



CTC Laboratories, Inc.

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TEST REPORT

Report No.: CTC20211531E12
FCC ID.....: XUJX431PROV5
Applicant.....: **Launch Tech Co., Ltd.**
Address.....: Launch Industrial Park, North of Wuhe Avenue, Banxuegang,
Longgang, Shenzhen, Guangdong, P.R. China
Manufacturer.....: Launch Tech Co., Ltd.
Address.....: Launch Industrial Park, North of Wuhe Avenue, Banxuegang,
Longgang, Shenzhen, Guangdong, P.R. China
Product Name.....: **AUTO Smart Diagnostic Tool**
Trade Mark.....: LAUNCH
Model/Type reference.....: X-431 PROS MINI V5.0
Listed Model(s): X-431 PRO MINI V5.0
Standard.....: **FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of receipt of test sample....: Sep. 13, 2021
Date of testing.....: Sep. 14, 2021 ~ Sep. 26, 2021
Date of issue.....: Sep. 27, 2021
Result.....: **PASS**

Compiled by:
(Printed name+signature) Terry Su

Supervised by:
(Printed name+signature) Miller Ma

Approved by:
(Printed name+signature) Walter Chen

Testing Laboratory Name.....: **CTC Laboratories, Inc.**

Address.....: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park,
Shenzhen, Guangdong, China

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**Table of Contents**

	Page
1. TEST SUMMARY.....	3
1.1. TEST STANDARDS.....	3
1.2. REPORT VERSION.....	3
1.3. TEST DESCRIPTION.....	4
1.4. TEST FACILITY	5
1.5. MEASUREMENT UNCERTAINTY.....	5
1.6. ENVIRONMENTAL CONDITIONS	6
2. GENERAL INFORMATION.....	7
2.1. CLIENT INFORMATION	7
2.2. GENERAL DESCRIPTION OF EUT.....	8
2.3. ACCESSORY EQUIPMENT INFORMATION	9
2.4. OPERATION STATE.....	10
2.5. MEASUREMENT INSTRUMENTS LIST	11
3. TEST ITEM AND RESULTS.....	13
3.1. CONDUCTED EMISSION.....	13
3.2. RADIATED EMISSION	15
3.3. BAND EDGE EMISSIONS (RADIATED)	37
3.4. BAND EDGE AND SPURIOUS EMISSIONS (CONDUCTED)	50
3.5. 20DB BANDWIDTH	51
3.6. CHANNEL SEPARATION.....	52
3.7. NUMBER OF HOPPING CHANNEL.....	53
3.8. DWELL TIME	54
3.9. PEAK OUTPUT POWER	55
3.10. DUTY CYCLE	56
3.11. ANTENNA REQUIREMENT	57



1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

RSS 247 Issue 2: Standard Specifications for Frequency Hopping Systems (FHSs) and Digital Transmission Systems (DTSs) Operating in the Bands 902-928MHz, 2400-2483.5MHz and 5725-5850MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version

Revised No.	Date of issue	Description
01	Sep. 27, 2021	Original



1.3. Test Description

FCC Part 15 Subpart C (15.247)/ RSS 247 Issue 2				
Test Item	Standard Section		Result	Test Engineer
	FCC	IC		
Antenna Requirement	15.203	/	Pass	Terry Su
Conducted Emission	15.207	RSS-Gen 8.8	N/A	N/A
Restricted Bands	15.205	RSS-Gen 8.10	Pass	Terry Su
Hopping Channel Separation	15.247(a)(1)	RSS 247 5.1 (b)	N/A	N/A
Dwell Time	15.247(a)(iii)	RSS 247 5.1 (d)	N/A	N/A
Peak Output Power	15.247(b)(1)	RSS 247 5.4 (b)	N/A	N/A
Number of Hopping Frequency	15.247(a)(iii)	RSS 247 5.1 (d)	N/A	N/A
Conducted Band Edge and Spurious Emissions	15.247(d)	RSS 247 5.5	N/A	N/A
Radiated Band Edge and Spurious Emissions	15.205&15.209&15.247(d)	RSS 247 5.5	Pass	Terry Su
Radiated Spurious Emission	15.247(d)&15.209	RSS 247 5.5&RSS-Gen 8.9	Pass	Terry Su
20dB Bandwidth	15.247(a)	RSS 247 5.1 (b)	N/A	N/A

Note: 1. "N/A" is not applicable.

2. The measurement uncertainty is not included in the test result.

3. The difference with the X-431 PRO3 V5.0 is that the screen is smaller and the RF antenna is different. The added items are Restricted Bands, Radiated Band Edge and Spurious Emissions , Radiated Spurious Emission. Other test data reference report No.: CTC20210728E12.



1.4. Test Facility

CTC Laboratories, Inc.

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

Laboratory accreditation

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

CNAS-Lab Code: L5365

CTC Laboratories, Inc. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation. Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

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
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 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)
Occupied Bandwidth	-----	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

1.6. Environmental conditions

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

Temperature:	21°C ~ 27°C
Relative Humidity:	40% ~ 60%
Air Pressure:	101kPa



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Launch Tech Co., Ltd.
Address:	Launch Industrial Park, North of Wuhe Avenue, Banxuegang, Long-gang, Shenzhen, Guangdong, P.R. China
Manufacturer:	Launch Tech Co., Ltd.
Address:	Launch Industrial Park, North of Wuhe Avenue, Banxuegang, Long-gang, Shenzhen, Guangdong, P.R. China



2.2. General Description of EUT

Product Name:	AUTO Smart Diagnostic Tool
Trade Mark:	LAUNCH
Model/Type reference:	X-431 PROS MINI V5.0
Listed Model(s):	X-431 PRO MINI V5.0
Model Difference:	All these models are identical in the same PCB, Layout and electrical circuit, The only difference is colour of shell and rubber sleeve.
Power supply:	5Vdc/5A from AC/DC Adapter 7.6Vdc from 6300mAh Li-ion Battery
Adapter model:	PSYC0505000US Input: 100-240V~ 50/60Hz 0.6A Max Output: 5Vdc/5A
Hardware version:	N/A
Software version:	N/A
Bluetooth 5.1/EDR	
Modulation:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	2.35dBi

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2.3. Accessory Equipment information

Equipment Information			
Name	Model	S/N	Manufacturer
/	/	/	/
/	/	/	/
Cable Information			
Name	Shielded Type	Ferrite Core	Length
/	/	/	/
Test Software Information			
Name	/	/	/
Engineering mode	/	/	/

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

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 25, 2021
2	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Mar. 15, 2022
3	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 25, 2021
4	Signal Generator	Agilent	E8257D	MY46521908	Dec. 25, 2021
5	Power Sensor	Agilent	U2021XA	MY5365004	Dec. 25, 2021
6	Power Sensor	Agilent	U2021XA	MY5365006	Dec. 25, 2021
7	Simultaneous Sampling DAQ	Agilent	U2531A	TW54493510	Dec. 25, 2021
8	Climate Chamber	TABAI	PR-4G	A8708055	Dec. 25, 2021
9	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	116410	Dec. 25, 2021
10	Climate Chamber	ESPEC	MT3065	/	Dec. 25, 2021
11	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	116410	Dec. 25, 2021
12	300328 v2.2.2 test system	TONSCEND	v2.6	/	/

Radiated Emission and Transmitter spurious emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	Rohde & Schwarz	ESCI	100658	Dec. 25, 2021
2	High pass filter	micro-tranics	HPM50111	142	Dec. 25, 2021
3	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4180	Dec. 25, 2021
4	Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25841	Dec. 25, 2021
5	Loop Antenna	LAPLAC	RF300	9138	Dec. 25, 2021
6	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 25, 2021
7	Horn Antenna	Schwarzbeck	BBHA 9120D	647	Dec. 25, 2021
8	Pre-Amplifier	HP	8447D	1937A03050	Dec. 25, 2021
9	Pre-Amplifier	EMCI	EMC051835	980075	Dec. 25, 2021
10	Antenna Mast	UC	UC3000	N/A	N/A
11	Turn Table	UC	UC3000	N/A	N/A
12	Cable Below 1GHz	Schwarzbeck	AK9515E	33155	Dec. 25, 2021
13	Cable Above 1GHz	Hubersuhner	SUCOFLEX102	DA1580	Dec. 25, 2021
14	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 25, 2021
15	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	Dec. 25, 2021

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16	RF Connection Cable	Chengdu E-Microwave	---	---	Dec. 25, 2021
17	High pass filter	Compliance Direction systems	BSU-6	34202	Dec. 25, 2021
18	Attenuator	Chengdu E-Microwave	EM-CAXX-10RNZ-3	---	Dec. 25, 2021
19	High and low temperature box	ESPEC	MT3065	12114019	Dec. 25, 2021

Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	Rohde & Schwarz	ENV216	101112	Dec. 25, 2021
2	LISN	Rohde & Schwarz	ENV216	101113	Dec. 25, 2021
3	EMI Test Receiver	Rohde & Schwarz	ESCI	100658	Dec. 25, 2021

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

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

3. TEST ITEM AND RESULTS

3.1. Conducted Emission

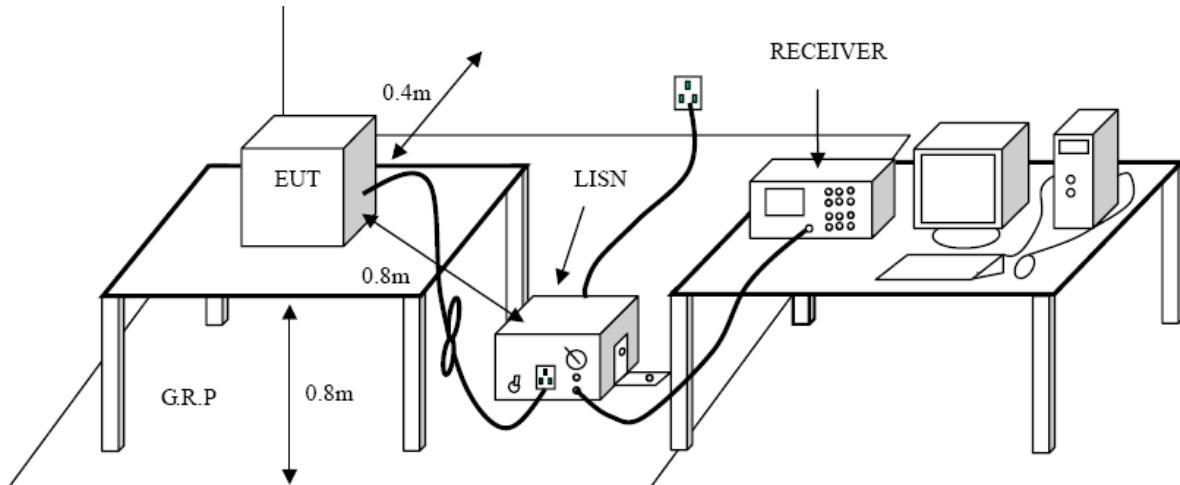
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207/ RSS – Gen 8.8

Frequency range (MHz)	Limit (dBuV)	
	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 impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment. 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)
4. 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.
5. 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.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

Test Mode

Please refer to the clause 2.4.



Test Results

Reference to the Report No.: CTC20210728E12.

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3.2. Radiated Emission

Limit

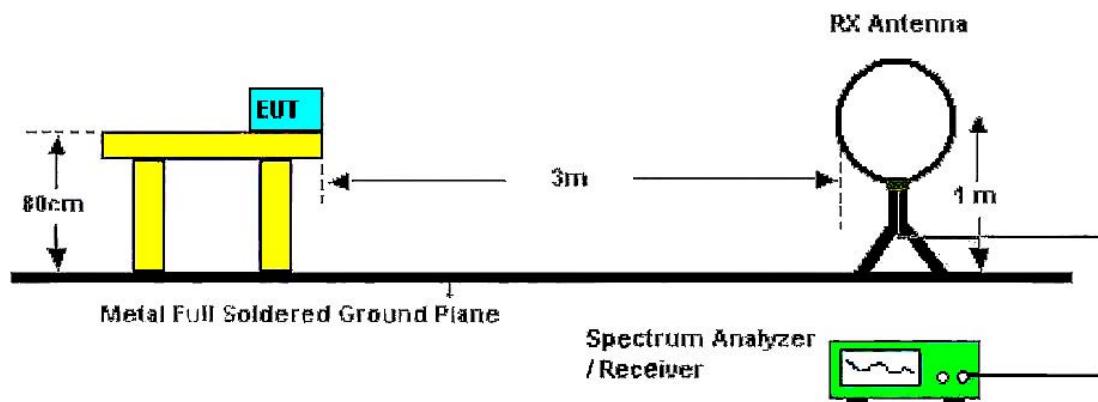
FCC CFR Title 47 Part 15 Subpart C Section 15.209/ RSS – Gen 8.9

Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

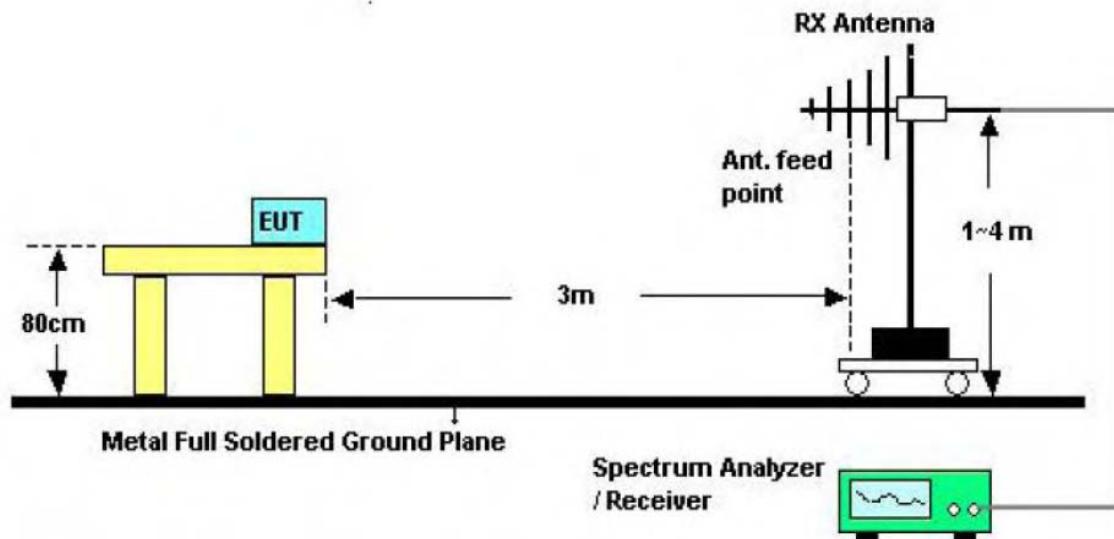
Note:

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

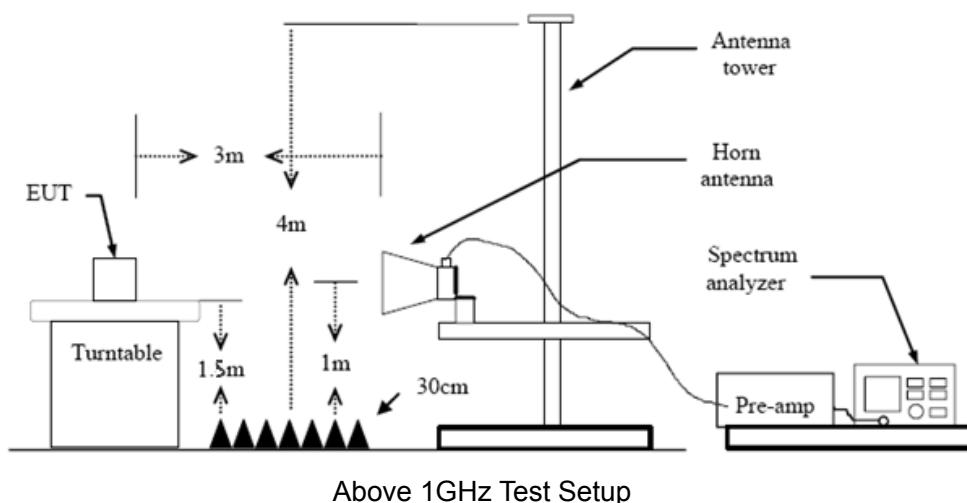
Test Configuration



Below 30MHz Test Setup



Below 1000MHz 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) Below 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.
 - (3) From 1 GHz to 10th harmonic:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW \geq 1/T Peak detector for Average value.

Note 1: For the 1/T& Duty Cycle please refer to clause 3.10 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

Test Result

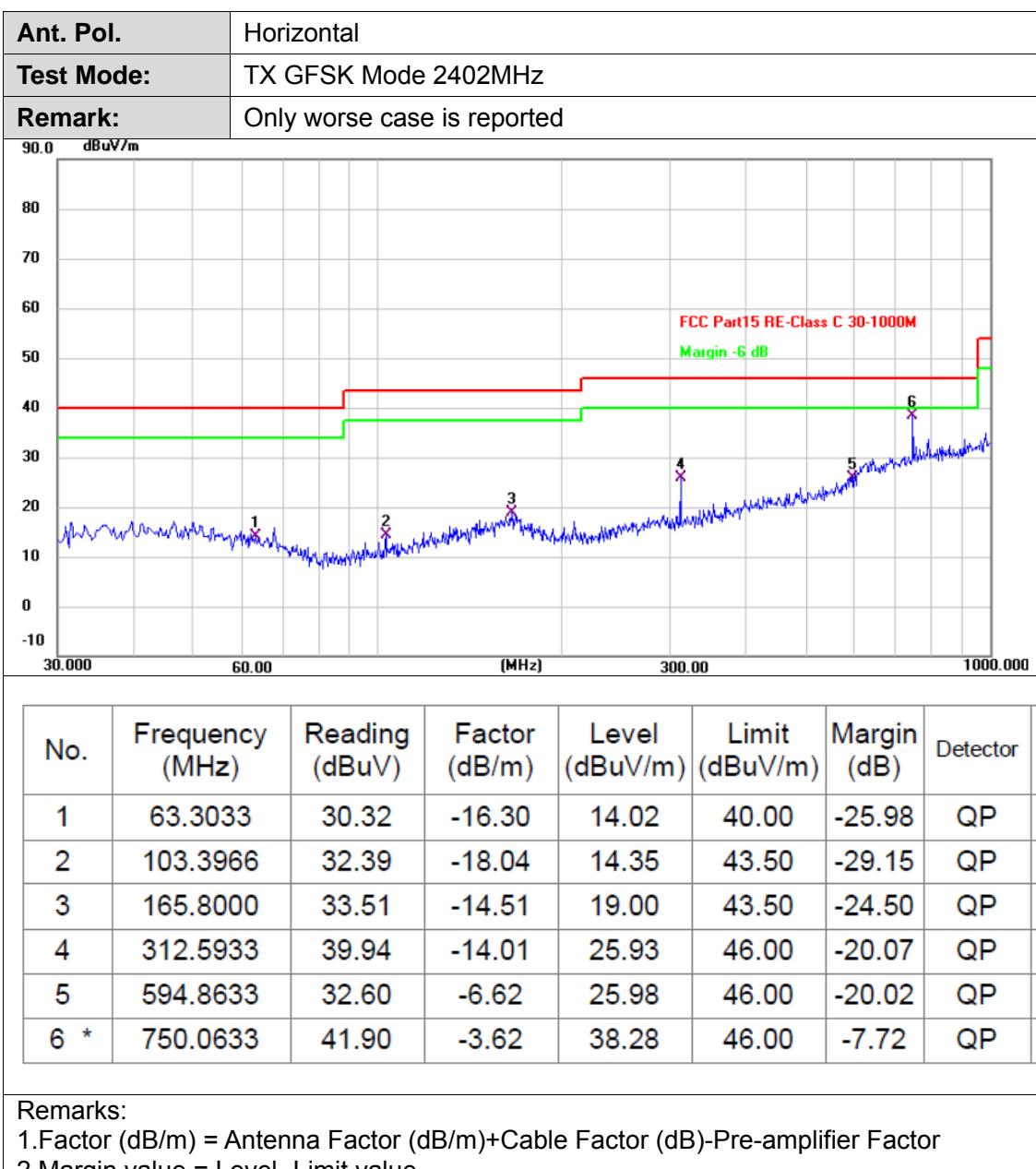
9 KHz-30 MHz

From 9 KHz to 30 MHz: Conclusion: PASS

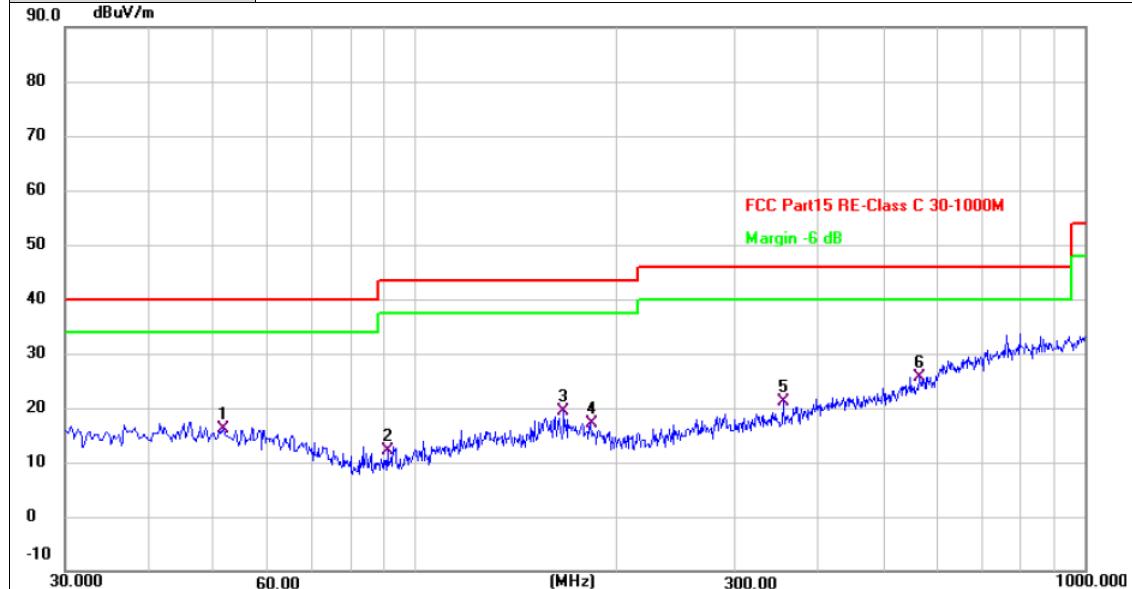
Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



30MHz-1GHz



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



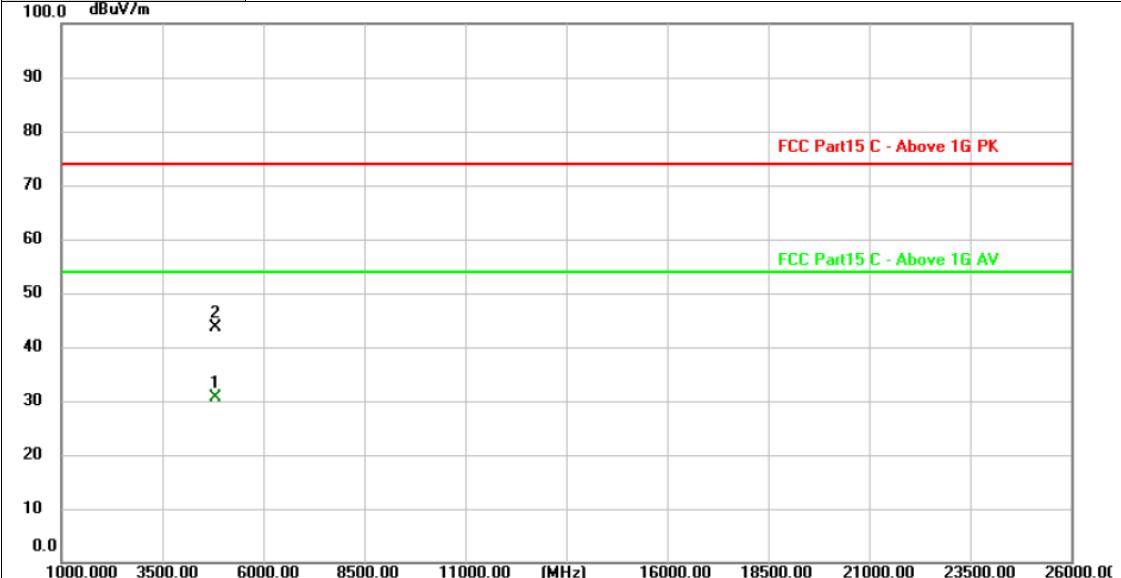
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	51.6633	30.88	-14.80	16.08	40.00	-23.92	QP
2	91.1100	31.64	-19.45	12.19	43.50	-31.31	QP
3	167.0932	33.92	-14.55	19.37	43.50	-24.13	QP
4	182.9367	33.62	-16.39	17.23	43.50	-26.27	QP
5	354.3032	34.15	-12.92	21.23	46.00	-24.77	QP
6 *	566.7333	33.13	-7.48	25.65	46.00	-20.35	QP

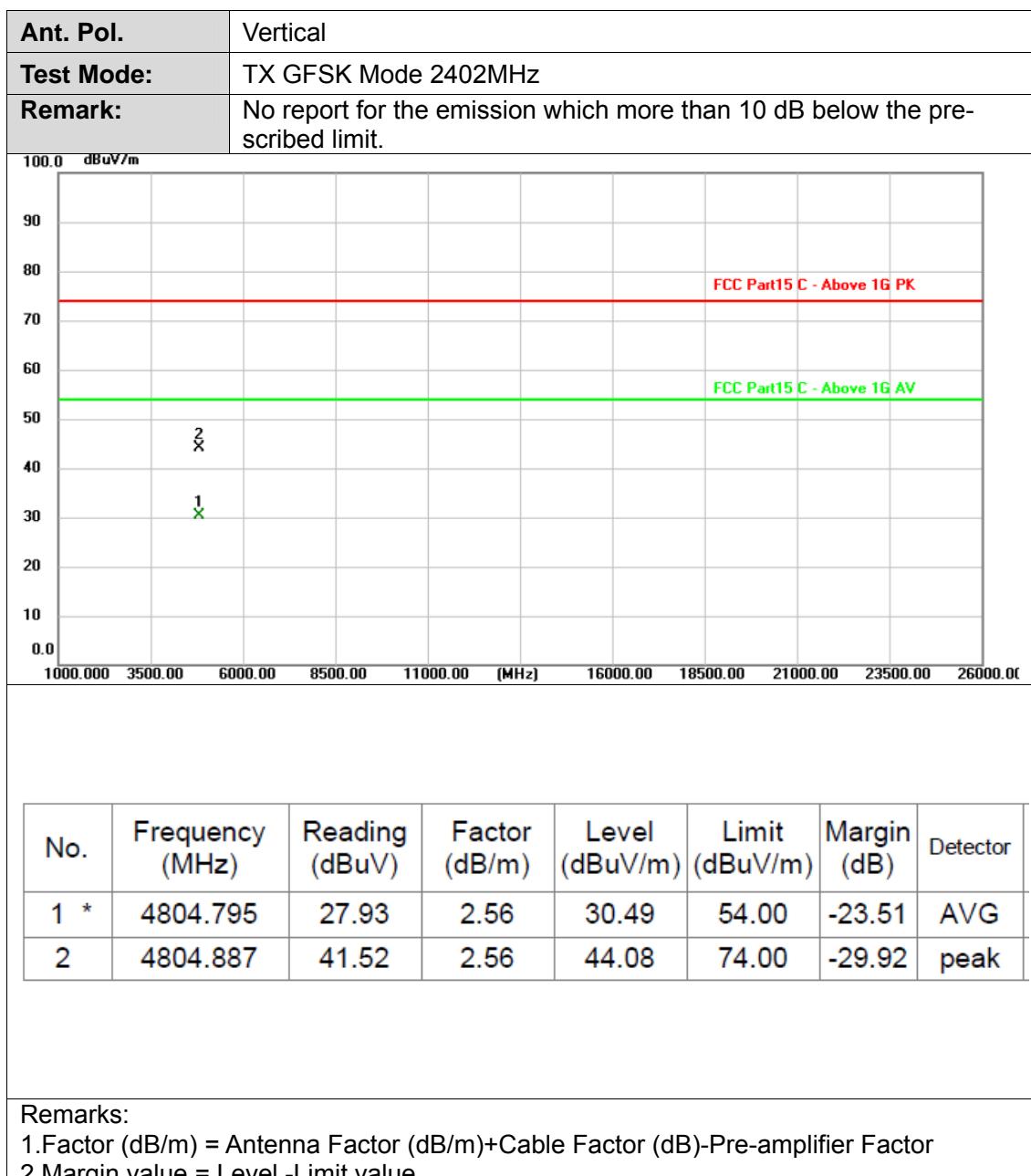
Remarks:

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



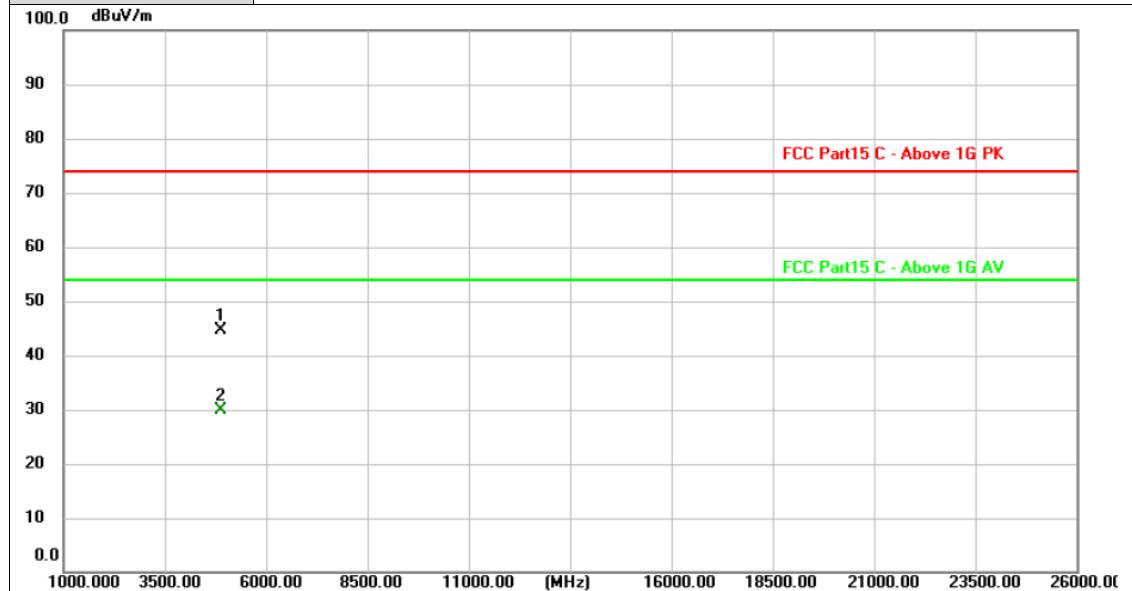
Above 1GHz

Ant. Pol.	Horizontal																														
Test Mode:	TX GFSK Mode 2402MHz																														
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																														
																															
<table border="1"><thead><tr><th>No.</th><th>Frequency (MHz)</th><th>Reading (dBuV)</th><th>Factor (dB/m)</th><th>Level (dBuV/m)</th><th>Limit (dBuV/m)</th><th>Margin (dB)</th><th>Detector</th></tr></thead><tbody><tr><td>1 *</td><td>4804.033</td><td>28.10</td><td>2.56</td><td>30.66</td><td>54.00</td><td>-23.34</td><td>AVG</td></tr><tr><td>2</td><td>4804.045</td><td>41.02</td><td>2.56</td><td>43.58</td><td>74.00</td><td>-30.42</td><td>peak</td></tr></tbody></table>								No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1 *	4804.033	28.10	2.56	30.66	54.00	-23.34	AVG	2	4804.045	41.02	2.56	43.58	74.00	-30.42	peak
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4804.033	28.10	2.56	30.66	54.00	-23.34	AVG																								
2	4804.045	41.02	2.56	43.58	74.00	-30.42	peak																								
<p>Remarks:</p> <p>1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor</p> <p>2. Margin value = Level -Limit value</p>																															





Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2441MHz
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.

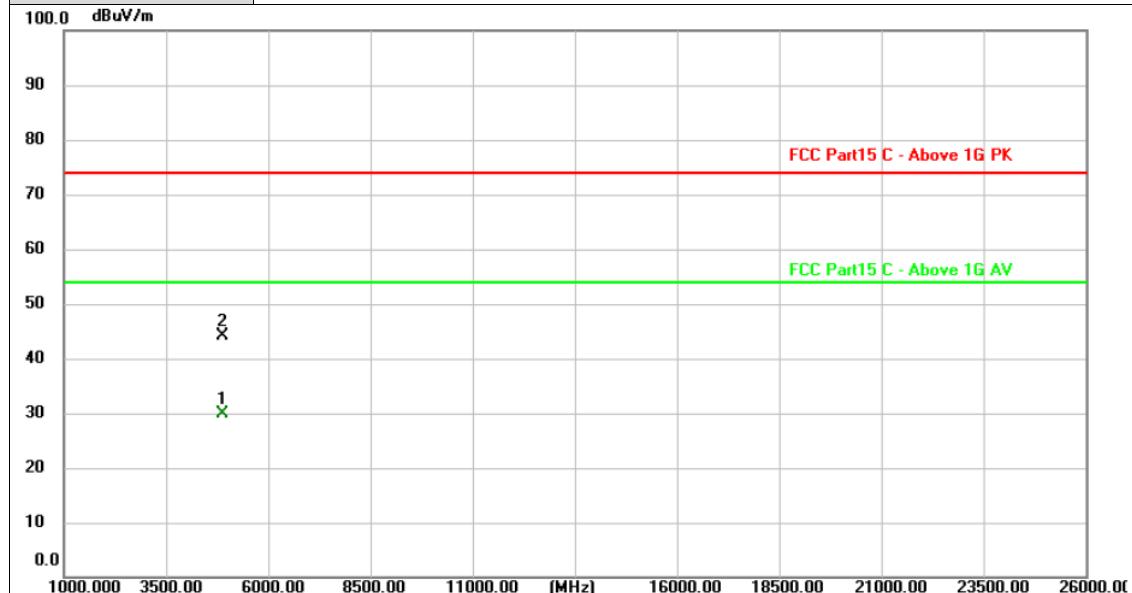


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.805	41.73	2.79	44.52	74.00	-29.48	peak
2 *	4882.385	27.07	2.79	29.86	54.00	-24.14	AVG

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 2441MHz
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4881.299	27.02	2.79	29.81	54.00	-24.19	AVG
2	4882.171	41.40	2.79	44.19	74.00	-29.81	peak

Remarks:

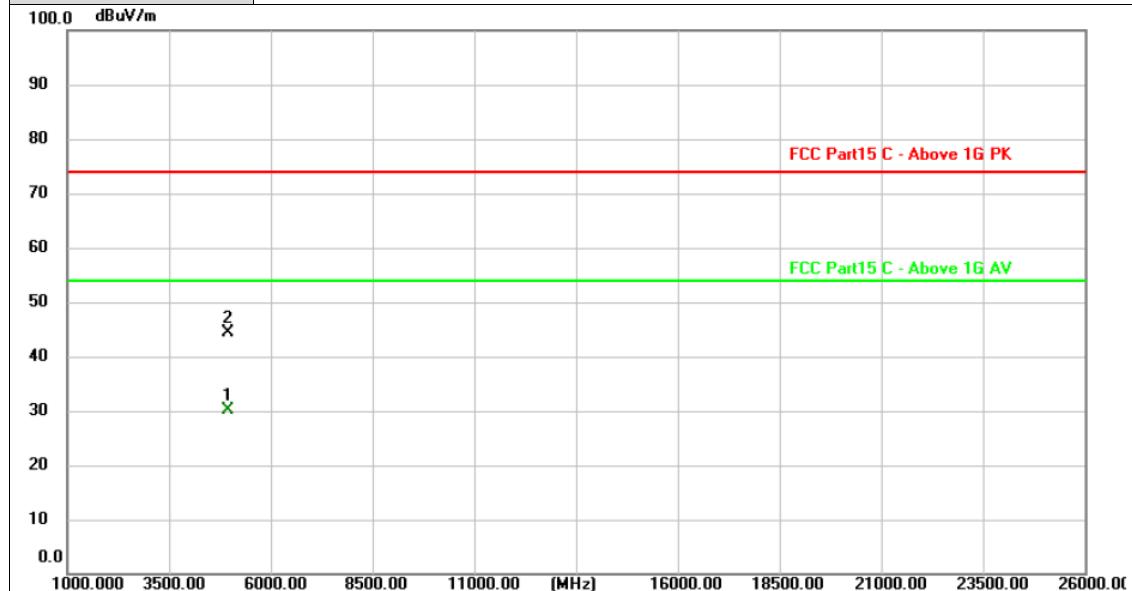
1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2. Margin value = Level -Limit value



Ant. Pol.	Horizontal																													
Test Mode:	TX GFSK Mode 2480MHz																													
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																													
 <table border="1"><thead><tr><th>No.</th><th>Frequency (MHz)</th><th>Reading (dBuV)</th><th>Factor (dB/m)</th><th>Level (dBuV/m)</th><th>Limit (dBuV/m)</th><th>Margin (dB)</th><th>Detector</th></tr></thead><tbody><tr><td>1</td><td>4959.047</td><td>41.68</td><td>3.04</td><td>44.72</td><td>74.00</td><td>-29.28</td><td>peak</td></tr><tr><td>2 *</td><td>4960.832</td><td>27.25</td><td>3.04</td><td>30.29</td><td>54.00</td><td>-23.71</td><td>AVG</td></tr></tbody></table>							No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1	4959.047	41.68	3.04	44.72	74.00	-29.28	peak	2 *	4960.832	27.25	3.04	30.29	54.00	-23.71	AVG
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																							
1	4959.047	41.68	3.04	44.72	74.00	-29.28	peak																							
2 *	4960.832	27.25	3.04	30.29	54.00	-23.71	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 10 dB below the pre-scribed limit.



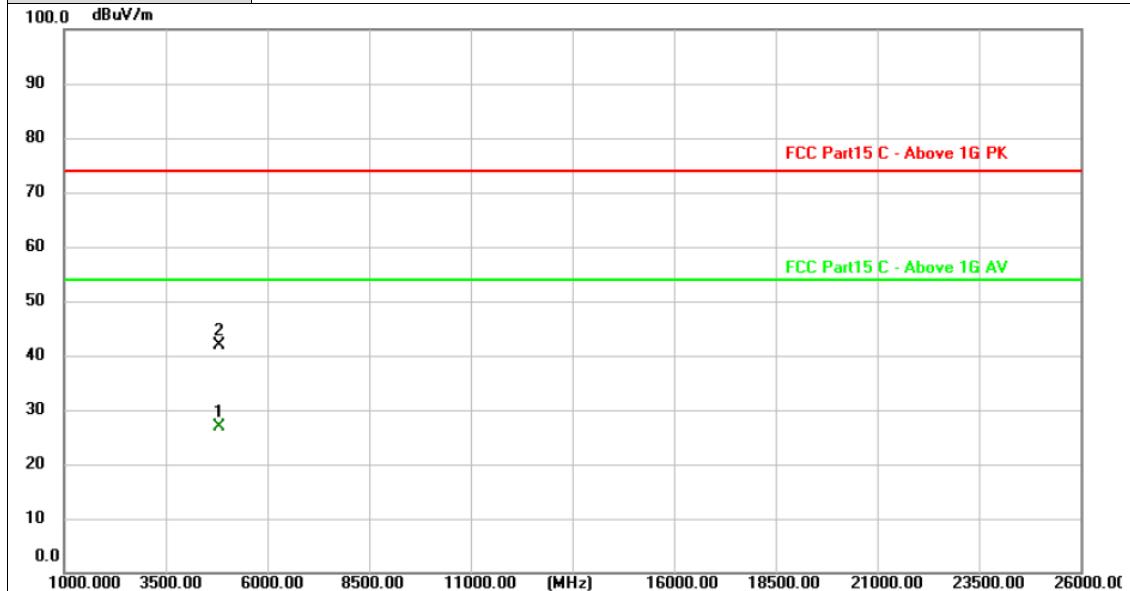
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4959.237	27.16	3.04	30.20	54.00	-23.80	AVG
2	4960.657	41.30	3.04	44.34	74.00	-29.66	peak

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 10 dB below the pre-scribed limit.



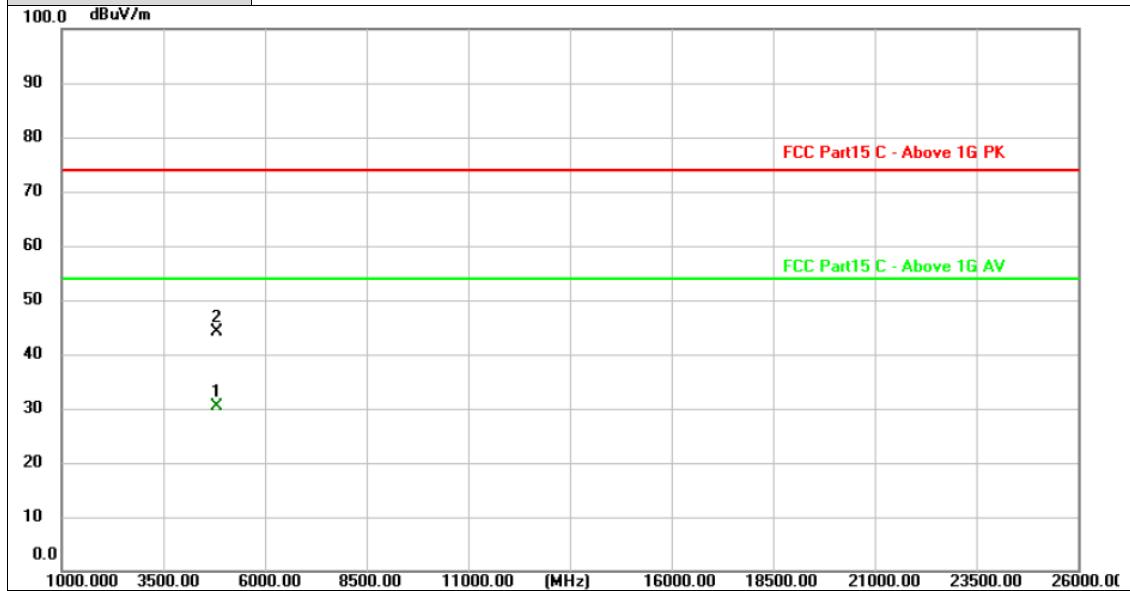
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.061	24.28	2.56	26.84	54.00	-27.16	AVG
2	4803.473	39.34	2.56	41.90	74.00	-32.10	peak

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 10 dB below the pre-scribed limit.



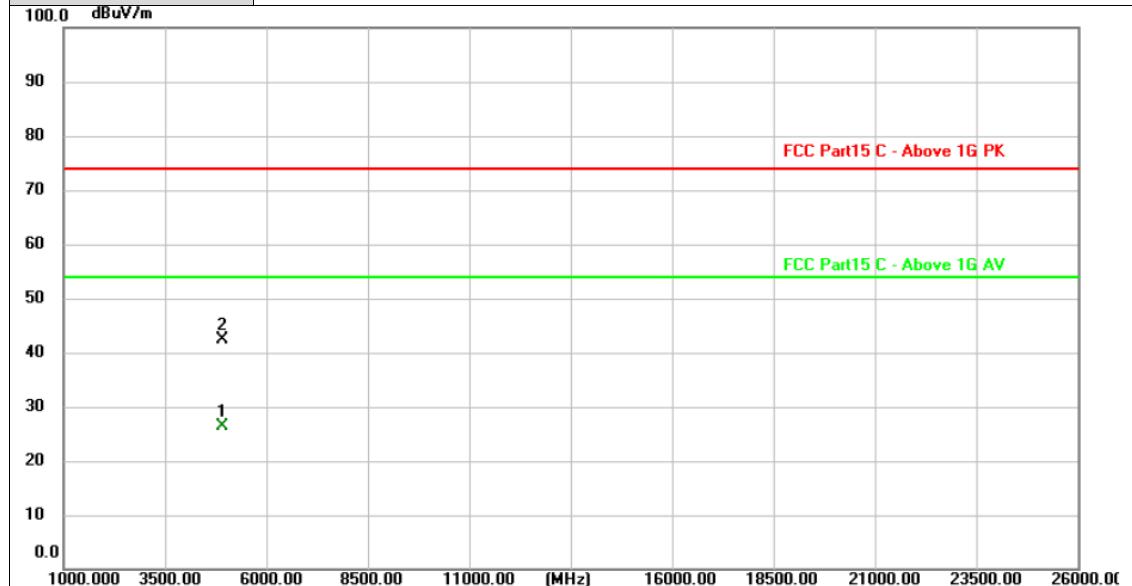
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4803.389	27.89	2.56	30.45	54.00	-23.55	AVG
2	4803.407	41.54	2.56	44.10	74.00	-29.90	peak

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 10 dB below the pre-scribed limit.



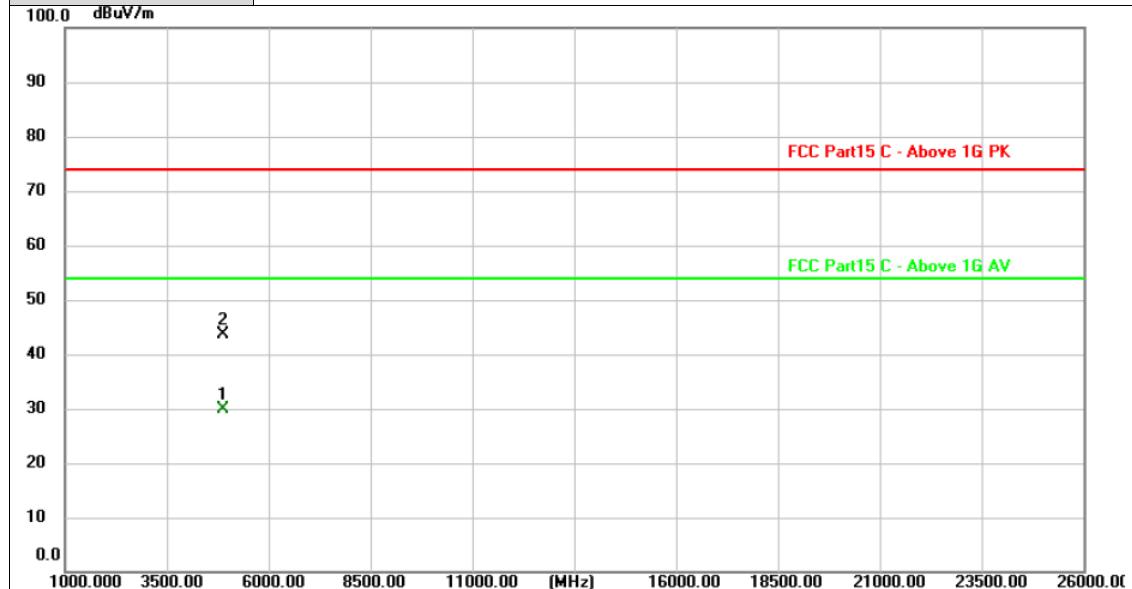
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4882.533	23.59	2.80	26.39	54.00	-27.61	AVG
2	4882.602	39.47	2.80	42.27	74.00	-31.73	peak

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 10 dB below the pre-scribed limit.

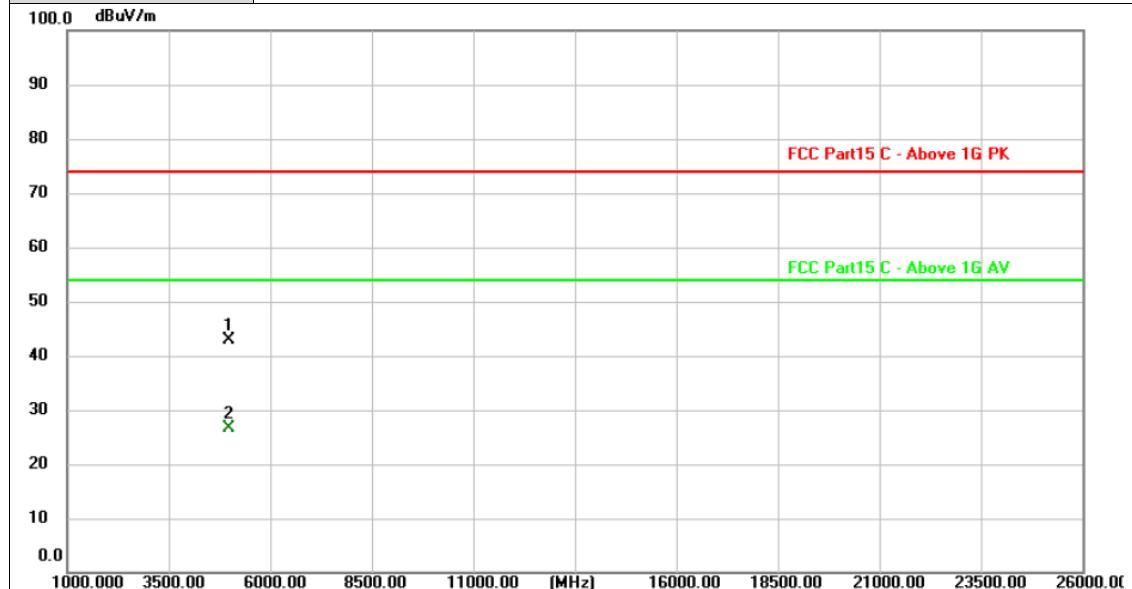


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4882.022	27.20	2.79	29.99	54.00	-24.01	AVG
2	4882.405	40.81	2.79	43.60	74.00	-30.40	peak

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 10 dB below the pre-scribed limit.



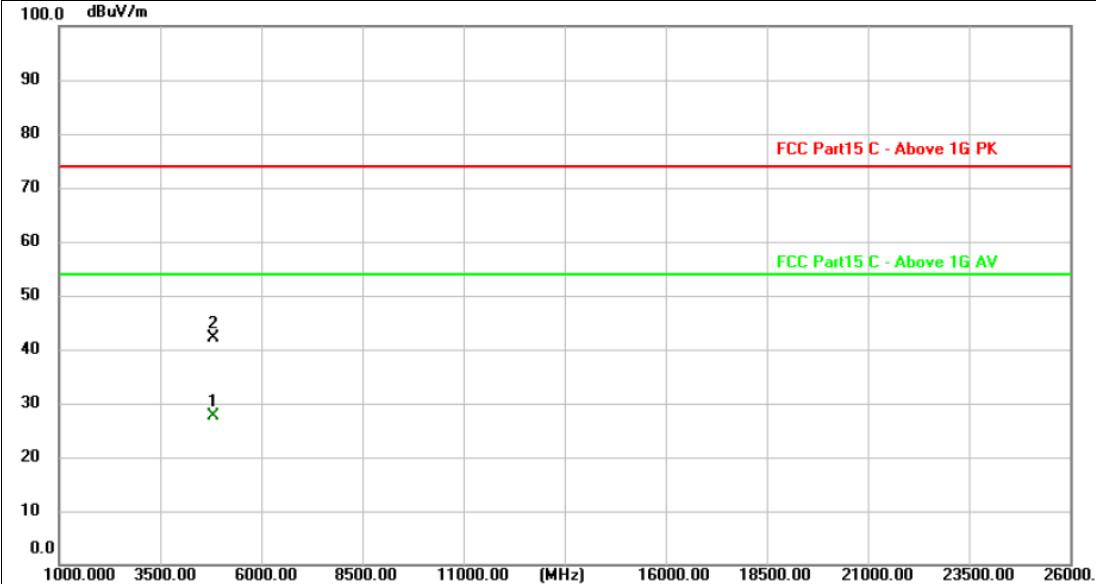
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.188	39.84	3.04	42.88	74.00	-31.12	peak
2 *	4960.091	23.58	3.04	26.62	54.00	-27.38	AVG

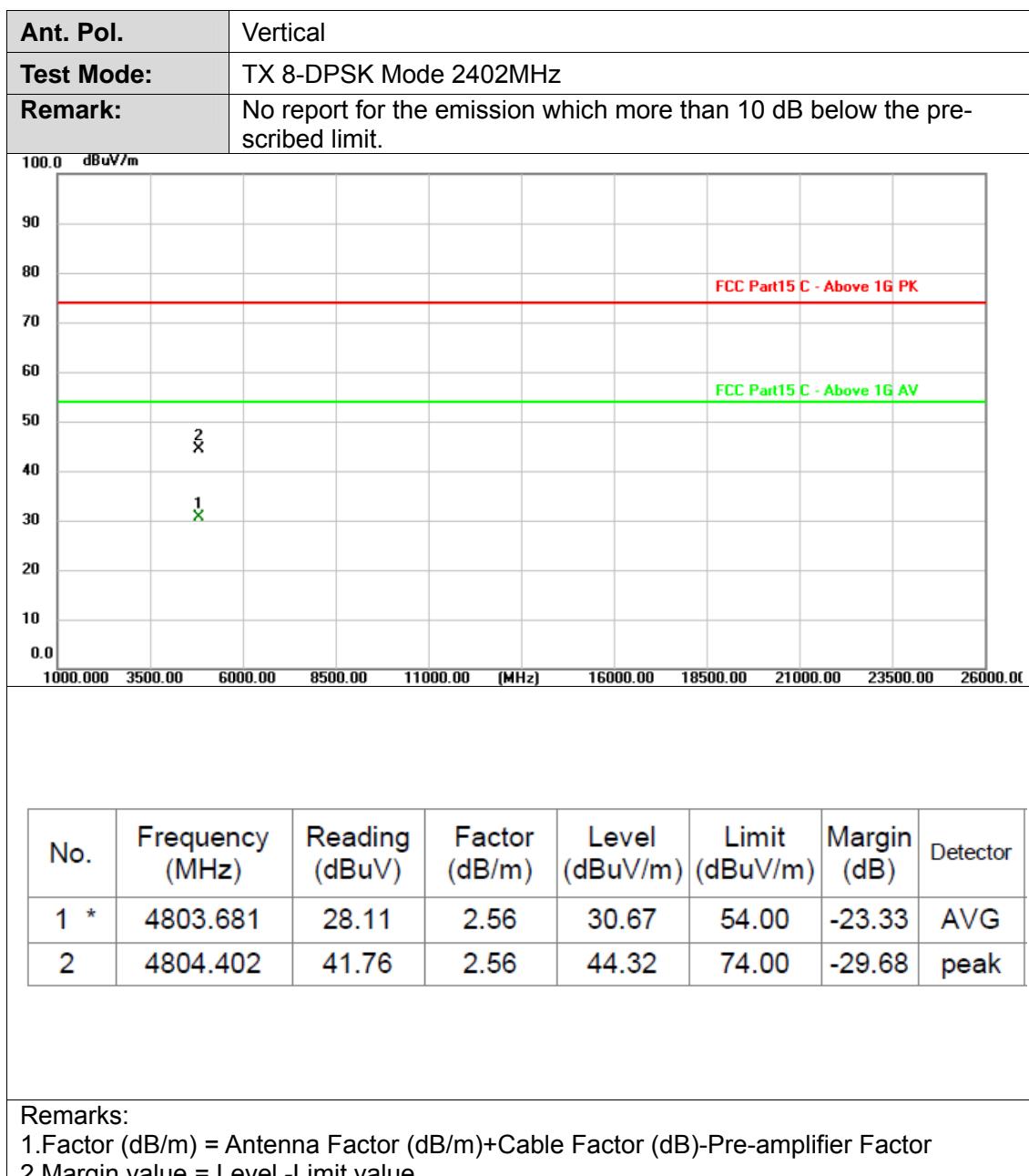
Remarks:

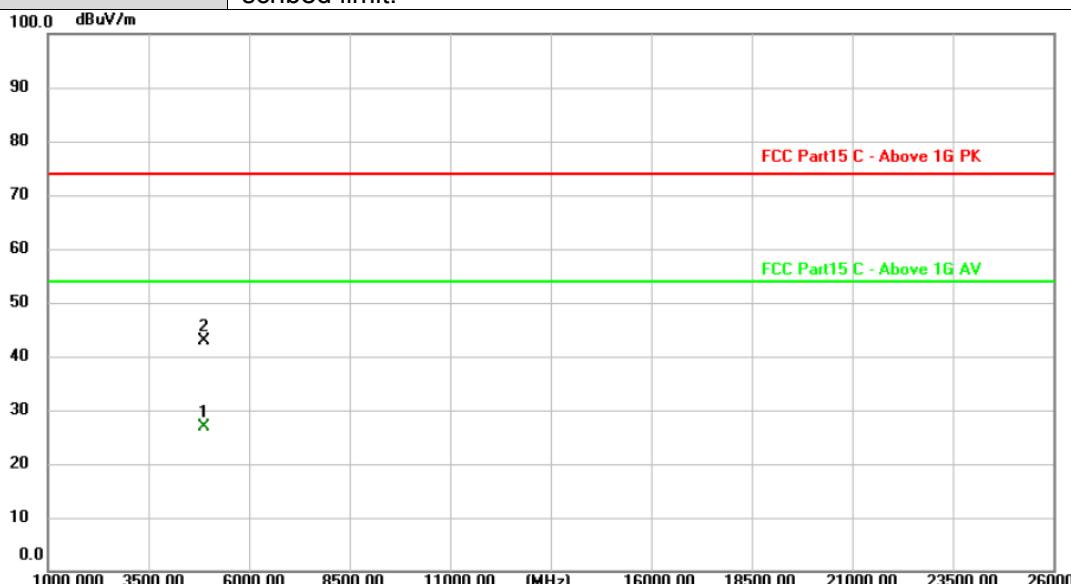
1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2. Margin value = Level -Limit value

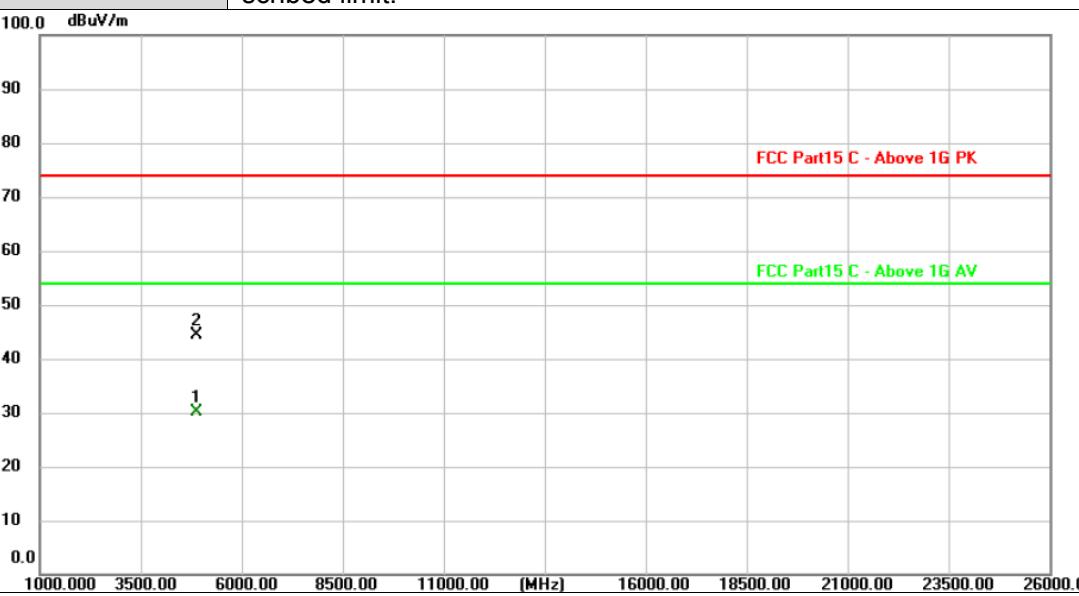


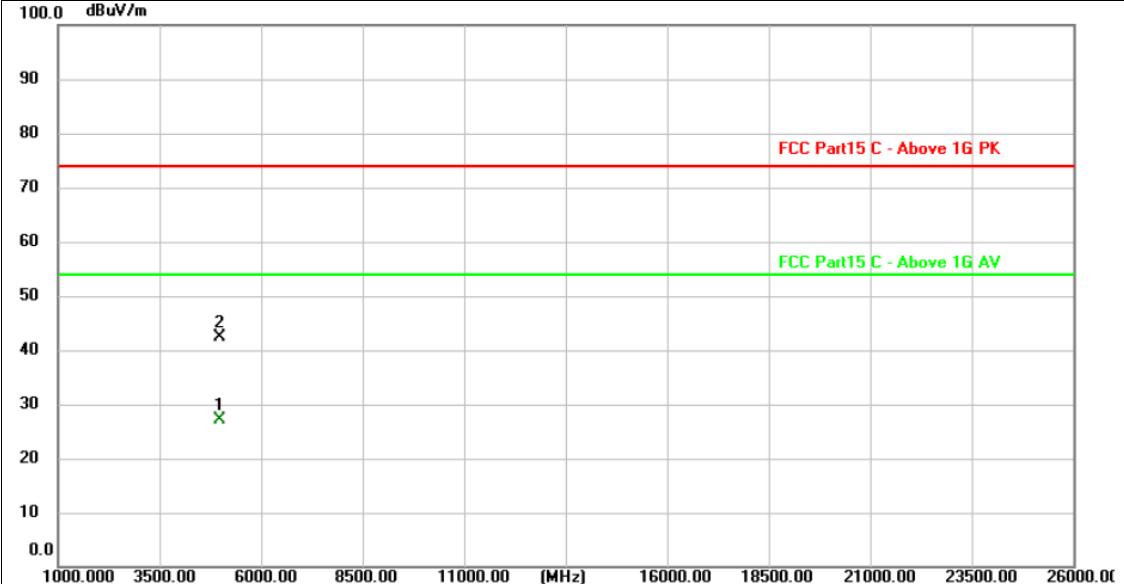
Ant. Pol.	Vertical																														
Test Mode:	TX $\pi/4$ -DQPSK Mode 2480MHz																														
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																														
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1	4959.589	41.26	3.04	44.30	74.00	-29.70	peak																								
2 *	4960.741	27.37	3.04	30.41	54.00	-23.59	AVG																								
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Ant. Pol.	Horizontal																															
Test Mode:	TX 8-DPSK Mode 2402MHz																															
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																															
																																
<table border="1"> <thead> <tr> <th>No.</th><th>Frequency (MHz)</th><th>Reading (dBuV)</th><th>Factor (dB/m)</th><th>Level (dBuV/m)</th><th>Limit (dBuV/m)</th><th>Margin (dB)</th><th>Detector</th></tr> </thead> <tbody> <tr> <td>1 *</td><td>4803.522</td><td>25.06</td><td>2.56</td><td>27.62</td><td>54.00</td><td>-26.38</td><td>AVG</td></tr> <tr> <td>2</td><td>4804.736</td><td>39.61</td><td>2.56</td><td>42.17</td><td>74.00</td><td>-31.83</td><td>peak</td></tr> </tbody> </table>									No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1 *	4803.522	25.06	2.56	27.62	54.00	-26.38	AVG	2	4804.736	39.61	2.56	42.17	74.00	-31.83	peak
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																									
1 *	4803.522	25.06	2.56	27.62	54.00	-26.38	AVG																									
2	4804.736	39.61	2.56	42.17	74.00	-31.83	peak																									
<p>Remarks:</p> <p>1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor</p> <p>2. Margin value = Level -Limit value</p>																																



Ant. Pol.	Horizontal																															
Test Mode:	TX 8-DPSK Mode 2441MHz																															
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																									
1 *	4881.305	24.07	2.79	26.86	54.00	-27.14	AVG																									
2	4881.985	39.98	2.79	42.77	74.00	-31.23	peak																									
<p>Remarks:</p> <p>1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor</p> <p>2. Margin value = Level -Limit value</p>																																

Ant. Pol.	Vertical																														
Test Mode:	TX 8-DPSK Mode 2441MHz																														
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																														
 <p>The plot shows a spectral emission mask for FCC Part 15 C. The Y-axis represents the level in dBuV/m from 0.0 to 100.0. The X-axis represents frequency in MHz from 1000.000 to 26000.00. A red horizontal line at approximately 73 dBuV/m is labeled 'FCC Part15 C - Above 1G PK'. A green horizontal line at approximately 54 dBuV/m is labeled 'FCC Part15 C - Above 1G AV'. Two data points are plotted: point 1 at approximately 30 dBuV/m and point 2 at approximately 45 dBuV/m. The plot area has a grid and a scale bar.</p>																															
<table border="1"> <thead> <tr> <th>No.</th> <th>Frequency (MHz)</th> <th>Reading (dBuV)</th> <th>Factor (dB/m)</th> <th>Level (dBuV/m)</th> <th>Limit (dBuV/m)</th> <th>Margin (dB)</th> <th>Detector</th> </tr> </thead> <tbody> <tr> <td>1 *</td> <td>4881.788</td> <td>27.46</td> <td>2.79</td> <td>30.25</td> <td>54.00</td> <td>-23.75</td> <td>AVG</td> </tr> <tr> <td>2</td> <td>4881.959</td> <td>41.61</td> <td>2.79</td> <td>44.40</td> <td>74.00</td> <td>-29.60</td> <td>peak</td> </tr> </tbody> </table>								No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1 *	4881.788	27.46	2.79	30.25	54.00	-23.75	AVG	2	4881.959	41.61	2.79	44.40	74.00	-29.60	peak
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																								
1 *	4881.788	27.46	2.79	30.25	54.00	-23.75	AVG																								
2	4881.959	41.61	2.79	44.40	74.00	-29.60	peak																								
<p>Remarks:</p> <p>1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor</p> <p>2. Margin value = Level -Limit value</p>																															

Ant. Pol.	Horizontal																															
Test Mode:	TX 8-DPSK Mode 2480MHz																															
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																															
 <p>The plot shows spectral emission levels in dBuV/m on the y-axis (0.0 to 100.0) versus frequency in MHz on the x-axis (1000.000 to 26000.00). A red horizontal line at 74 dBuV/m represents the 'FCC Part15 C - Above 1G PK' limit. A green horizontal line at 54 dBuV/m represents the 'FCC Part15 C - Above 1G AV' limit. Two data points are plotted: point 1 at approximately 4960.287 MHz with a reading of 24.12 dBuV and a factor of 3.04 dB/m; point 2 at approximately 4960.944 MHz with a reading of 39.42 dBuV and a factor of 3.04 dB/m. The plot area is a grid with major ticks every 500 MHz and major labels every 3500 MHz.</p>																																
<table border="1"> <thead> <tr> <th>No.</th> <th>Frequency (MHz)</th> <th>Reading (dBuV)</th> <th>Factor (dB/m)</th> <th>Level (dBuV/m)</th> <th>Limit (dBuV/m)</th> <th>Margin (dB)</th> <th>Detector</th> </tr> </thead> <tbody> <tr> <td>1 *</td> <td>4960.287</td> <td>24.12</td> <td>3.04</td> <td>27.16</td> <td>54.00</td> <td>-26.84</td> <td>AVG</td> </tr> <tr> <td>2</td> <td>4960.944</td> <td>39.42</td> <td>3.04</td> <td>42.46</td> <td>74.00</td> <td>-31.54</td> <td>peak</td> </tr> </tbody> </table>									No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1 *	4960.287	24.12	3.04	27.16	54.00	-26.84	AVG	2	4960.944	39.42	3.04	42.46	74.00	-31.54	peak
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector																									
1 *	4960.287	24.12	3.04	27.16	54.00	-26.84	AVG																									
2	4960.944	39.42	3.04	42.46	74.00	-31.54	peak																									
<p>Remarks:</p> <p>1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor</p> <p>2. Margin value = Level -Limit value</p>																																



Ant. Pol.	Vertical																														
Test Mode:	TX 8-DPSK Mode 2480MHz																														
Remark:	No report for the emission which more than 10 dB below the pre-scribed limit.																														
<table border="1"><thead><tr><th>No.</th><th>Frequency (MHz)</th><th>Reading (dBuV)</th><th>Factor (dB/m)</th><th>Level (dBuV/m)</th><th>Limit (dBuV/m)</th><th>Margin (dB)</th><th>Detector</th></tr></thead><tbody><tr><td>1</td><td>4959.773</td><td>40.94</td><td>3.04</td><td>43.98</td><td>74.00</td><td>-30.02</td><td>peak</td></tr><tr><td>2 *</td><td>4960.828</td><td>27.12</td><td>3.04</td><td>30.16</td><td>54.00</td><td>-23.84</td><td>AVG</td></tr></tbody></table>								No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	1	4959.773	40.94	3.04	43.98	74.00	-30.02	peak	2 *	4960.828	27.12	3.04	30.16	54.00	-23.84	AVG
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<p>Remarks:</p> <p>1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor</p> <p>2. Margin value = Level -Limit value</p>																															

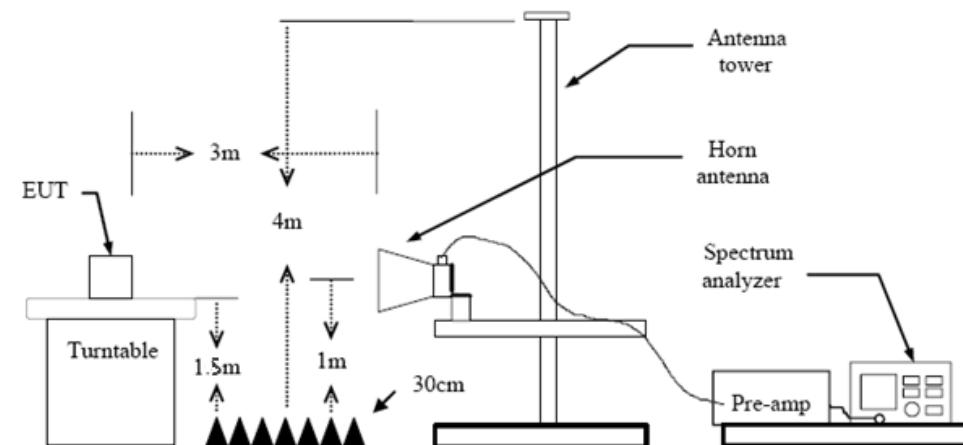
3.3. Band Edge Emissions (Radiated)

Limit

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

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

Test Configuration



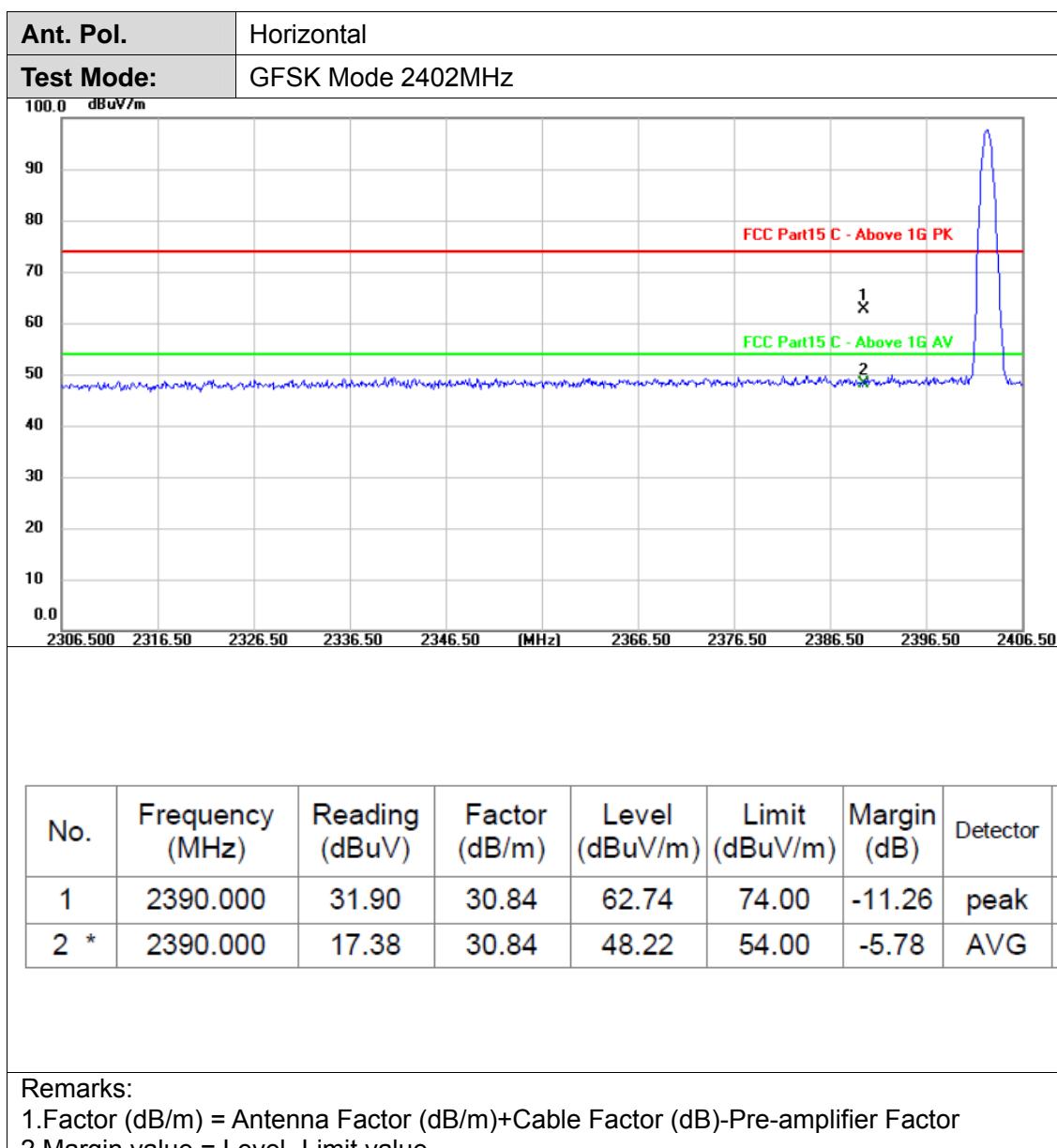
Test Procedure

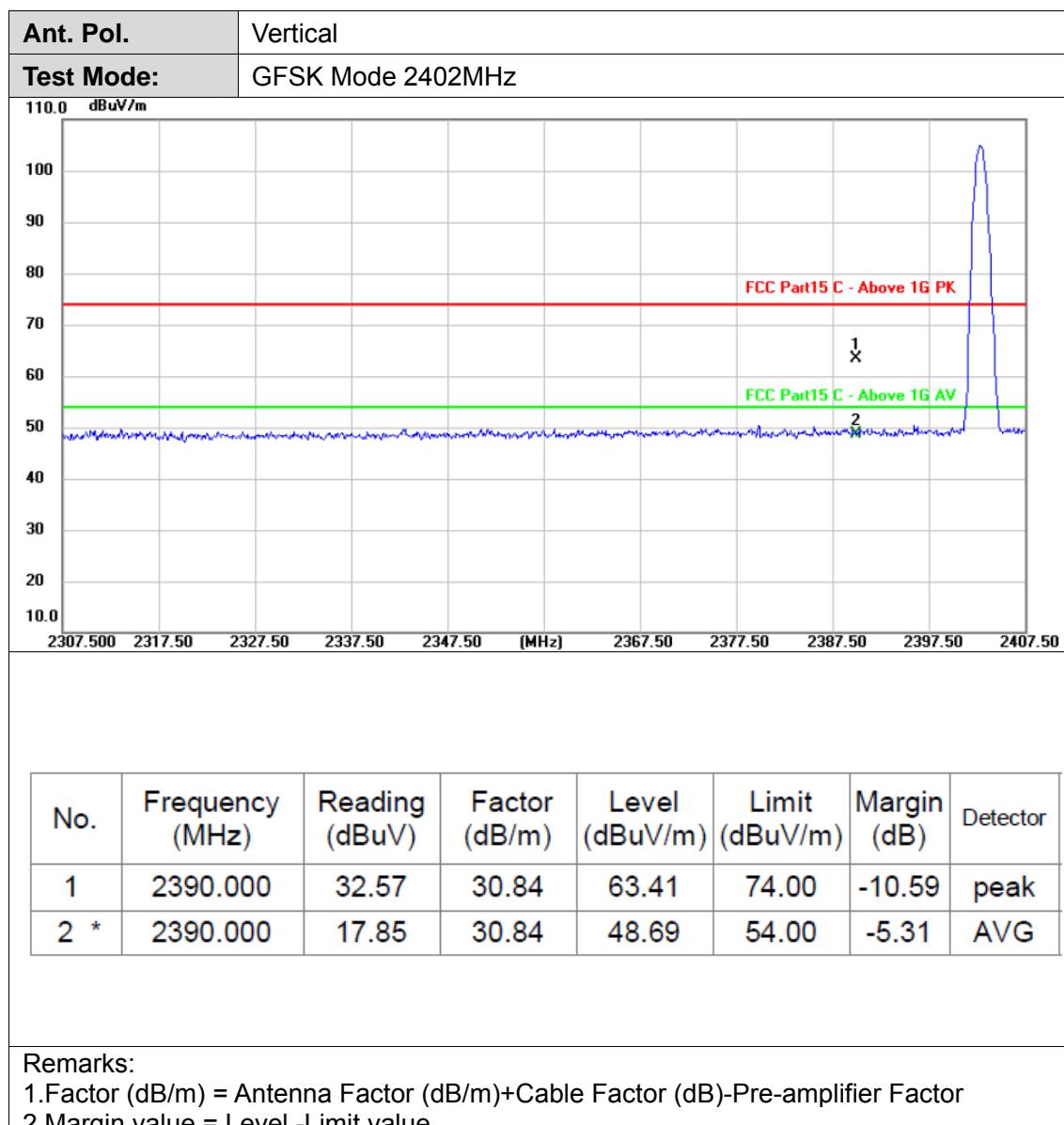
1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna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

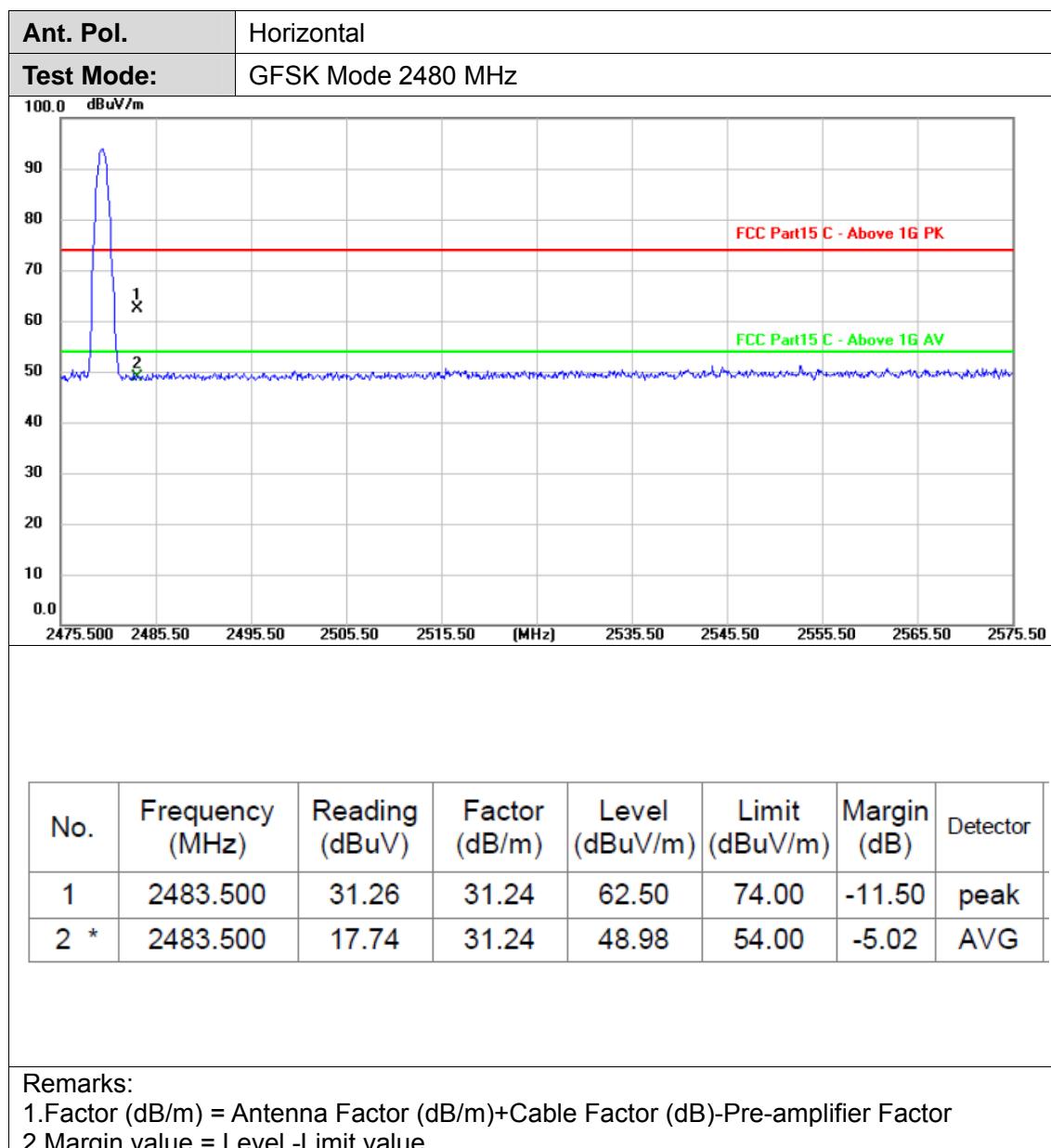
Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.9 Duty Cycle.

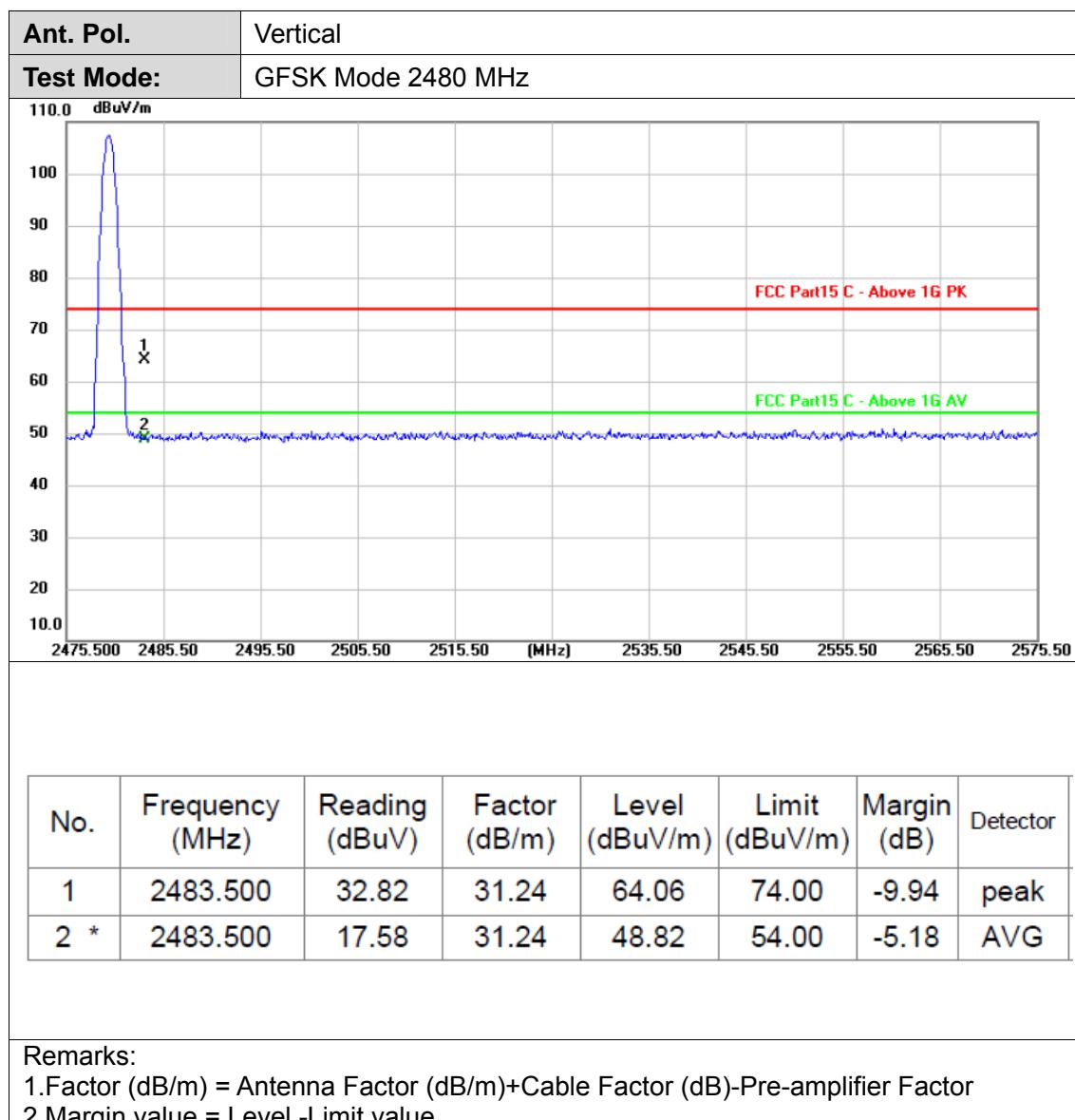
Test Mode

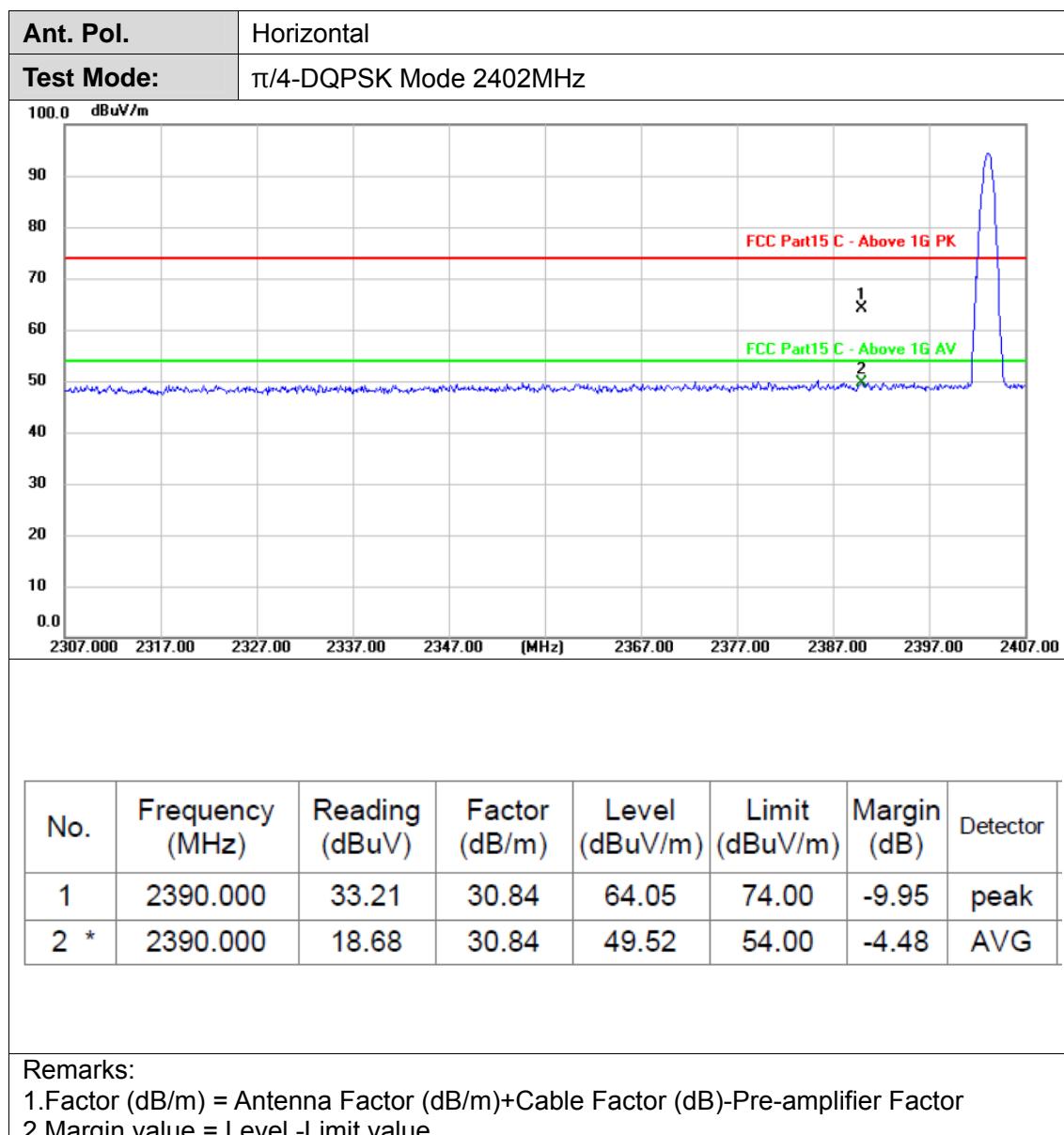
Please refer to the clause 2.4.

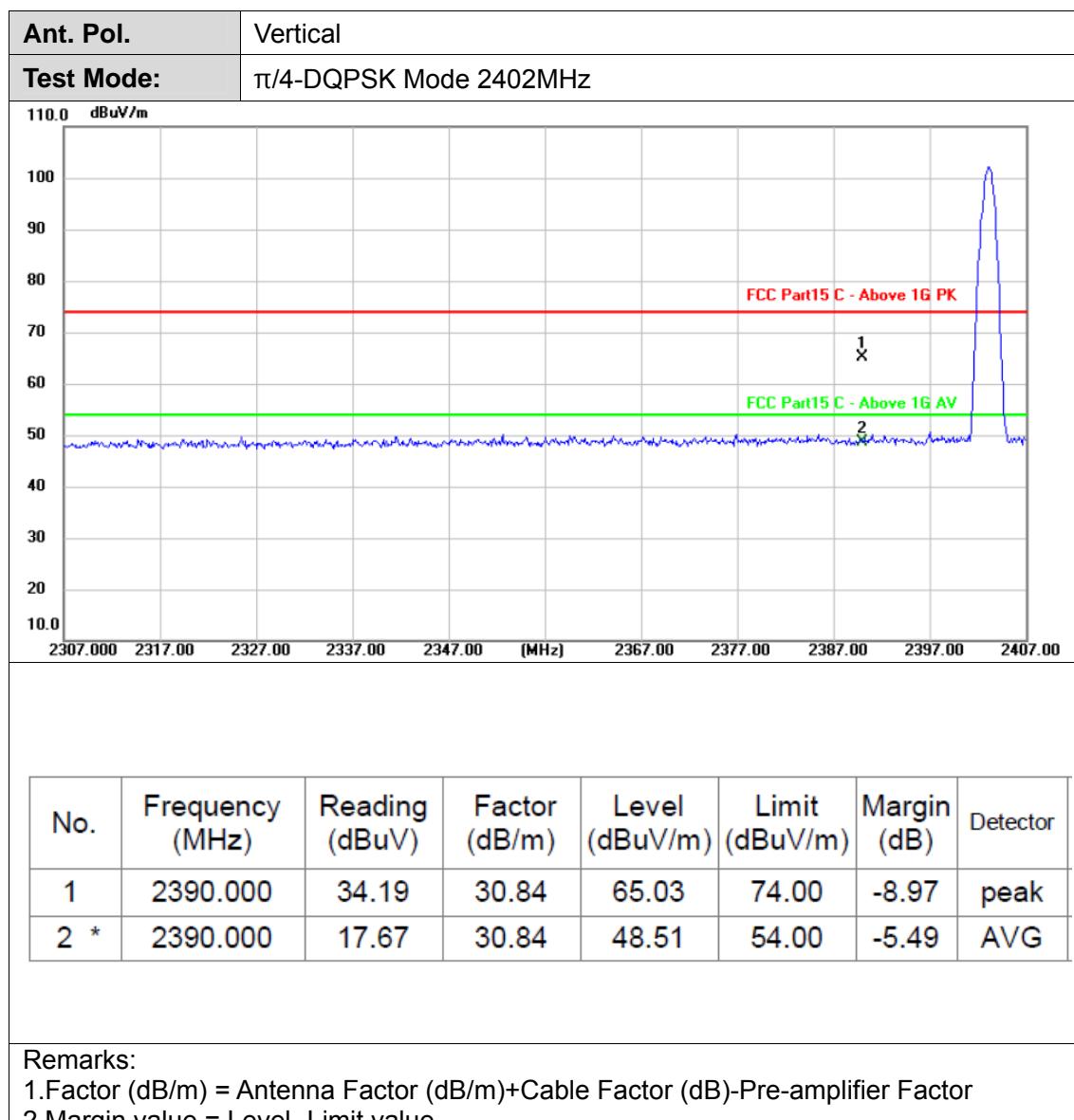
**Test Results**

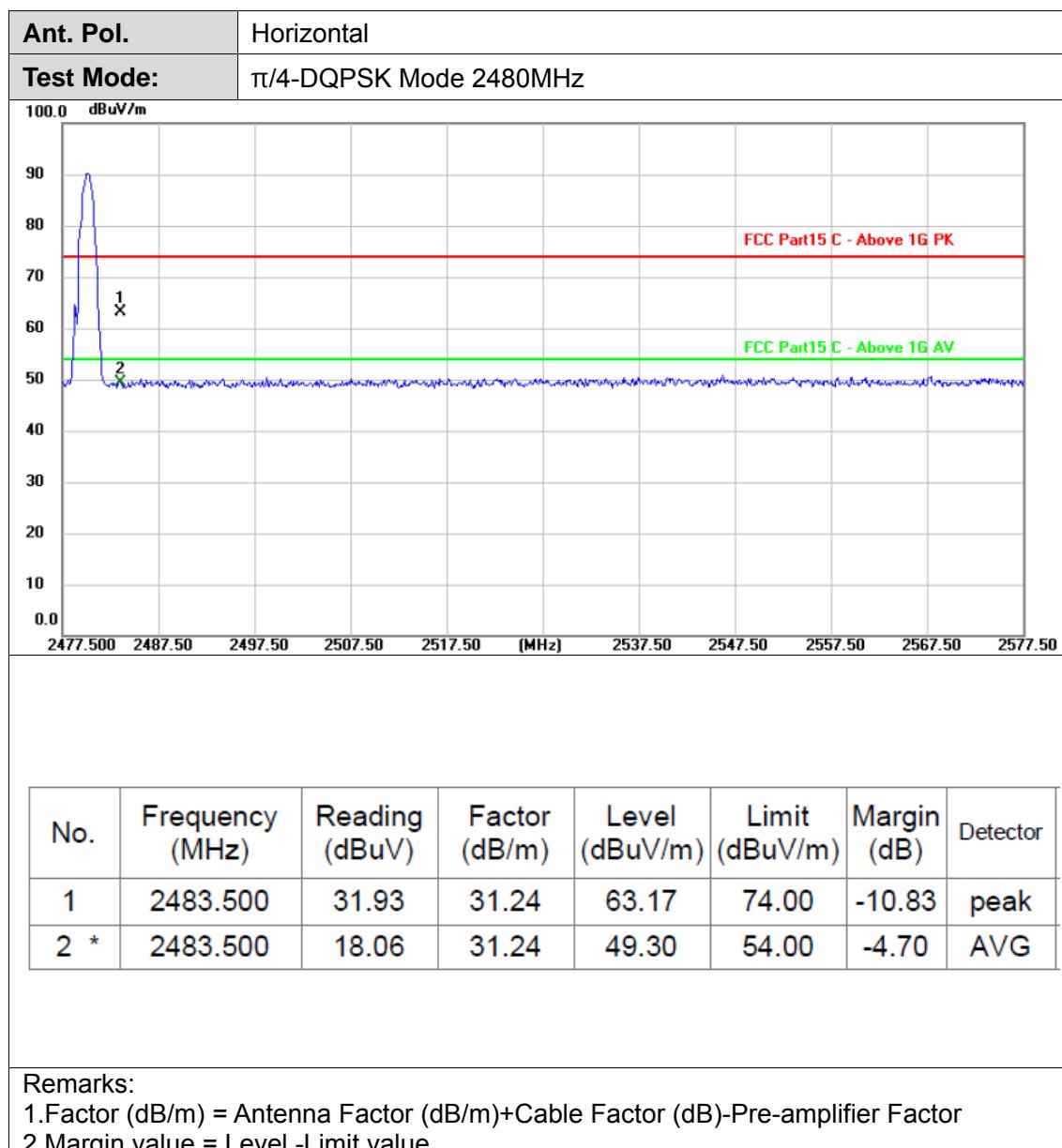


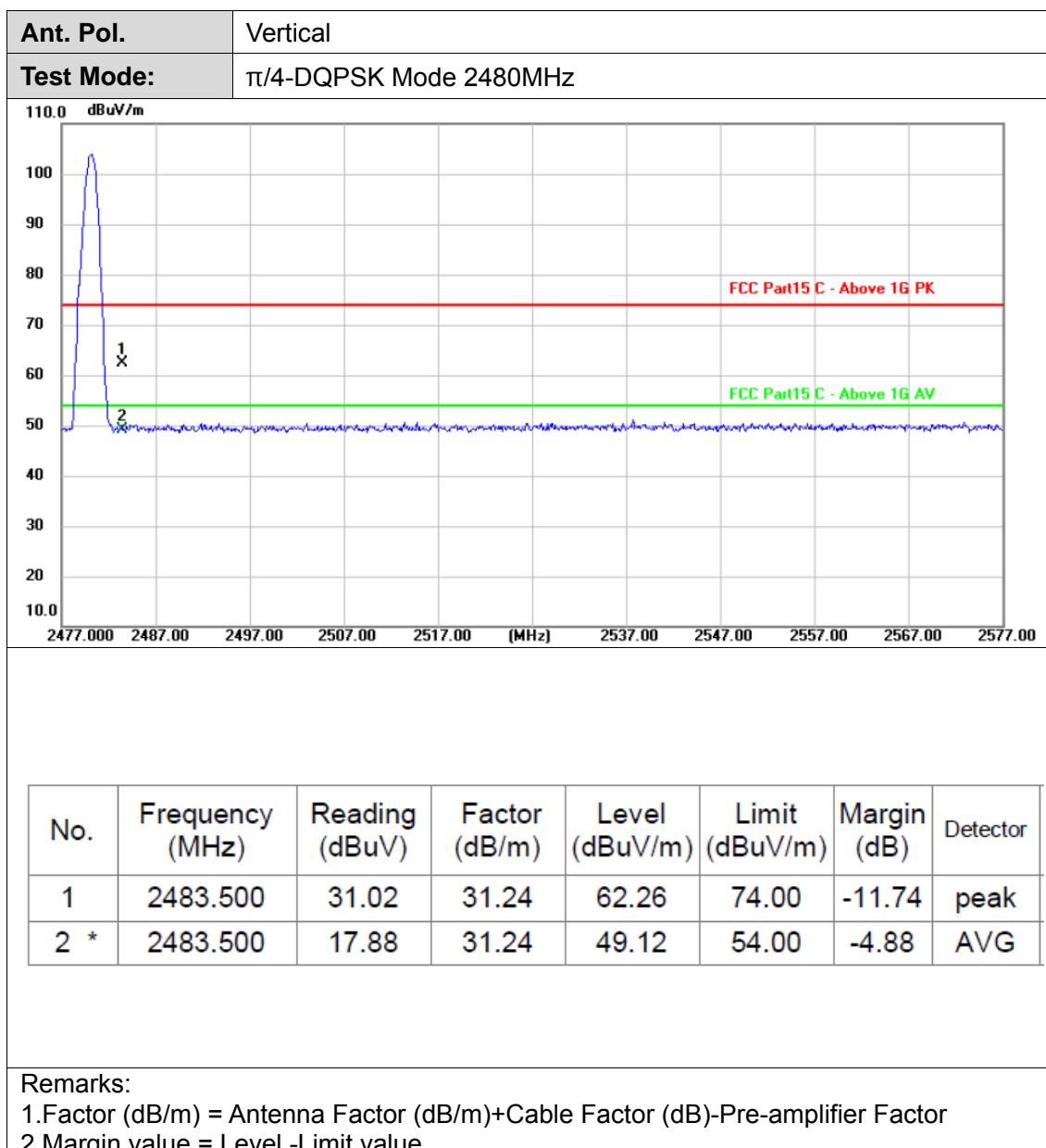


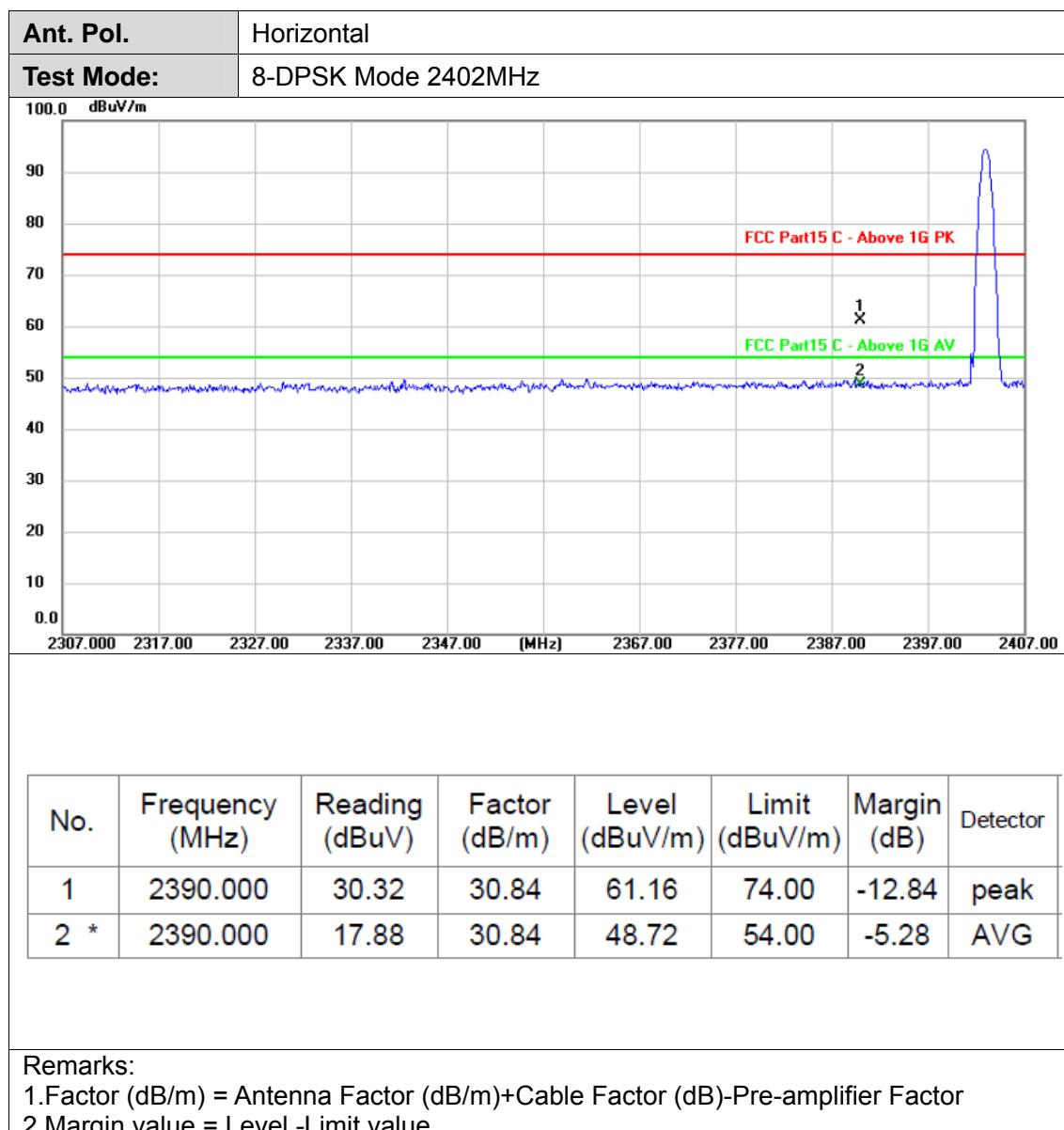


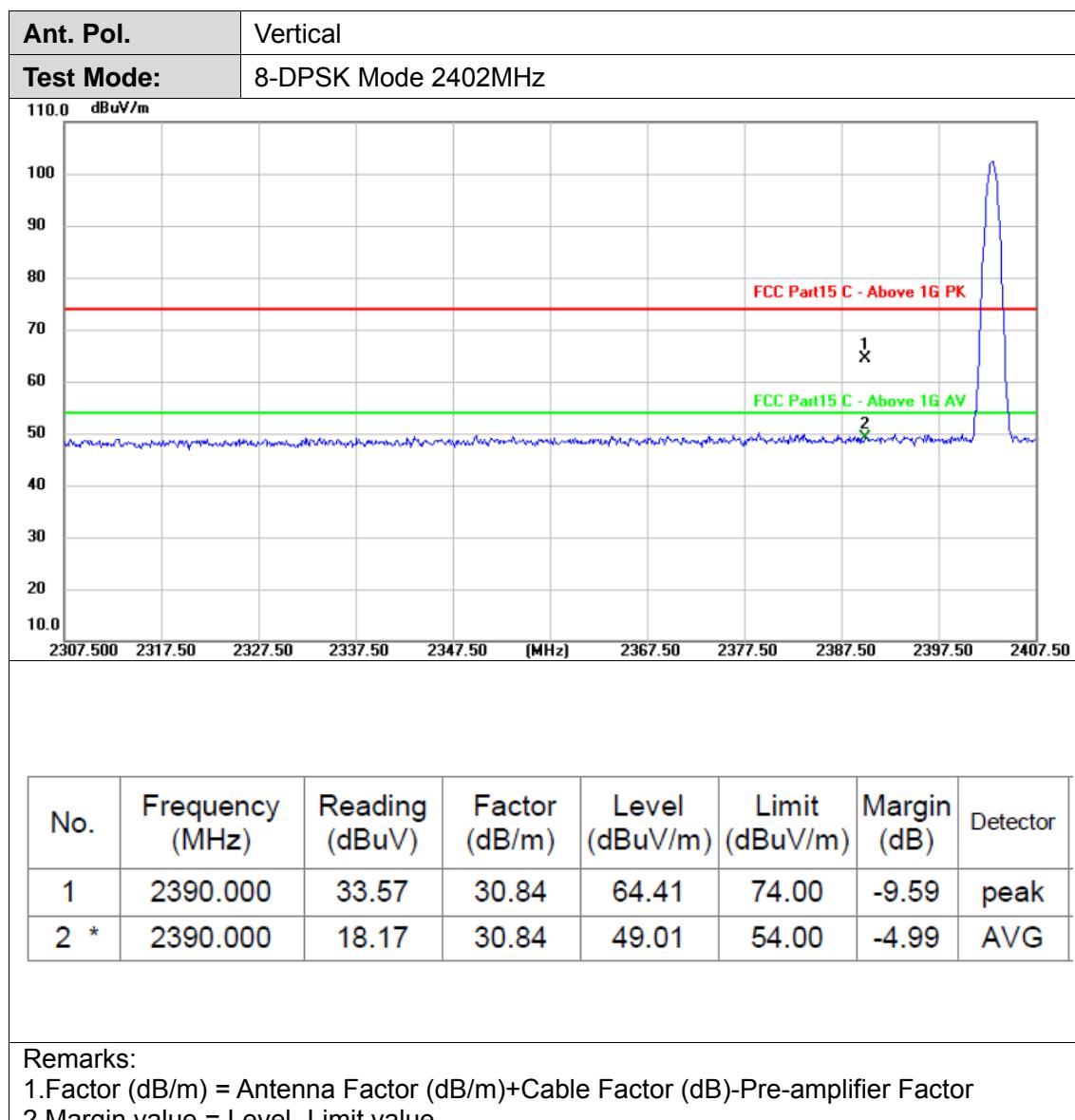


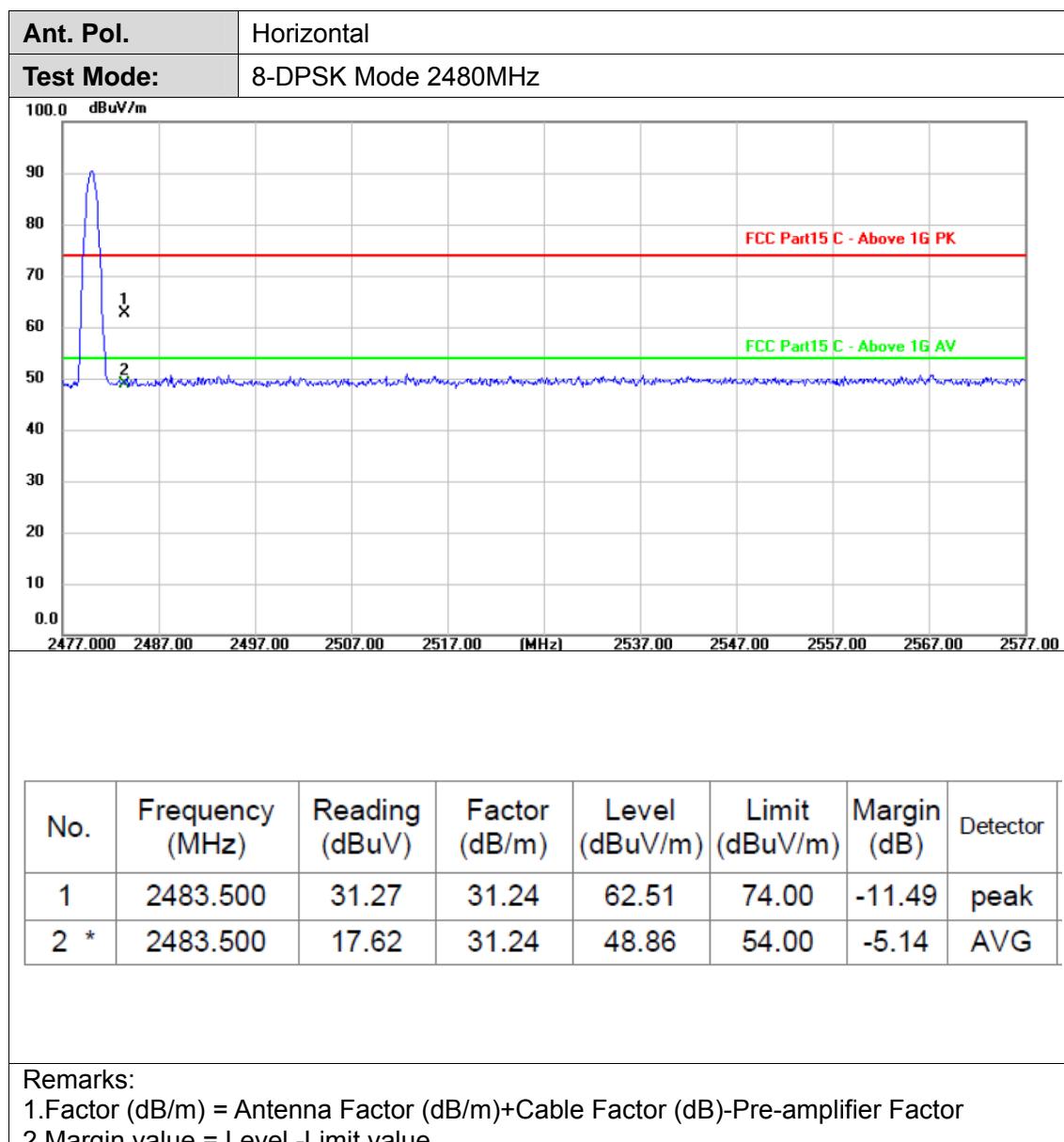


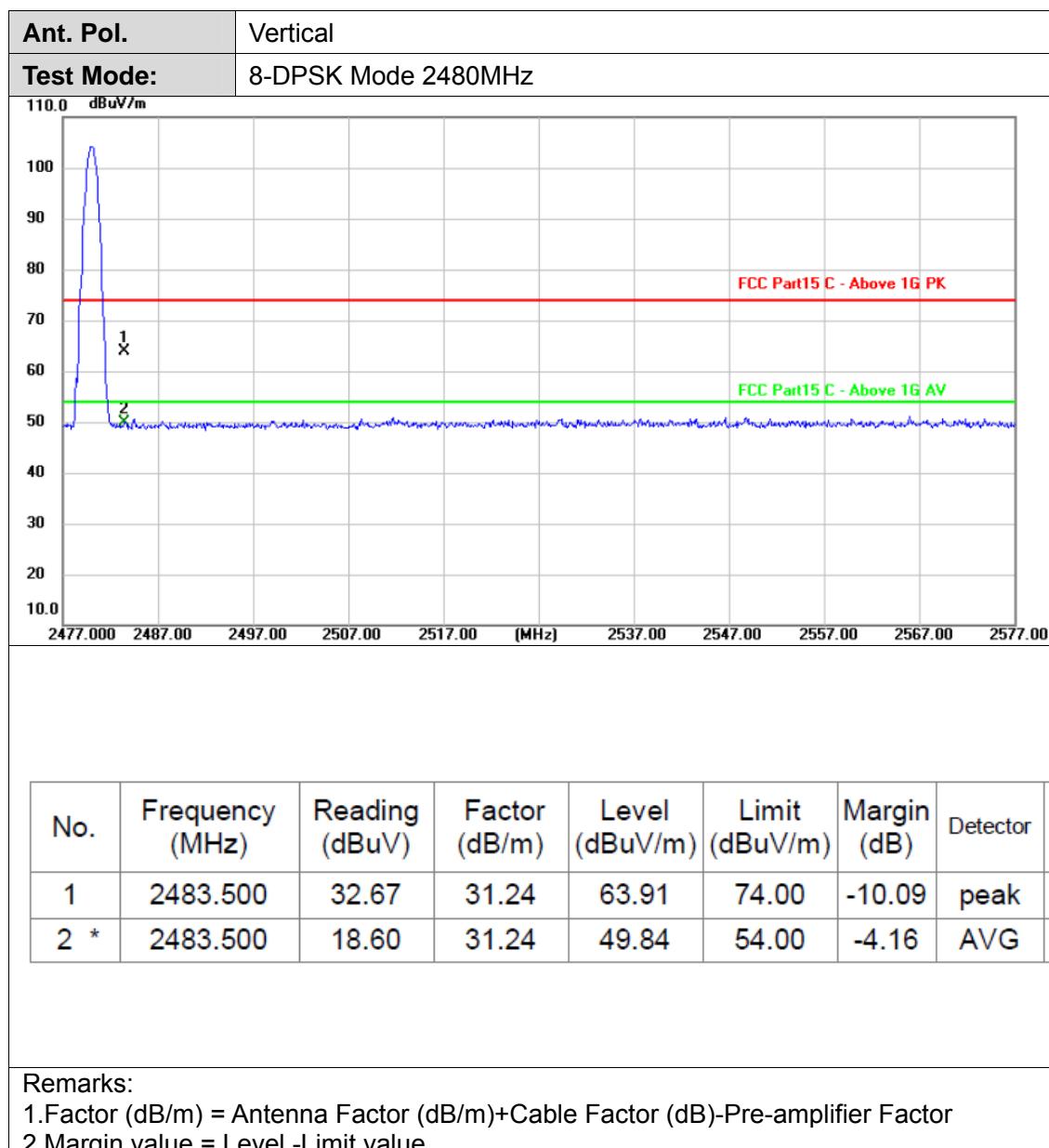










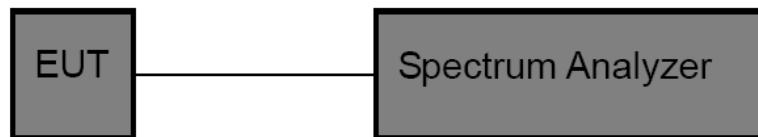


3.4. Band edge and Spurious Emissions (Conducted)

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.

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 Results

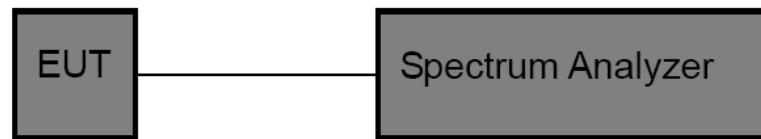
Reference to the Report No.: CTC20210728E12.

3.5. 20DB Bandwidth

Limit

N/A

Test Configuration



Test Procedure

5. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
6. OCB and 20dB Spectrum Setting:
 - (1) Set RBW = 1% ~ 5% occupied bandwidth.
 - (2) Set the video bandwidth (VBW) \geq 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 Results

Reference to the Report No.: CTC20210728E12.

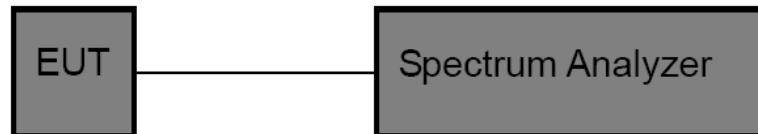
3.6. Channel Separation

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1)/ RSS-247 5.1 b :

Test Item	Limit	Frequency Range(MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

Test Configuration



Test Procedure

7. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
8. Spectrum Setting:
 - (1) Set RBW = 100 kHz.
 - (2) Set the video bandwidth (VBW) \geq 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Test Mode

Please refer to the clause 2.4.

Test Results

Reference to the Report No.: CTC20210728E12.

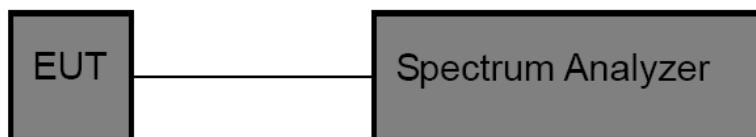
3.7. Number of Hopping Channel

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(iii)/ RSS-247 5.1 d:

Section	Test Item	Limit
15.247 (a)(iii)/ RSS-247 5.1 d:	Number of Hopping Channel	>15

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. Spectrum Setting:
 - (1) Peak Detector: RBW=100 kHz, VBW \geq RBW, Sweep time= Auto.

Test Mode

Please refer to the clause 2.4.

Test Result

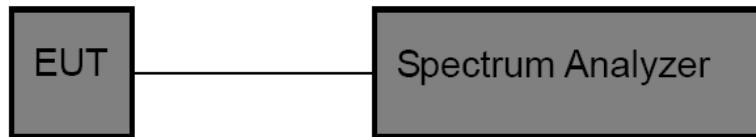
Reference to the Report No.: CTC20210728E12.

3.8. Dwell Time

Limit

Section	Test Item	Limit
15.247(a)(iii)/ RSS-247 5.1 d	Average Time of Occupancy	0.4 sec

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. Spectrum Setting:
 - (1) Spectrum Setting: $RBW=1\text{MHz}$, $VBW \geq RBW$.
 - (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
 - (3) Sweep Time is more than once pulse time.
 - (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
 - (5) Measure the maximum time duration of one single pulse.
 - (6) Set the EUT for packet transmitting.

Test Mode

Please refer to the clause 2.4.

Test Result

Reference to the Report No.: CTC20210728E12.

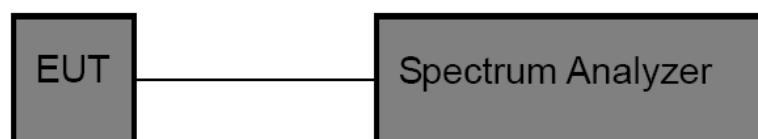
3.9. Peak Output Power

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1) / RSS-247 5.4 b:

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125mW(21dBm)	2400~2483.5

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. Spectrum Setting:
 - (1) Set RBW> 20DB Bandwidth.
 - (2) Set the video bandwidth (VBW) \geq RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Test Mode

Please refer to the clause 2.4.

Test Result

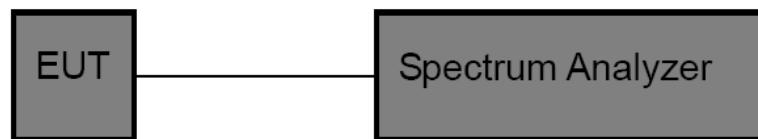
Reference to the Report No.: CTC20210728E12.

3.10. Duty Cycle

Limit

None, for report purposes only.

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. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:
Set analyzer center frequency to test channel center frequency.
Set the span to 0Hz
Set the RBW to 10MHz
Set the VBW to 10MHz
Detector: Peak
Sweep time: Auto
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

Test Mode

Please refer to the clause 2.4.

Test Result

Reference to the Report No.: CTC20210728E12.



3.11. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

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 antenna that uses a unique coupling to the intentional radiator, 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.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Test Result

The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

*****THE END*****