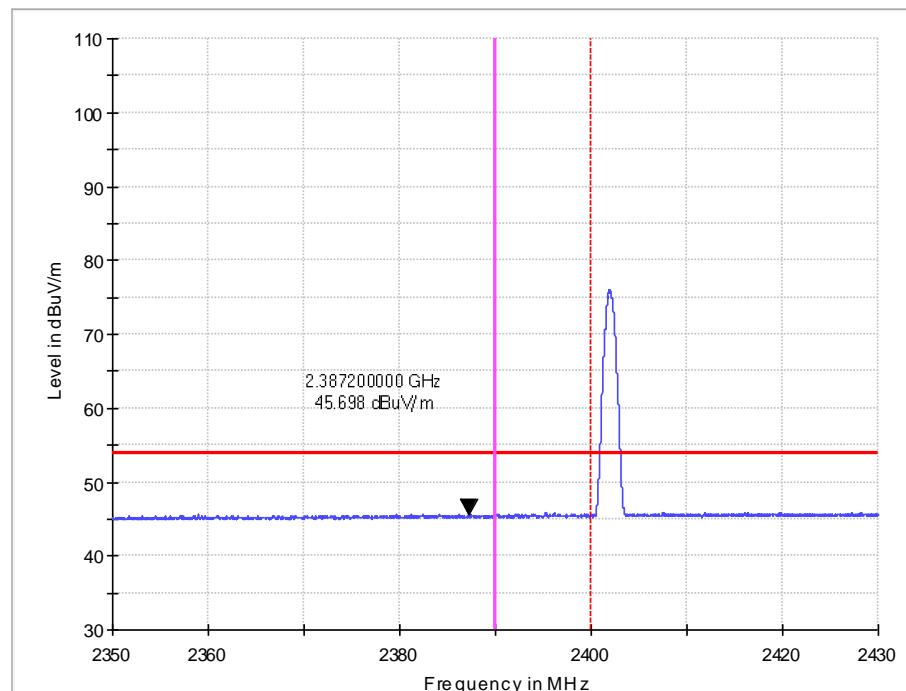
Vertical



AV
Horizontal

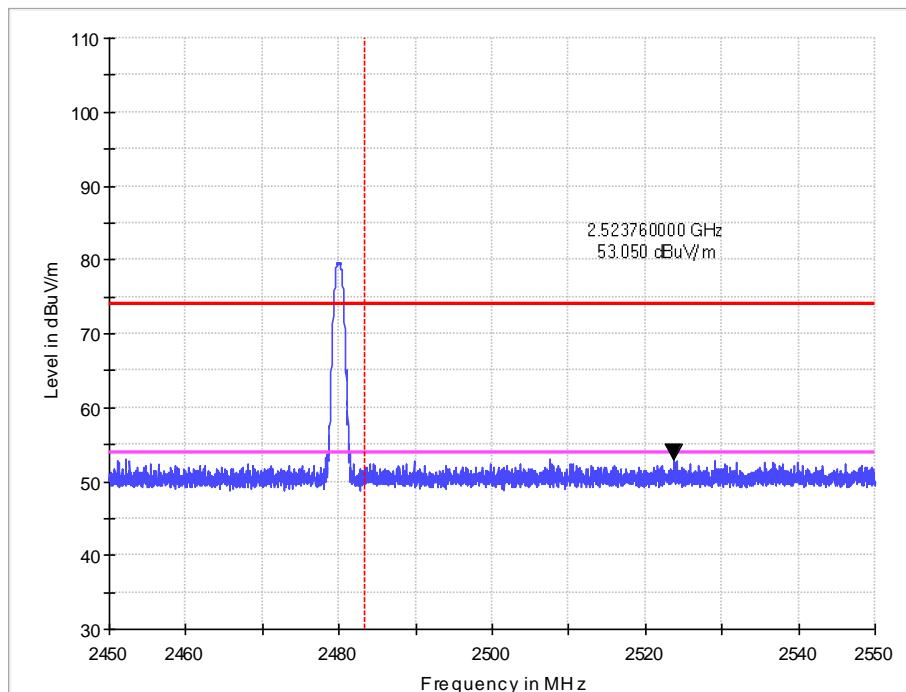


Vertical

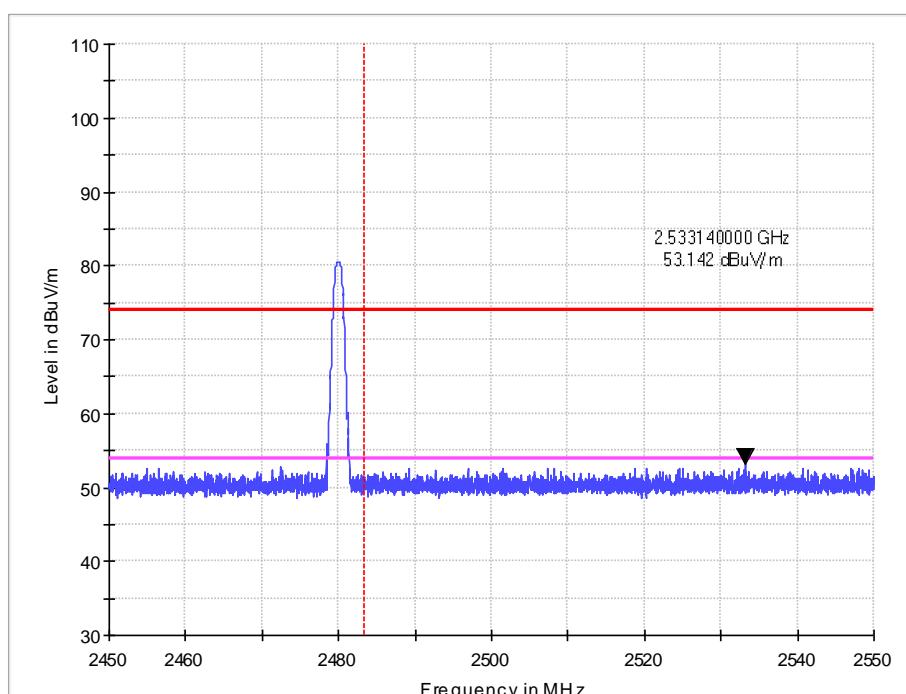


GFSK

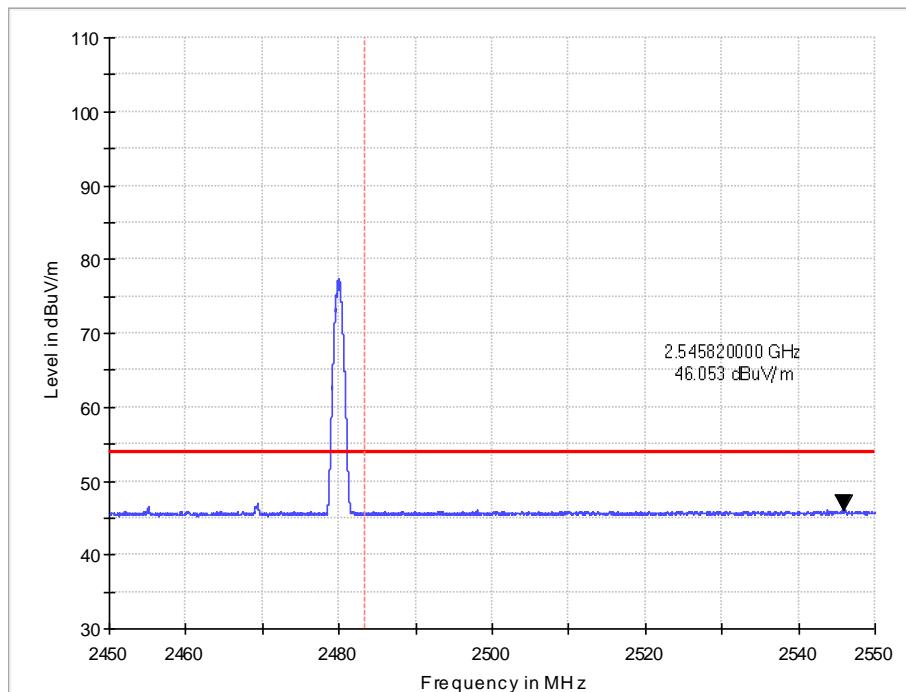
Upper edge
PK
Horizontal



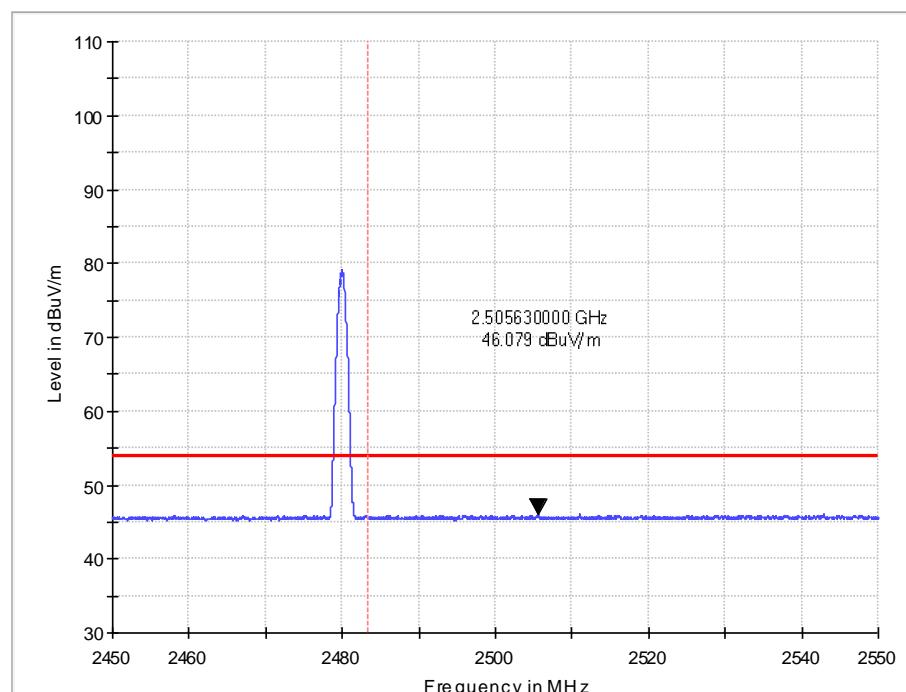
Vertical



AV
Horizontal



Vertical



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.

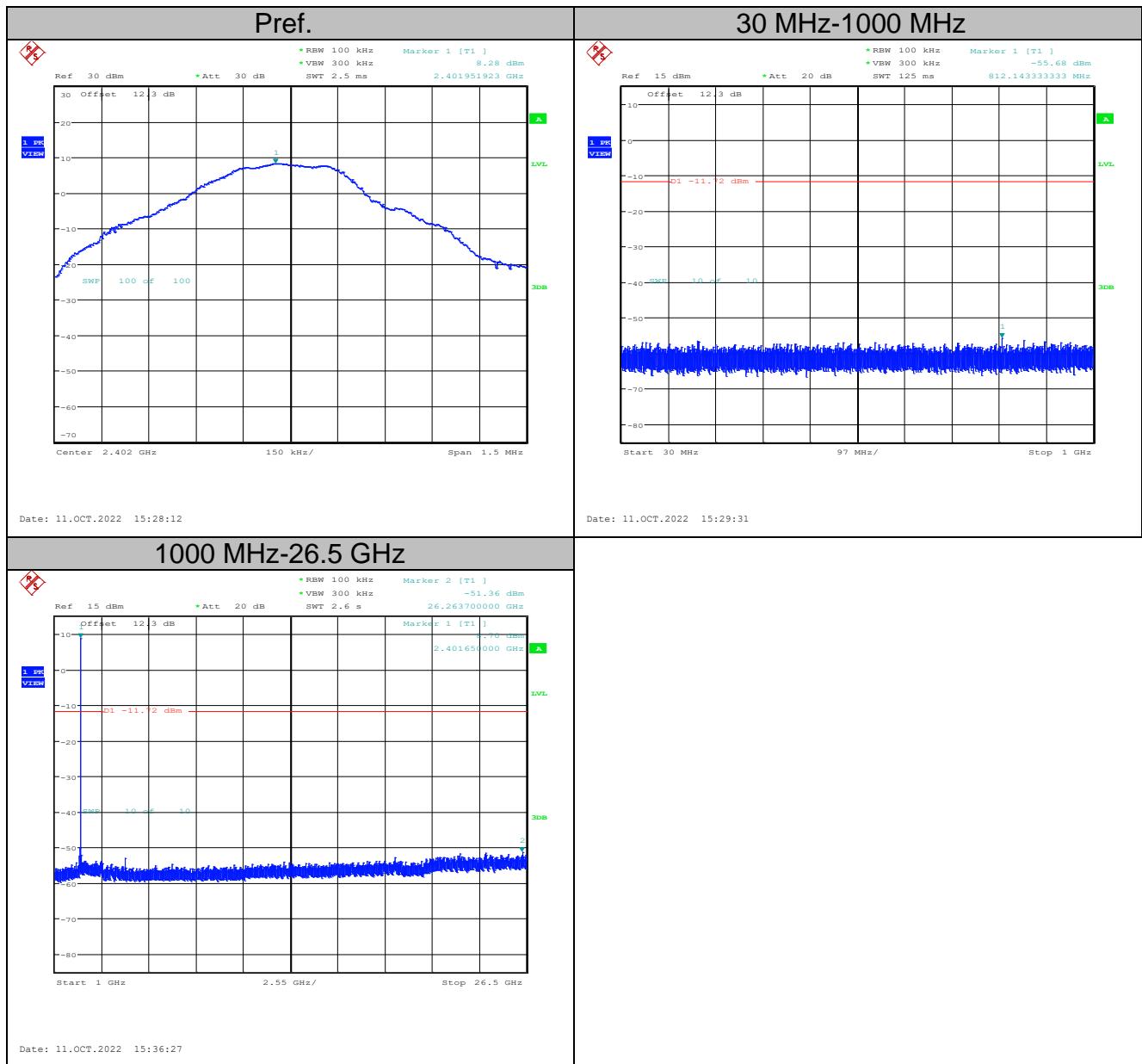
The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

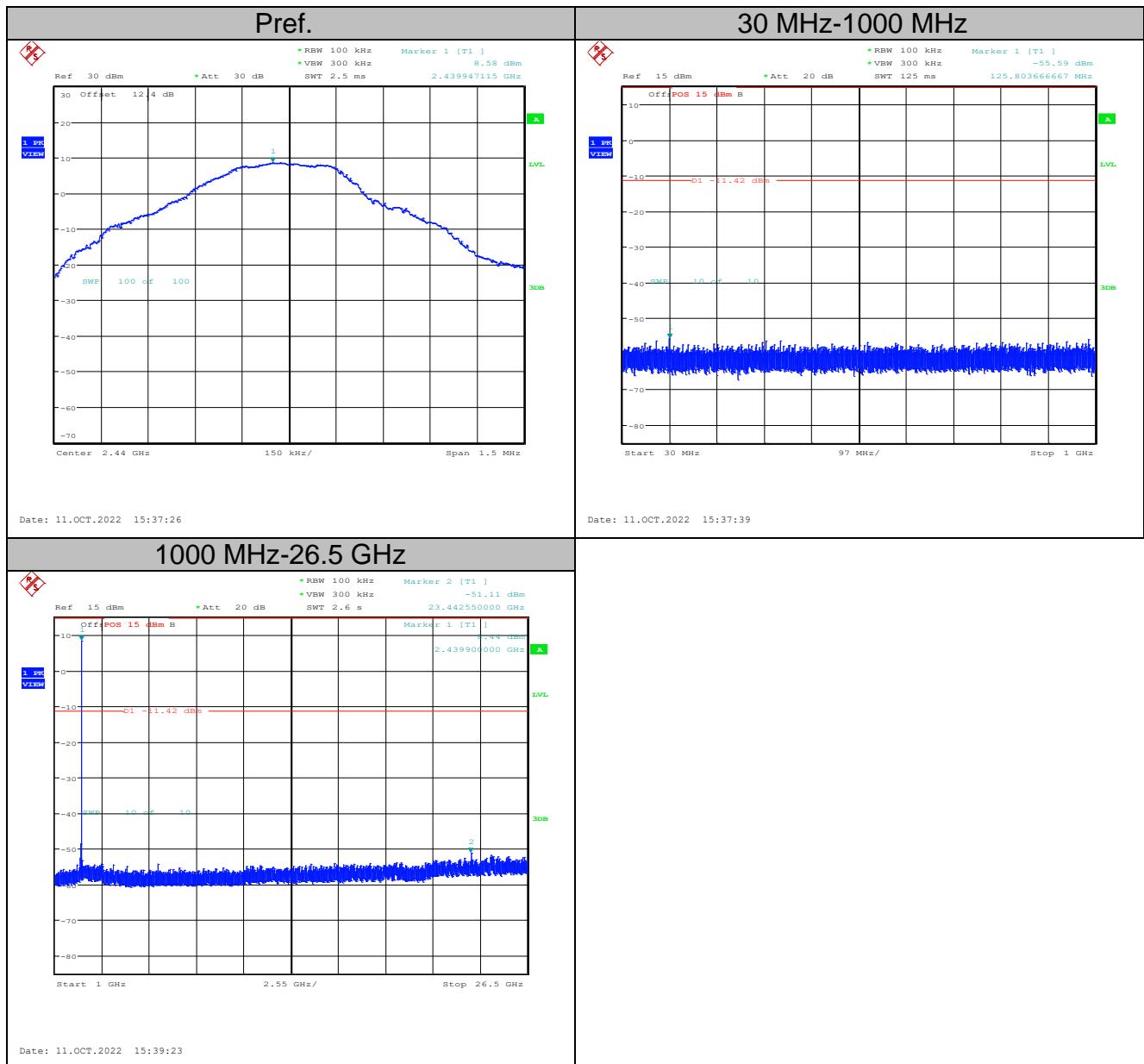
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal

13.3. Test Data

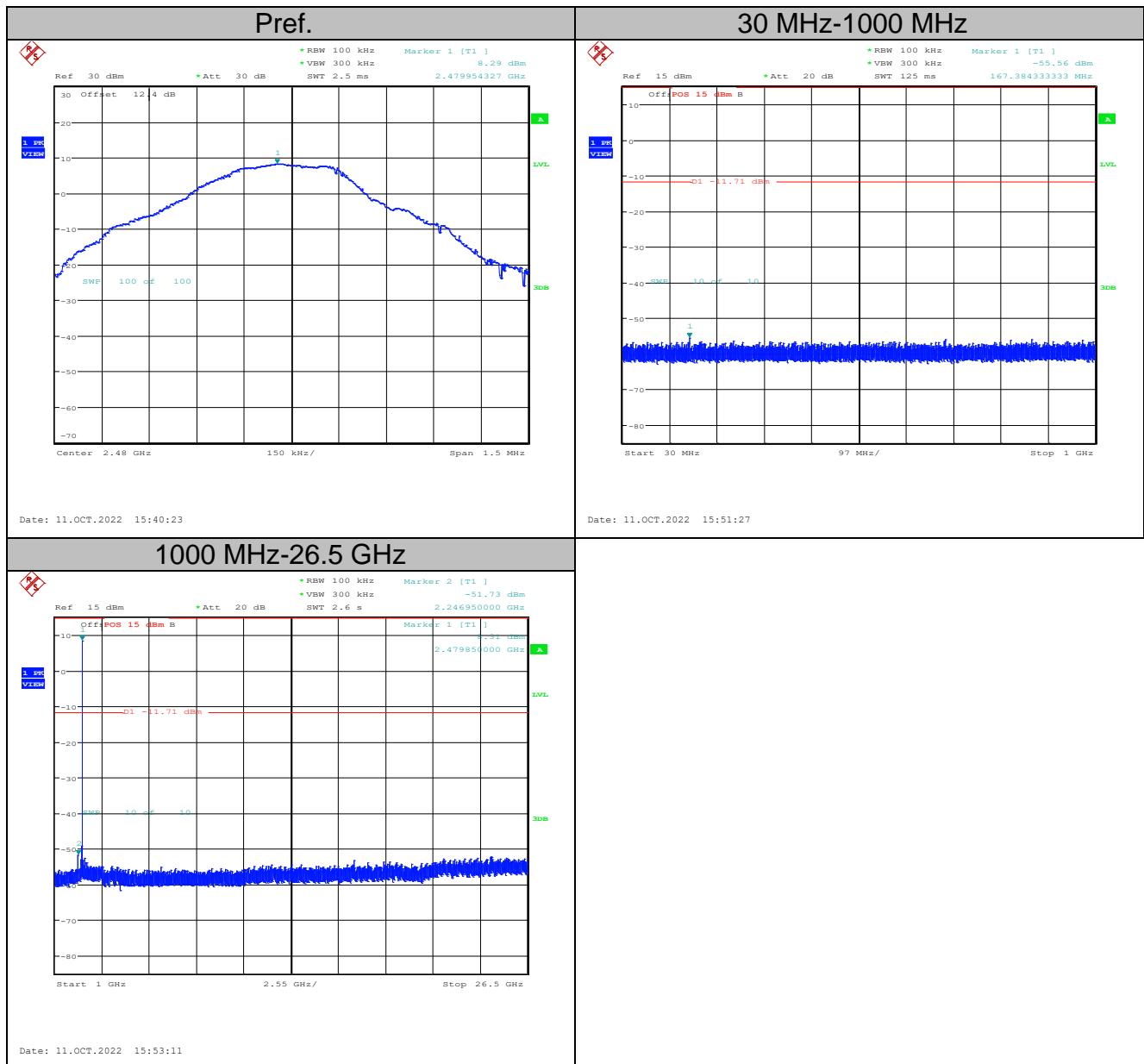
GFSK 2402MHz



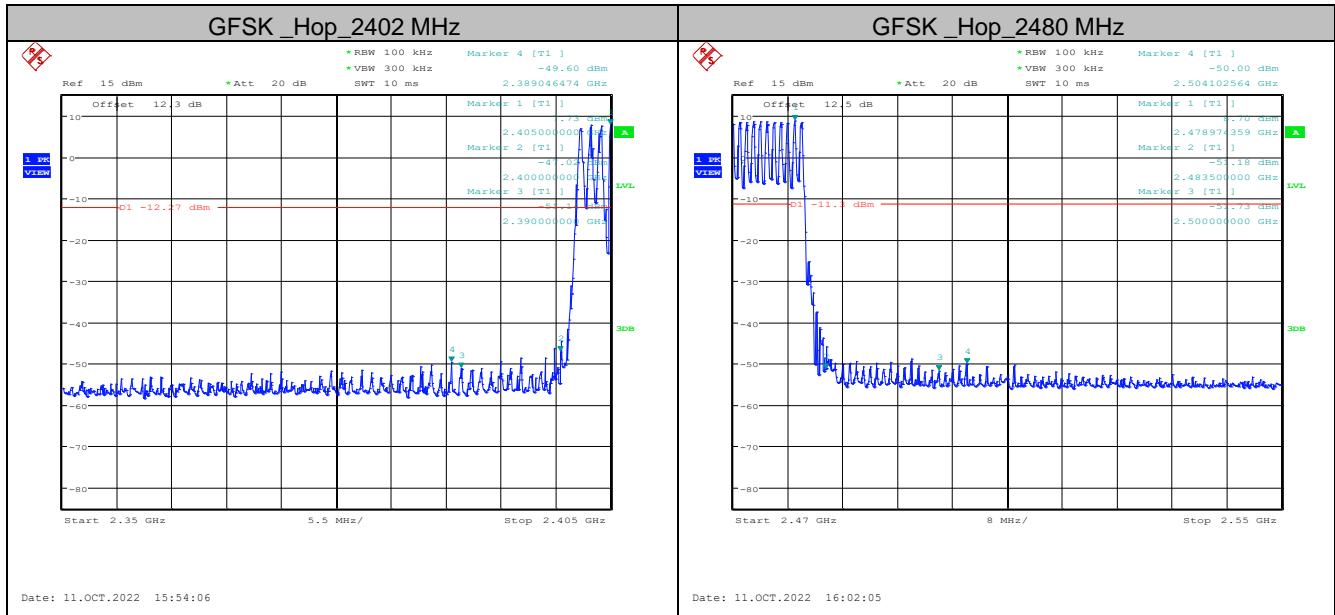
GFSK
2440MHz



GFSK 2480MHz



GFSK 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-----