



TEST REPORT

Report No. : **CTC2024283513**

FCC ID : **2AR24-X4K-BOX**

Applicant : **Shenzhen Absen Optoelectronic Co., Ltd**

Address : 18-20/F, Tower A, Building 3, Phase I, Tian An Cloud Park,
NO.2018, Xuegang Rd, Bantian, Longgang District, Shenzhen,
Guangdong, P.R. China

Manufacturer : Shenzhen Absen Optoelectronic Co., Ltd

Address : 18-20/F, Tower A, Building 3, Phase I, Tian An Cloud Park,
NO.2018, Xuegang Rd, Bantian, Longgang District, Shenzhen,
Guangdong, P.R. China

Product Name : **LED Multimedia Processor**

Trade Mark : **Abjen**

Model/Type reference : Absen X4K-BOX

Listed Model(s) : /

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

Test Report Form No : CTC-TR-059_A2

Master TRF : Dated 2025-05-12

Date of receipt of test sample : Dec. 20, 2024

Date of testing : Feb. 22, 2025 ~ Mar. 19, 2025

Date of issue : Jul. 02, 2025

Result : **PASS**

Compiled by:

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Lucy Lan

Supervised by:

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Approved by:

(Printed name+signature)

Totti Zhao

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Society : yz.cncaq.com



1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

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

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

1.2. Report Version

Revised No.	Report No.	Date of issue	Description
01	CTC2024283513	Jul. 02, 2025	Original

1.3. Test Description

FCC Part 15 Subpart C (15.247)			
Test Item	Standard Section	Result	Test Engineer
Antenna Requirement	15.203	Pass	Marrow
Conducted Emission	15.207	Pass	Marrow
Restricted Bands	15.205	Pass	Marrow
Hopping Channel Separation	15.247(a)(1)	Pass	Marrow
Dwell Time	15.247(a)(iii)	Pass	Marrow
Peak Output Power	15.247(b)(1)	Pass	Marrow
Number of Hopping Frequency	15.247(a)(iii)	Pass	Marrow
Conducted Band Edge and Spurious Emissions	15.247(d)	Pass	Marrow
Radiated Band Edge and Spurious Emissions	15.205&15.209&15.247(d)	Pass	Marrow
Radiated Spurious Emission	15.247(d) &15.209	Pass	Marrow
20dB Bandwidth	15.247(a)	Pass	Marrow

Note:

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

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TRF No: CTC-TR-059_A2



1.4. Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: Room 107, 108, 207, 208, 303 of Building A, Room 101 of Building B, No.7, Lanqing 1st Road, Luhu Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China

Laboratory accreditation

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

A2LA-Lab Cert. No.: 4340.01

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

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

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

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

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



1.5. Measurement Uncertainty

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

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

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

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

1.6. Environmental Conditions

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

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



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Shenzhen Absen Optoelectronic Co., Ltd
Address:	18-20/F, Tower A, Building 3, Phase I, Tian An Cloud Park, NO.2018, Xuegang Rd, Bantian, Longgang District, Shenzhen, Guangdong, P.R. China
Manufacturer:	Shenzhen Absen Optoelectronic Co., Ltd
Address:	18-20/F, Tower A, Building 3, Phase I, Tian An Cloud Park, NO.2018, Xuegang Rd, Bantian, Longgang District, Shenzhen, Guangdong, P.R. China
Factory:	Huizhou Absen Optoelectronic Limited.
Address:	No. 03, Donghua South road, Dongjiang Hi-tech Industry Park, Huizhou. Guangdong, China

2.2. General Description of EUT

Product Name:	LED Multimedia Processor
Trade Mark:	
Model/Type reference:	Absen X4K-BOX
Listed Model(s):	/
Model Difference:	/
Sample ID:	CTC241127-005-S002
Power Supply:	INPUT: 100-240V~50/60Hz 11.5A
Hardware Version:	/
Software Version:	/
Bluetooth 5.0 / BR+EDR	
Modulation:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation Frequency:	2402MHz~2480MHz
Channel Number:	79
Channel Separation:	1MHz
Antenna Type:	PCB Antenna
Antenna Gain:	2.98dBi



2.3. Accessory Equipment Information

Equipment Information			
Name	Model	S/N	Manufacturer
Notebook	ThinkPad T460s	/	Lenovo
Cable Information			
Name	Shielded Type	Ferrite Core	Length
LAN Cable	Unshielded	NO	150cm
Test Software Information			
Name	Version	/	/
Secure CRT	/	/	/



2.4. Operation State

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

Operation Frequency List:

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

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

Test Mode:

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



2.5. Measurement Instruments List

RF Test System - SRD					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Spectrum Analyzer	R&S	FSV40-N	101654	Aug. 06, 2025
2	EXG Analog Signal Generator	Keysight	N5173B	MY59100842	Dec. 12, 2025
3	MXG Vector Signal Generator	Keysight	N5182B	MY59100212	Dec. 12, 2025
4	Wideband Radio Communication Tester	R&S	CMW500	102257	May 24, 2025
5	RF Control Unit	Tonscend	JS0806-2	/	Aug. 21, 2025
6	High and low temperature test chamber	ESPEC	MT3035	/	Mar. 21, 2025
7	Test Software	Tonscend	JS1120-3	V3.3.38	/

Radiated emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9163	01026	Dec. 24, 2025
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-647	Sep. 25, 2025
3	Test Receiver	Keysight	N9038A	MY56400071	Dec. 12, 2025
4	Broadband Amplifier	Schwarzbeck	BBV9743B	259	Dec. 12, 2025
5	Mirowave Broadband Amplifier	Schwarzbeck	BBV9718C	111	Dec. 12, 2025
6	3m chamber 3	YIHENG	EE106	/	Aug. 28, 2026
7	Test Software	FARA	EZ-EMC	FA-03A2	/

Conducted emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	R&S	ENV216	101112	Dec. 12, 2025
2	LISN	R&S	ENV216	101113	Dec. 12, 2025
3	EMI Test Receiver	R&S	ESCI	100524	Dec. 12, 2025
4	ISN CAT6	Schwarzbeck	NTFM 8158	CAT6-8158-0046	Dec. 12, 2025
5	ISN CAT5	Schwarzbeck	NTFM 8158	CAT5-8158-0046	Dec. 12, 2025
6	Test Software	R&S	EMC32	6.10.10	/

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

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

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

3. TEST ITEM AND RESULTS

3.1. Conducted Emission

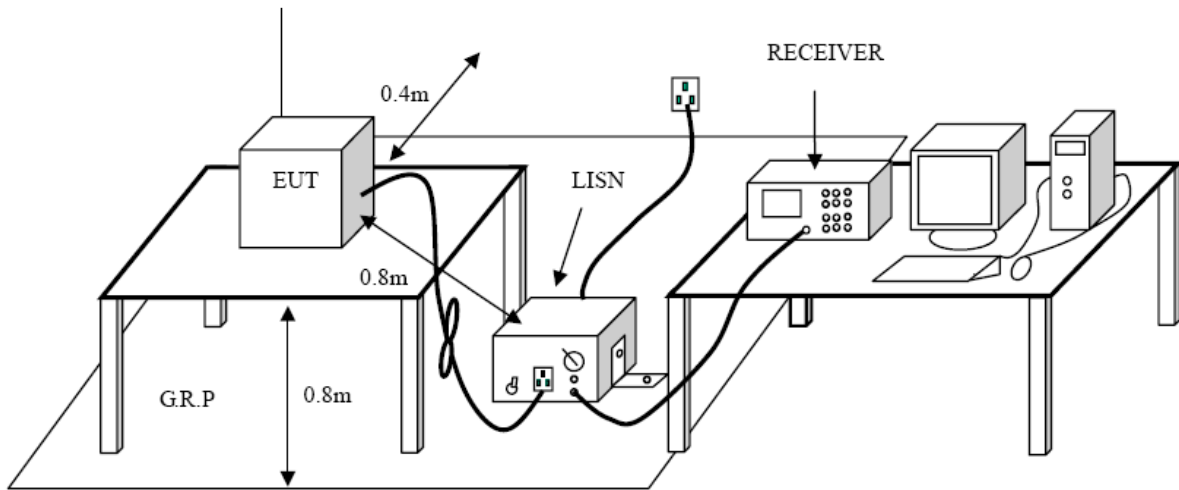
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46 *
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

Test Configuration



Test Procedure

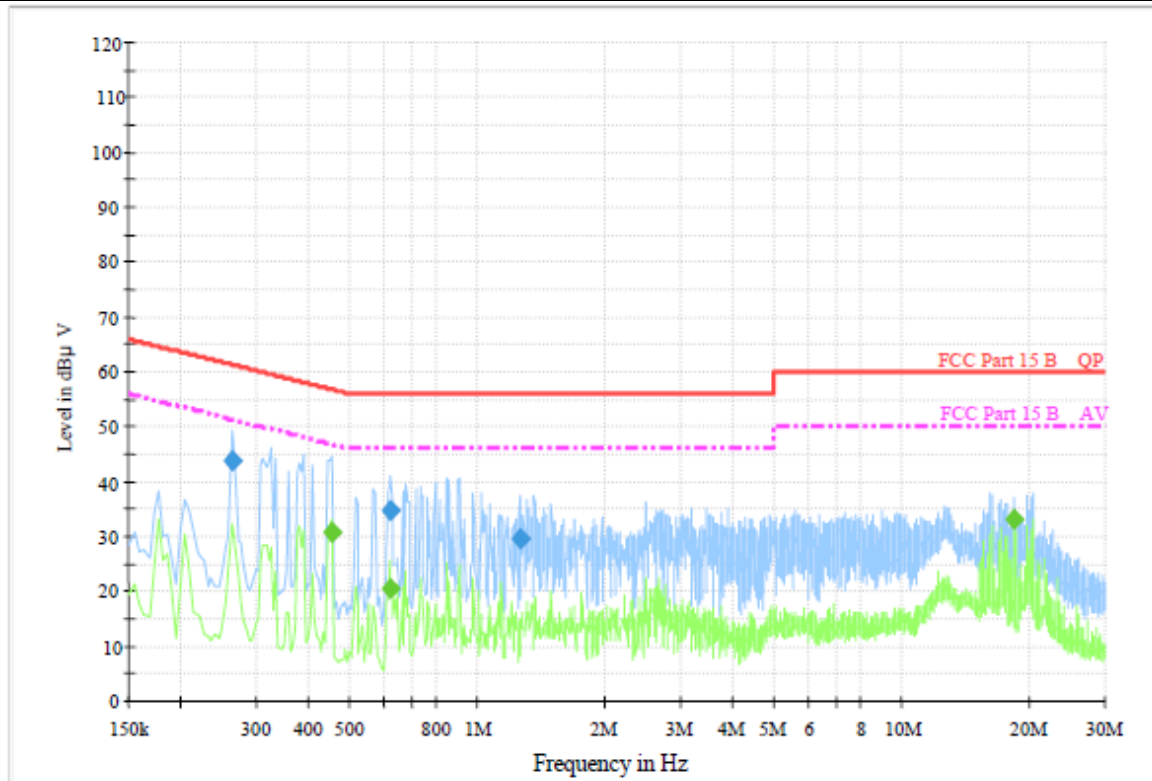
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from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

Test Mode

Please refer to the clause 2.4.

**Test Result**

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

**Final Measurement Detector 1**

Frequency (MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.262500	43.9	1000.00	9.000	On	L1	9.5	17.5	61.4	
0.622500	34.8	1000.00	9.000	On	L1	9.5	21.2	56.0	
1.252500	29.6	1000.00	9.000	On	L1	9.7	26.4	56.0	

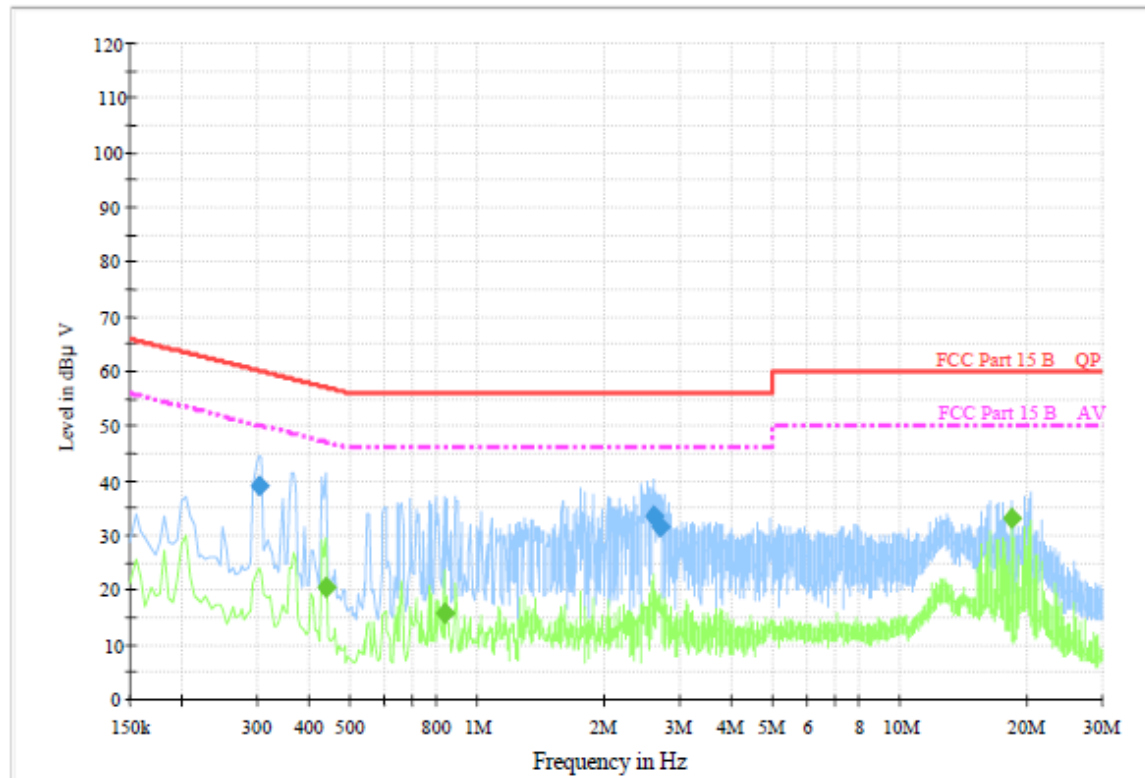
Final Measurement Detector 2

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.451500	30.7	1000.00	9.000	On	L1	9.4	16.1	46.8	
0.618000	20.4	1000.00	9.000	On	L1	9.5	25.6	46.0	
18.244500	33.3	1000.00	9.000	On	L1	9.8	16.7	50.0	

Emission Level = Read Level + Correct Factor



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



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.303000	39.0	1000.00	9.000	On	N	9.5	21.2	60.2	
2.611500	33.5	1000.00	9.000	On	N	9.6	22.5	56.0	
2.710500	31.5	1000.00	9.000	On	N	9.5	24.5	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.438000	20.5	1000.00	9.000	On	N	9.4	26.6	47.1	
0.829500	15.8	1000.00	9.000	On	N	9.6	30.2	46.0	
18.244500	33.0	1000.00	9.000	On	N	9.8	17.0	50.0	

Emission Level = Read Level + Correct Factor

3.2. Radiated Emission

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.209

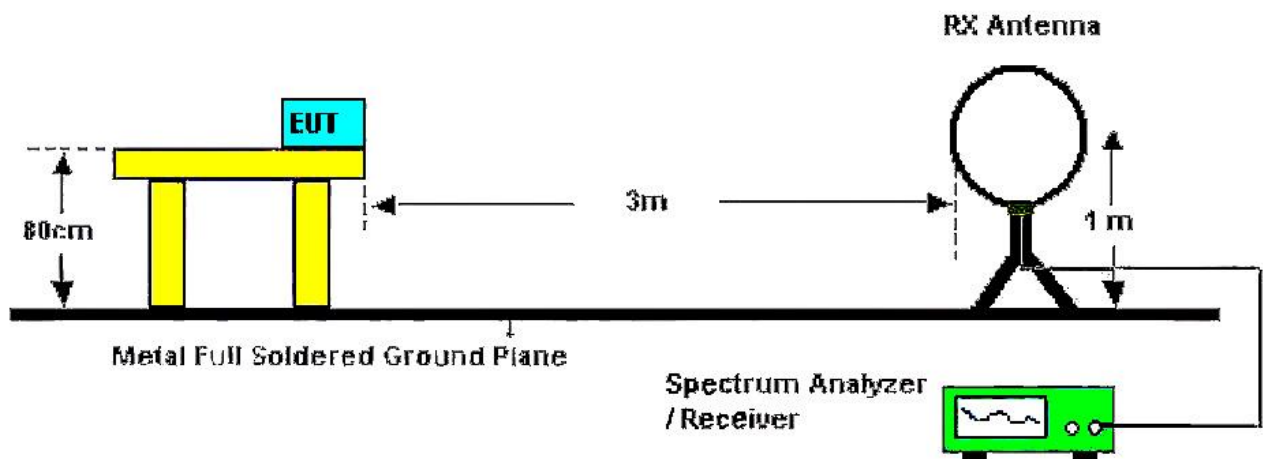
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

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

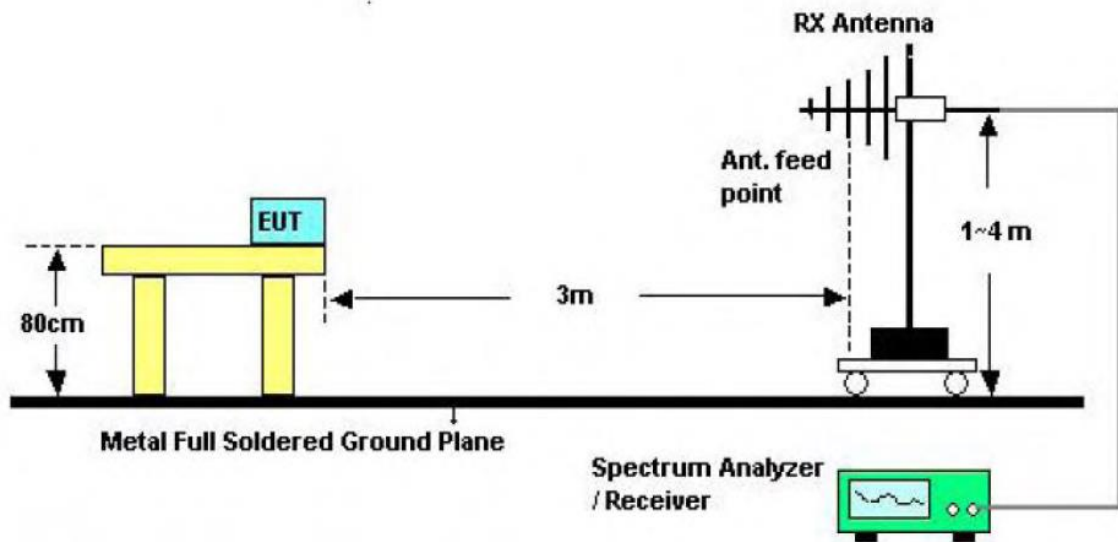
Note:

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

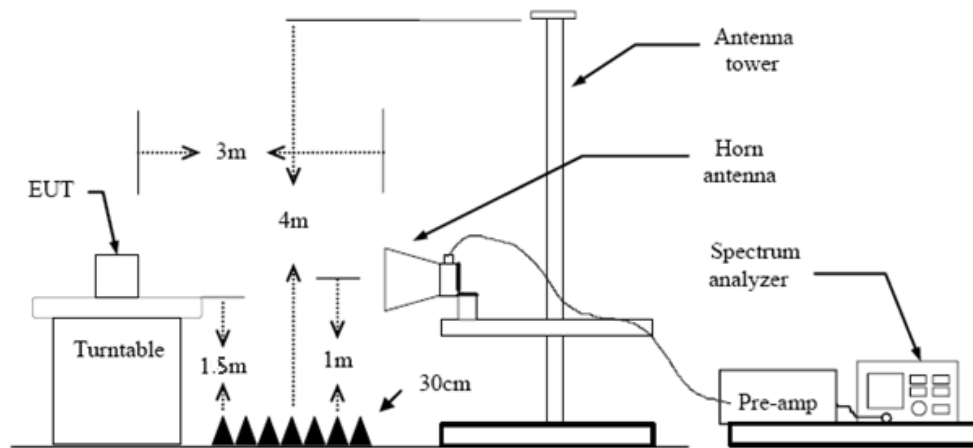
Test Configuration



Below 30MHz Test Setup



30-1000MHz Test Setup



Above 1GHz Test Setup

Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) 9k – 150kHz:
RBW=300 Hz, VBW=1 kHz, Sweep=auto, Detector function=peak, Trace=max hold
 - (3) 0.15M – 30MHz:
RBW=10 kHz, VBW=30 kHz, Sweep=auto, Detector function=peak, Trace=max hold
 - (4) 30M - 1 GHz:
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold



If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

(5) From 1 GHz to 10th harmonic:

RBW=1MHz, VBW=3MHz Peak detector for Peak value.

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

Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

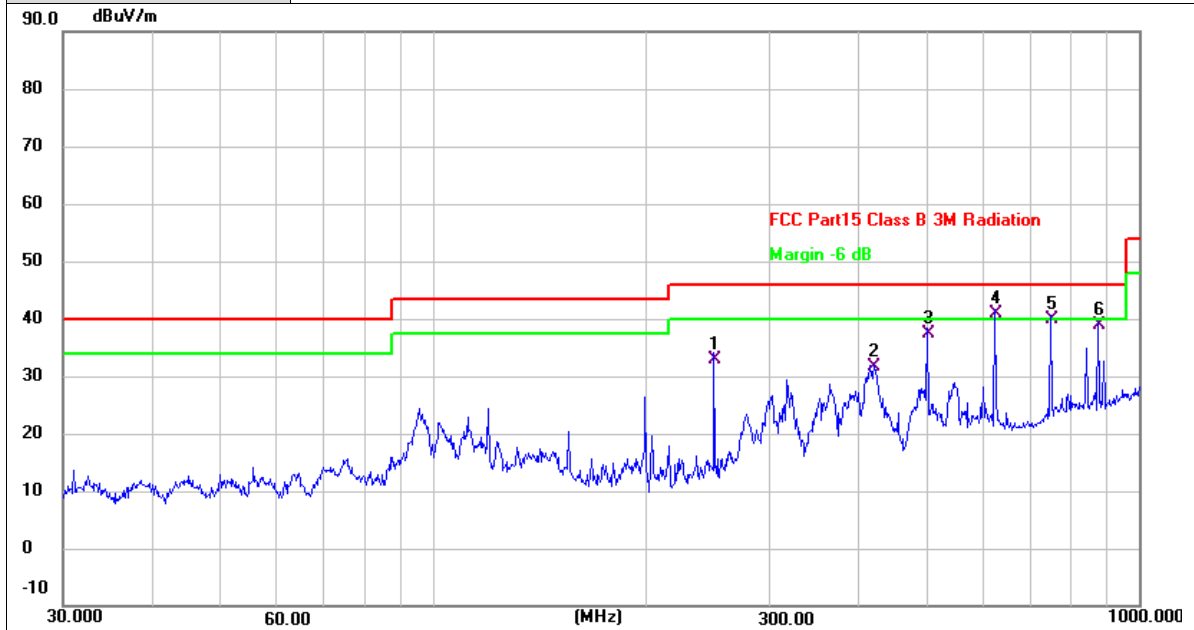
Test Result

9 kHz~30 MHz

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

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

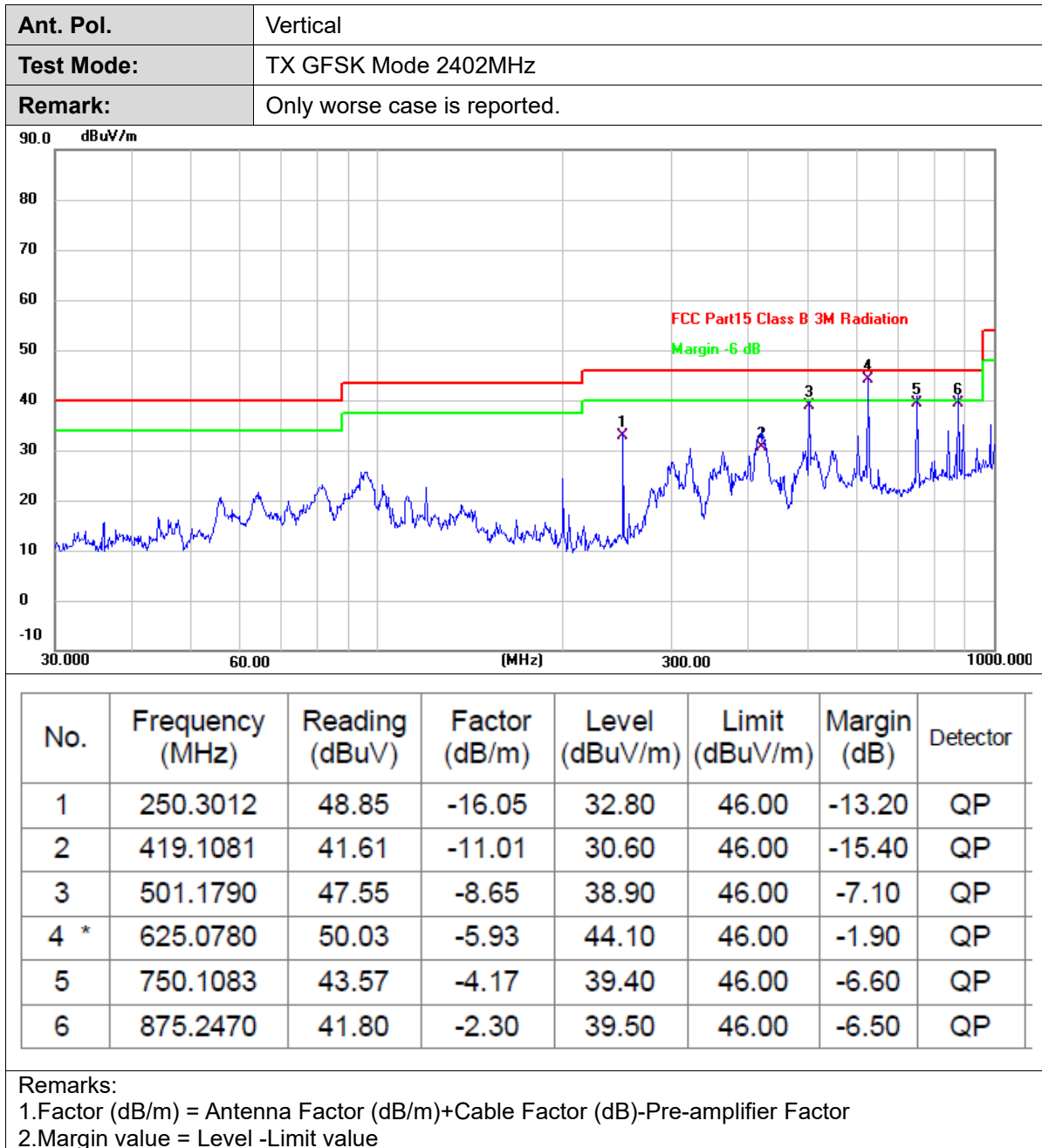
Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2402MHz
Remark:	Only worse case is reported.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	250.3012	48.85	-16.05	32.80	46.00	-13.20	QP
2	422.0577	42.52	-10.92	31.60	46.00	-14.40	QP
3	501.1790	46.05	-8.65	37.40	46.00	-8.60	QP
4 *	625.0780	46.73	-5.93	40.80	46.00	-5.20	QP
5	750.1083	44.07	-4.17	39.90	46.00	-6.10	QP
6	875.2470	41.10	-2.30	38.80	46.00	-7.20	QP

Remarks:

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





Above 1GHz

Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4803.193	39.74	1.84	41.58	74.00	-32.42	peak
2 *	4804.205	25.76	1.84	27.60	54.00	-26.40	AVG

Remarks:

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

2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX GFSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.875	25.92	1.84	27.76	54.00	-26.24	AVG
2	4804.691	40.97	1.84	42.81	74.00	-31.19	peak

Remarks:

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

2.Margin value = Level -Limit value



Ant. Pol.	Horizontal						
Test Mode:	TX GFSK Mode 2441MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4882.034	26.10	1.96	28.06	54.00	-25.94	AVG
2	4882.585	40.04	1.96	42.00	74.00	-32.00	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX GFSK Mode 2441MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBUV)	Factor (dB/m)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector
1 *	4881.292	26.02	1.96	27.98	54.00	-26.02	AVG
2	4882.741	40.65	1.97	42.62	74.00	-31.38	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX GFSK Mode 2480MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4959.527	25.11	2.08	27.19	54.00	-26.81	AVG
2	4960.240	38.89	2.08	40.97	74.00	-33.03	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX GFSK Mode 2480MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4959.761	24.82	2.08	26.90	54.00	-27.10	AVG
2	4960.731	39.15	2.08	41.23	74.00	-32.77	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX $\pi/4$ -DQPSK Mode 2402MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.597	25.96	1.84	27.80	54.00	-26.20	AVG
2	4804.111	39.83	1.84	41.67	74.00	-32.33	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX $\pi/4$ -DQPSK Mode 2402MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.699	26.19	1.84	28.03	54.00	-25.97	AVG
2	4803.834	39.49	1.84	41.33	74.00	-32.67	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX $\pi/4$ -DQPSK Mode 2441MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.220	40.18	1.96	42.14	74.00	-31.86	peak
2 *	4882.905	26.22	1.97	28.19	54.00	-25.81	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX $\pi/4$ -DQPSK Mode 2441MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.067	40.66	1.96	42.62	74.00	-31.38	peak
2 *	4881.214	26.09	1.96	28.05	54.00	-25.95	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX $\pi/4$ -DQPSK Mode 2480MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.215	39.01	2.08	41.09	74.00	-32.91	peak
2 *	4959.805	24.97	2.08	27.05	54.00	-26.95	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX $\pi/4$ -DQPSK Mode 2480MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4960.082	25.01	2.08	27.09	54.00	-26.91	AVG
2	4960.973	38.79	2.08	40.87	74.00	-33.13	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX 8-DPSK Mode 2402MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.067	26.31	1.84	28.15	54.00	-25.85	AVG
2	4803.131	40.73	1.84	42.57	74.00	-31.43	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX 8-DPSK Mode 2402MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.026	25.85	1.84	27.69	54.00	-26.31	AVG
2	4804.731	40.39	1.84	42.23	74.00	-31.77	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX 8-DPSK Mode 2441MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.103	40.65	1.96	42.61	74.00	-31.39	peak
2 *	4882.980	26.19	1.97	28.16	54.00	-25.84	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX 8-DPSK Mode 2441MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.837	40.54	1.96	42.50	74.00	-31.50	peak
2 *	4882.409	25.87	1.96	27.83	54.00	-26.17	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal						
Test Mode:	TX 8-DPSK Mode 2480MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBUV)	Factor (dB/m)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector
1 *	4959.993	24.94	2.08	27.02	54.00	-26.98	AVG
2	4960.131	38.74	2.08	40.82	74.00	-33.18	peak
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

Ant. Pol.	Vertical						
Test Mode:	TX 8-DPSK Mode 2480MHz						
Remark:	No report for the emission which more than 20 dB below the prescribed limit.						
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.341	40.81	2.08	42.89	74.00	-31.11	peak
2 *	4960.020	24.93	2.08	27.01	54.00	-26.99	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							

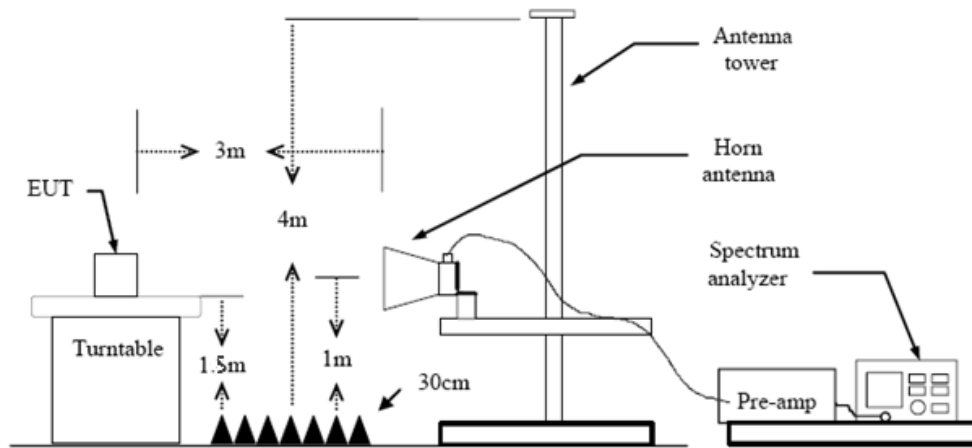
3.3. Band Edge Emissions (Radiated)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)

Restricted Frequency Band (MHz)	(dBμV/m) (at 3m)	
	Peak	Average
2310 ~ 2390	74	54
2483.5 ~ 2500	74	54

Test Configuration



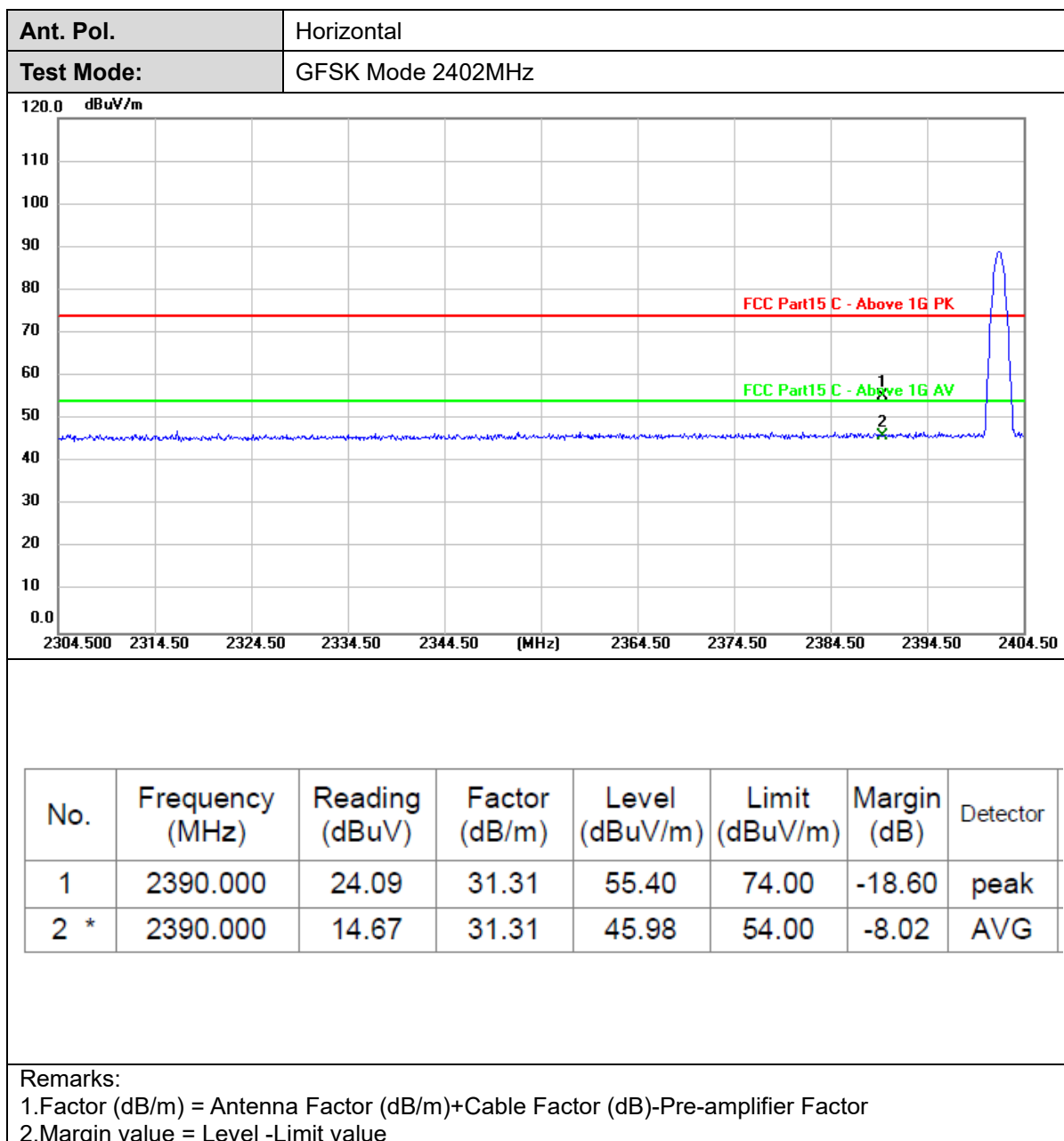
Test Procedure

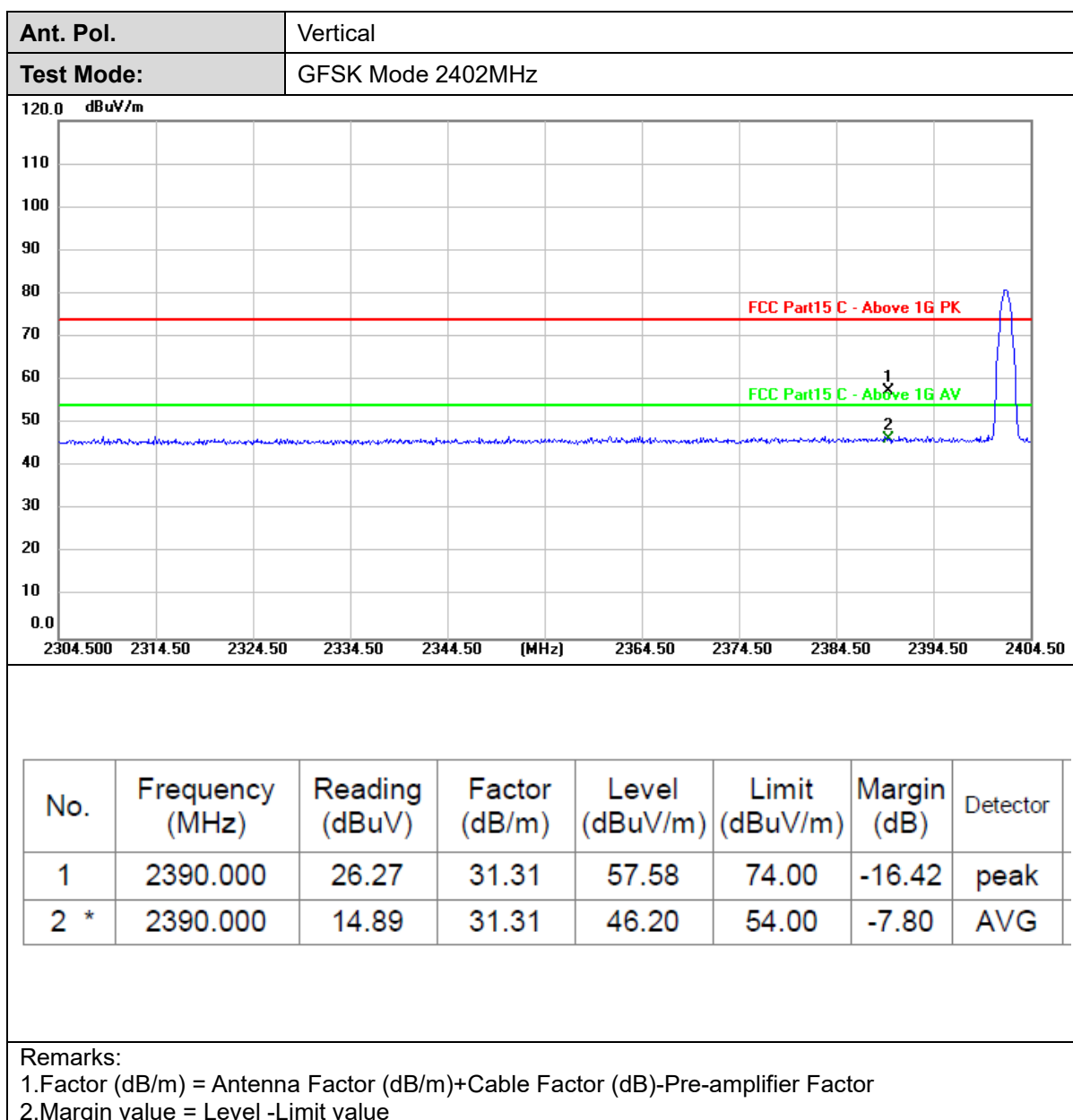
1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna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

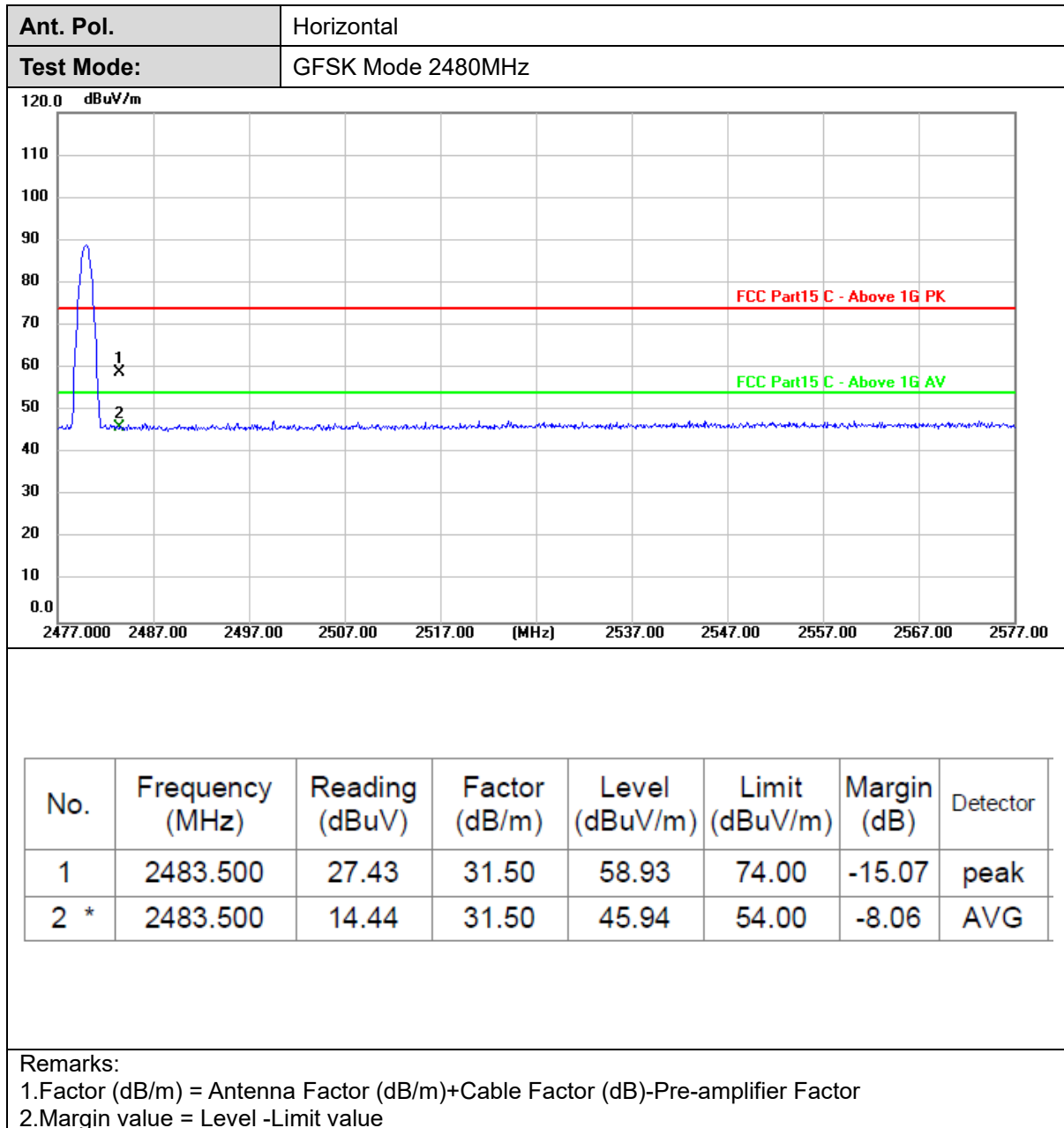
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

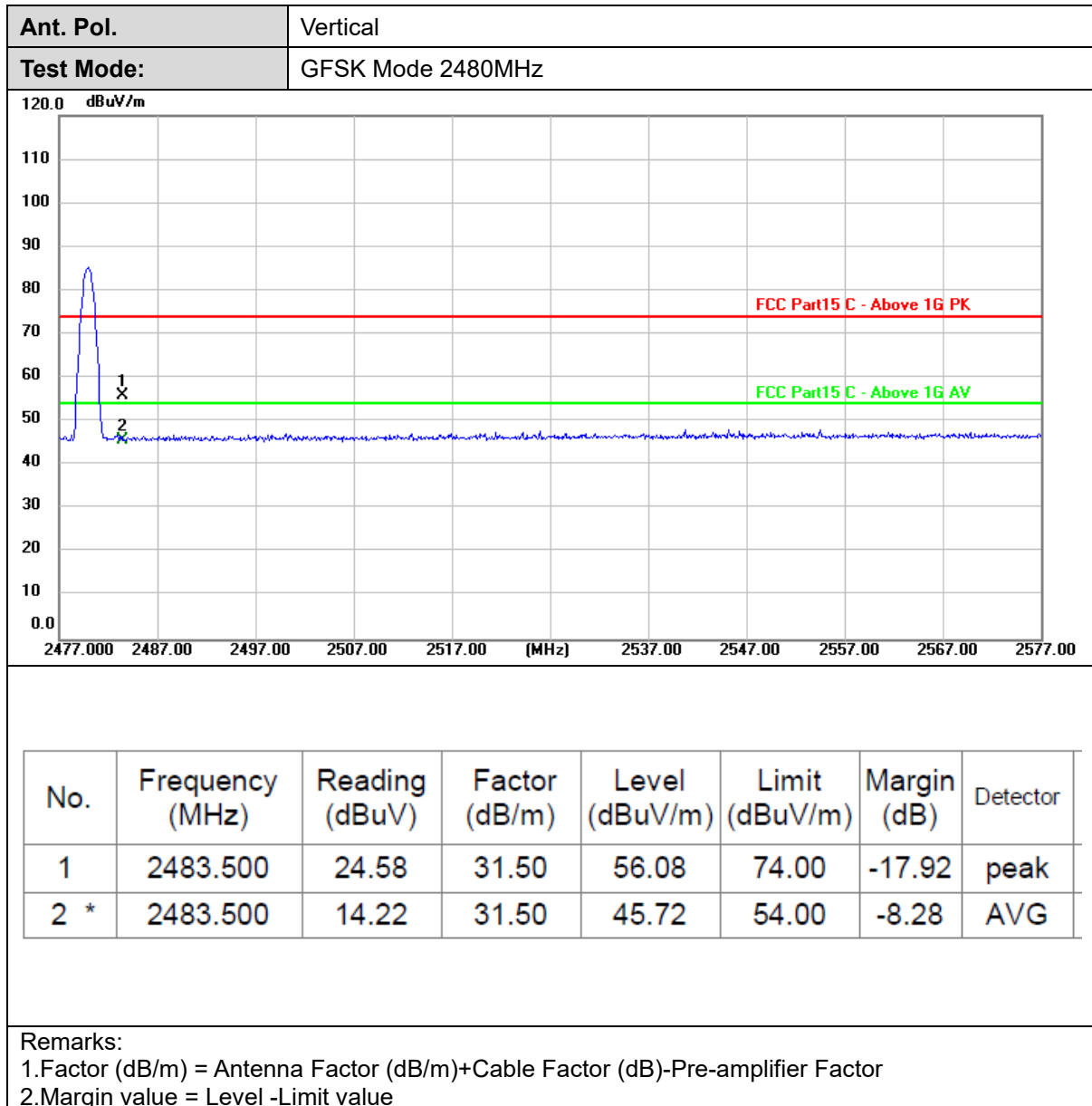
Test Mode

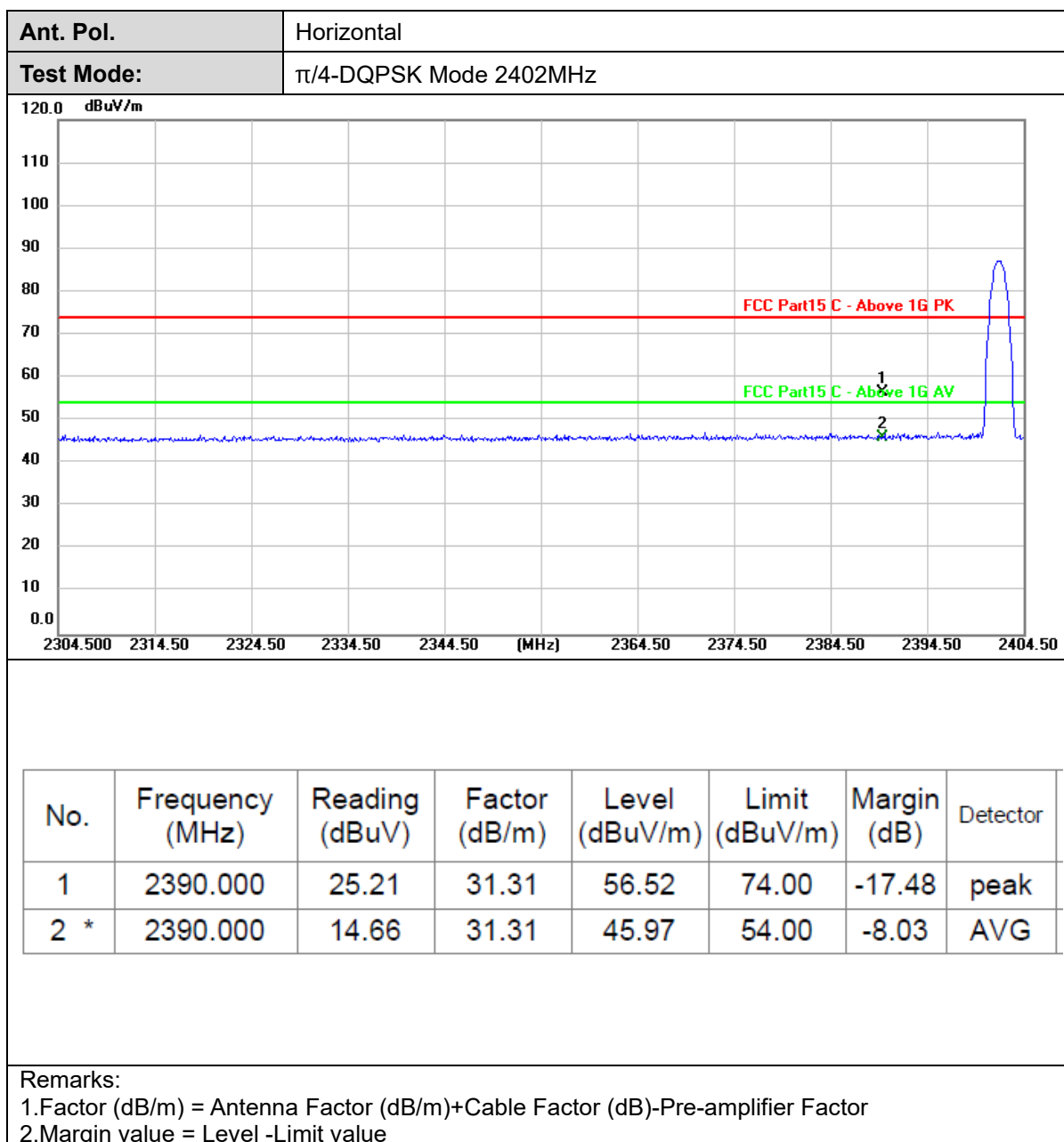
Please refer to the clause 2.4.

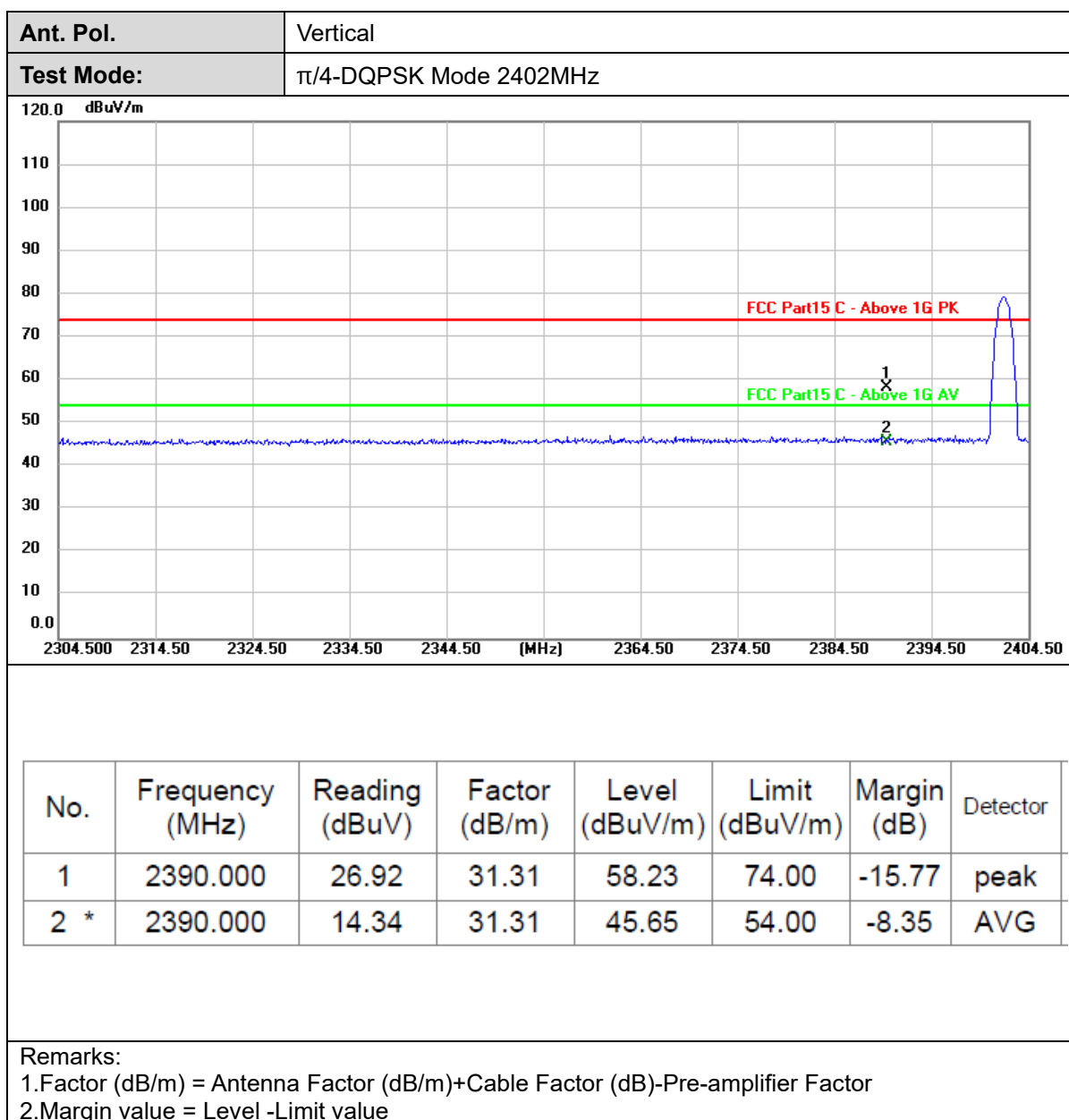
**Test Result**

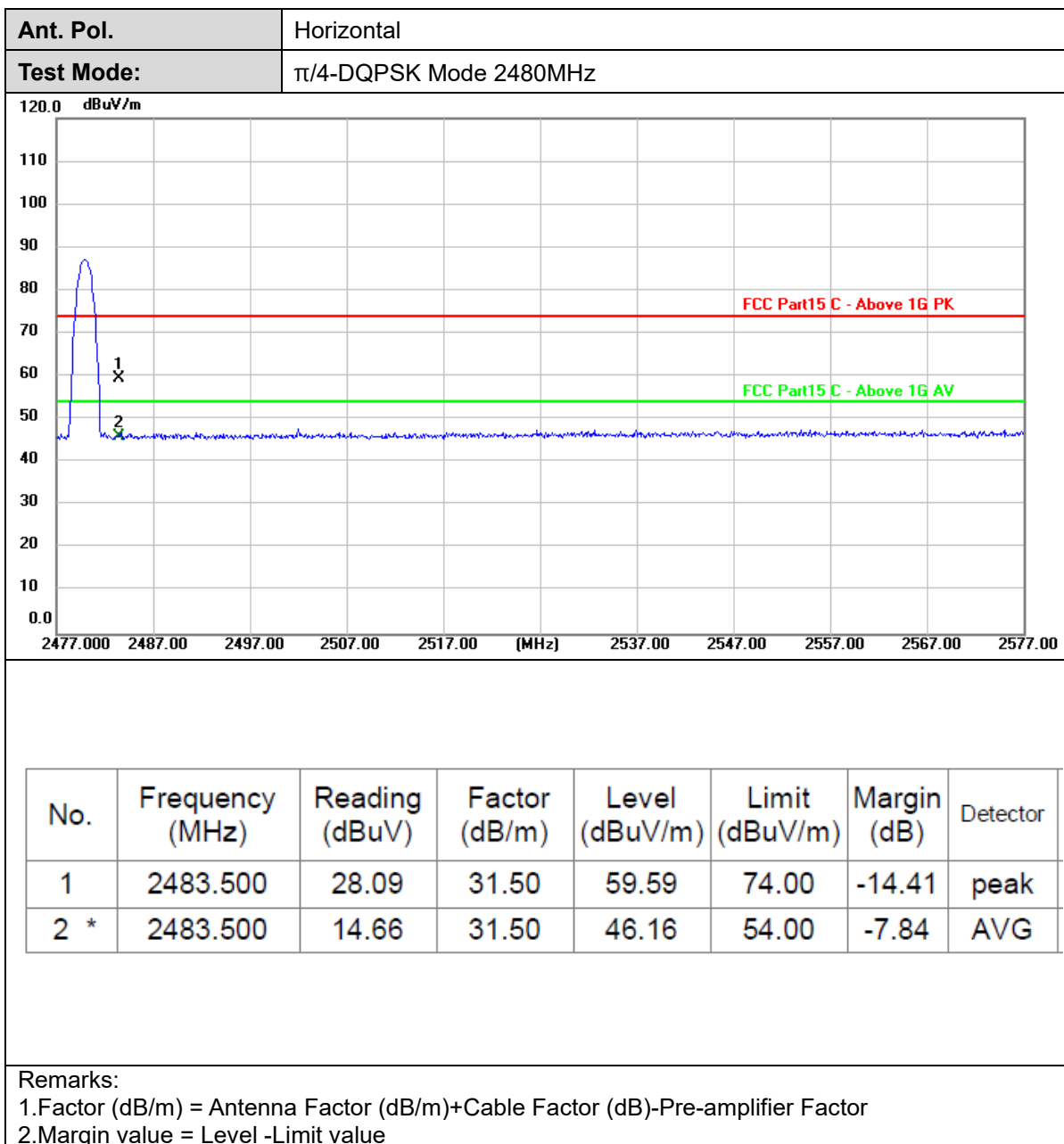


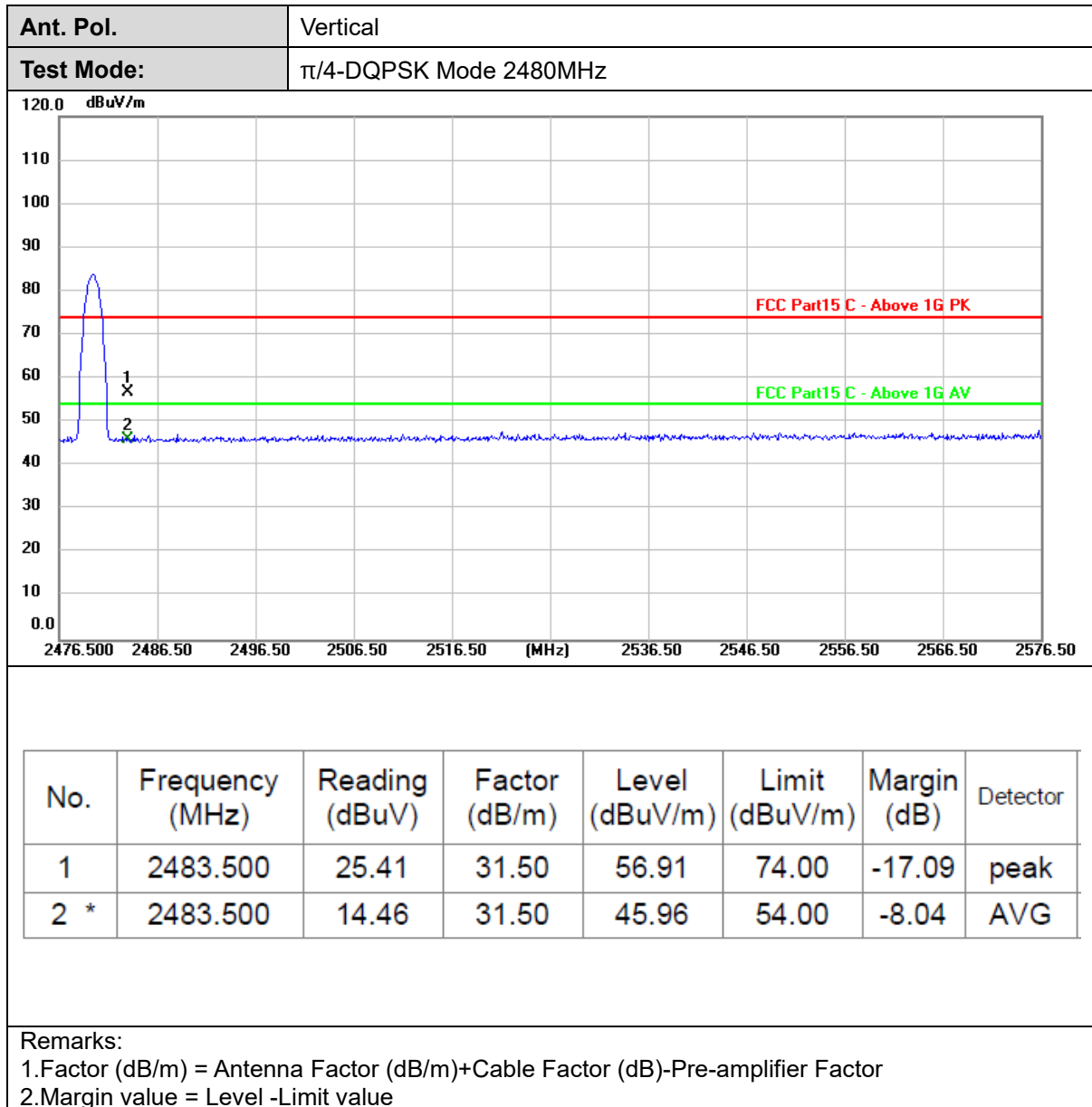


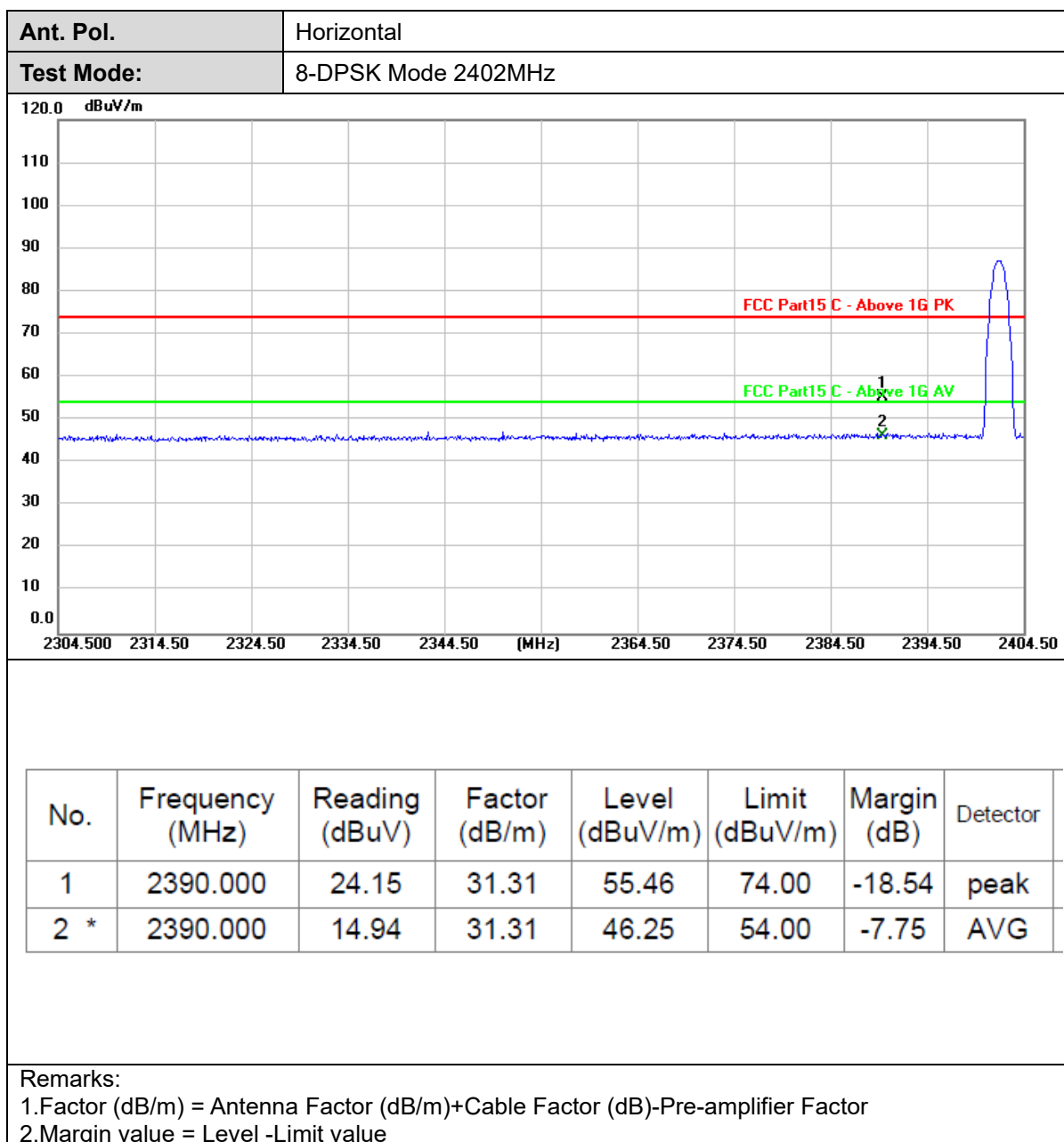


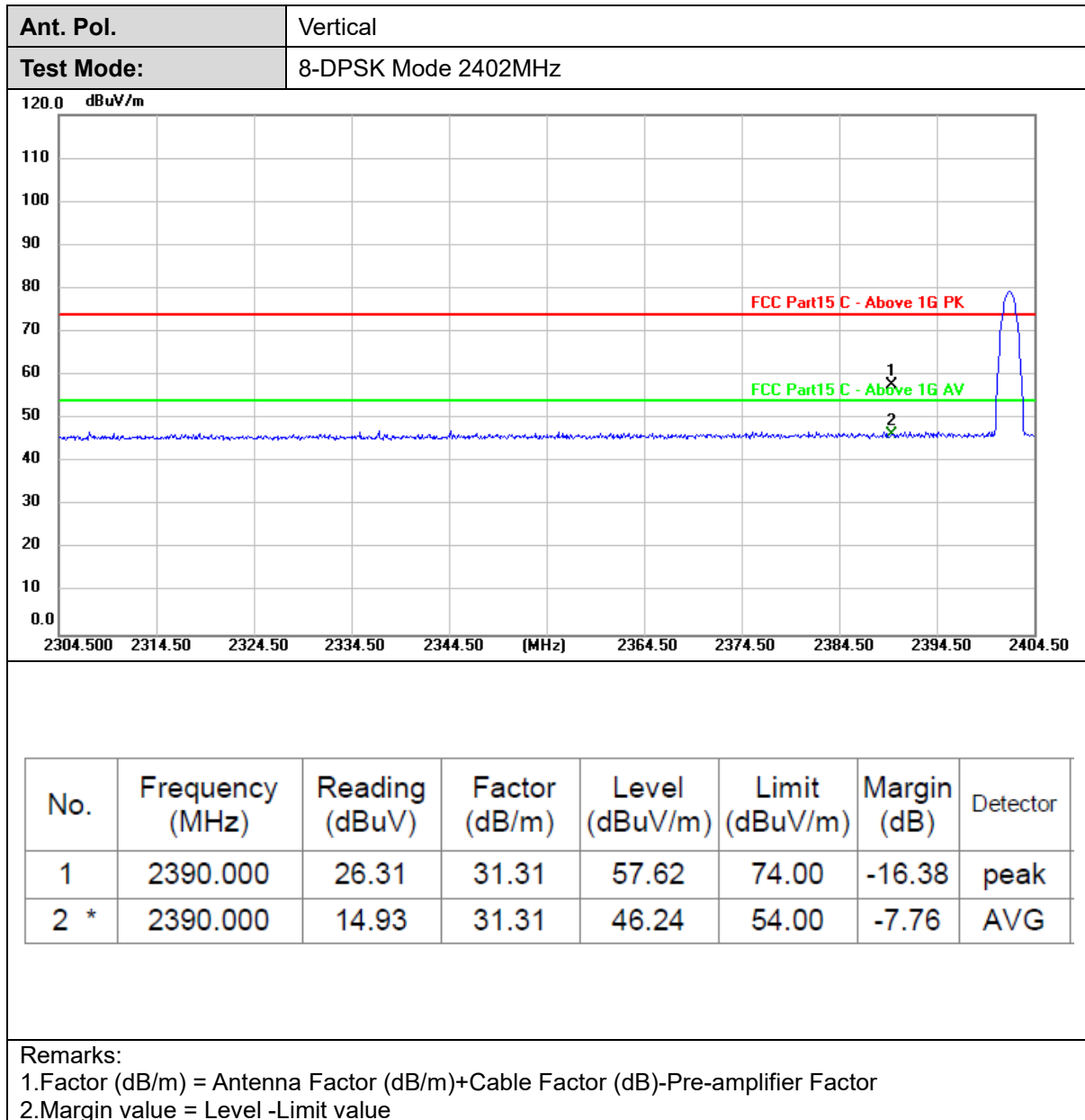


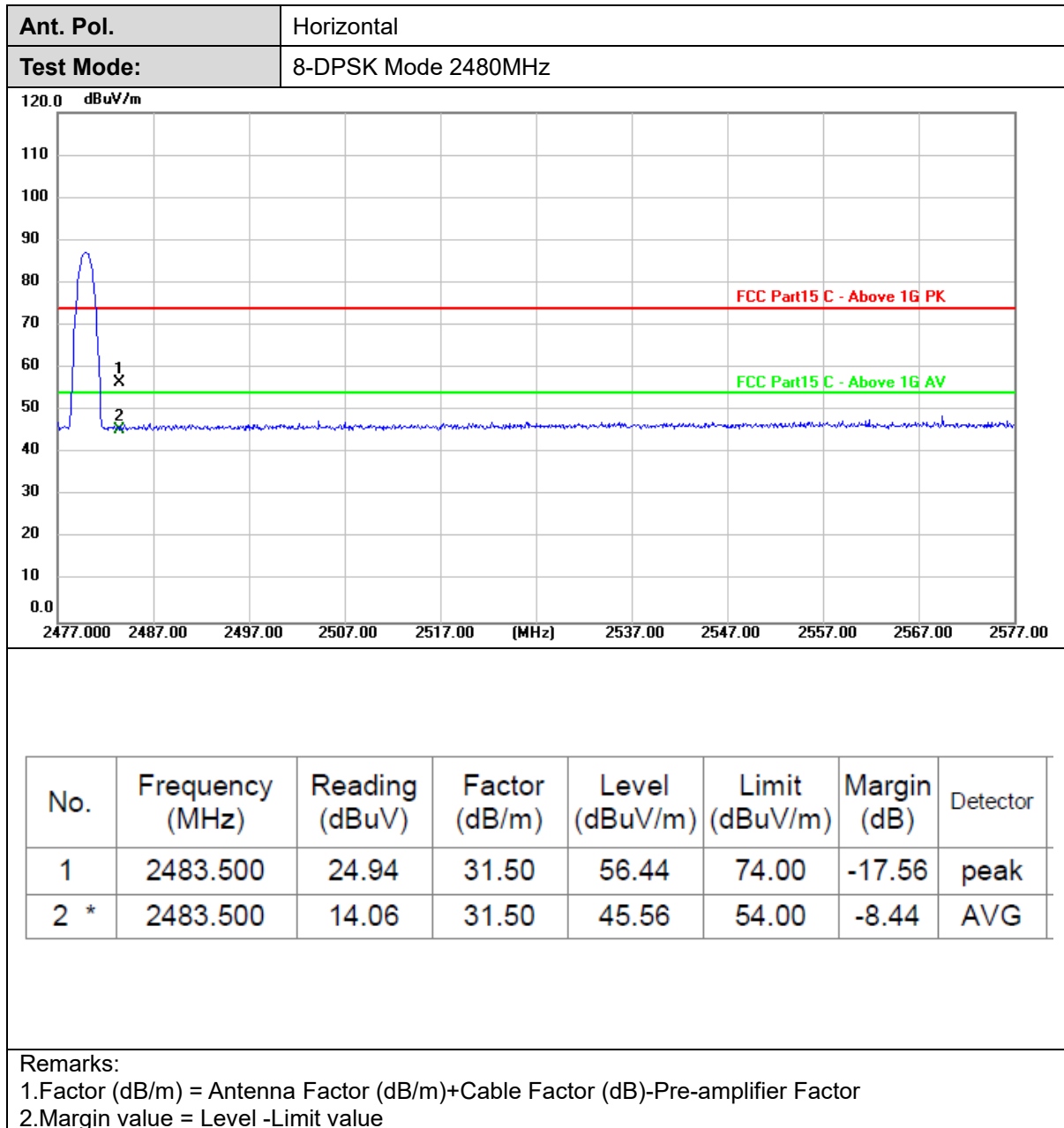


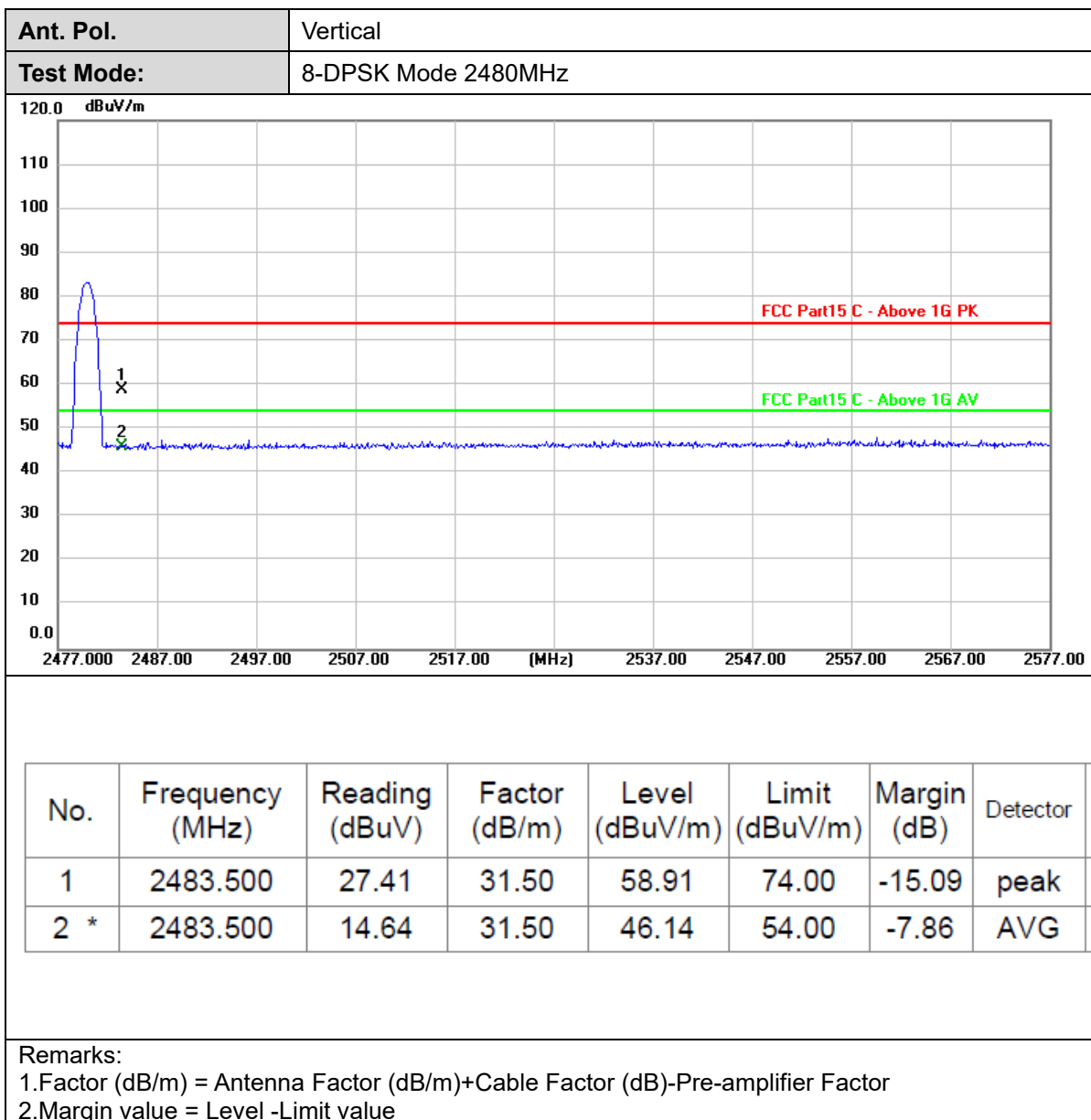












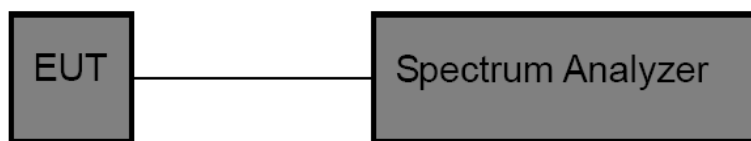
3.4. Band Edge and Spurious Emissions (Conducted)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)

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

Test Configuration



Test Procedure

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

Test Mode

Please refer to the clause 2.4.

Test Result

**Band Edge Conducted Test**

TestMode	Antenna	ChName	Freq(MHz)	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	1.55	-47.07	≤-18.45	PASS
		High	2480	1.61	-46.6	≤-18.39	PASS
		Low	Hop_2402	0.65	-46.97	≤-19.35	PASS
		High	Hop_2480	1.20	-47.02	≤-18.8	PASS
2DH5	Ant1	Low	2402	-0.10	-47.21	≤-20.1	PASS
		High	2480	0.05	-46.59	≤-19.95	PASS
		Low	Hop_2402	0.02	-47.33	≤-19.98	PASS
		High	Hop_2480	0.02	-46.53	≤-19.98	PASS
3DH5	Ant1	Low	2402	1.50	-46.8	≤-18.5	PASS
		High	2480	1.25	-46.64	≤-18.75	PASS
		Low	Hop_2402	0.66	-46.81	≤-19.34	PASS
		High	Hop_2480	1.46	-46.08	≤-18.54	PASS

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TRF No: CTC-TR-059_A2

Society : yz.cncaq.com

**Conducted Spurious Emissions Test**

TestMode	Antenna	Freq(MHz)	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	1.51	1.51	---	PASS
			30~1000	1.51	-48.42	≤-18.49	PASS
			1000~26500	1.51	-40.95	≤-18.49	PASS
		2441	Reference	1.76	1.76	---	PASS
			30~1000	1.76	-47.55	≤-18.24	PASS
			1000~26500	1.76	-40.78	≤-18.24	PASS
		2480	Reference	1.72	1.72	---	PASS
			30~1000	1.72	-48.02	≤-18.28	PASS
			1000~26500	1.72	-41.11	≤-18.28	PASS
2DH5	Ant1	2402	Reference	1.30	1.30	---	PASS
			30~1000	1.30	-48.23	≤-18.7	PASS
			1000~26500	1.30	-40.37	≤-18.7	PASS
		2441	Reference	0.90	0.90	---	PASS
			30~1000	0.90	-48.11	≤-19.1	PASS
			1000~26500	0.90	-40.98	≤-19.1	PASS
		2480	Reference	1.08	1.08	---	PASS
			30~1000	1.08	-48.39	≤-18.92	PASS
			1000~26500	1.08	-41.14	≤-18.92	PASS
3DH5	Ant1	2402	Reference	1.42	1.42	---	PASS
			30~1000	1.42	-47.67	≤-18.58	PASS
			1000~26500	1.42	-41.53	≤-18.58	PASS
		2441	Reference	1.04	1.04	---	PASS
			30~1000	1.04	-48.07	≤-18.96	PASS
			1000~26500	1.04	-39.97	≤-18.96	PASS
		2480	Reference	1.24	1.24	---	PASS
			30~1000	1.24	-48.57	≤-18.76	PASS
			1000~26500	1.24	-41.61	≤-18.76	PASS

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Society : yz.cncaq.com



Band Edge Conducted Test plot as follows:



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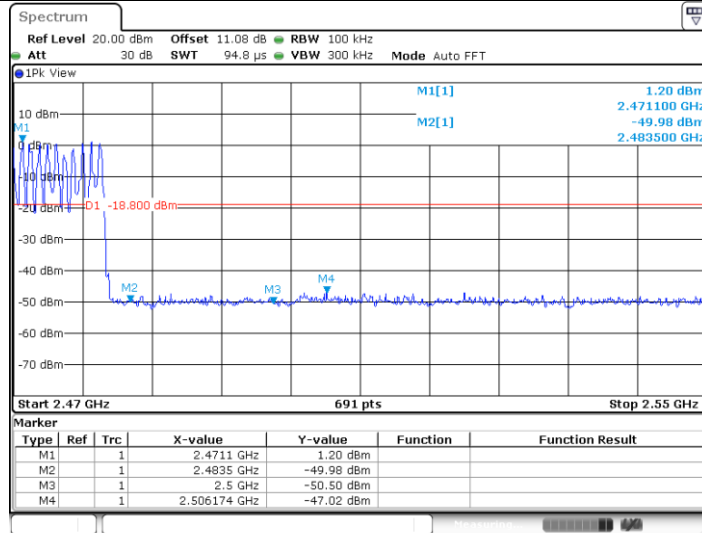
Room 107, 108, 207, 208, 303 of Building A, Room 101 of Building B, No.7, Lanqing 1st Road, Luhua Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China Tel.: (86)755-27521059 Fax: (86)755-27521011 Http://www.sz-ctc.org.cn

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TRF No: CTC-TR-059_A2

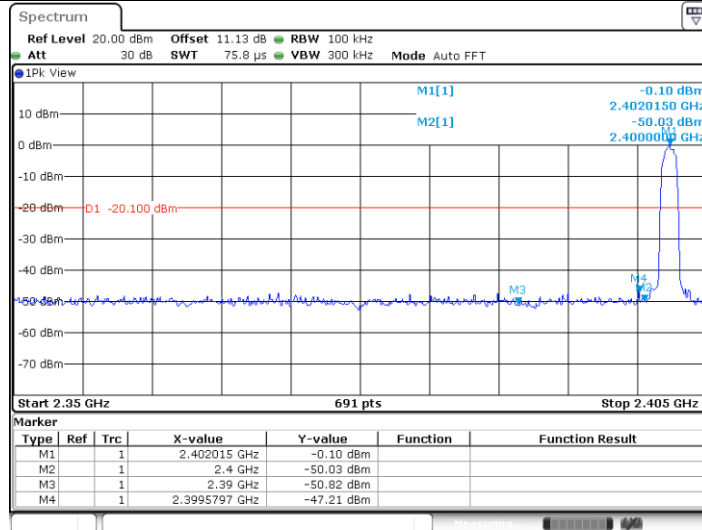


DH5 Ant1 High Hop 2480



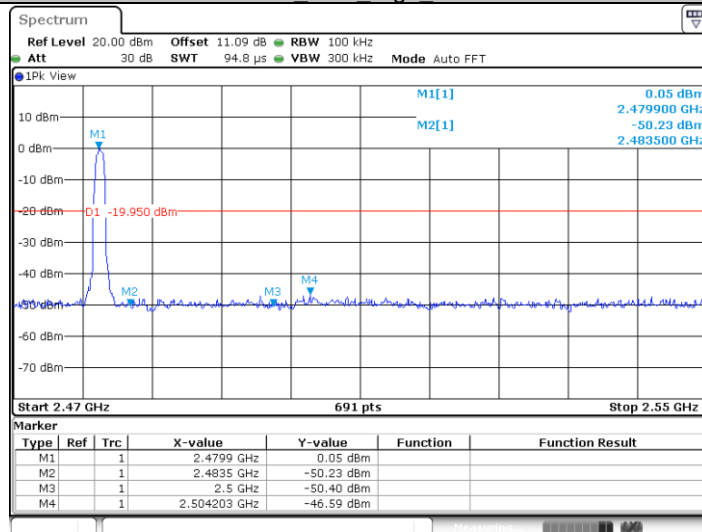
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2DH5 Ant1 Low 2402



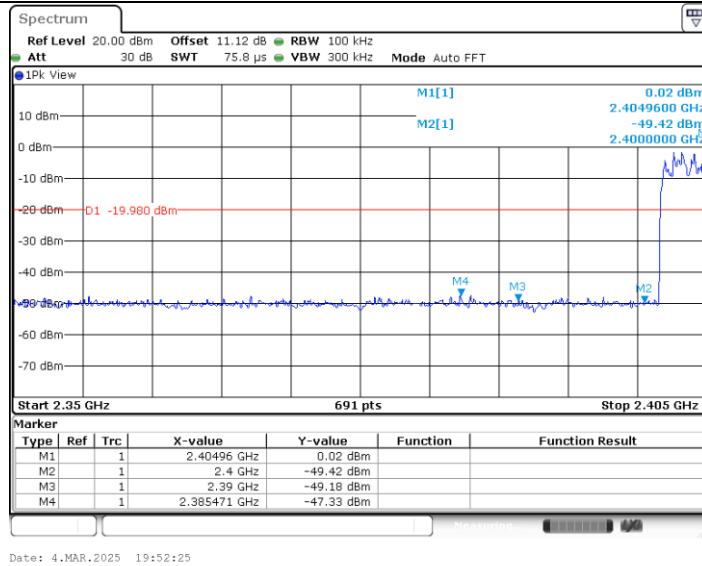
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2DH5 Ant1 High 2480

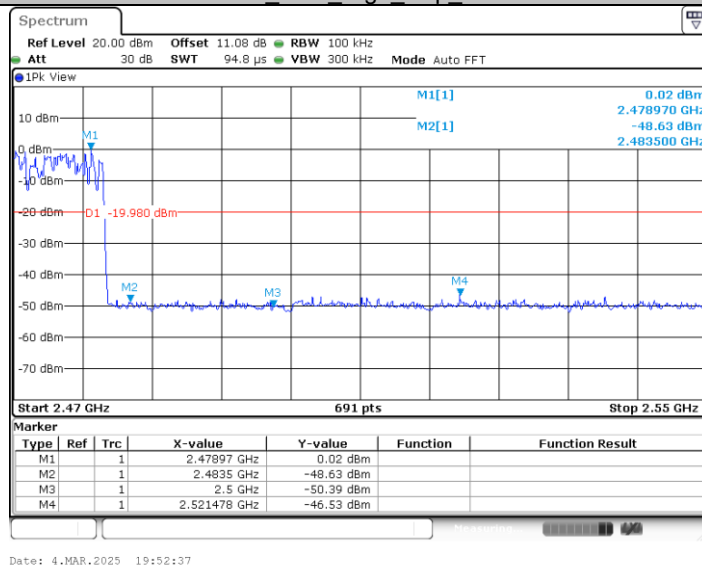


Date: 4.MAR.2025 20:37:02

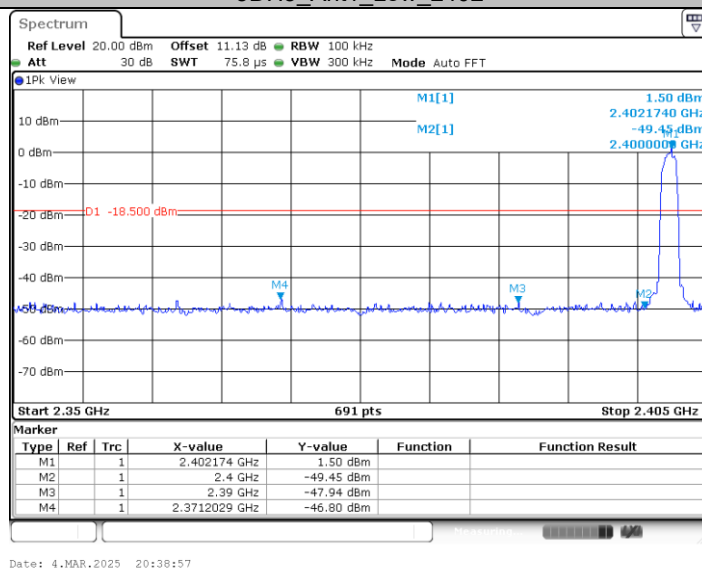
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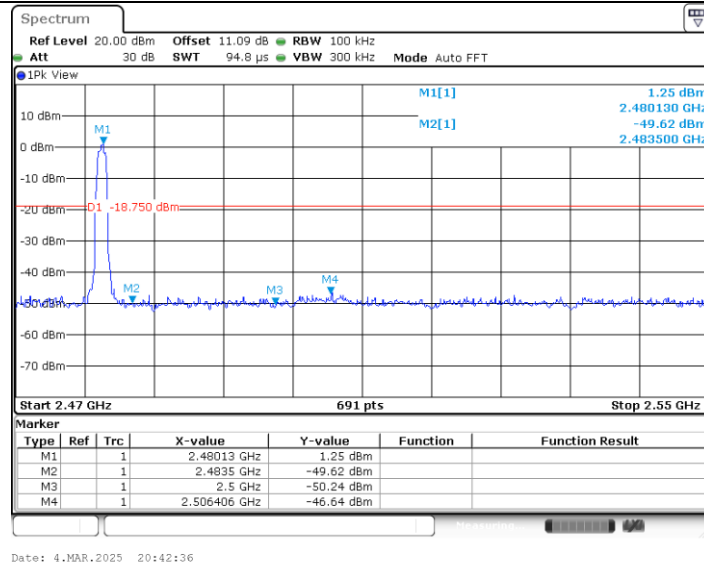
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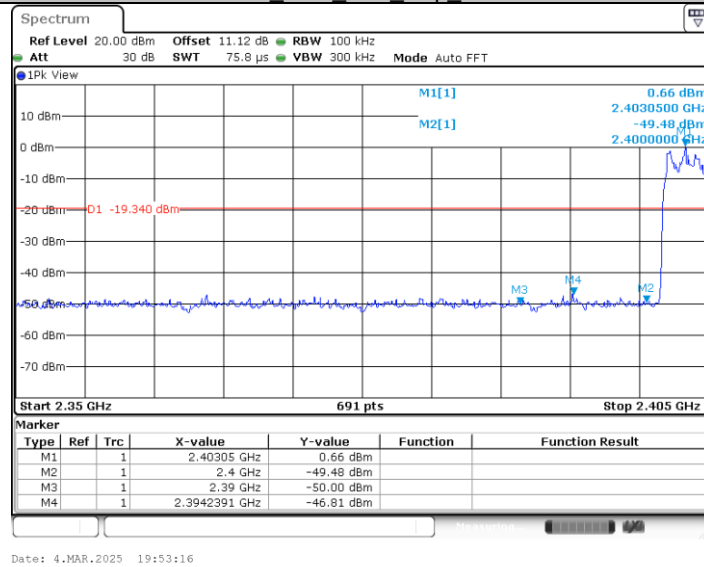
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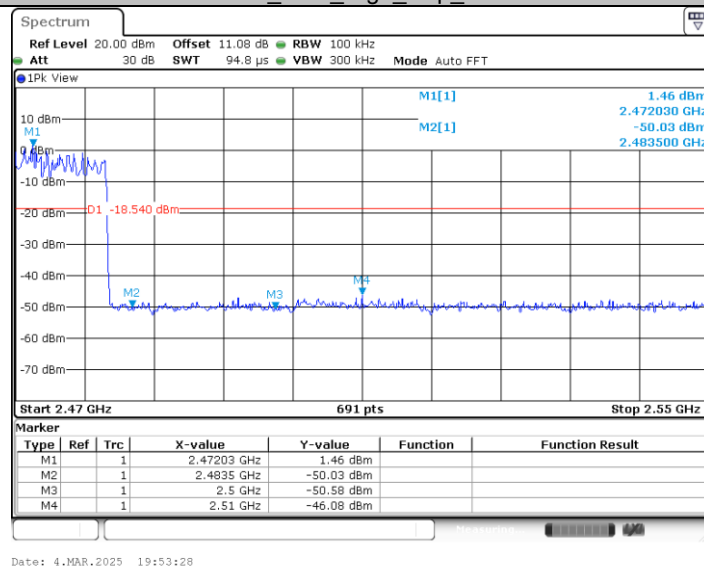
3DH5 Ant1 High 2480



3DH5 Ant1 Low Hop 2402



3DH5 Ant1 High Hop 2480



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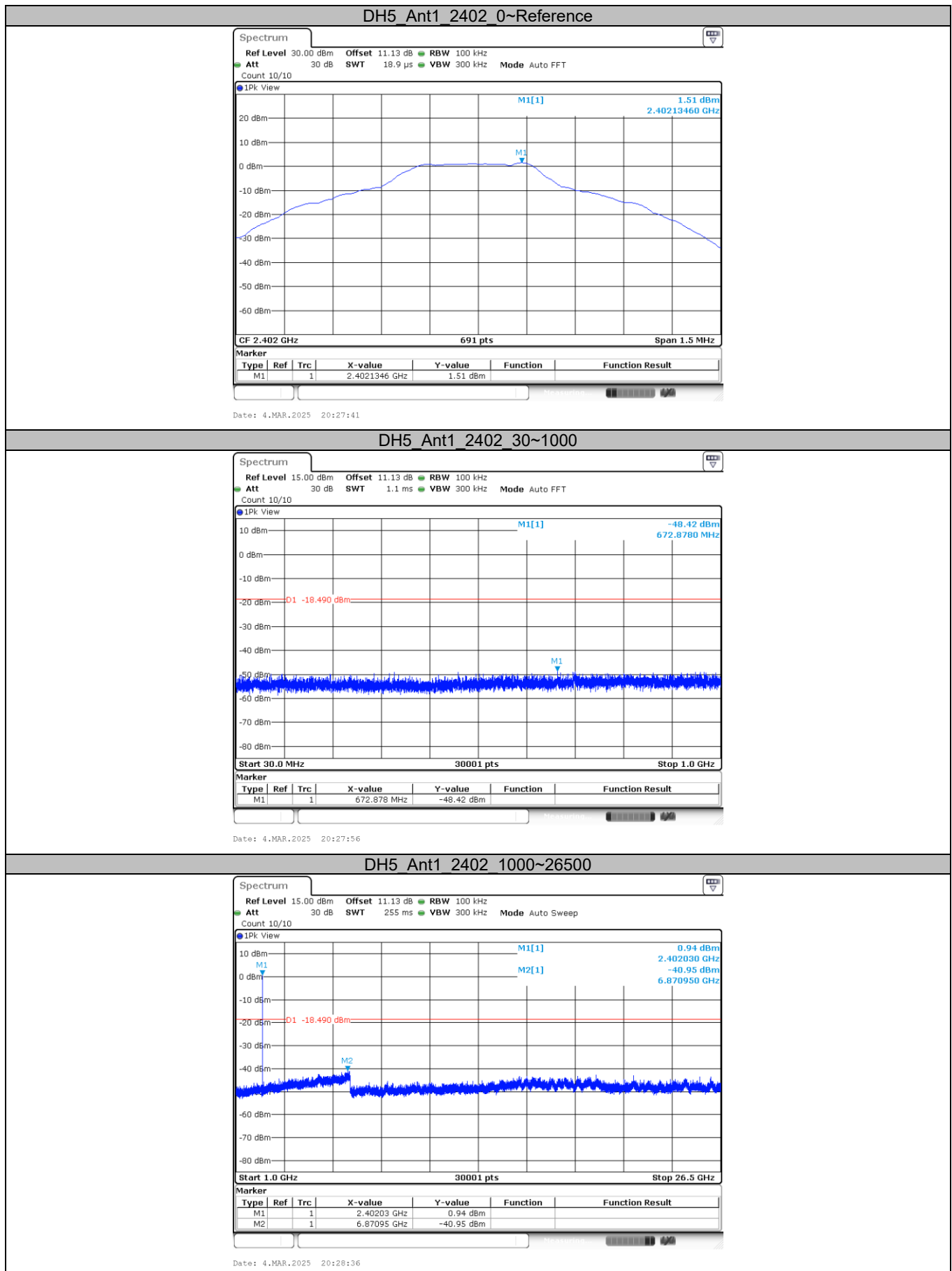
Room 107, 108, 207, 208, 303 of Building A, Room 101 of Building B, No.7, Lanqing 1st Road, Luhua Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China Tel.: (86)755-27521059 Fax: (86)755-27521011 Http://www.sz-ctc.org.cn

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Conducted Spurious Emissions Test plot as follows



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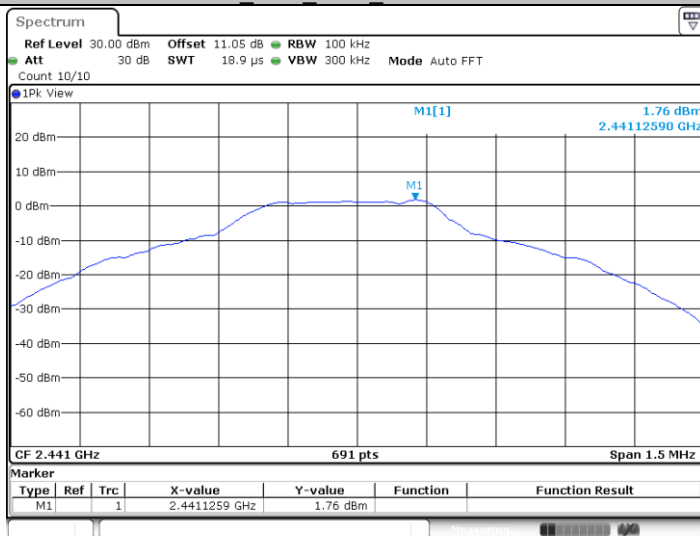
Room 107, 108, 207, 208, 303 of Building A, Room 101 of Building B, No.7, Lanqing 1st Road, Luhua Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China Tel.: (86)755-27521059 Fax: (86)755-27521011 Http://www.sz-ctc.org.cn

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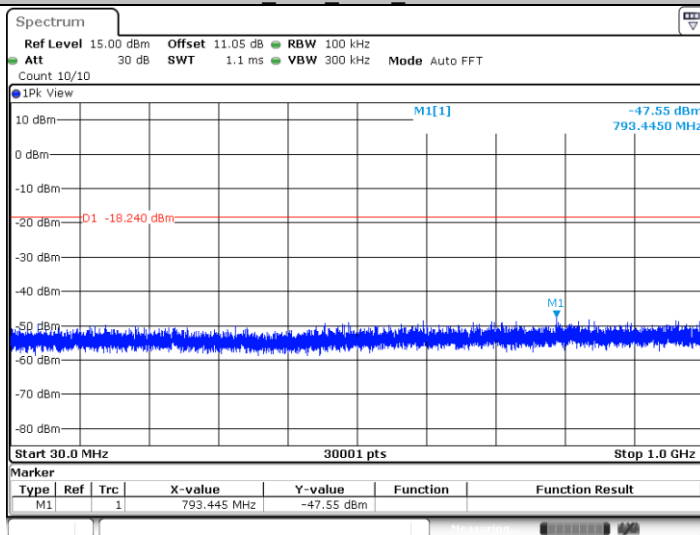
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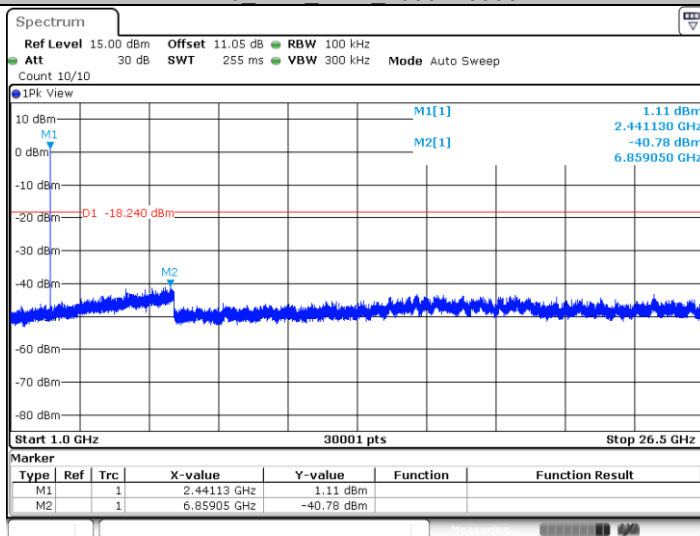
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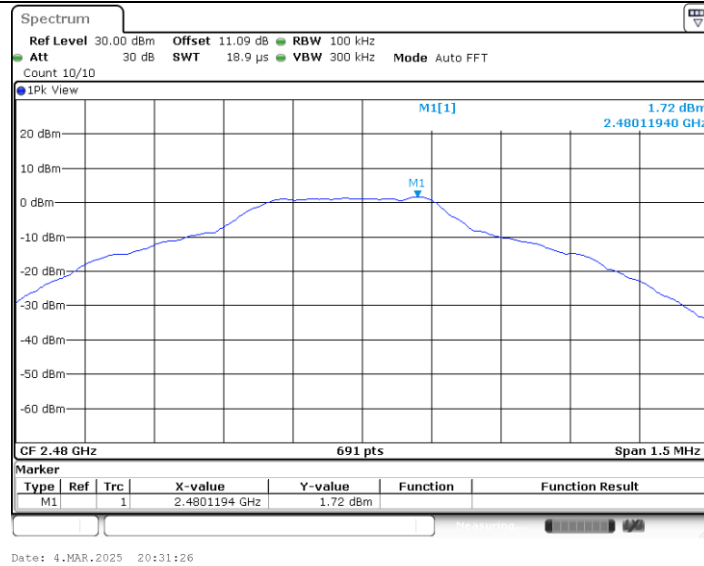
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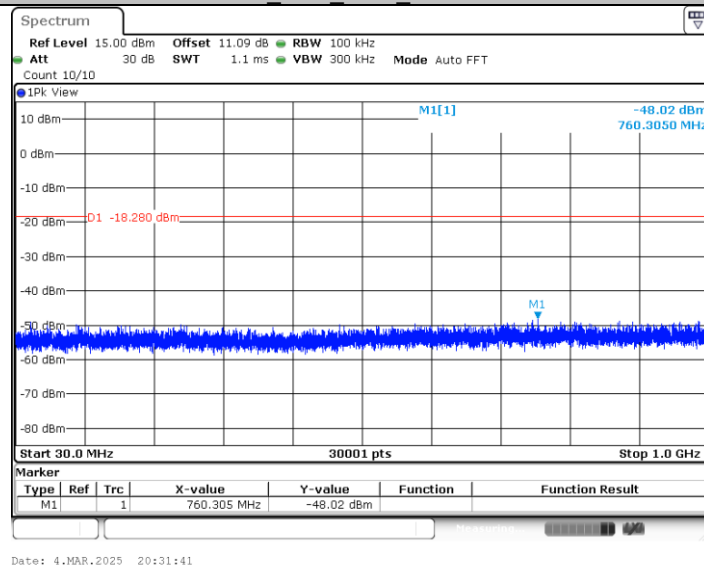
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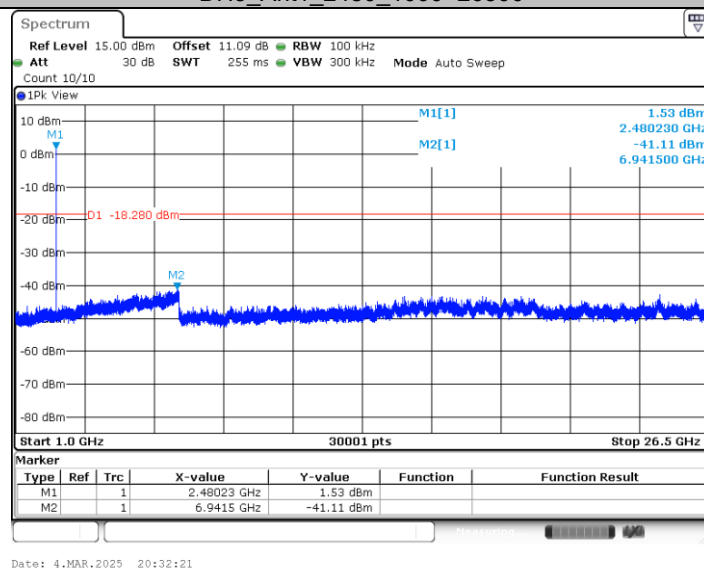
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DH5_Ant1_2480_30~1000



DH5_Ant1_2480_1000~26500



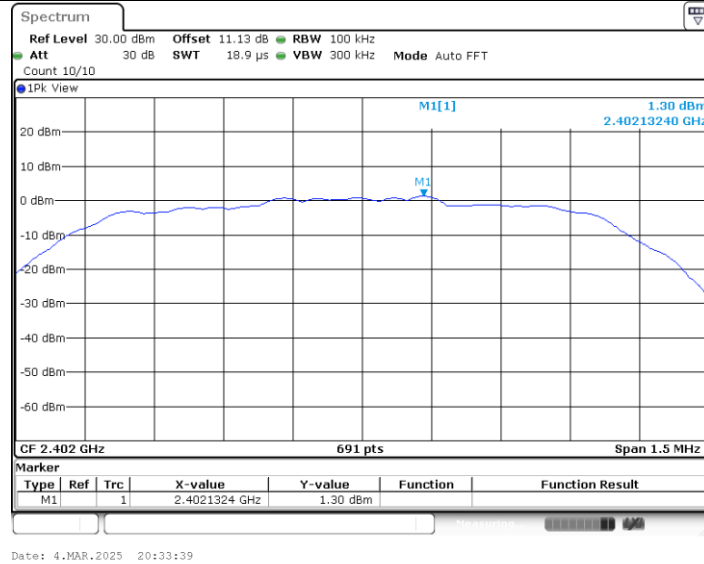
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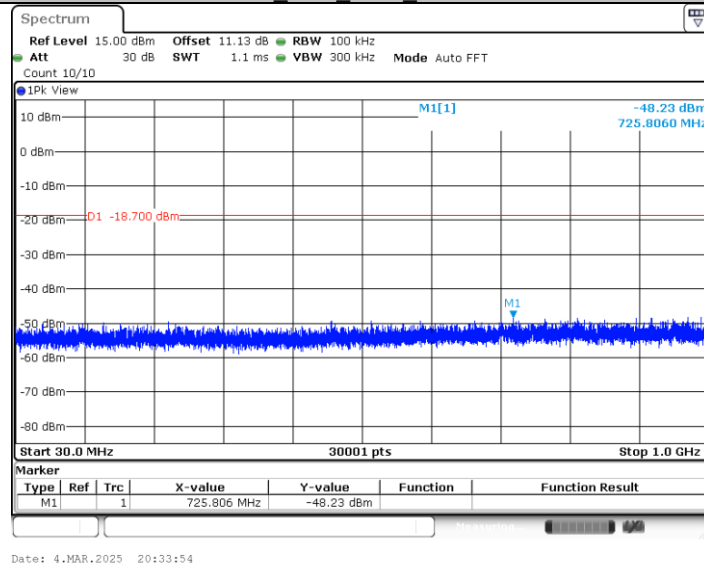
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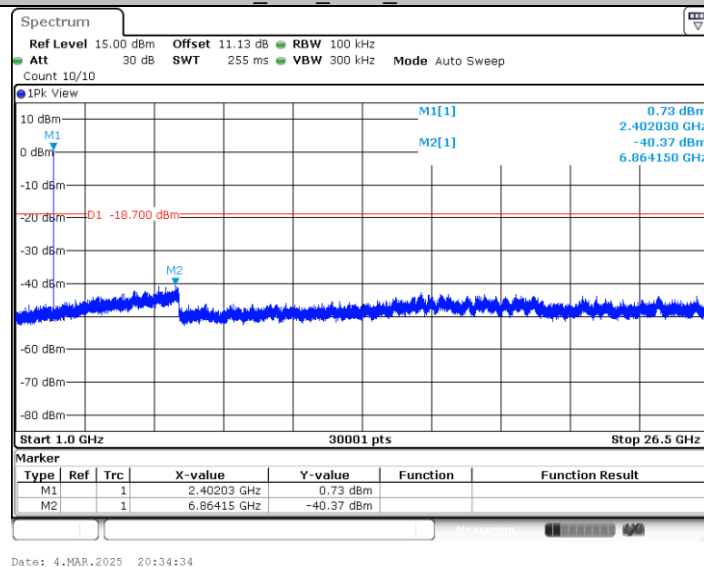
TRF No: CTC-TR-059_A2



2DH5_Ant1_2402_30~1000



2DH5_Ant1_2402_1000~26500



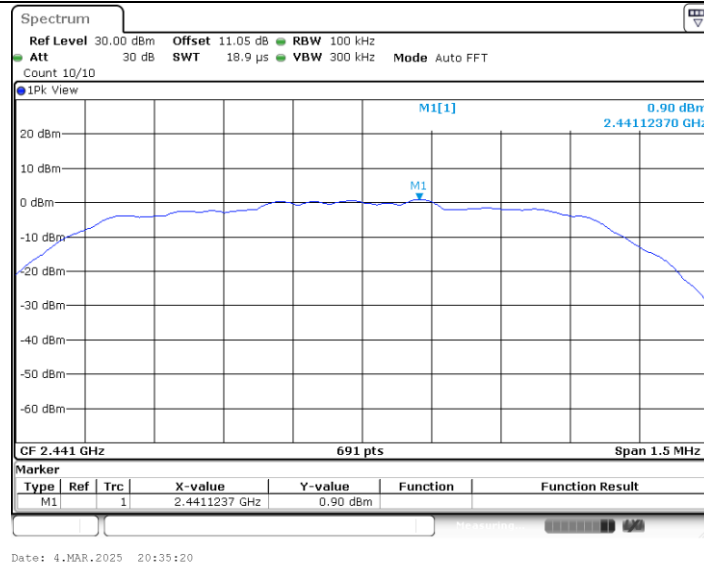
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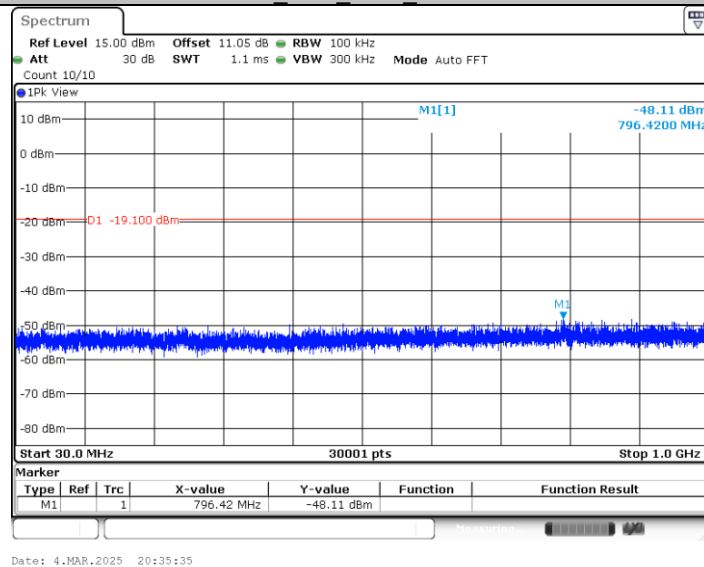
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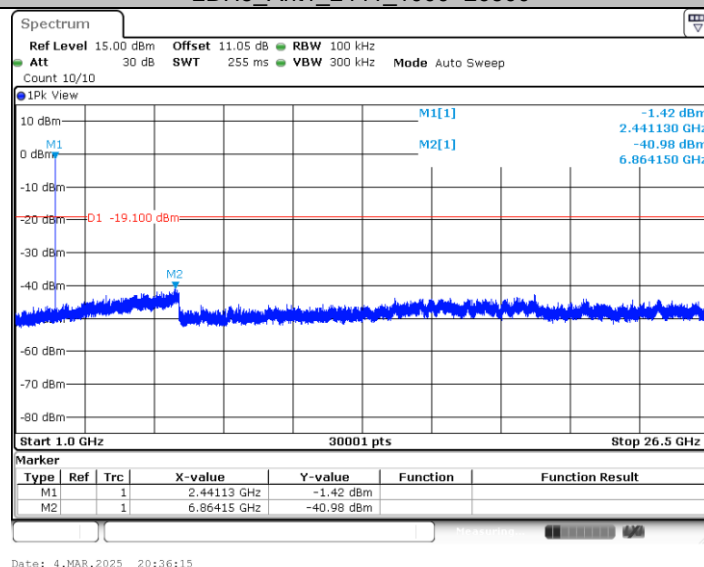
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2DH5_Ant1_2441_1000~26500



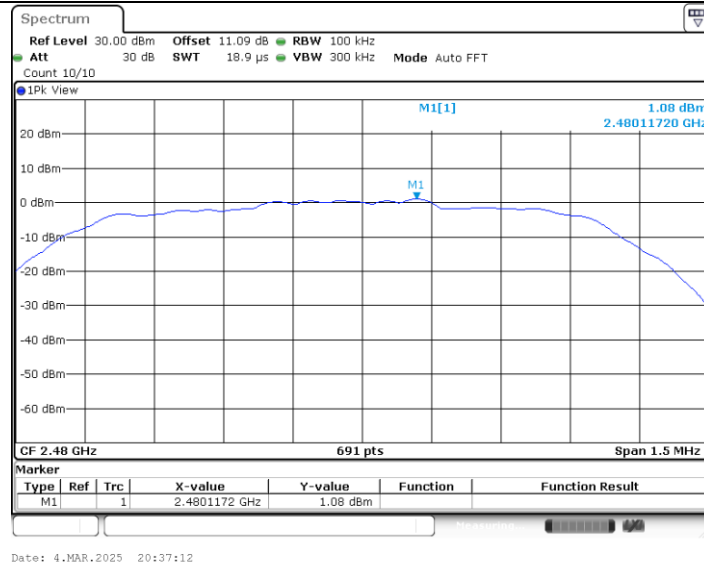
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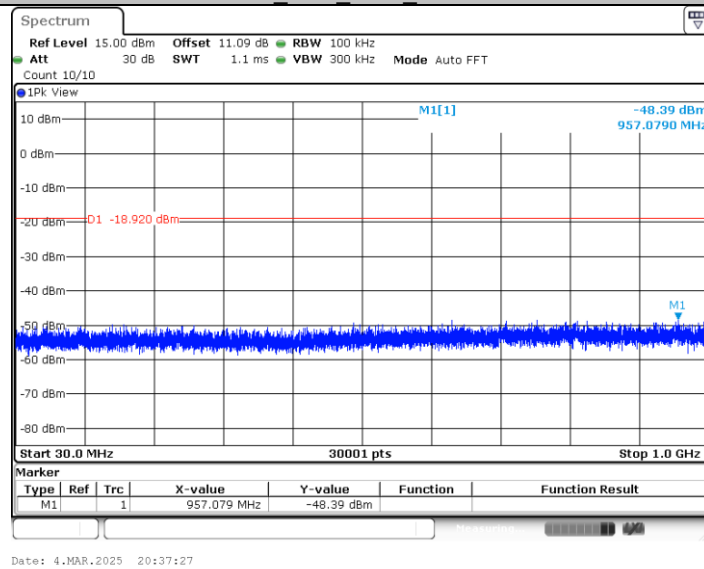
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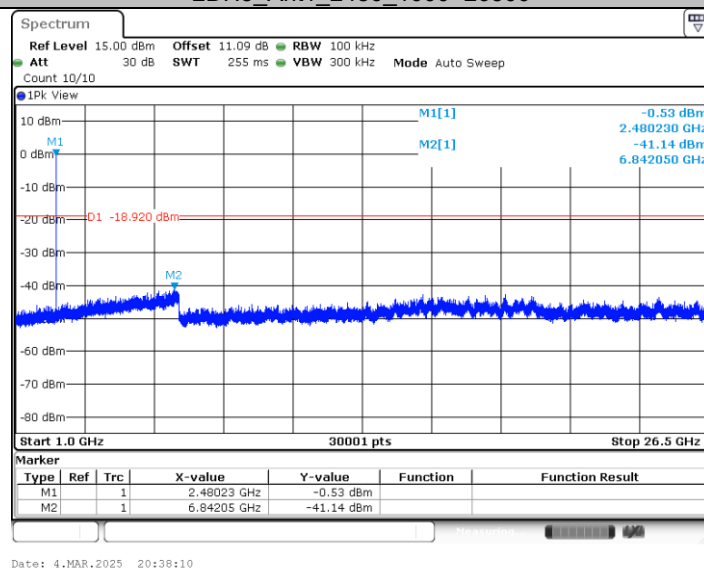
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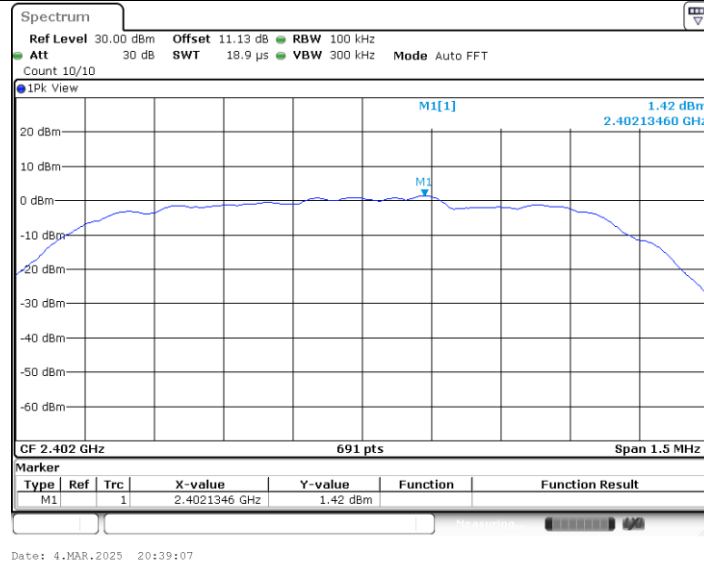
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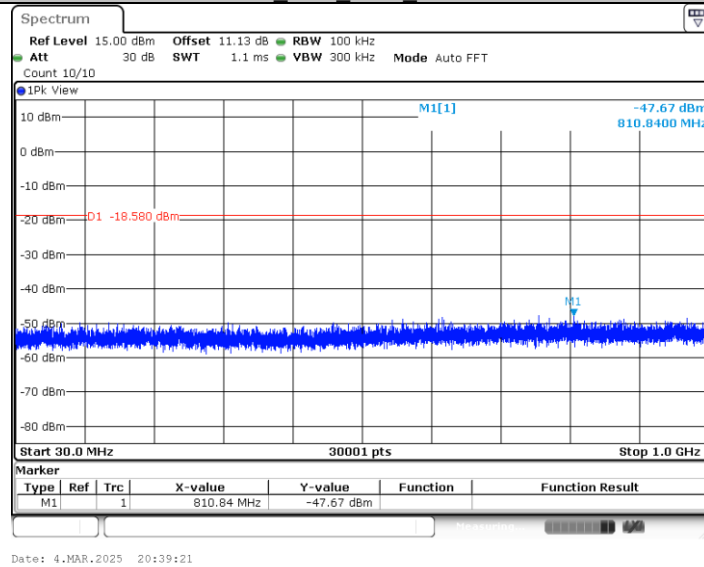
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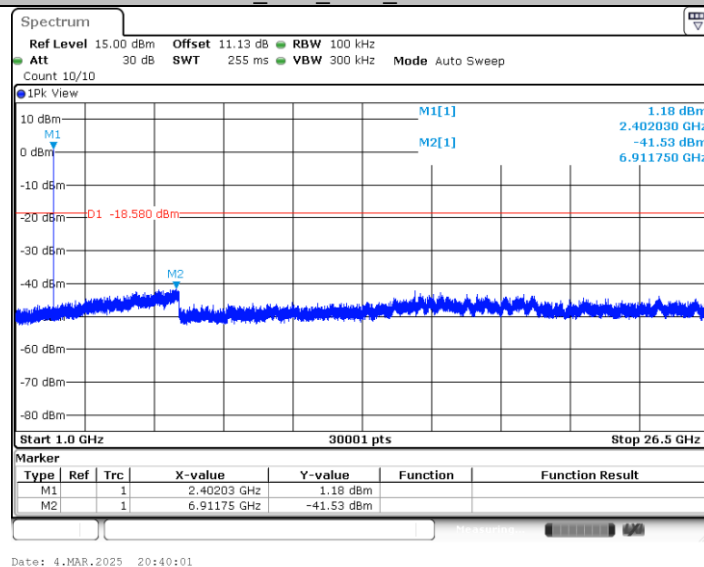
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3DH5_Ant1_2402_30~1000



3DH5_Ant1_2402_1000~26500



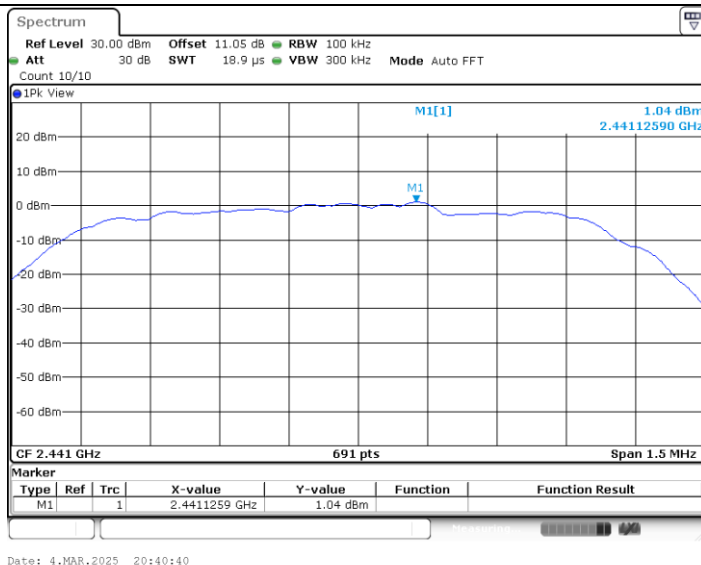
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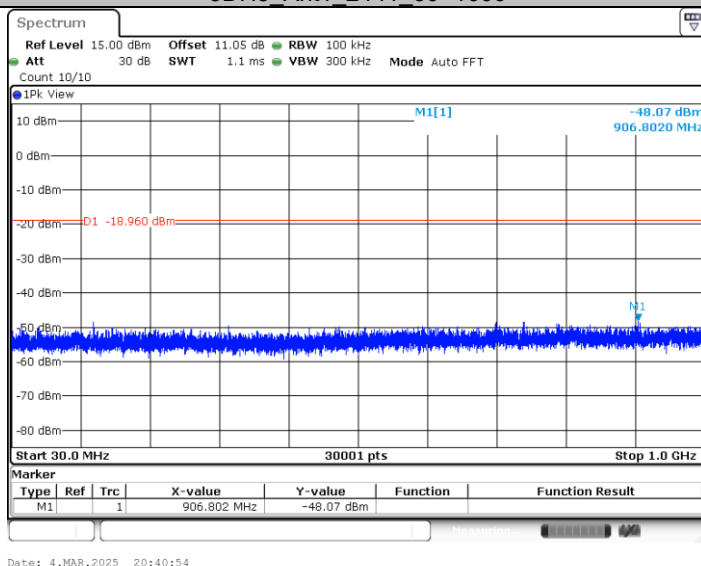
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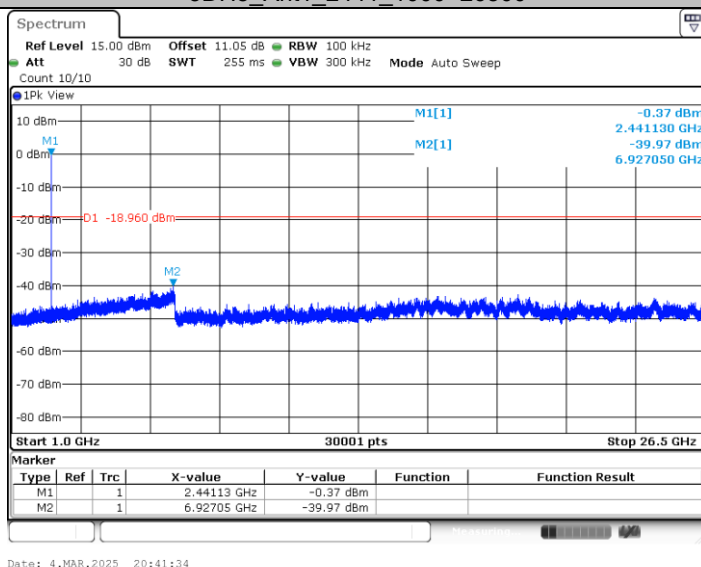
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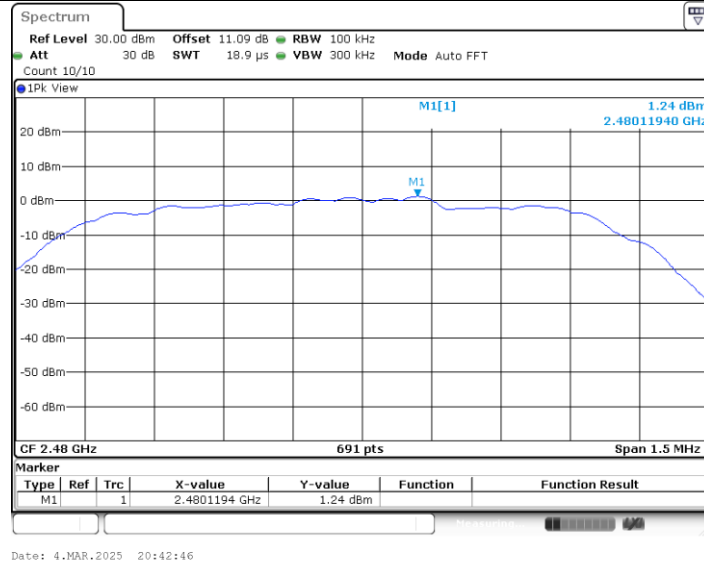
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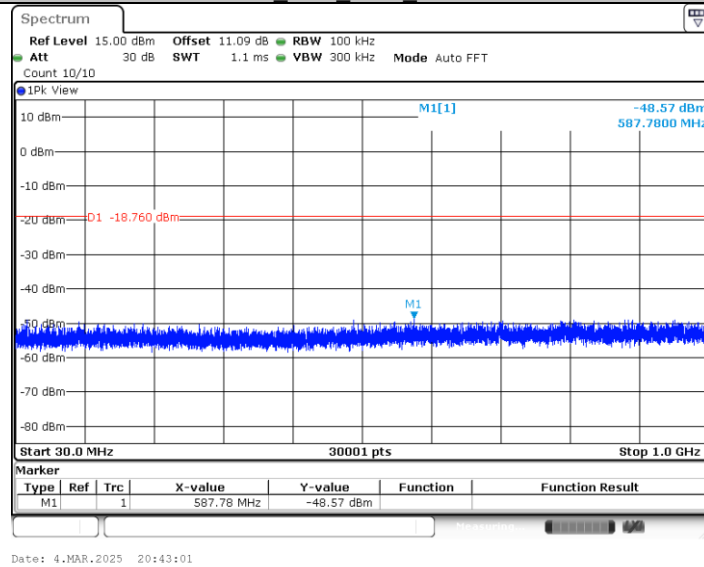
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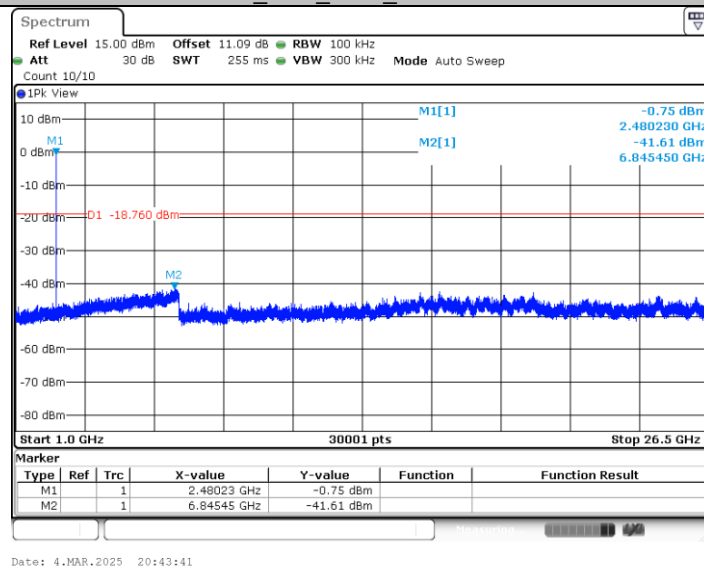
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3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500



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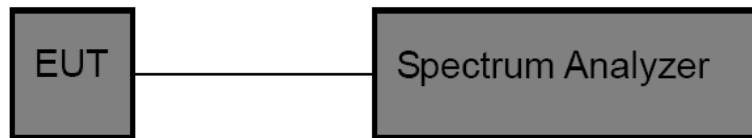


3.5. 20dB Bandwidth

Limit

N/A

Test Configuration



Test Procedure

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

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

Test Mode

Please refer to the clause 2.4.

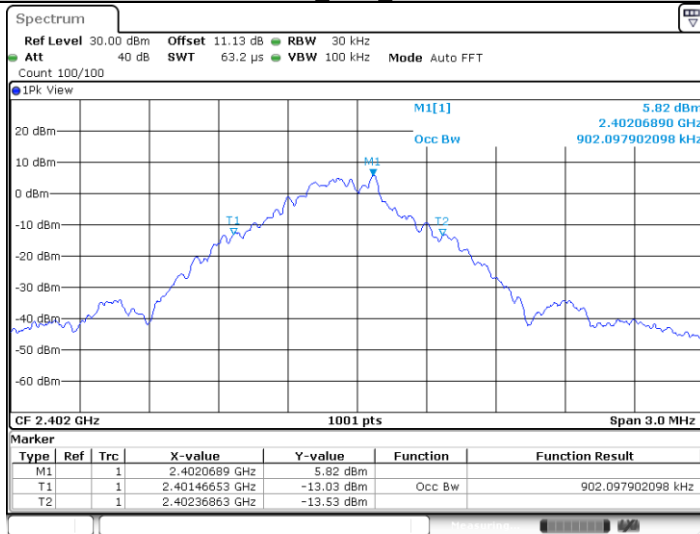
Test Result

Test Mode	Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)	20dB Bandwidth *2/3 (MHz)
GFSK	2402	0.902	0.95	0.633
	2441	0.914	0.95	0.633
	2480	0.884	0.94	0.627
$\pi/4$ -DQPSK	2402	1.196	1.34	0.893
	2441	1.196	1.34	0.893
	2480	1.196	1.34	0.893
8-DPSK	2402	1.196	1.31	0.873
	2441	1.199	1.31	0.873
	2480	1.196	1.33	0.887



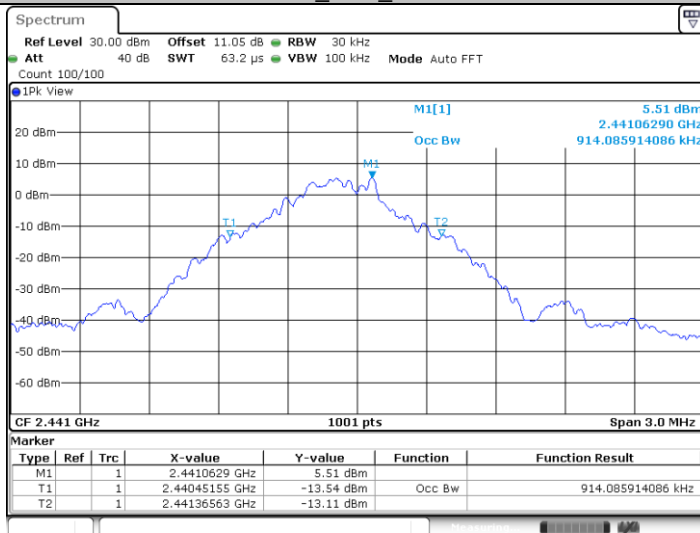
99% Bandwidth:

DH5_Ant1_2402



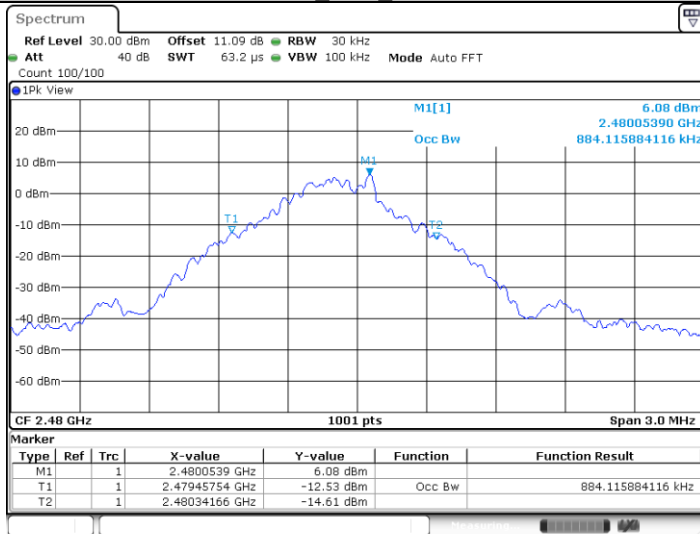
Date: 26.FEB.2025 18:20:11

DH5_Ant1_2441



Date: 26.FEB.2025 18:25:32

DH5_Ant1_2480



Date: 26.FEB.2025 18:39:19

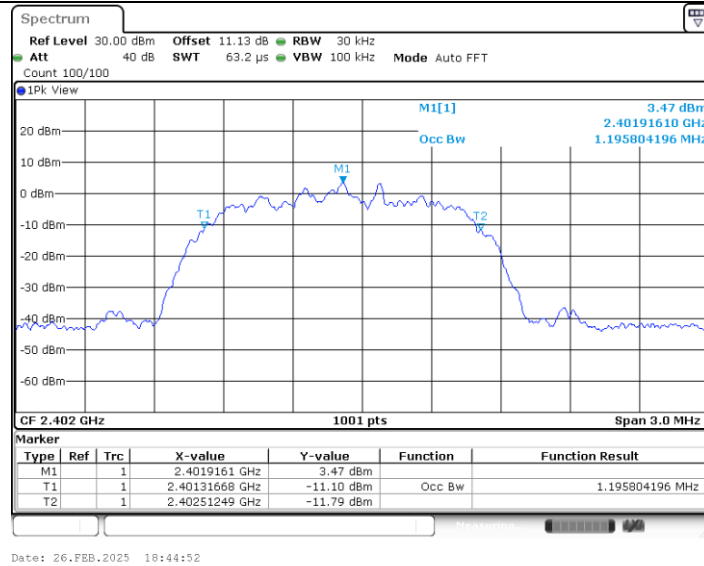
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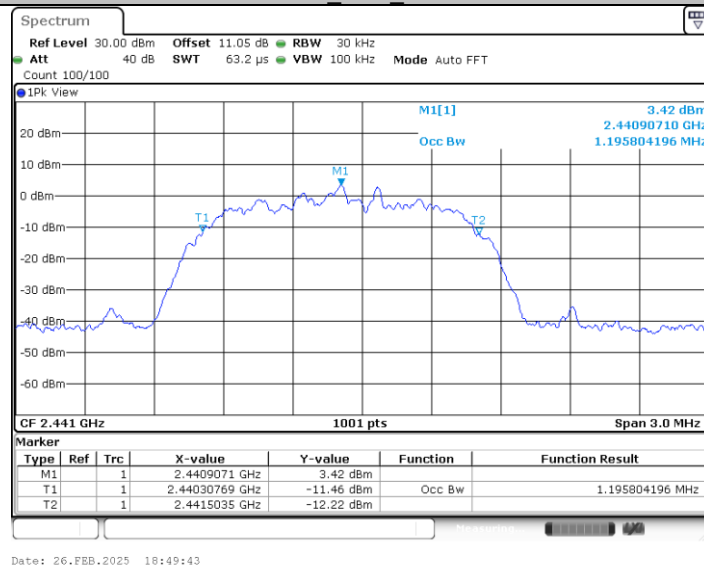
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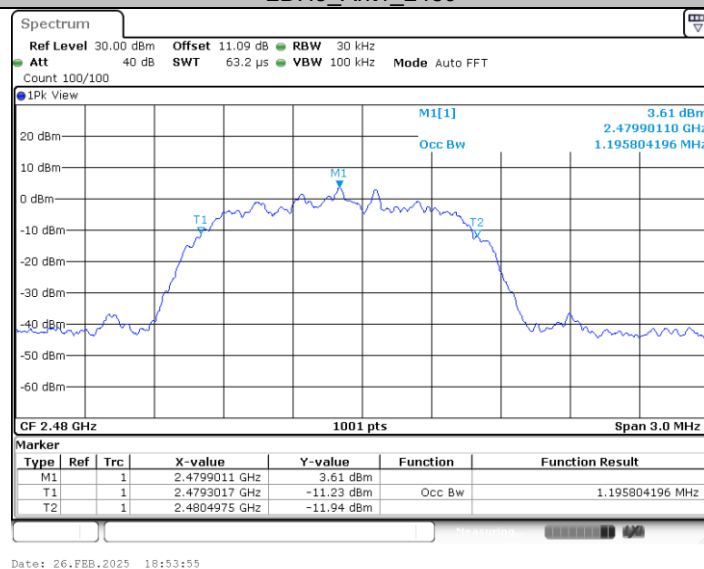
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2DH5_Ant1_2441



2DH5_Ant1_2480



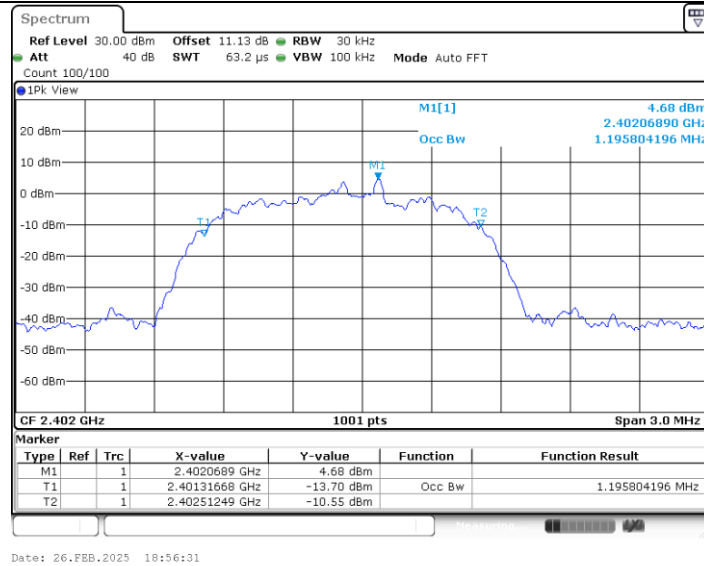
3DH5_Ant1_2402

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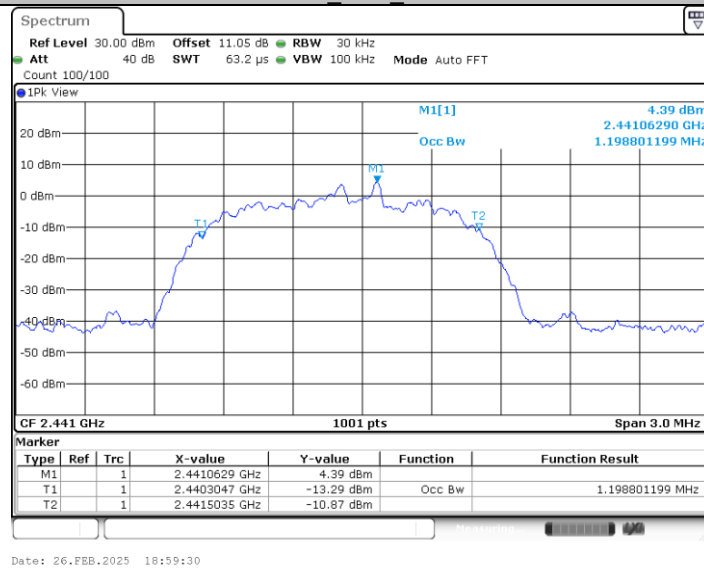
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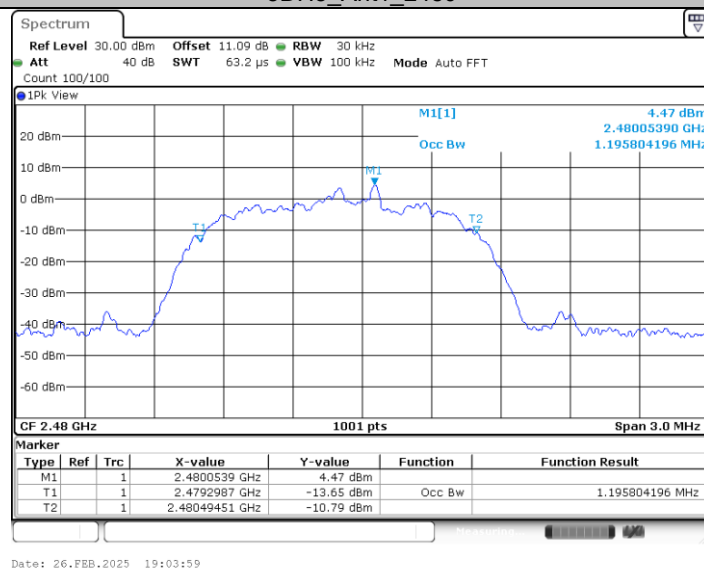
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3DH5_Ant1_2441



3DH5_Ant1_2480



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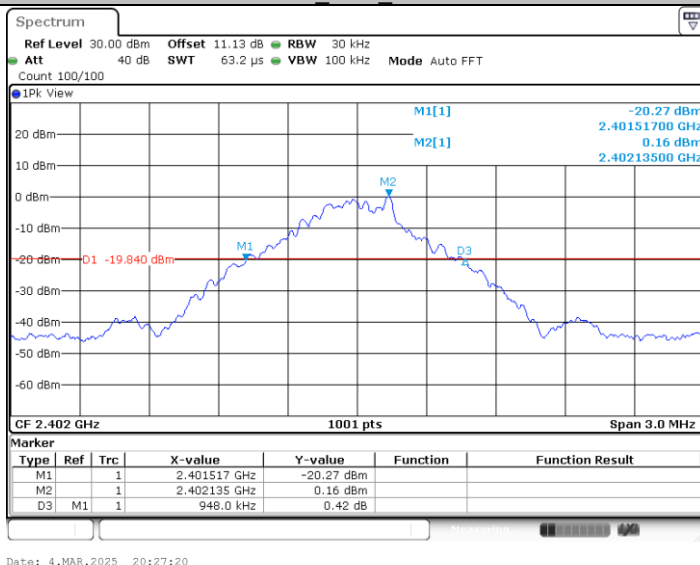
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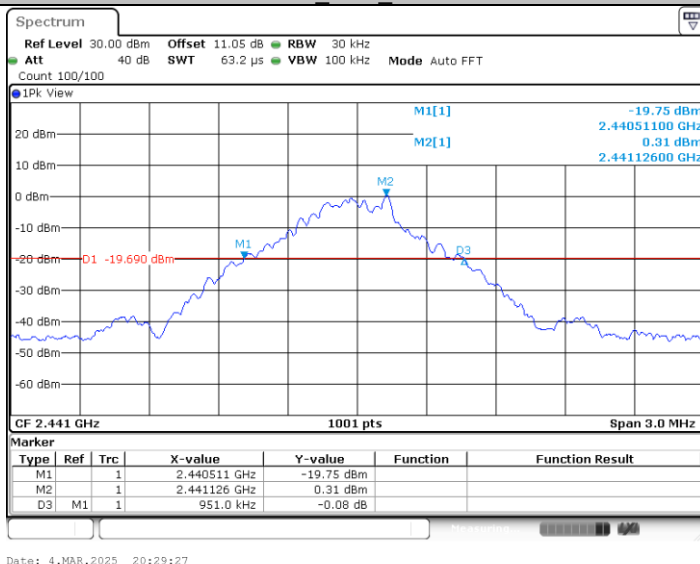


20dB Bandwidth:

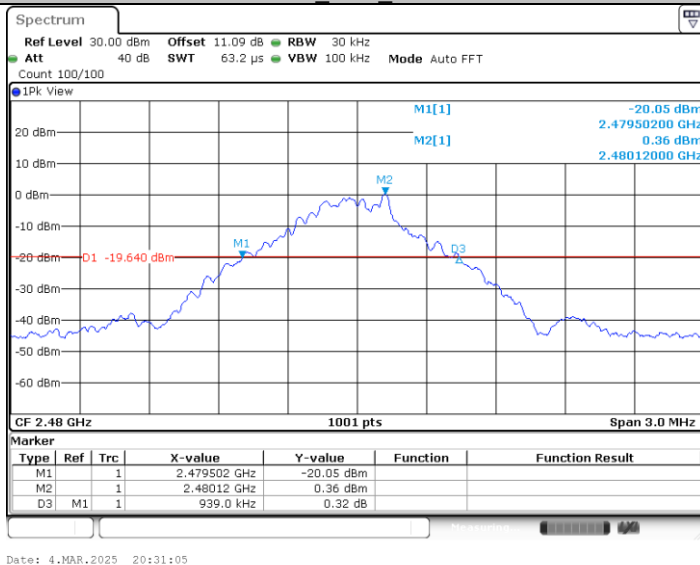
DH5 Ant1_2402



DH5 Ant1_2441



DH5 Ant1_2480



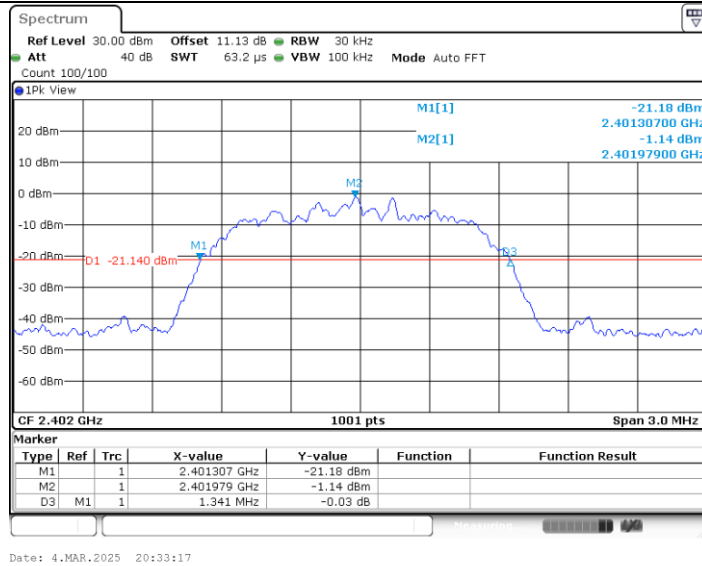
2DH5 Ant1_2402

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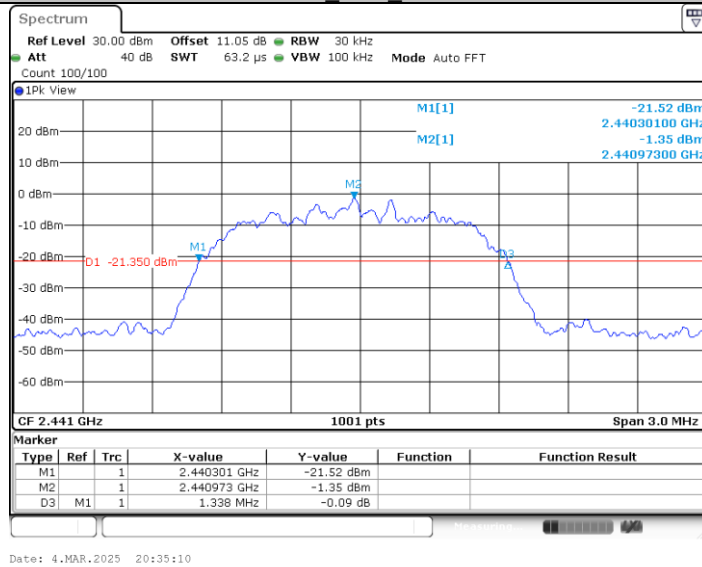
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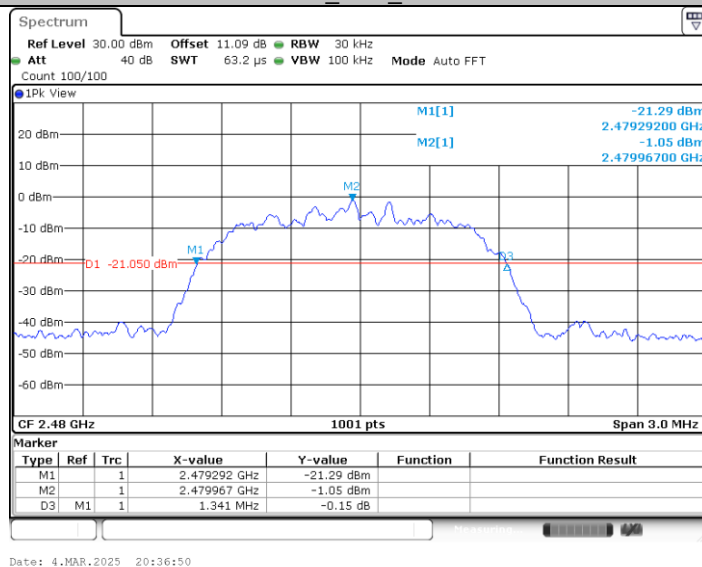
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2DH5_Ant1_2441



2DH5_Ant1_2480



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