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TEST REPORT

Report No.: CTC20231666E12

FCC ID.....: 2AR24-XBOX

Applicant: Shenzhen Absen Optoelectronic Co.,Ltd

Address.....: 18-20/F, Tower A, Building 3, Phase I, Tian An Cloud Park,
N0.2018, 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,
N0.2018, Xuegang Rd, Bantian, Longgang District, Shenzhen,
Guangdong, P.R. China

Product Name: LED Multimedia Processor

Trade Mark: 

Model/Type reference.....: X-Box

Listed Model(s): /

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

Date of receipt of test sample.....: Aug. 18, 2023

Date of testing.....: Aug. 19, 2023 ~ Dec. 3, 2023

Date of issue.....: Aug. 09, 2024

Result.....: PASS

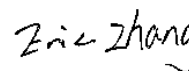
Compiled by:

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Approved by:

(Printed name+signature) Totti Zhao



Testing Laboratory Name: CTC Laboratories, Inc.

Address.....: Room 101 Building B, No. 7, Lanqing 1st Road, Luh Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China

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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	CTC20231666E12	Aug. 09, 2024	Original

1.3. Test Description

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

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.



1.4. Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: Room 101 of Building B, Room 107, 108, 207, 208 of Building A, No. 7, Lanqing 1st Road, Luhuhu 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, N0.2018, 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, N0.2018, 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:	absen
Model/Type reference:	X-Box
Listed Model(s):	/
Model Difference:	/
Power Supply:	AC 100-240V~2.6A 50/60Hz
RF Module Model:	AP6275S
Hardware Version:	/
Software Version:	/
Bluetooth 5.1 / 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:	3.52dBi



2.3. Accessory Equipment Information

Equipment Information			
Name	Model	S/N	Manufacturer
Notebook	ThinkPad T460s	/	Lenovo
Cable Information			
Name	Shielded Type	Ferrite Core	Length
USB Cable	Unshielded	NO	150cm
Test Software Information			
Name	Version	/	/
adb.exe	/	/	/



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					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	MXA Signal Analyzer	Keysight	N9020A	MY46471737	Dec. 16, 2023
2	High and low temperature test chamber	ESPEC	MT3035	/	Mar. 24, 2024
3	Test Software	WCS	WCS-WCN	2023.08.04	/

Radiated Emission (3m chamber 3)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9163	01026	Dec. 18, 2024
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-647	Dec. 01, 2024
3	Test Receiver	Keysight	N9038A	MY56400071	Dec. 16, 2023
4	Broadband Amplifier	SCHWARZBECK	BBV9743B	259	Dec. 16, 2023
5	Mirowave Broadband Amplifier	SCHWARZBECK	BBV9718C	111	Dec. 16, 2023
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. 16, 2023
2	LISN	R&S	ENV216	101113	Dec. 16, 2023
3	EMI Test Receiver	R&S	ESCS30	100353	Dec. 16, 2023
4	ISN CAT6	Schwarzbeck	NTFM 8158	CAT6-8158-0046	Dec. 16, 2023
5	ISN CAT5	Schwarzbeck	NTFM 8158	CAT5-8158-0046	Dec. 16, 2023
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

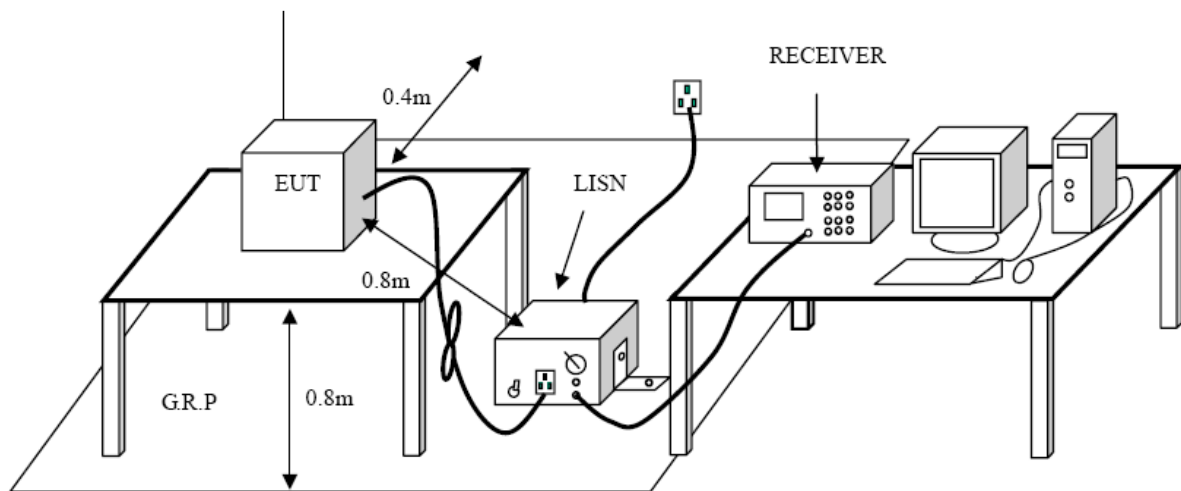
Limit

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

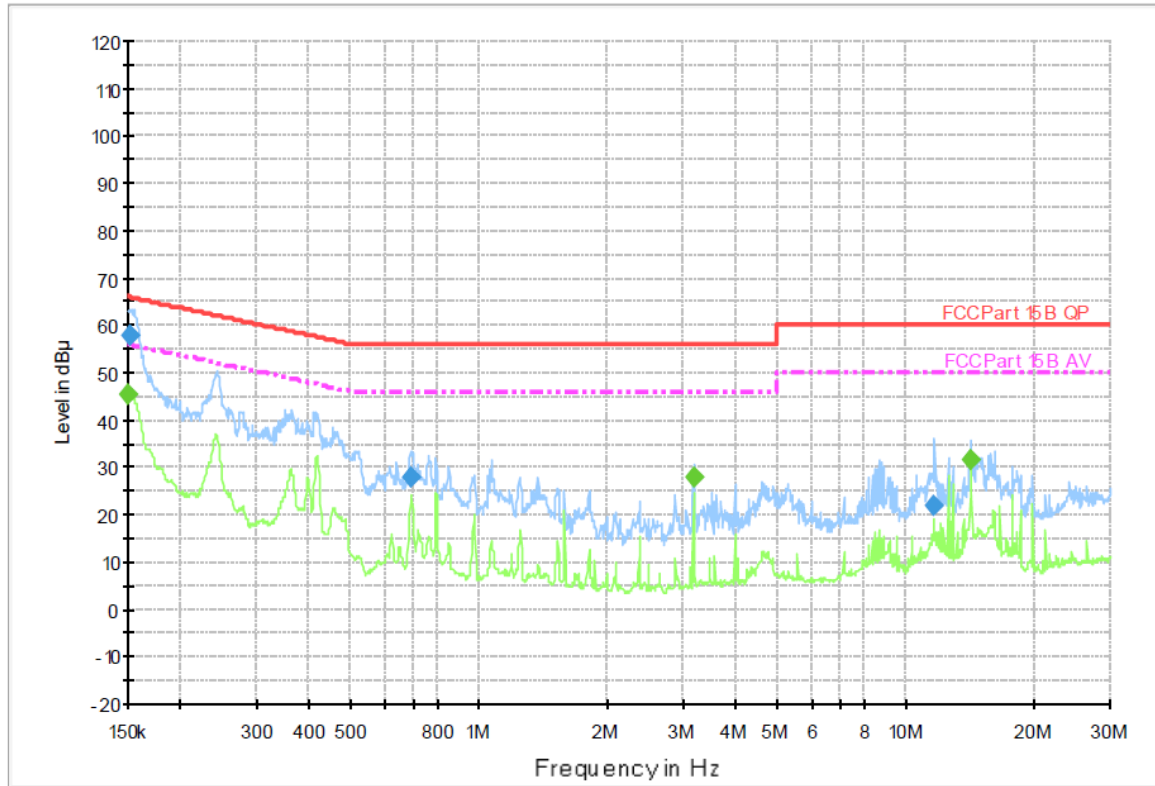
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from 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 (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.151200	57.9	1000.00	9.000	On	L1	9.4	8.1	65.9	
0.689240	28.1	1000.00	9.000	On	L1	9.5	27.9	56.0	
11.636930	21.9	1000.00	9.000	On	L1	9.7	38.1	60.0	

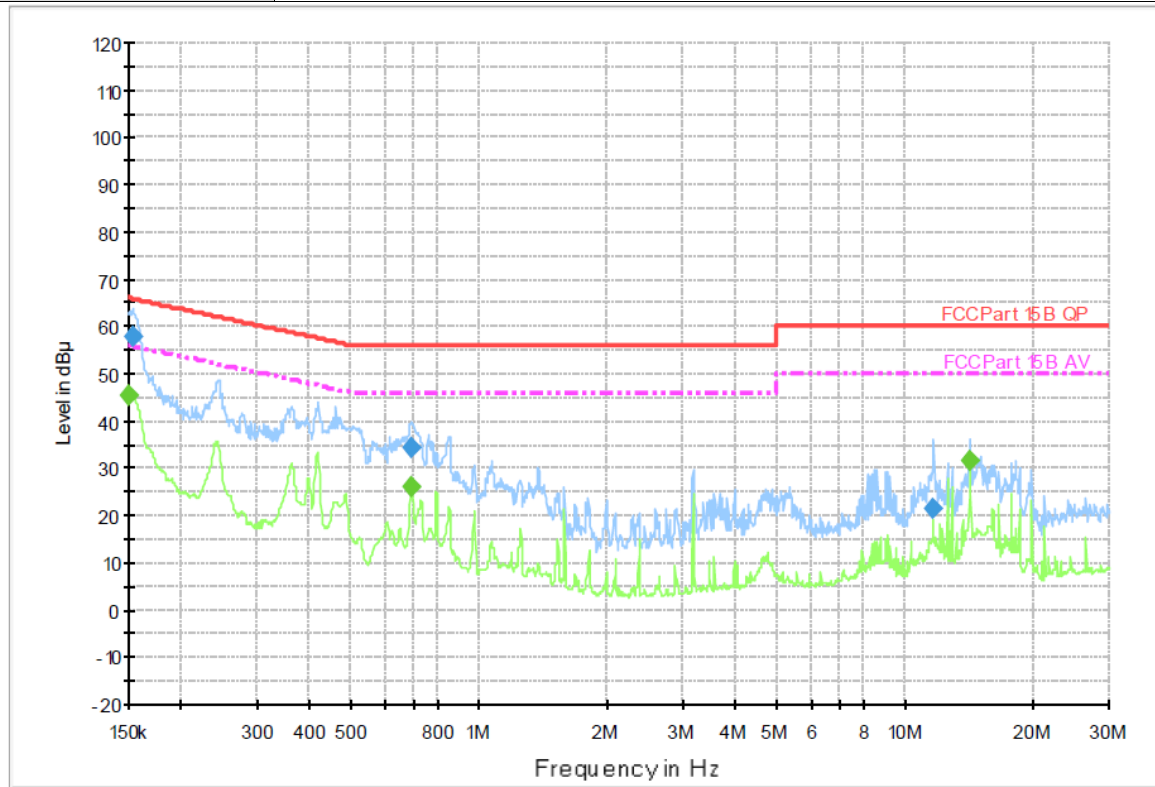
Final Measurement Detector 2

Frequency (MHz)	Average (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.150600	45.2	1000.00	9.000	On	L1	9.4	10.8	56.0	
3.167000	28.0	1000.00	9.000	On	L1	9.5	18.0	46.0	
14.151110	31.4	1000.00	9.000	On	L1	9.8	18.6	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 (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.153640	57.9	1000.00	9.000	On	N	9.3	7.9	65.8	
0.694760	34.4	1000.00	9.000	On	N	9.4	21.6	56.0	
11.636930	21.6	1000.00	9.000	On	N	9.6	38.4	60.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.150000	45.5	1000.00	9.000	On	N	9.3	10.5	56.0	
0.692000	25.8	1000.00	9.000	On	N	9.4	20.2	46.0	
14.151110	31.4	1000.00	9.000	On	N	9.6	18.6	50.0	

Emission Level = Read Level + Correct Factor

3.2. Radiated Emission

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.209

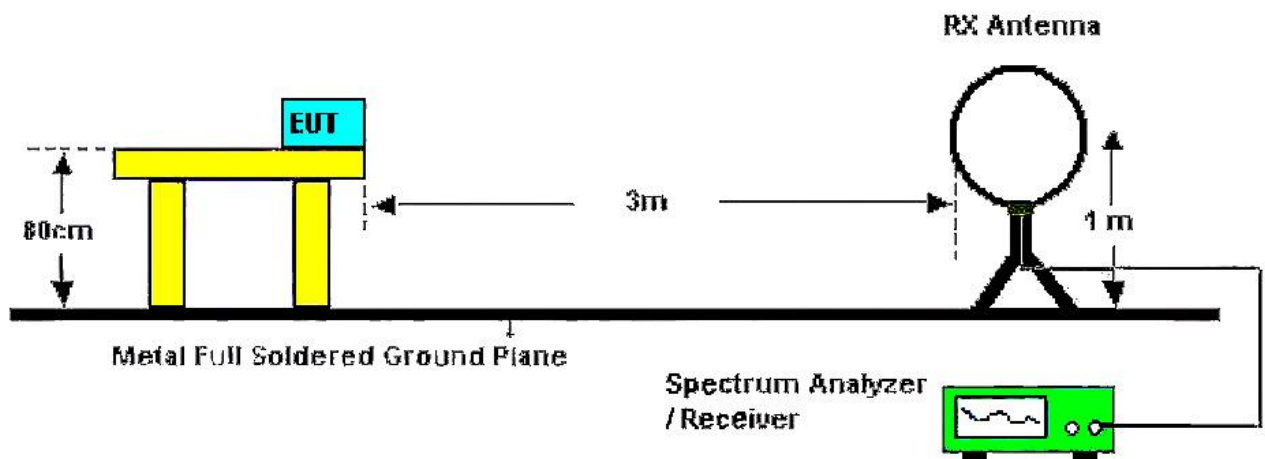
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

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

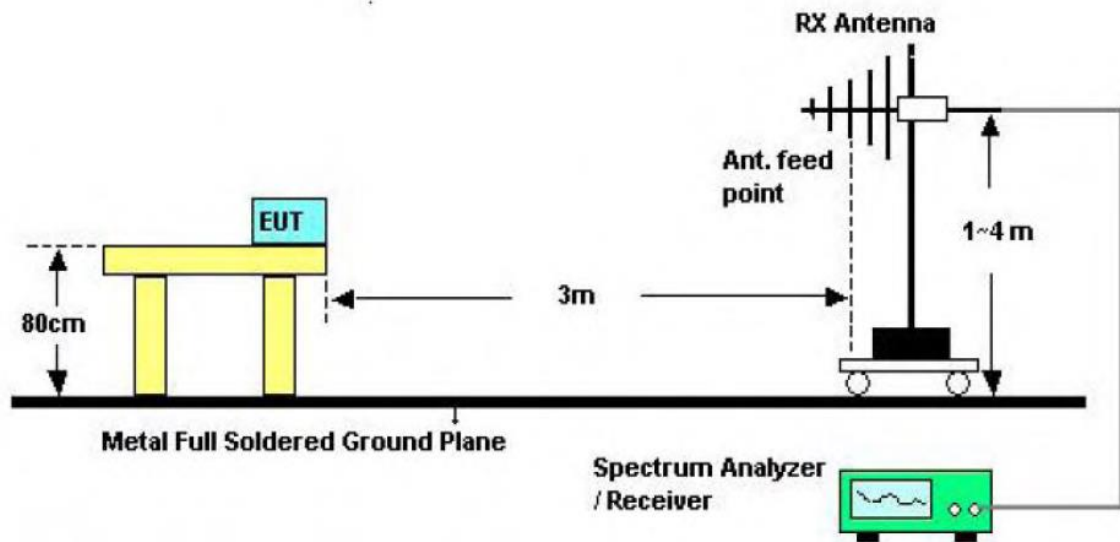
Note:

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

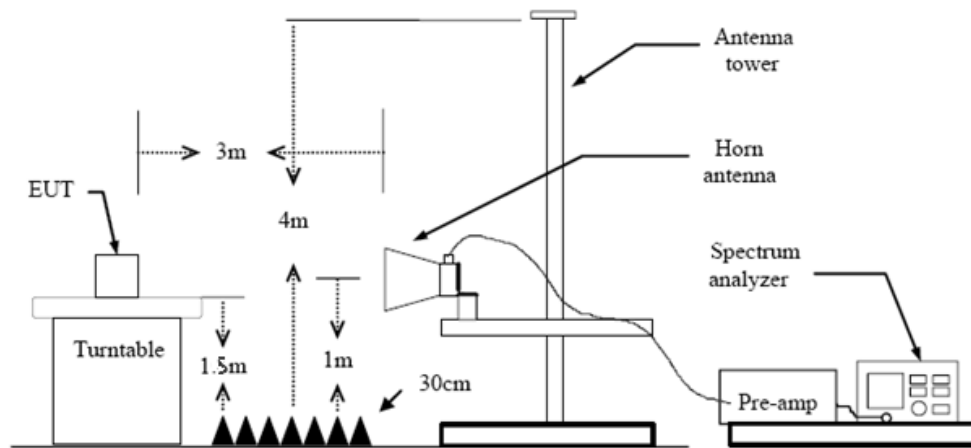
Test Configuration



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

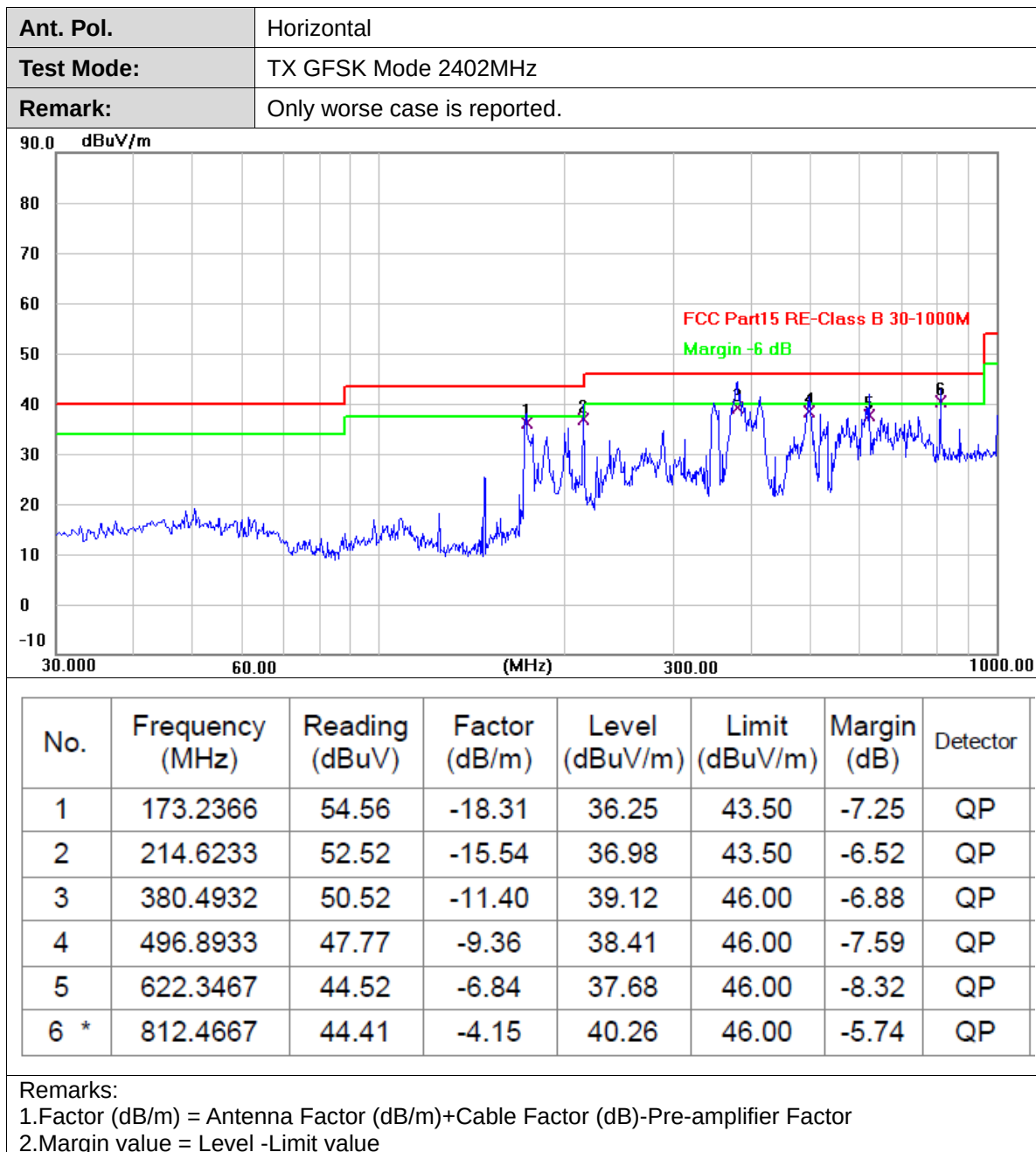
9 kHz~30 MHz

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.

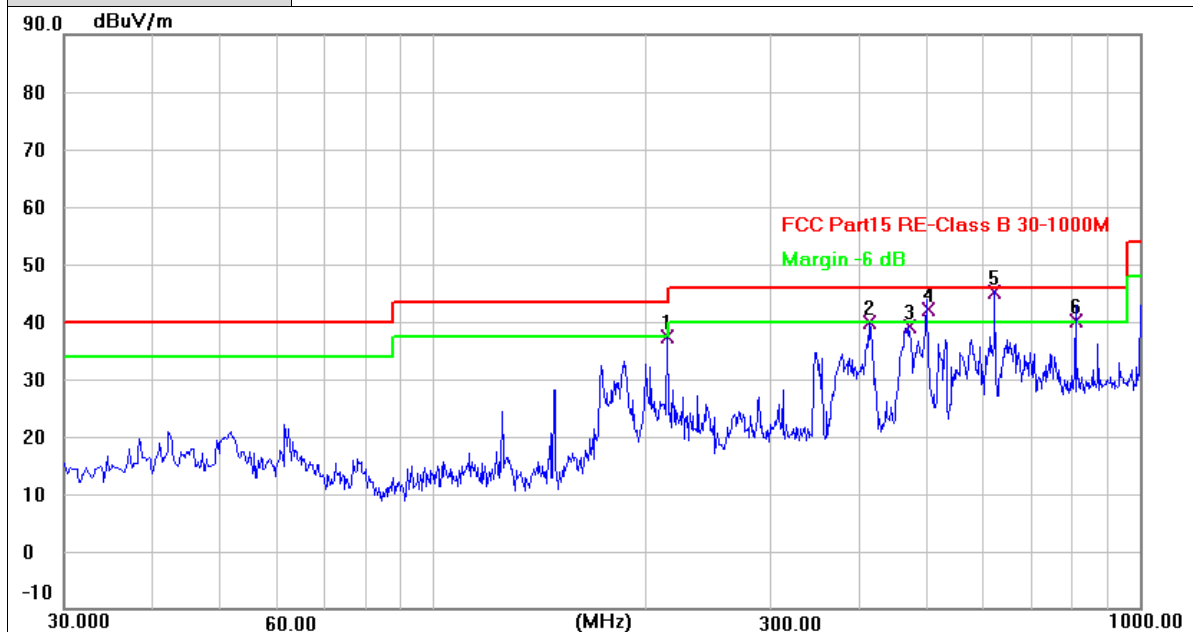


30MHz-1GHz





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



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	214.3000	53.05	-15.55	37.50	43.50	-6.00	QP
2	413.7967	50.67	-10.90	39.77	46.00	-6.23	QP
3	471.0267	49.01	-9.88	39.13	46.00	-6.87	QP
4 !	500.1267	51.48	-9.29	42.19	46.00	-3.81	QP
5 *	624.9333	51.85	-6.80	45.05	46.00	-0.95	QP
6 !	812.4667	44.40	-4.15	40.25	46.00	-5.75	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 *	4803.160	25.58	2.07	27.65	54.00	-26.35	AVG
2	4803.814	39.29	2.08	41.37	74.00	-32.63	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 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	4803.071	40.60	2.07	42.67	74.00	-31.33	peak
2 *	4803.883	24.74	2.08	26.82	54.00	-27.18	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 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 *	4881.450	23.98	2.18	26.16	54.00	-27.84	AVG
2	4882.695	39.17	2.18	41.35	74.00	-32.65	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 *	4881.848	24.24	2.18	26.42	54.00	-27.58	AVG
2	4882.307	39.66	2.18	41.84	74.00	-32.16	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	4959.490	38.45	2.30	40.75	74.00	-33.25	peak
2 *	4960.129	23.57	2.30	25.87	54.00	-28.13	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 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	4959.209	39.22	2.30	41.52	74.00	-32.48	peak
2 *	4960.786	23.45	2.30	25.75	54.00	-28.25	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 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	4803.949	40.47	2.08	42.55	74.00	-31.45	peak
2 *	4803.999	24.99	2.08	27.07	54.00	-26.93	AVG

Remarks:

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

2.Margin value = Level -Limit value

Ant. Pol.	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 *	4803.192	24.64	2.07	26.71	54.00	-27.29	AVG
2	4803.947	39.67	2.08	41.75	74.00	-32.25	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 *	4882.600	24.15	2.18	26.33	54.00	-27.67	AVG
2	4882.886	39.61	2.18	41.79	74.00	-32.21	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 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 *	4882.033	24.35	2.18	26.53	54.00	-27.47	AVG
2	4882.245	39.75	2.18	41.93	74.00	-32.07	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 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	4959.996	40.01	2.30	42.31	74.00	-31.69	peak
2 *	4960.827	23.61	2.30	25.91	54.00	-28.09	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	4959.736	39.68	2.30	41.98	74.00	-32.02	peak
2 *	4959.911	23.41	2.30	25.71	54.00	-28.29	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 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	4804.235	40.89	2.08	42.97	74.00	-31.03	peak
2 *	4804.342	24.95	2.08	27.03	54.00	-26.97	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 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	4803.513	39.82	2.08	41.90	74.00	-32.10	peak
2 *	4803.931	25.45	2.08	27.53	54.00	-26.47	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 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 *	4882.454	24.44	2.18	26.62	54.00	-27.38	AVG
2	4882.717	39.36	2.18	41.54	74.00	-32.46	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 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	4882.009	38.02	2.18	40.20	74.00	-33.80	peak
2 *	4882.673	23.77	2.18	25.95	54.00	-28.05	AVG
Remarks: 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value							



Ant. Pol.	Horizontal
Test Mode:	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	4960.148	38.89	2.30	41.19	74.00	-32.81	peak
2 *	4960.966	23.98	2.30	26.28	54.00	-27.72	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 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 *	4959.710	23.52	2.30	25.82	54.00	-28.18	AVG
2	4960.058	38.84	2.30	41.14	74.00	-32.86	peak

Remarks:

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

2.Margin value = Level -Limit value

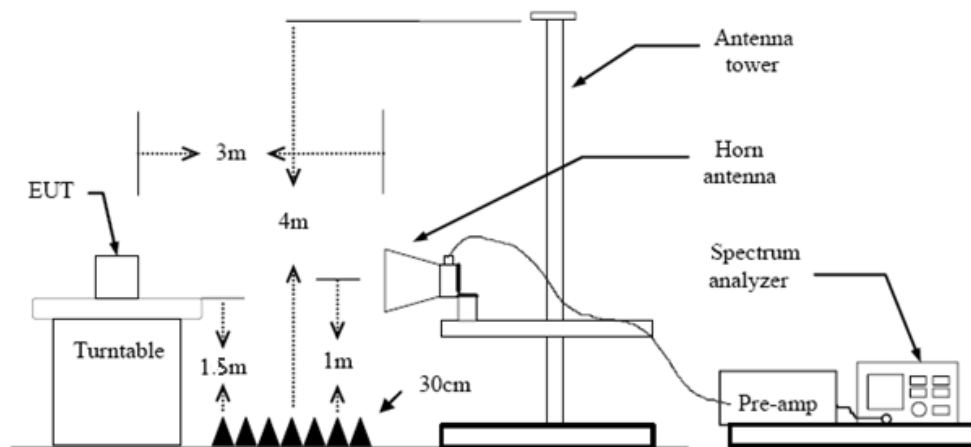
3.3. Band Edge Emissions (Radiated)

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



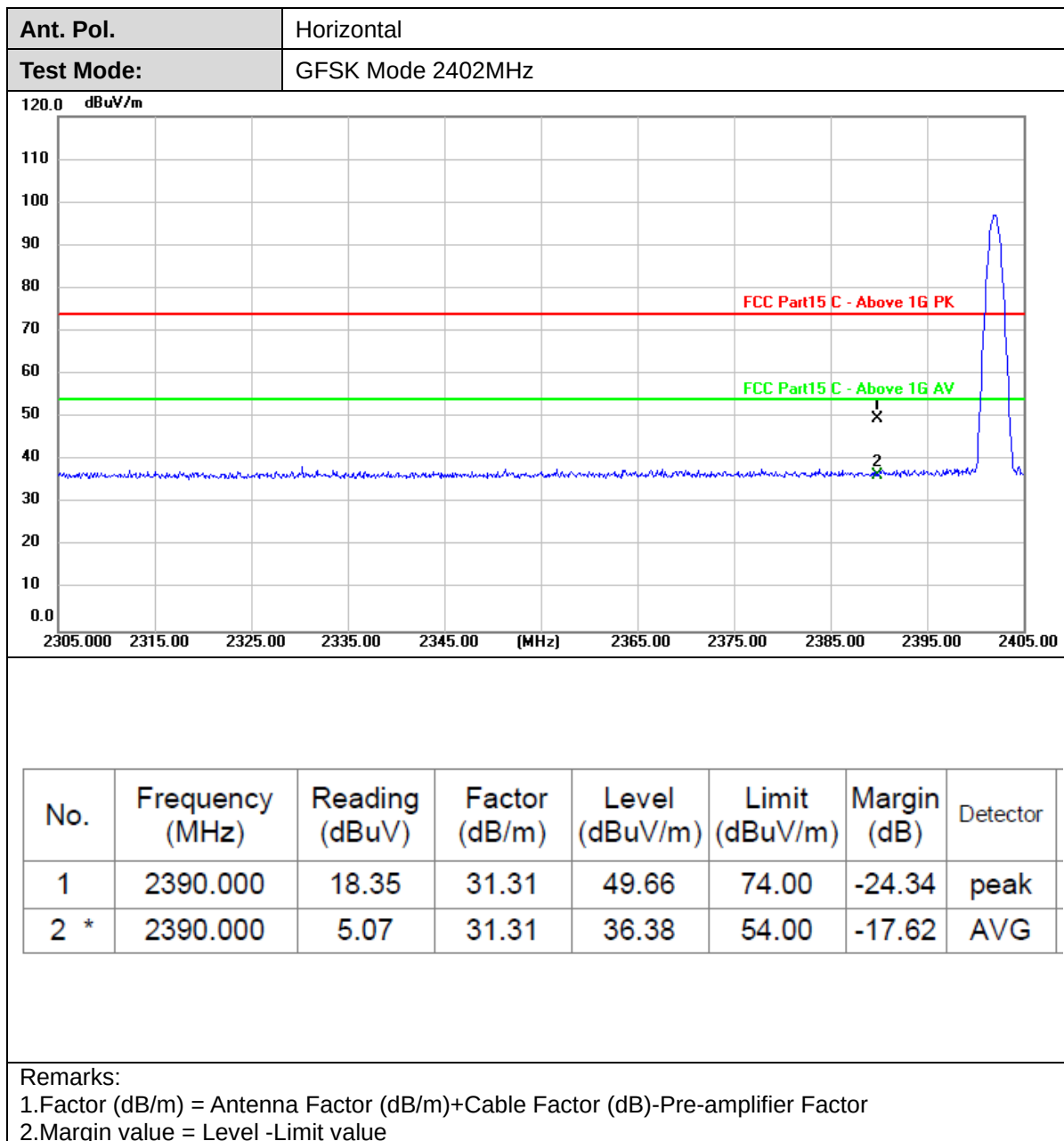
Test Procedure

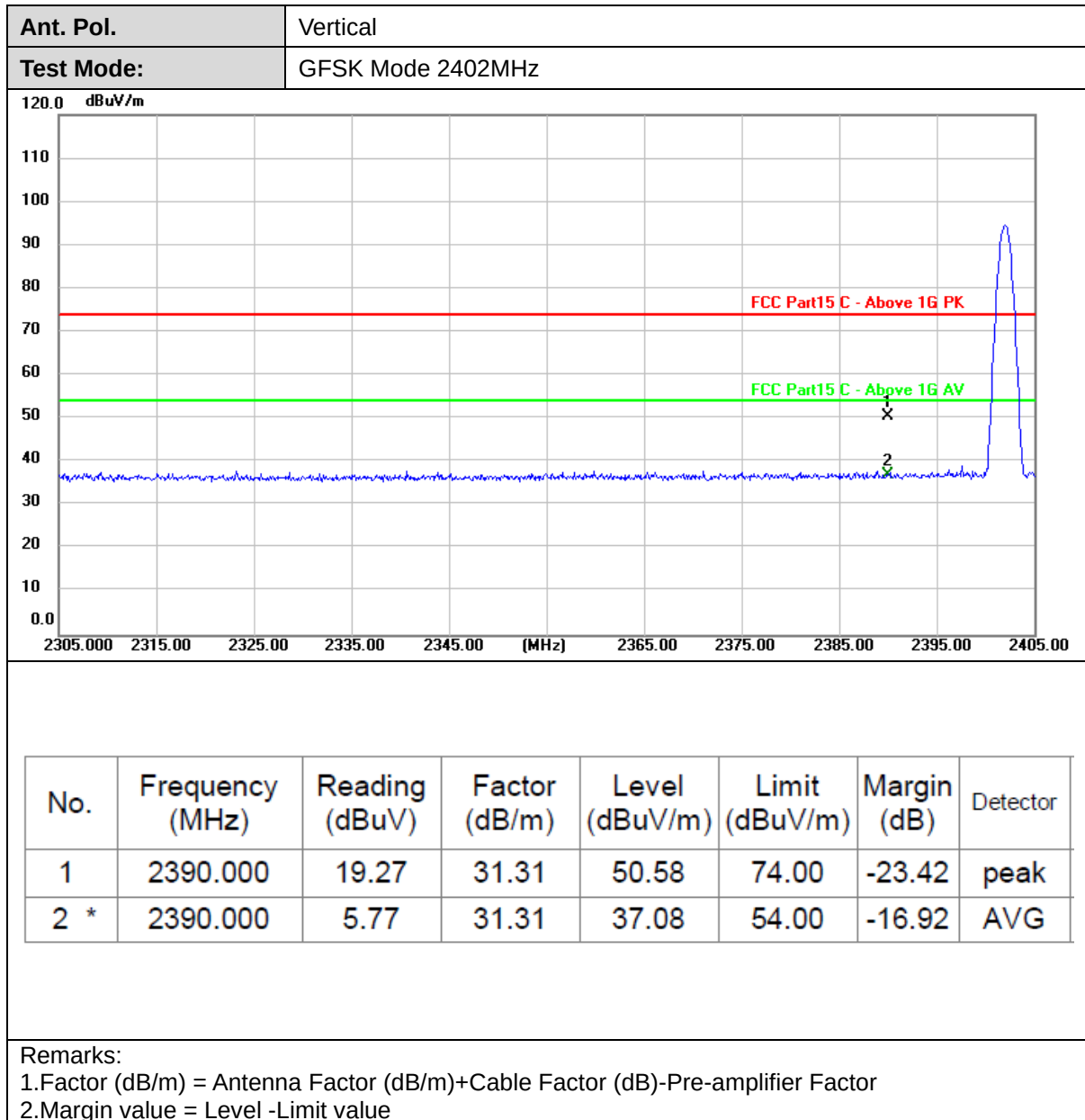
1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna 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.

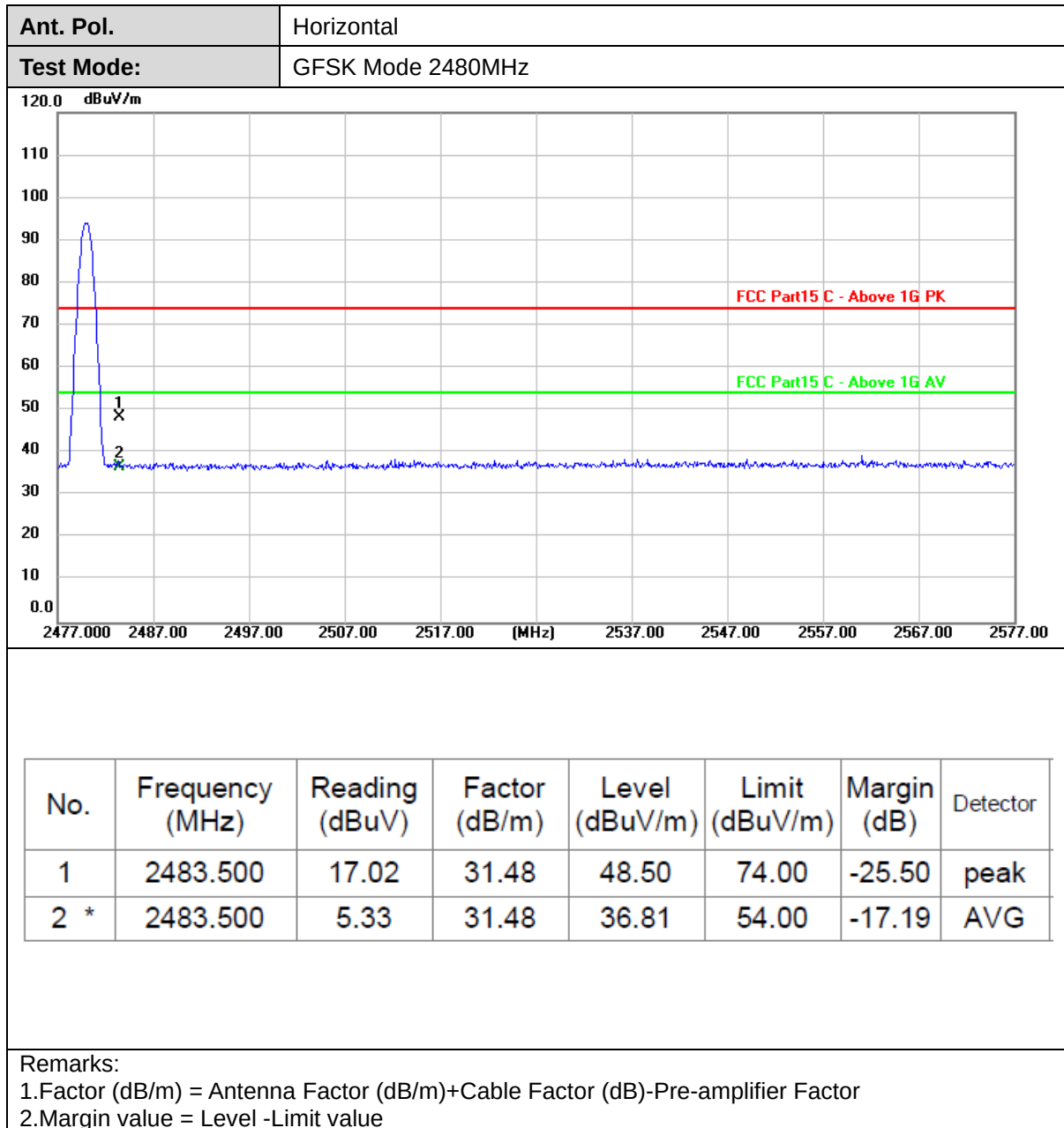
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

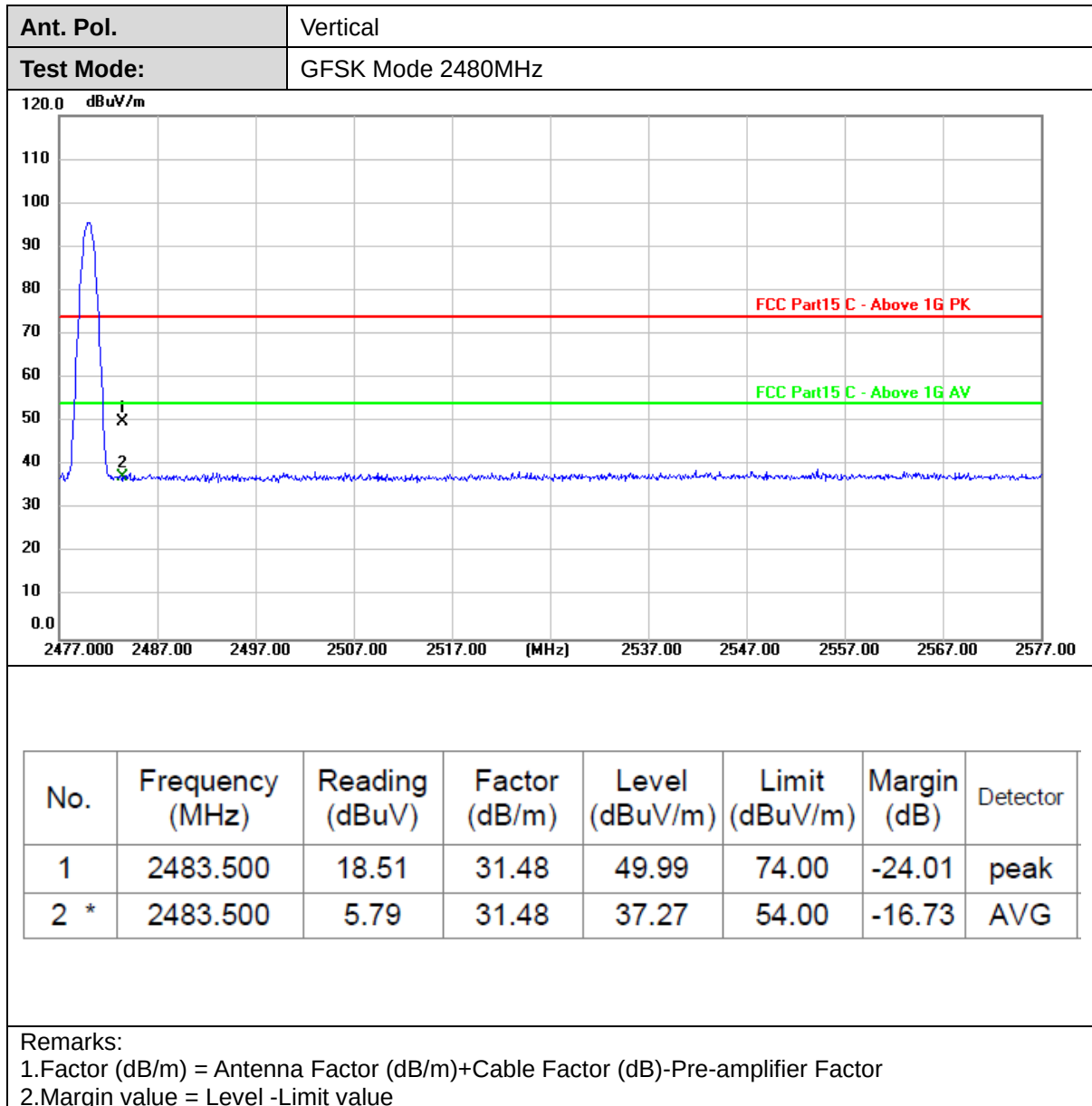
Test Mode

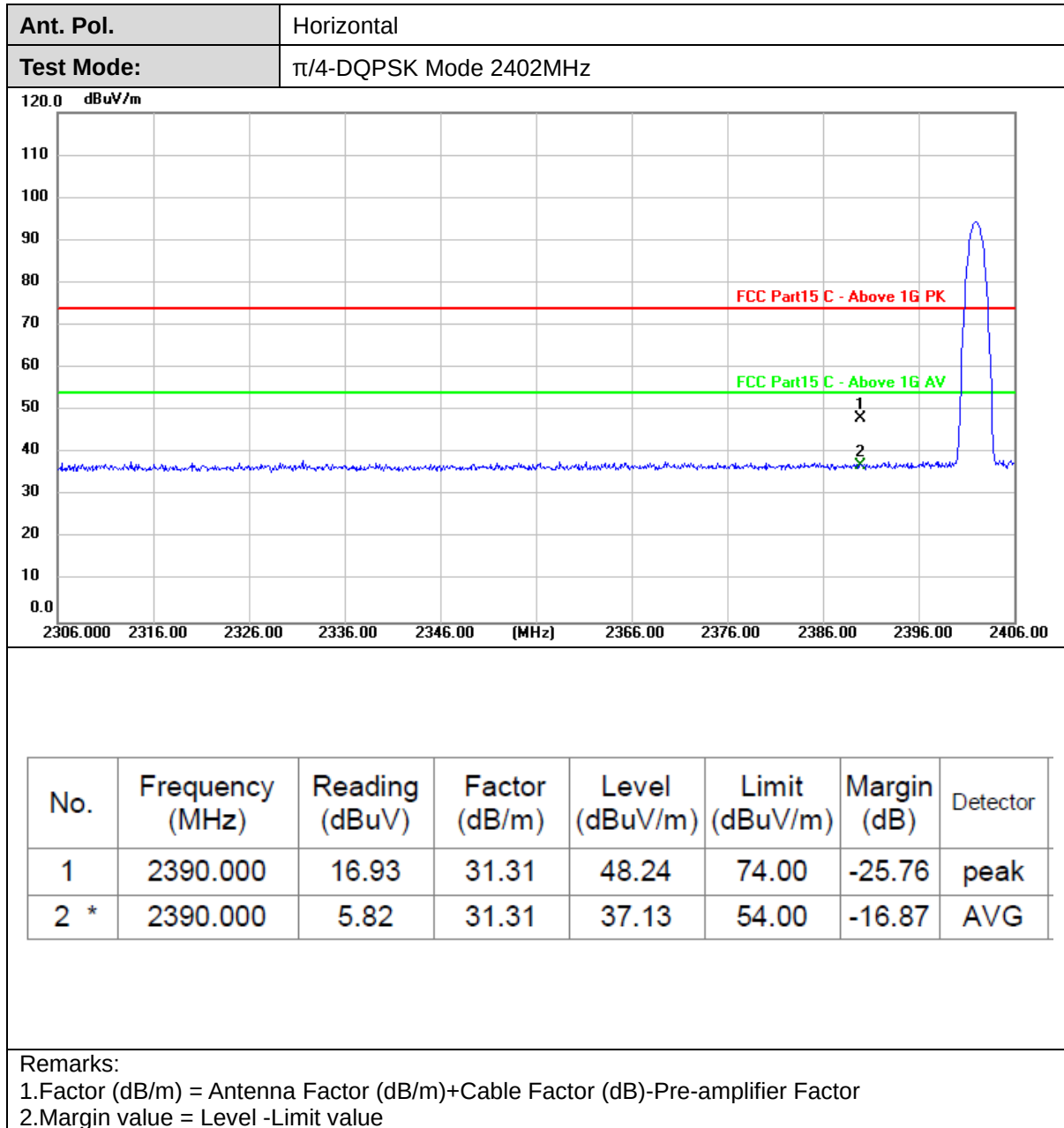
Please refer to the clause 2.4.

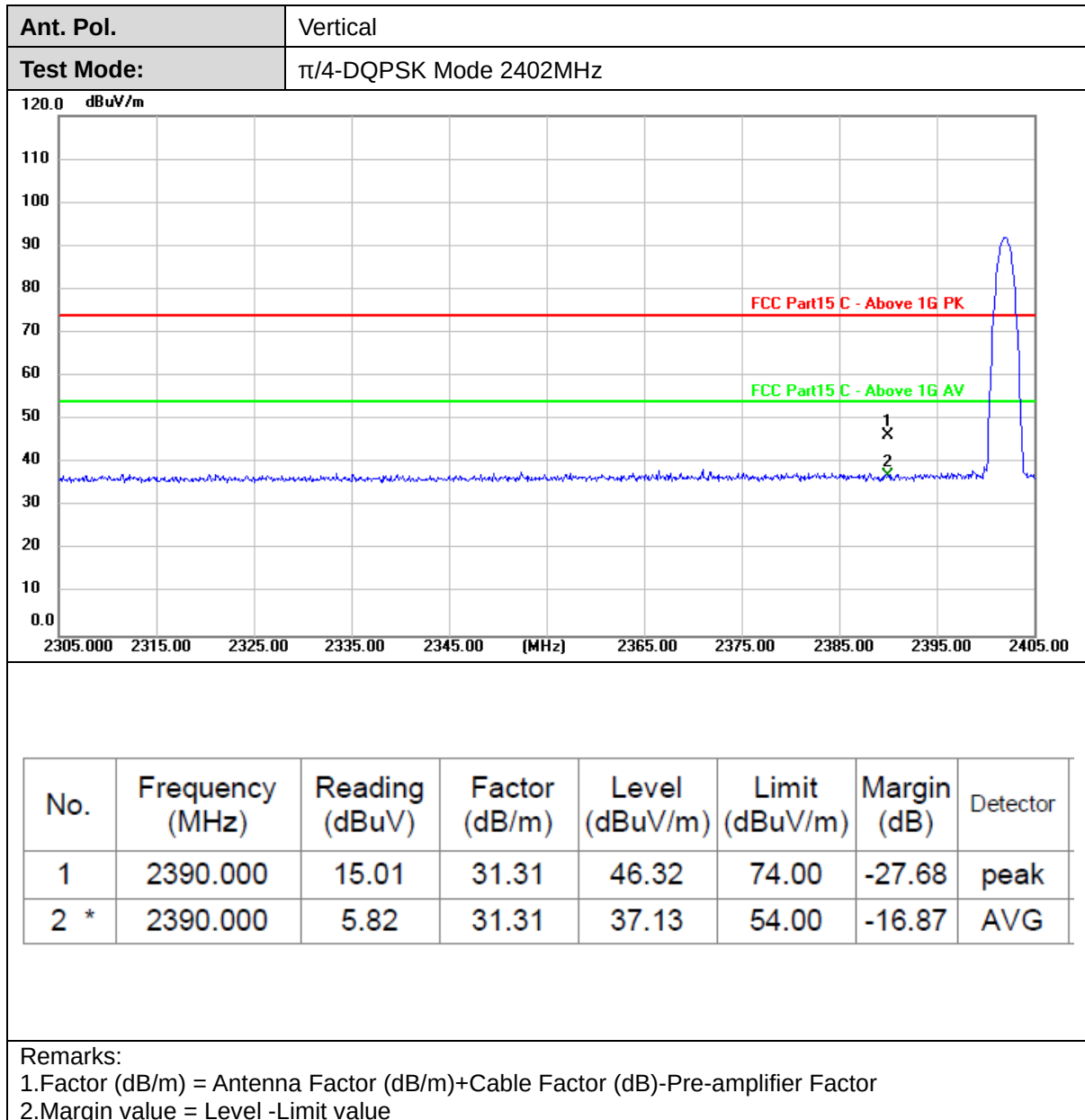
**Test Result**

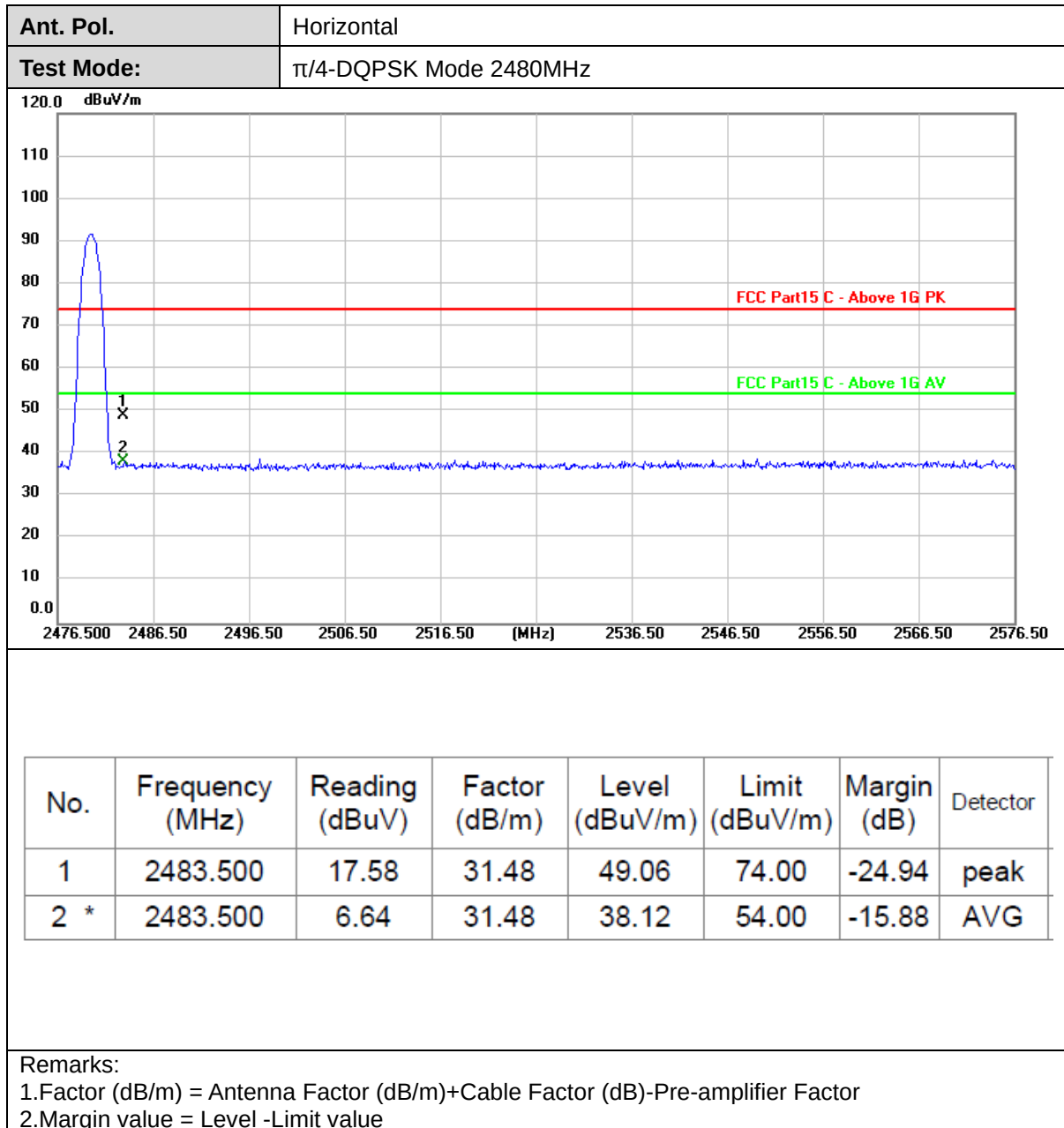


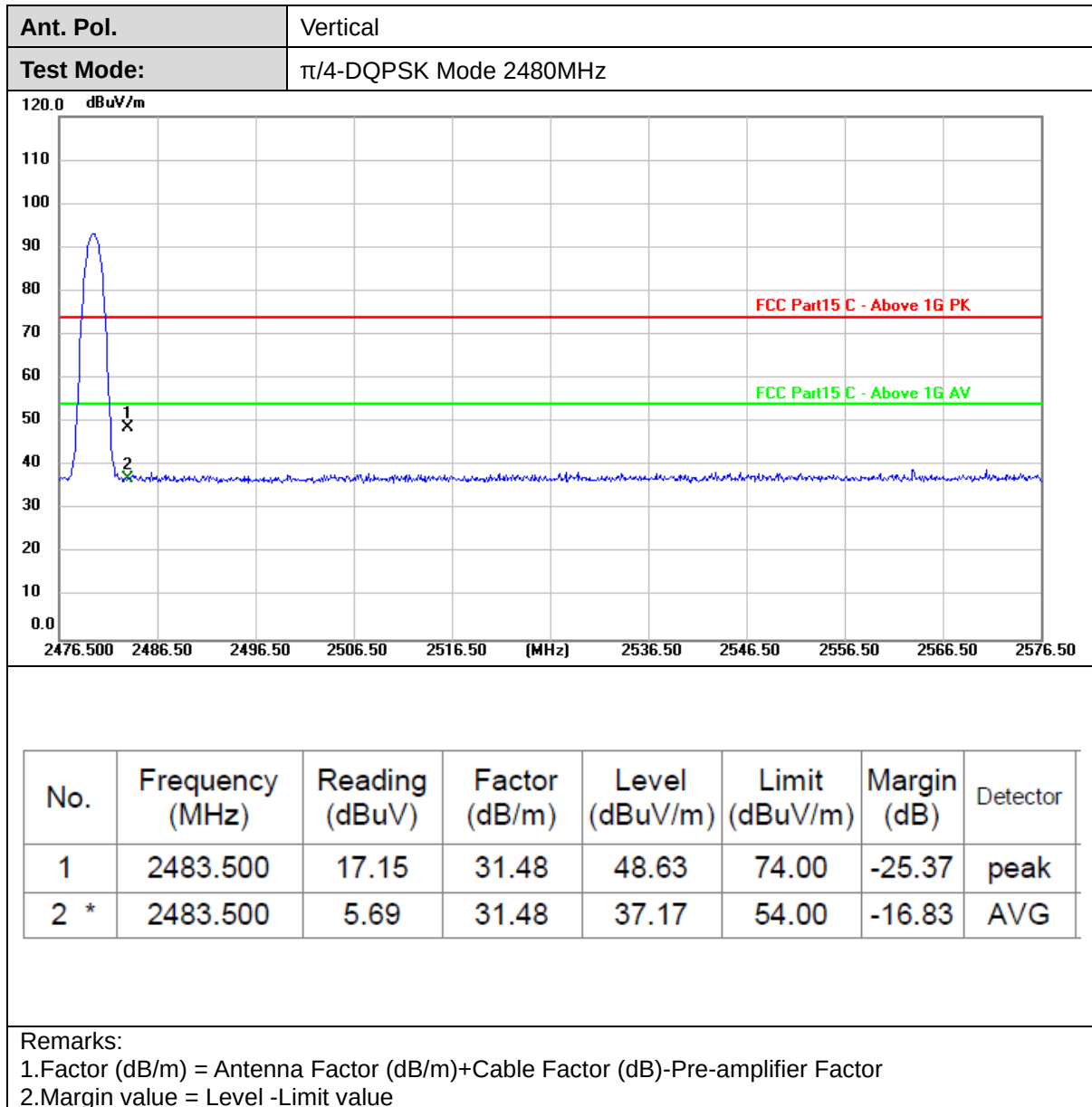


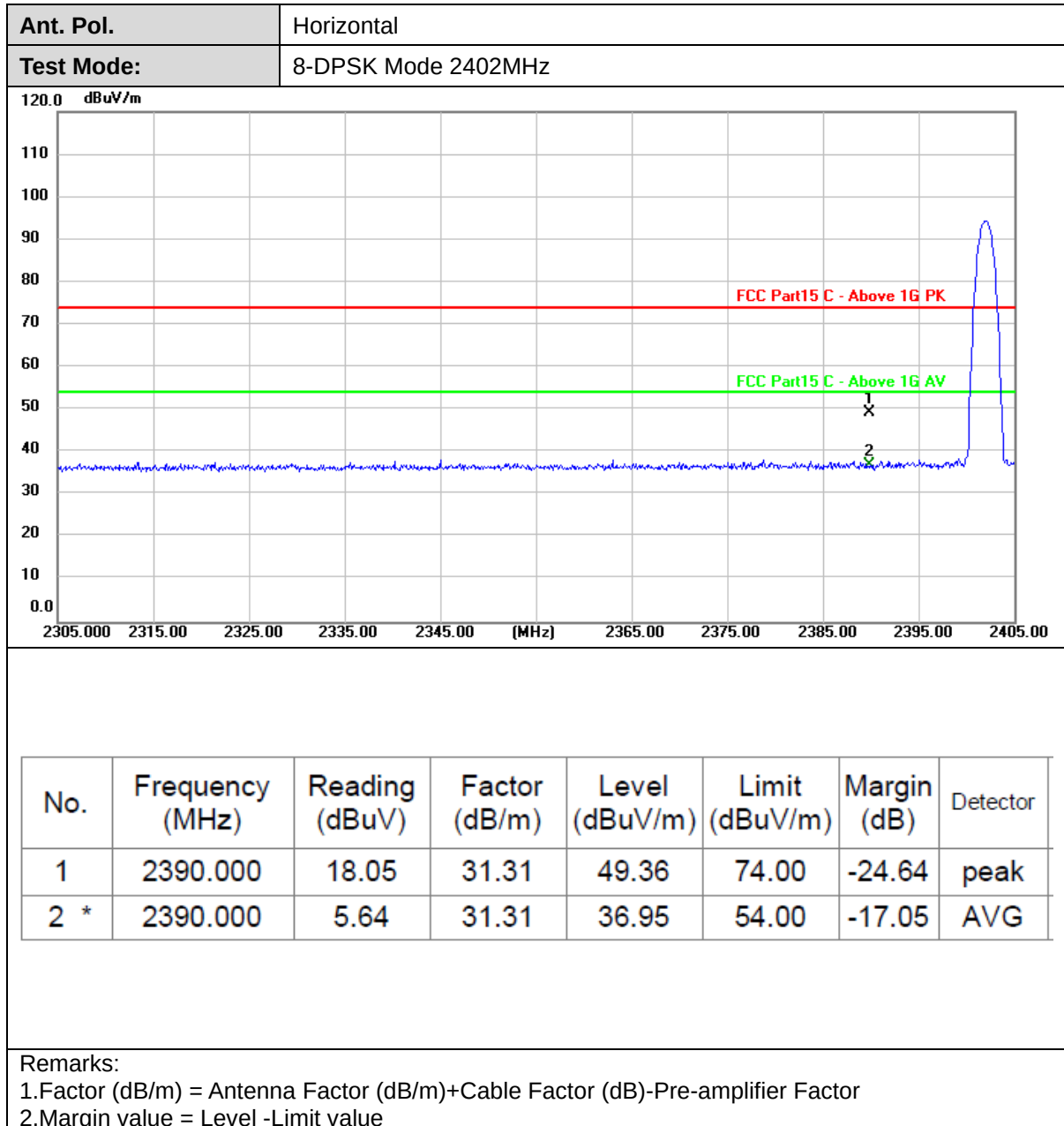


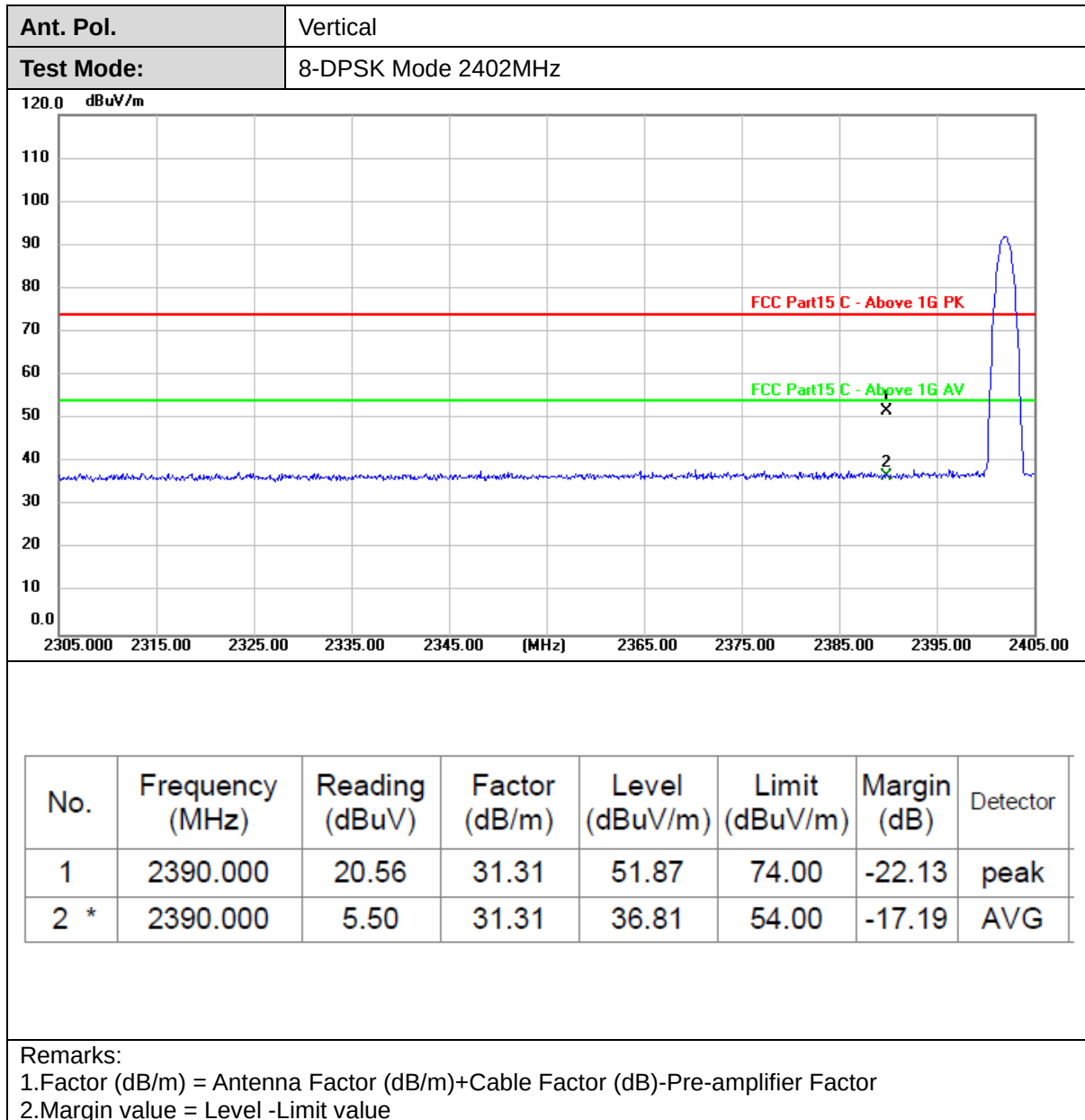


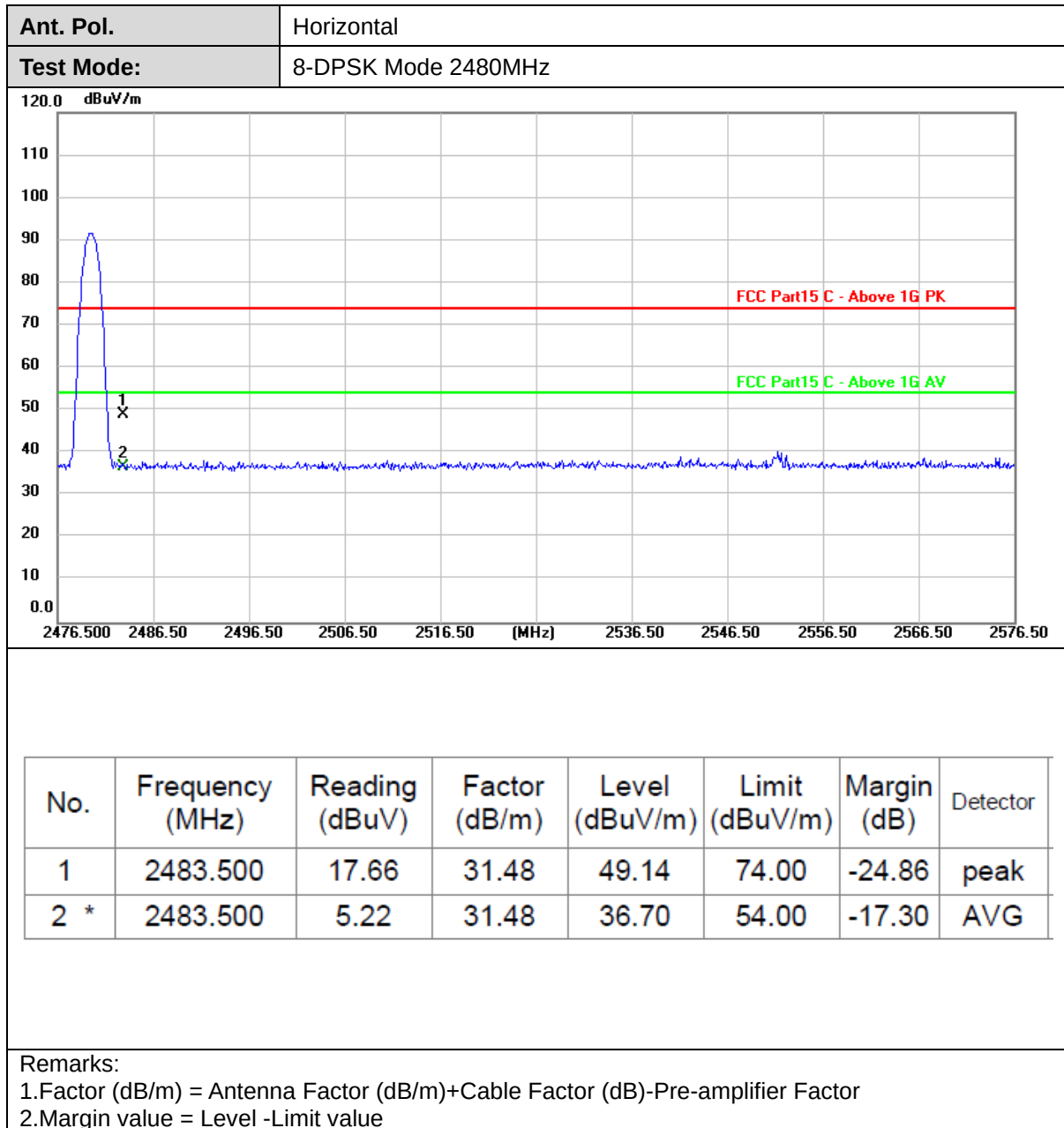


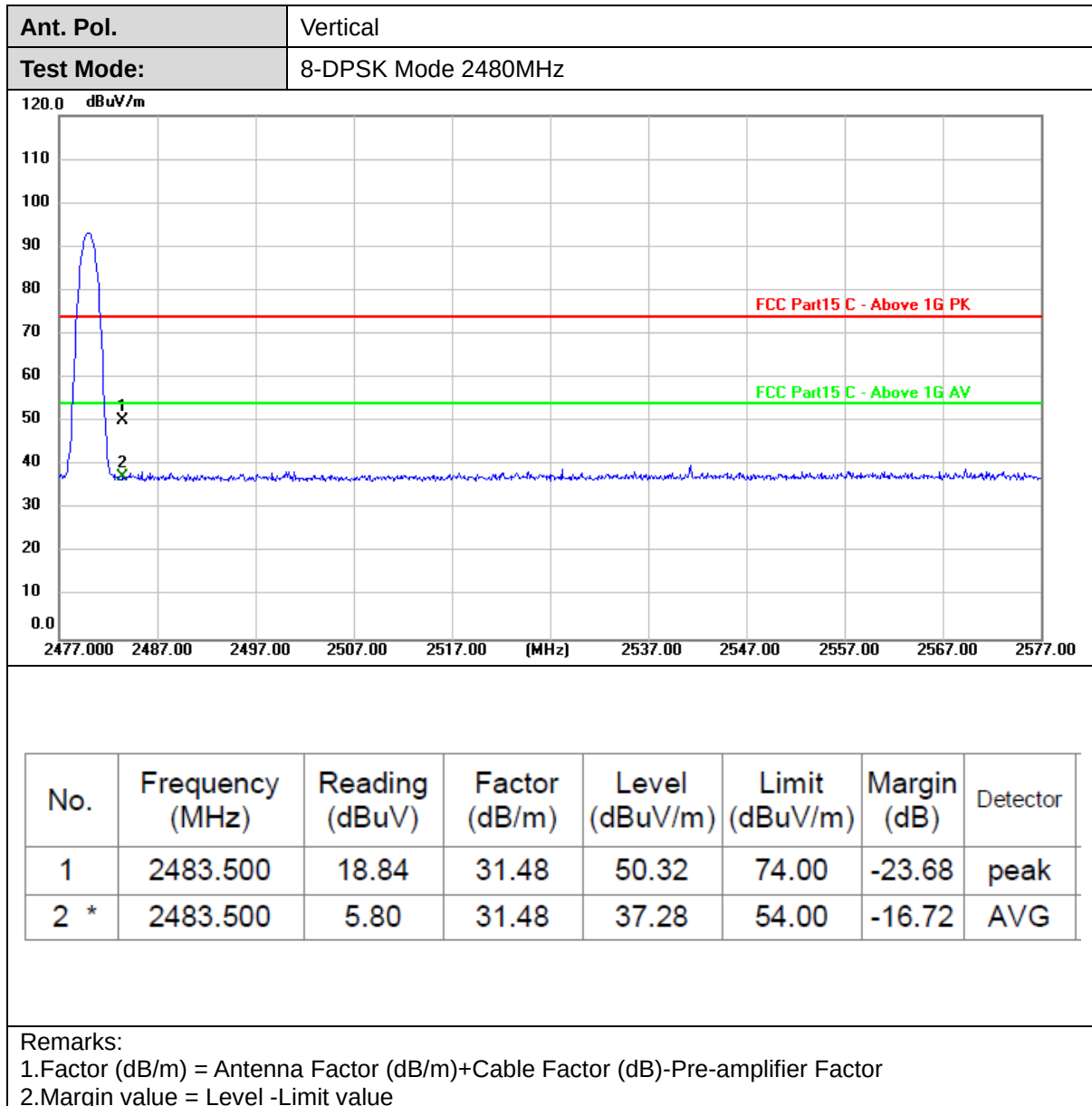














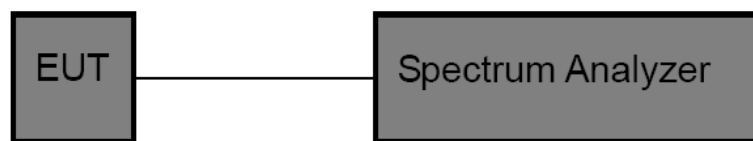
3.4. Band Edge and Spurious Emissions (Conducted)

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

**(1) Band Edge Conducted Test & Conducted Spurious Emissions Test****Non-Hopping**

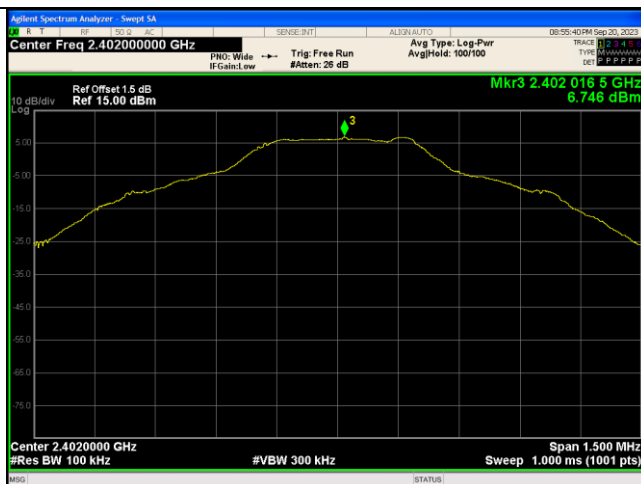
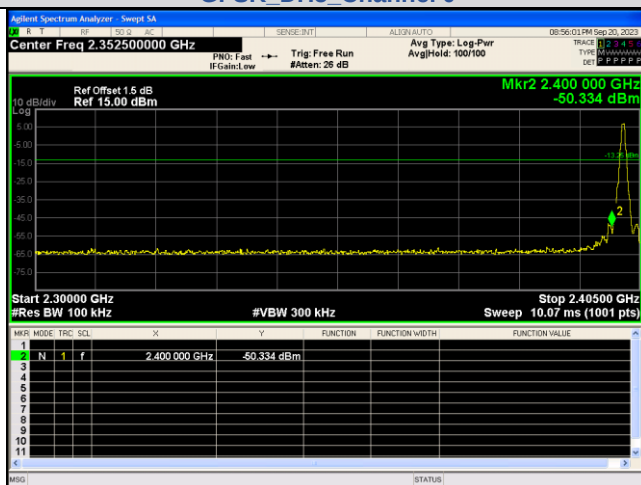
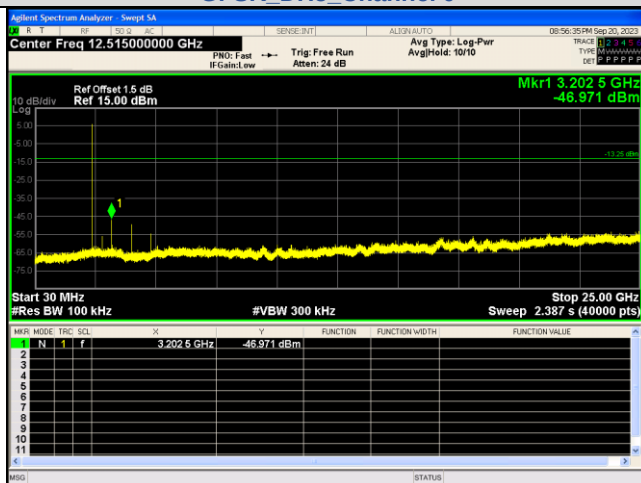
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2400.00	-50.334	-13.25	-37.084	PASS
			3202.52	-46.971	-13.25	-33.721	PASS
		39	3254.96	-50.541	-13.59	-36.951	PASS
			2483.50	-57.660	-13.41	-44.250	PASS
			3306.77	-52.350	-13.41	-38.940	PASS
$\pi/4$ DQPSK	2-DH5	0	2400.00	-53.439	-14.87	-38.569	PASS
			3202.52	-46.443	-14.87	-31.573	PASS
		39	3254.96	-48.498	-15.33	-33.168	PASS
			2483.50	-57.971	-14.84	-43.131	PASS
			3306.77	-49.304	-14.84	-34.464	PASS
8DPSK	3-DH5	0	2400.00	-51.213	-14.92	-36.293	PASS
			3202.52	-46.042	-14.92	-31.122	PASS
		39	3254.96	-47.888	-14.87	-33.018	PASS
			2483.50	-57.028	-14.78	-42.248	PASS
			3306.77	-50.089	-14.78	-35.309	PASS

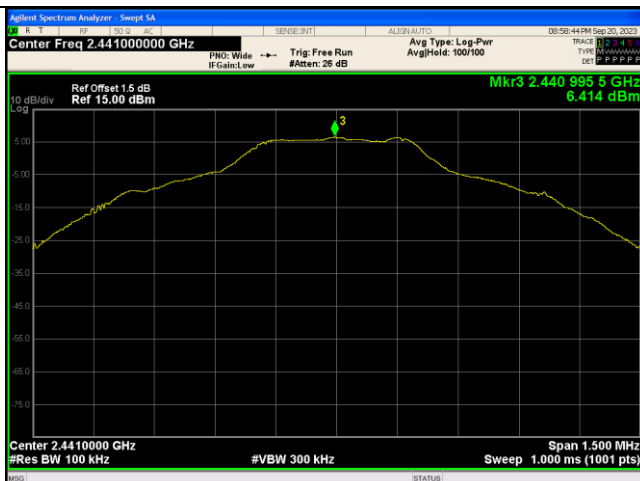
Hopping

Modulation	Packet	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	2400.00	-59.817	-13.33	-46.487	PASS
		2483.50	-61.895	-14.53	-47.365	PASS
$\pi/4$ DQPSK	2-DH5	2400.00	-59.435	-16.02	-43.415	PASS
		2483.50	-62.087	-15.93	-46.157	PASS
8DPSK	3-DH5	2400.00	-59.354	-15.62	-43.734	PASS
		2483.50	-62.963	-14.57	-48.393	PASS

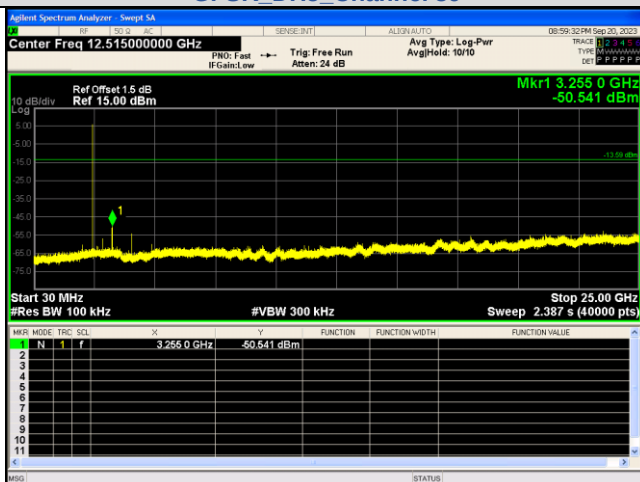


Test plot as follows:

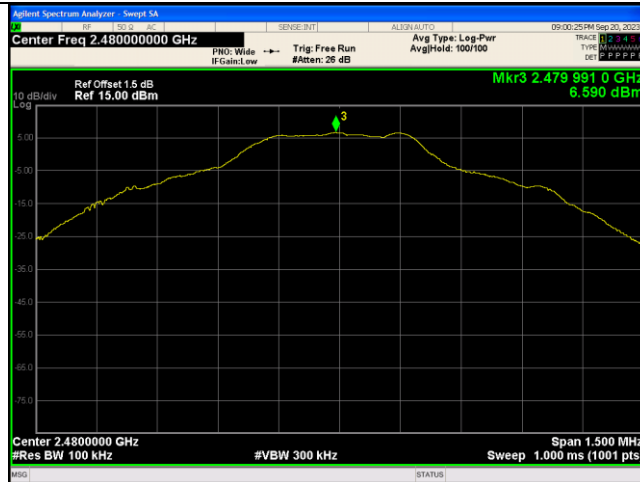
In-Band Reference Level
GFSK DH5 Channel 0Out Of Band Emission
GFSK DH5 Channel 0Spurious Emission
GFSK DH5 Channel 0



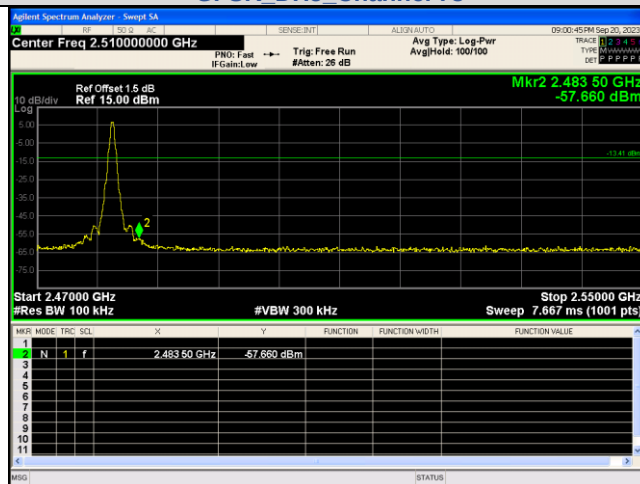
In-Band Reference Level GFSK DH5 Channel 39



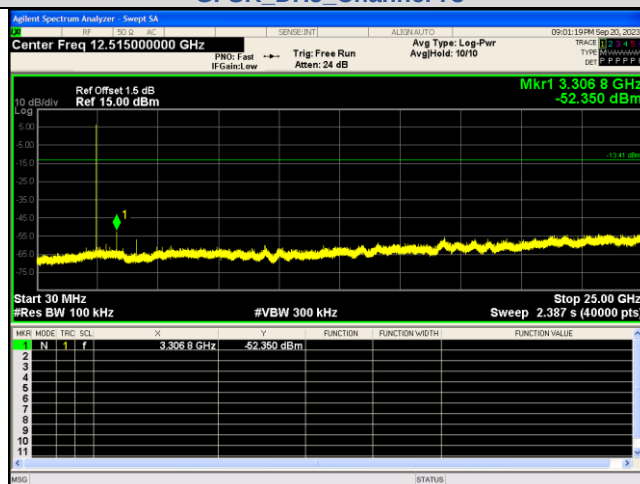
Spurious Emissions GFSK DH5 Channel 39



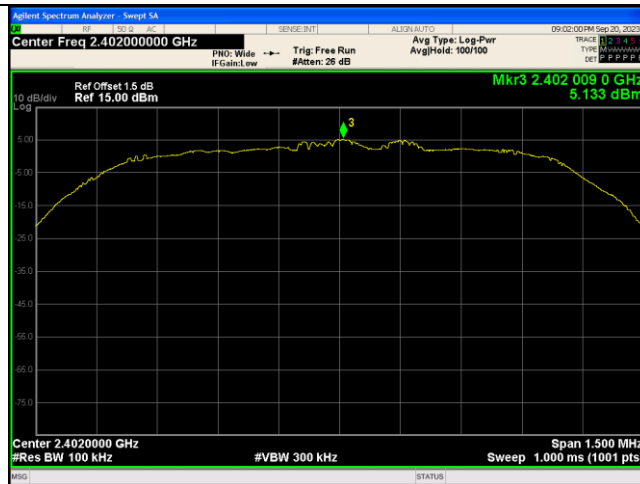
In-Band Reference Level
GFSK DH5 Channel 78



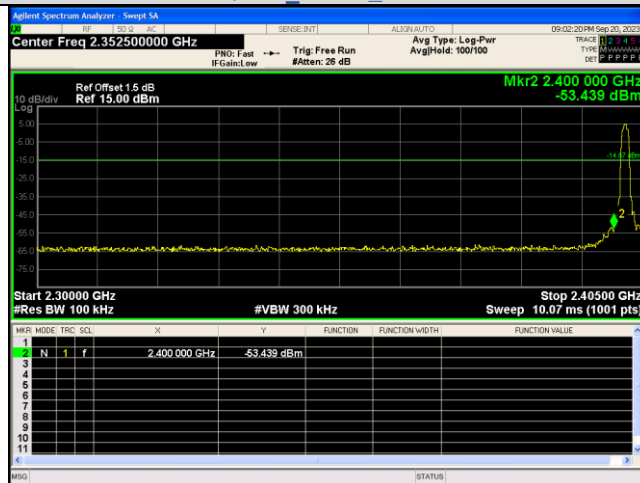
Out Of Band Emission
GFSK DH5 Channel 78



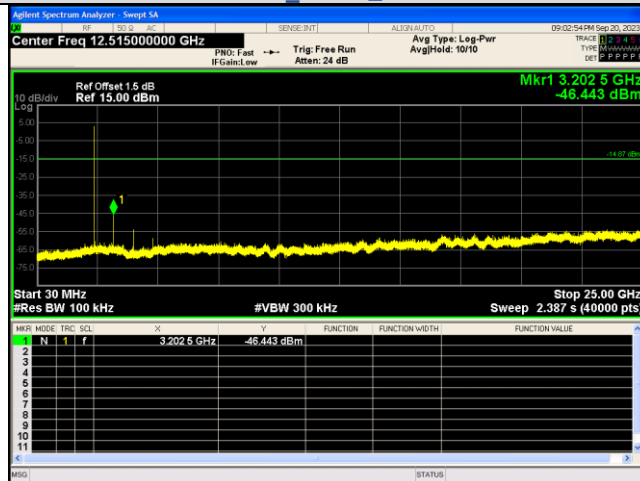
Spurious Emission
GFSK DH5 Channel 78



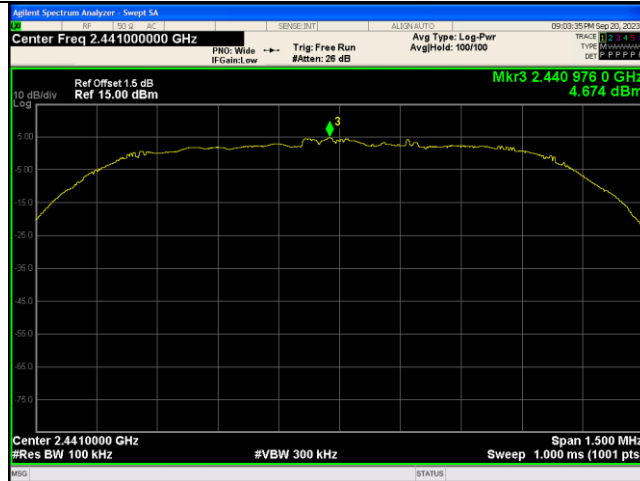
In-Band Reference Level $\pi/4$ DQPSK 2-DH5 Channel 0



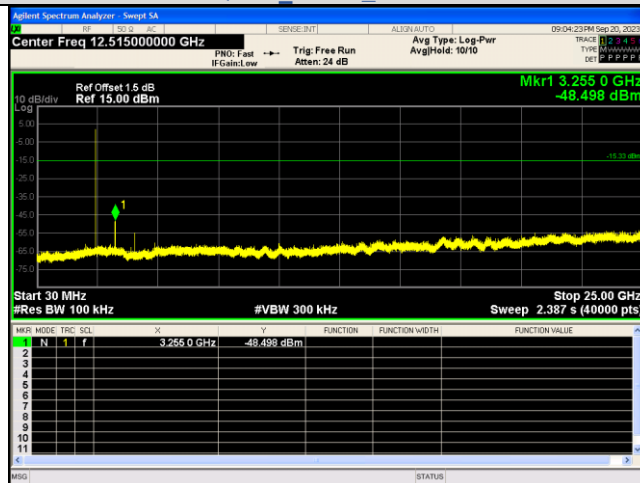
Out Of Band Emission $\pi/4$ DQPSK 2-DH5 Channel 0



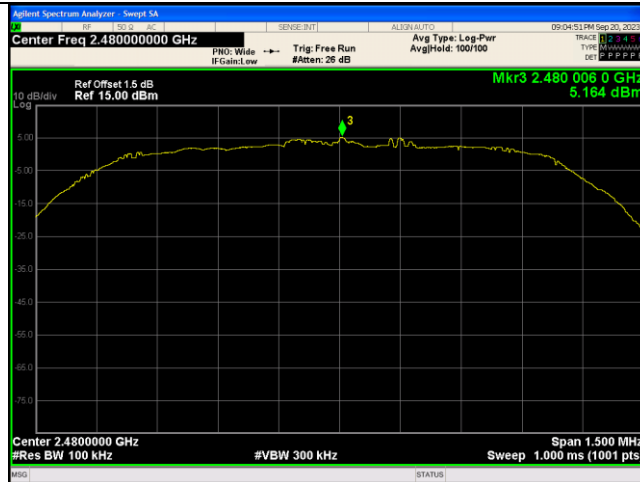
Spurious Emission $\pi/4$ DQPSK 2-DH5 Channel 0



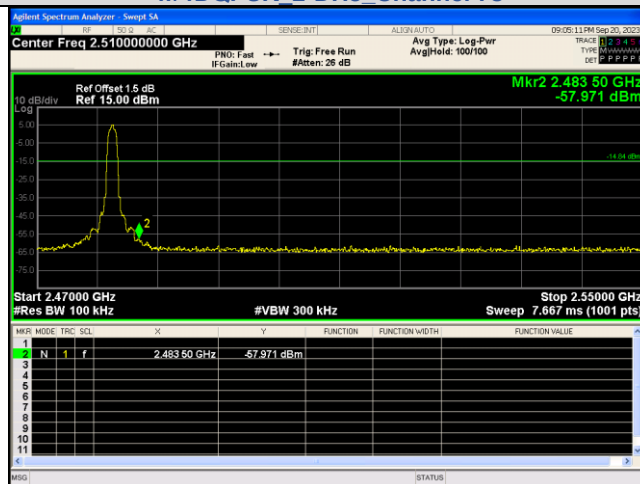
In-Band Reference Level $\pi/4$ DQPSK 2-DH5 Channel 39



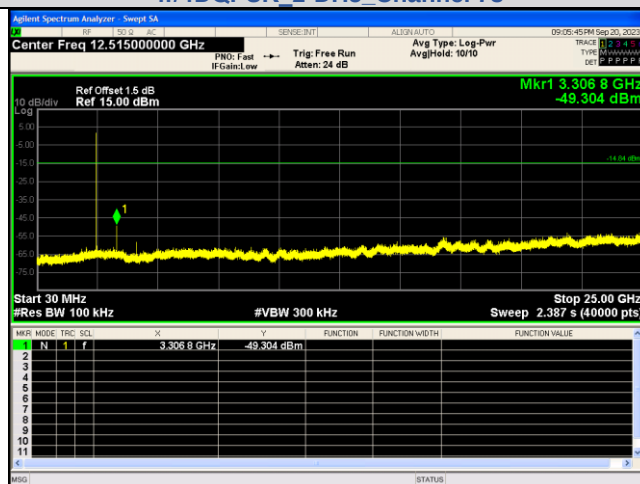
Spurious Emissions $\pi/4$ DQPSK 2-DH5 Channel 39



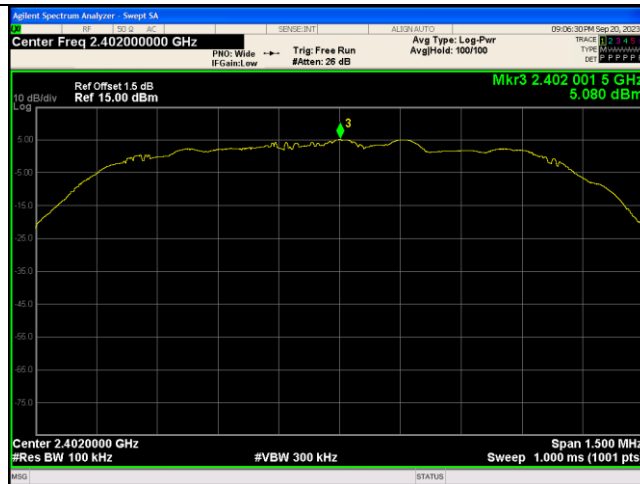
In-Band Reference Level
 $\pi/4$ DQPSK 2-DH5 Channel 78



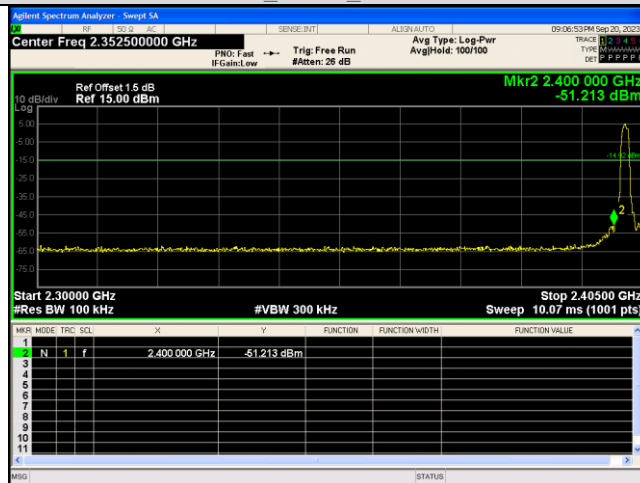
Out Of Band Emission
 $\pi/4$ DQPSK 2-DH5 Channel 78



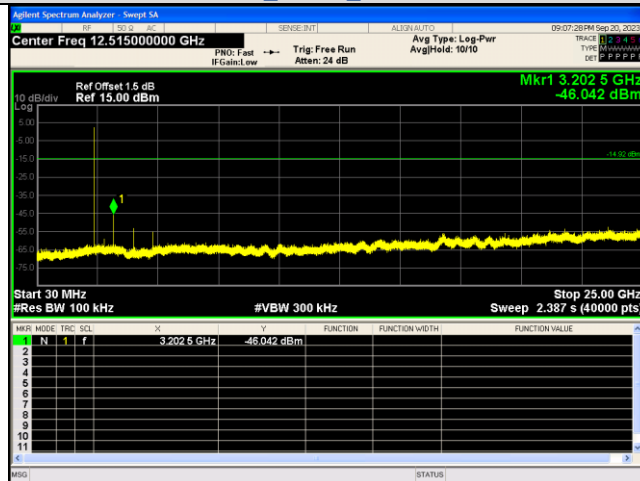
Spurious Emission
 $\pi/4$ DQPSK 2-DH5 Channel 78



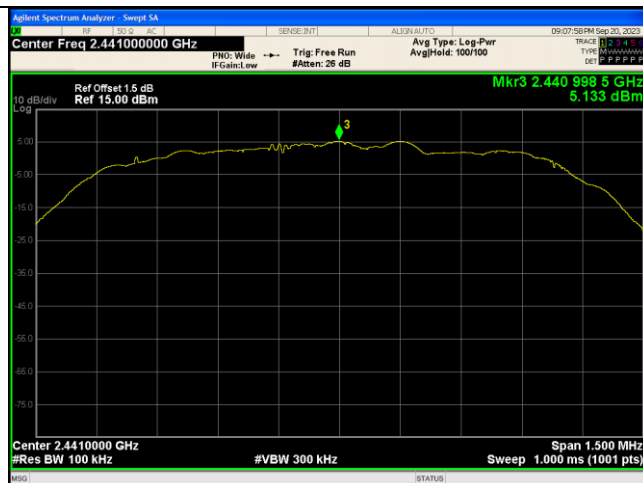
In-Band Reference Level 8DPSK 3-DH5 Channel 0



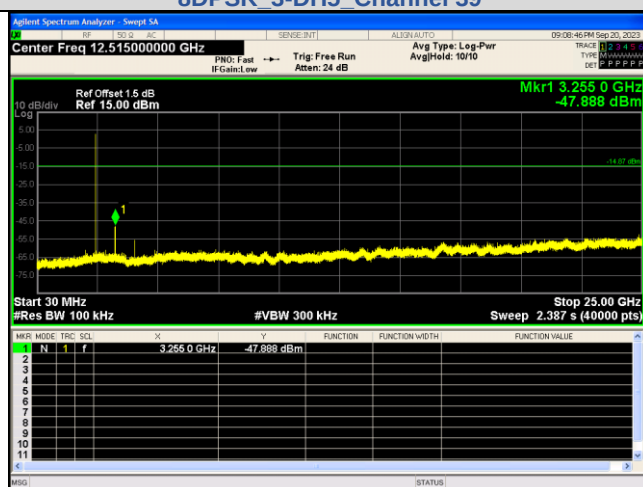
Out Of Band Emission 8DPSK 3-DH5 Channel 0



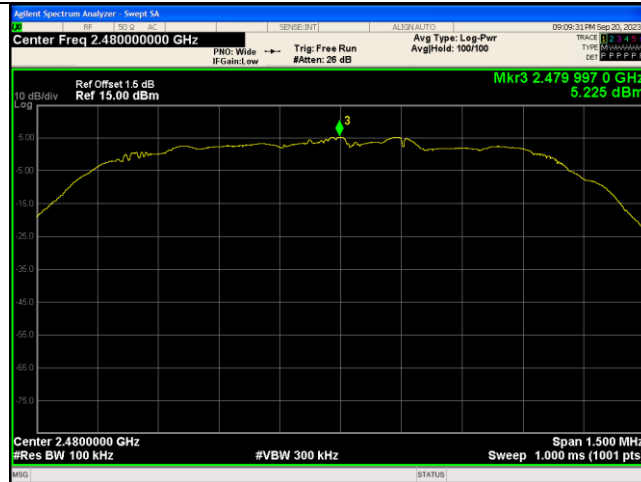
Spurious Emission 8DPSK 3-DH5 Channel 0



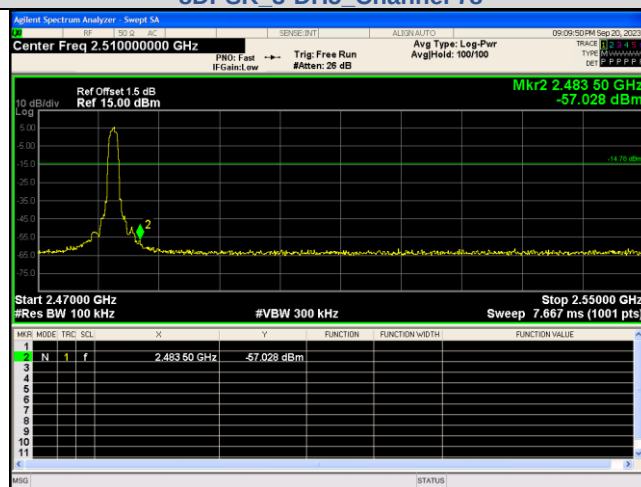
In-Band Reference Level
8DPSK 3-DH5 Channel 39



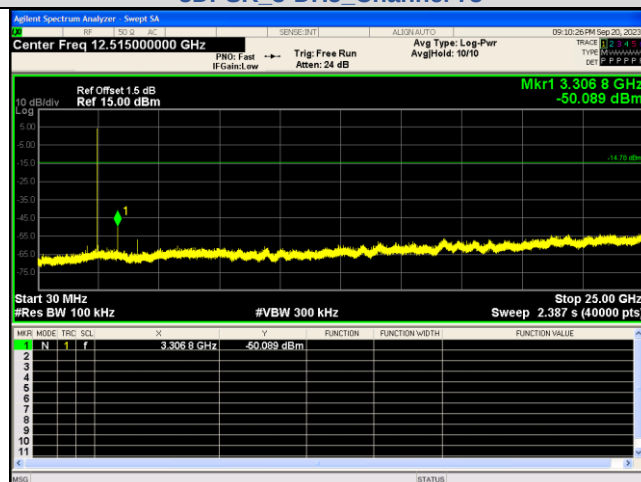
Spurious Emissions
8DPSK 3-DH5 Channel 39



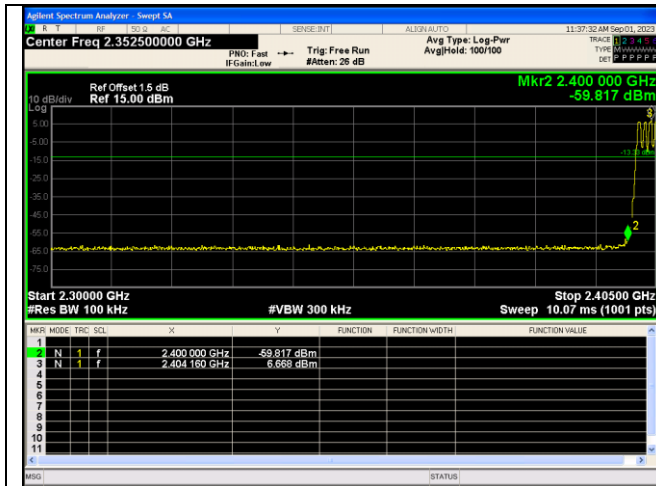
In-Band Reference Level
8DPSK 3-DH5 Channel 78



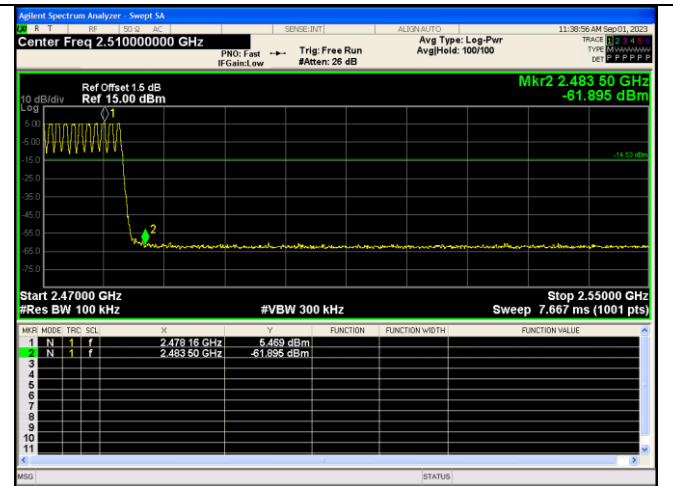
Out Of Band Emission
8DPSK 3-DH5 Channel 78



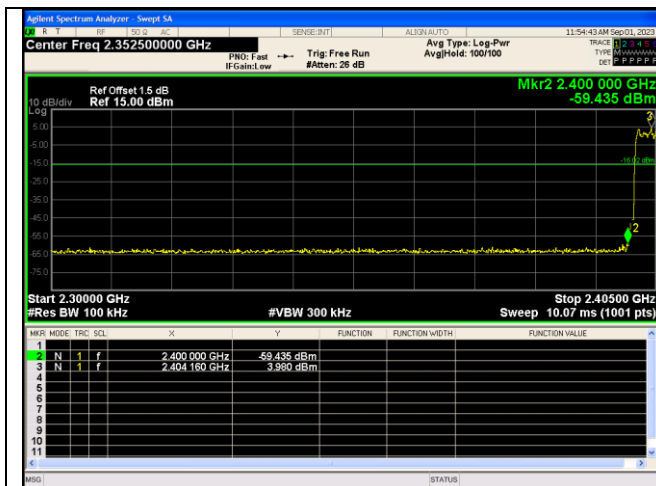
Spurious Emission
8DPSK 3-DH5 Channel 78



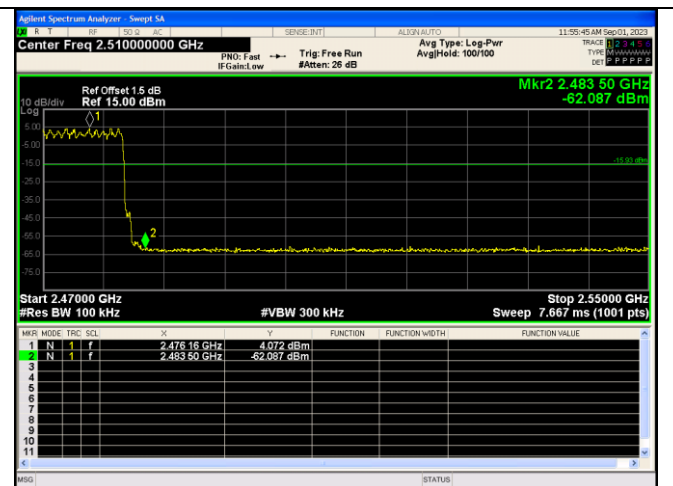
Out Of Band Emission(Left)
GFSK DH5 Channel Hopping



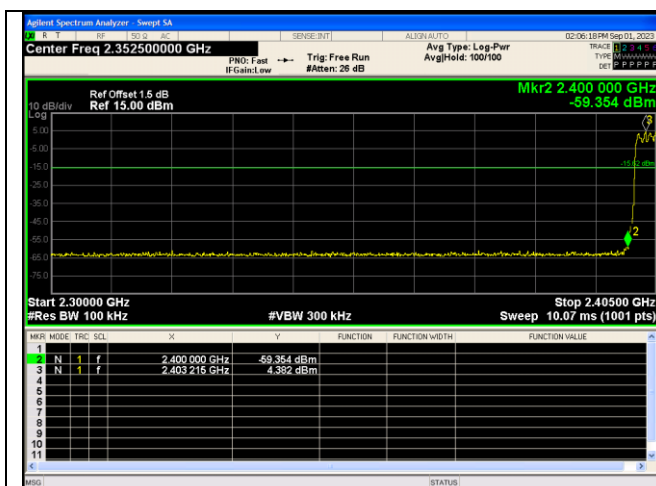
Out Of Band Emission(Right)
GFSK DH5 Channel Hopping



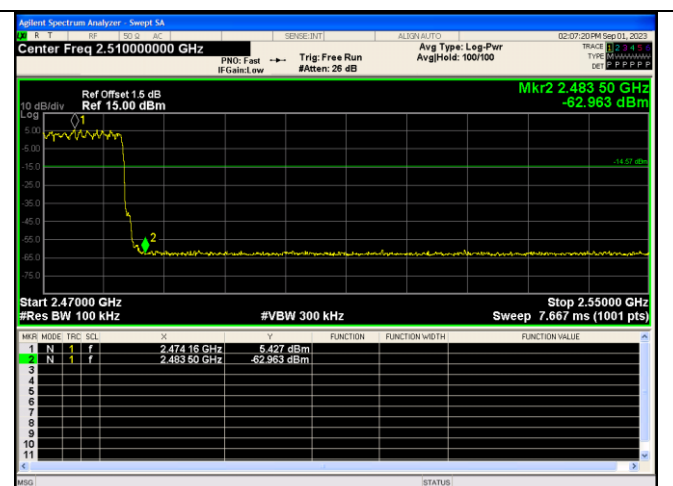
Out Of Band Emission(Left)
 $\pi/4$ DQPSK 2-DH5 Channel Hopping



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



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



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

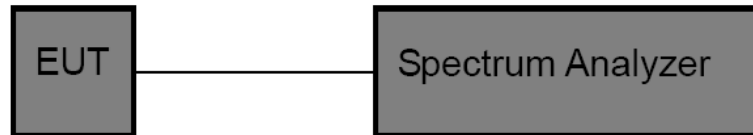


3.5. 20dB Bandwidth

Limit

N/A

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. OCB and 20dB Spectrum Setting:
 - (1) Set RBW = 1% ~ 5% occupied bandwidth.
 - (2) Set the video bandwidth (VBW) ≥ 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	0.87521	0.9543	0.636
	2441	0.86838	1.009	0.673
	2480	0.86868	1.016	0.677
$\pi/4$ -DQPSK	2402	1.2045	1.346	0.897
	2441	1.2032	1.346	0.897
	2480	1.1968	1.347	0.898
8-DPSK	2402	1.1943	1.309	0.873
	2441	1.2086	1.308	0.872
	2480	1.2075	1.308	0.872