

RF TEST REPORT

For

Wireless Earbuds

Model Number: E509A

FCC ID: 2ABZ2-E509A

IC: 12739A-E509A

Report Number : WT238001737

Test Laboratory : Shenzhen Academy of Metrology and Quality
Inspection
Site Location : No.4, Tongfa Road, Xili Street, Nanshan District,
Shenzhen, Guangdong, 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	2023.10.26	Initial issue

TEST REPORT DECLARATION

Applicant : OnePlus Technology (shenzhen) Co.,Ltd.
Address : 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building,
Binhe Avenue North,Futian District, Shenzhen, China
Manufacturer : OnePlus Technology (shenzhen) Co.,Ltd.
Address : 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building,
Binhe Avenue North,Futian District, Shenzhen, China
EUT Description : Wireless Earbuds
Model No. : E509A
Trade mark : ONEPLUS
Serial Number : /
FCC ID : 2ABZ2-E509A
IC : 12739A-E509A
HVIN : E509A

Test Standards:

FCC Part 15 Subpart C
RSS-247 Issue 3 (2023-08)
RSS-GEN Issue 5 (2021-02)

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: 陈司林 Date: Oct.26, 2023
(Chen Silin 陈司林)
Checked by: 万晓婧 Date: Oct.26, 2023
(Wan Xiaojing 万晓婧)
Approved by: 林奕翔 Date: Oct.26, 2023
(Lin Yixiang 林奕翔)

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	10
3.6. Test Conditions.....	10
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	32
7.1. Limits of 20dB Bandwidth Measurement.....	32
7.2. Test Procedure	32
7.3. Test Setup	32
7.4. Test Data	32
8. CARRIER FREQUENCY SEPARATION MEASUREMENT.....	38
8.1. Limits of Carrier Frequency Separation Measurement	38
8.2. Test Procedure	38
8.3. Test Setup	38
8.4. Test Data	38
9. NUMBER OF HOPPING CHANNEL	44
9.1. Limits of Number of Hopping Channel.....	44
9.2. Test Procedure	44
9.3. Test Setup	44
9.4. Test Data	44
10. TIME OF OCCUPANCY.....	47

10.1.	Limits of Time Occupancy.....	47
10.2.	Test Procedure	47
10.3.	Test Data	47
11.	MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT	58
11.1.	Limits of Maximum Conducted Output Power Measurement.....	58
11.2.	Test Procedure	58
11.3.	Test Data	58
12.	BAND EDGES MEASUREMENT.....	66
12.1.	Limits of Band Edges Measurement	66
12.2.	Test Procedure	66
12.3.	Test Data	66
13.	CONDUCTED SPURIOUS EMISSION.....	83
13.1.	Limits of Band Edges Measurement	83
13.2.	Test Procedure	83
13.3.	Test Data	83
14.	99% OCCUPIED BANDWIDTH.....	102
14.1.	LIMITS OF 99%Occupied Bandwidth	102
14.2.	TEST PROCEDURE.....	102
14.3.	TEST DATA.....	102
15.	ANTENNA REQUIREMENTS.....	109
15.1.	Antenna Connector	109
15.2.	Antenna Gain	109

1. TEST RESULTS SUMMARY

Table 1 Test Results Summary

Test Items	FCC Rules	IC Rules	Test Results
20dB bandwidth measurement	15.247 (a) (1)	RSS-247 Clause 5.1(a)	Pass
Carrier frequency separation measurement	15.247 (a) (1)	RSS-247 Clause 5.1(b)	Pass
Number of hopping channel	15.247 (a) (1) III	RSS-247 Clause 5.1(d)	Pass
Time of occupancy	15.247 (a) (1) III	RSS-247 Clause 5.1(d)	Pass
Maximum conducted output power	15.247 (b) (1)	RSS-247 Clause 5.4(b)	Pass
Band edge compliance measurement	15.247 (d)	RSS-247 Clause 5.5	Pass
Radiated spurious emission & Radiated restricted band measurement	15.247 (d) / 15.205 & 15.209	RSS-Gen Clause 8.9	Pass
Conducted spurious emission	15.247 (d)	RSS-247 Clause 5.5	Pass
Conducted emission	15.207	RSS-GEN, Clause 8.8	Pass
99% Occupied bandwidth	N/A	RSS-Gen Clause 6.7	Pass
Antenna requirements	15.203	RSS-GEN, Clause 6.8	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/manufacture.

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 $U=3.7\text{dB}$ $k=2$

150 kHz~30MHz $U=3.3\text{dB}$ $k=2$

Radiated Emission

30MHz~1000MHz $U=4.3\text{dB}$ $k=2$

1GHz~6GHz $U=4.6\text{ dB}$ $k=2$

6GHz~40GHz $U=5.1\text{dB}$ $k=2$

3. PRODUCT DESCRIPTION

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

3.1. EUT Description

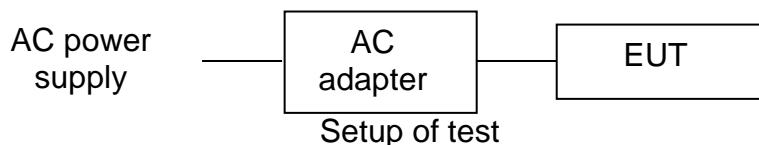
Description	: Wireless Earbuds
Manufacturer	: OnePlus Technology (shenzhen) Co.,Ltd.
Model Number	: E509A
Operate Frequency	: 2.402GHz~2.480GHz
Antenna Designation	: Internal antenna Left earphone: 1.2dBi Right earphone: 1.2dBi
Operating voltage	: DC3.0V (Low)/DC3.85V (Nominal)/DC4.4V (Max)
Modulation	: GFSK, $\pi/4$ -DQPSK, 8DPSK
Software Version	: V087
Hardware Version	: X22E3_0

Remark:

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

This submittal(s) (test report) is intended for FCC ID: **2ABZ2-E509A** filing to comply with Section 15.207, 15.209, 15.247 of the FCC Part 15 Subpart C.
Intended for IC: 12739A-E509A filing to comply with RSS-247 Issue 3, RSS-GEN Issue 5 of the IC Rules.

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 $\pi/4$ -DQPSK, 8DPSK modulation. Tests were performed with Basic rate GFSK modulation and EDR mode 8DPSK modulation.

According to FCC §15.247(a)(1), a frequency hopping spread spectrum system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

3.5. Support Equipment List

Table 2 Support Equipment List

Name	Model No	S/N	Manufacturer
Adapter 1# for EUT	VCB3HDUH	---	HUIZHOU GOLDEN LAKE INDUSTRIAL CO., LTD.
Rechargeable Li-ion Polymer Battery for Charging Case	631940	---	Xinyu Ganfeng Electronics Co.,LTD.
Rechargeable Li-ion Polymer Battery for Earbuds	112570		Xinyu Ganfeng Electronics Co.,LTD.
USB Cable for EUT	DL129	---	Dongguan City Falin Electronic Co.,Ltd

3.6. Test Conditions

Date of test: Oct.13, 2023- Oct.25, 2023

Date of EUT Receive: Oct.09, 2023

Temperature: 20°C-23°C

Relative Humidity: 49%-55%

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
SB90584/05	Test Receiver	R&S	ESCI	Jun.30,2023	1 Year
SB8501/06	AMN	R&S	ESH2-Z5	Jan.19,2023	1 Year
SB9548	Shielded Room	Albatross	SR	Aug.30,2023	1 Year
SB17366	Test Receiver	R&S	ESR26	May 30,2023	1 Year
SB3345	Loop Antenna	Schwarzbeck	FMZB1516-113	Jan.19,2023	1 Year
SB3955	Broadband Antenna	SCHWARZBECK	VULB9163	May 30,2023	1 Year
SB13958	Horn Antenna	R&S	HF907	May 30,2023	1 Year
SB9555/01	Semi Anechoic Chamber	Albatross	9×6×6(m)	Aug.15,2023	1 Year
SB8501/09	Test Receiver	R&S	ESU40	Jan.19,2023	1 Year
SB3435	Horn Antenna	R&S	HF906	Nov.28,2022	1 Year
SB9058/03	Pre-Amplifier	R&S	SCU 18	Jan.19,2023	1 Year
SB8501/11	Antenna	R&S	3160-09	Feb.22,2023	3 Years
SB8501/12	Antenna	R&S	3160-10	Feb.22,2023	3 Years
SB8501/16	Pre-Amplifier	R&S	SCU-26	Jan.19,2023	1 Year
SB9059	Pre-Amplifier	R&S	SCU-40	Aug.21,2023	1 Year
SB9555/02	Fully Anechoic Chamber	Albatross	10.0×5.2× 5.4(m)	Aug.15,2023	1 Year
SB9060	Signal Analyzer	R&S	FSQ40	Apr.24, 2023	1 Year

Table 4 Test software

Name	Manufacturer	Version
Bluetooth and WiFi Test System	Shenzhen JS tonscond co.,ltd	3.2.22

5. CONDUCTED EMISSION TEST

5.1. Test Standard and Limit

5.1.1. Test Standard

FCC Part 15 15.207
IC RSS-Gen Clause 8.8

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

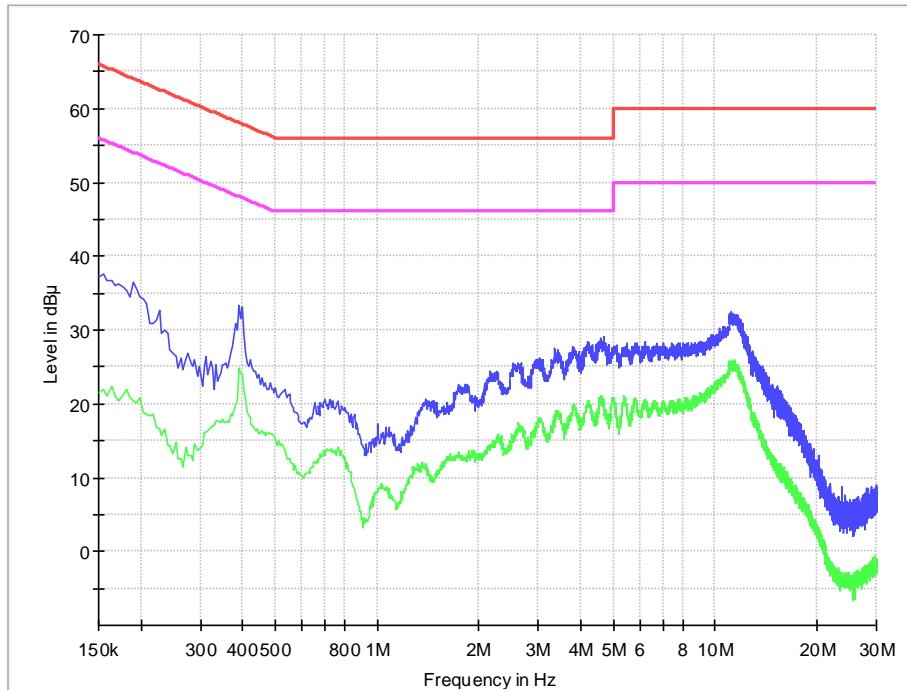
The emissions don't show in below are too low against the limits. Refer to the test curves.

Table 6 Conducted Emission Test Data

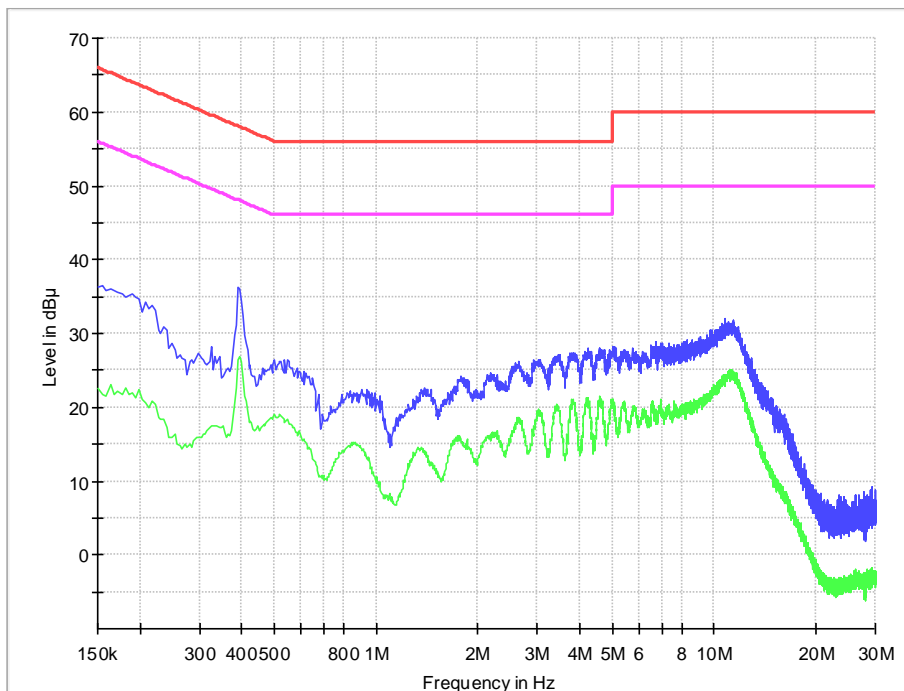
Test mode: Charging and Transmitting								
	Frequency (MHz)	Correction Factor (dB)	Quasi-Peak			Average		
			Reading (dB μ V)	Emission Level (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Emission Level (dB μ V)	Limit (dB μ V)
Line	0.19	9.7	22.2	31.9	64.0	11.3	21	54.0
	0.388	9.7	20.8	30.5	58.1	14.6	24.3	48.1
	2.989	9.9	13.4	23.3	56	7.7	17.6	46
	3.849	9.9	13.9	23.8	56	9.4	19.3	46
	4.6	9.9	15.0	24.9	56	10.8	20.7	46
	11.044	9.9	19.7	29.6	60	15.5	25.4	50
Neutral	0.163	9.7	24.5	34.2	65.3	13.8	23.5	55.3
	0.388	9.7	23.1	32.8	58.1	17.9	27.6	48.1
	3.003	9.9	14.8	24.7	56	9.3	19.2	46
	3.826	9.9	15.3	25.2	56	11.0	20.9	46
	4.609	9.9	15.4	25.3	56	11.2	21.1	46
	10.819	9.9	18.5	28.4	60	14.2	24.1	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
RSS-247 Clause 5.5 & RSS GEN Clause 8.9

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.

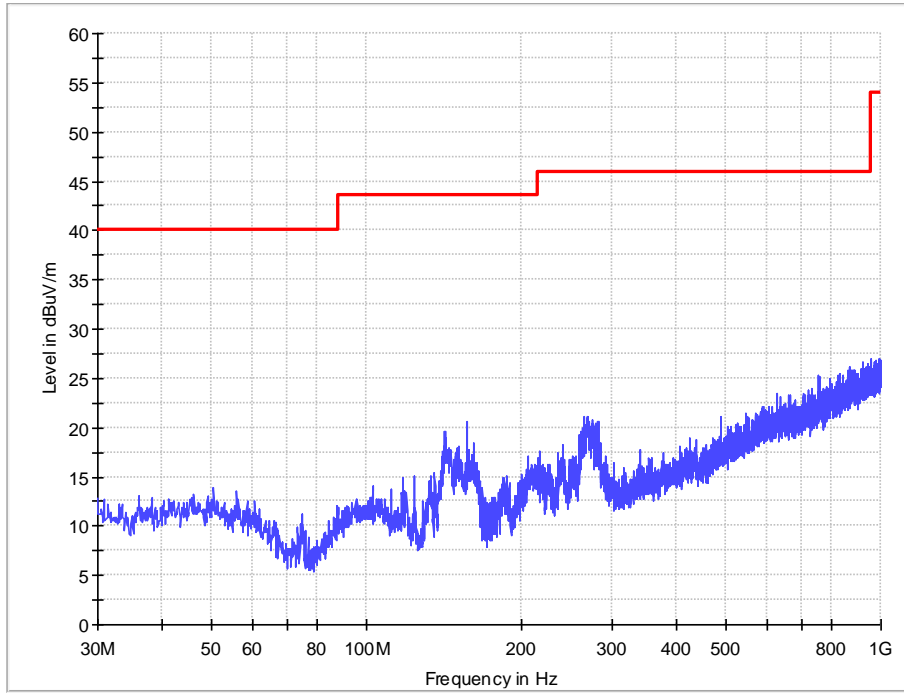
Table 10 Radiated Emission Test Data 30MHz-1GHz

Frequency (MHz)	Cable Loss +preamp (dB)	Antenna Factor (dB)	Reading (dBµV/m)	Level (dBµV/m)	Polarity (Horizontal/Vertical)	Limit (dBµV/m)	Margin (dB)	Note
75.105	1.0	7.8	10.8	19.6	Vertical	40.0	20.4	QP
117.785	1.3	12.3	8.1	21.7	Vertical	43.5	21.8	QP
123.896	1.2	10.5	6.8	18.5	Vertical	43.5	25.0	QP
147.661	1.4	8.2	11.2	20.8	Vertical	43.5	22.7	QP
181.126	1.6	9.7	9.5	20.8	Vertical	43.5	22.7	QP
205.376	1.6	10.6	7.4	19.6	Vertical	43.5	23.9	QP
141.938	1.3	8.2	5.6	15.1	Horizontal	43.5	28.4	QP
149.601	1.5	8.2	3.5	13.2	Horizontal	43.5	30.3	QP
156.973	1.4	8.3	6.0	15.7	Horizontal	43.5	27.8	QP
161.629	1.5	8.7	1.0	11.2	Horizontal	43.5	32.3	QP
241.169	1.9	12.1	-6.0	8.0	Horizontal	46	38.0	QP
268.232	2.0	12.1	2.2	16.3	Horizontal	46	29.7	QP

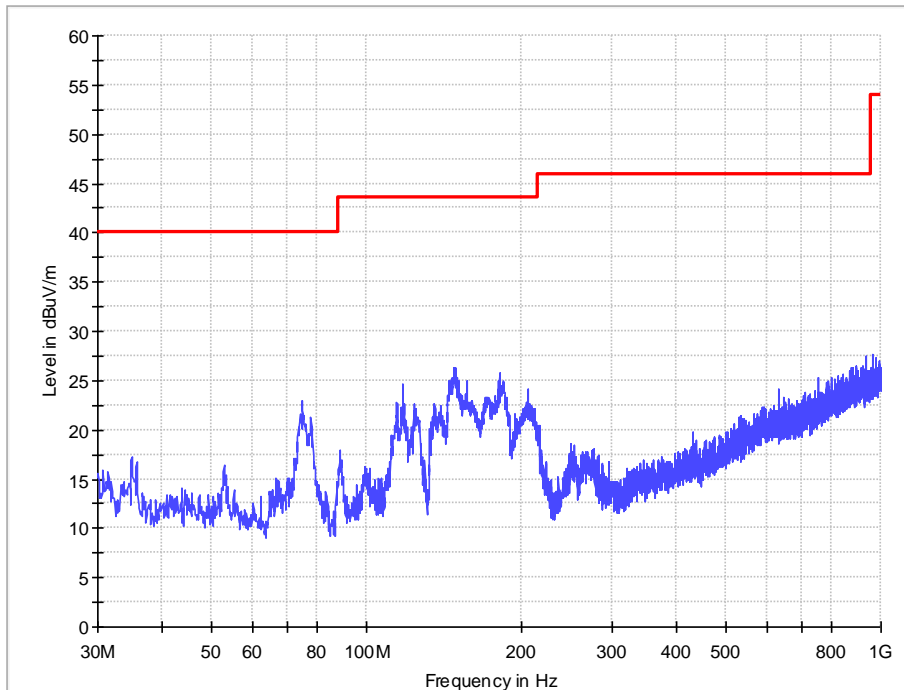
Remark: Emission level (dBµV)=Read Value(dBµV/m) + Antenna Factor(dB)+ Cable Loss +preamp(dB)

30MHz-1GHz

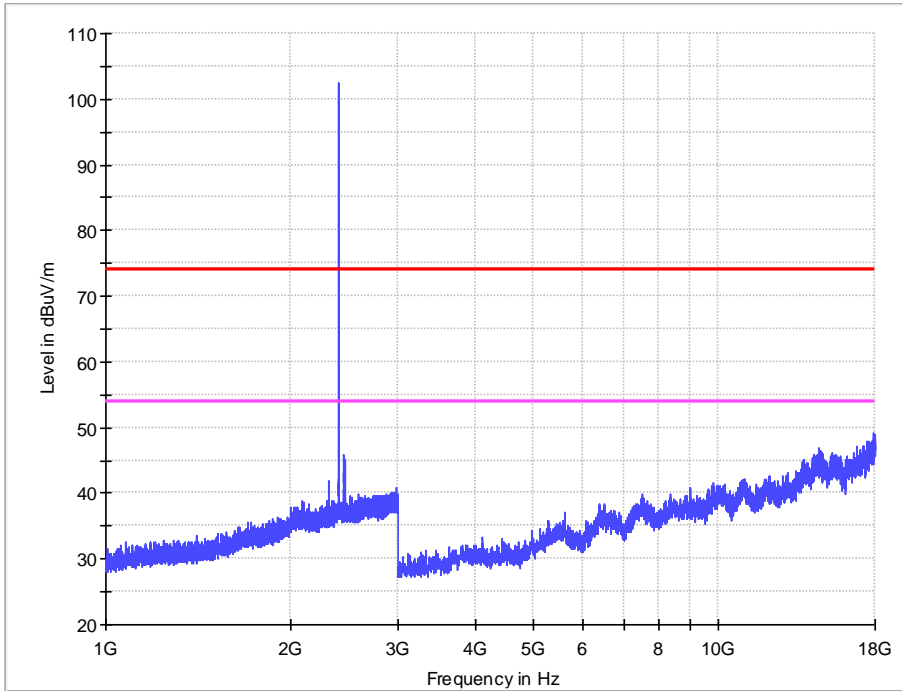
Horizontal



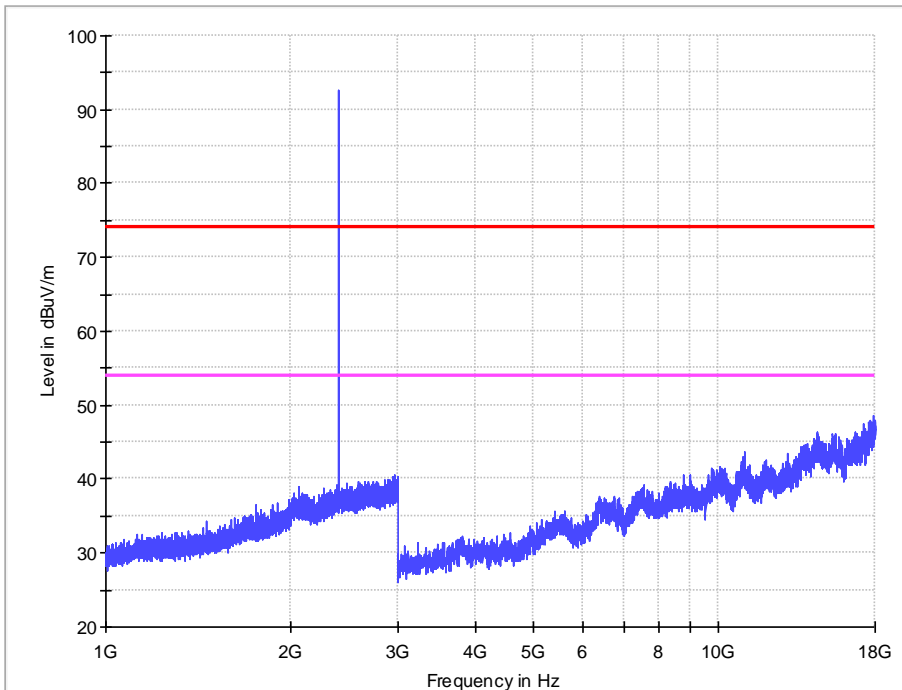
Vertical



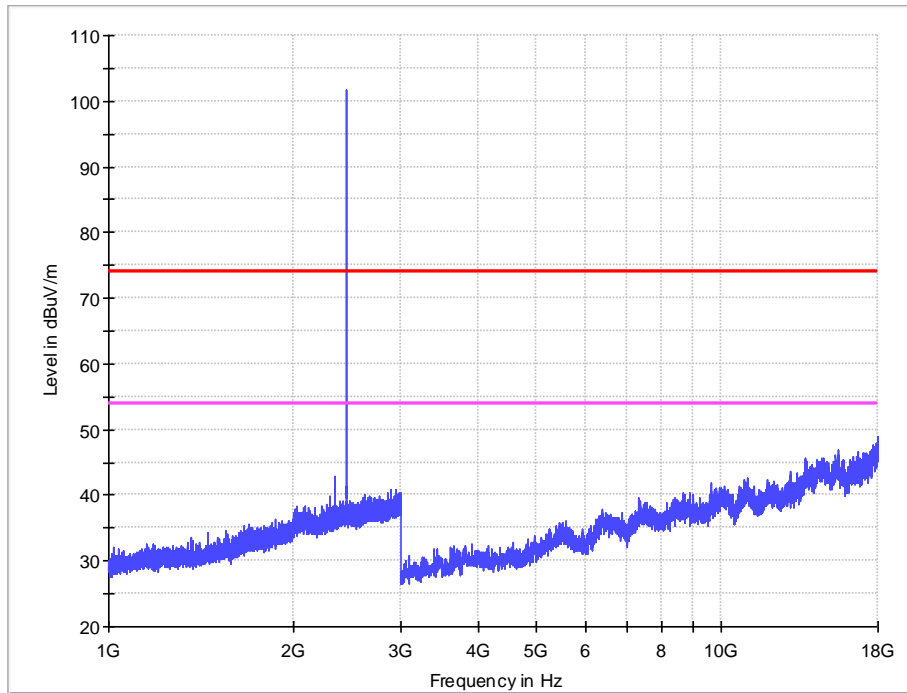
Left:
1GHz-18GHz
GFSK CH0
Horizontal



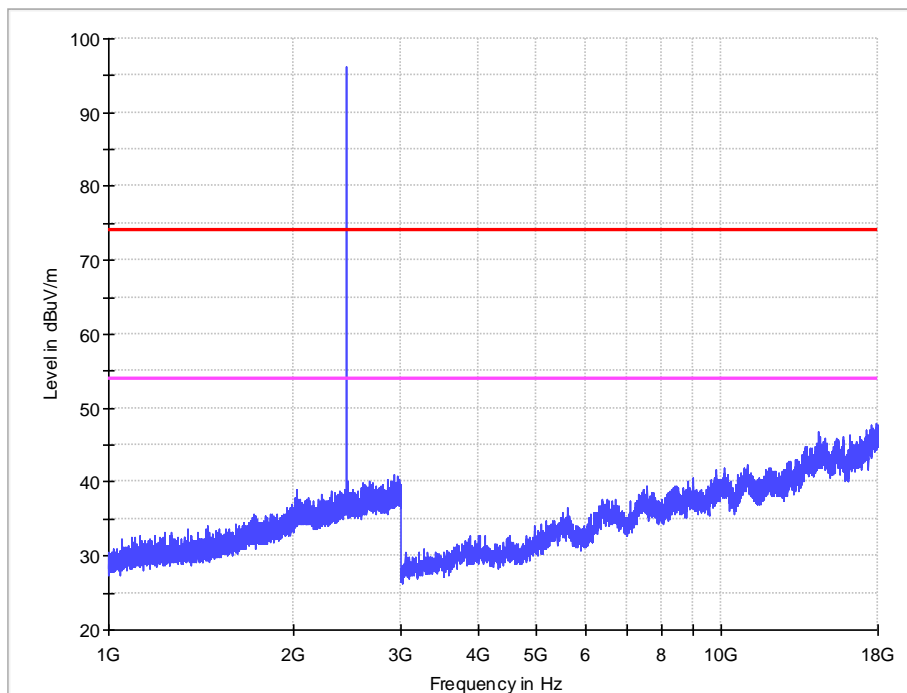
Vertical



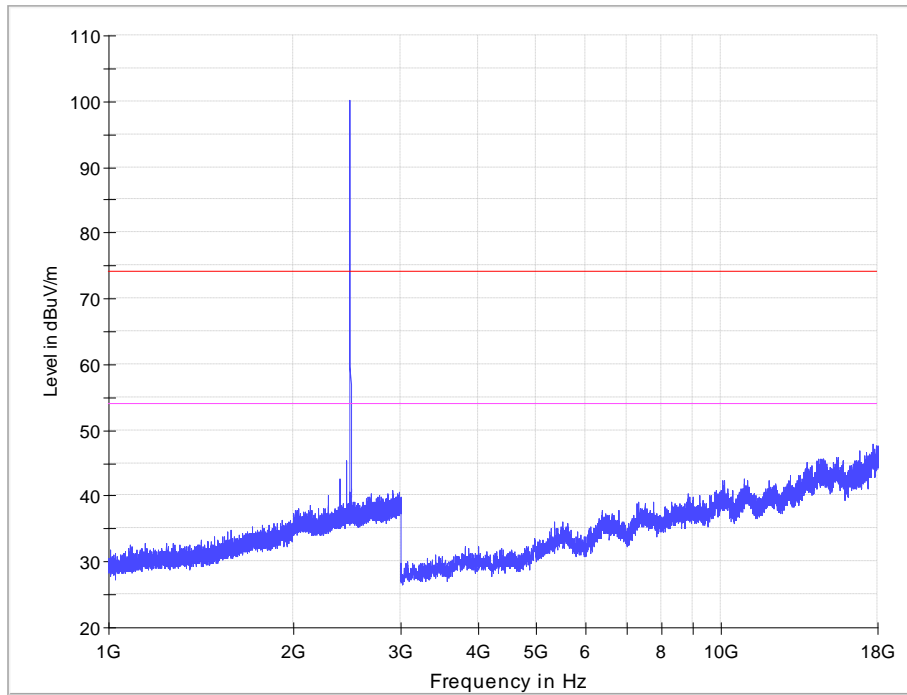
Left:
1GHz-18GHz
GFSK CH39
Horizontal



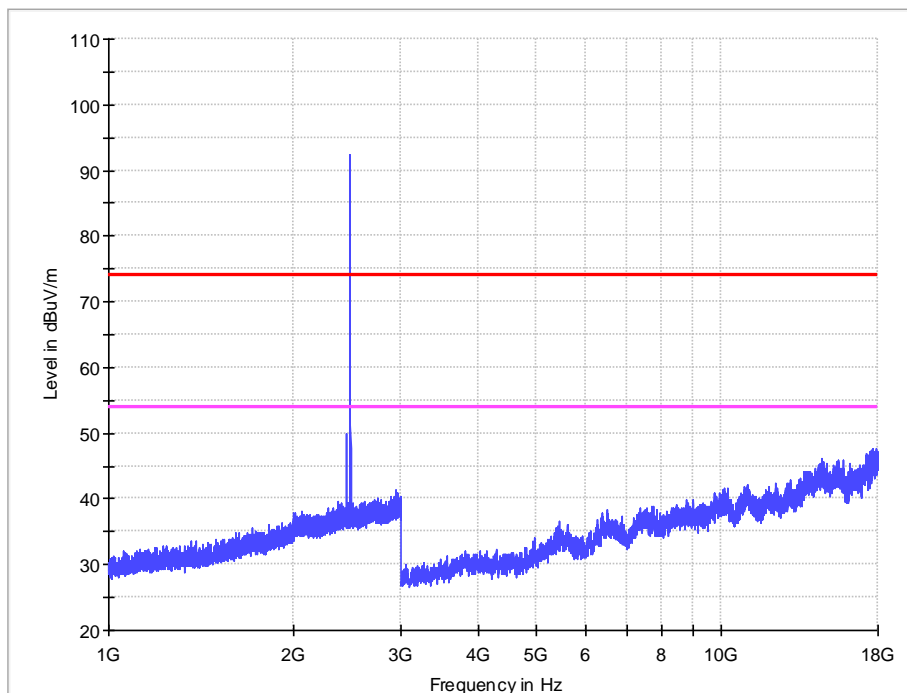
Vertical



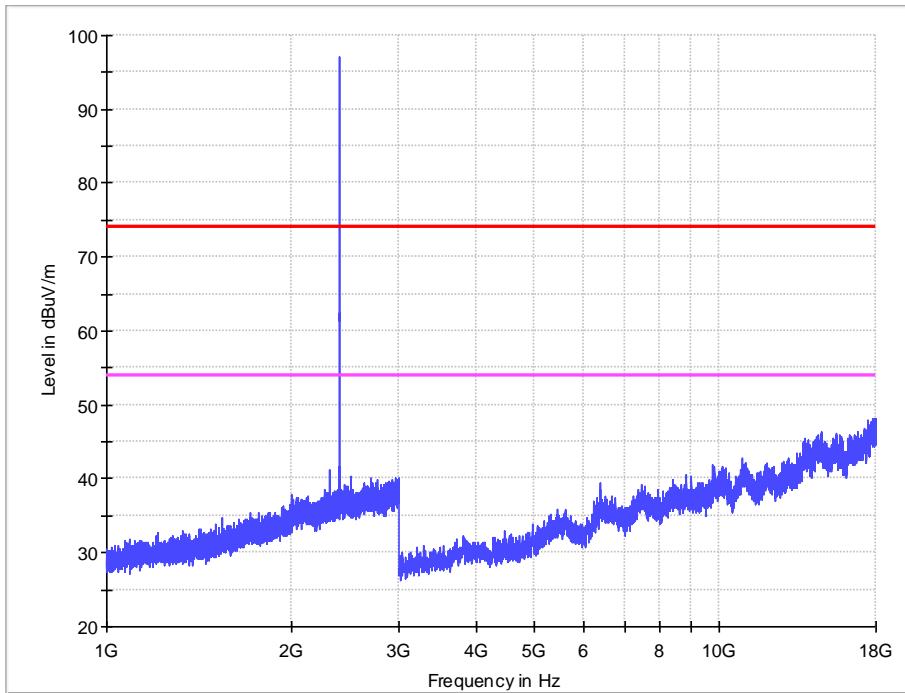
Left:
1GHz-18GHz
GFSK CH78
Horizontal



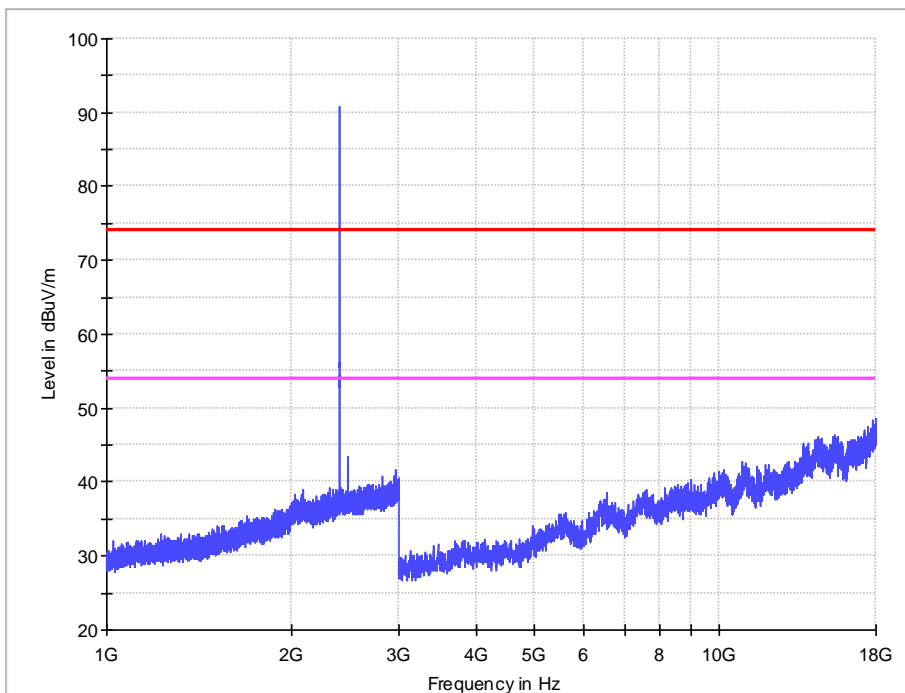
Vertical



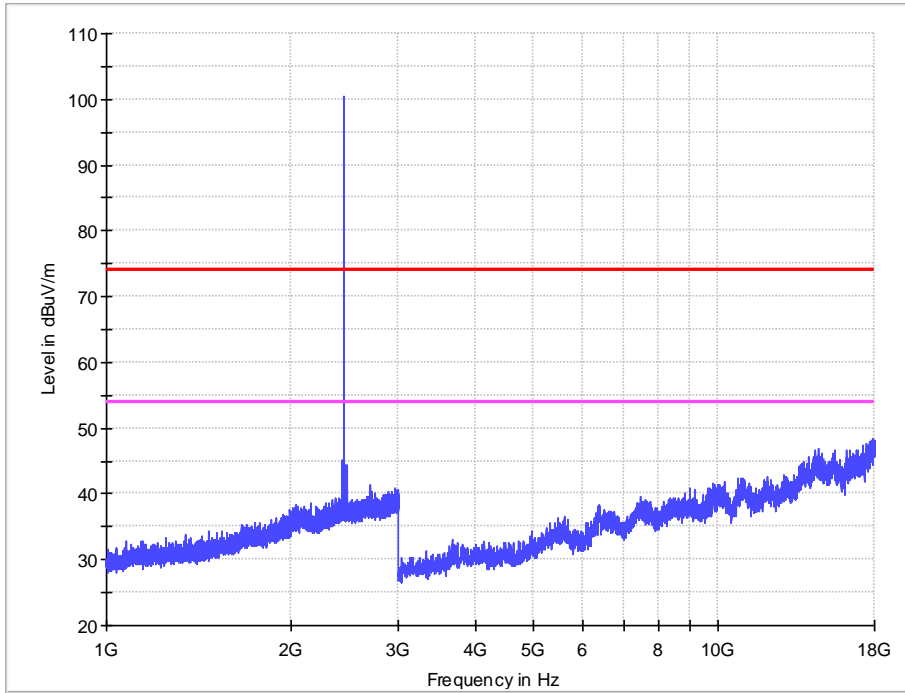
Left:
1GHz-18GHz
8DPSK CH0
Horizontal



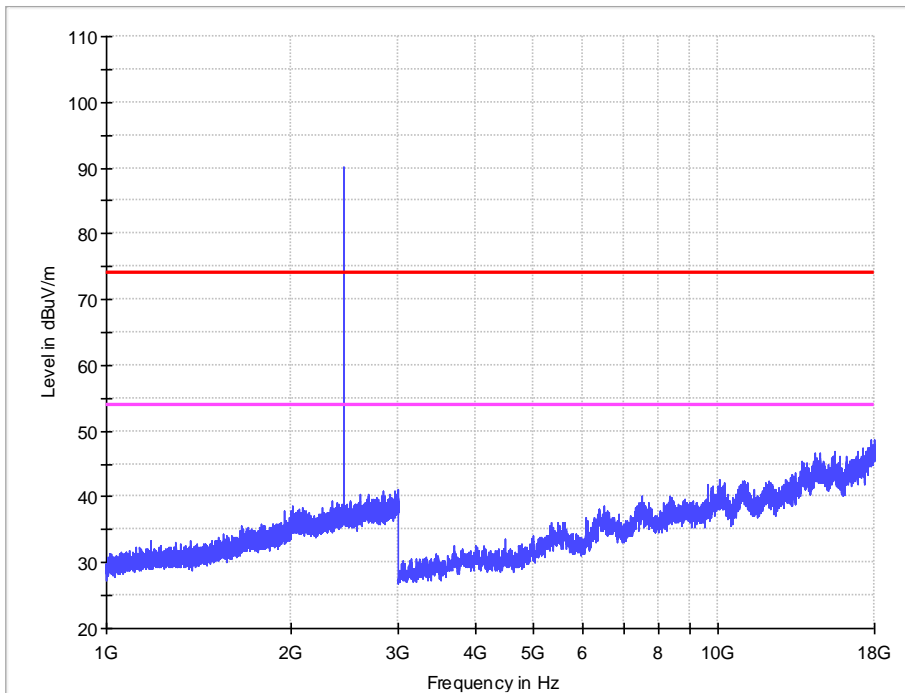
Vertical



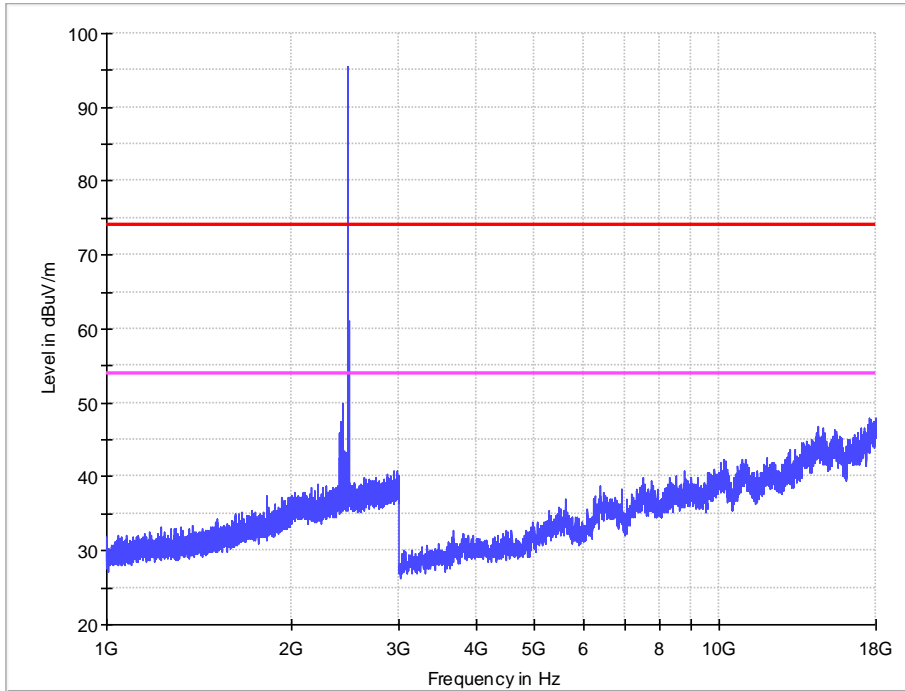
Left:
1GHz-18GHz
8DPSK CH39
Horizontal



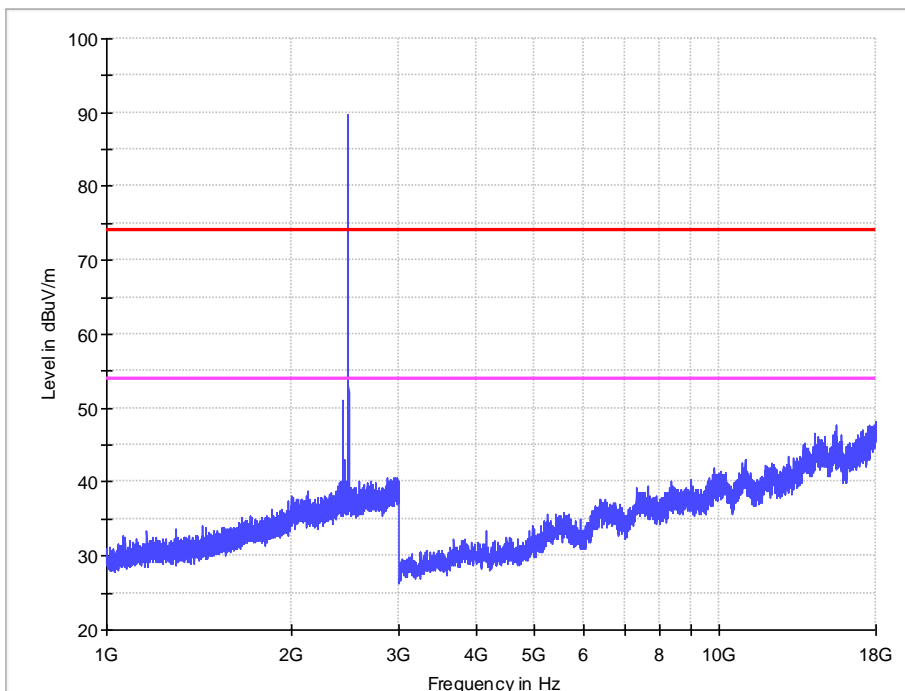
Vertical



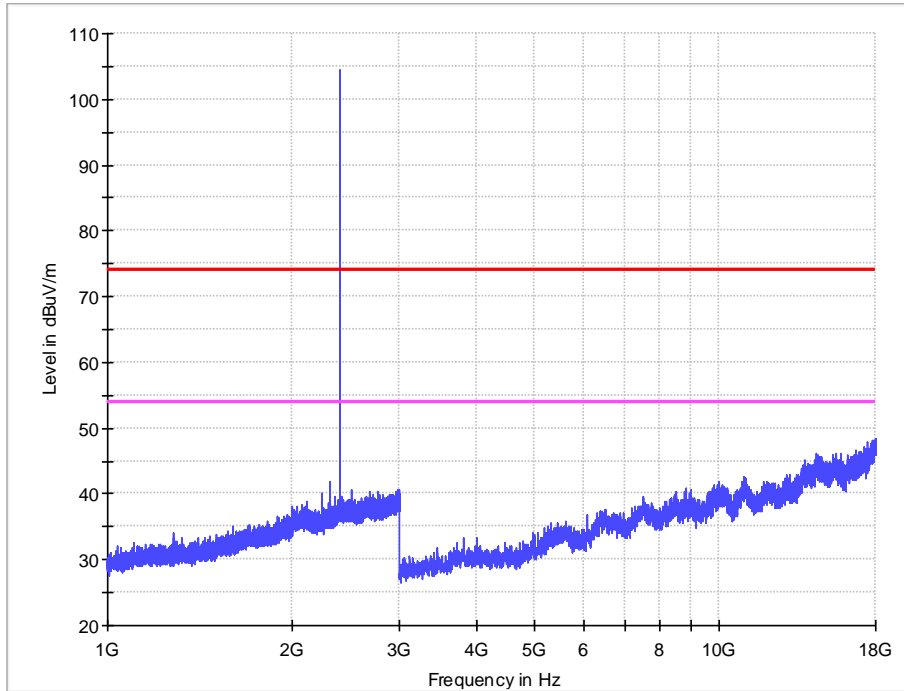
Left:
1GHz-18GHz
8DPSK CH78
Horizontal



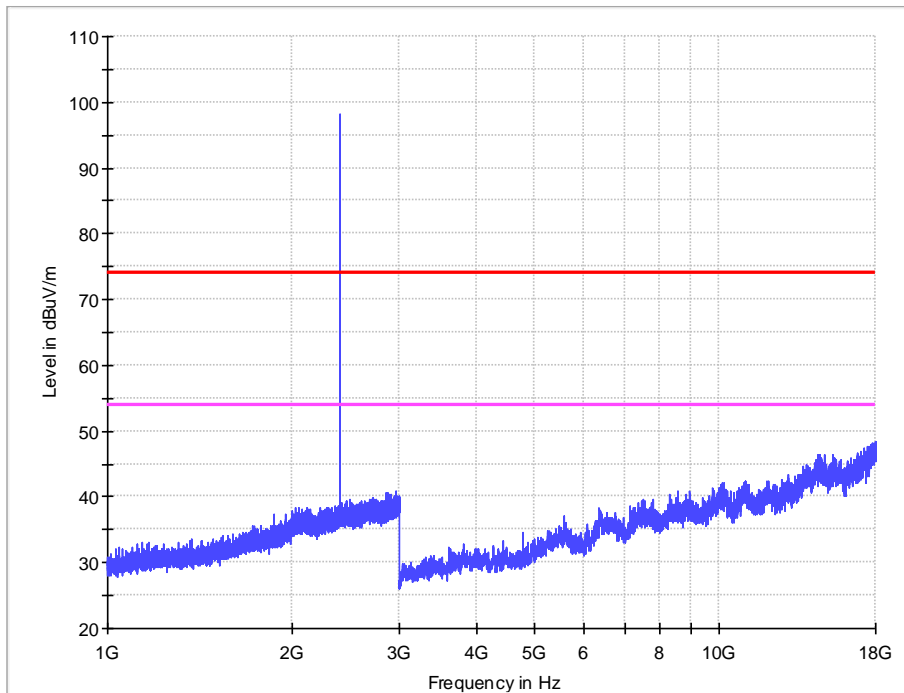
Vertical



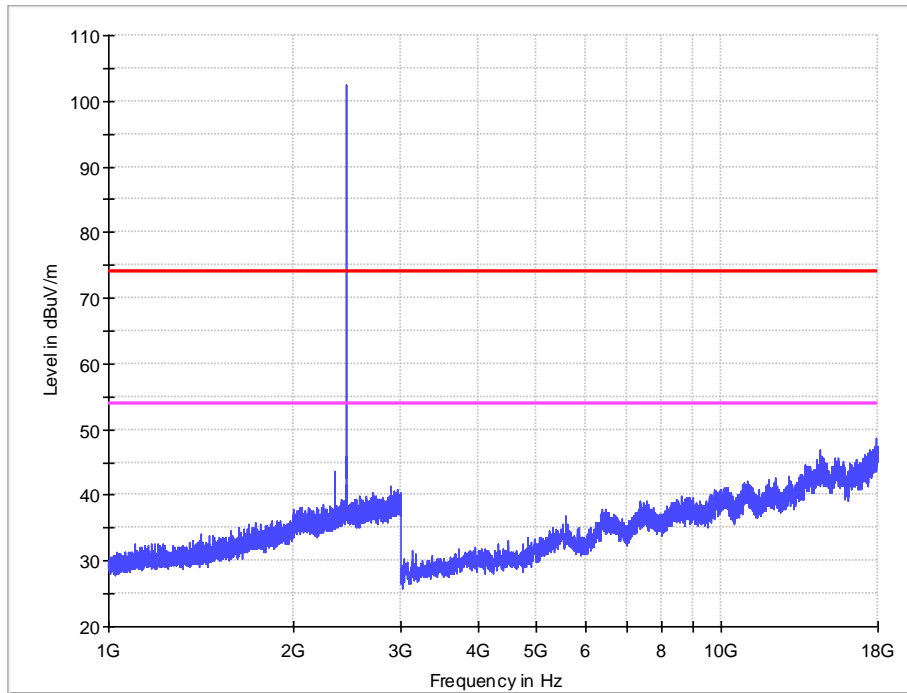
Right:
1GHz-18GHz
GFSK CH0
Horizontal



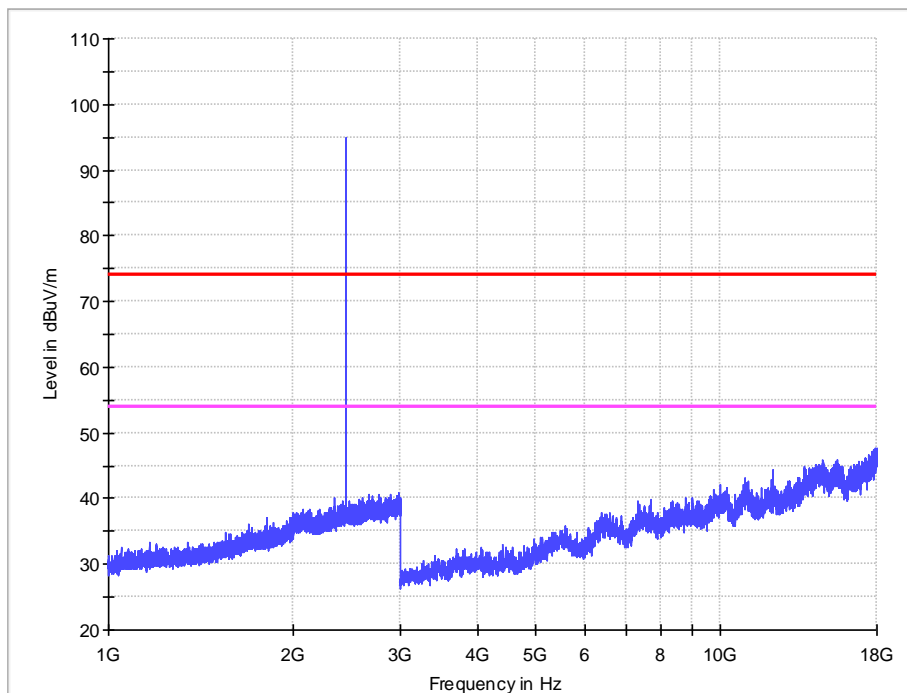
Vertical



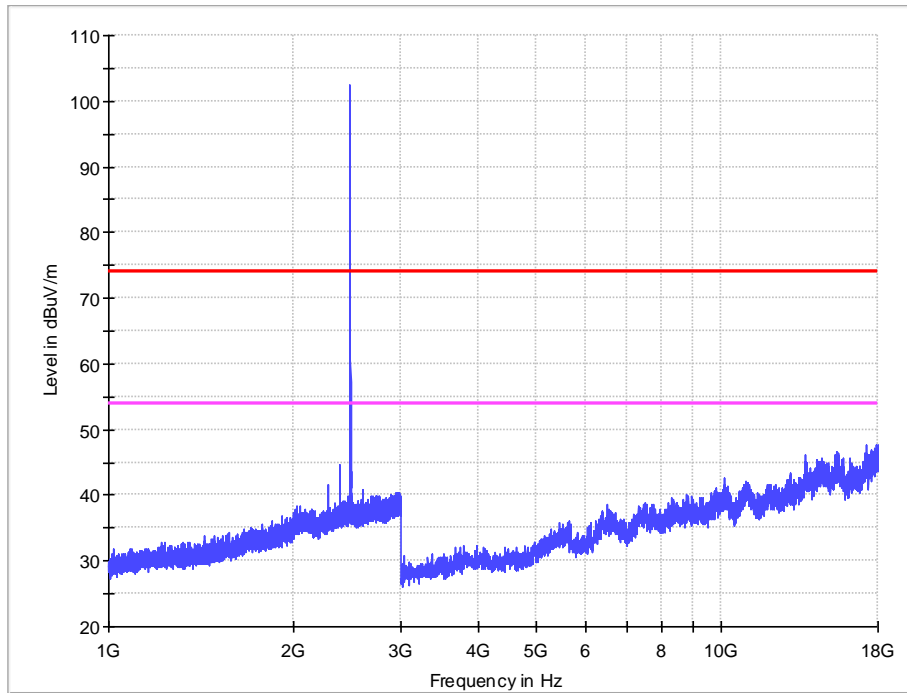
Right:
1GHz-18GHz
GFSK CH39
Horizontal



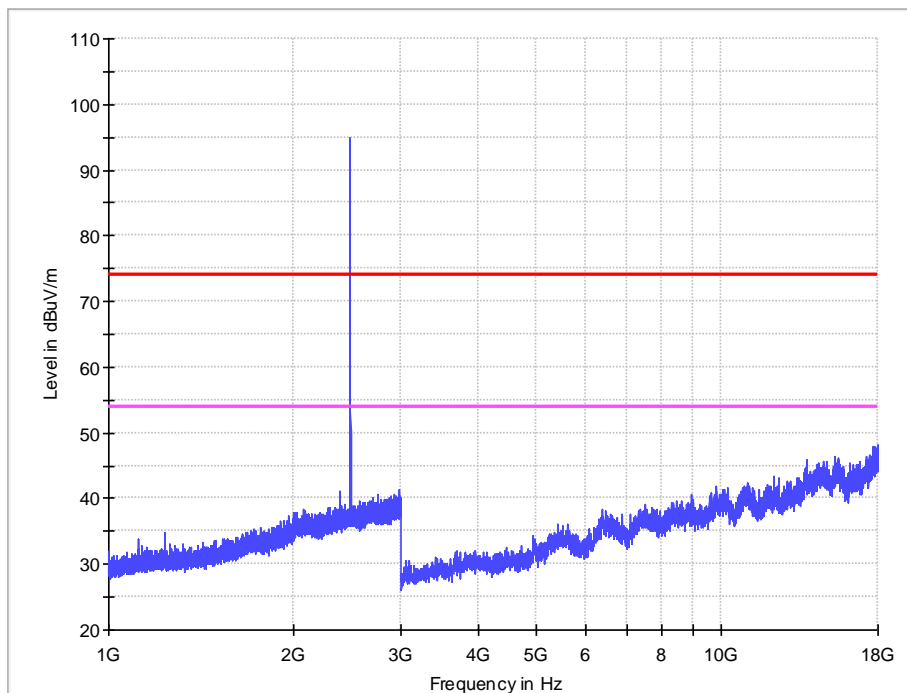
Vertical



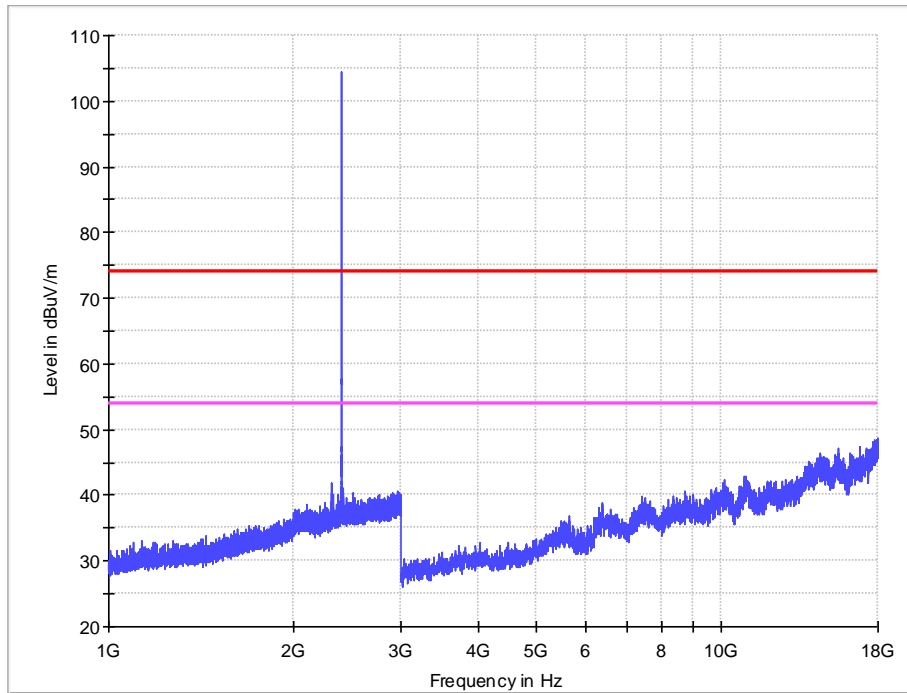
Right:
1GHz-18GHz
GFSK CH78
Horizontal



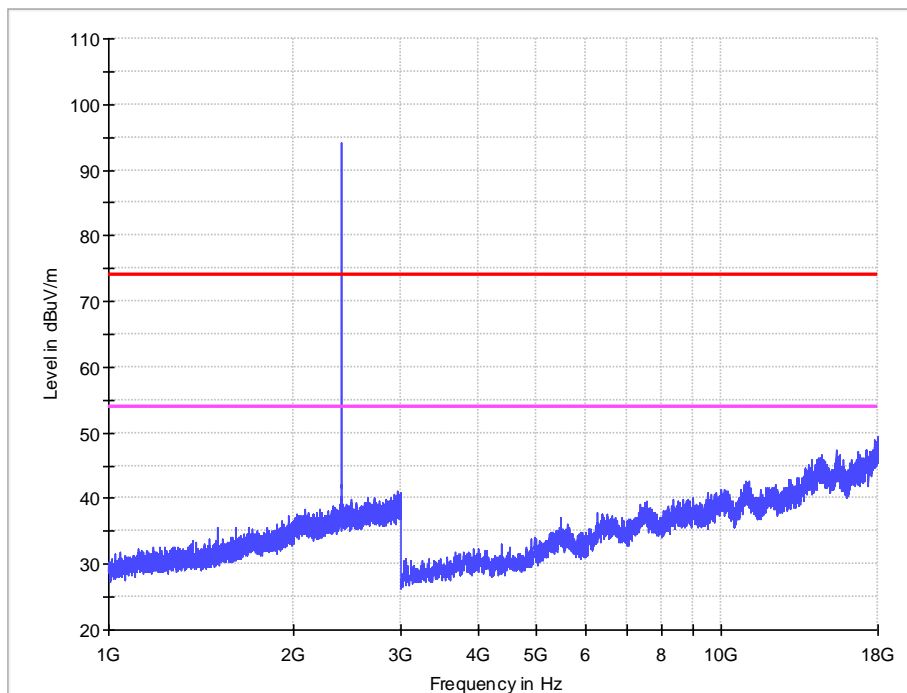
Vertical



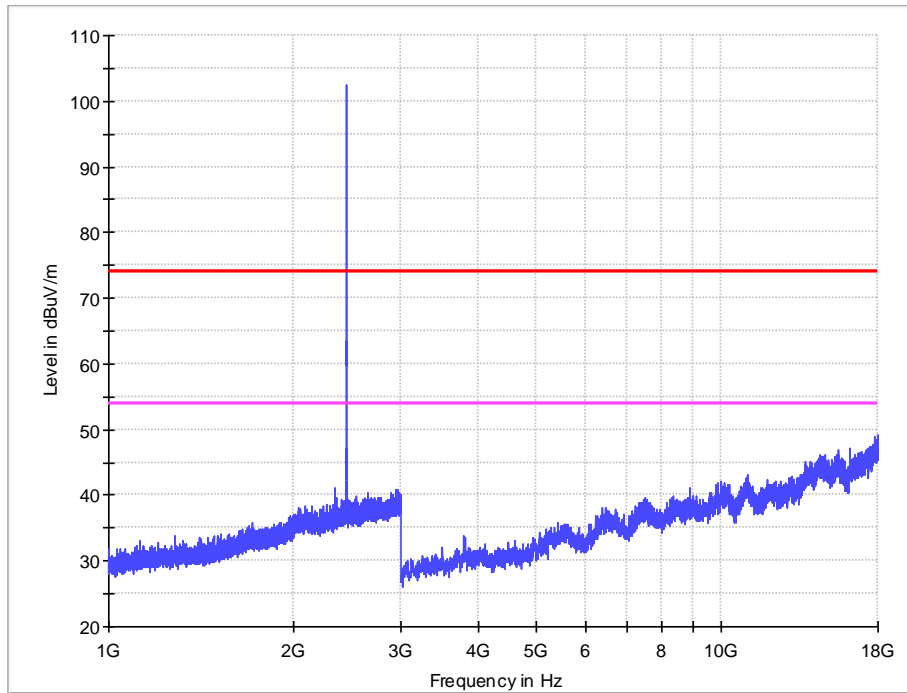
Right:
1GHz-18GHz
8DPSK CH0
Horizontal



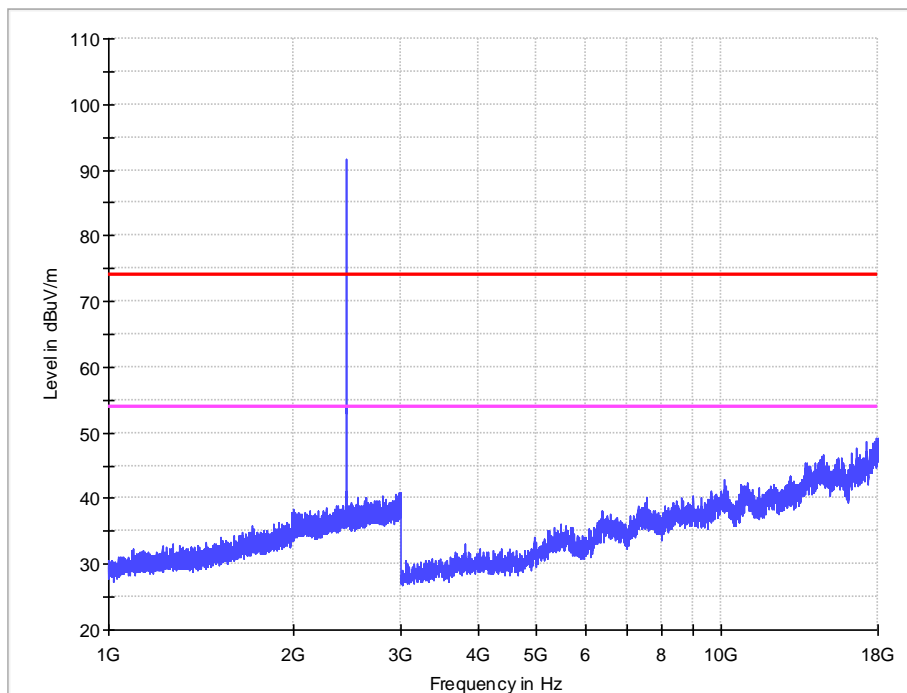
Vertical



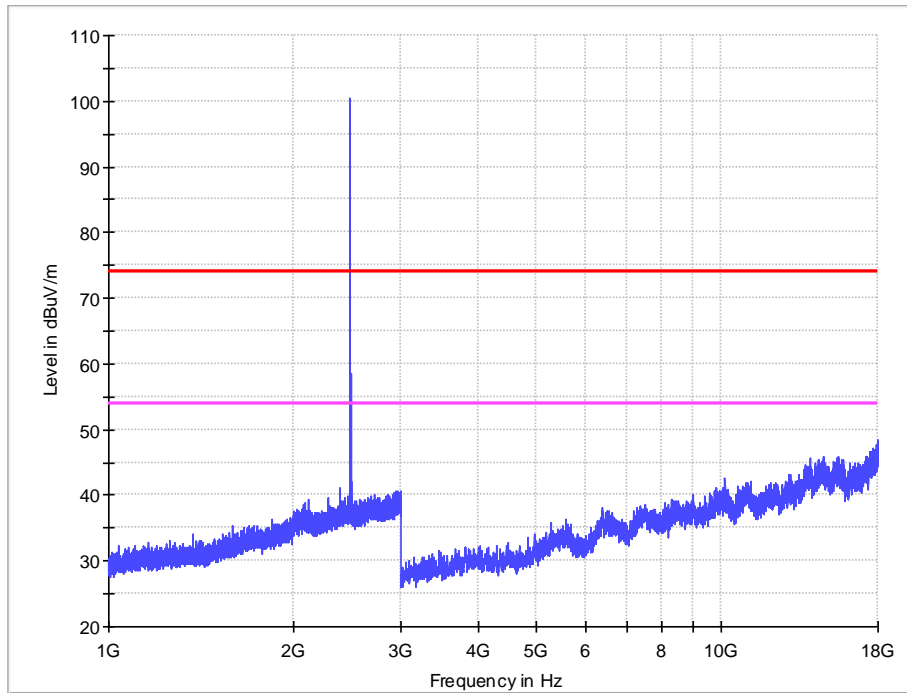
Right:
1GHz-18GHz
8DPSK CH39
Horizontal



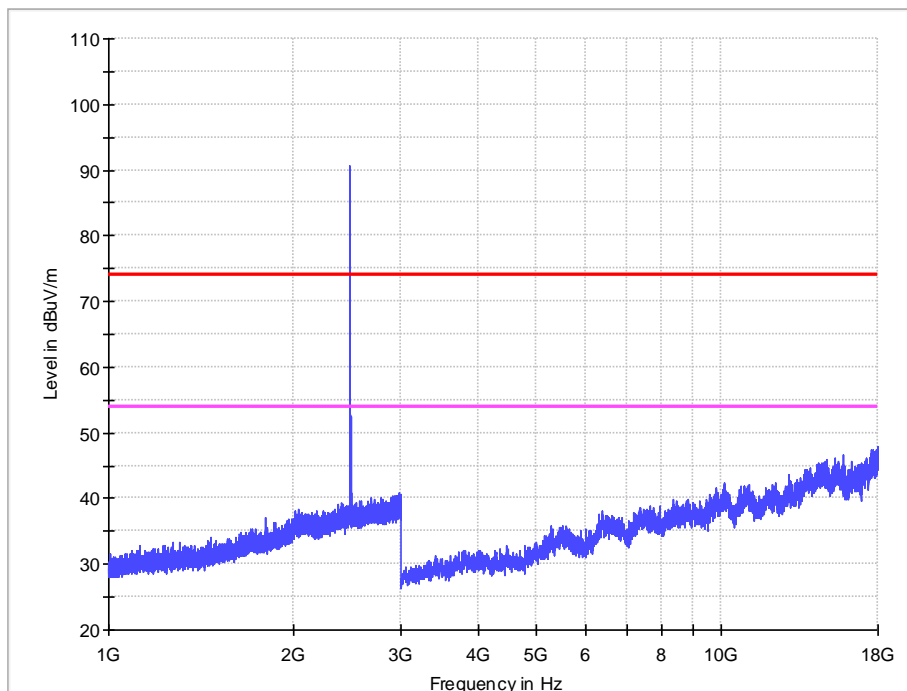
Vertical



Right:
1GHz-18GHz
8DPSK CH78
Horizontal

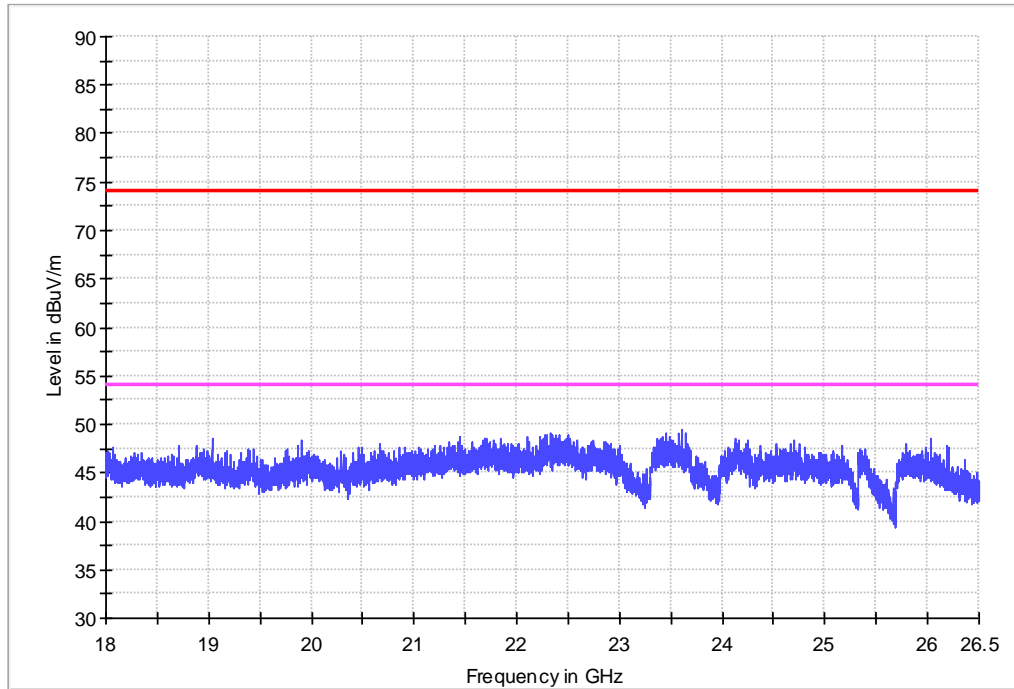


Vertical



18-26.5GHz

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



Vertical

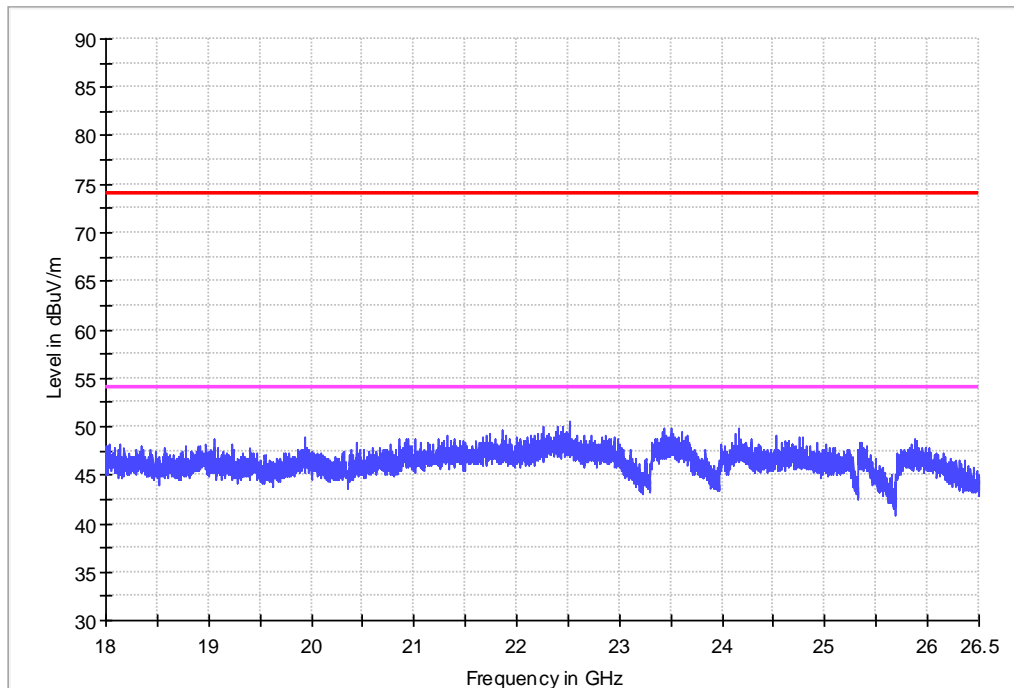


Table 11 Restricted Band Radiated Emission Data

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

Left:

Table 12 20dB Bandwidth Test Data

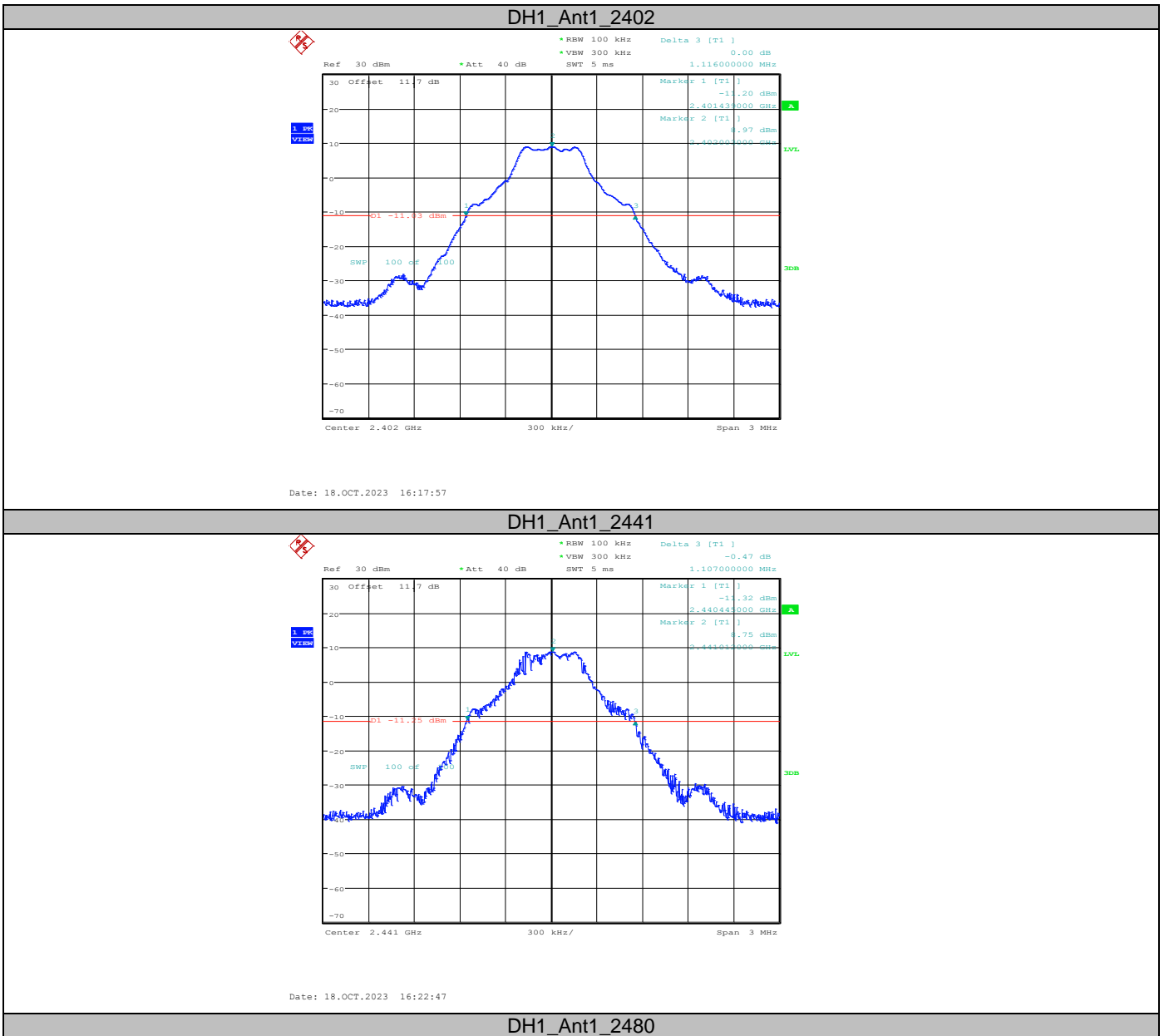
TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.12	2401.44	2402.56	---	---
		2441	1.11	2440.45	2441.55	---	---
		2480	1.11	2479.44	2480.55	---	---
3DH1	Ant1	2402	1.30	2401.35	2402.65	---	---
		2441	1.29	2440.36	2441.65	---	---
		2480	1.30	2479.35	2480.65	---	---

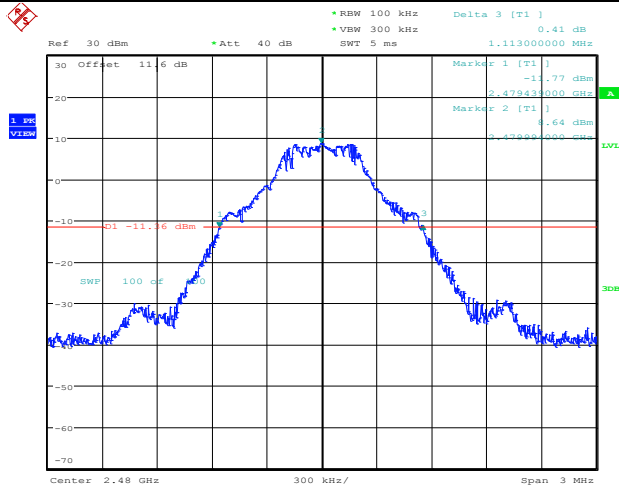
Right:

Table 13 20dB Bandwidth Test Data

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.11	2401.44	2402.55	---	---
		2441	1.10	2440.45	2441.55	---	---
		2480	1.10	2479.45	2480.55	---	---
3DH1	Ant1	2402	1.29	2401.36	2402.65	---	---
		2441	1.29	2440.35	2441.64	---	---
		2480	1.27	2479.36	2480.63	---	---

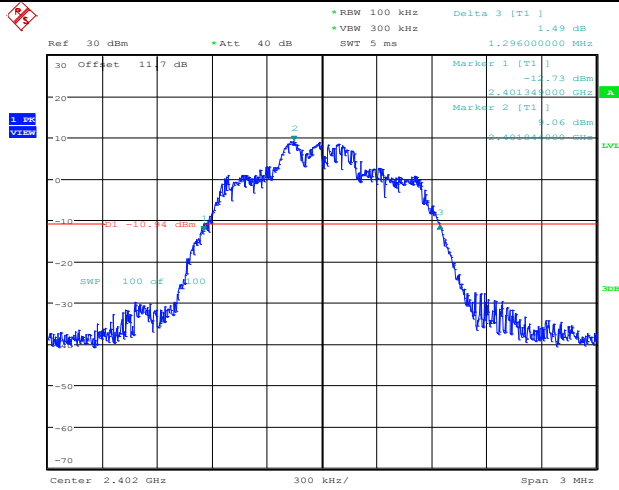
Left:





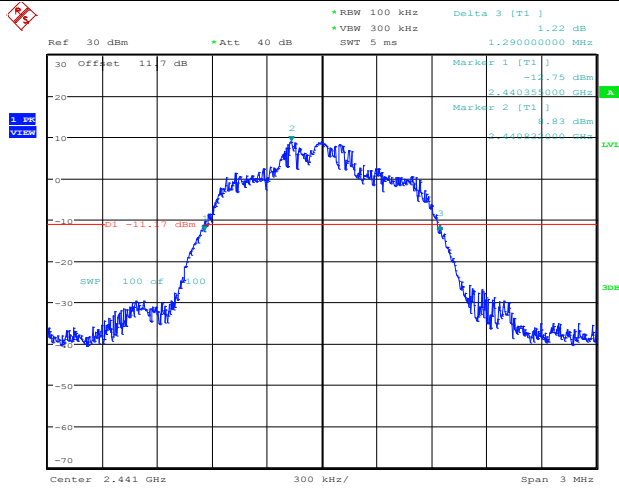
Date: 18.OCT.2023 16:27:36

3DH1_Ant1_2402



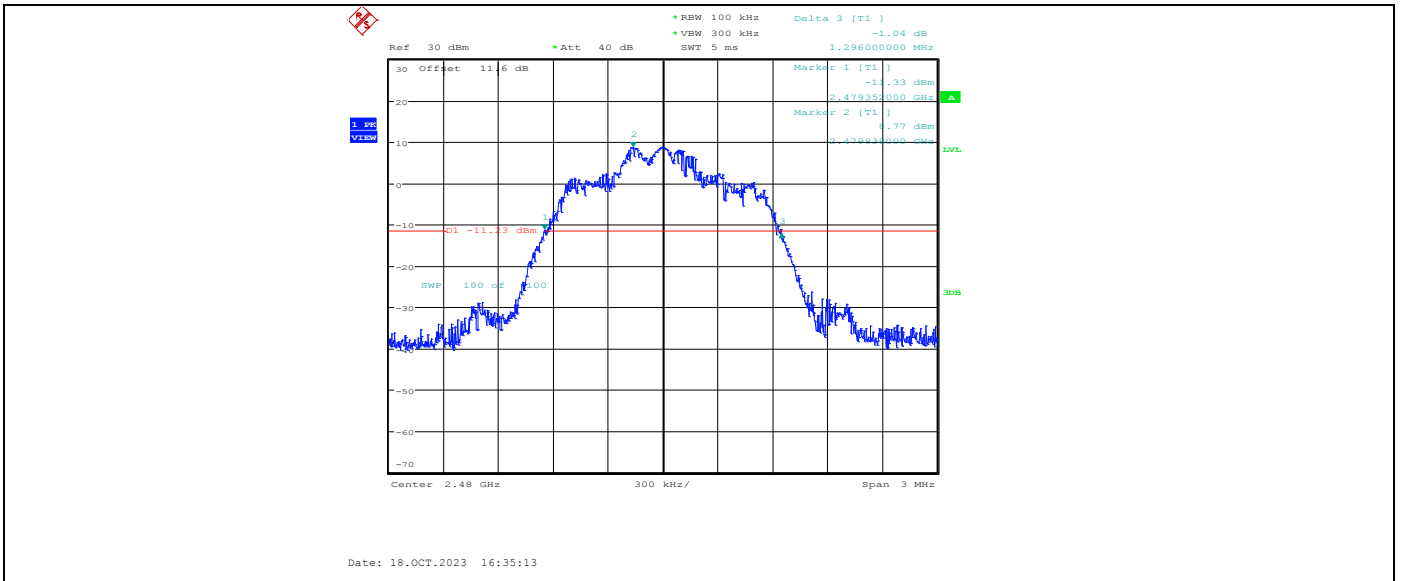
Date: 18.OCT.2023 16:31:31

3DH1_Ant1_2441

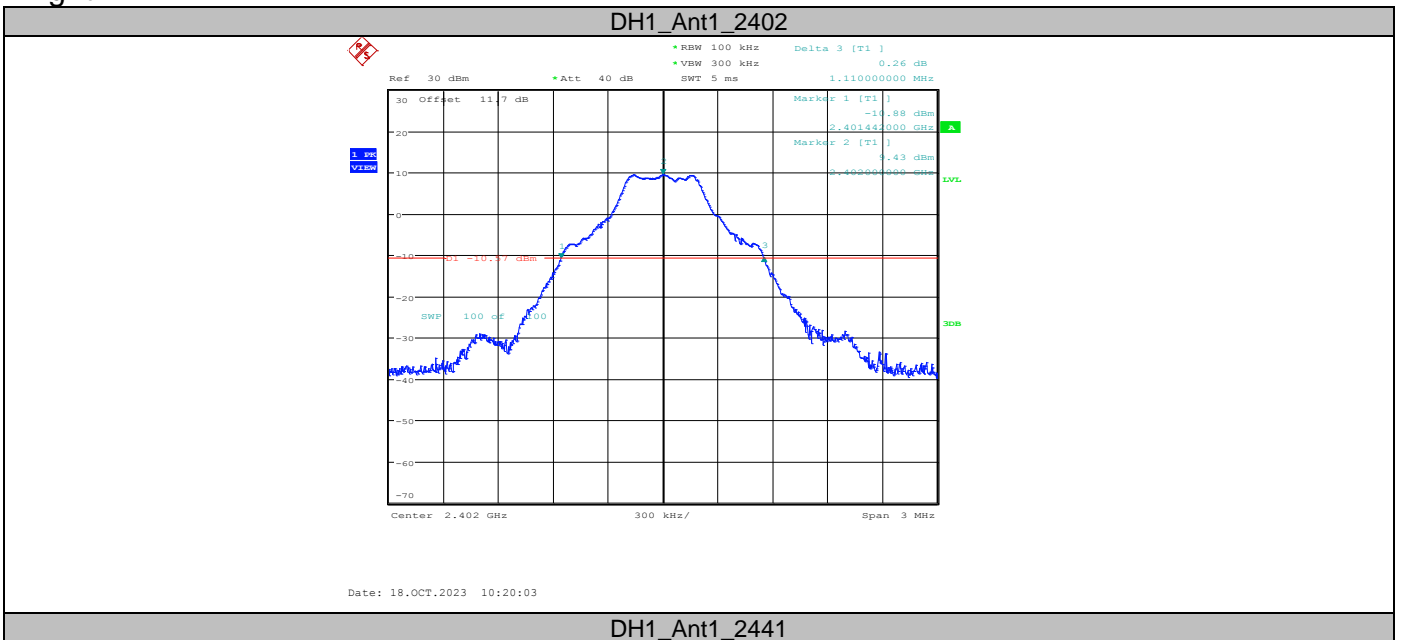


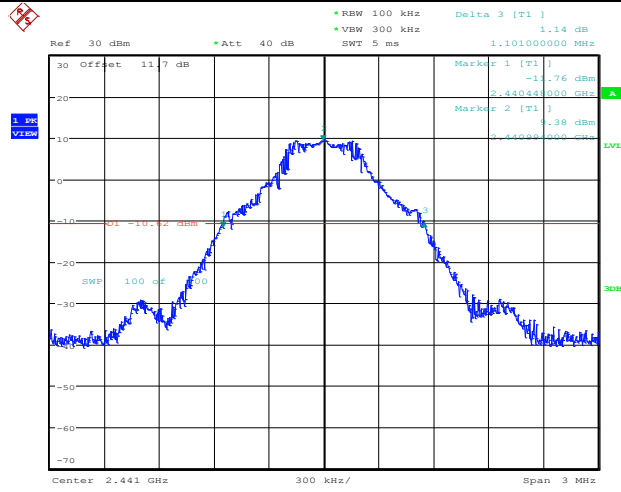
Date: 18.OCT.2023 16:33:08

3DH1_Ant1_2480



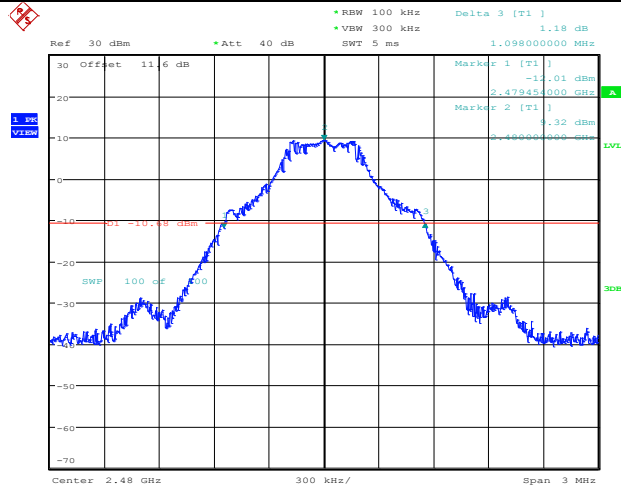
Right:





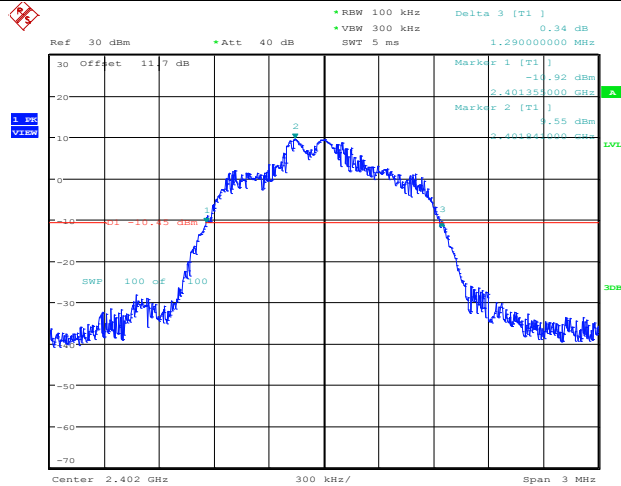
Date: 18.OCT.2023 10:24:39

DH1_Ant1_2480



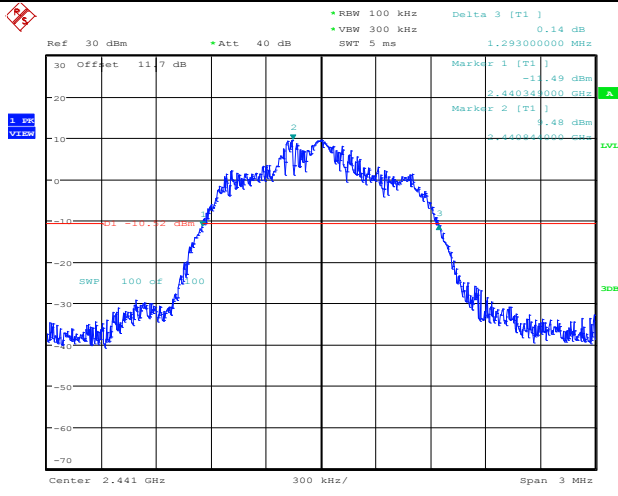
Date: 18.OCT.2023 10:28:28

3DH1_Ant1_2402



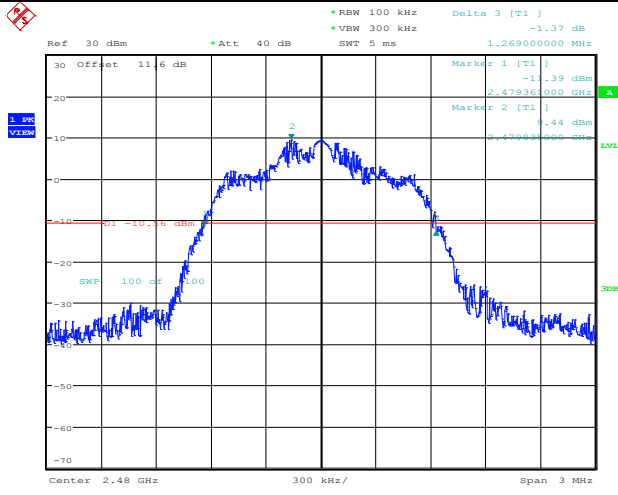
Date: 18.OCT.2023 10:32:53

3DH1_Ant1_2441



Date: 18.OCT.2023 10:44:42

3DH1_Ant1_2480



Date: 18.OCT.2023 10:47:35

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

Left:

Table 14 Carrier Frequencies Separation

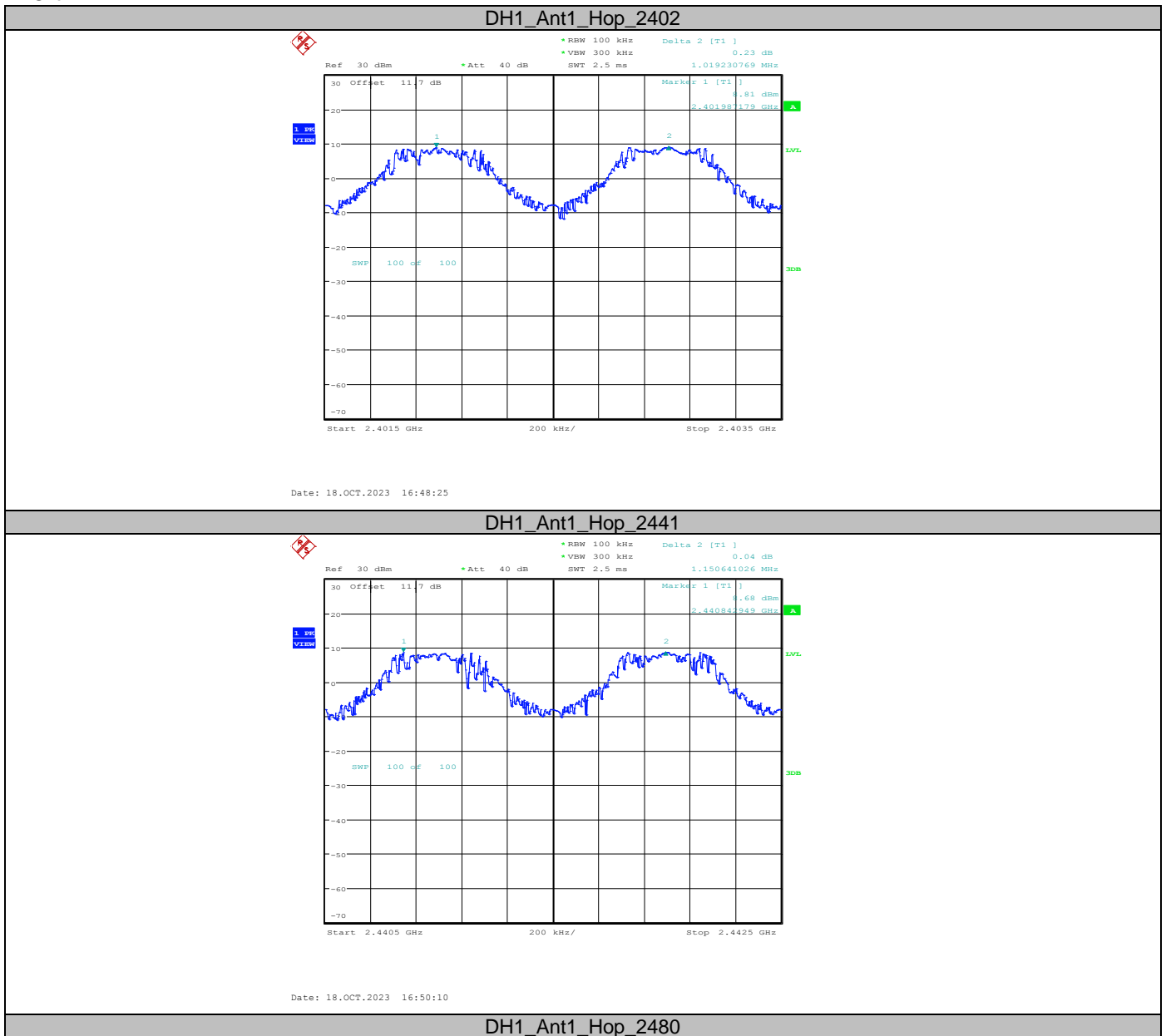
TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	Hop_2402	1.019	≥0.747	PASS
		Hop_2441	1.151	≥0.747	PASS
		Hop_2480	0.99	≥0.747	PASS
3DH1	Ant1	Hop_2402	0.994	≥0.867	PASS
		Hop_2441	1.157	≥0.867	PASS
		Hop_2480	0.99	≥0.867	PASS

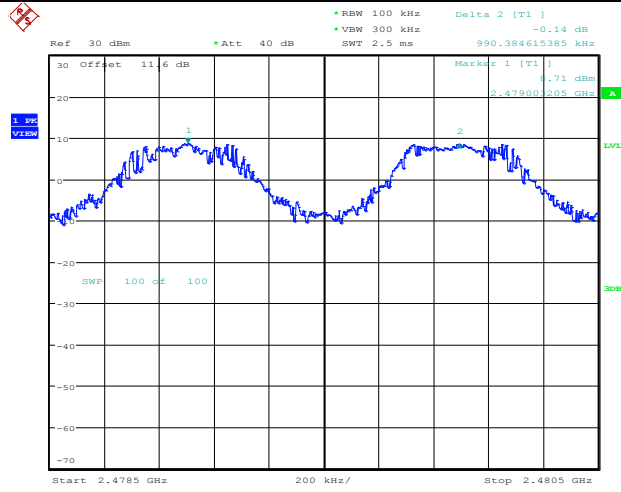
Right:

Table 15 Carrier Frequencies Separation

TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	Hop_2402	1	≥0.740	PASS
		Hop_2441	1	≥0.740	PASS
		Hop_2480	1.003	≥0.740	PASS
3DH1	Ant1	Hop_2402	1.151	≥0.860	PASS
		Hop_2441	1.01	≥0.860	PASS
		Hop_2480	1.006	≥0.860	PASS

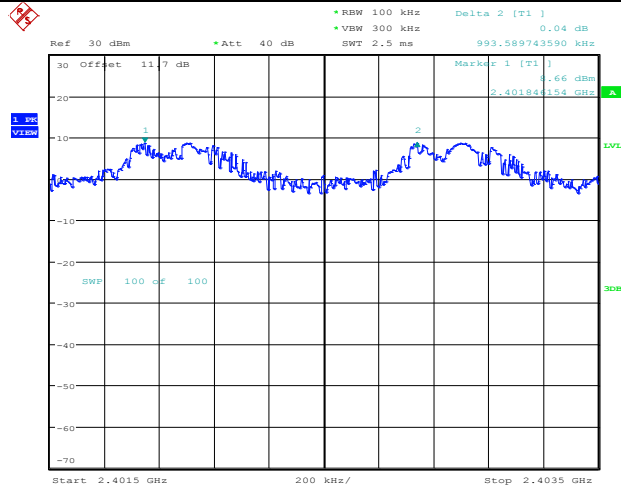
Left:





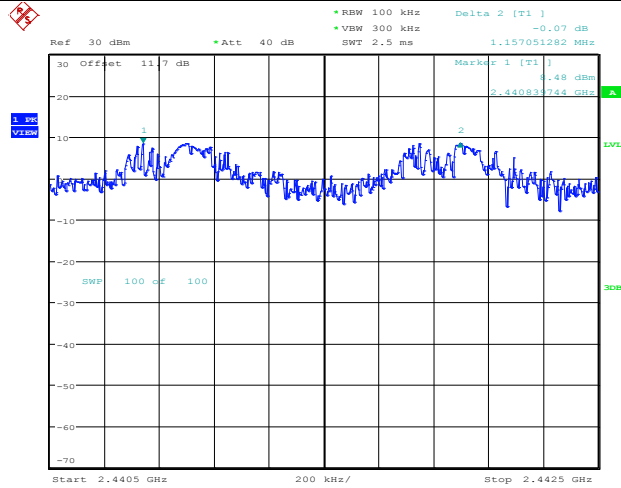
Date: 18.OCT.2023 16:52:06

3DH1_Ant1_Hop_2402



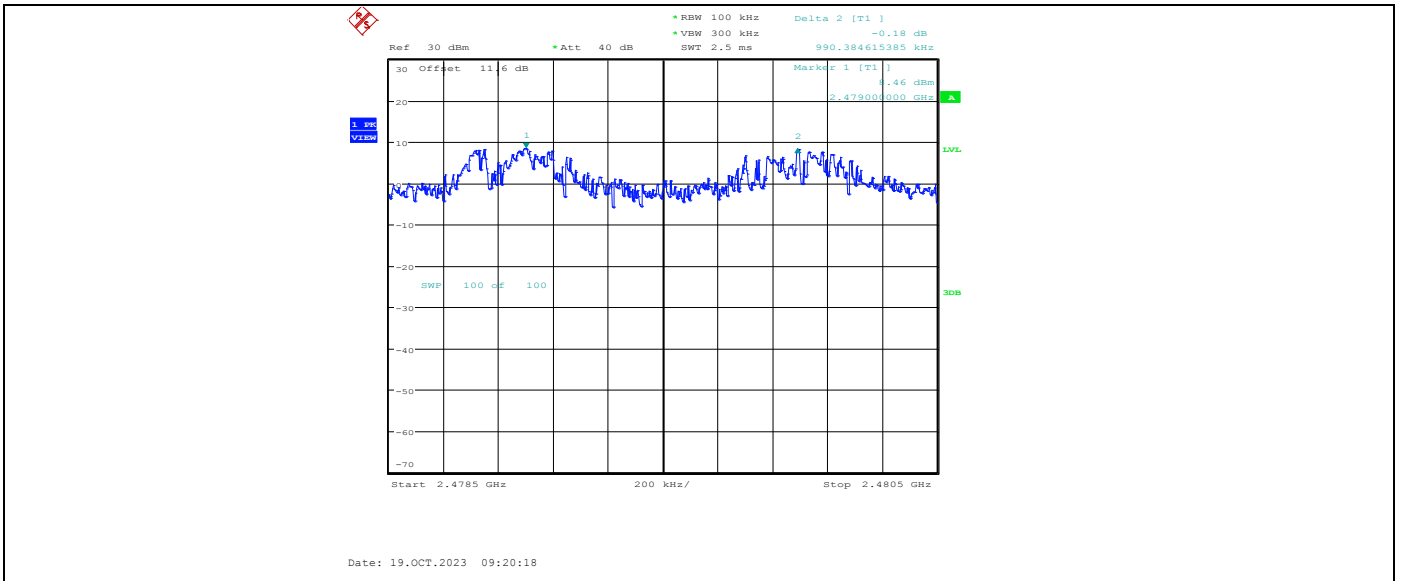
Date: 19.OCT.2023 08:52:54

3DH1_Ant1_Hop_2441

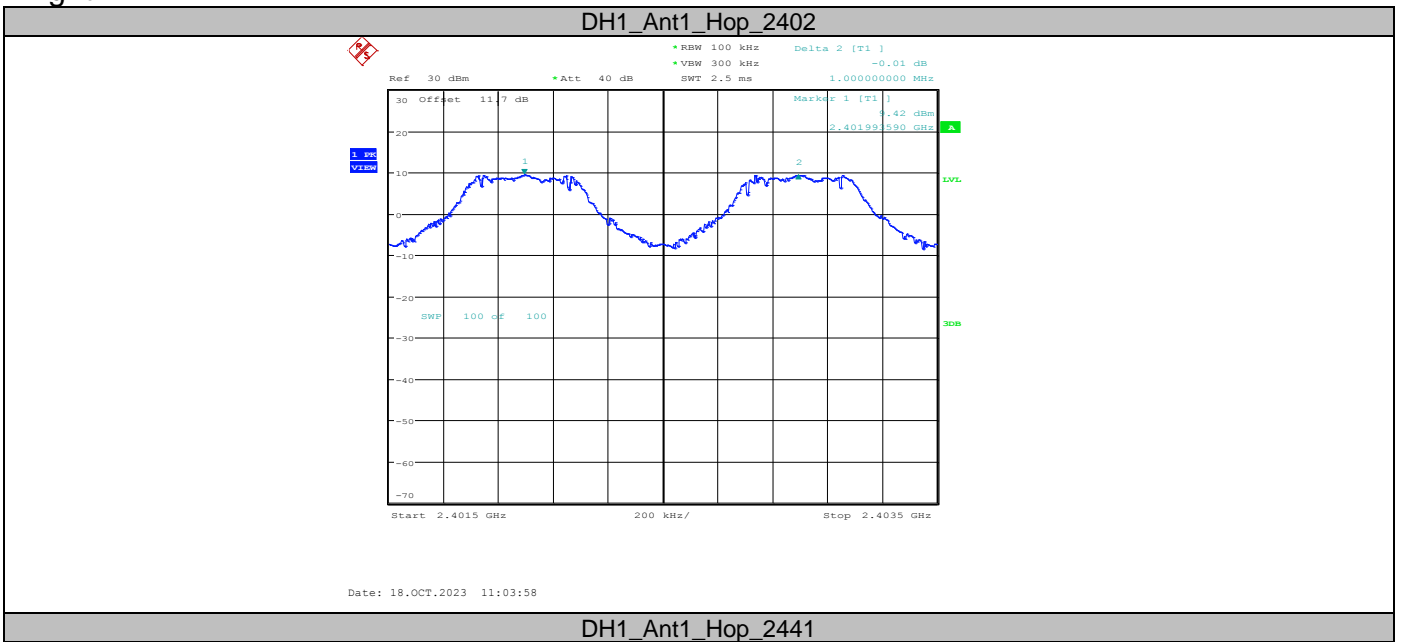


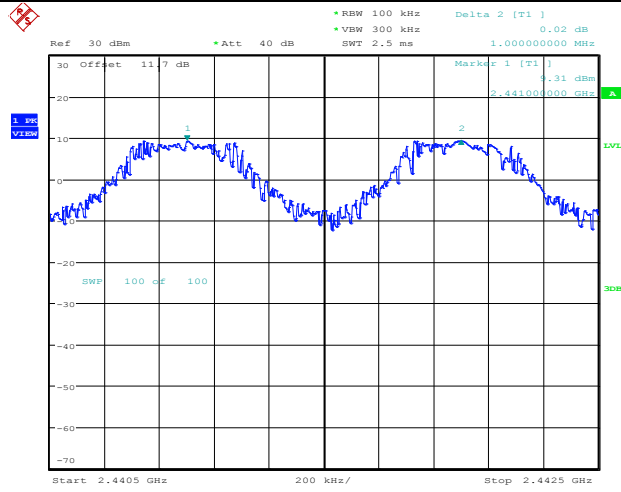
Date: 19.OCT.2023 09:08:39

3DH1_Ant1_Hop_2480



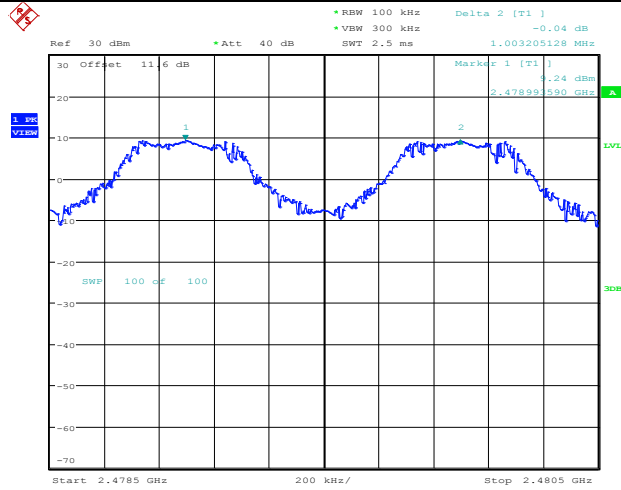
Right:





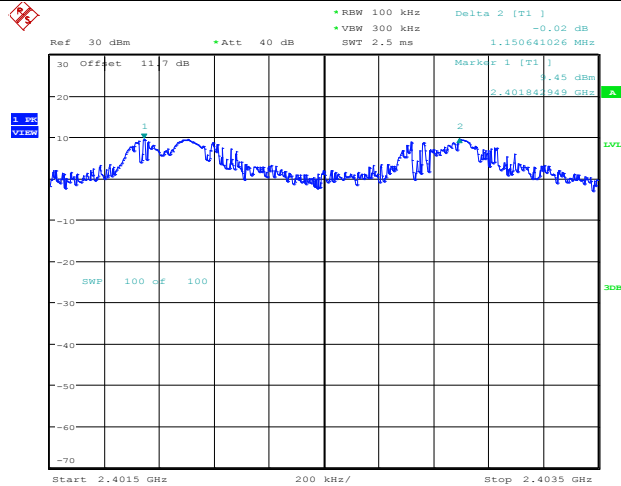
Date: 18.OCT.2023 11:05:22

DH1_Ant1_Hop_2480



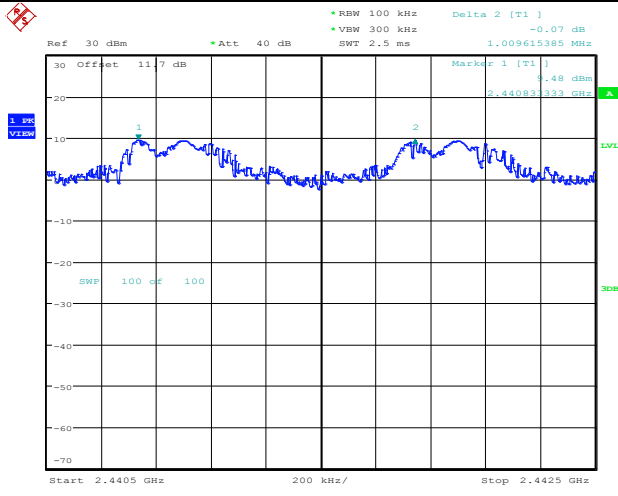
Date: 18.OCT.2023 11:16:03

3DH1_Ant1_Hop_2402



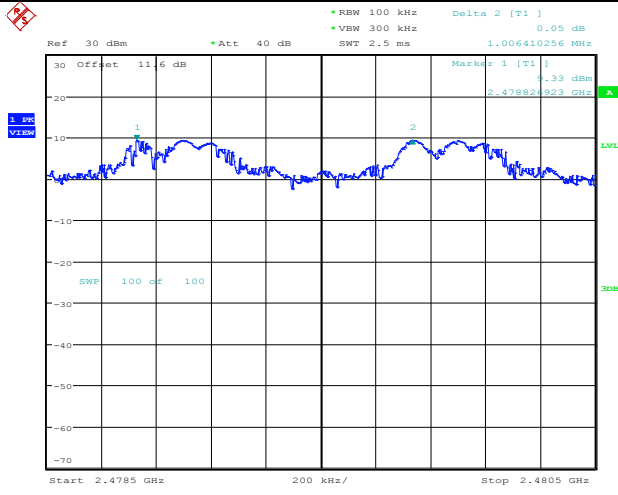
Date: 18.OCT.2023 11:37:22

3DH1_Ant1_Hop_2441



Date: 18.OCT.2023 11:40:08

3DH1_Ant1_Hop_2480



Date: 18.OCT.2023 11:45:17

9. NUMBER OF HOPPING CHANNEL

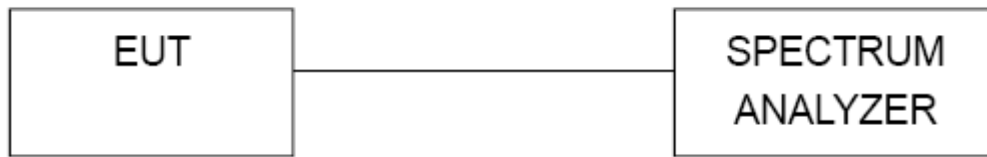
9.1.Limits of Number of Hopping Channel

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

Left:

Table 16 Hopping Channel Number Test Data

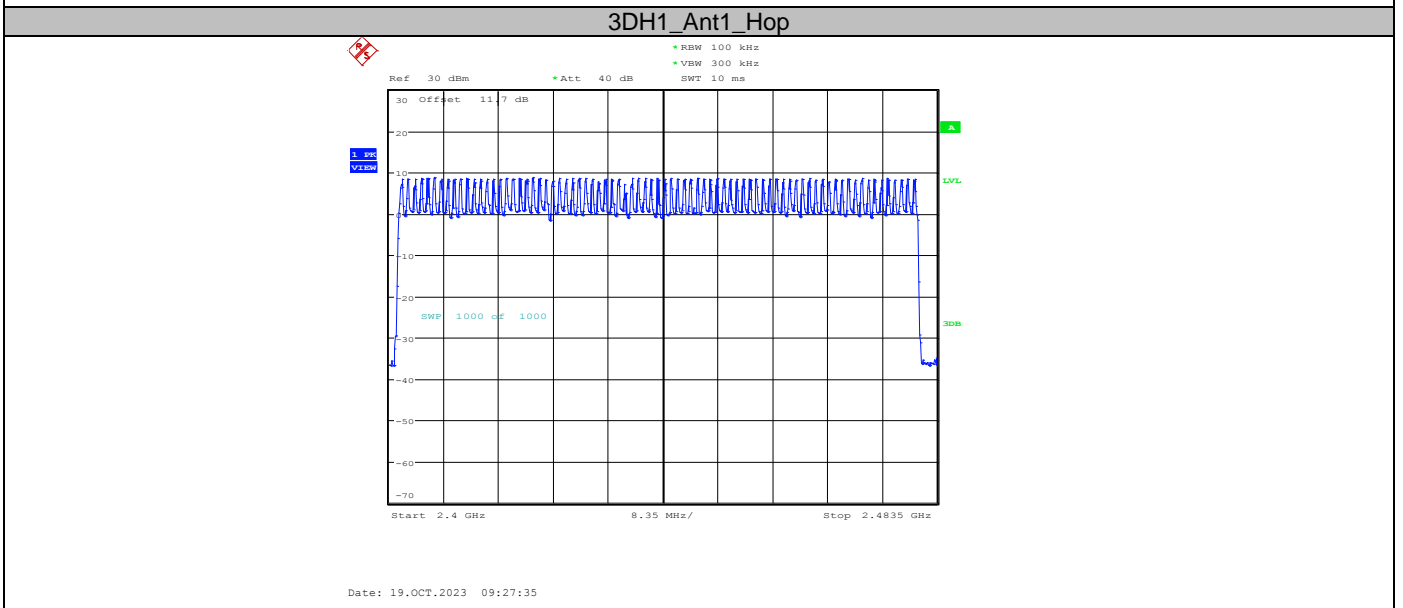
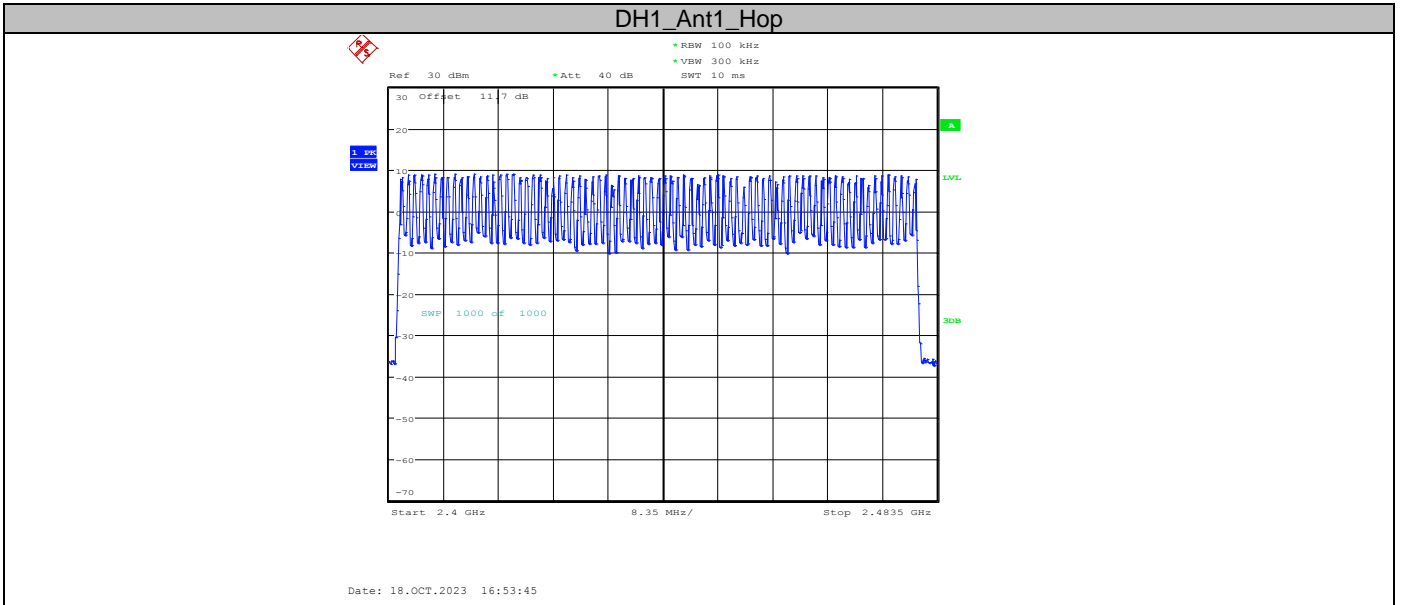
TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	Hop	79	≥15	PASS
3DH1	Ant1	Hop	79	≥15	PASS

Right:

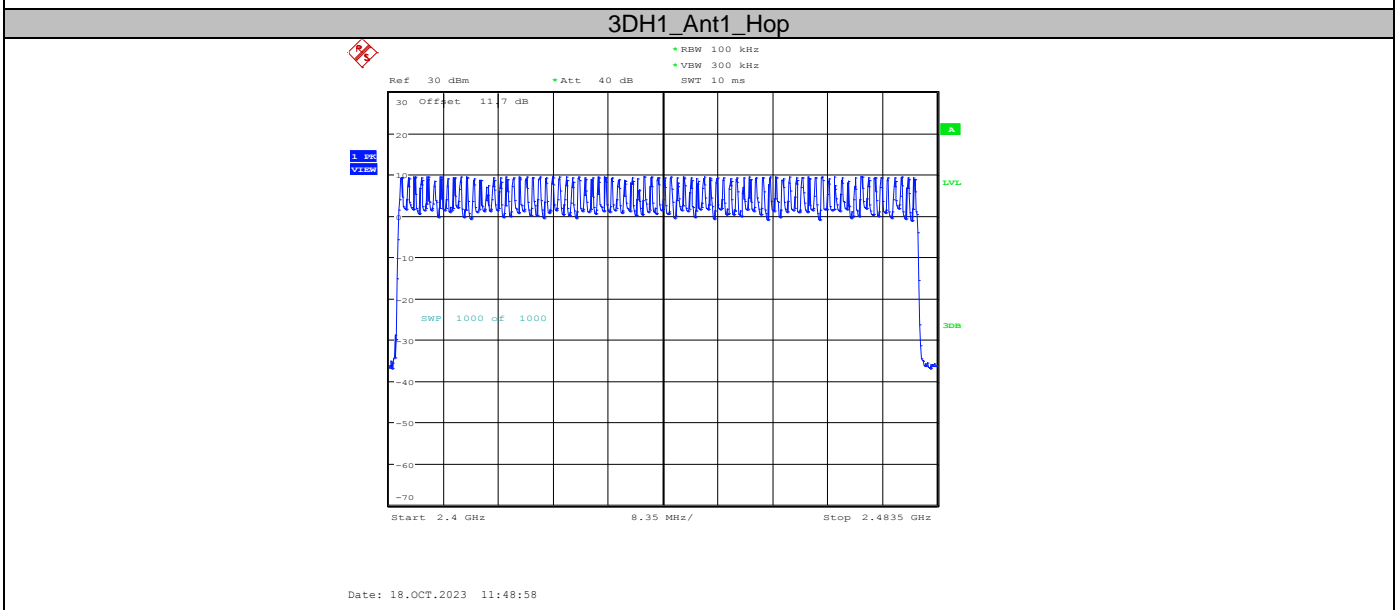
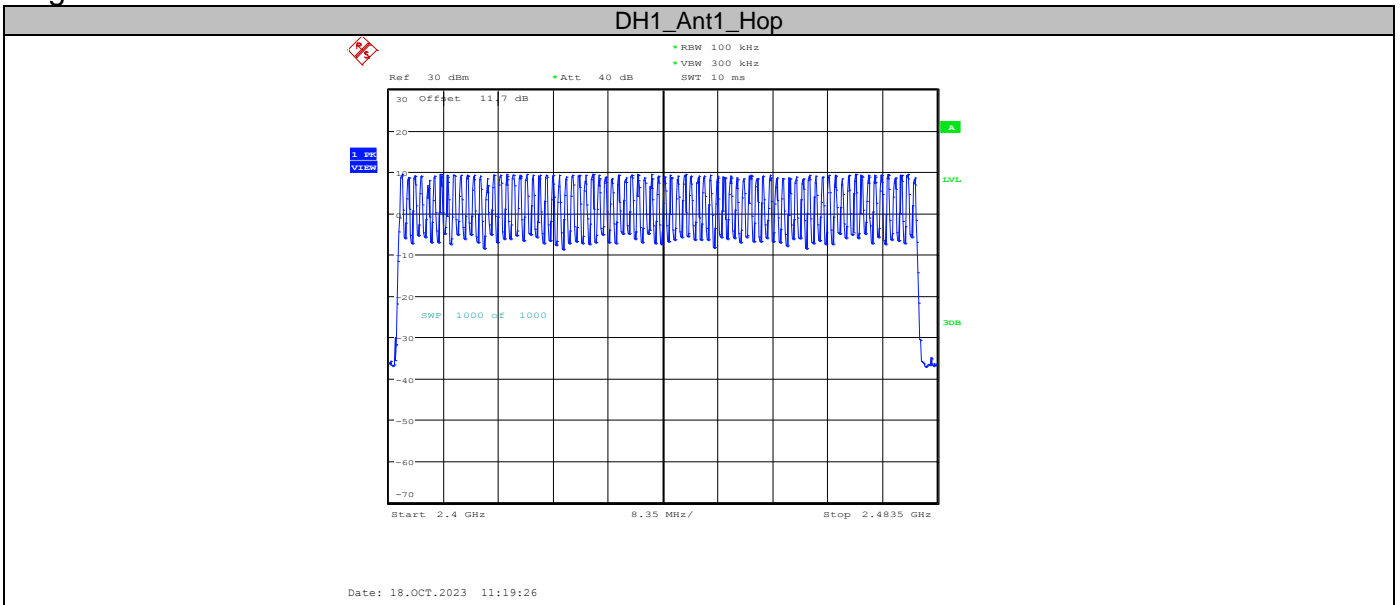
Table 17 Hopping Channel Number Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	Hop	79	≥15	PASS
3DH1	Ant1	Hop	79	≥15	PASS

Left:



Right:



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

Left:

Table 18 Time of Occupancy

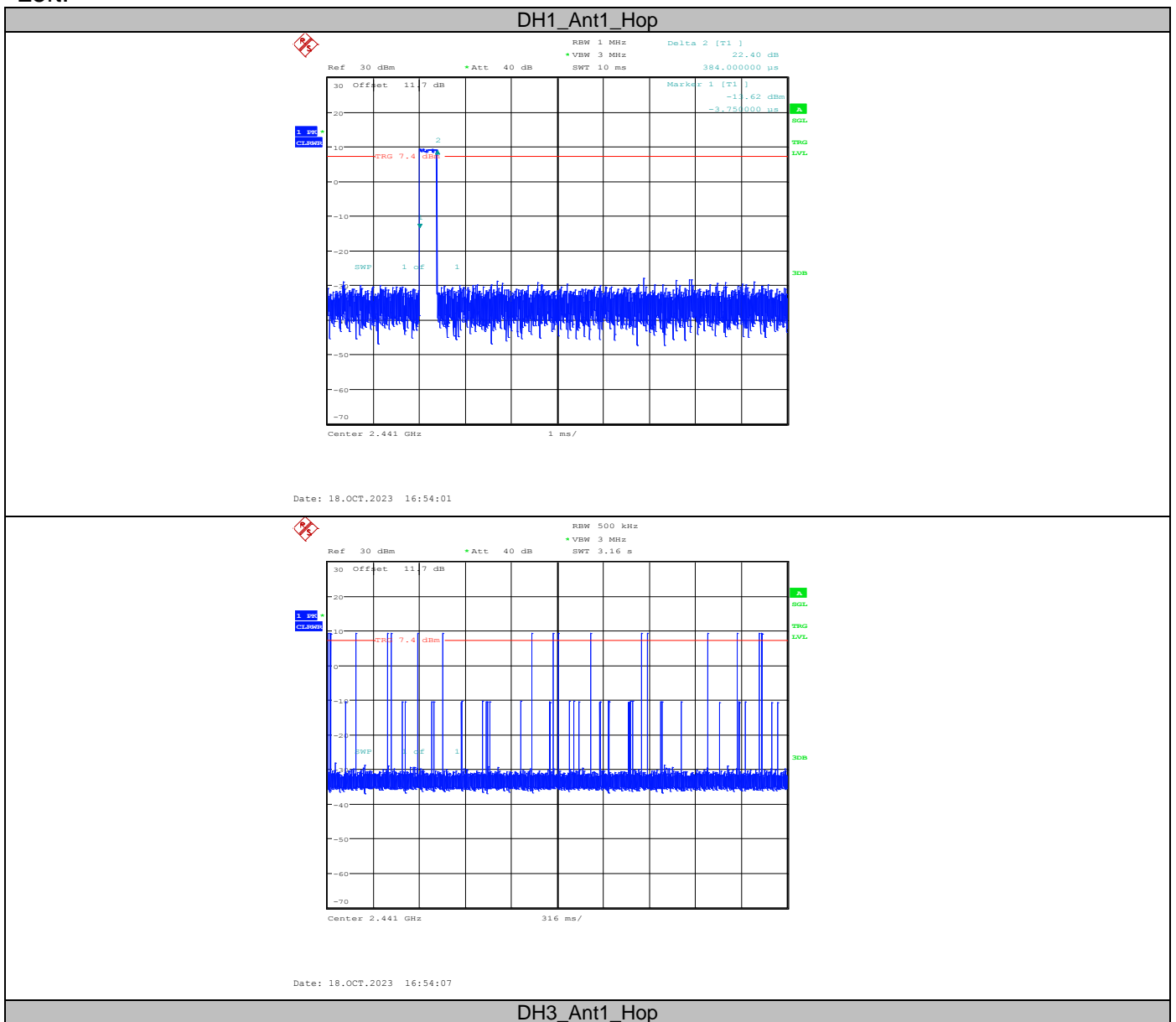
TestMode	Antenna	Channel	BurstWidth	TotalHops	Result	Limit	Verdict
DH1	Ant1	Hop	0.384	170	0.065	≤0.4	PASS
DH3	Ant1	Hop	1.639	150	0.246	≤0.4	PASS
DH5	Ant1	Hop	2.888	100	0.289	≤0.4	PASS
3DH1	Ant1	Hop	0.393	180	0.071	≤0.4	PASS
3DH3	Ant1	Hop	1.644	70	0.115	≤0.4	PASS
3DH5	Ant1	Hop	2.894	120	0.347	≤0.4	PASS

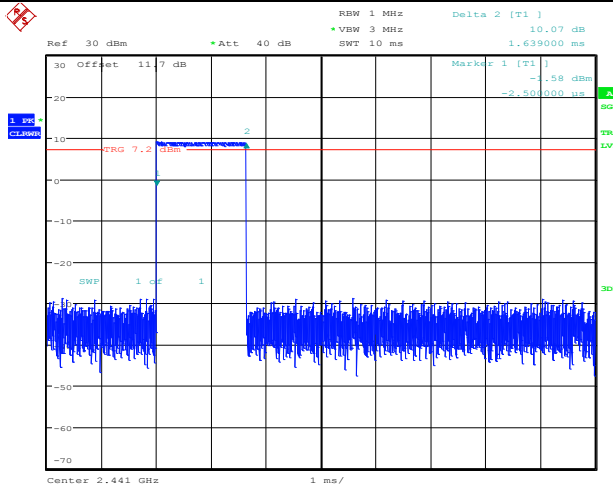
Right:

Table 19 Time of Occupancy

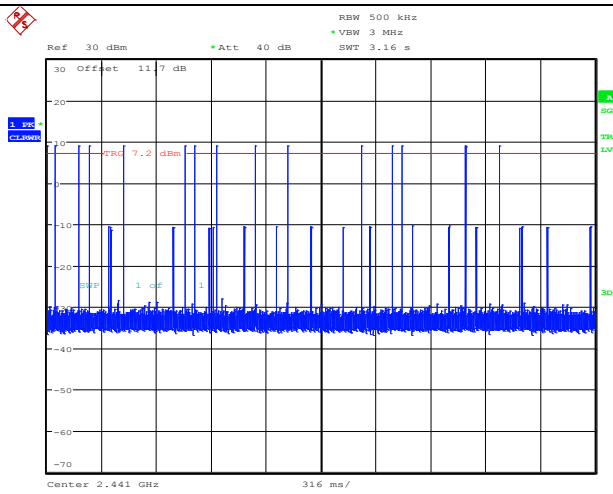
TestMode	Antenna	Channel	BurstWidth	TotalHops	Result	Limit	Verdict
DH1	Ant1	Hop	0.383	180	0.069	≤0.4	PASS
DH3	Ant1	Hop	1.640	90	0.148	≤0.4	PASS
DH5	Ant1	Hop	2.888	80	0.231	≤0.4	PASS
3DH1	Ant1	Hop	0.393	170	0.067	≤0.4	PASS
3DH3	Ant1	Hop	1.643	80	0.131	≤0.4	PASS
3DH5	Ant1	Hop	2.894	60	0.174	≤0.4	PASS

Left:



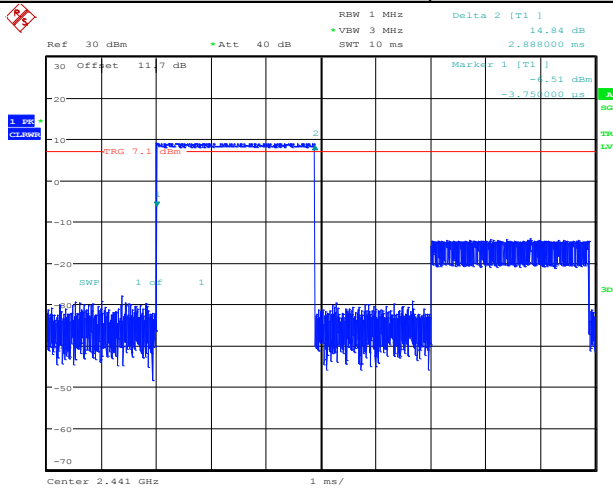


Date: 19.OCT.2023 09:43:44

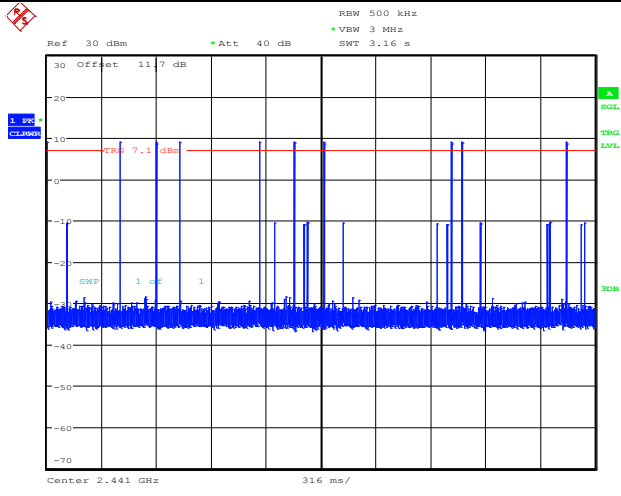


Date: 19.OCT.2023 09:43:50

DH5_Ant1_Hop

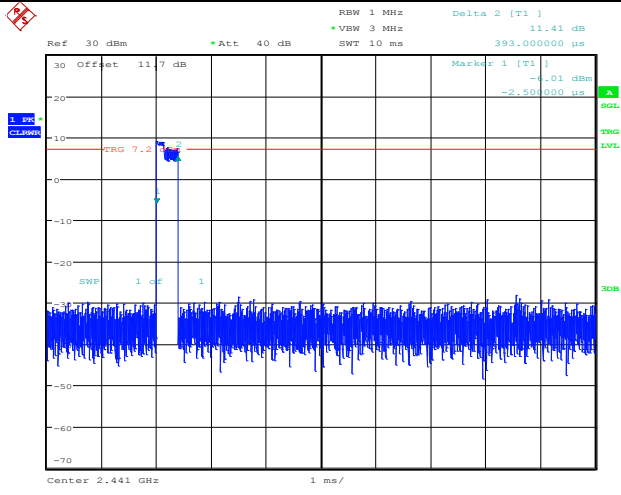


Date: 19.OCT.2023 09:57:41

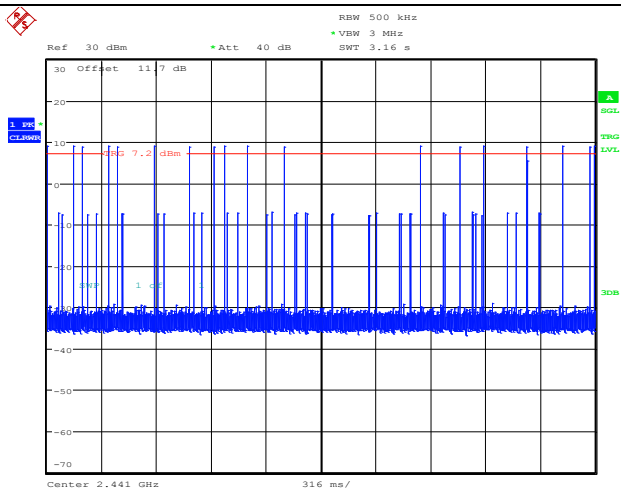


Date: 19.OCT.2023 09:57:47

2DH1_Ant1_Hop

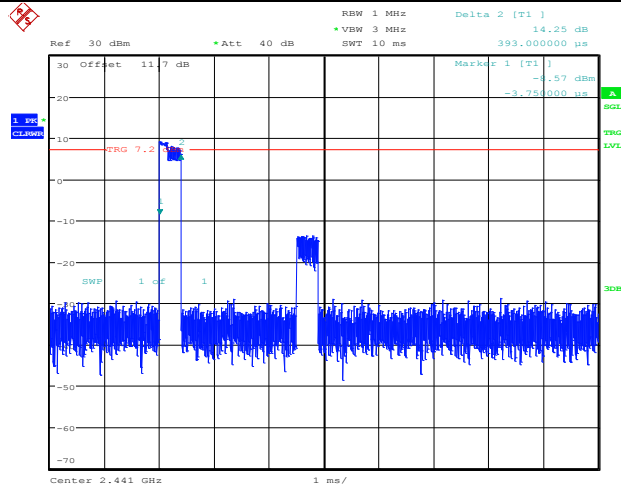


Date: 19.OCT.2023 10:51:38

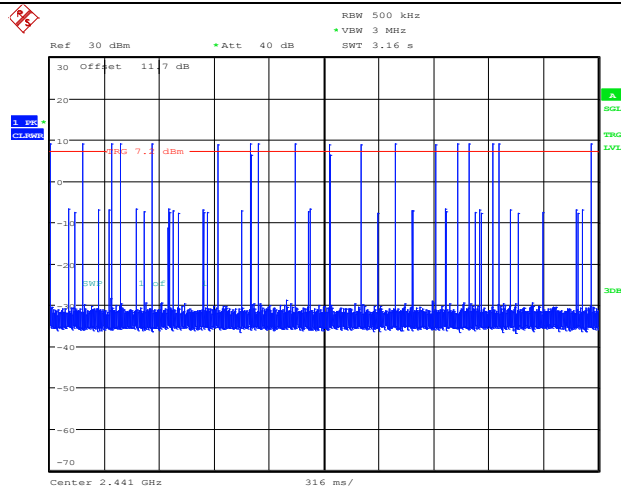


Date: 19.OCT.2023 10:51:44

3DH1_Ant1_Hop

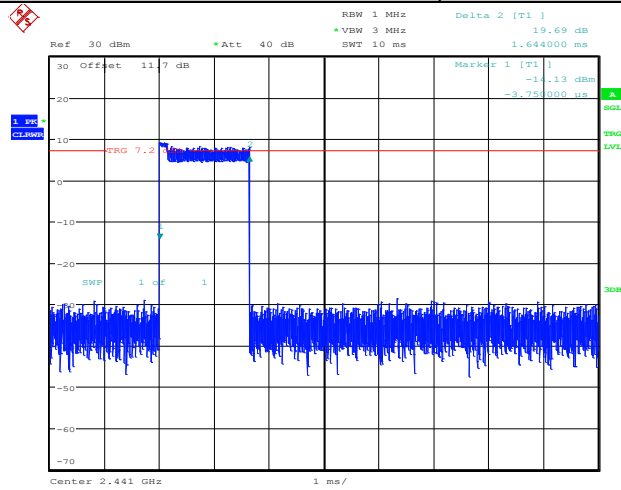


Date: 19.OCT.2023 09:39:33

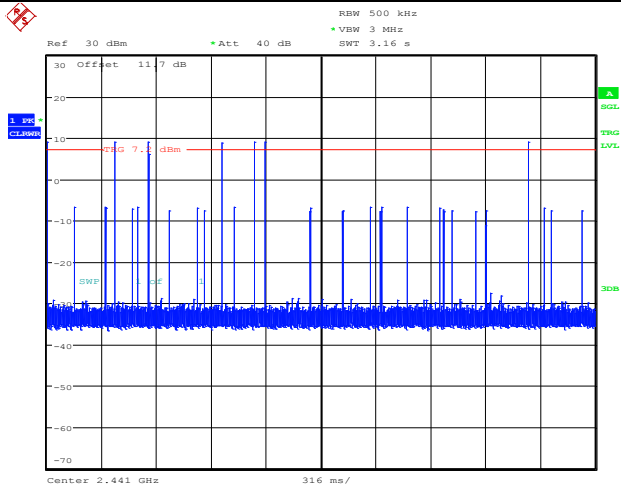


Date: 19.OCT.2023 09:39:39

3DH3_Ant1_Hop

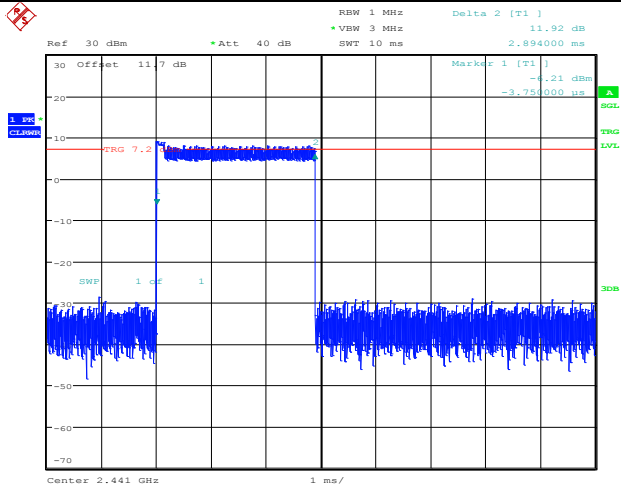


Date: 19.OCT.2023 09:46:51

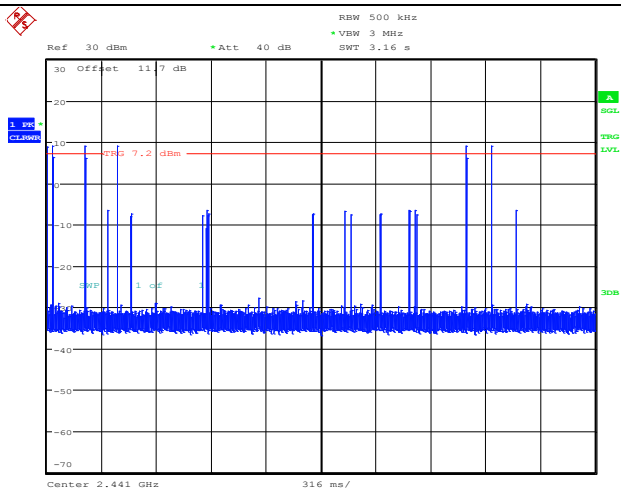


Date: 19.OCT.2023 09:46:57

3DH5_Ant1_Hop

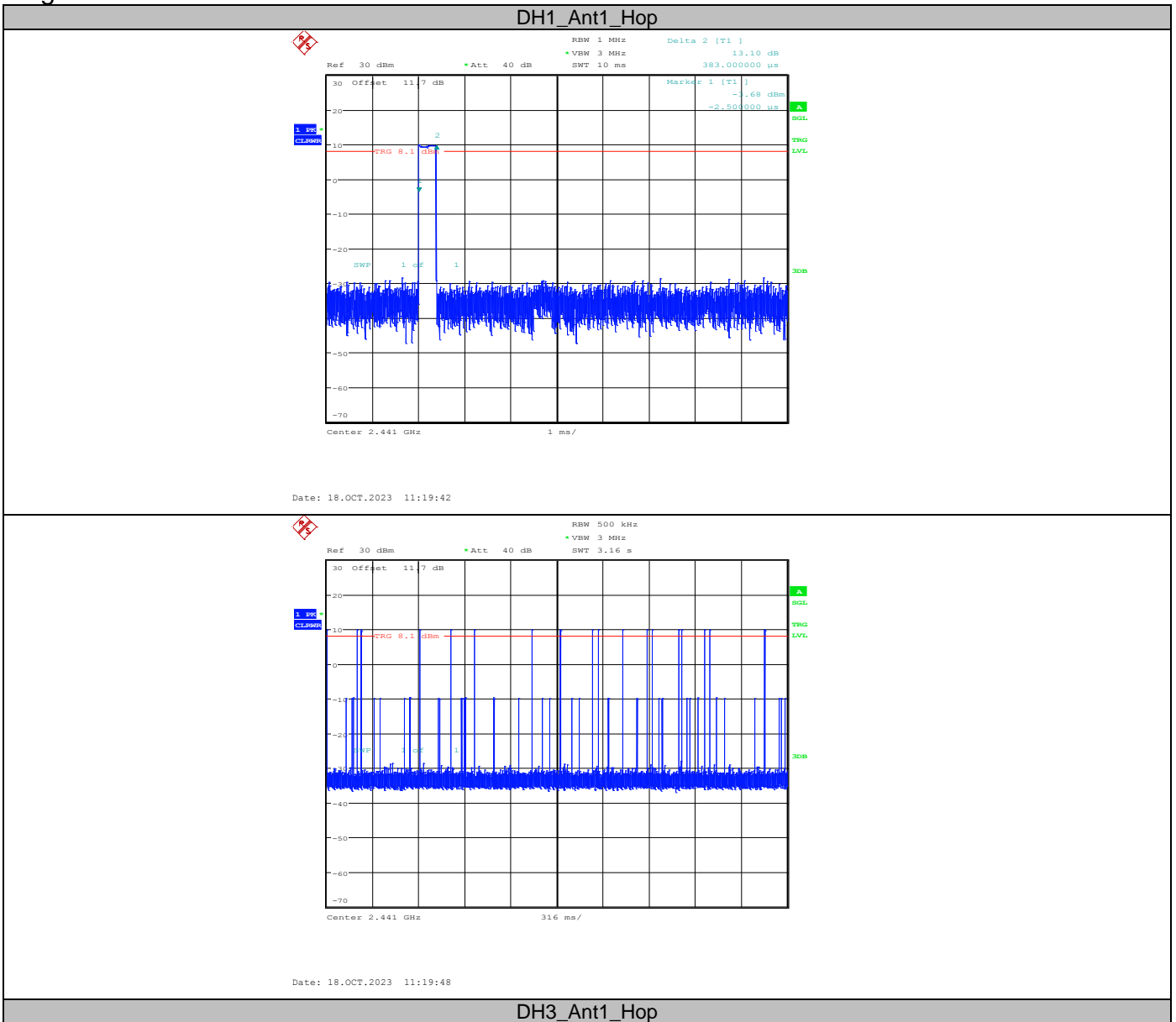


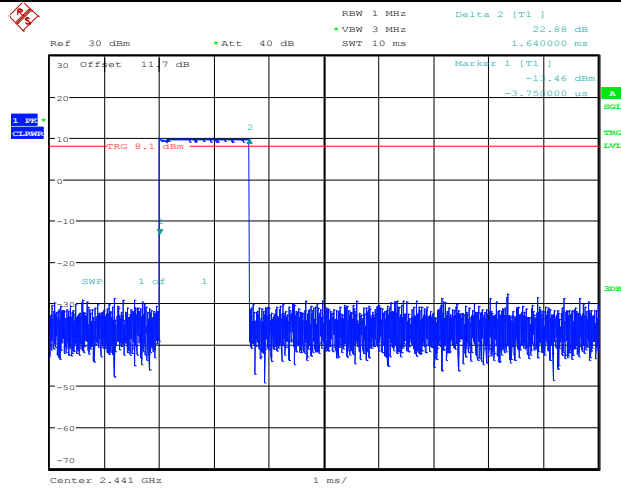
Date: 19.OCT.2023 10:00:01



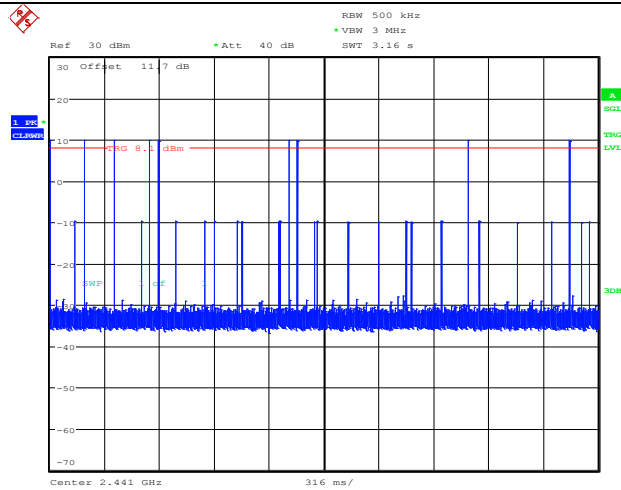
Date: 19.OCT.2023 10:00:07

Right:



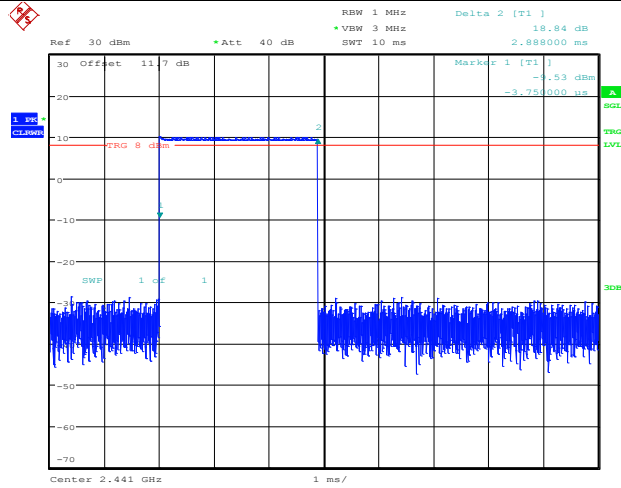


Date: 18.OCT.2023 11:50:03

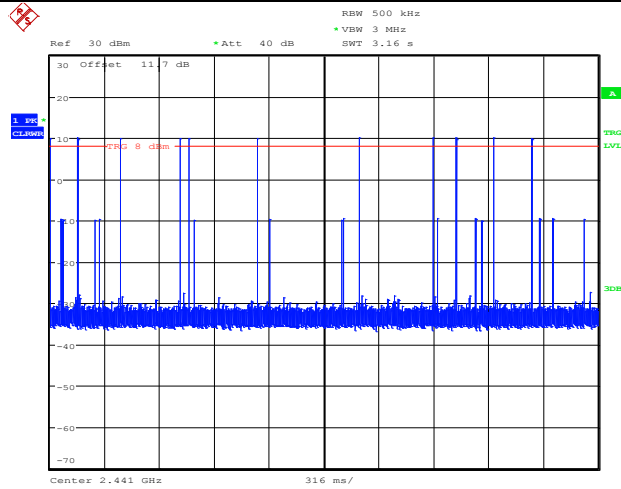


Date: 18.OCT.2023 11:50:09

DH5_Ant1_Hop

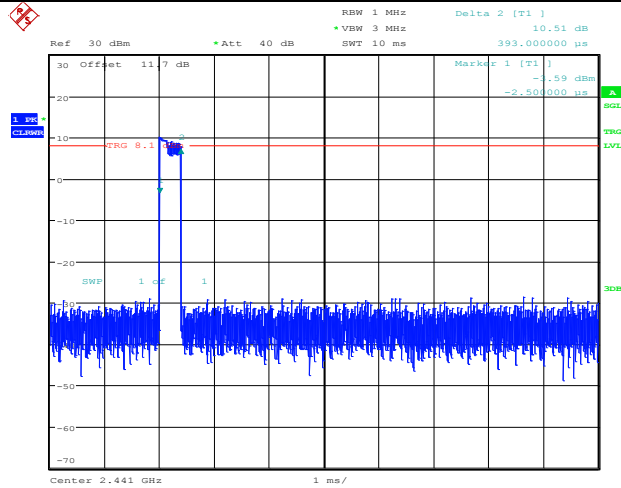


Date: 18.OCT.2023 14:07:14

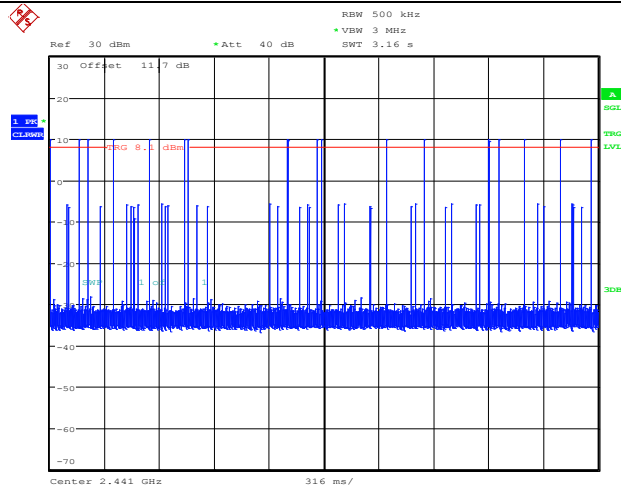


Date: 18.OCT.2023 14:07:45

3DH1_Ant1_Hop

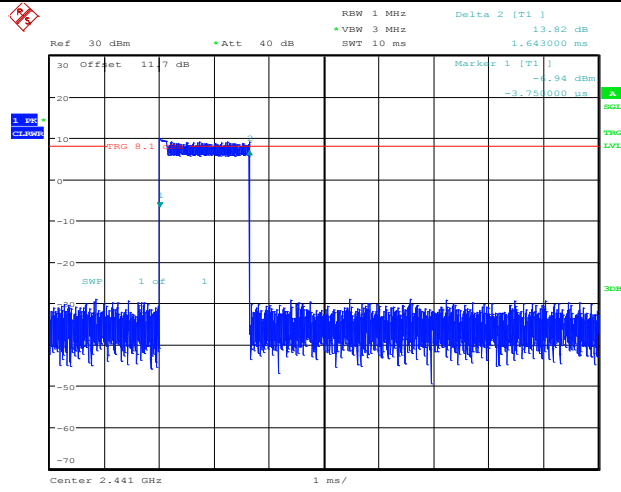


Date: 18.OCT.2023 11:49:14

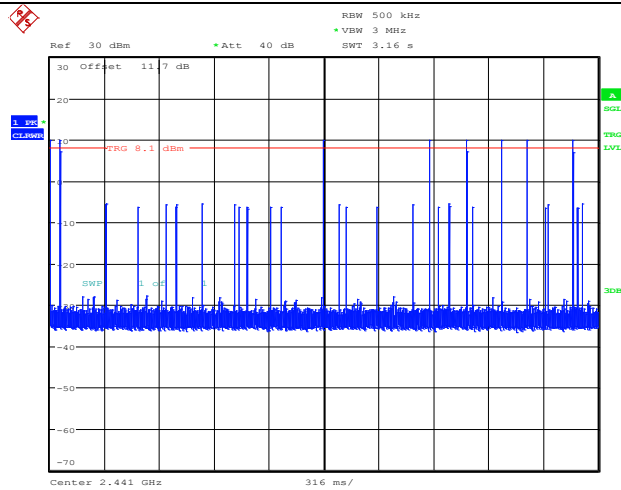


Date: 18.OCT.2023 11:49:20

3DH3_Ant1_Hop

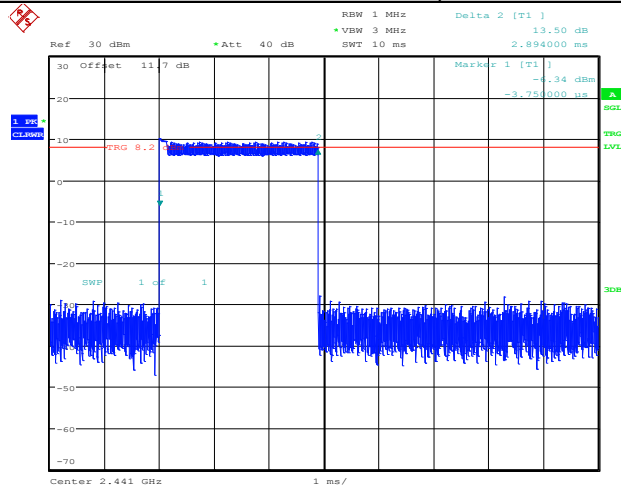


Date: 18.OCT.2023 11:50:55

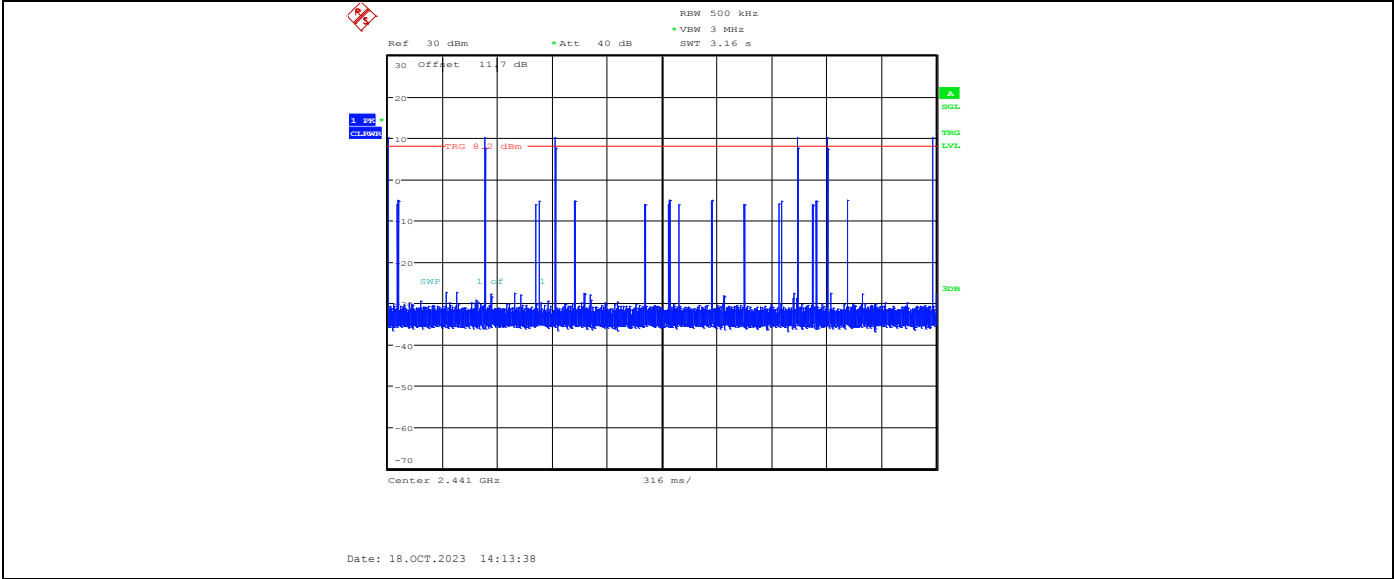


Date: 18.OCT.2023 11:51:01

3DH5_Ant1_Hop



Date: 18.OCT.2023 14:13:32



Date: 18.OCT.2023 14:13:38

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(b), 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.
The e.i.r.p. shall not exceed 4 W

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

Left:

Table 20 Maximum Conducted Output Power Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	2402	9.64	≤20.97	PASS
		2441	9.46	≤20.97	PASS
		2480	9.4	≤20.97	PASS
2DH1	Ant1	2402	9.37	≤20.97	PASS
		2441	9.23	≤20.97	PASS
		2480	9.12	≤20.97	PASS
3DH1	Ant1	2402	9.71	≤20.97	PASS
		2441	9.55	≤20.97	PASS
		2480	9.39	≤20.97	PASS

Table 21 E.I.R.P Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	2402	10.84	≤36.02	PASS
		2441	10.66	≤36.02	PASS
		2480	10.6	≤36.02	PASS
2DH1	Ant1	2402	10.57	≤36.02	PASS
		2441	10.43	≤36.02	PASS
		2480	10.32	≤36.02	PASS
3DH1	Ant1	2402	10.91	≤36.02	PASS
		2441	10.75	≤36.02	PASS
		2480	10.59	≤36.02	PASS

Right:

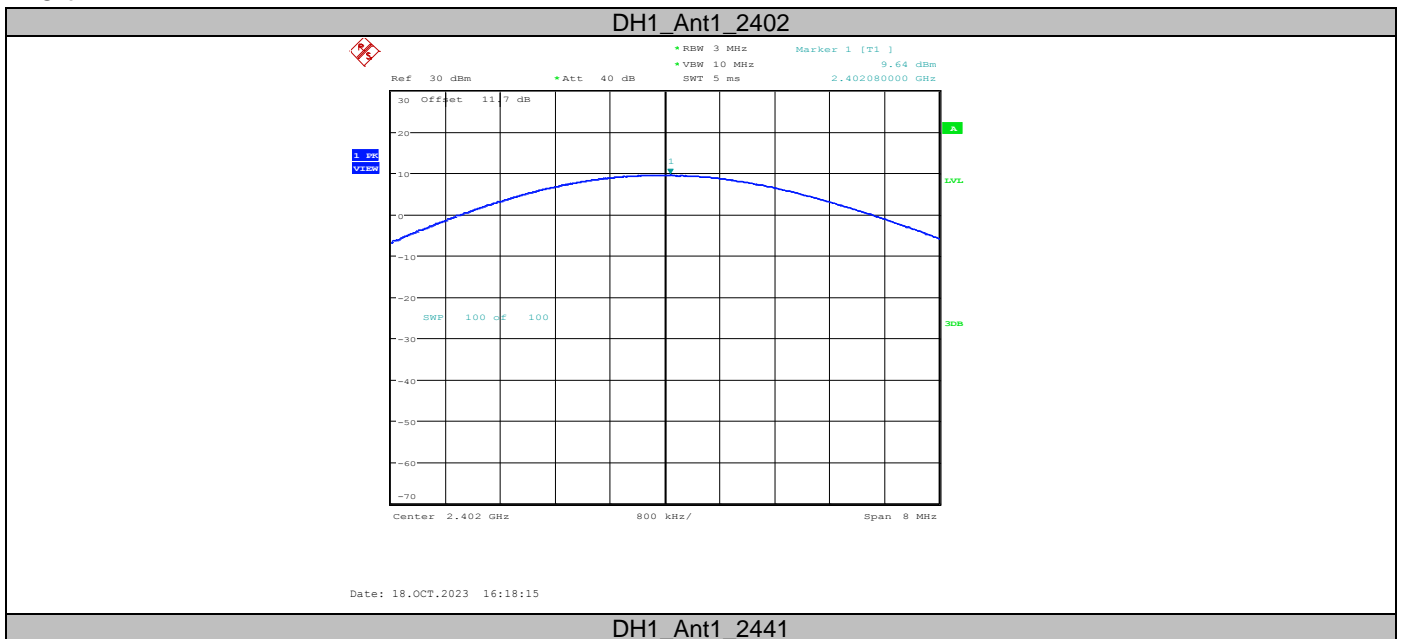
Table 22 Maximum Conducted Output Power Test Data

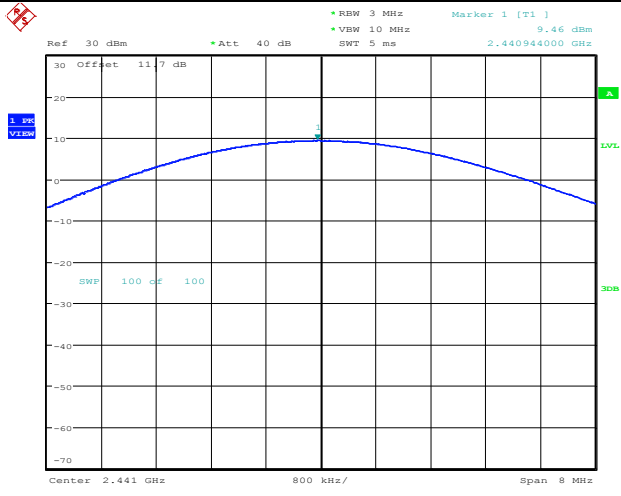
TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	2402	10.26	≤20.97	PASS
		2441	10.15	≤20.97	PASS
		2480	10.09	≤20.97	PASS
2DH1	Ant1	2402	10.54	≤20.97	PASS
		2441	10.41	≤20.97	PASS
		2480	10.3	≤20.97	PASS
3DH1	Ant1	2402	10.22	≤20.97	PASS
		2441	10.16	≤20.97	PASS
		2480	10.07	≤20.97	PASS

Table 23 E.I.R.P Test Data

TestMode	Antenna	Channel	Result	Limit	Verdict
DH1	Ant1	2402	11.46	≤36.02	PASS
		2441	11.35	≤36.02	PASS
		2480	11.29	≤36.02	PASS
2DH1	Ant1	2402	11.74	≤36.02	PASS
		2441	11.61	≤36.02	PASS
		2480	11.5	≤36.02	PASS
3DH1	Ant1	2402	11.42	≤36.02	PASS
		2441	11.36	≤36.02	PASS
		2480	11.27	≤36.02	PASS

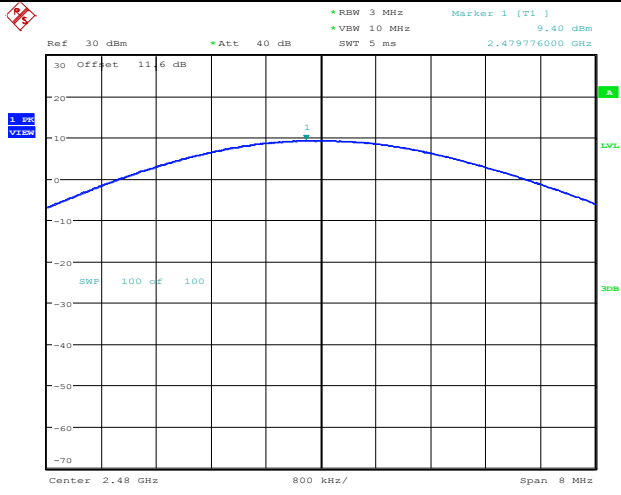
Left:





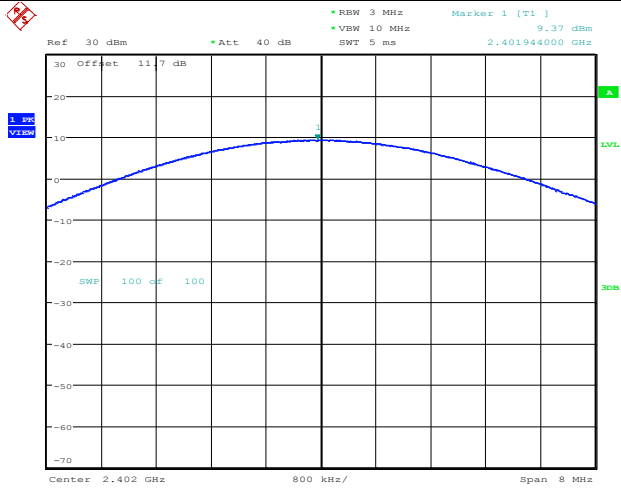
Date: 18.OCT.2023 16:23:06

DH1_Ant1_2480



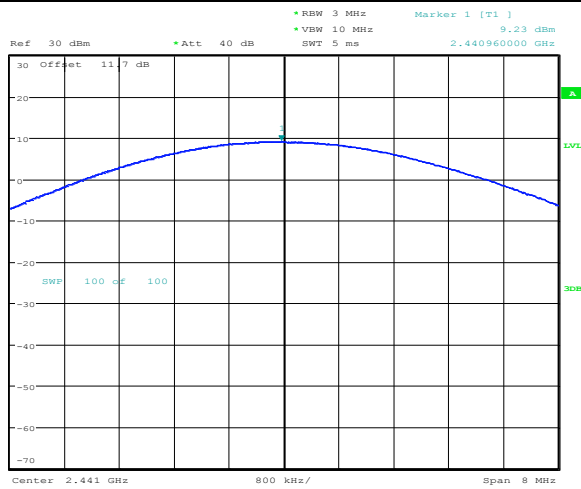
Date: 18.OCT.2023 16:27:54

2DH1_Ant1_2402



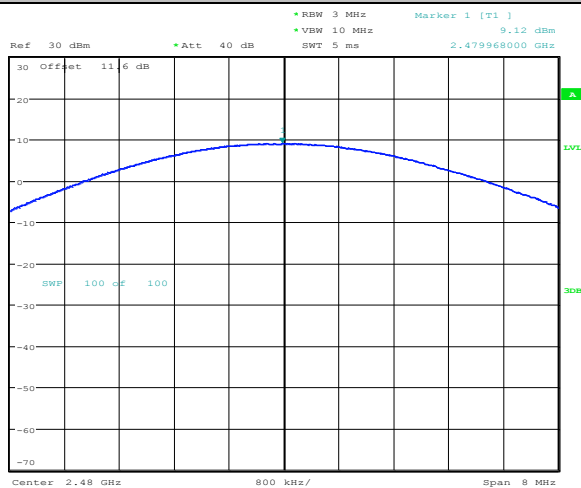
Date: 19.OCT.2023 10:02:39

2DH1_Ant1_2441



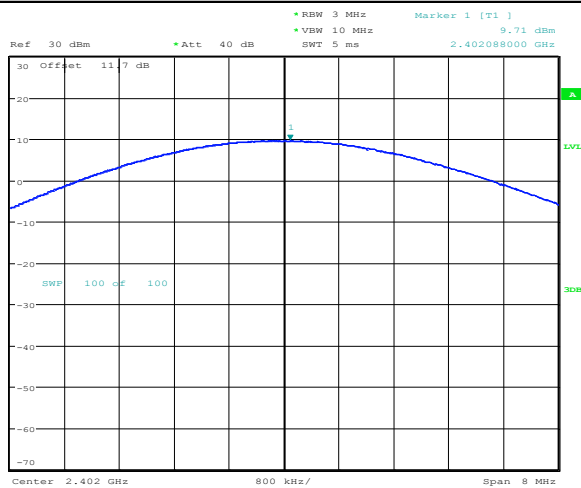
Date: 19.OCT.2023 10:08:10

2DH1_Ant1_2480



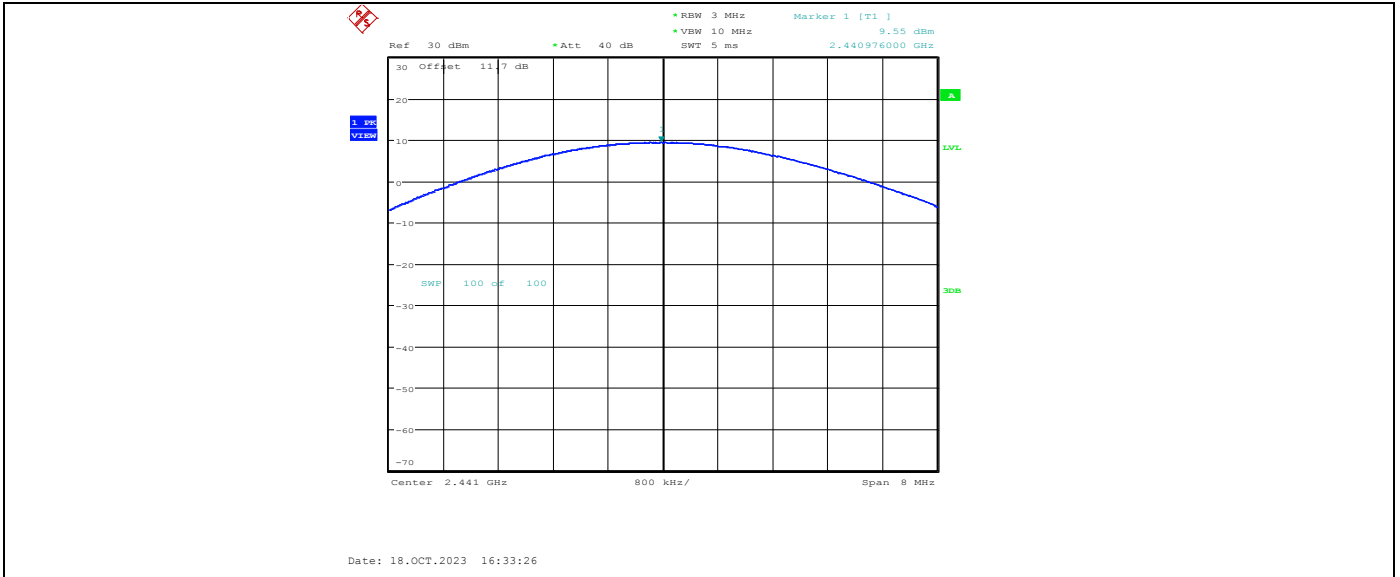
Date: 19.OCT.2023 10:11:01

3DH1_Ant1_2402

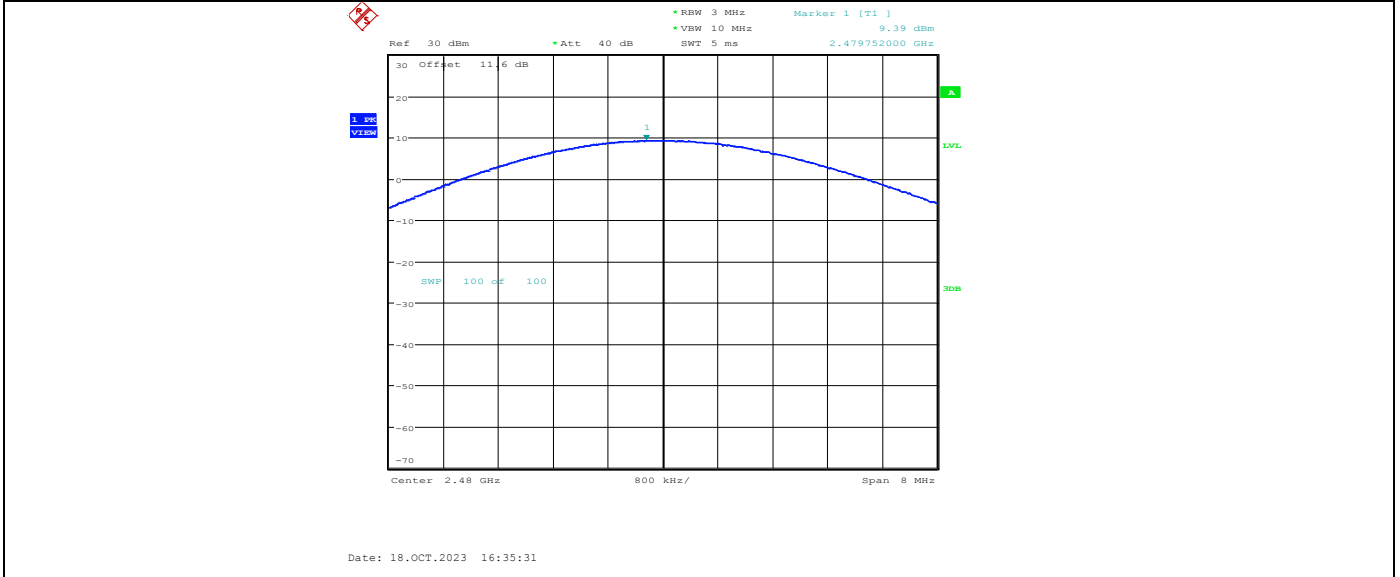


Date: 18.OCT.2023 16:31:49

3DH1_Ant1_2441

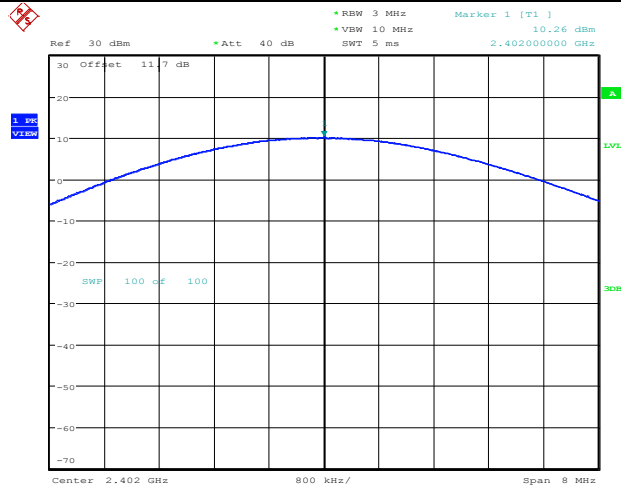


3DH1_Ant1_2480



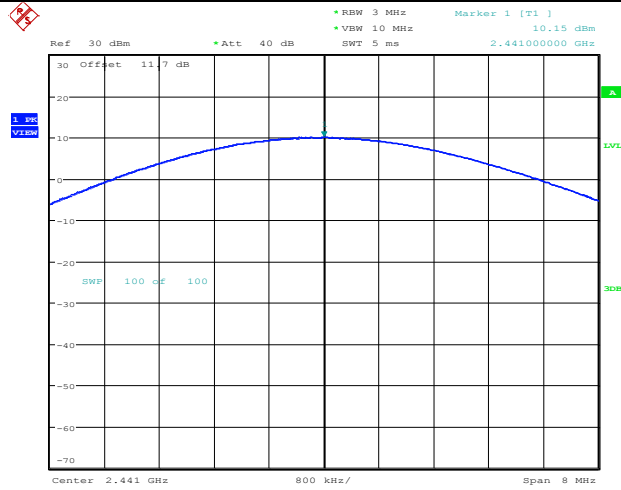
Right:

DH1_Ant1_2402



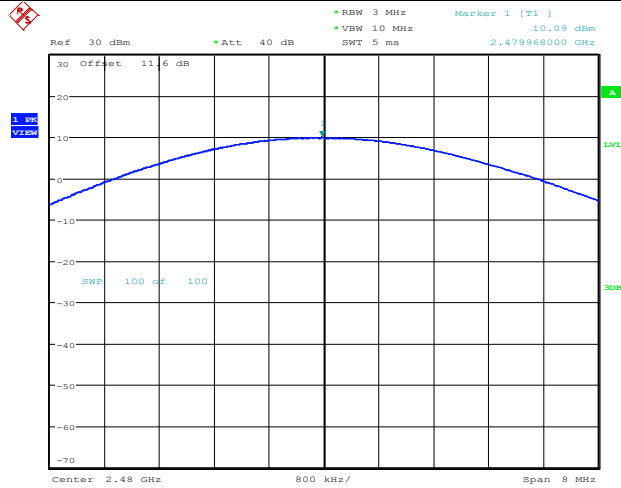
Date: 18.OCT.2023 10:20:15

DH1_Ant1_2441



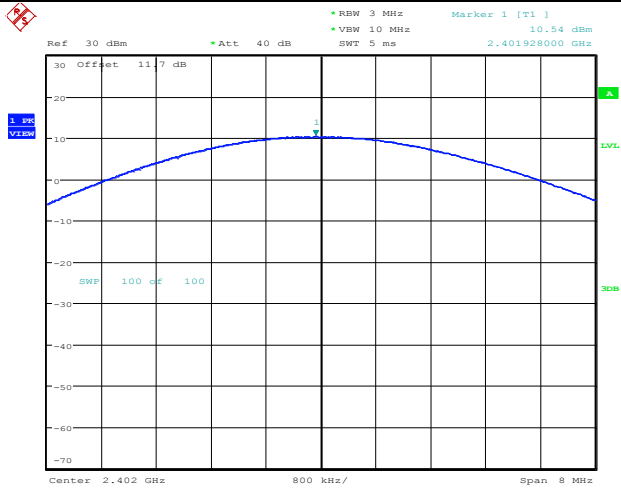
Date: 18.OCT.2023 10:24:57

DH1_Ant1_2480



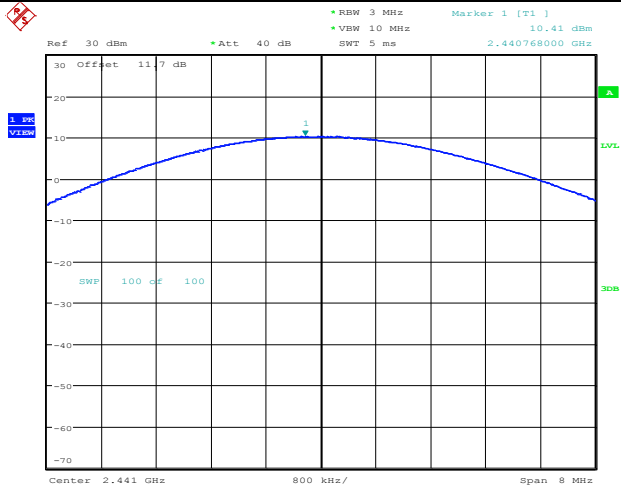
Date: 18.OCT.2023 10:28:46

2DH1_Ant1_2402



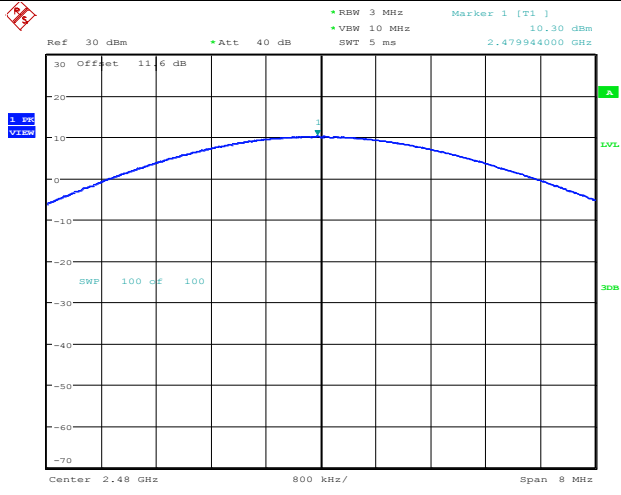
Date: 18.OCT.2023 15:09:10

2DH1_Ant1_2441



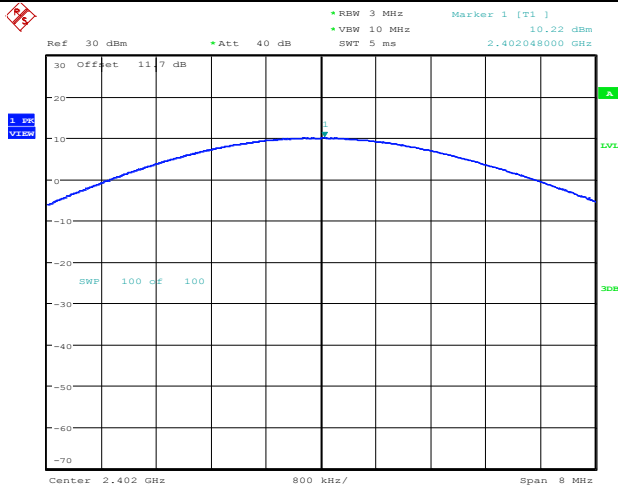
Date: 18.OCT.2023 15:11:21

2DH1_Ant1_2480



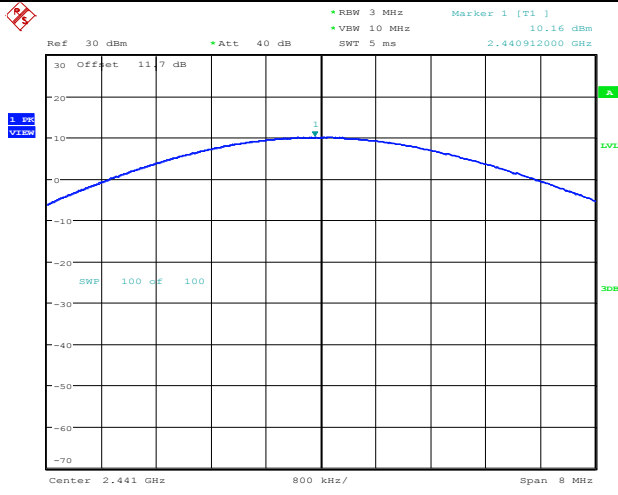
Date: 18.OCT.2023 15:13:57

3DH1_Ant1_2402



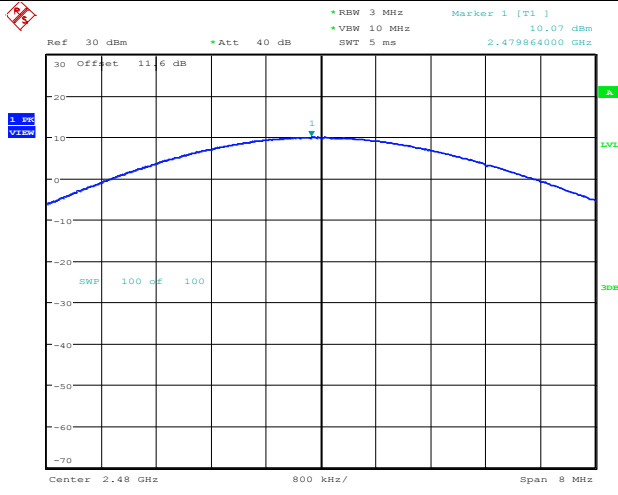
Date: 18.OCT.2023 10:33:11

3DH1_Ant1_2441



Date: 18.OCT.2023 10:45:00

3DH1_Ant1_2480



Date: 18.OCT.2023 10:47:53

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).

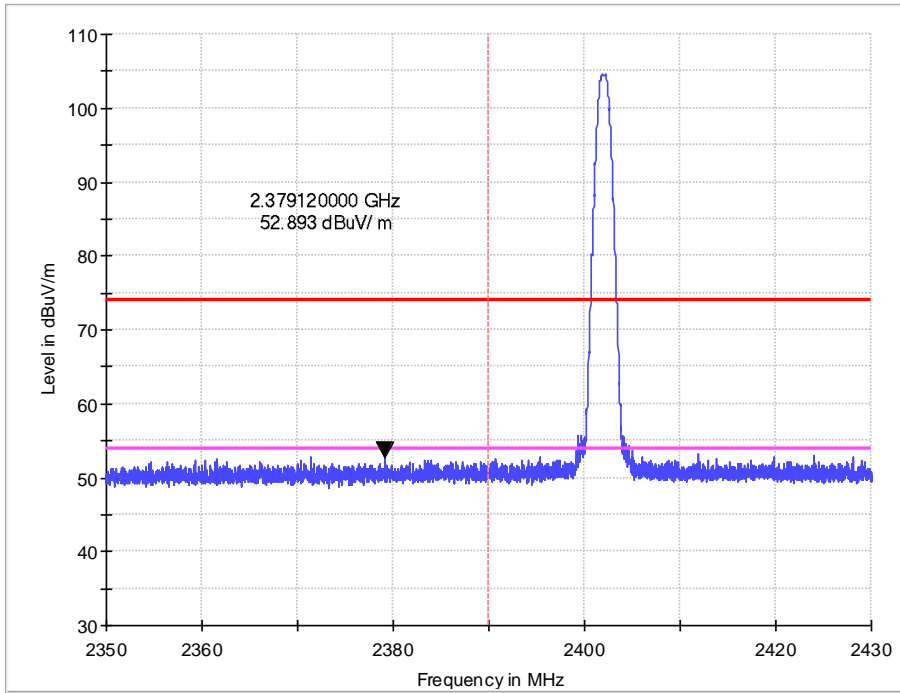
12.2.Test Procedure

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.

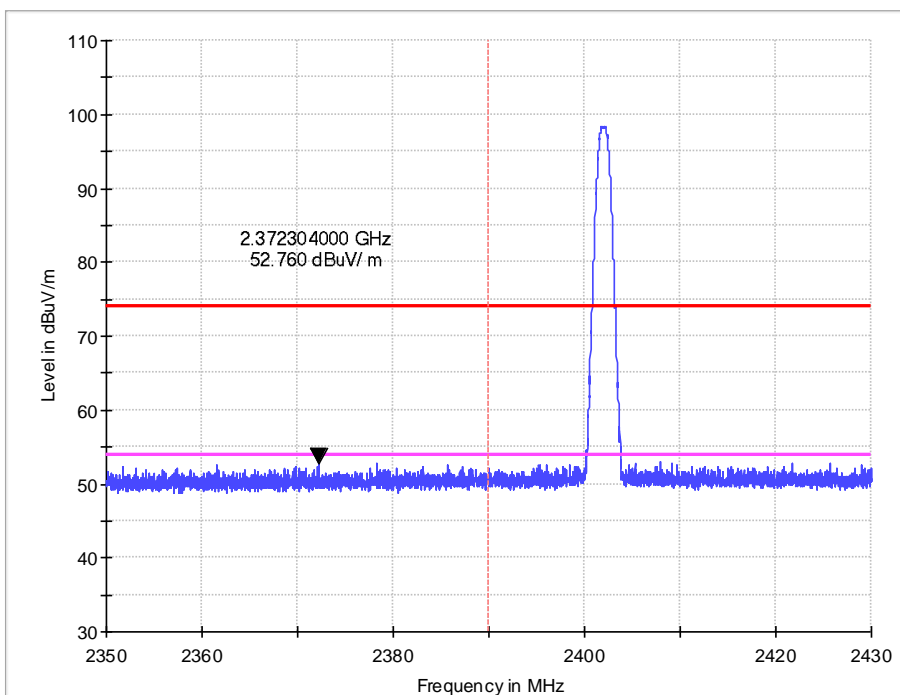
12.3.Test Data

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

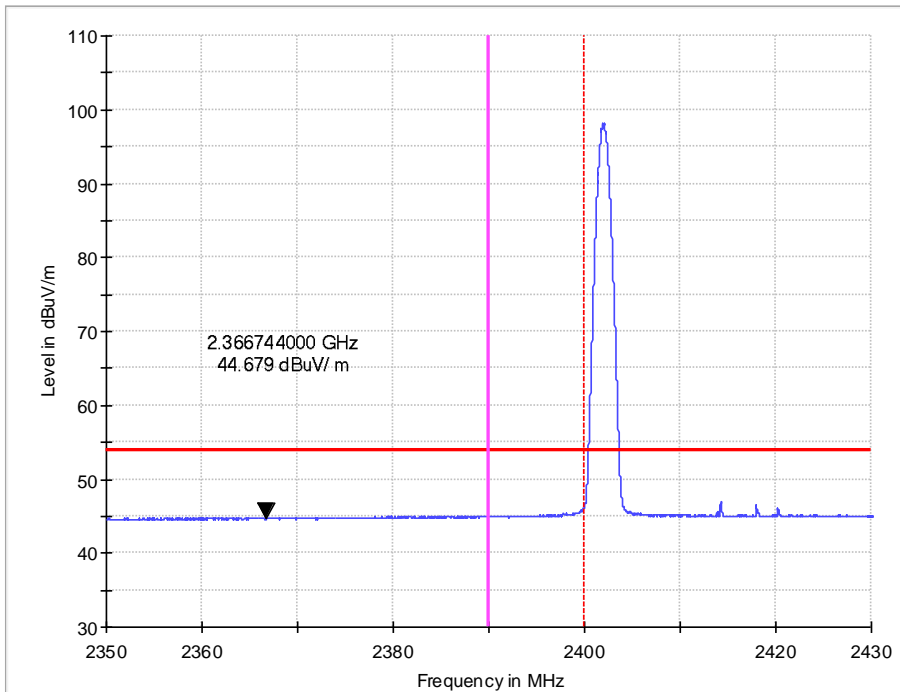
Left:
GFSK
Low edge
PK
Horizontal



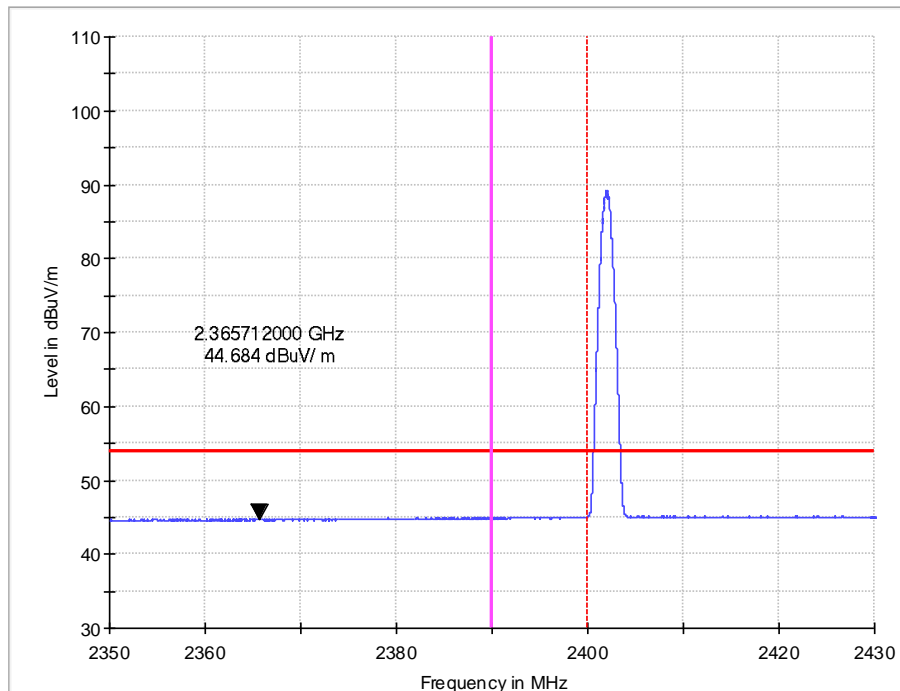
Vertical



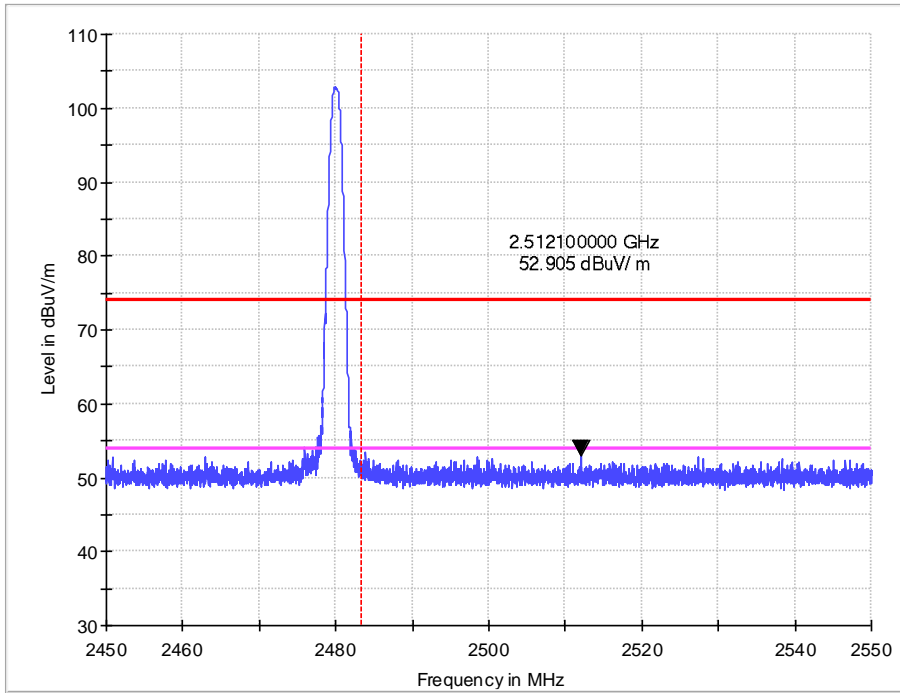
AV
Horizontal



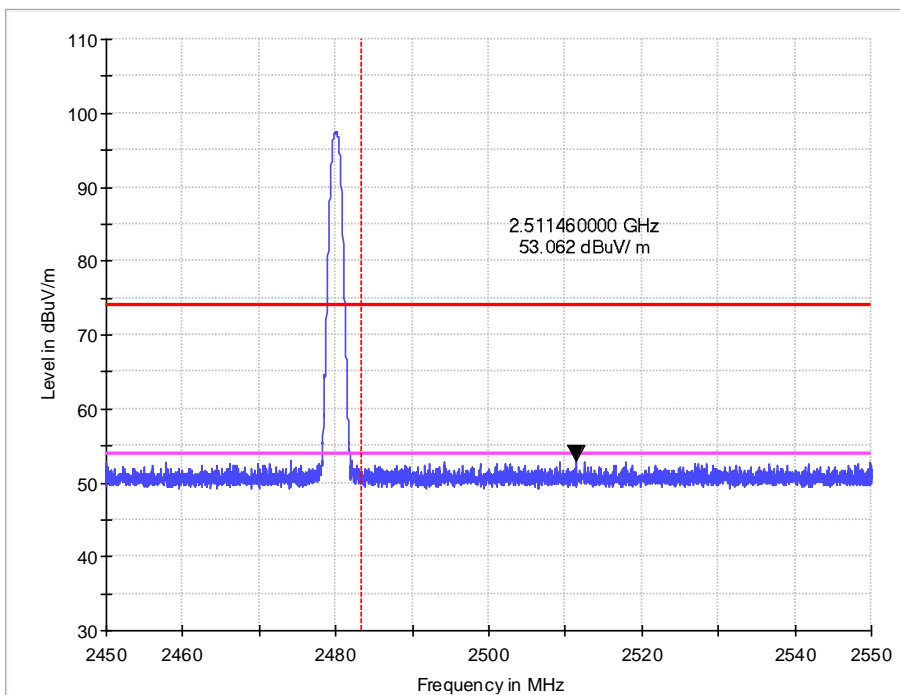
Vertical



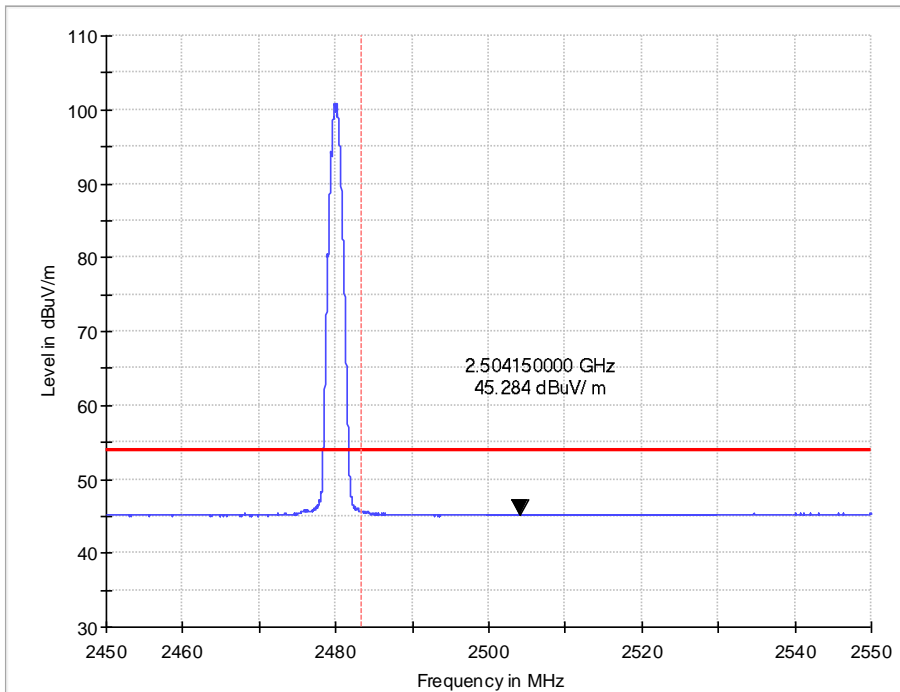
Left:
GFSK
Upper edge
PK
Horizontal



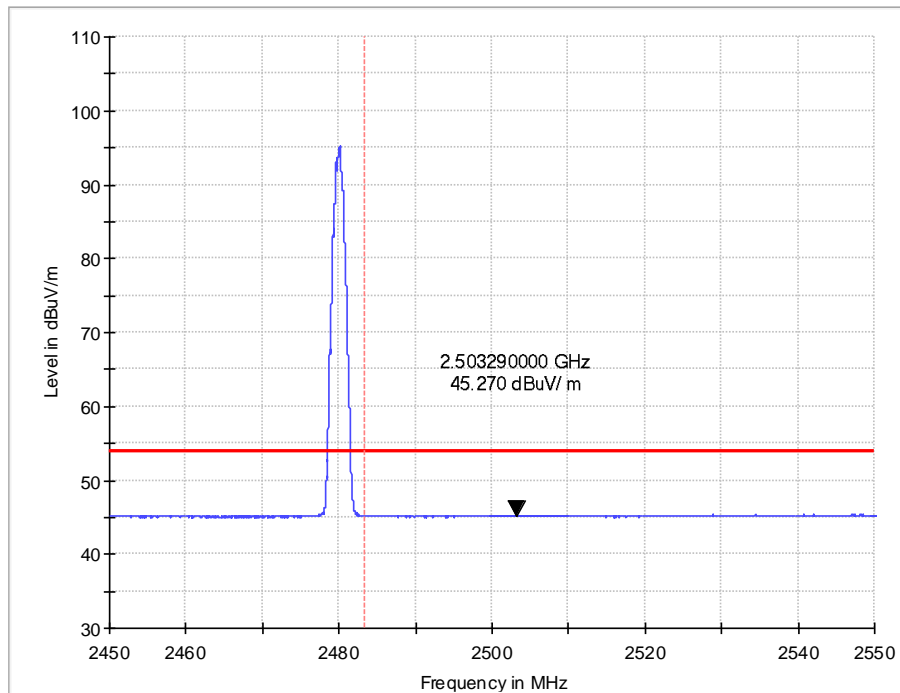
Vertical



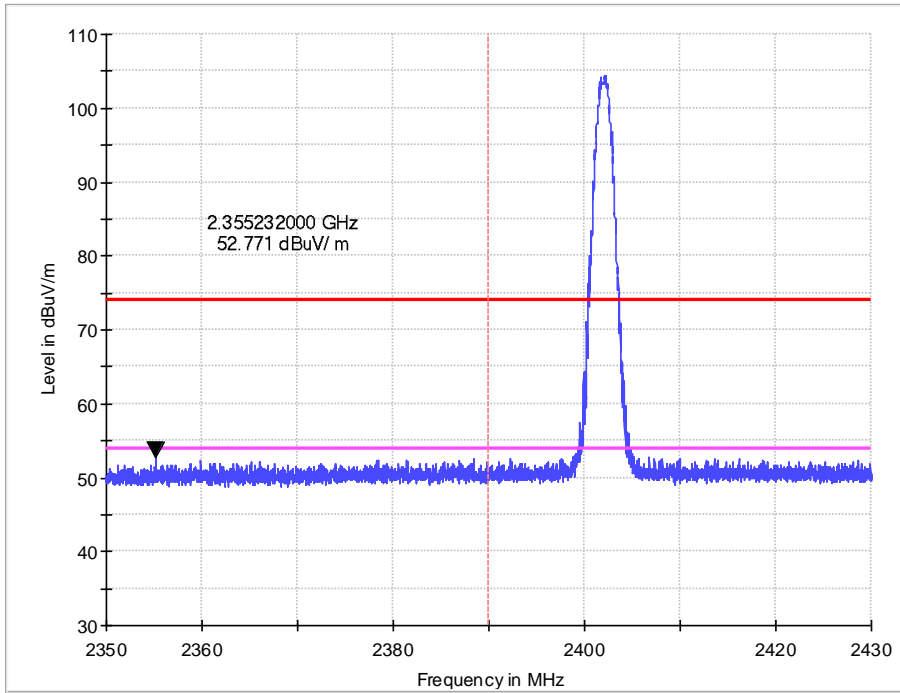
AV
Horizontal



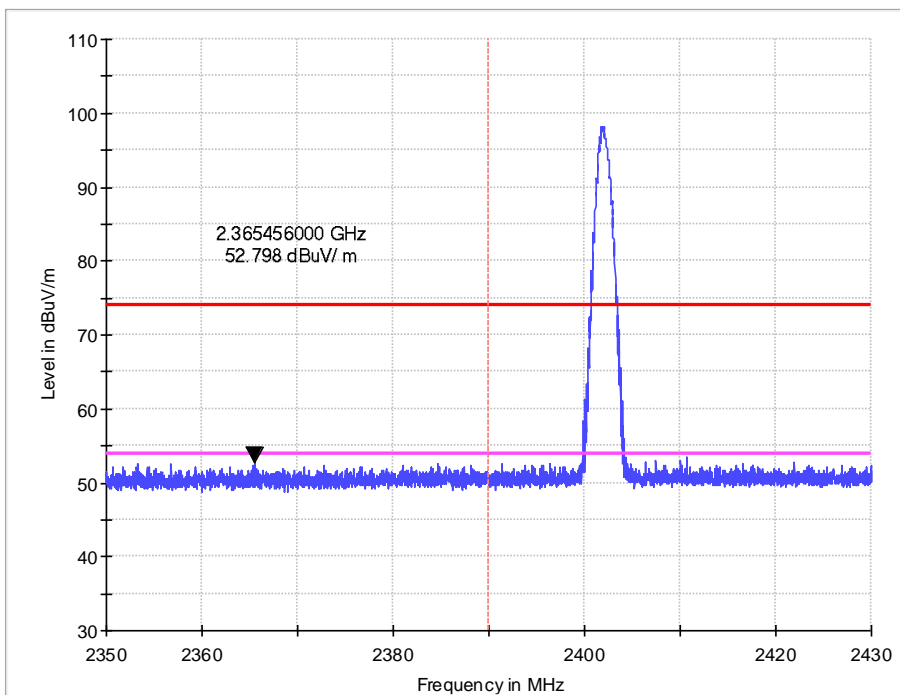
Vertical



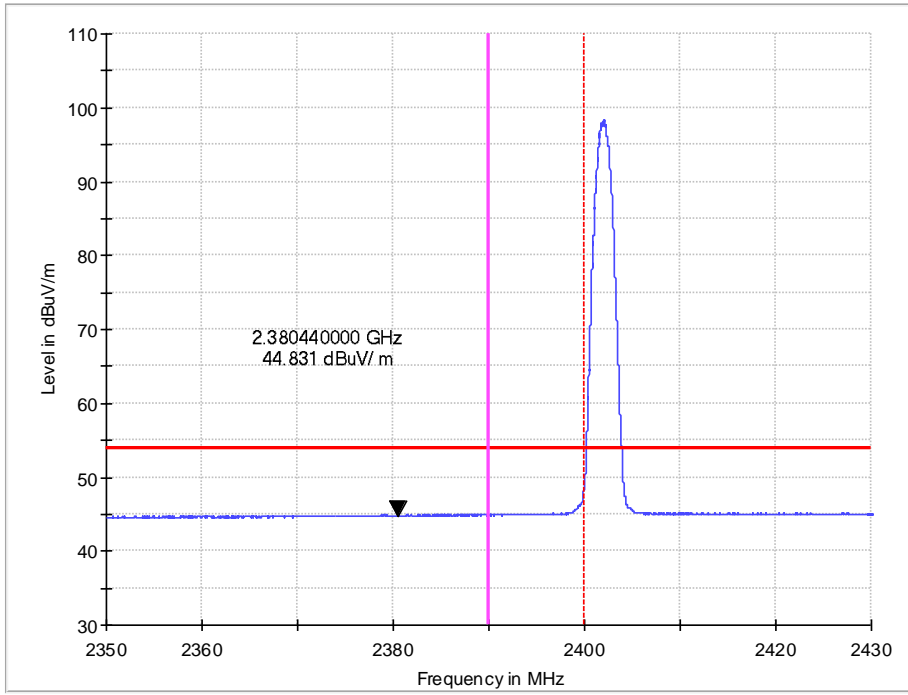
Left:
8DPSK
Low edge
PK
Horizontal



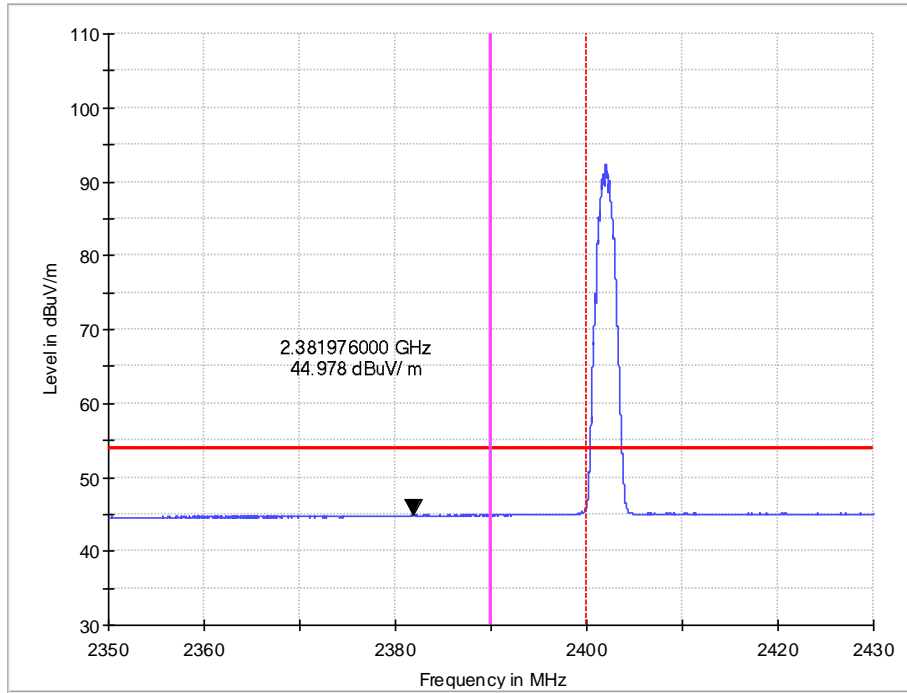
Vertical



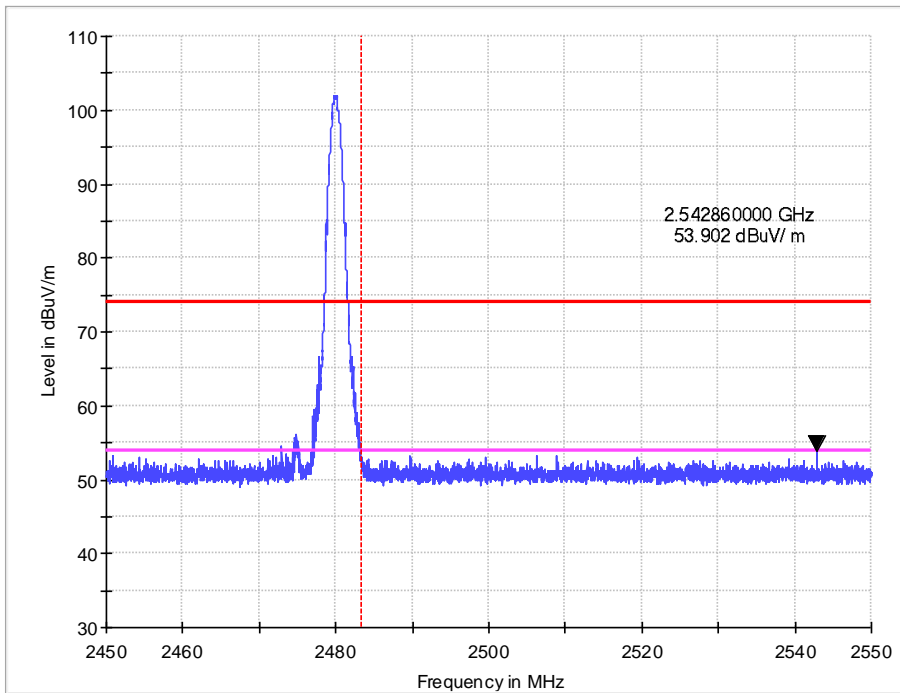
AV
Horizontal



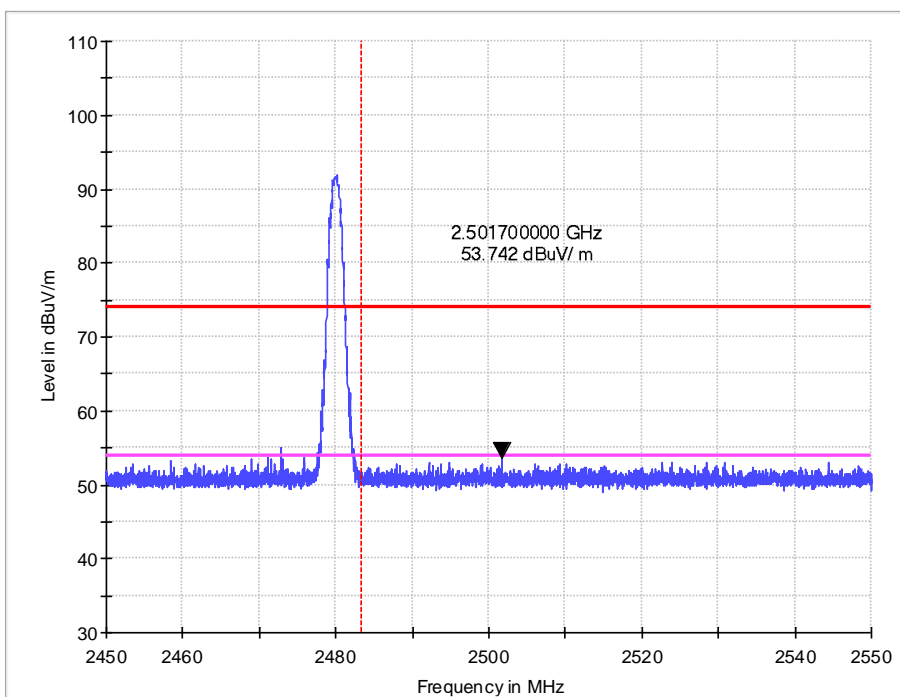
Vertical



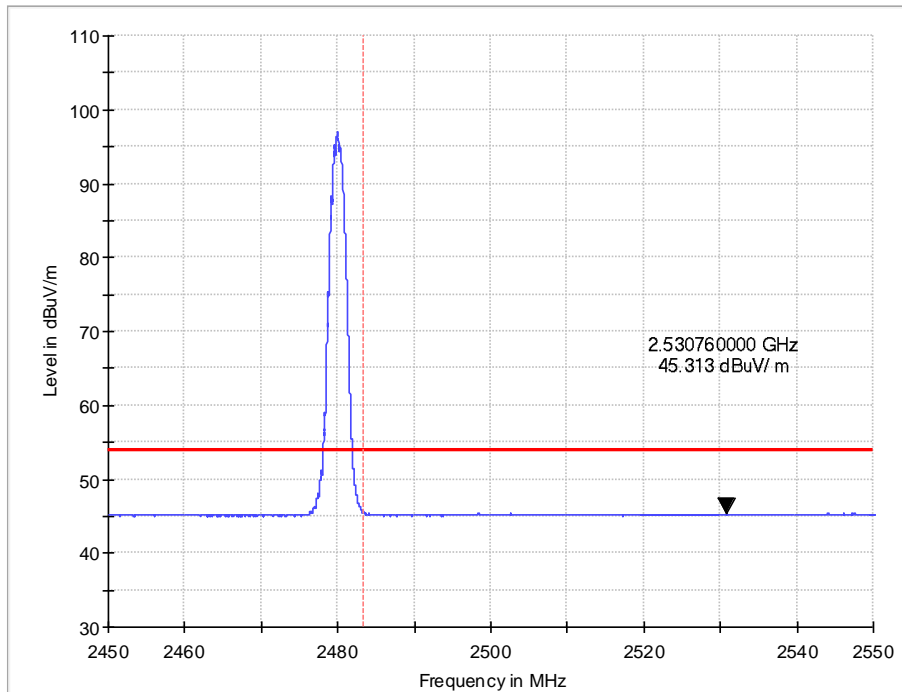
Left:
8DPSK
Upper Edge
PK
Horizontal



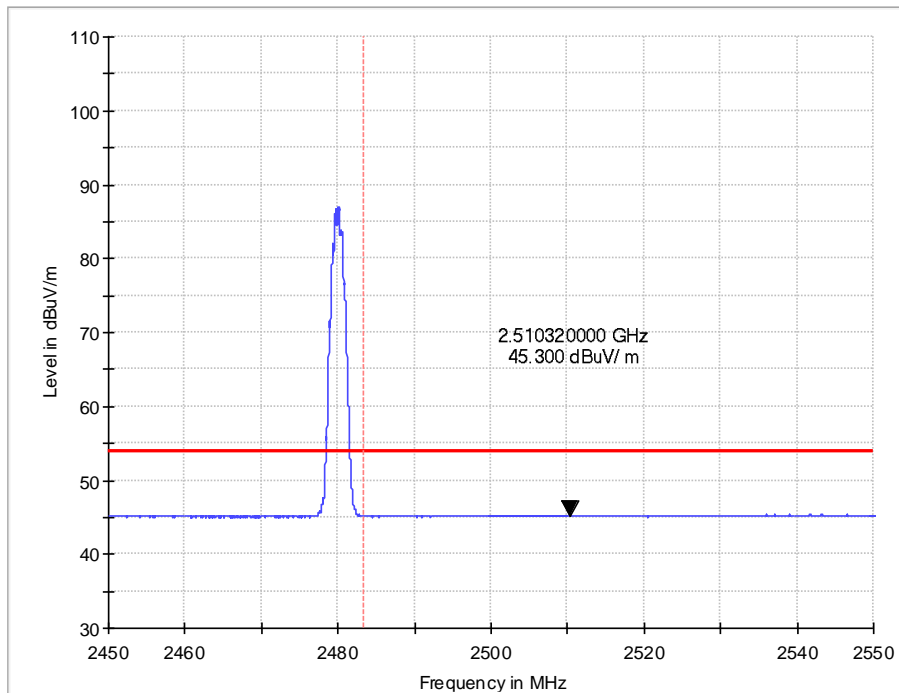
Vertical



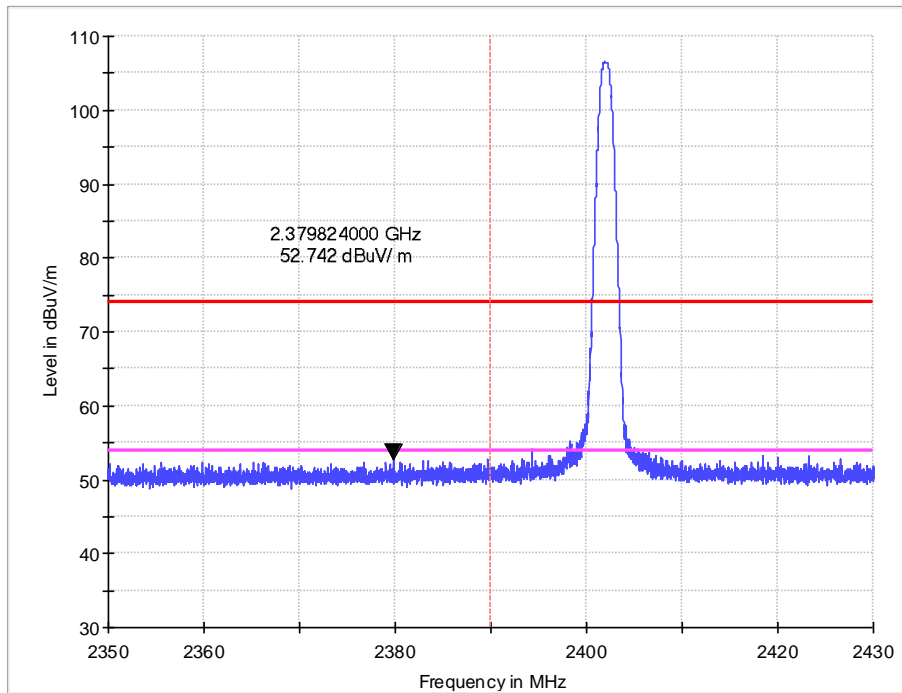
AV
Horizontal



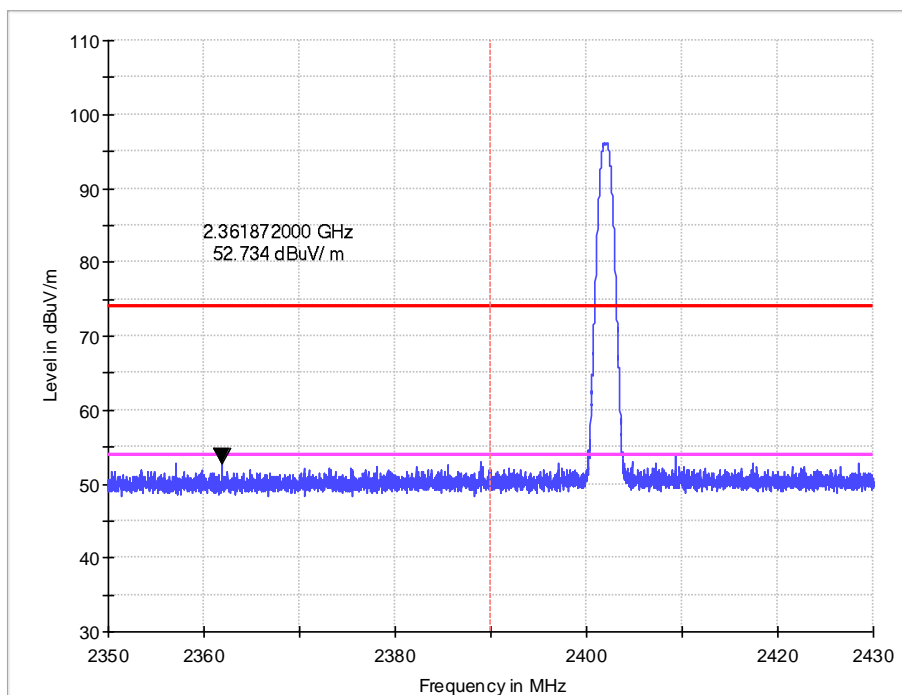
Vertical



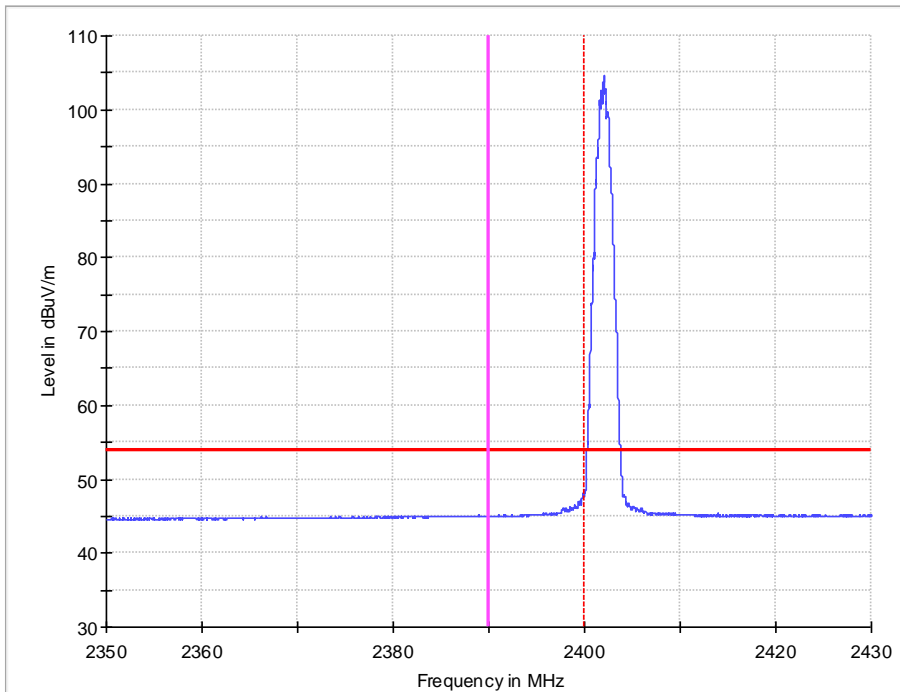
Right:
GFSK
Low edge
PK
Horizontal



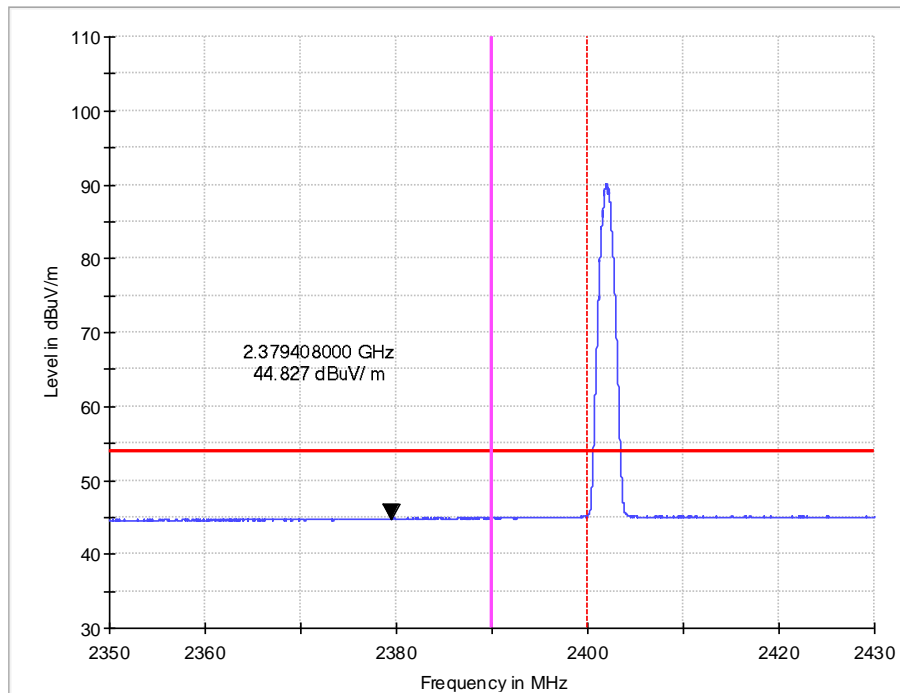
Vertical



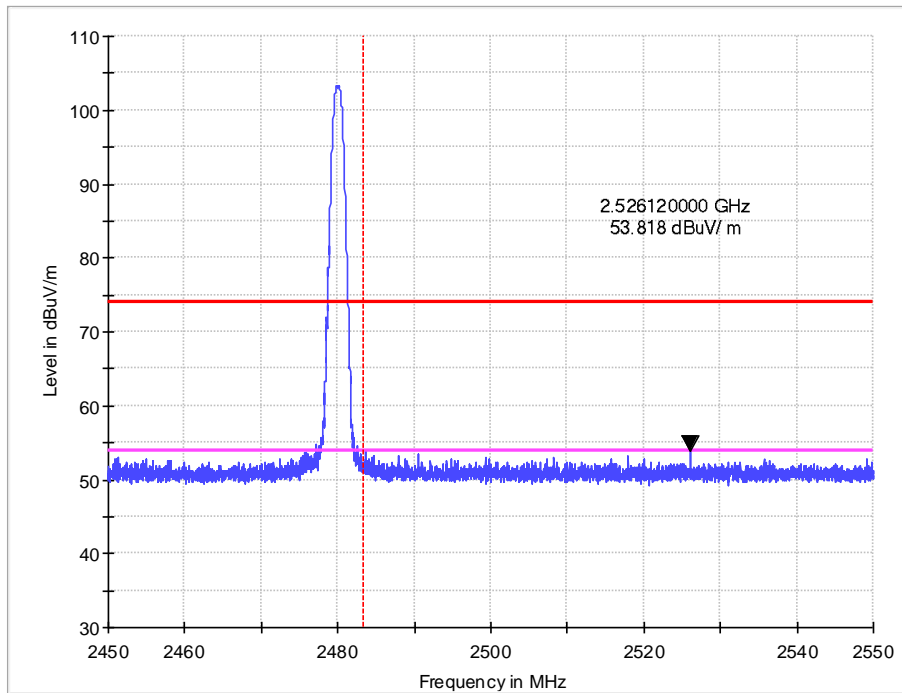
AV
Horizontal



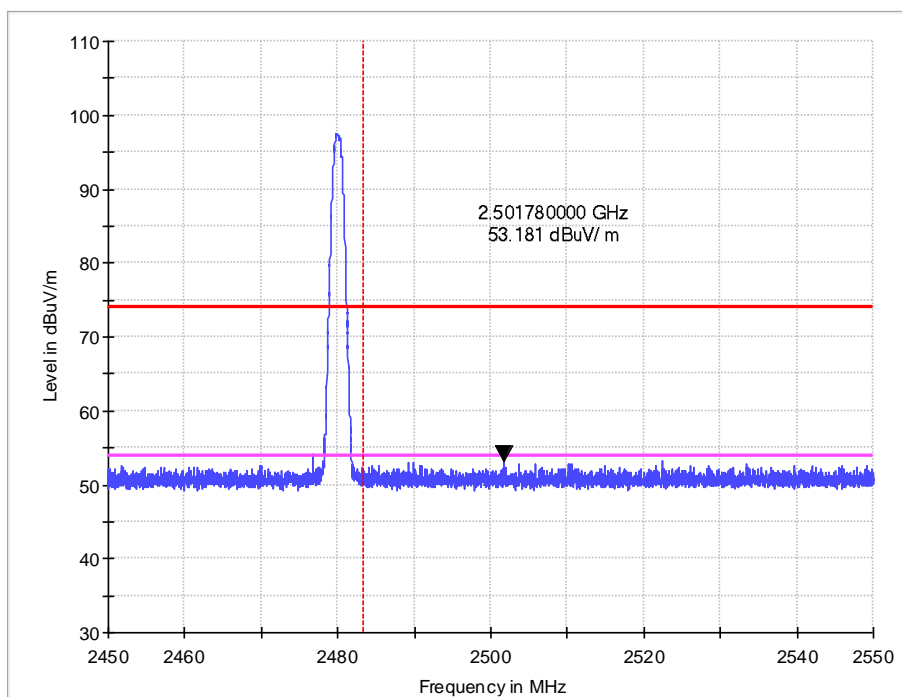
Vertical



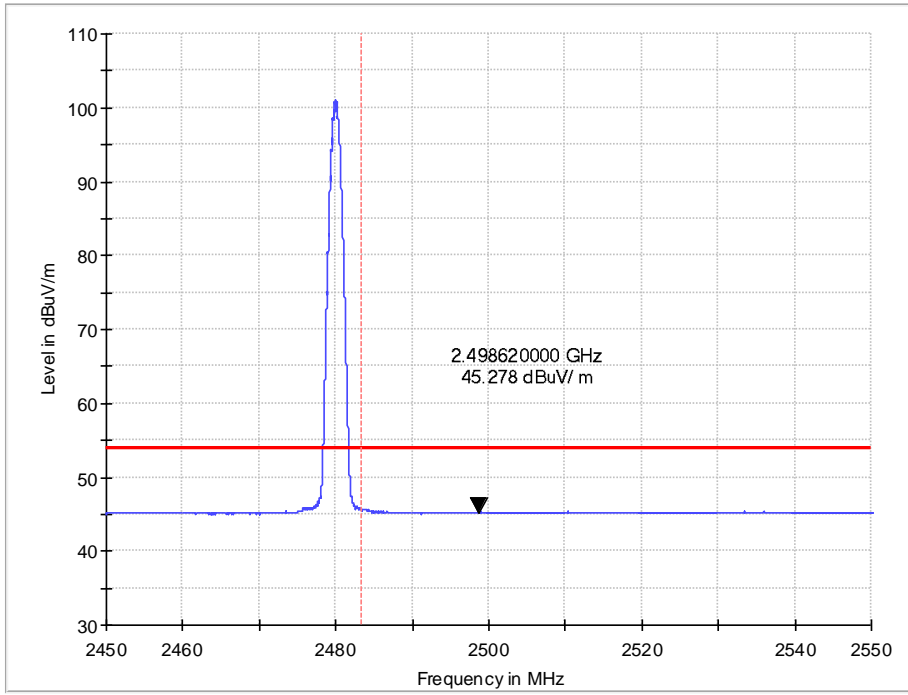
Right:
GFSK
Upper edge
PK
Horizontal



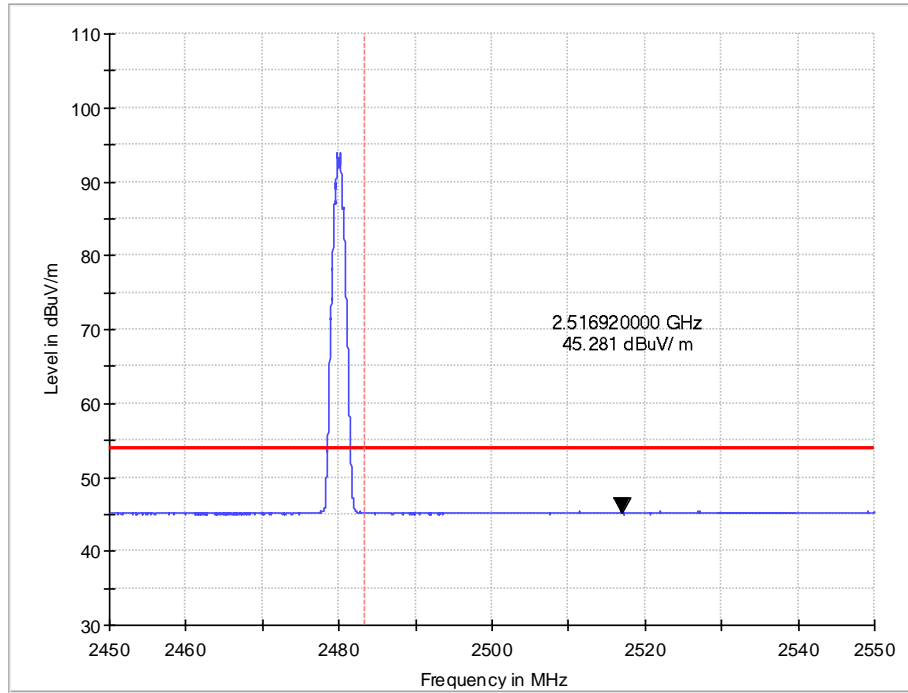
Vertical



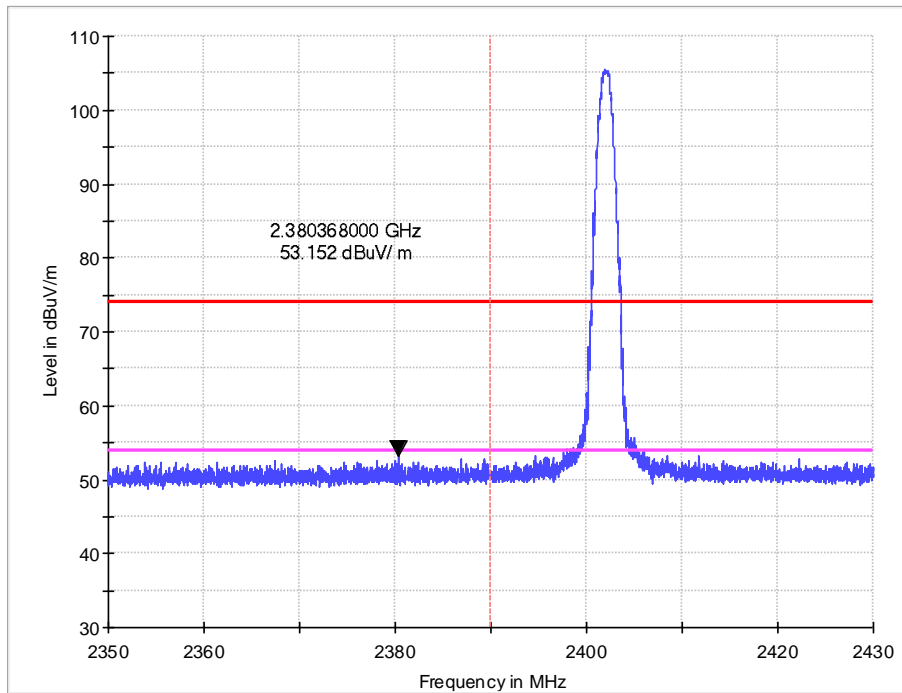
AV
Horizontal



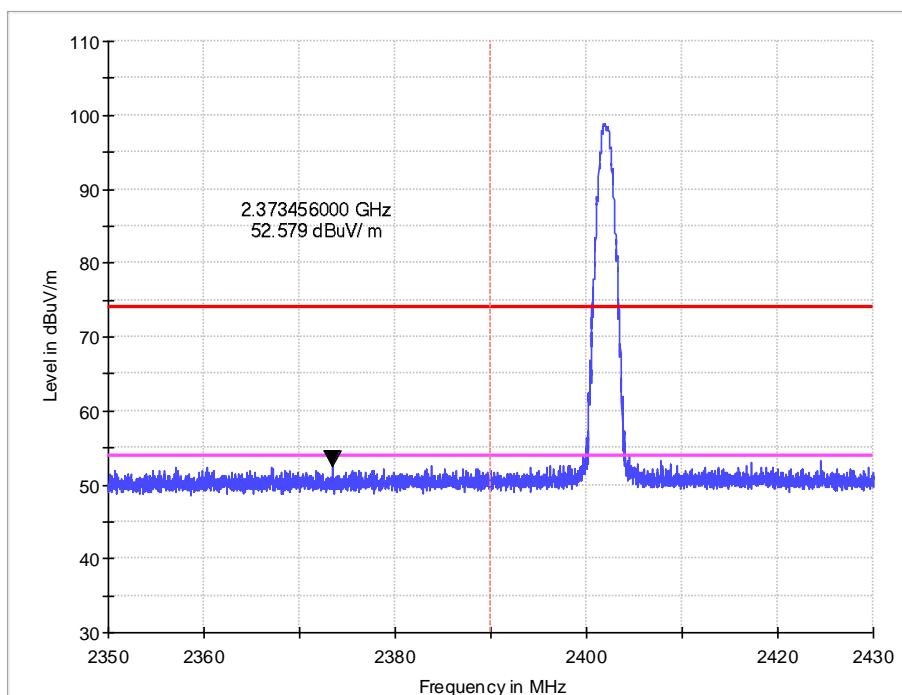
Vertical



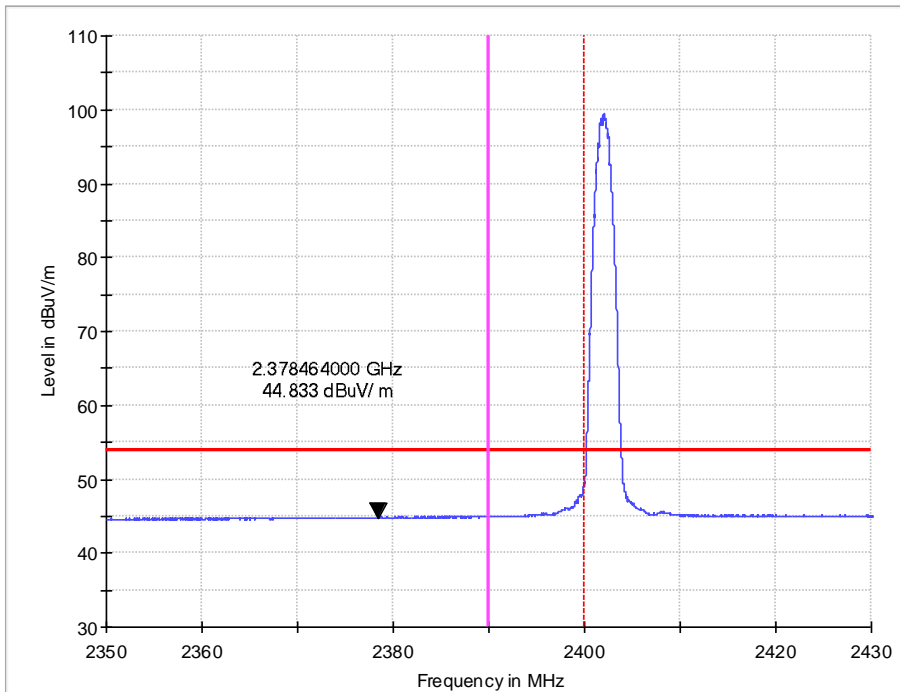
Right:
8DPSK
Low edge
PK
Horizontal



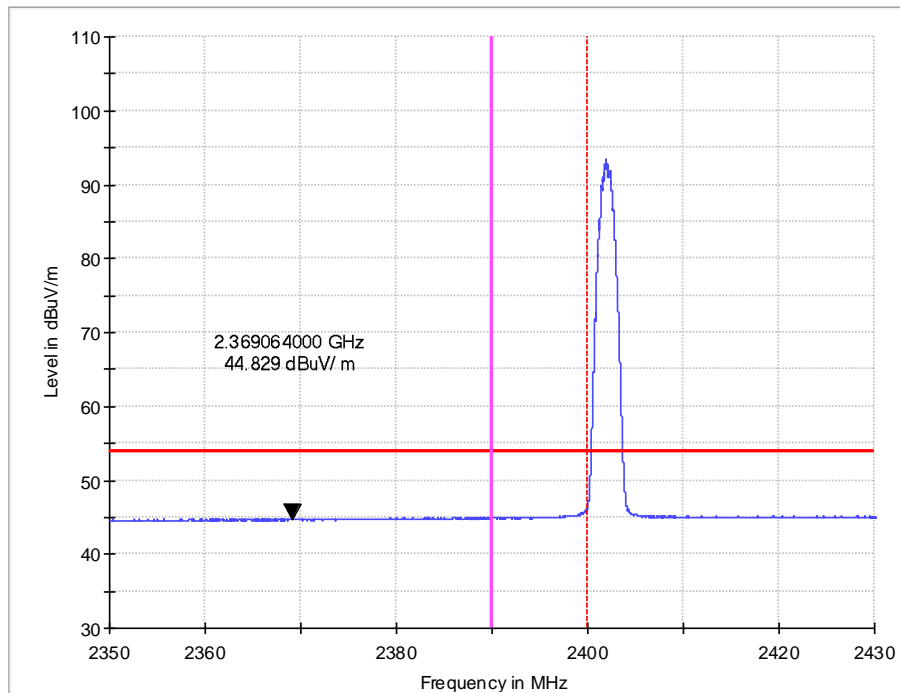
Vertical



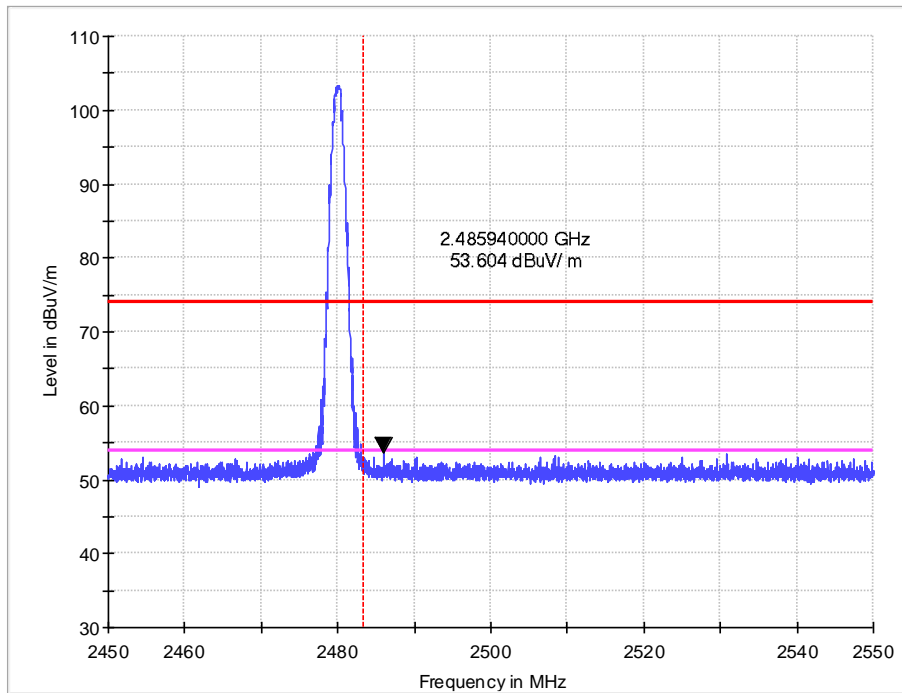
AV
Horizontal



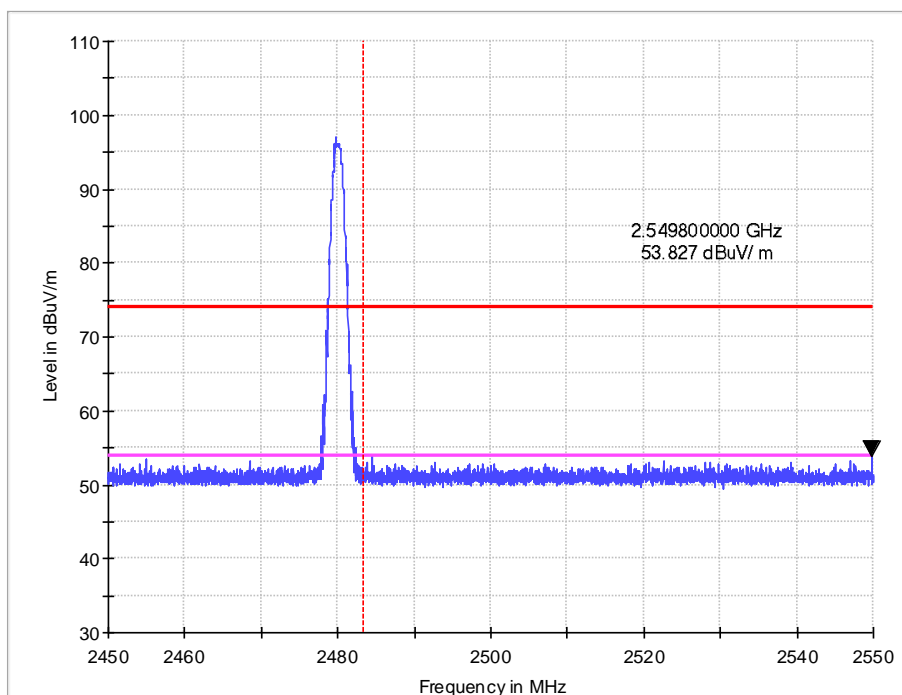
Vertical



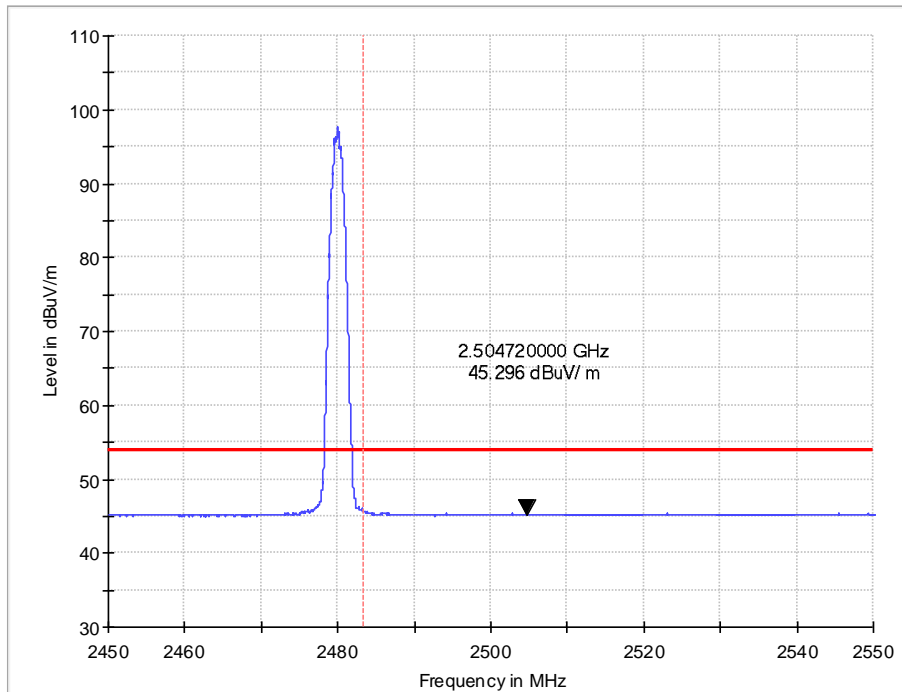
Right:
8DPSK
Upper Edge
PK
Horizontal



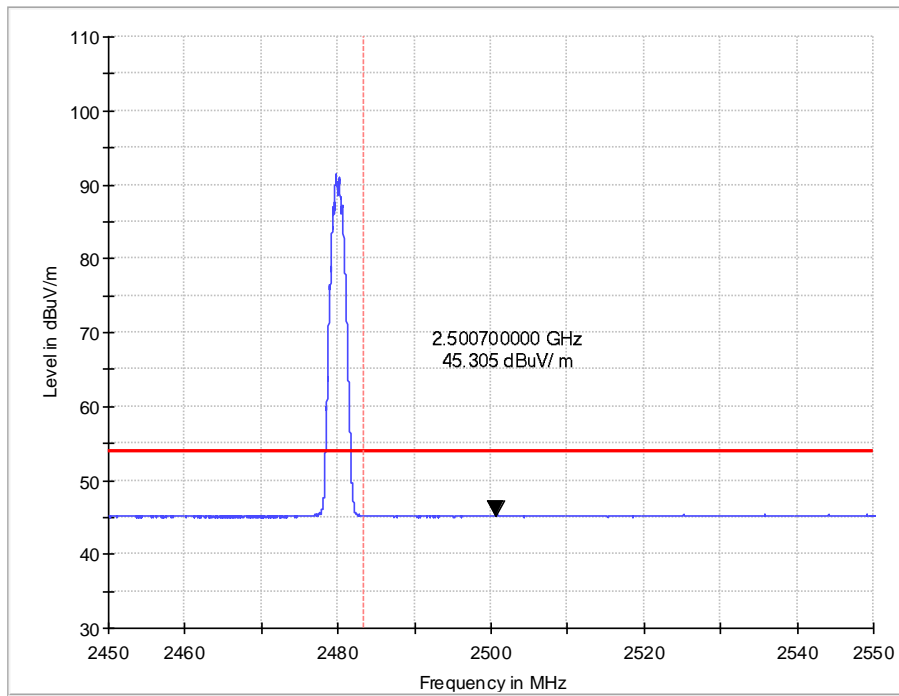
Vertical



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

Left:

Table 24 Maximum Conducted Spurious Emission Test Data

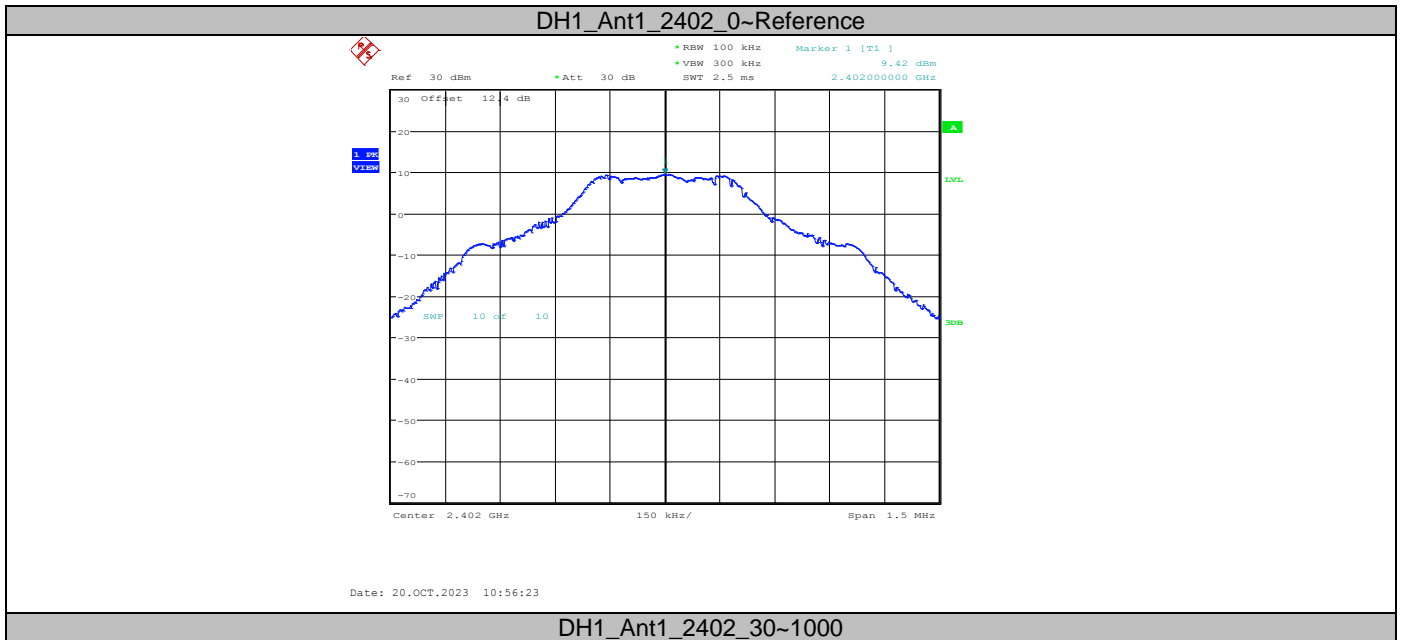
TestMode	Antenna	Channel	FreqRange	RefLevel	Result	Limit	Verdict
DH1	Ant1	2402	Reference	9.42	9.42	---	PASS
			30~1000	9.42	-55.13	≤-10.58	PASS
			1000~26500	9.42	-51.81	≤-10.58	PASS
		2441	Reference	8.81	8.81	---	PASS
			30~1000	8.81	-54.37	≤-11.19	PASS
			1000~26500	8.81	-52.88	≤-11.19	PASS
		2480	Reference	8.73	8.73	---	PASS
			30~1000	8.73	-54.01	≤-11.27	PASS
			1000~26500	8.73	-52.4	≤-11.27	PASS
3DH1	Ant1	2402	Reference	9.11	9.11	---	PASS
			30~1000	9.11	-55.42	≤-10.89	PASS
			1000~26500	9.11	-51.79	≤-10.89	PASS
		2441	Reference	8.88	8.88	---	PASS
			30~1000	8.88	-55.18	≤-11.12	PASS
			1000~26500	8.88	-52.1	≤-11.12	PASS
		2480	Reference	8.73	8.73	---	PASS
			30~1000	8.73	-55.55	≤-11.27	PASS
			1000~26500	8.73	-52.5	≤-11.27	PASS

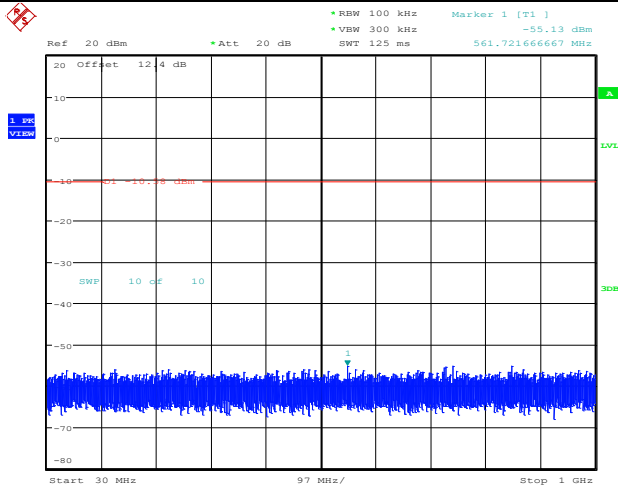
Right:

Table 25 Maximum Conducted Spurious Emission Test Data

TestMode	Antenna	Channel	FreqRange	RefLevel	Result	Limit	Verdict
DH1	Ant1	2402	Reference	9.42	9.42	---	PASS
			30~1000	9.42	-55.08	≤-10.58	PASS
			1000~26500	9.42	-52.42	≤-10.58	PASS
		2441	Reference	9.27	9.27	---	PASS
			30~1000	9.27	-55.31	≤-10.73	PASS
			1000~26500	9.27	-51.16	≤-10.73	PASS
		2480	Reference	9.26	9.26	---	PASS
			30~1000	9.26	-55	≤-10.74	PASS
			1000~26500	9.26	-52.4	≤-10.74	PASS
3DH1	Ant1	2402	Reference	9.55	9.55	---	PASS
			30~1000	9.55	-55.83	≤-10.45	PASS
			1000~26500	9.55	-52.35	≤-10.45	PASS
		2441	Reference	8.52	8.52	---	PASS
			30~1000	8.52	-55.74	≤-11.48	PASS
			1000~26500	8.52	-52.4	≤-11.48	PASS
		2480	Reference	9.19	9.19	---	PASS
			30~1000	9.19	-54.54	≤-10.81	PASS
			1000~26500	9.19	-51.91	≤-10.81	PASS

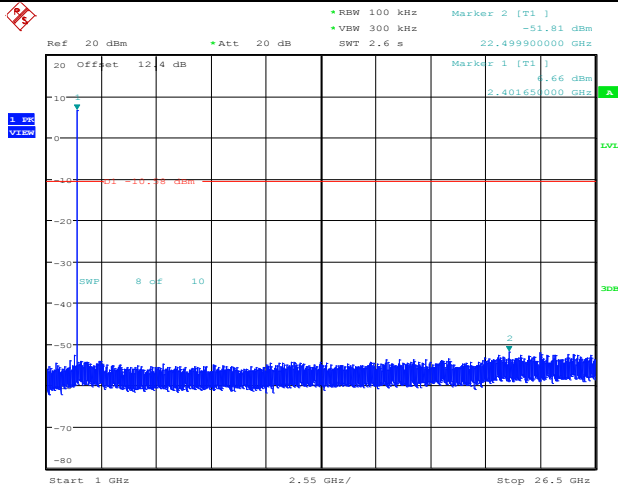
Left:





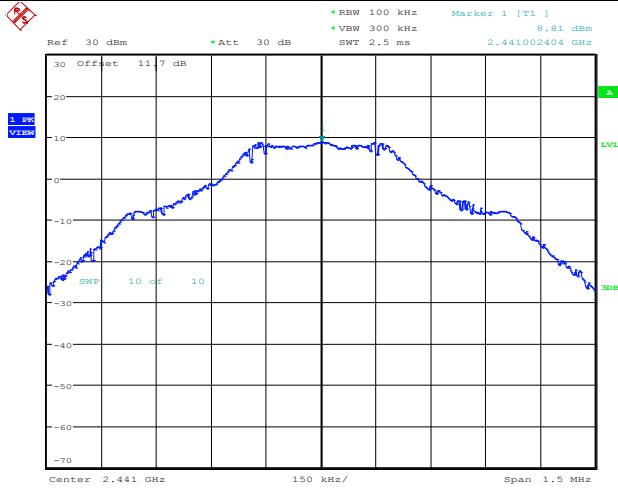
Date: 20.OCT.2023 10:56:30

DH1_Ant1_2402_1000-26500



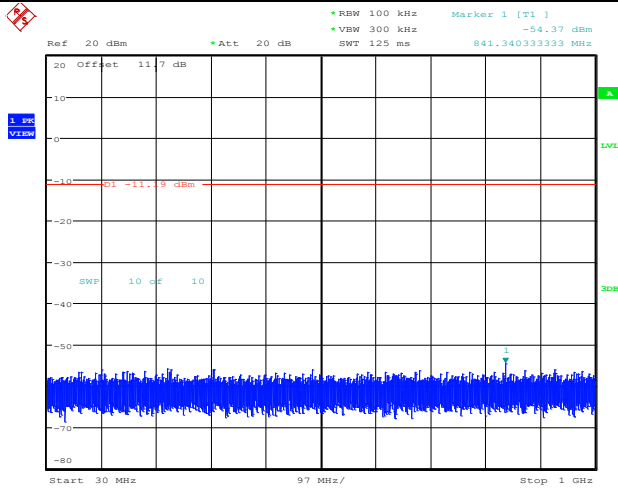
Date: 20.OCT.2023 10:56:53

DH1_Ant1_2441_0-Reference



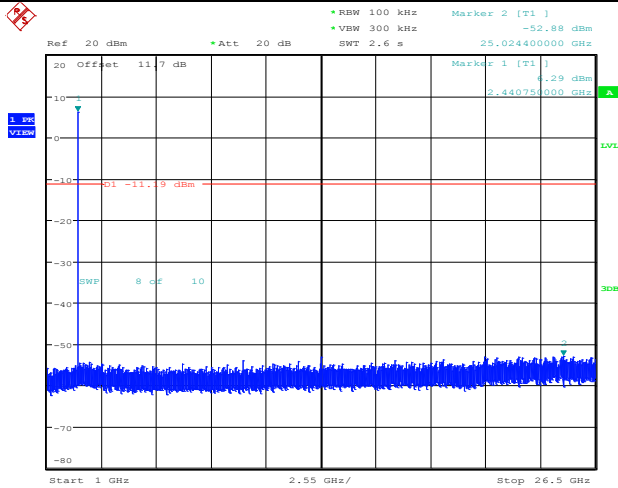
Date: 18.OCT.2023 16:23:23

DH1_Ant1_2441_30-1000



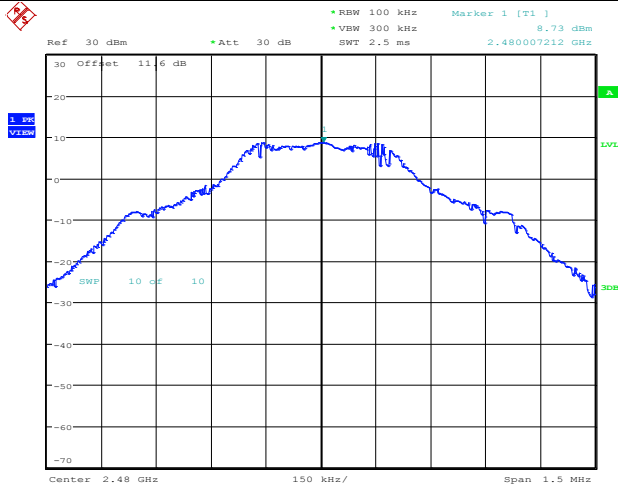
Date: 18.OCT.2023 16:23:30

DH1_Ant1_2441_1000~26500



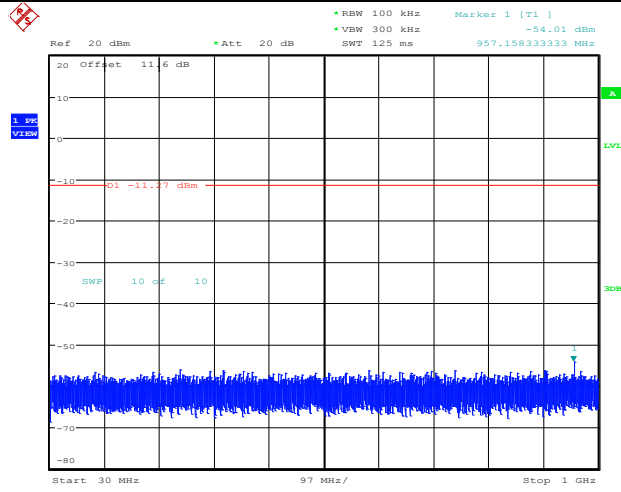
Date: 18.OCT.2023 16:23:53

DH1_Ant1_2480_0~Reference



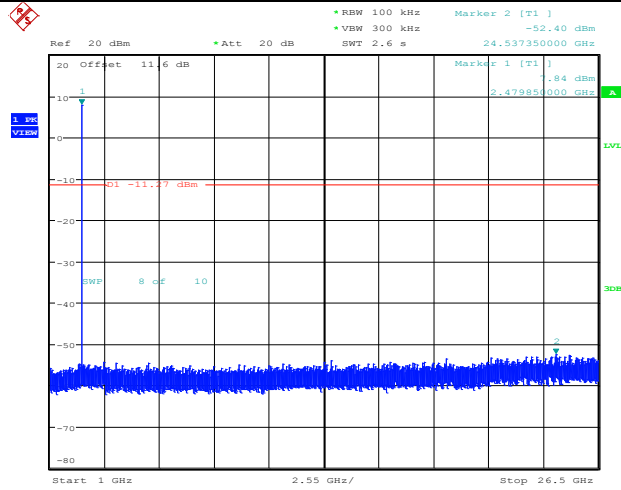
Date: 18.OCT.2023 16:28:11

DH1_Ant1_2480_30~1000



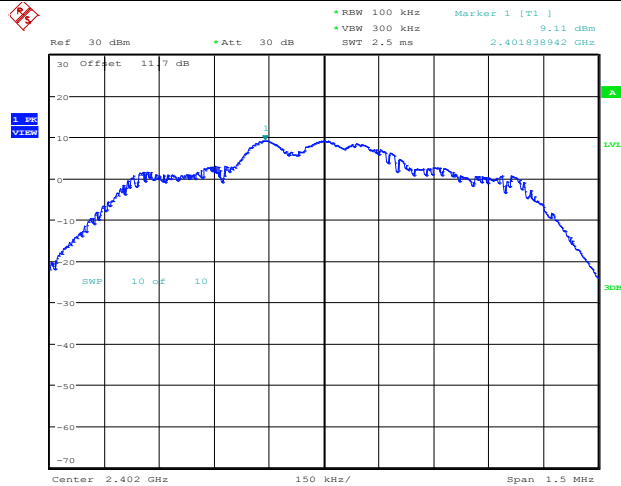
Date: 18.OCT.2023 16:28:18

DH1_Ant1_2480_1000-26500



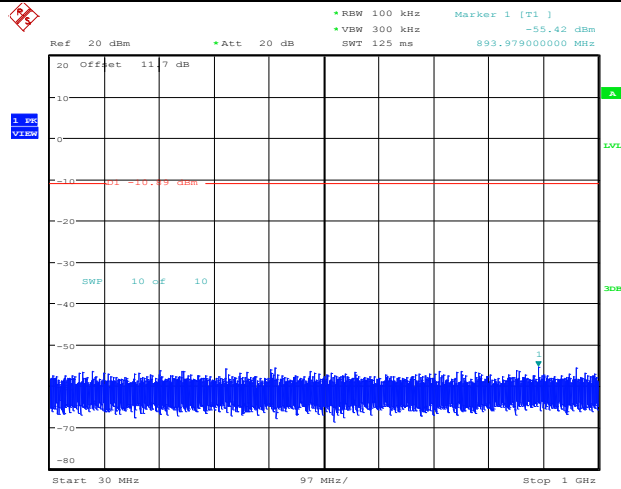
Date: 18.OCT.2023 16:28:41

3DH1_Ant1_2402_0-Reference



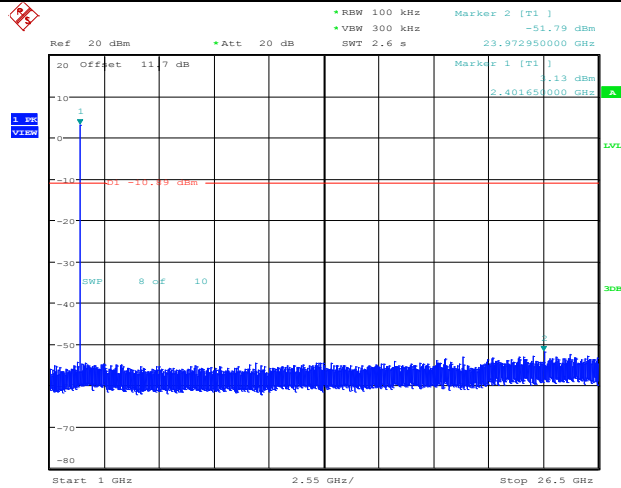
Date: 18.OCT.2023 16:32:06

3DH1_Ant1_2402_30-1000



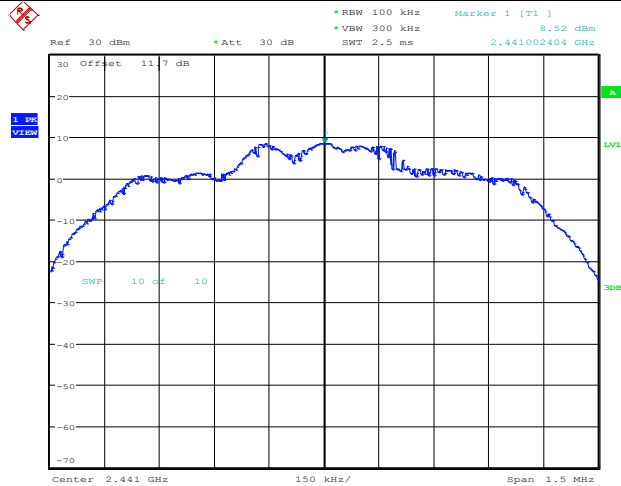
Date: 18.OCT.2023 16:32:13

3DH1_Ant1_2402_1000~26500



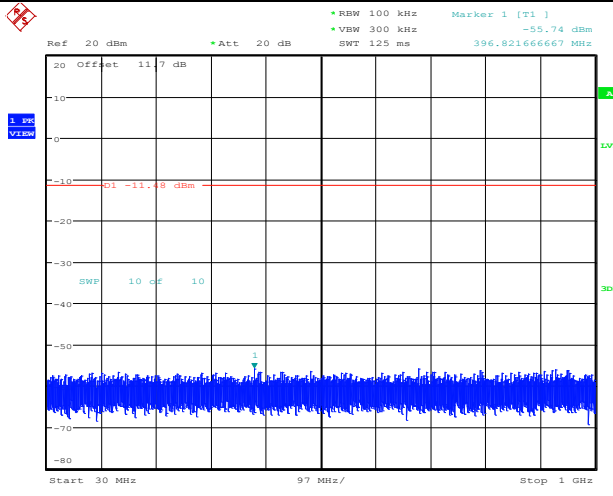
Date: 18.OCT.2023 16:32:36

3DH1_Ant1_2441_0~Reference



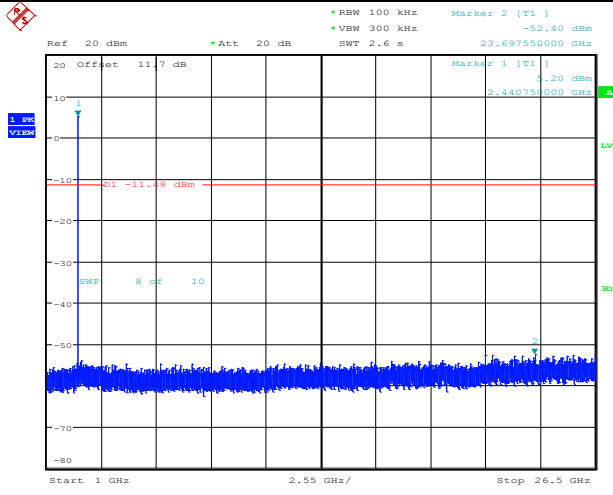
Date: 19.OCT.2023 10:08:27

3DH1_Ant1_2441_30~1000



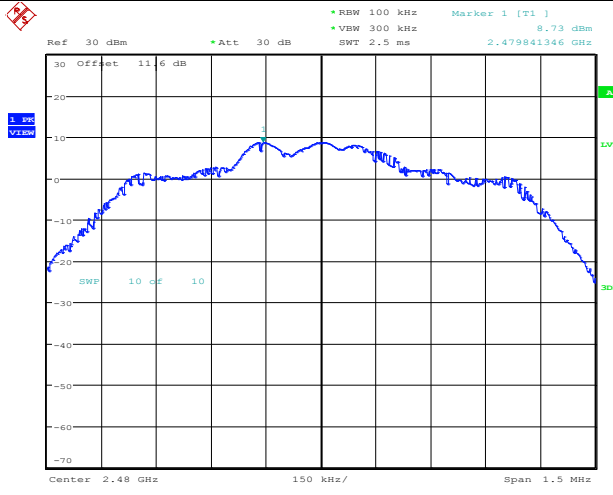
Date: 19.OCT.2023 10:08:34

3DH1_Ant1_2441_1000~26500



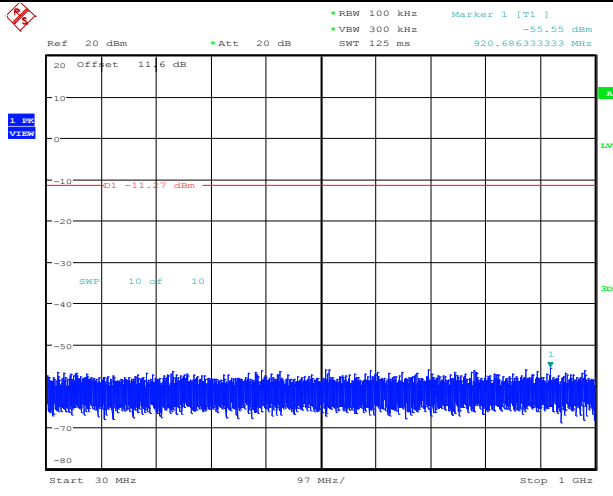
Date: 19.OCT.2023 10:08:57

3DH1_Ant1_2480_0~Reference



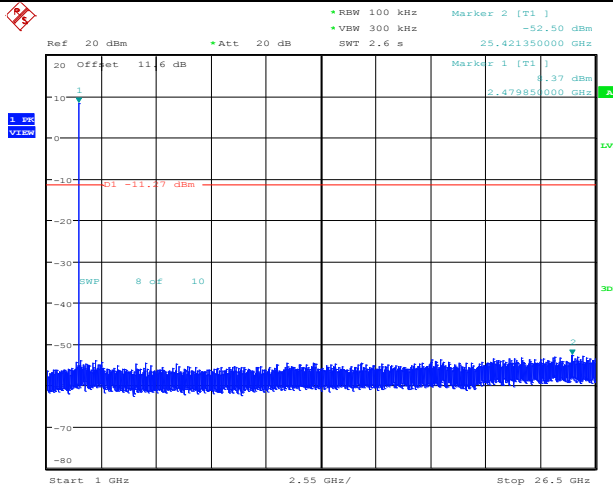
Date: 18.OCT.2023 16:35:49

3DH1_Ant1_2480_30~1000



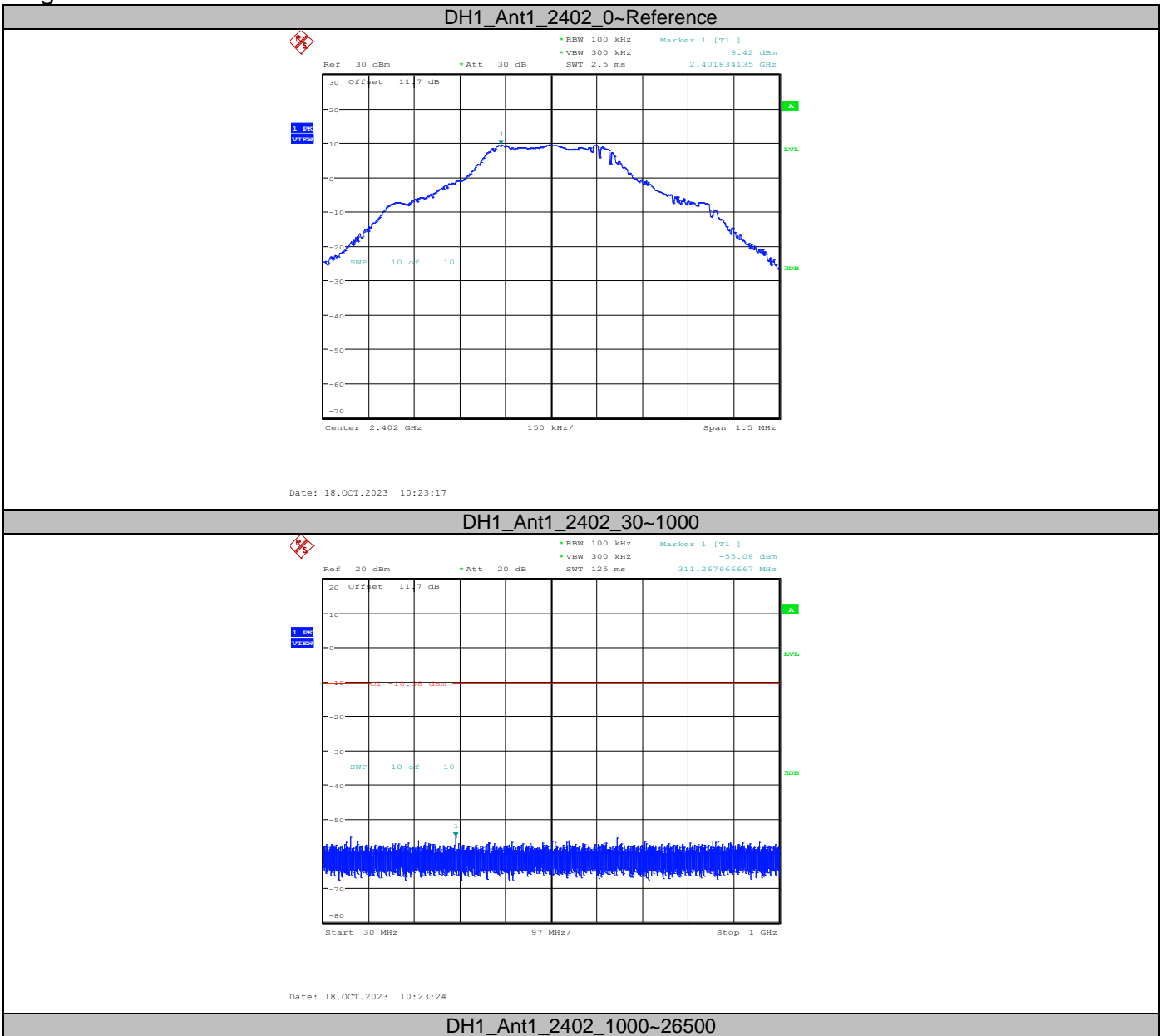
Date: 18.OCT.2023 16:35:56

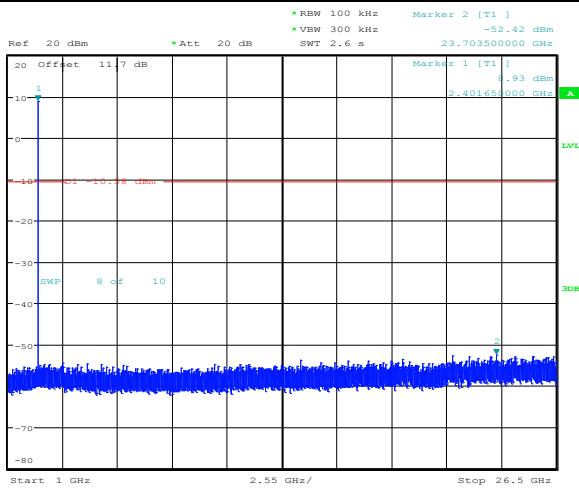
3DH1_Ant1_2480_1000~26500



Date: 18.OCT.2023 16:36:18

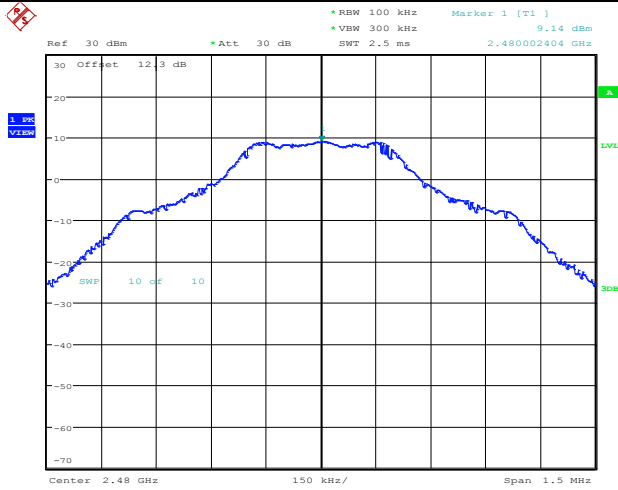
Right:





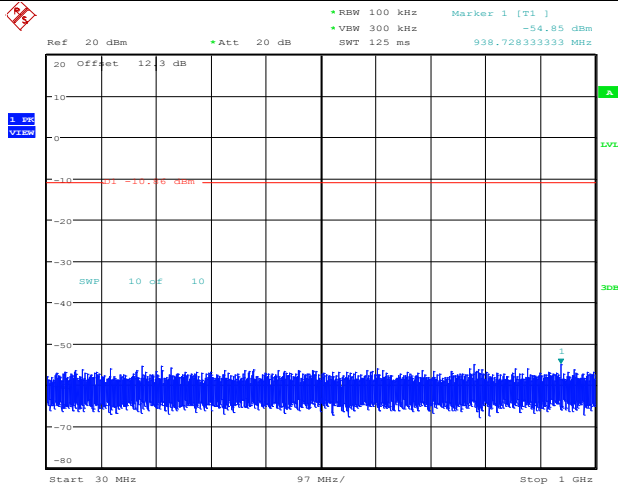
Date: 18.OCT.2023 10:23:47

DH1_Ant1_2441_0~Reference



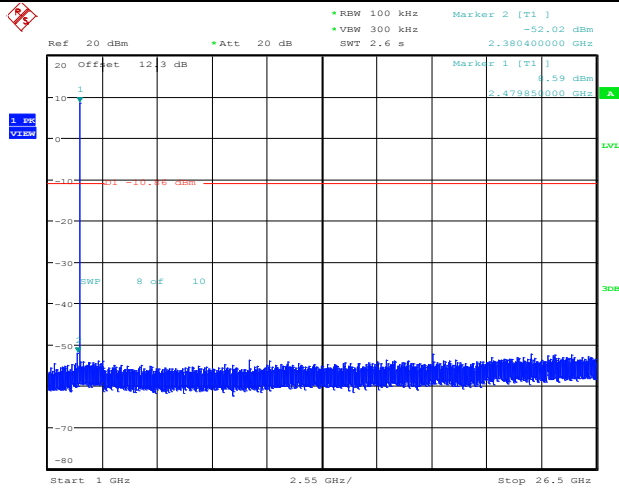
Date: 20.OCT.2023 11:02:32

DH1_Ant1_2441_30~1000



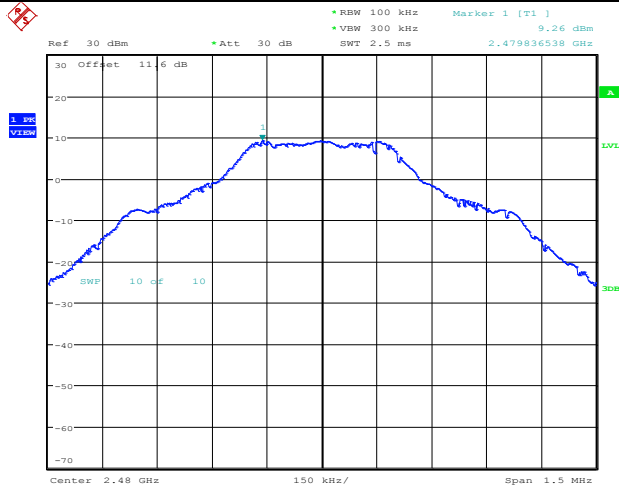
Date: 20.OCT.2023 11:02:39

DH1_Ant1_2441_1000~26500



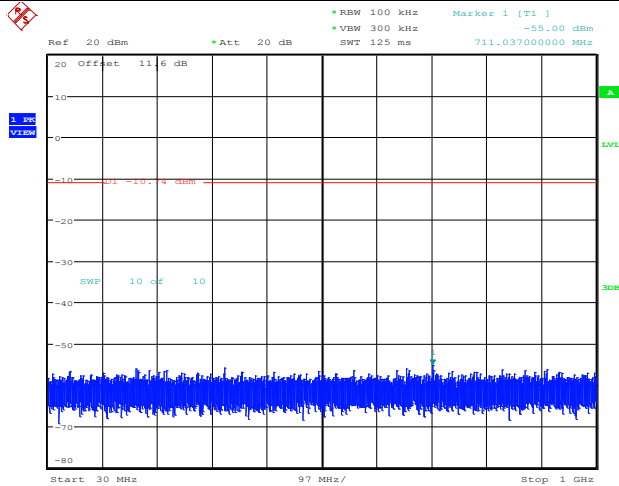
Date: 20.OCT.2023 11:03:02

DH1_Ant1_2480_0-Reference



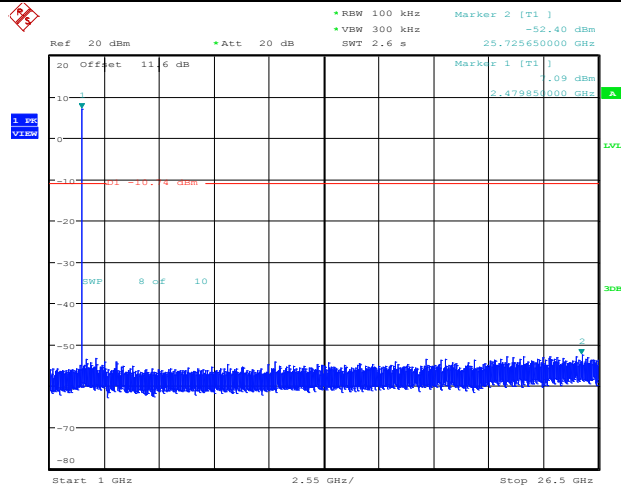
Date: 18.OCT.2023 10:29:03

DH1_Ant1_2480_30~1000



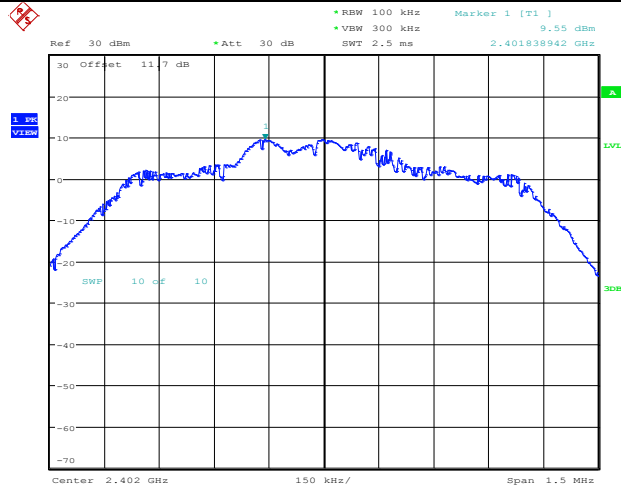
Date: 18.OCT.2023 10:29:10

DH1_Ant1_2480_1000-26500



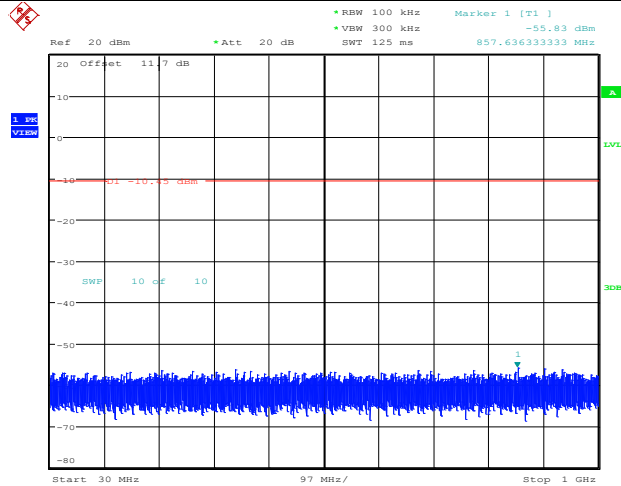
Date: 18.OCT.2023 10:29:33

3DH1_Ant1_2402_0~Reference



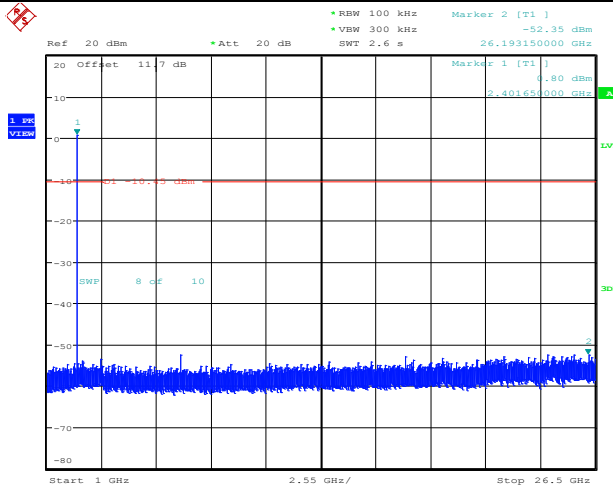
Date: 18.OCT.2023 10:33:29

3DH1_Ant1_2402_30~1000



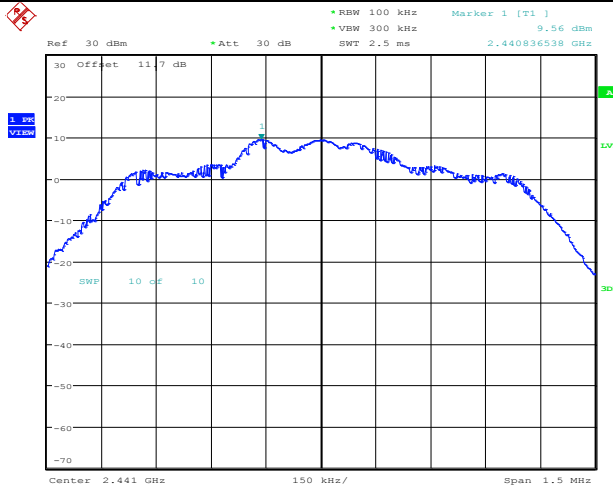
Date: 18.OCT.2023 10:33:36

3DH1_Ant1_2402_1000~26500



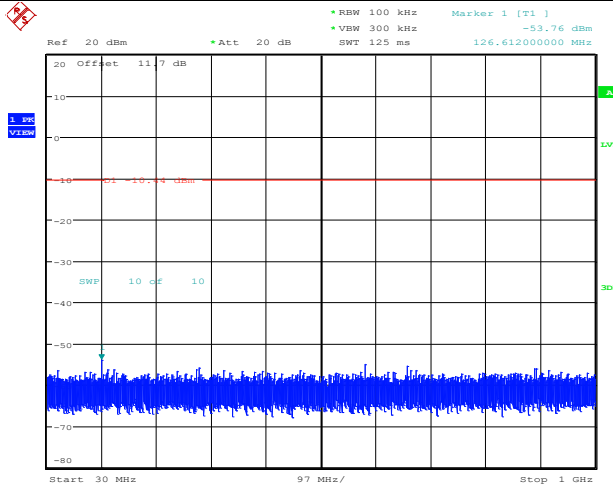
Date: 18.OCT.2023 10:33:58

3DH1_Ant1_2441_0~Reference



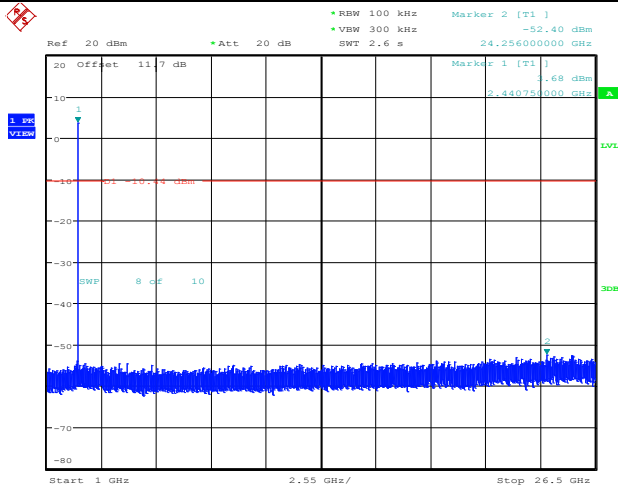
Date: 18.OCT.2023 10:45:17

3DH1_Ant1_2441_30~1000



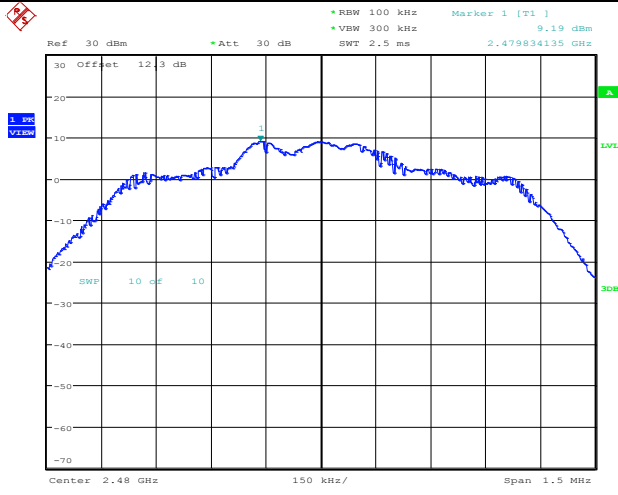
Date: 18.OCT.2023 10:45:24

3DH1_Ant1_2441_1000~26500



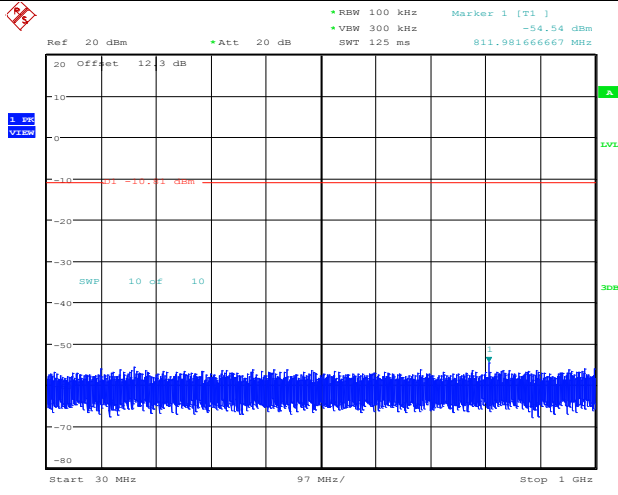
Date: 18.OCT.2023 10:45:47

3DH1_Ant1_2480_0~Reference



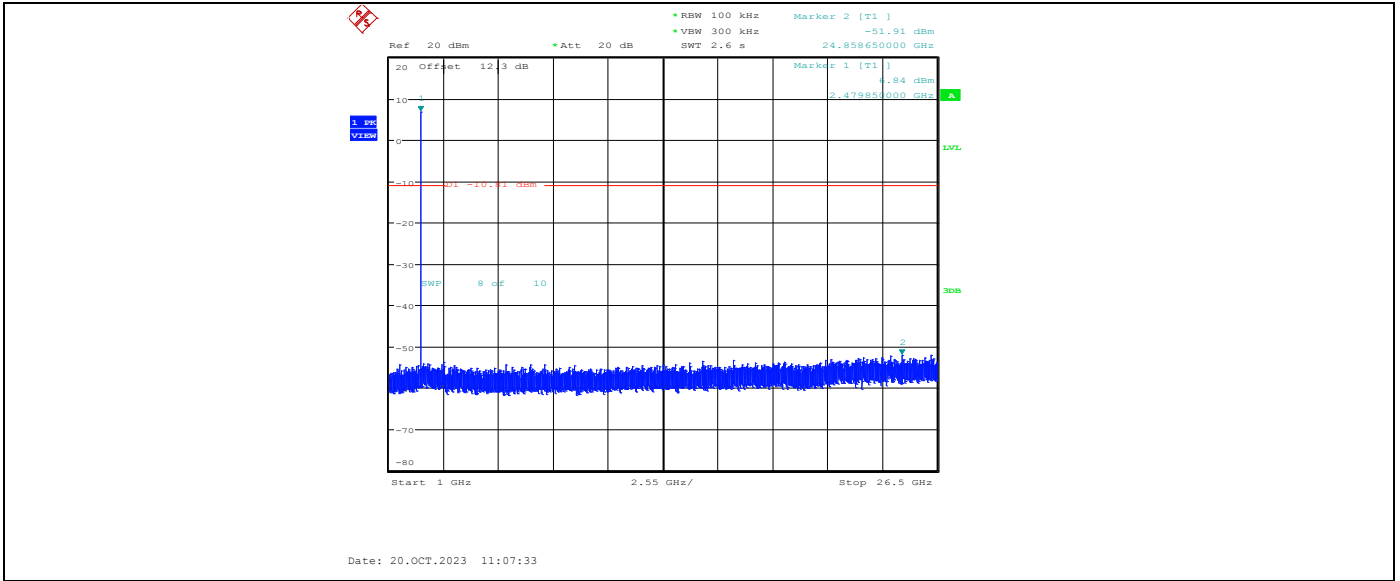
Date: 20.OCT.2023 11:07:03

3DH1_Ant1_2480_30~1000



Date: 20.OCT.2023 11:07:10

3DH1_Ant1_2480_1000~26500



Left:

Table 26 Band edge Test Data

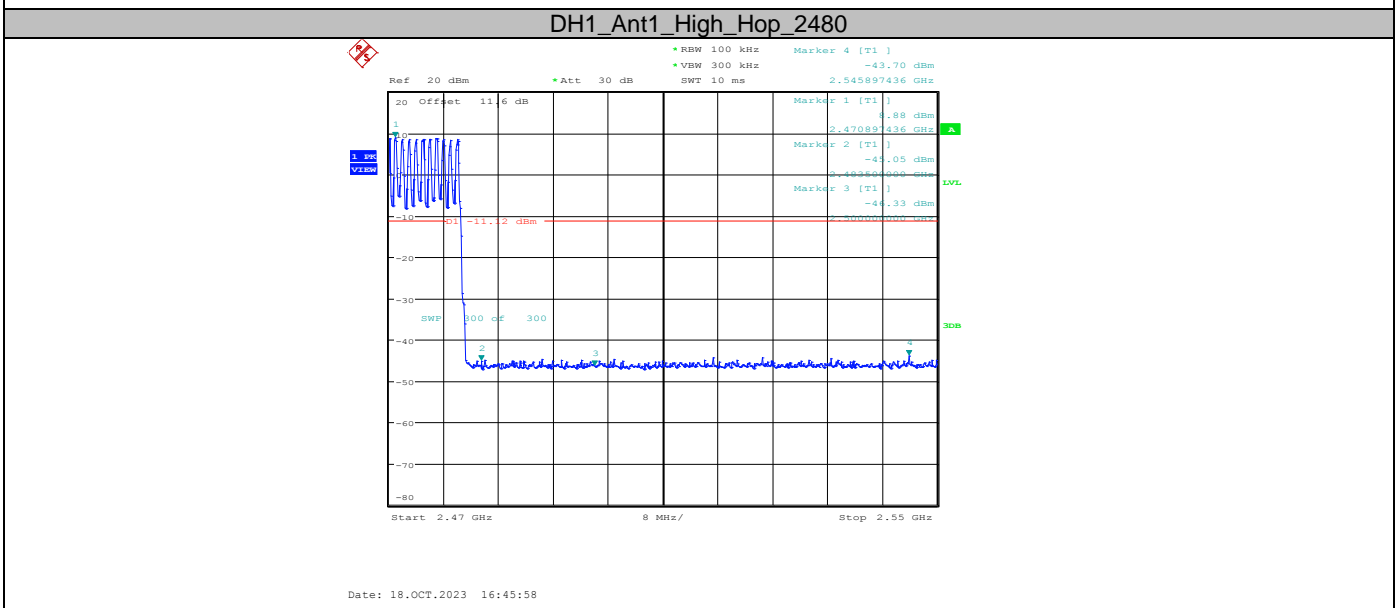
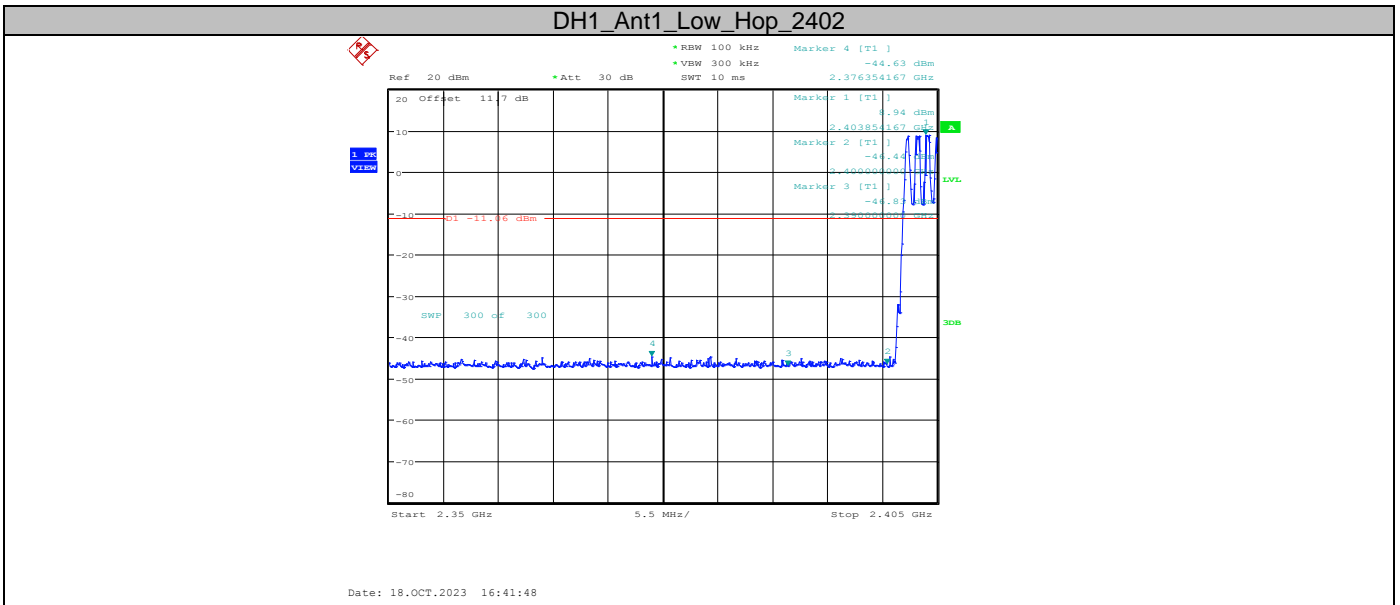
TestMode	Antenna	ChName	Channel	RefLevel	Result	Limit	Verdict
DH1	Ant1	Low	Hop_2402	8.94	-44.63	≤-11.06	PASS
		High	Hop_2480	8.88	-43.7	≤-11.12	PASS
2DH1	Ant1	Low	Hop_2402	8.60	-44.56	≤-11.4	PASS
		High	Hop_2480	8.62	-44.13	≤-11.38	PASS
3DH1	Ant1	Low	Hop_2402	8.76	-44.92	≤-11.24	PASS
		High	Hop_2480	8.47	-44.58	≤-11.53	PASS

Right:

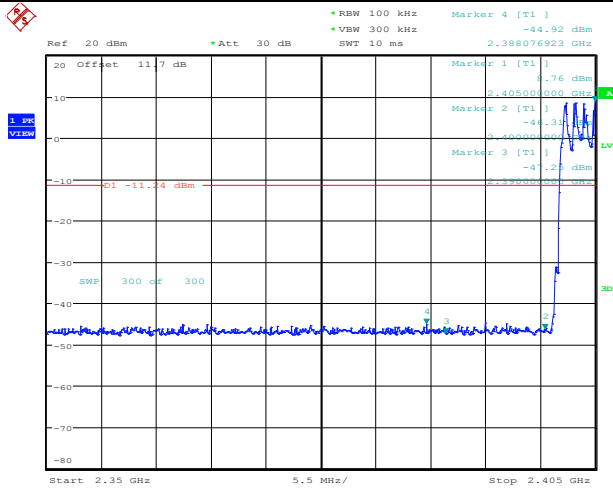
Table 27 Band edge Test Data

TestMode	Antenna	ChName	Channel	RefLevel	Result	Limit	Verdict
DH1	Ant1	Low	Hop_2402	9.48	-44.21	≤-10.52	PASS
		High	Hop_2480	9.40	-44.69	≤-10.6	PASS
3DH1	Ant1	Low	Hop_2402	9.44	-44.91	≤-10.56	PASS
		High	Hop_2480	9.48	-44.1	≤-10.52	PASS

Left:

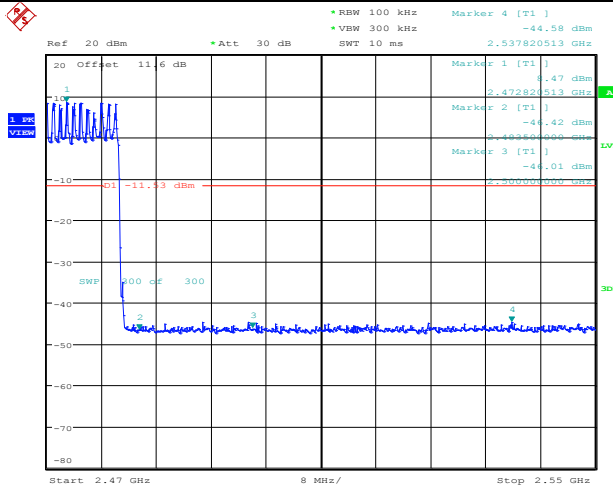


3DH1_Ant1_Low_Hop_2402



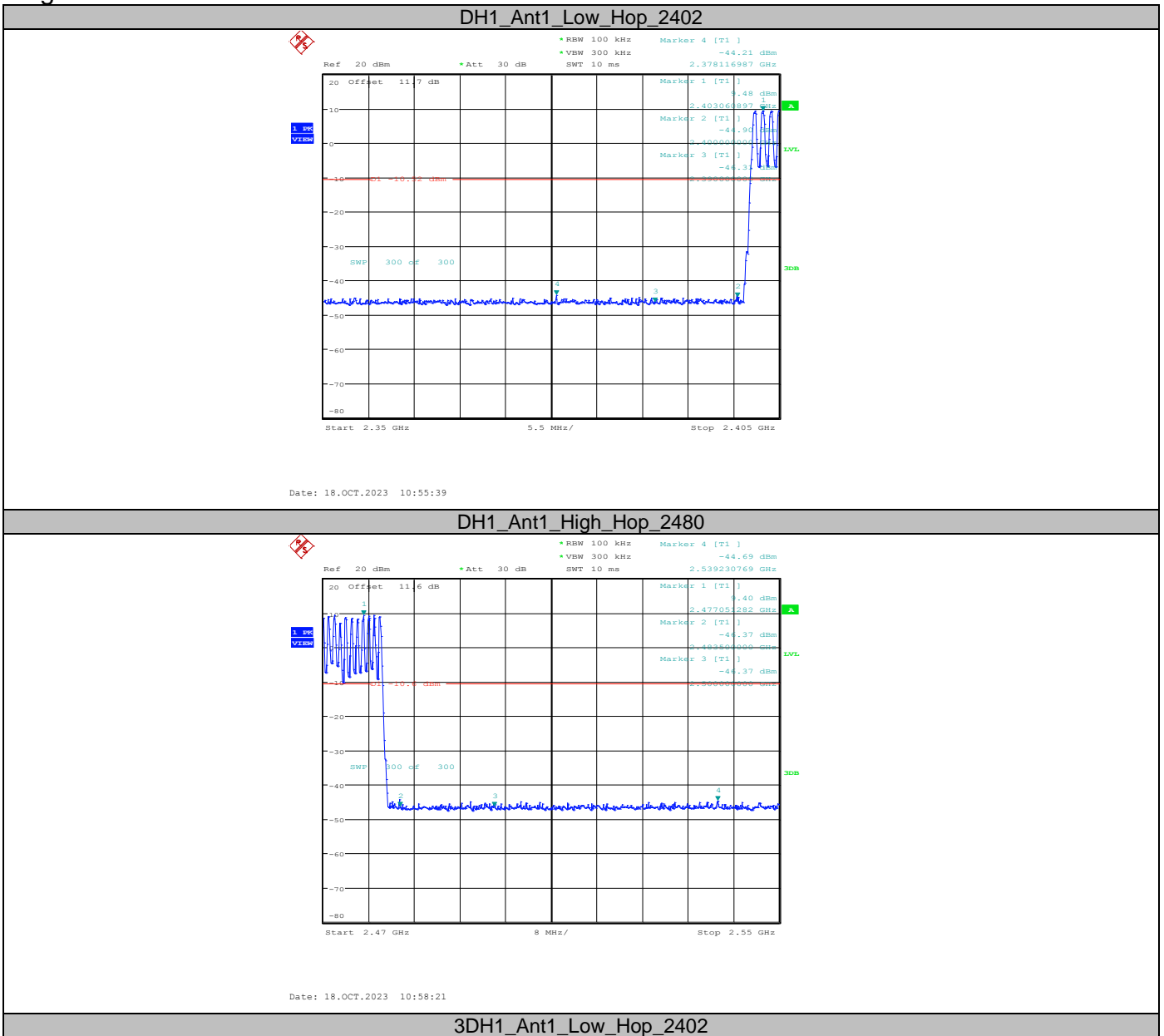
Date: 19.OCT.2023 08:40:26

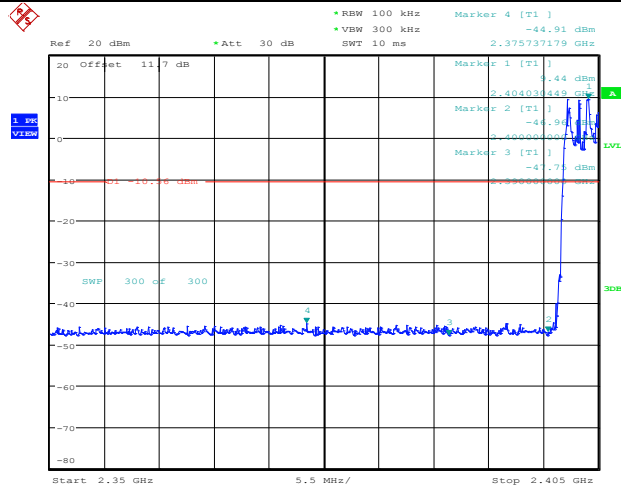
3DH1_Ant1_High_Hop_2480



Date: 19.OCT.2023 08:43:11

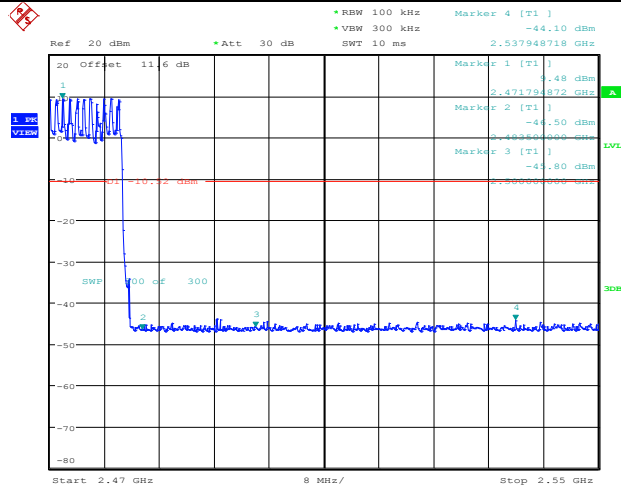
Right:





Date: 18.OCT.2023 11:27:32

3DH1_Ant1_High_Hop_2480



Date: 18.OCT.2023 11:34:57

14.99% OCCUPIED BANDWIDTH

14.1.LIMITS OF 99%Occupied Bandwidth

None; for reporting purposes only

14.2.TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer.

The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled

14.3.TEST DATA

Left:

Table 28 99%Occupied Bandwidth Test Data

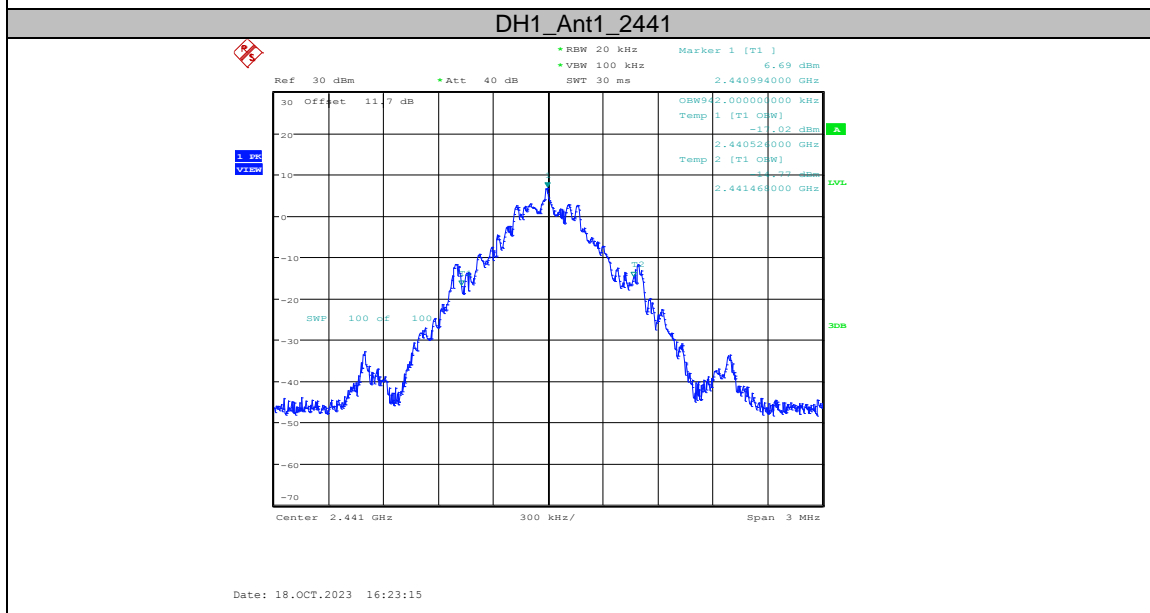
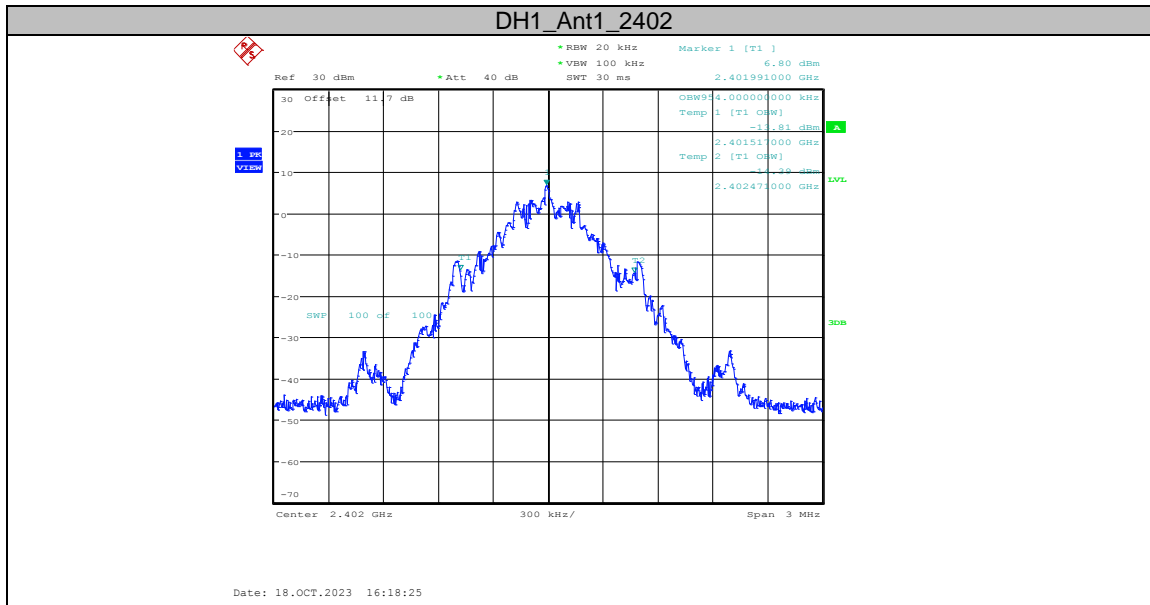
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	0.954	2401.5170	2402.4710	---	---
		2441	0.942	2440.5260	2441.4680	---	---
		2480	0.948	2479.5230	2480.4710	---	---
3DH1	Ant1	2402	1.107	2401.4510	2402.5580	---	---
		2441	1.104	2440.4540	2441.5580	---	---
		2480	1.107	2479.4510	2480.5580	---	---

Right:

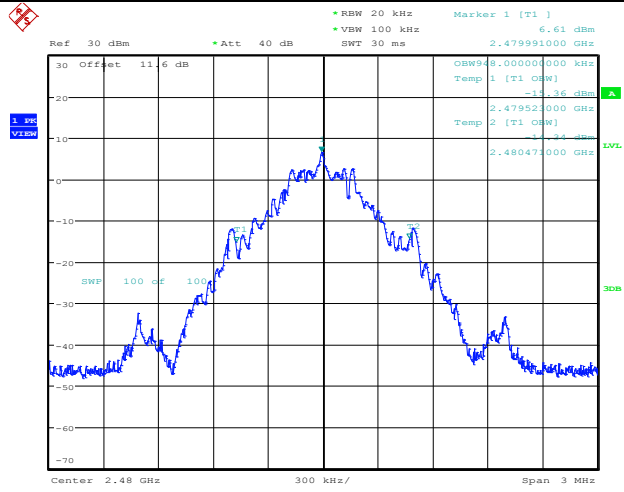
Table 29 99%Occupied Bandwidth Test Data

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	0.951	2401.5200	2402.4710	---	---
		2441	0.942	2440.5230	2441.4650	---	---
		2480	0.942	2479.5230	2480.4650	---	---
3DH1	Ant1	2402	1.107	2401.4510	2402.5580	---	---
		2441	1.107	2440.4510	2441.5580	---	---
		2480	1.11	2479.4480	2480.5580	---	---

Left:

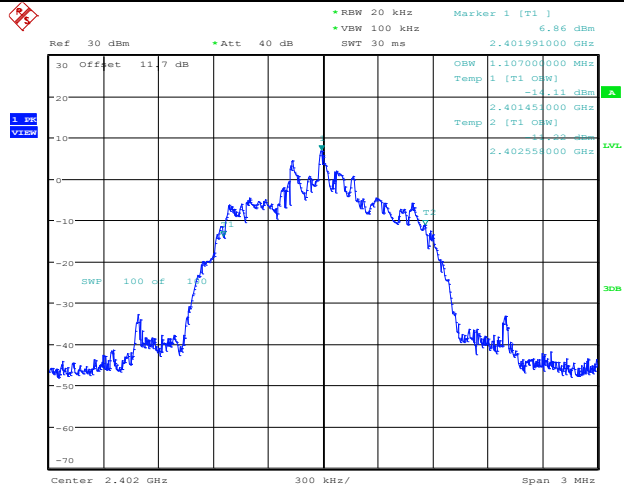


DH1_Ant1_2480



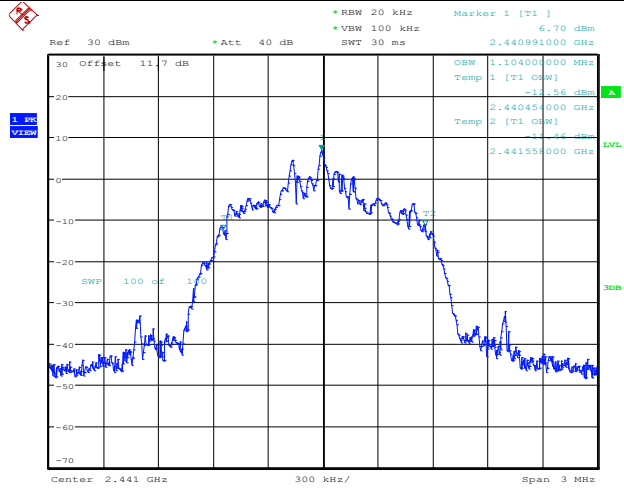
Date: 18.OCT.2023 16:28:03

3DH1_Ant1_2402



Date: 18.OCT.2023 16:31:59

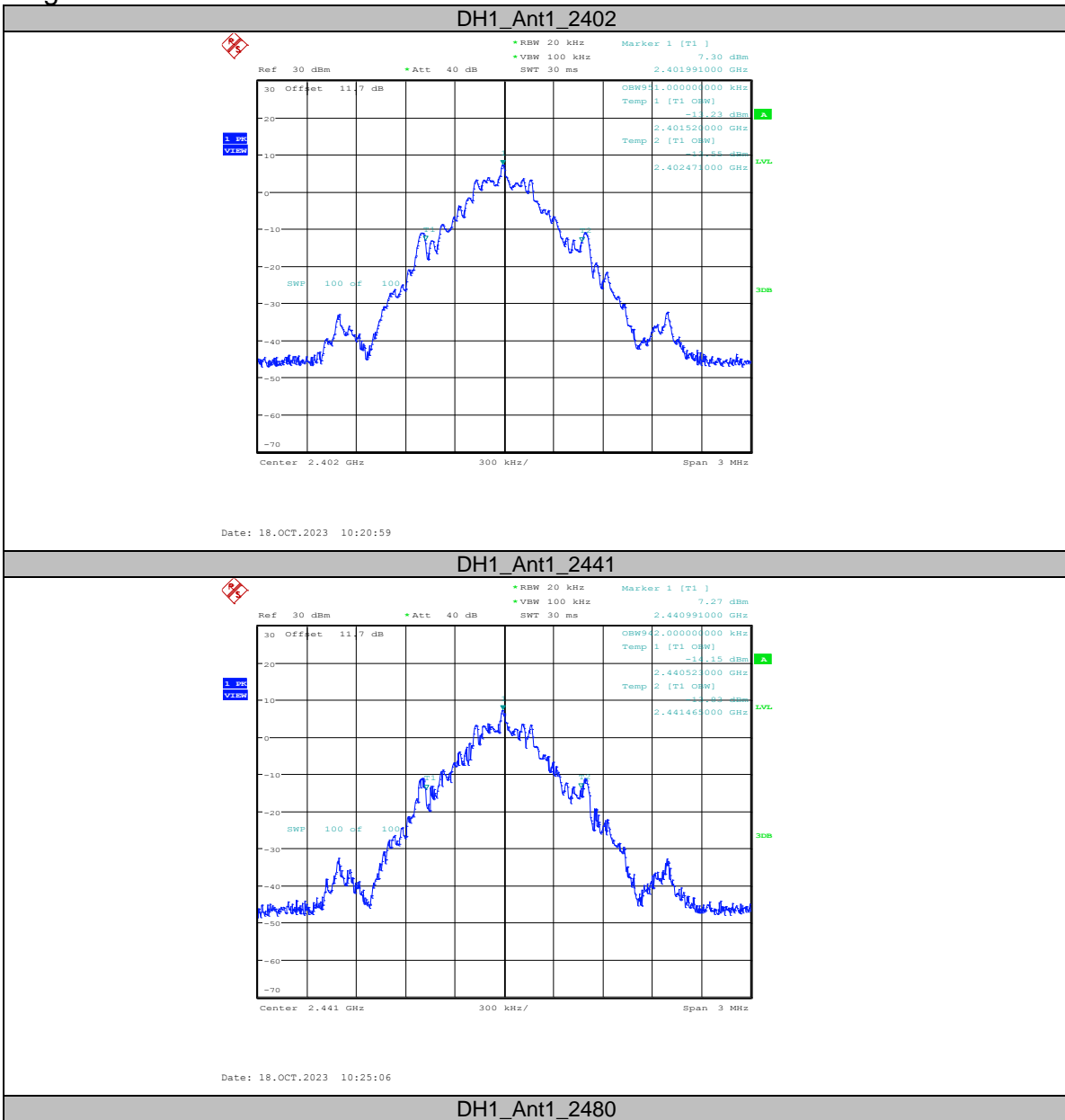
3DH1_Ant1_2441

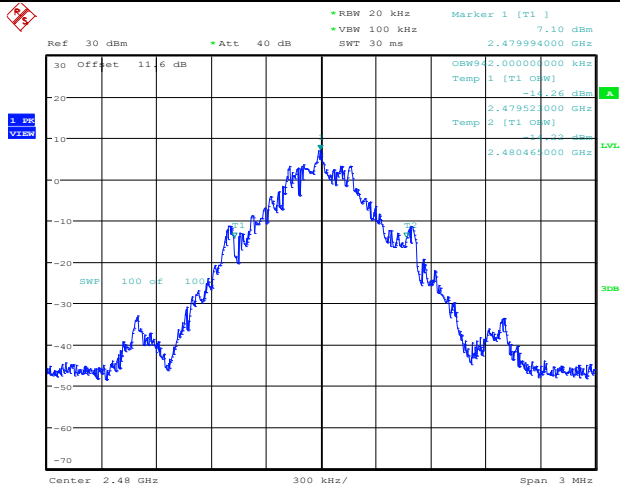


Date: 18.OCT.2023 16:33:35

3DH1_Ant1_2480

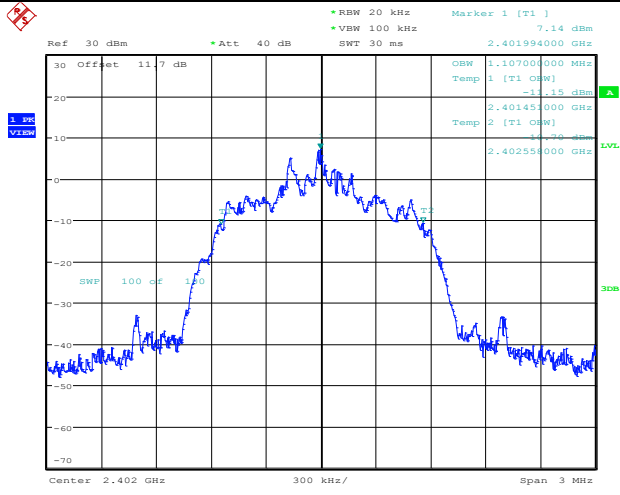
Right:





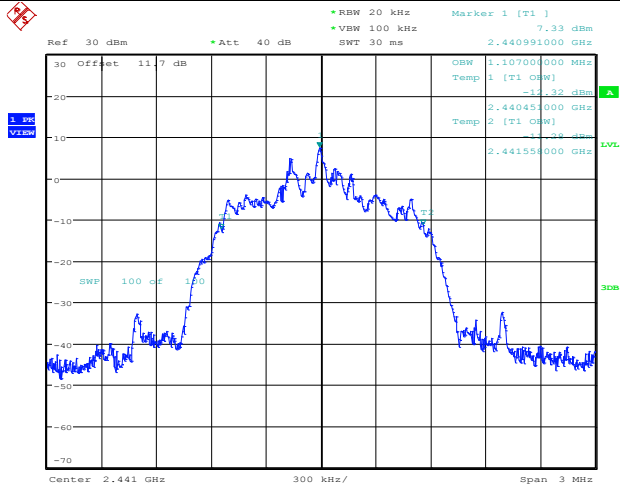
Date: 18.OCT.2023 10:28:55

3DH1_Ant1_2402



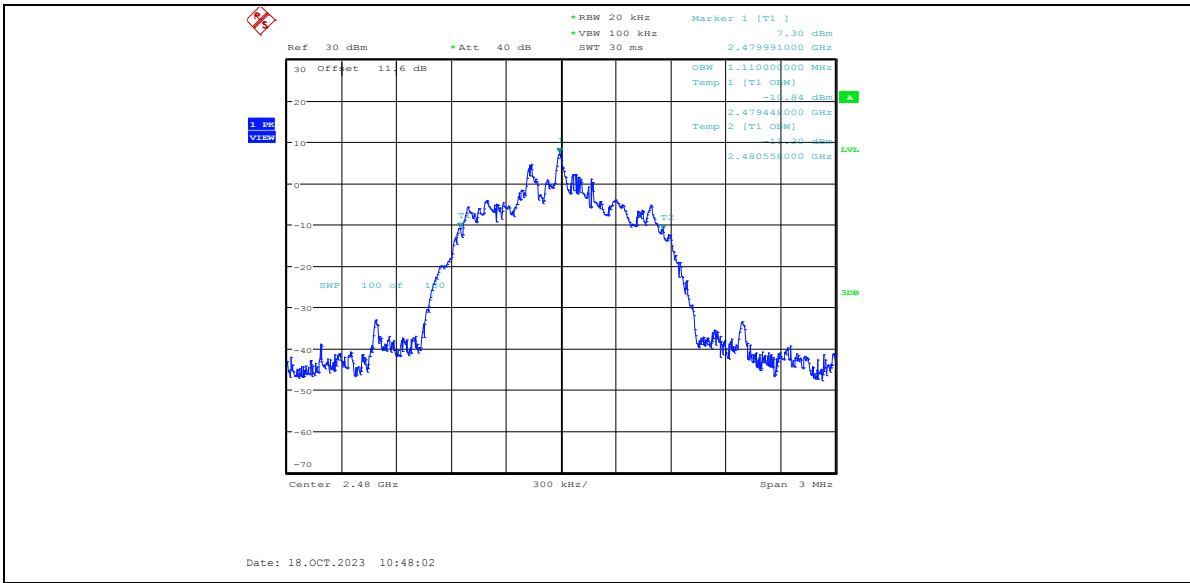
Date: 18.OCT.2023 10:33:21

3DH1_Ant1_2441



Date: 18.OCT.2023 10:45:09

3DH1_Ant1_2480



15. 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.

According to RSS-GEN Section 6.8, 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 EUT has a built in antenna which is integrated inside the enclosure, this is permanently attached antenna and meets the requirements of this section.

15.1. Antenna Connector

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

15.2. Antenna Gain

The antenna gain of EUT is less than 6 dBi.

END OF REPORT