

RF Test Report

Applicant : iWaylink Inc.

Product Type : Portable data terminal

Trade Name : IMOTION GROUP or



Model Number : TC603

Applicable Standard : FCC 47 CFR PART 15 SUBPART C
ANSI C63.10:2013

Received Date : Oct. 21, 2021

Test Period : Nov. 06 ~ Nov 10, 2021

Issued Date : Jan. 18, 2022

Issued by

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade District,
Taoyuan City 33465, Taiwan (R.O.C.)
Tel : +886-3-2710188 / Fax : +886-3-2710190



Taiwan Accreditation Foundation accreditation number: 1330
Frequency Range : 9 kHz to 40 GHz
Test Firm MRA designation number: TW0010

Note:

- 1.The test results are valid only for samples provided by customers and under the test conditions described in this report.
- 2.This report shall not be reproduced except in full, without the written approval of A Test Lab Technology Corporation.
- 3.The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Revision History

Rev.	Issued Date	Revisions	Revised By
00	Jan. 18, 2022	Initial Issue	Emma Chao

Verification of Compliance

Applicant : iWaylink Inc.

Product Type : Portable data terminal

Trade Name : IMOTION GROUP or 

Model Number : TC603

FCC ID : SPYTC603

EUT Rated Voltage : DC 5.0 V, 3.0 A / DC 9.0 V, 2.0 A

Test Voltage : 120 Vac / 60 Hz

Applicable Standard : FCC 47 CFR PART 15 SUBPART C
ANSI C63.10:2013

Test Result : Complied

Performing Lab. : A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade District,
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Tel : +886-3-2710188 / Fax : +886-3-2710190
Taiwan Accreditation Foundation accreditation number: 1330
<http://www.atl-lab.com.tw/e-index.htm>



A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By :


(Kai Yu Yang)

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Appendix A. Test Setup Photographs

1 General Information

1.1. Summary of Test Result

Standard	Item	Result	Remark
15.207	AC Power Conducted Emission	PASS	-----
15.203	Antenna Requirement	PASS	-----
15.247(b)(1)	Max. Output Power	PASS	-----
15.247(d)	Transmitter Radiated Emissions	PASS	-----
15.247(a)(1)	20 dB RF Bandwidth	PASS	-----
15.247(a)(1)	Carrier Frequency Separation	PASS	-----
15.247(a)(1)(iii)	Number of Hopping	PASS	-----
15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	PASS	-----
15.247(d)	Out of Band Conducted Spurious Emission	PASS	-----

Decision Rule

- Uncertainty is not included.
- Uncertainty is included.

Standard	Description
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
DA 00-705	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conducted Emission	150 kHz ~ 30 MHz	2.7 dB
Radiated Emission	9 kHz ~ 30 MHz	2.2 dB
	30 MHz ~ 1000 MHz	5.1 dB
	1000 MHz ~ 18000 MHz	5.2 dB
	18000 MHz ~ 26500 MHz	4.6 dB
	26500 MHz ~ 40000 MHz	4.6 dB
Conducted Output Power		1.1 dB
RF Bandwidth		4.7 %
Power Spectral Density		1.1 dB

2 EUT Description

Applicant	iWaylink Inc. 6F., No. 288, Sec. 6, Civic Blvd., Xinyi Dist., Taipei City 110, Taiwan		
Product	Portable data terminal		
Trade Name	IMOTION GROUP or  imotion group		
Model Number	TC603		
FCC ID	SPYTC603		
Frequency Range	2402 ~ 2480 MHz		
Modulation Type	GFSK for 1 Mbps		
	$\pi/4$ -DQPSK for 2 Mbps		
	8DPSK for 3 Mbps		
Operate Temp. Range	-10 ~ +50 °C		
Antenna information	Type	Max. Gain (dBi)	
	PIFA Antenna	0.6	
Max. RF Output Power	GFSK for 1 Mbps	0.01429	W
	$\pi/4$ -DQPSK for 2 Mbps	0.01259	W
	8DPSK for 3 Mbps	0.01312	W

3 Test Methodology

3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Pre-Test Mode
Mode 1: Transmit mode
Mode 2: GFSK Continuous TX mode
Mode 3: $\pi/4$ -DQPSK Continuous TX mode
Mode 4: 8DPSK Continuous TX mode

After verification, all tests were carried out with the worst case test modes.

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Y axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

Final-Test Mode
Mode 1: Transmit mode
Mode 2: GFSK Continuous TX mode
Mode 4: 8DPSK Continuous TX mode

Description of Test Modes

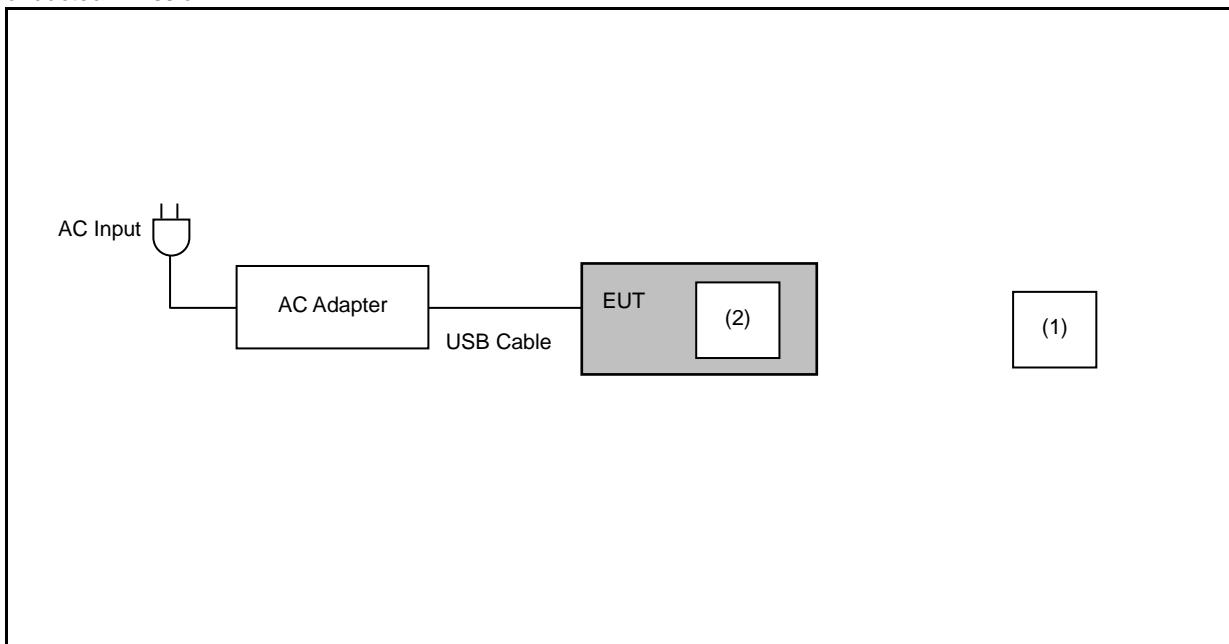
Preliminary tests were performed in different modulation to find the worst case. The modulation has shown the worst-case in section 4.5. Investigation has been done on all the possible configurations for searching the worst cases.

3.2. EUT Test Step

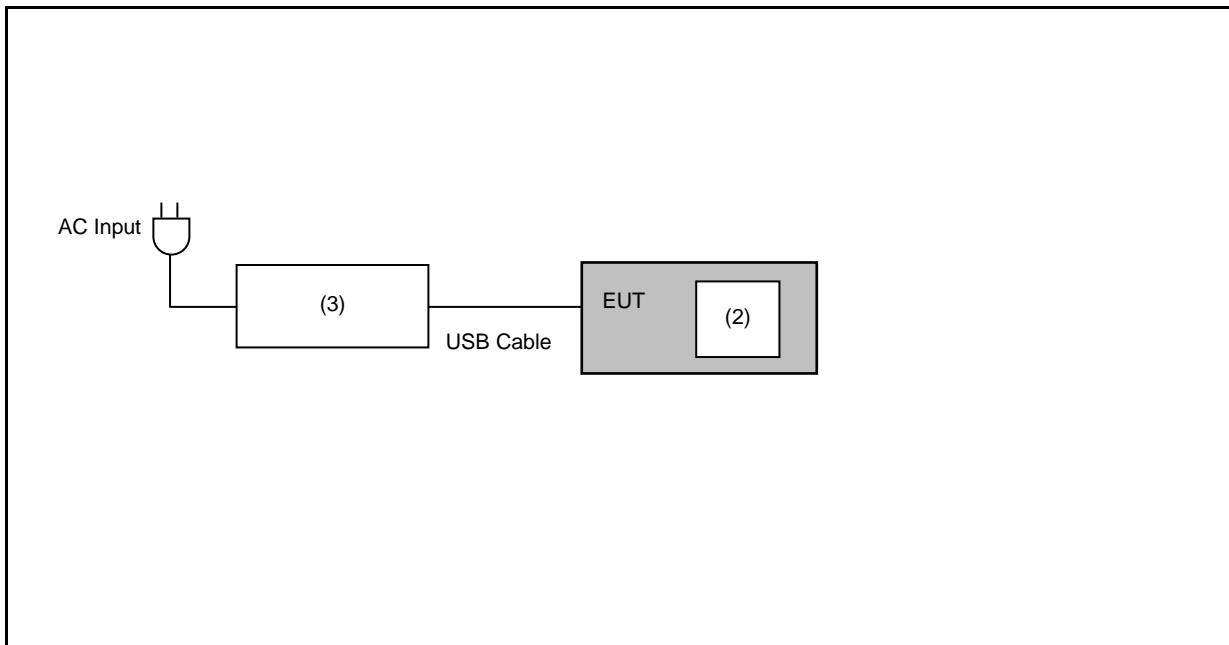
1	Setup the EUT shown on "Configuration of Test System Details."
2	Turn on the power of all equipment.
3	Turn on TX function
4	EUT run test program.

3.3. Configuration of Test System Details

Conducted Emission



Radiated Emission



Devices Description					
Product		Manufacturer	Model Number	Serial Number	Power Cord
(1)	Portable Bluetooth Speaker	harman/kardon	HK NEO	---	---
(2)	Micro SD Card	Transcend	9153BA 8G 07DS1	---	---
(3)	Notebook	ASUS	BU400A	---	---

3.4. Test Instruments

For Conducted Emission

Test Period: Nov. 06, 2021

Testing Engineer: Louis Shen

Use	Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESCI	100367	05/21/2021	1 year
<input type="checkbox"/>	Test Receiver	R&S	ESCI	101000	11/27/2020	1 year
<input checked="" type="checkbox"/>	LISN	R&S	ENV216	101040	03/29/2021	1 year
<input checked="" type="checkbox"/>	LISN	R&S	ENV216	101041	04/08/2021	1 year
<input checked="" type="checkbox"/>	RF Cable	Woken	00100D1380194M	TE-02-03	05/28/2021	1 year
<input checked="" type="checkbox"/>	Software	EZ EMC	1.1.4.3	N/A	N.C.R.	---

Note: N.C.R. = No Calibration Request.

For Conducted

Test Period: Nov. 10, 2021

Testing Engineer: Brian Lin

Use	Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
<input type="checkbox"/>	Power Sensor	Anritsu	MA2411B	1126022	09/03/2021	1 year
<input type="checkbox"/>	Power Meter	Anritsu	ML2495A	1135009	09/03/2021	1 year
<input checked="" type="checkbox"/>	Power Sensor	Agilent	N1921A	MY45241957	12/09/2020	1 year
<input checked="" type="checkbox"/>	Power Meter	Agilent	N1911A	MY45101619	12/09/2020	1 year
<input checked="" type="checkbox"/>	Spectrum Analyzer (10 Hz~26.5 GHz)	Keysight	N9010B	MY59071418	03/17/2021	1 year
<input type="checkbox"/>	Spectrum Analyzer (9 kHz~26.5 GHz)	Agilent	N9010A	MY48030518	07/23/2021	1 year
<input type="checkbox"/>	Spectrum Analyzer (20 Hz~26.5 GHz)	Agilent	N9020A	US47520902	09/09/2021	1 year
<input type="checkbox"/>	Spectrum Analyzer (3 Hz~50 GHz)	Agilent	N9030A	MY53120541	01/08/2021	1 year
<input type="checkbox"/>	Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	03/30/2021	1 year
<input type="checkbox"/>	Signal Generator	Keysight	N5182B	MY53052569	04/20/2021	1 year
<input type="checkbox"/>	Signal Generator	Keysight	N5182BX07	MY59360221	04/20/2021	1 year
<input checked="" type="checkbox"/>	Bluetooth Tester	R&S	CBT	100350	03/17/2021	2 years
<input type="checkbox"/>	Wireless Connectivity Tester	R&S	CMW270	102208	06/02/2021	1 year
<input type="checkbox"/>	Power Supply	KEITHLEY	2303	4045290	02/01/2021	1 year
<input type="checkbox"/>	RF Communication Test Set	HP	8920A	3344A03297	08/10/2021	1 year

Note: N.C.R. = No Calibration Request.

For Radiated Emissions
 Test Period: Nov. 10, 2021
 Testing Engineer: Marc.Yeh

Radiation test sites		Semi Anechoic Room				
Use	Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
<input type="checkbox"/>	Spectrum Analyzer (10 Hz~44 GHz)	Keysight	N9010A	MY52221312	01/18/2021	1 year
<input type="checkbox"/>	Spectrum Analyzer (3 Hz~50 GHz)	Agilent	N9030A	MY53120541	01/08/2021	1 year
<input checked="" type="checkbox"/>	Spectrum Analyzer (2 Hz~50 GHz)	Keysight	N9030B	MY57143537	04/19/2021	1 year
<input checked="" type="checkbox"/>	Amplifier (100 kHz~1.3 GHz)	Agilent	8447D	2944A11119	01/15/2021	1 year
<input type="checkbox"/>	Amplifier (100 kHz~1.3 GHz)	Agilent	8447D	2944A10961	07/06/2021	1 year
<input type="checkbox"/>	Broadband Amplifier (100 kHz~1 GHz)	Titan	T0910E00014330A 1F	001	07/23/2021	1 year
<input type="checkbox"/>	Amplifier (1 GHz~26.5 GHz)	Agilent	8449B	3008A02237	10/21/2021	1 year
<input checked="" type="checkbox"/>	Broadband Amplifier (1 GHz~26.5 GHz)	Titan	T0912E01263025A 1F	002	07/26/2021	1 year
<input type="checkbox"/>	Preamplifier (26.5 GHz~40 GHz)	EMCI	EMC2654045	980028	08/19/2021	1 year
<input checked="" type="checkbox"/>	Loop Antenna (9 kHz~30 MHz)	COM-POWER CORPORATION	AL-130	121014	04/07/2021	1 year
<input checked="" type="checkbox"/>	Trilog Broadband Antenna (30 kHz~1 GHz)	Schwarzbeck Mess-Elektronik	VULB9168	01146	07/19/2021	1 year
<input type="checkbox"/>	Trilog Broadband Antenna (30 kHz~1 GHz)	Schwarzbeck Mess-Elektronik	VULB9168	416	11/11/2020	1 year
<input checked="" type="checkbox"/>	Broadband Horn Antenna (1 GHz~18 GHz)	Schwarzbeck Mess-Elektronik	9120D	02207	07/09/2021	1 year
<input type="checkbox"/>	Broadband Horn Antenna (1 GHz~18 GHz)	Schwarzbeck Mess-Elektronik	9120D	9120D-550	08/24/2021	1 year
<input checked="" type="checkbox"/>	Broadband Horn Antenna (18 GHz~40 GHz)	Schwarzbeck Mess-Elektronik	9170	9170-320	08/24/2021	1 year
<input type="checkbox"/>	Horn Antenna (18 GHz~40 GHz)	ETS	3116	00086467	12/03/2020	1 year
<input type="checkbox"/>	RF Cable	EMCI	EMC104-N-N-6000	TE01-1	02/19/2021	1 year
<input type="checkbox"/>	Microwave Cable	EMCI	EMC104-SM-SM-1 3000	170814	02/19/2021	1 year
<input type="checkbox"/>	Microwave Cable	EMCI	EMC102-KM-KM-1 4000	151001	02/19/2021	1 year
<input checked="" type="checkbox"/>	Coaxial Cable	Titan	T0710AT327A10A 100	J11005	08/06/2021	1 year
<input checked="" type="checkbox"/>	Coaxial Cable	Titan	T0710AT327A10A 900	J11004	08/06/2021	1 year
<input checked="" type="checkbox"/>	Coaxial Cable	Titan	CFD400NL-LW	001	08/06/2021	1 year
<input checked="" type="checkbox"/>	Bluetooth Tester	R&S	CBT	100350	03/17/2021	2 years
<input type="checkbox"/>	Wireless Connectivity Tester	R&S	CMW270	102208	06/02/2021	1 year
<input type="checkbox"/>	Power Supply	KEITHLEY	2303	4045290	02/01/2021	1 year
<input checked="" type="checkbox"/>	Software	EZ EMC	1.1.4.4	N/A	N.C.R.	---

Note: N.C.R. = No Calibration Request.

3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	20-30
Humidity (%RH)	25-75	45-75

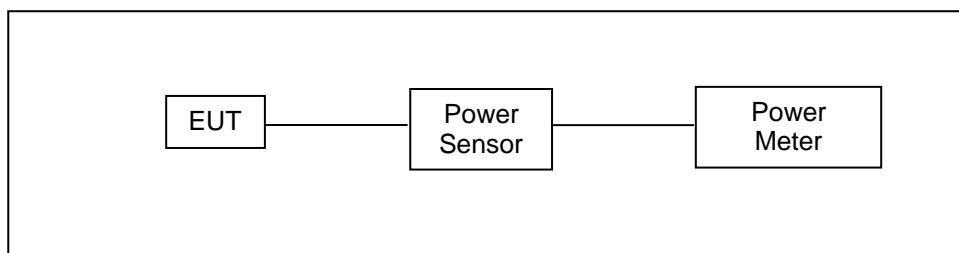
4 Measurement Procedure

4.1. Maximum Conducted Output Power Measurement

■ Limit

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels < 0.125 watt.

■ Test Setup



■ Test Procedure

Testing must be done according to this procedure, FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The tests below are run with the EUT's transmitter set at high power in TX mode. The EUT is needed to force selection of output power level and channel number. While testing, EUT was set to transmit continuously. Remove the Subjective device's antenna and connect the RF output port to power sensor. The maximum peak output power shall not exceed 1 watt.

Use a direct connection between the antenna port of transmitter and the power sensor, for prevent the power sensor input attenuation 40-50 dB. Set the RBW Bandwidth of the emission or use a channel power meter mode.

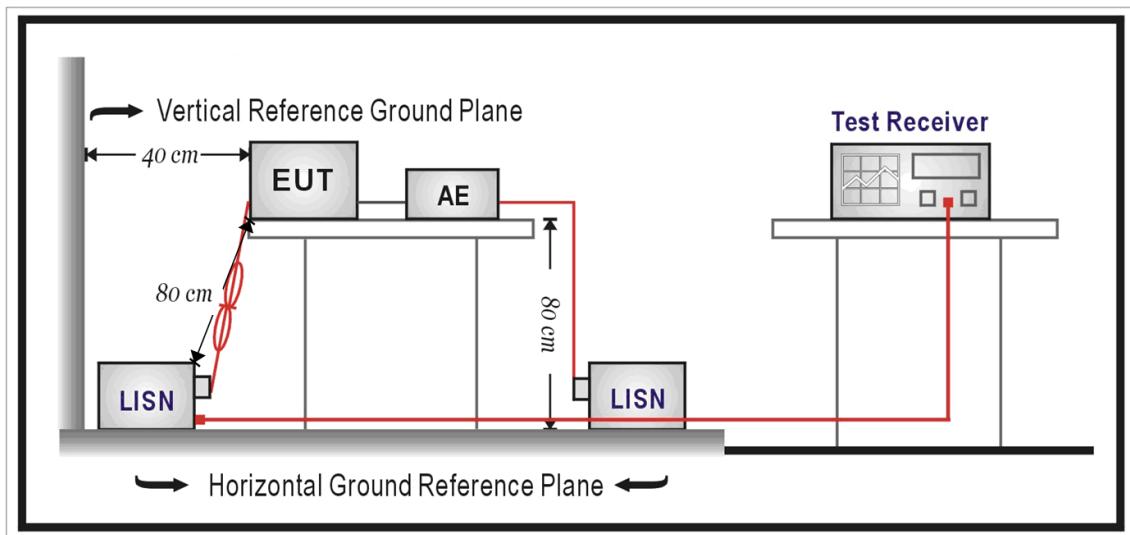
For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm). For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to $(GAIN - 6)/3$ dBm. The antenna port of the EUT was connected to the input of a power sensor. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

4.2. AC Power Line Conducted Emission Measurement

■ Limit

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

■ Test Setup



■ Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50Ω // $50 \mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50Ω // $50 \mu\text{H}$ coupling impedance with 50Ω termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40 cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80 cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12 mm insulating material.

Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150 kHz to 30 MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8 m from the AMN. If the mains power cable is longer than 1 m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4 m. All of interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1 m. All 50Ω ports of the LISN shall be resistively terminated into 50Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

4.3. Radiated Emission Measurement

■ Limit

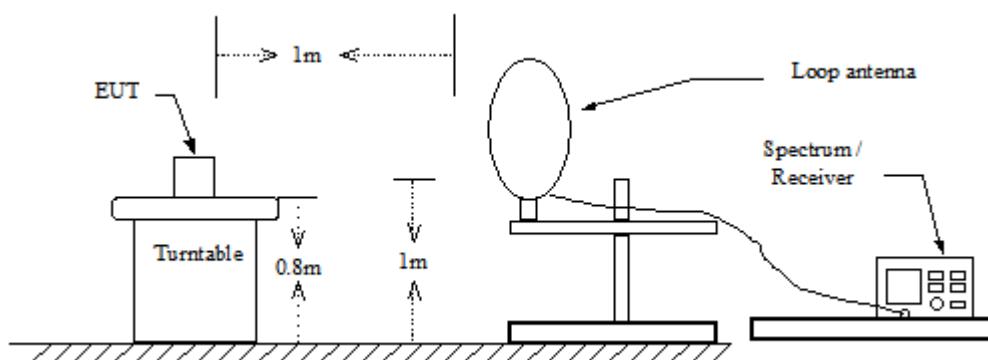
According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μ V/m at 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
Above 960	500	3

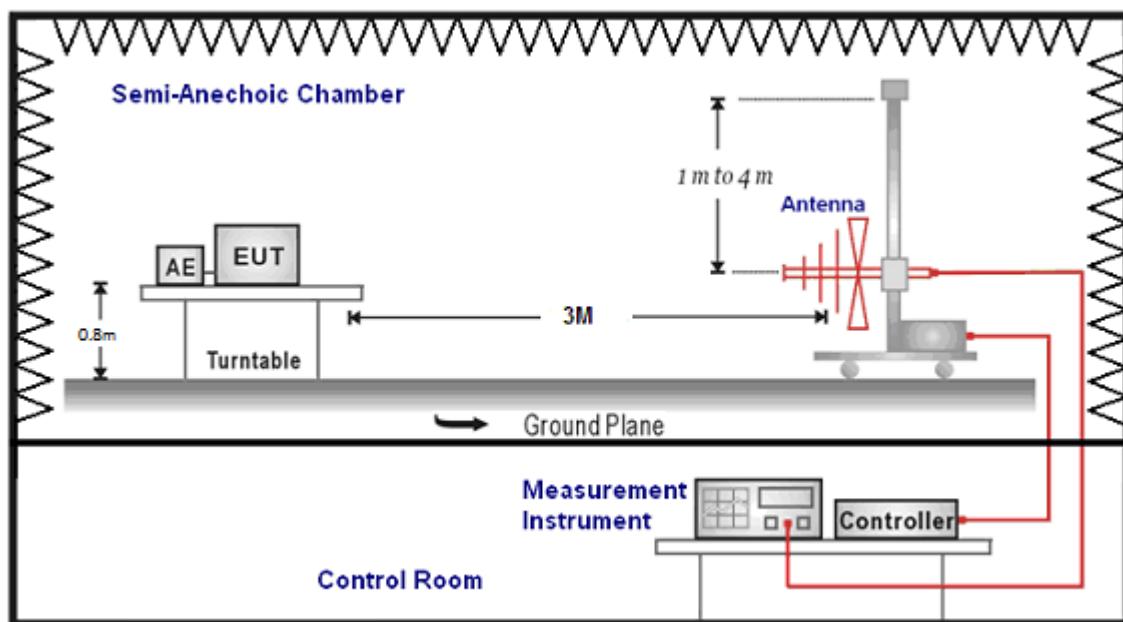
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

■ Setup

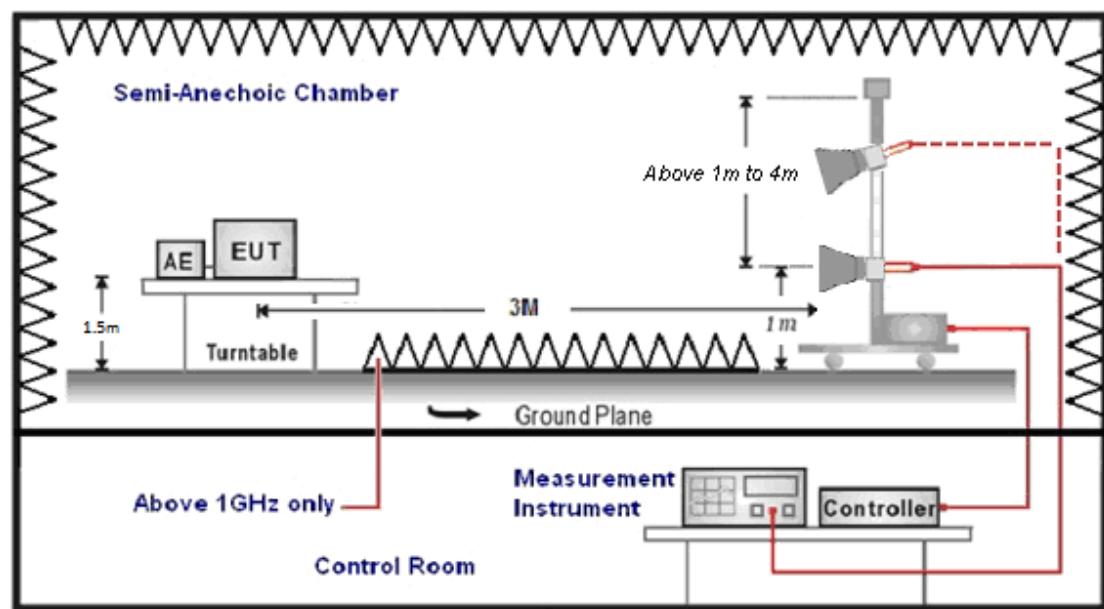
9 kHz ~ 30 MHz



Below 1 GHz



Above 1 GHz



■ Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 26.5 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements when Duty cycle >98 % / 1/T for average measurements when Duty cycle <98 %. A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna was used in frequencies 1 – 26.5 GHz at a distance of 1 meter. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts pre meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro colts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

$$(1) \text{ Amplitude (dBuV/m)} = \text{FI (dBuV)} + \text{AF (dBuV)} + \text{CL (dBuV)} - \text{Gain (dB)}$$

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

$$(2) \text{ Actual Amplitude (dBuV/m)} = \text{Amplitude (dBuV)} - \text{Dis(dB)}$$

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(a) For fundamental frequency : Transmitter Output < +30 dBm

(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

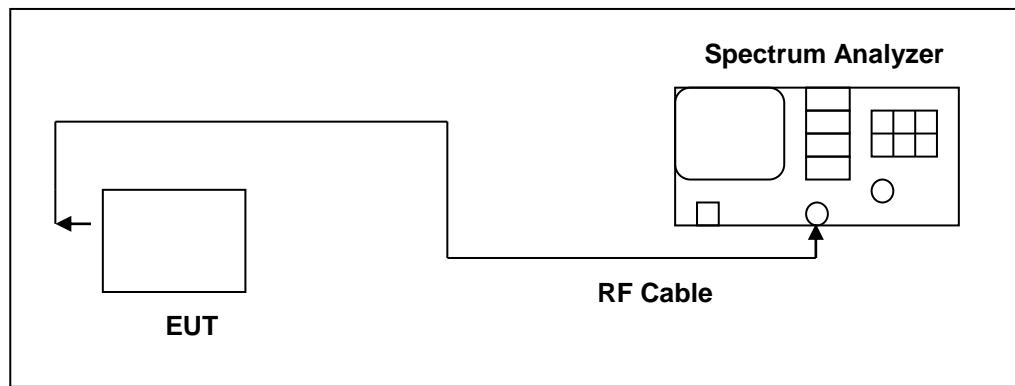
Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

4.4. 20 dB RF Bandwidth Measurement

■ **Limit**

N/A

■ **Test Setup**



■ **Test Procedure**

Testing must be done according to this procedure, FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = approx. 2 to 3 times the 20 dB bandwidth, centered on a hopping frequency
2. RBW \geq 1 % of the 20 dB span
3. VBW \geq RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

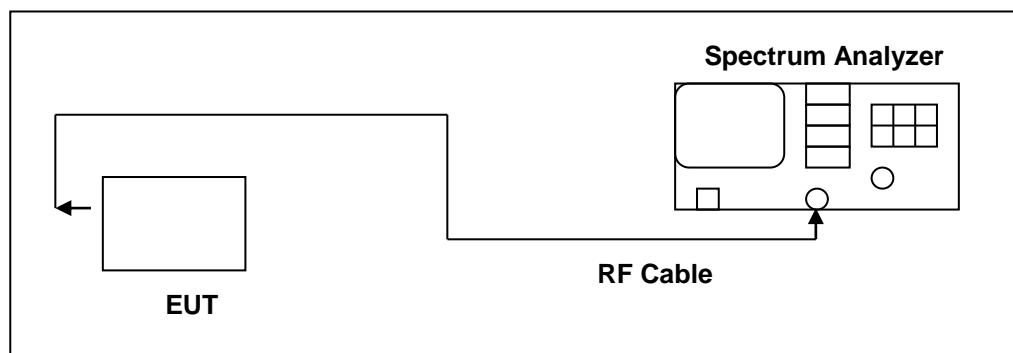
The trace was allowed to stabilize. The EUT was transmitting at its maximum data rate. The marker-to-peak function was used to set the marker to the peak of the emission. The marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function and marker was moved to the other side of the emission until it was even with the reference marker. The marker-delta reading at this point was the 20 dB bandwidth of the emission.

4.5. Carrier Frequency Separation Measurement

■ Limit

Title 47 of the CFR, Part 15 Subpart (c) 15.247(a)(1) requires the measurement of the bandwidth of the transmission between the -20 dB points on the transmitted spectrum. The results of this test determine the limits for channel spacing. The channel spacing shall be a minimum of 25 kHz or the 20 dB bandwidth, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel.

■ Test Setup



■ Test Procedure

Testing must be done according to this procedure, FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth frequency hopping function of the EUT was enabled. The following spectrum analyzer settings were used:

1. Span = wide enough to capture the peaks of two adjacent channels
2. Resolution (or IF) Bandwidth (RBW) \geq 1 % of the span
3. Video (or Average) Bandwidth (VBW) \geq RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

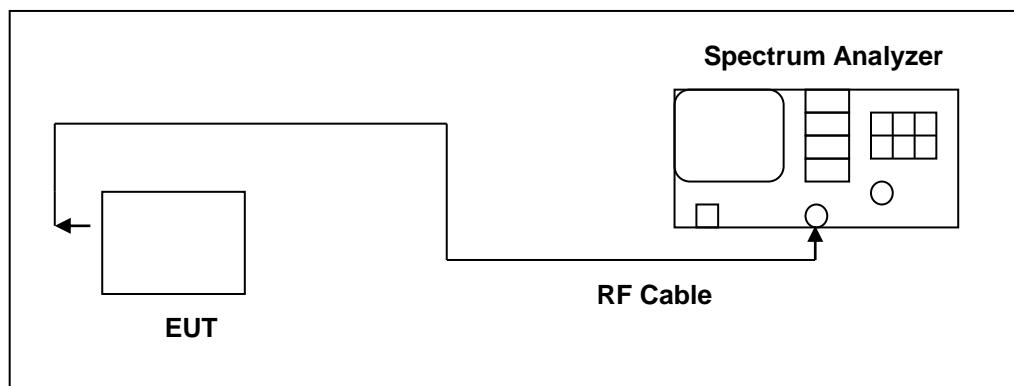
The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

4.6. Number of Hopping Measurement

■ Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

■ Test Setup



■ Test Procedure

Testing must be done according to this procedure, FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = the frequency band of operation
2. RBW \geq 1 % of the span
3. VBW \geq RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

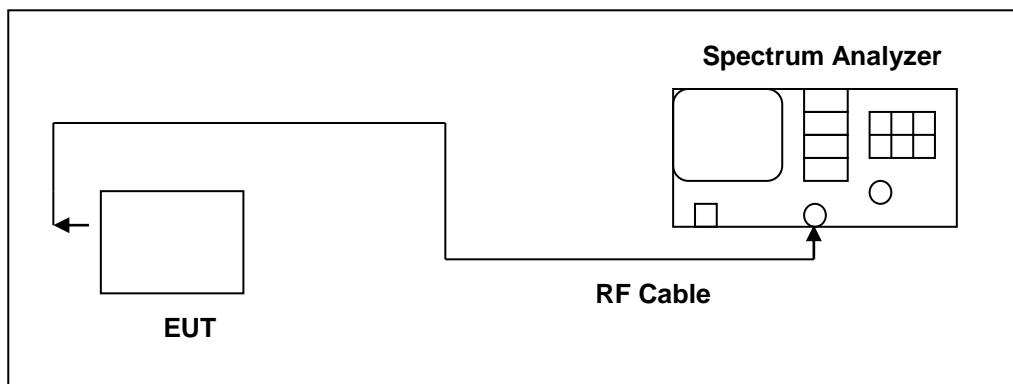
The trace was allowed to stabilize.

4.7. Time of Occupancy (Dwell Time) Measurement

■ Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

■ Test Setup



■ Test Procedure

Testing must be done according to this procedure, FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the spectrum through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth hopping function of the EUT was enabled. The following spectrum analyzer settings were used:

1. Span = zero span, centered on a hopping channel
2. RBW = 1 MHz
3. VBW \geq RBW
4. Sweep = as necessary to capture the entire dwell time per hopping channel
5. Detector function = peak
6. Trace = max hold

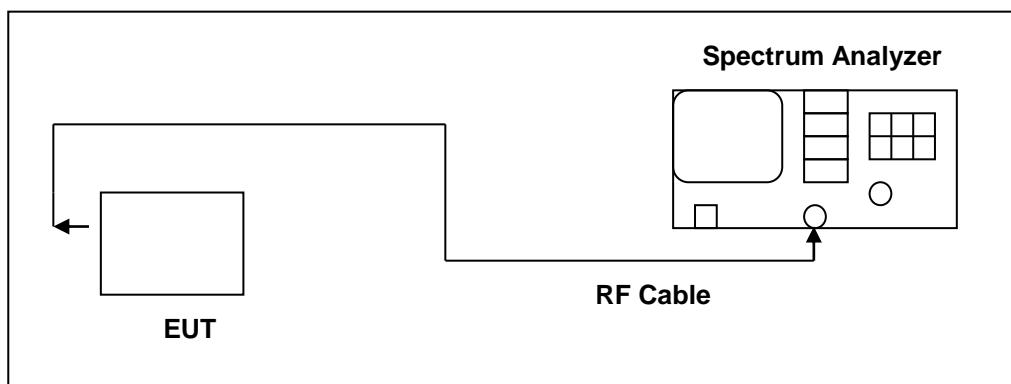
The marker-delta function was used to determine the dwell time.

4.8. Out of Band Conducted Emissions Measurement

■ Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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

■ Test Setup



■ Test Procedure

Testing must be done according to this procedure, FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function. All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the pass band. The test was performed at 3 channels (Channel 0, 39, 78)

4.9. Antenna Measurement

■ Limit

For intentional device, according to 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.

And According to 15.247 (b)(4), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

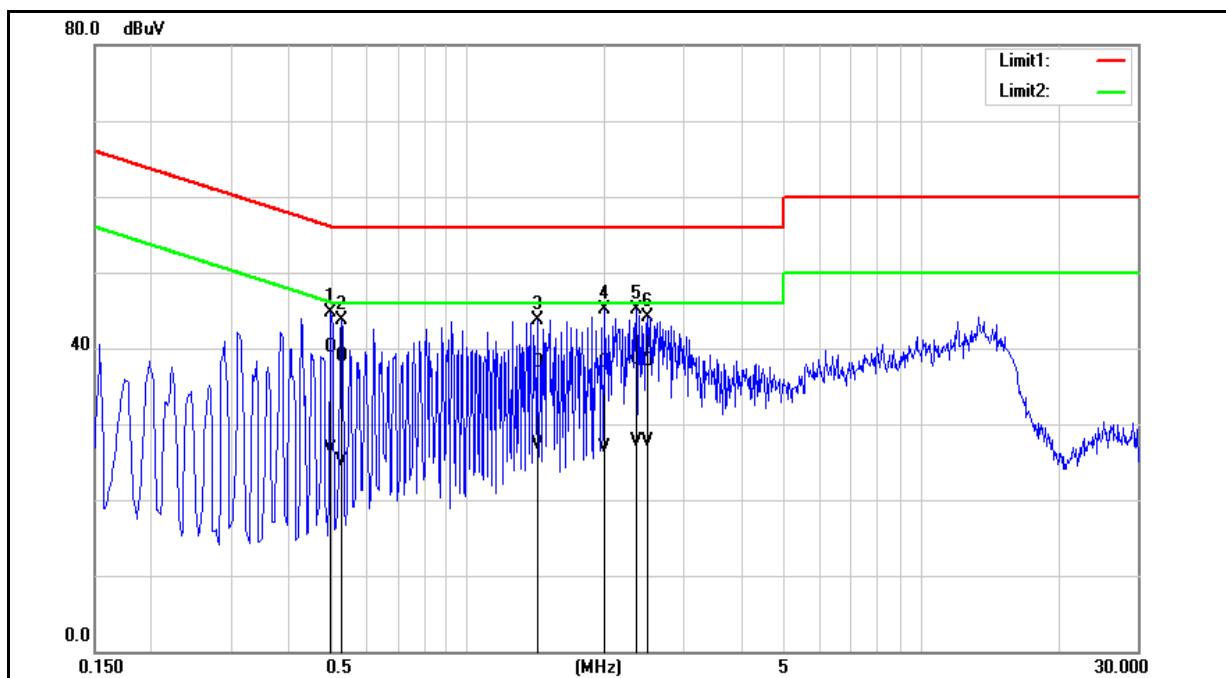
■ Antenna Connector Construction

See section 2 – antenna information.

5 Test Results

5.1 Conducted Emission

Standard:	FCC Part 15.247	Line:	L1
Test item:	Conducted Emission	Power:	AC 120 V/60 Hz
Mode:	Mode 1		
Description:			

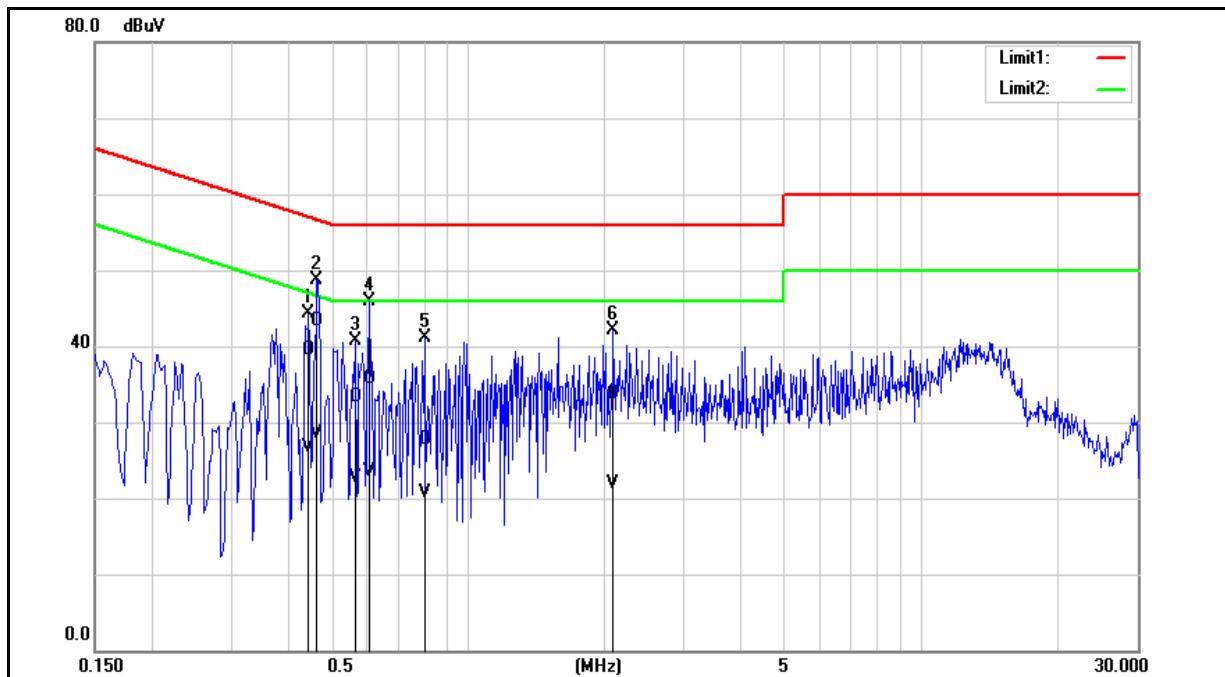


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.4980	30.31	17.03	9.74	40.05	26.77	56.03	46.03	-15.98	-19.26	Pass
2	0.5260	29.17	15.36	9.74	38.91	25.10	56.00	46.00	-17.09	-20.90	Pass
3	1.4220	28.24	17.50	9.77	38.01	27.27	56.00	46.00	-17.99	-18.73	Pass
4	2.0020	28.26	17.16	9.80	38.06	26.96	56.00	46.00	-17.94	-19.04	Pass
5	2.3460	28.63	17.90	9.81	38.44	27.71	56.00	46.00	-17.56	-18.29	Pass
6	2.4980	28.55	17.83	9.81	38.36	27.64	56.00	46.00	-17.64	-18.36	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Standard:	FCC Part 15.247	Line:	N
Test item:	Conducted Emission	Power:	AC 120 V/60 Hz
Mode:	Mode 1		
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	Avg reading (dBuV)	Correction factor (dB)	QP result (dBuV)	Avg result (dBuV)	QP limit (dBuV)	Avg limit (dBuV)	QP margin (dB)	Avg margin (dB)	Remark
1	0.4460	29.79	16.89	9.73	39.52	26.62	56.95	46.95	-17.43	-20.33	Pass
2	0.4660	33.67	18.82	9.73	43.40	28.55	56.58	46.58	-13.18	-18.03	Pass
3	0.5660	23.65	12.92	9.73	33.38	22.65	56.00	46.00	-22.62	-23.35	Pass
4	0.6060	25.90	13.72	9.73	35.63	23.45	56.00	46.00	-20.37	-22.55	Pass
5	0.8020	18.03	11.05	9.75	27.78	20.80	56.00	46.00	-28.22	-25.20	Pass
6	2.0900	23.89	12.18	9.80	33.69	21.98	56.00	46.00	-22.31	-24.02	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

5.2 Conducted Test Results

Maximum Conducted Output Power Measurement

Test Mode	Frequency (MHz)	RF Power setting in Test Software	Test Software Version
Mode 2	2402	Default	CBT
	2441	Default	
	2480	Default	
Mode 3	2402	Default	CBT
	2441	Default	
	2480	Default	
Mode 4	2402	Default	CBT
	2441	Default	
	2480	Default	

Test Mode	Frequency (MHz)	Packet Type	Average Power		Peak Power		Limit (W)
			(dBm)	(W)	(dBm)	(W)	
Mode 2	2402	DH1	11.10	0.01288	11.42	0.01387	≤ 0.125
		DH3	11.12	0.01294	11.48	0.01406	≤ 0.125
		DH5	11.21	0.01321	11.55	0.01429	≤ 0.125
	2441	DH1	10.45	0.01109	10.83	0.01211	≤ 0.125
		DH3	10.49	0.01119	10.87	0.01222	≤ 0.125
		DH5	10.54	0.01132	10.92	0.01236	≤ 0.125
	2480	DH1	10.94	0.01242	11.27	0.01340	≤ 0.125
		DH3	10.97	0.01250	11.30	0.01349	≤ 0.125
		DH5	11.04	0.01271	11.39	0.01377	≤ 0.125
Mode 3	2402	2DH1	8.62	0.00728	10.83	0.01211	≤ 0.125
		2DH3	8.80	0.00759	10.91	0.01233	≤ 0.125
		2DH5	8.87	0.00771	11.00	0.01259	≤ 0.125
	2441	2DH1	7.74	0.00594	10.28	0.01067	≤ 0.125
		2DH3	7.82	0.00605	10.32	0.01076	≤ 0.125
		2DH5	7.89	0.00615	10.35	0.01084	≤ 0.125
	2480	2DH1	8.47	0.00703	10.81	0.01205	≤ 0.125
		2DH3	8.51	0.00710	10.86	0.01219	≤ 0.125
		2DH5	8.57	0.00719	10.94	0.01242	≤ 0.125
Mode 4	2402	3DH1	8.69	0.00740	10.96	0.01247	≤ 0.125
		3DH3	8.87	0.00771	11.06	0.01276	≤ 0.125
		3DH5	8.94	0.00783	11.18	0.01312	≤ 0.125
	2441	3DH1	7.98	0.00628	10.37	0.01089	≤ 0.125
		3DH3	8.05	0.00638	10.43	0.01104	≤ 0.125
		3DH5	8.09	0.00644	10.45	0.01109	≤ 0.125
	2480	3DH1	8.59	0.00723	10.92	0.01236	≤ 0.125
		3DH3	8.64	0.00731	10.95	0.01245	≤ 0.125
		3DH5	8.71	0.00743	11.01	0.01262	≤ 0.125

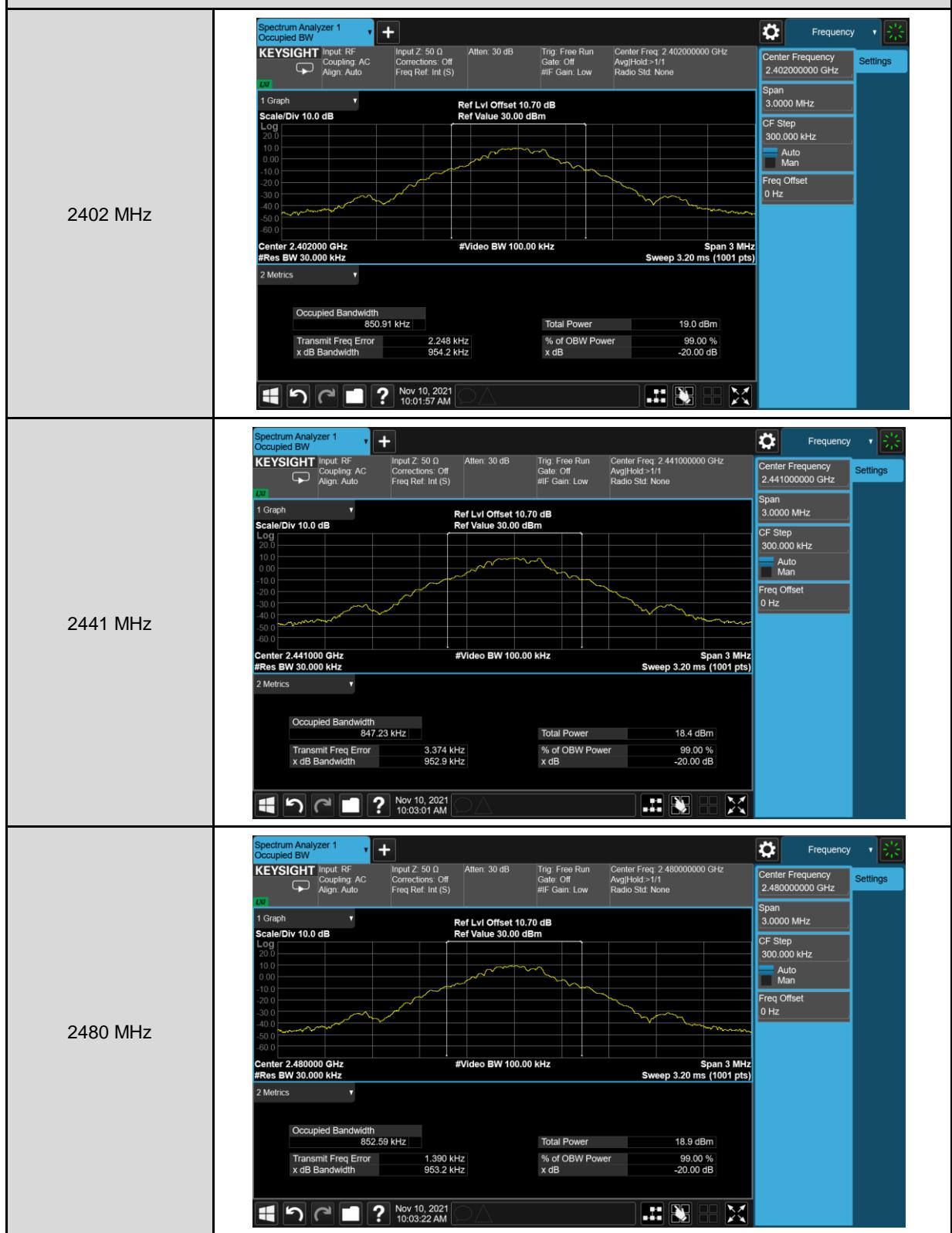
Note: The relevant measured result has the offset with cable loss already.

20 dB RF Bandwidth Measurement

Test Mode	Frequency (MHz)	Measurement Results (MHz)
Mode 2	2402	0.954
	2441	0.953
	2480	0.953
Mode 4	2402	1.286
	2441	1.304
	2480	1.304

■ Test Graphs

Mode 2: GFSK Continuous TX mode



Mode 4: 8DPSK Continuous TX mode

2402 MHz



2441 MHz



2480 MHz



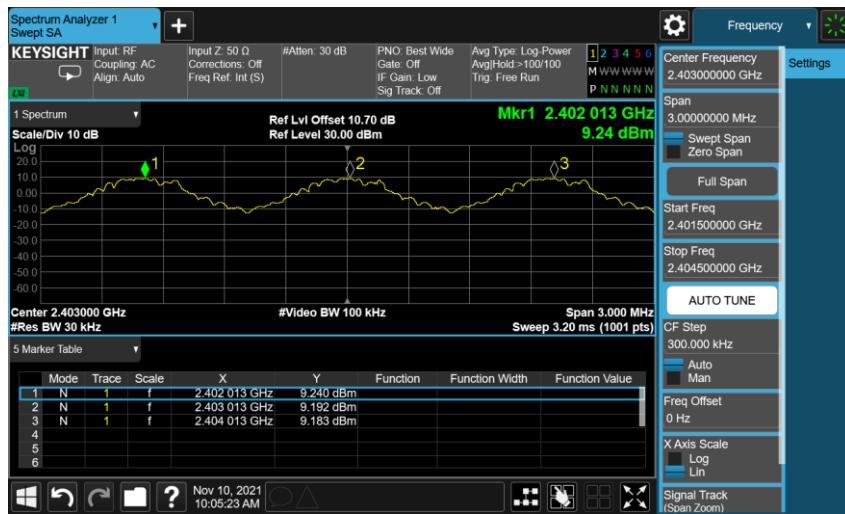
Carrier Frequency Separation Measurement

Test Mode	Frequency (MHz)	Measurement Results (MHz)	Limit (MHz)
Mode 2	2402	1.000	≥ 0.636
	2441	1.000	≥ 0.635
	2480	1.000	≥ 0.635
Mode 4	2402	1.000	≥ 0.857
	2441	1.000	≥ 0.869
	2480	1.000	≥ 0.869

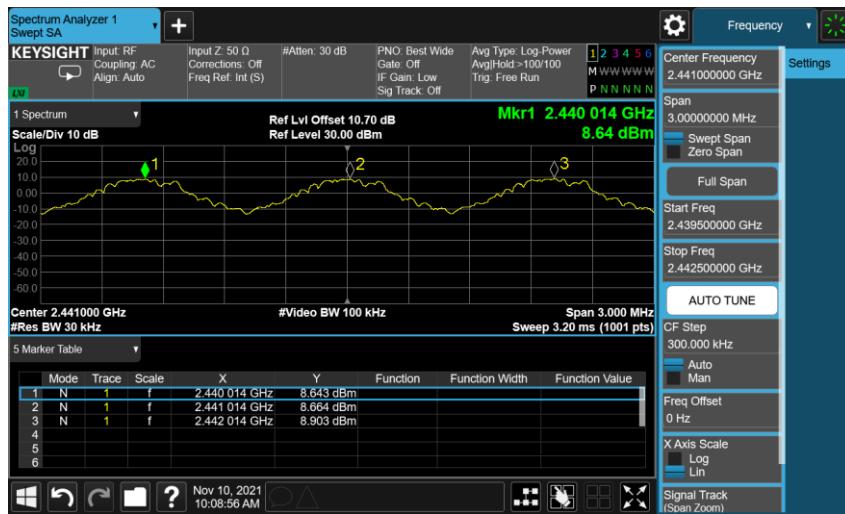
■ Test Graphs

Mode 2: GFSK Continuous TX mode

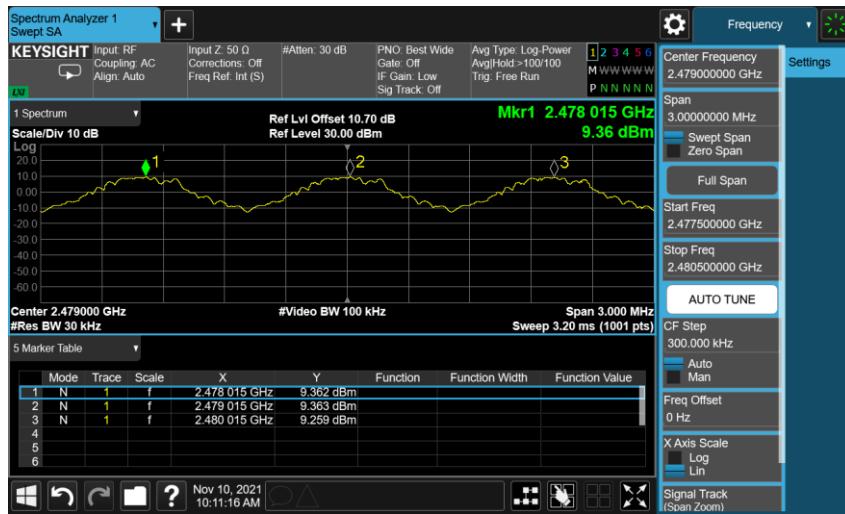
2402 MHz



2441 MHz

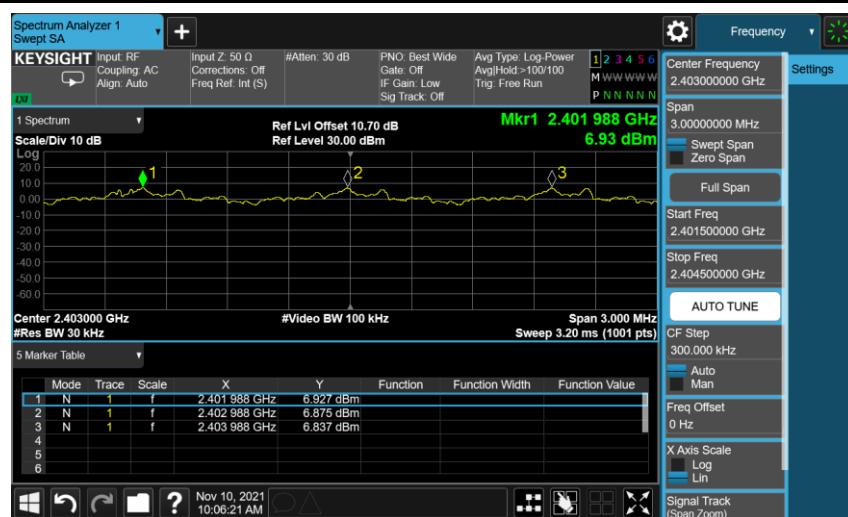


2480 MHz

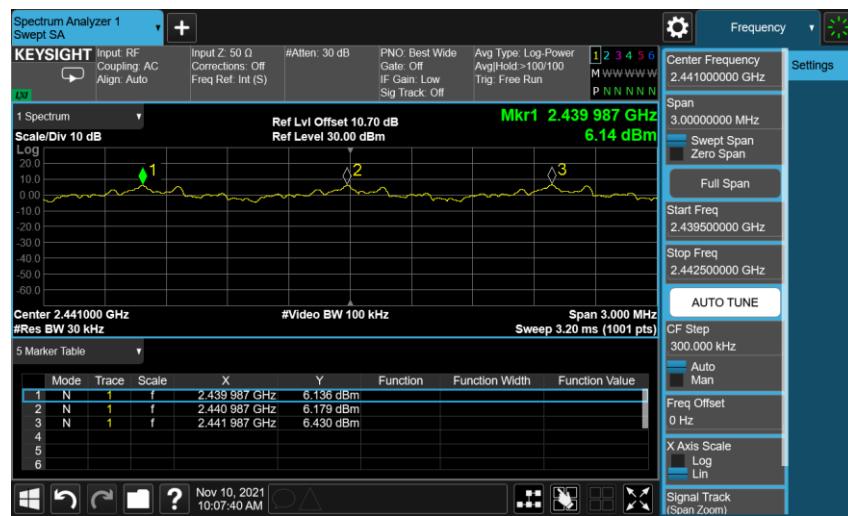


Mode 4: 8DPSK Continuous TX mode

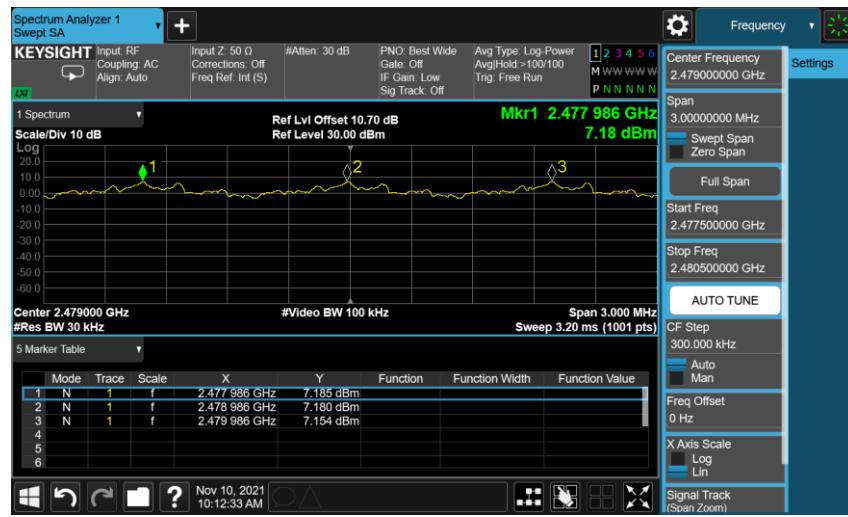
2402 MHz



2441 MHz



2480 MHz



Number of Hopping Measurement

Test Mode	Frequency Range (MHz)	Measurement Results (Ch)	Limit (ch)
Mode 2	2402 - 2480	79	≥ 15
Mode 4	2402 - 2480	79	≥ 15

■ Test Graphs

Mode 2: GFSK Continuous TX mode

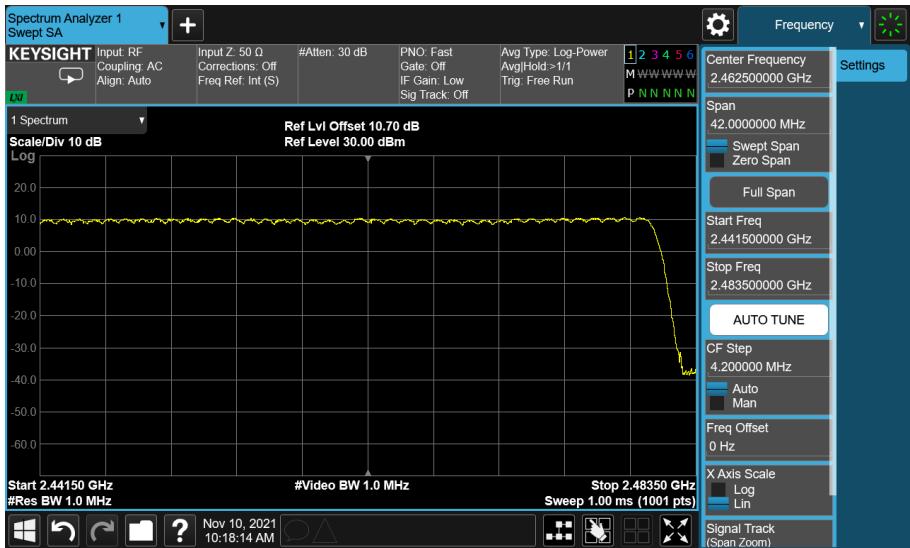


Mode 4: 8DPSK Continuous TX mode

CH0~CH39



CH40~CH78



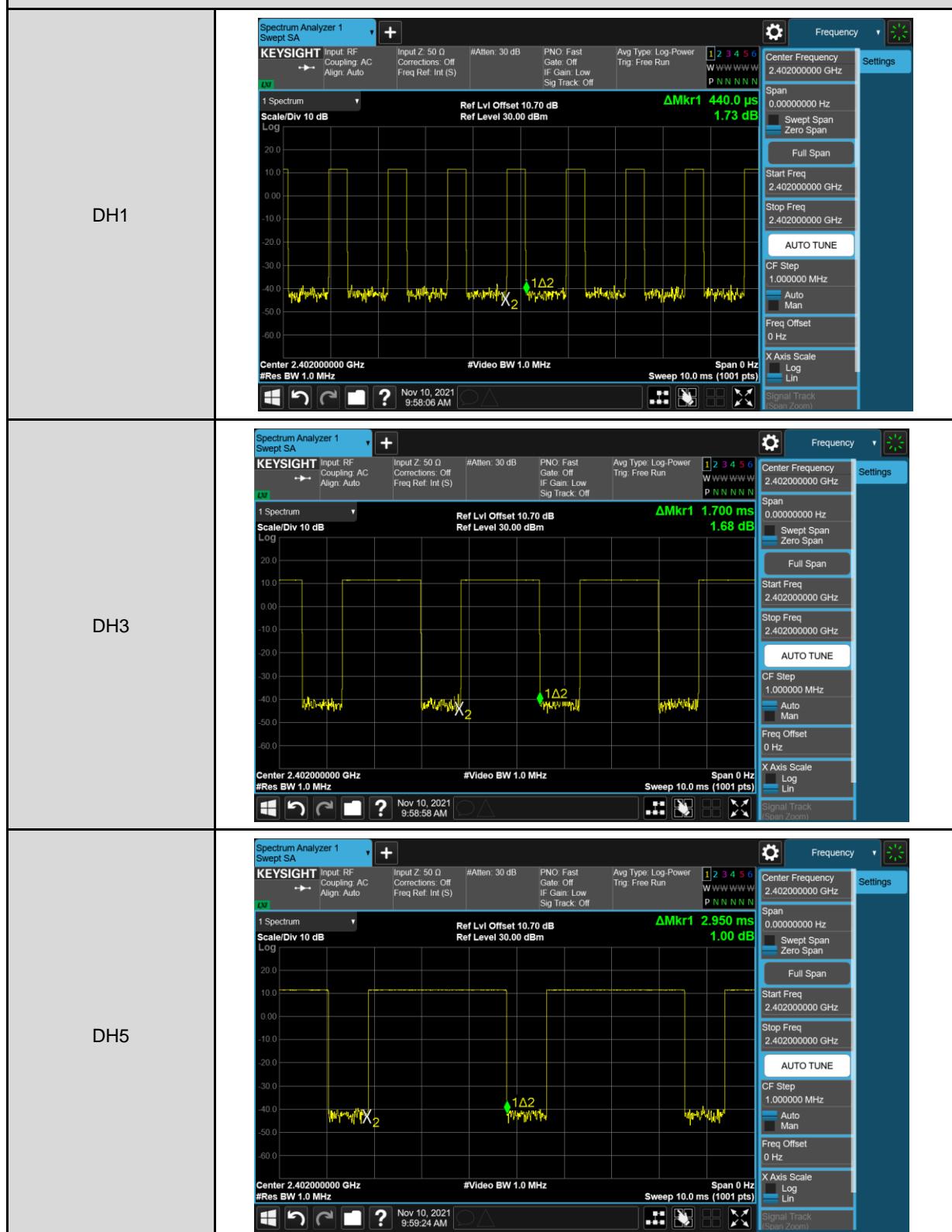
Time of Occupancy (Dwell Time) Measurement

Mode 2: GFSK Continuous TX mode	
DH1	
Cycle Calculate	$79CH * 0.4 = 31.6$ (sec)
The EUT Hopping Number per Sec	1600 times/sec
Each Channel Dwell Times per Sec	$800/79CH = 10.13$ (times/sec)
Each Channel Dwell Times on Cycle(1)	$31.6 * 10.13 = 320.108$ (times)
Each Channel Dwell Times (2)	0.440 ms
Dwell Times on Cycle (1) * (2)	140.848 ms
LIMIT(msc)	< = 400
DH3	
Cycle Calculate	$79CH * 0.4 = 31.6$ (sec)
The EUT Hopping Number per Sec	1600 times/sec
Each Channel Dwell Times per Sec	$400/79CH = 5.1$ (times/sec)
Each Channel Dwell Times on Cycle(1)	$31.6 * 5.1 = 161.16$ (times)
Each Channel Dwell Times (2)	1.700 ms
Dwell Times on Cycle (1) * (2)	271.823 ms
LIMIT(msc)	< = 400
DH5	
Cycle Calculate	$79CH * 0.4 = 31.6$ (sec)
The EUT Hopping Number per Sec	1600 times/sec
Each Channel Dwell Times per Sec	$266.7/79CH = 3.37$ (times/sec)
Each Channel Dwell Times on Cycle(1)	$31.6 * 3.37 = 106.492$ (times)
Each Channel Dwell Times (2)	2.950 ms
Dwell Times on Cycle (1) * (2)	315.084 ms
LIMIT(msc)	< = 400

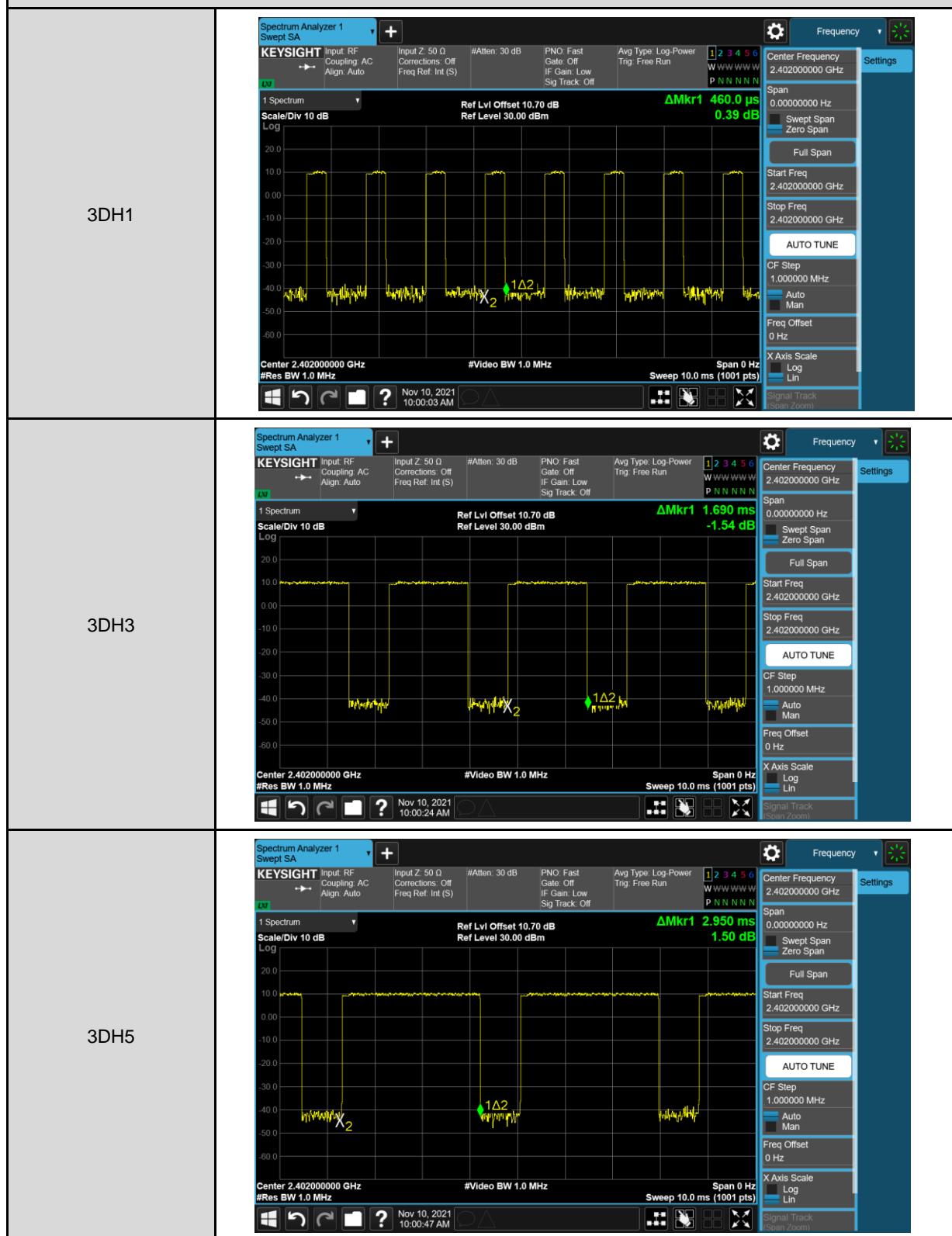
Mode 4: 8DPSK Continuous TX mode	
3DH1	
Cycle Calculate	$79CH * 0.4 = 31.6$ (sec)
The EUT Hopping Number per Sec	1600 times/sec
Each Channel Dwell Times per Sec	$800/79CH = 10.13$ (times/sec)
Each Channel Dwell Times on Cycle(1)	$31.6 * 10.13 = 320.108$ (times)
Each Channel Dwell Times (2)	0.460 ms
Dwell Times on Cycle (1) * (2)	147.250 ms
LIMIT(msc)	< = 400
3DH3	
Cycle Calculate	$79CH * 0.4 = 31.6$ (sec)
The EUT Hopping Number per Sec	1600 times/sec
Each Channel Dwell Times per Sec	$400/79CH = 5.1$ (times/sec)
Each Channel Dwell Times on Cycle(1)	$31.6 * 5.1 = 161.16$ (times)
Each Channel Dwell Times (2)	1.690 ms
Dwell Times on Cycle (1) * (2)	270.224 ms
LIMIT(msc)	< = 400
3DH5	
Cycle Calculate	$79CH * 0.4 = 31.6$ (sec)
The EUT Hopping Number per Sec	1600 times/sec
Each Channel Dwell Times per Sec	$266.7/79CH = 3.37$ (times/sec)
Each Channel Dwell Times on Cycle(1)	$31.6 * 3.37 = 106.492$ (times)
Each Channel Dwell Times (2)	2.950 ms
Dwell Times on Cycle (1) * (2)	315.084 ms
LIMIT(msc)	< = 400

■ Test Graphs

Mode 2: GFSK Continuous TX mode



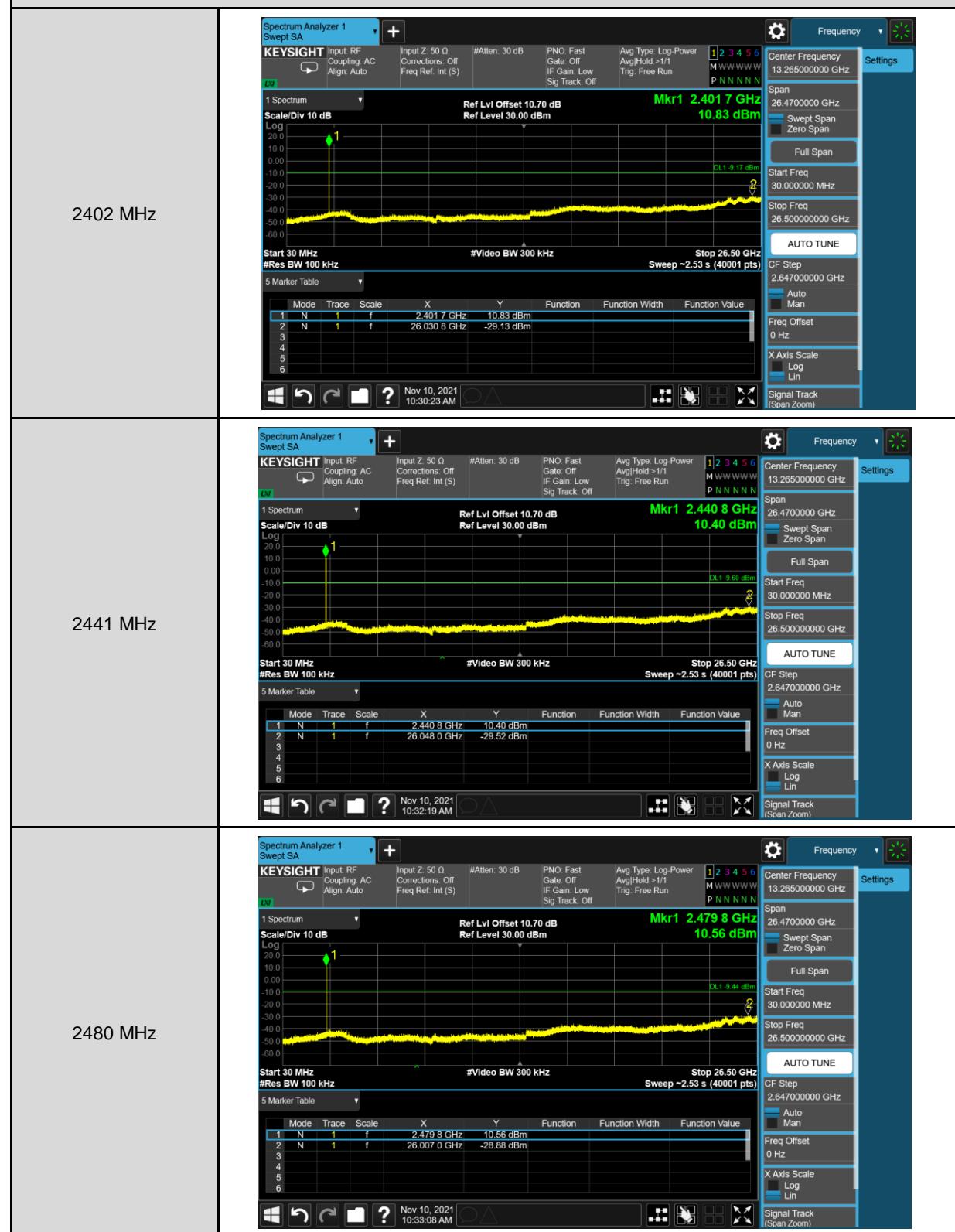
Mode 4: 8DPSK Continuous TX mode



Out of Band Conducted Emissions Measurement

■ Test Graphs

Mode 2: GFSK Continuous TX mode



Mode 4: 8DPSK Continuous TX mode

2402 MHz



2441 MHz

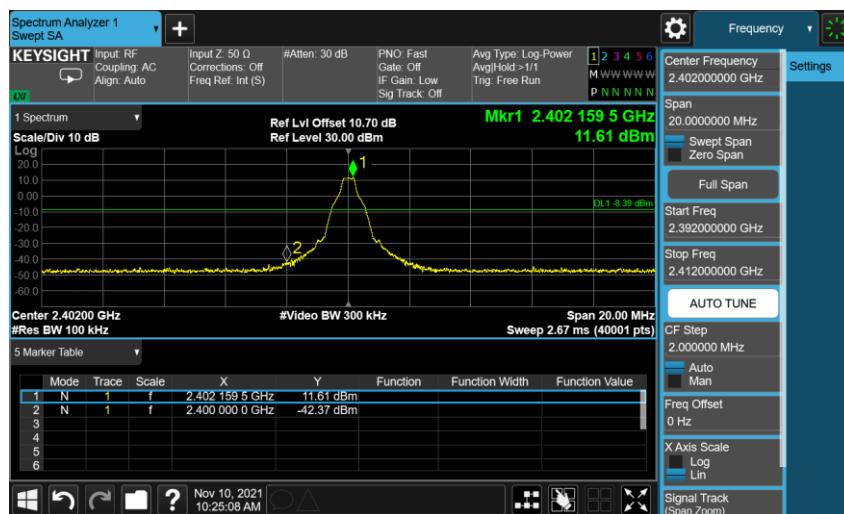


2480 MHz

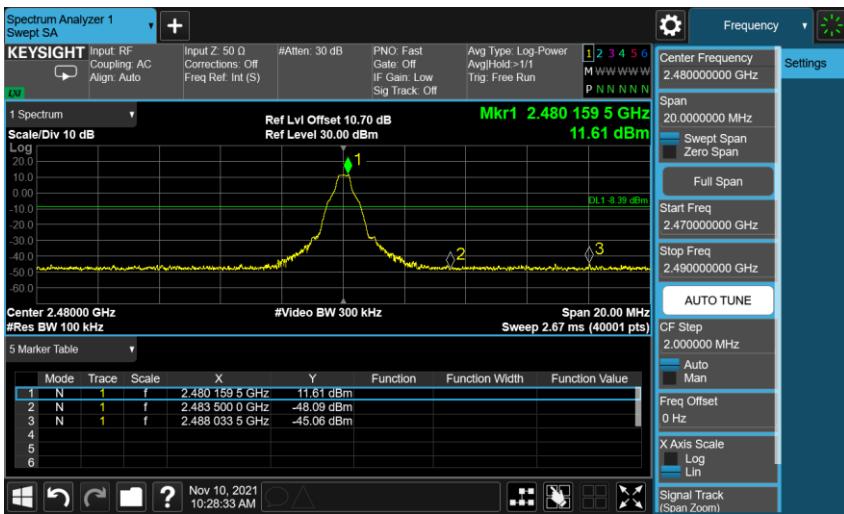


Mode 2: GFSK Continuous TX mode _ Un-hopping

2402 MHz

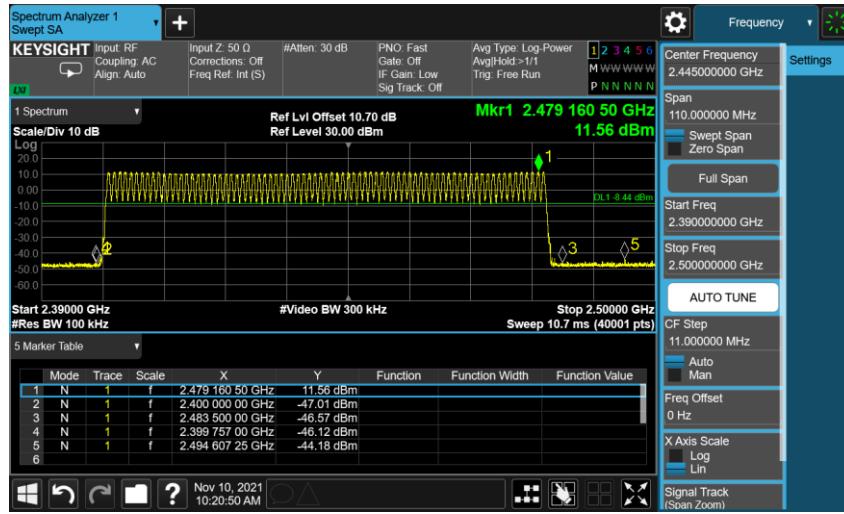


2480 MHz



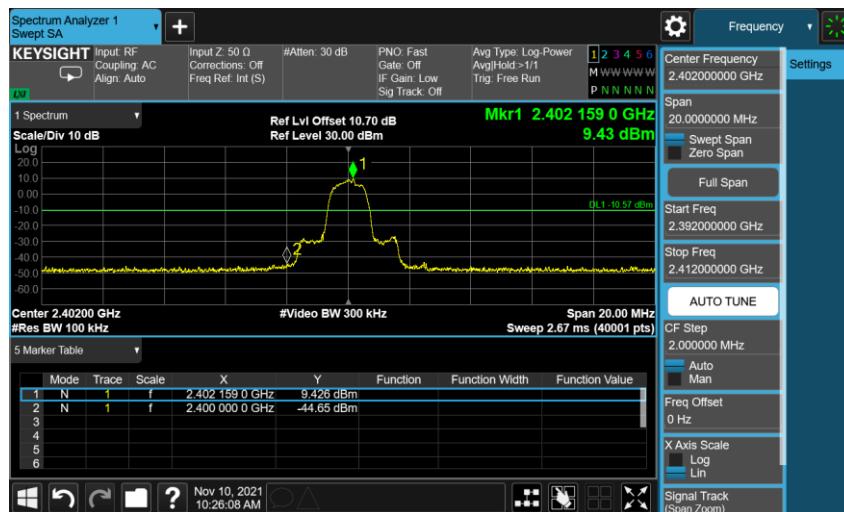
Mode 2: GFSK Continuous TX mode _ Hopping

2402 ~ 2480 MHz

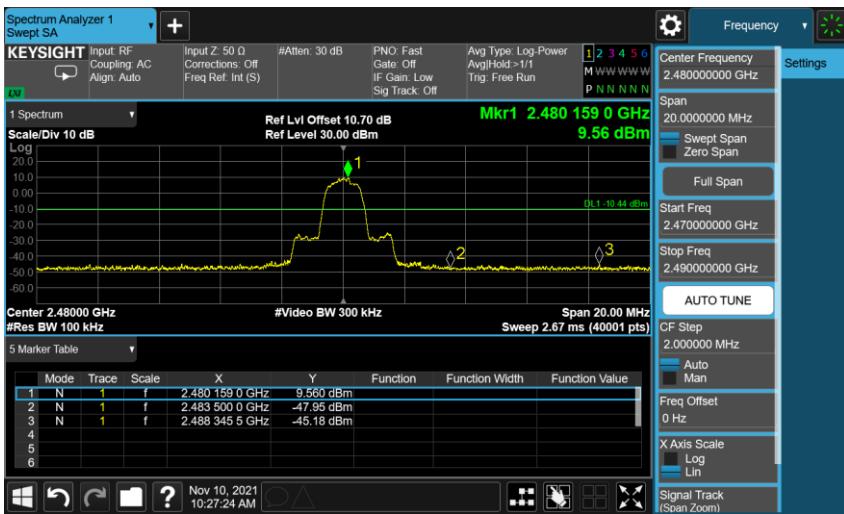


Mode 4: 8DPSK Continuous TX mode _ Un-hopping

2402 MHz

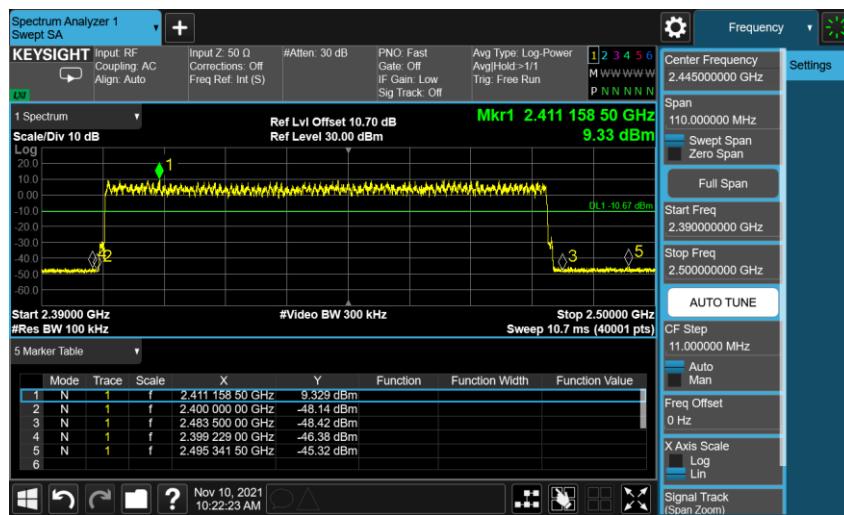


2480 MHz



Mode 4: 8DPSK Continuous TX mode _ Un-hopping

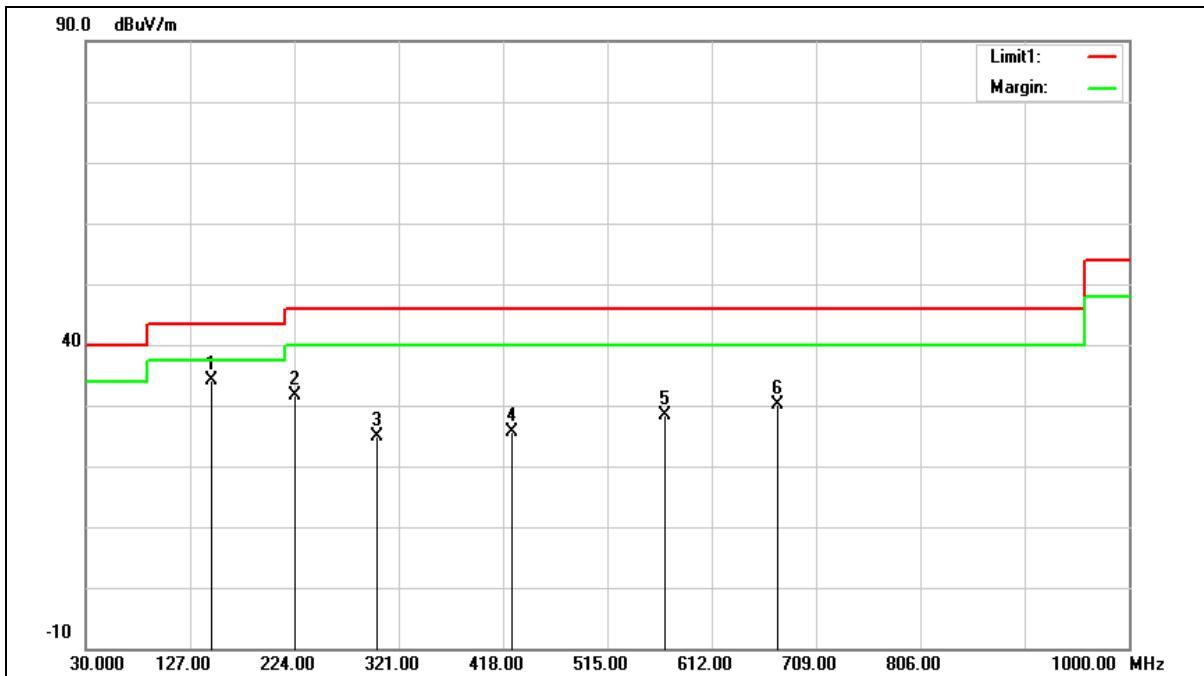
2402 ~ 2480 MHz



5.3 Radiated Emission Measurement

Below 1 GHz

Standard:	FCC Part 15.247	Test Distance:	3m
Mode:	Mode 1		
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	147.3700	40.89	-6.83	34.06	43.50	-9.44	QP
2	224.0000	39.92	-8.33	31.59	46.00	-14.41	QP
3	300.6300	30.34	-5.44	24.90	46.00	-21.10	QP
4	425.7600	28.48	-2.90	25.58	46.00	-20.42	QP
5	568.3500	28.72	-0.35	28.37	46.00	-17.63	QP
6	673.1100	28.45	1.63	30.08	46.00	-15.92	QP

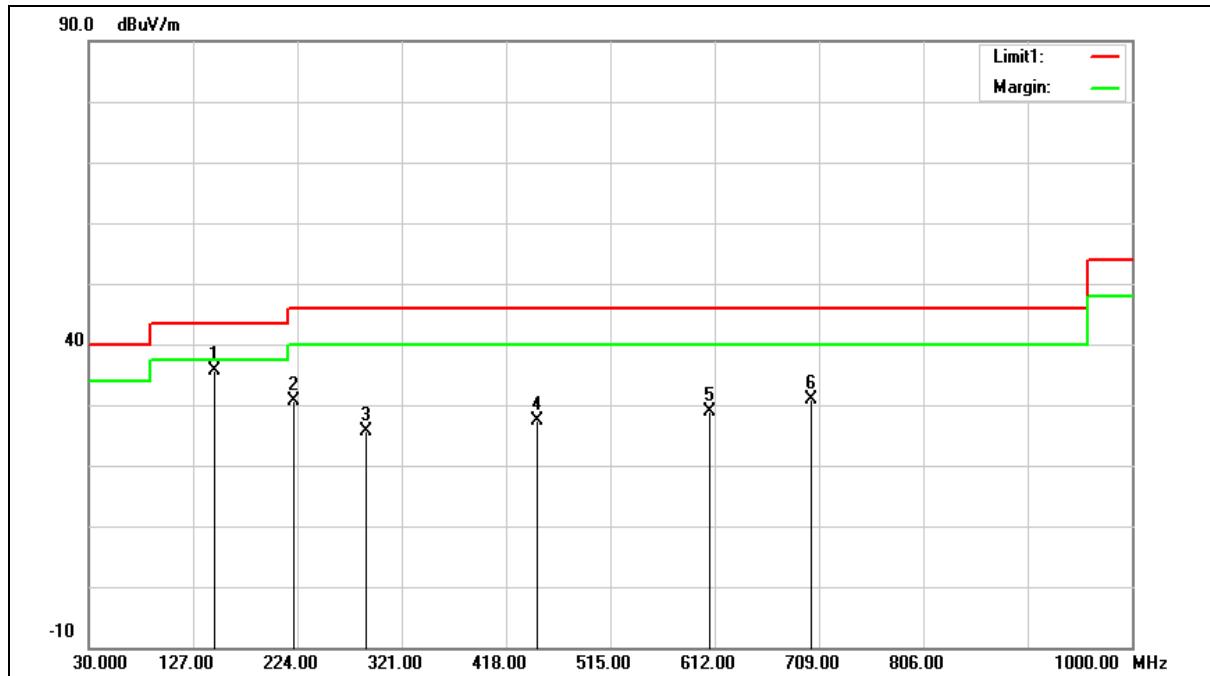
Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

 Example: $34.06 = -6.83 + 40.89$

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3m
Mode:	Mode 1		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	147.3700	42.58	-6.83	35.75	43.50	-7.75	QP
2	220.1200	39.12	-8.59	30.53	46.00	-15.47	QP
3	288.0200	31.17	-5.65	25.52	46.00	-20.48	QP
4	447.1000	30.09	-2.59	27.50	46.00	-18.50	QP
5	607.1500	28.26	0.63	28.89	46.00	-17.11	QP
6	702.2100	28.69	2.27	30.96	46.00	-15.04	QP

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: $35.75 = -6.83 + 42.58$

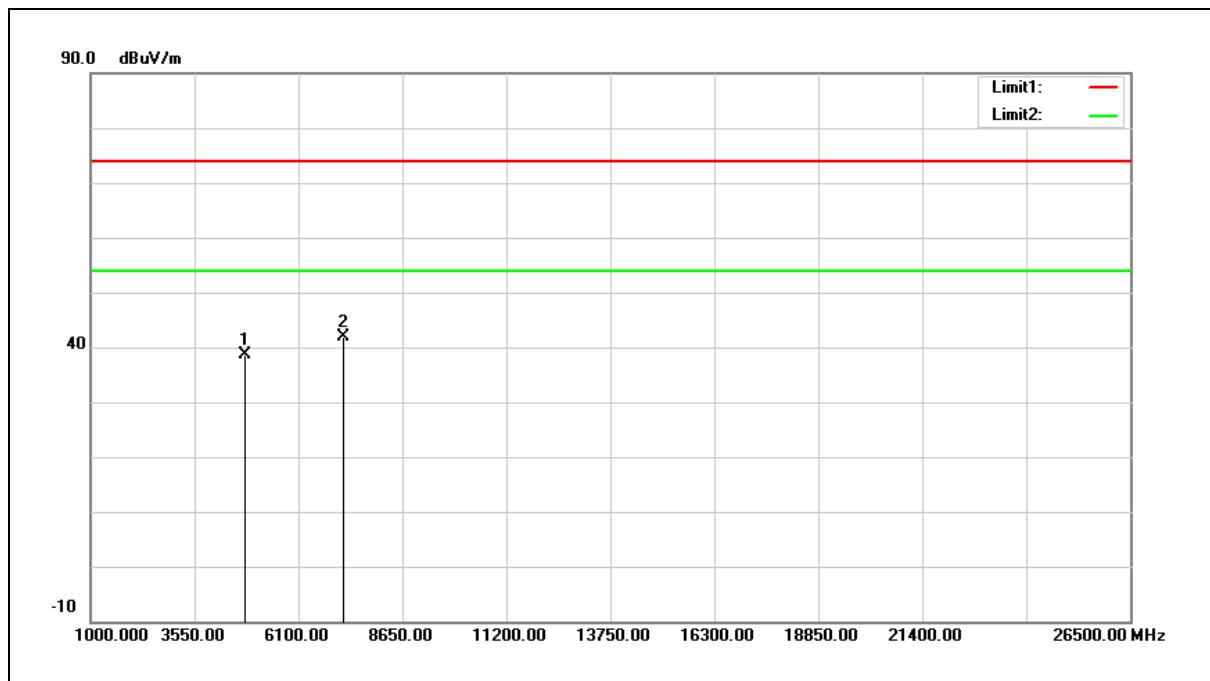
2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Harmonic

Above 1 GHz

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2402 MHz		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



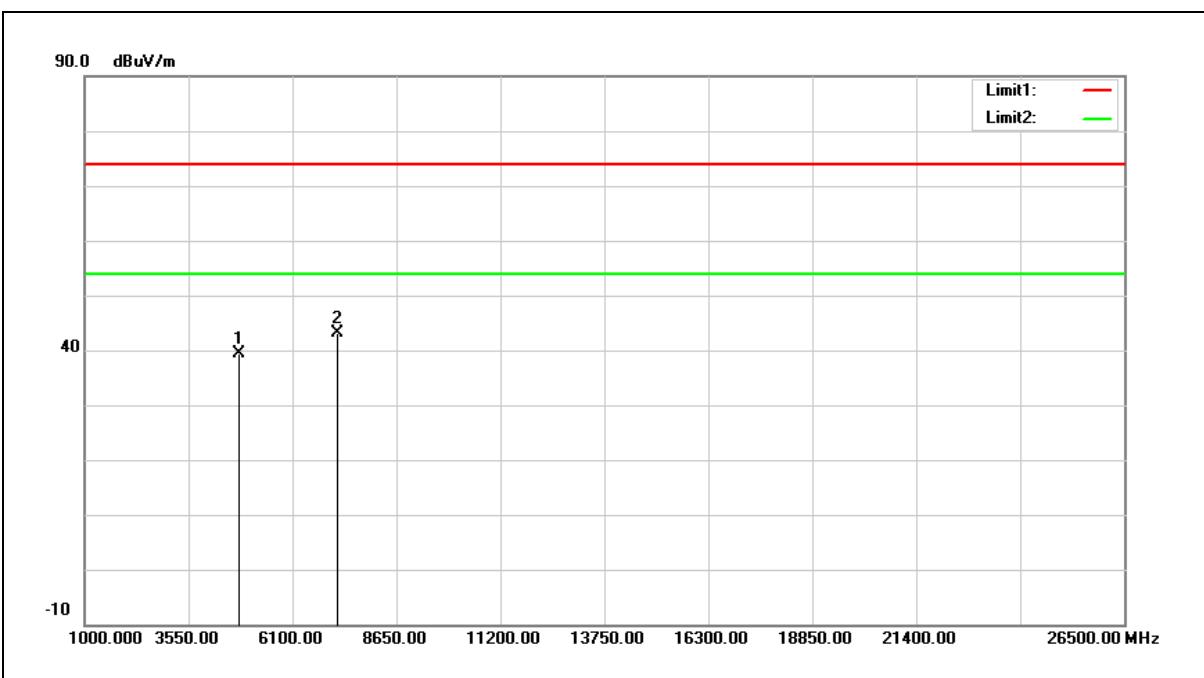
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4804.000	39.55	-1.04	38.51	74.00	-35.49	peak
2	7206.000	35.96	6.04	42.00	74.00	-32.00	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2402 MHz		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



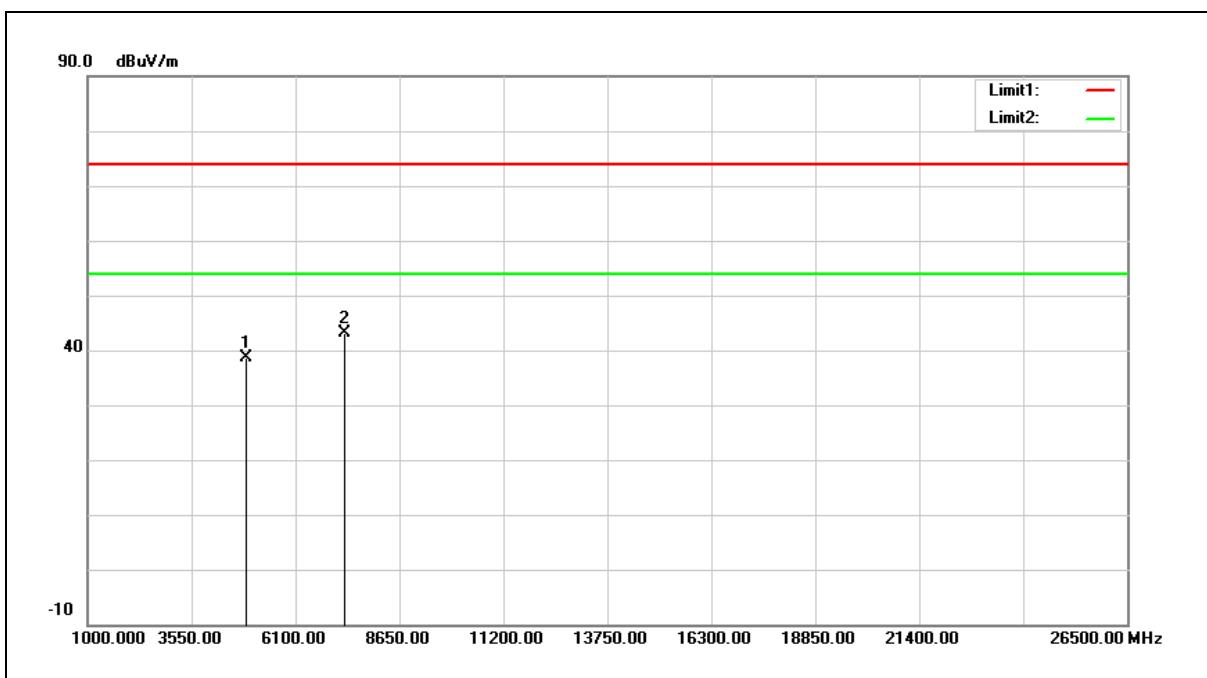
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4804.000	40.34	-1.04	39.30	74.00	-34.70	peak
2	7206.000	37.20	6.04	43.24	74.00	-30.76	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2441 MHz		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



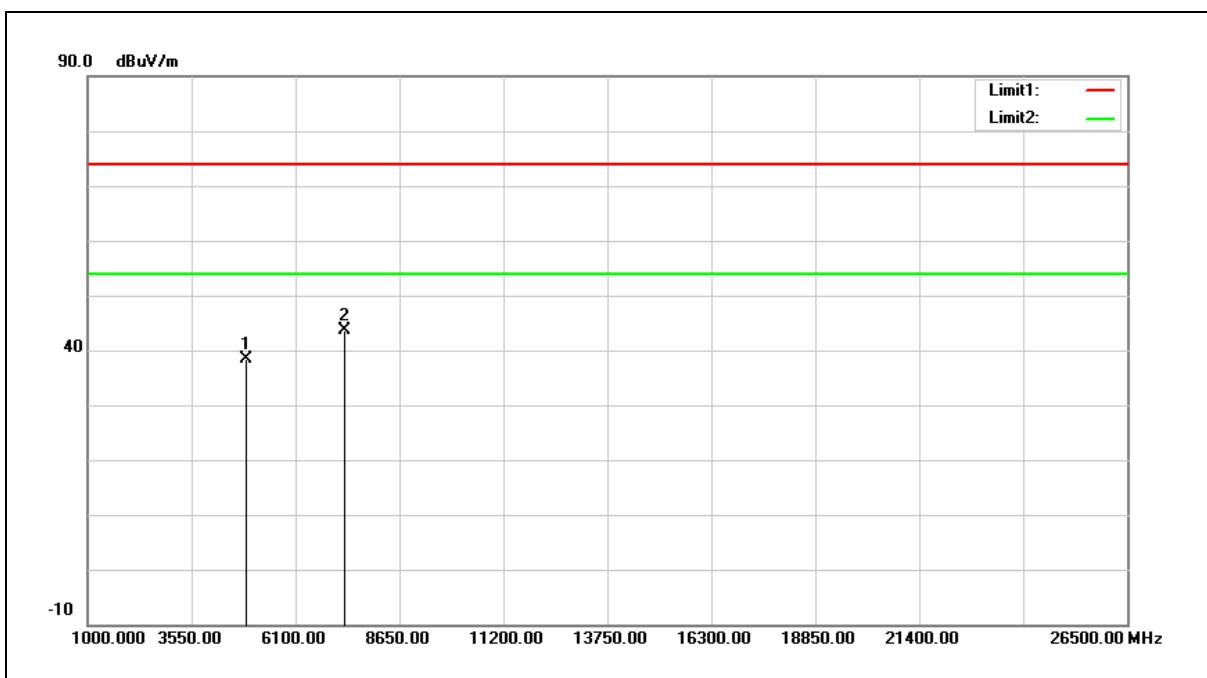
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4882.000	39.29	-0.77	38.52	74.00	-35.48	peak
2	7323.000	36.63	6.50	43.13	74.00	-30.87	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2441 MHz		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



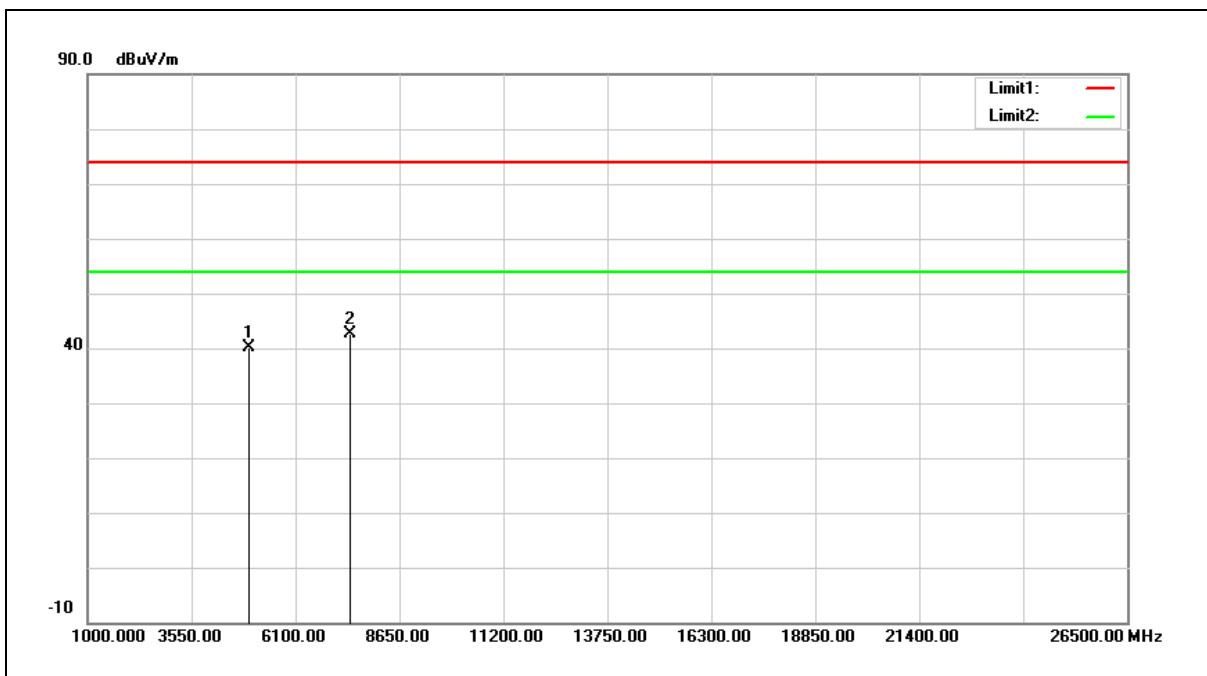
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4882.000	39.14	-0.77	38.37	74.00	-35.63	peak
2	7323.000	37.10	6.50	43.60	74.00	-30.40	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2480 MHz		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



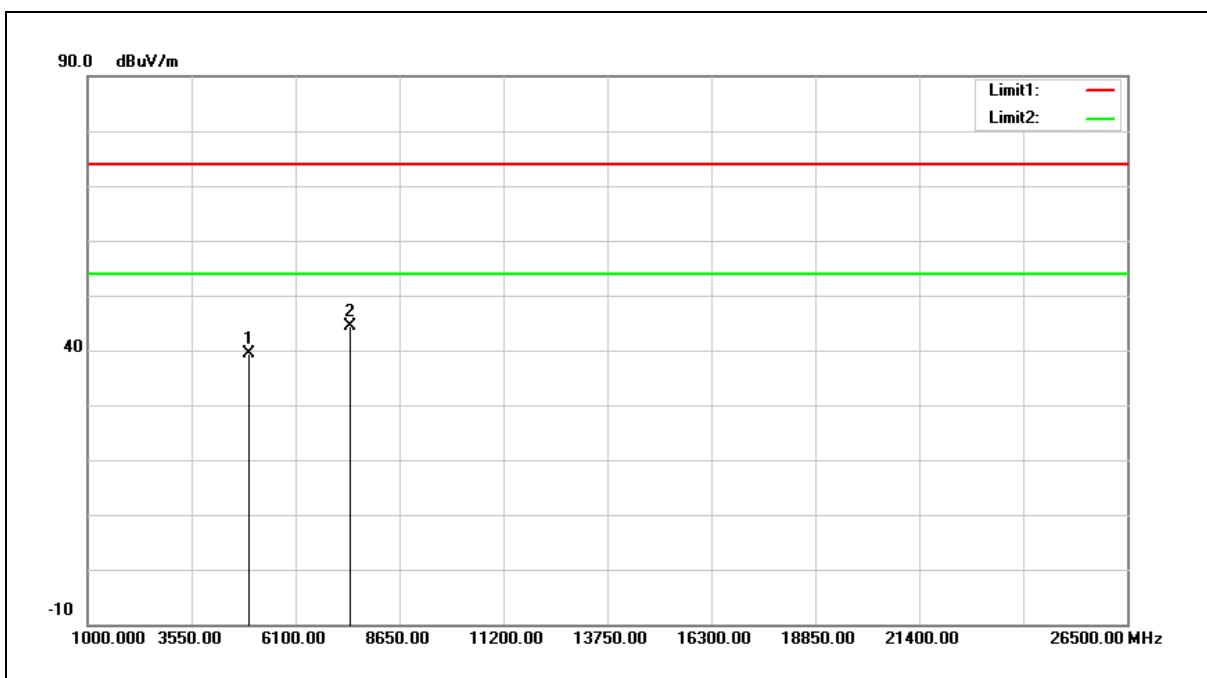
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	40.52	-0.50	40.02	74.00	-33.98	peak
2	7440.000	35.64	6.95	42.59	74.00	-31.41	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2480 MHz		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



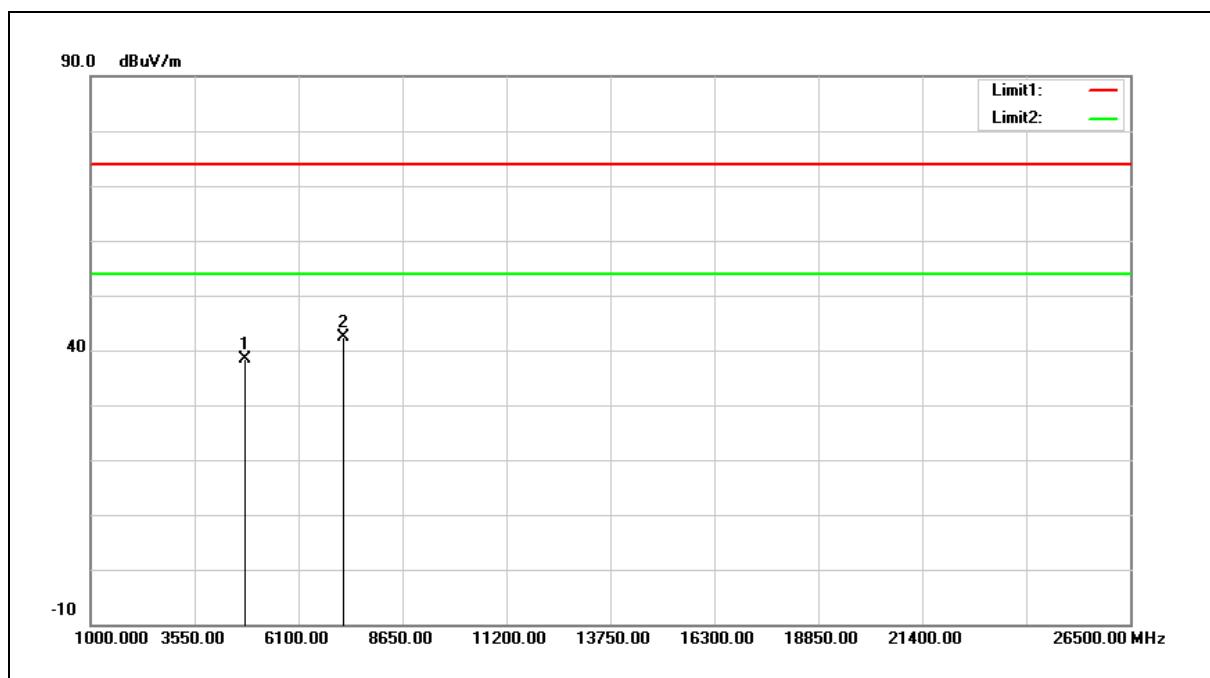
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	39.91	-0.50	39.41	74.00	-34.59	peak
2	7440.000	37.45	6.95	44.40	74.00	-29.60	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2402 MHz		
Mode:	Mode 4		
Ant.Polar.:	Horizontal		



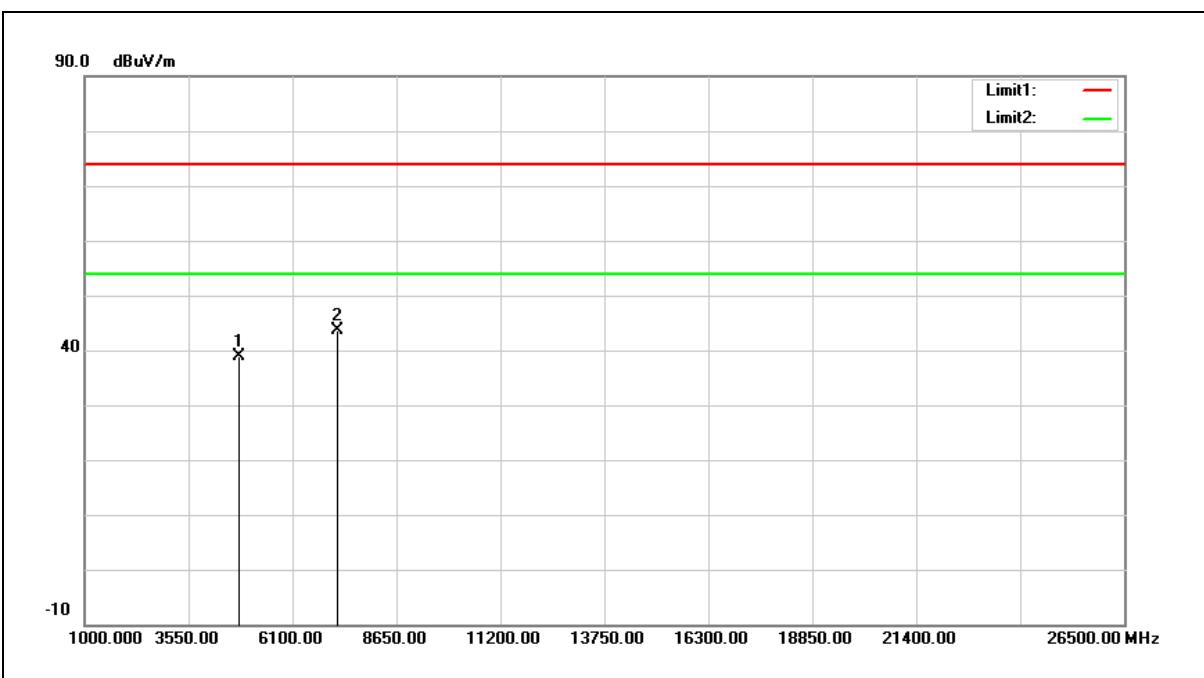
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4804.000	39.50	-1.04	38.46	74.00	-35.54	peak
2	7206.000	36.44	6.04	42.48	74.00	-31.52	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2402 MHz		
Mode:	Mode 4		
Ant.Polar.:	Vertical		



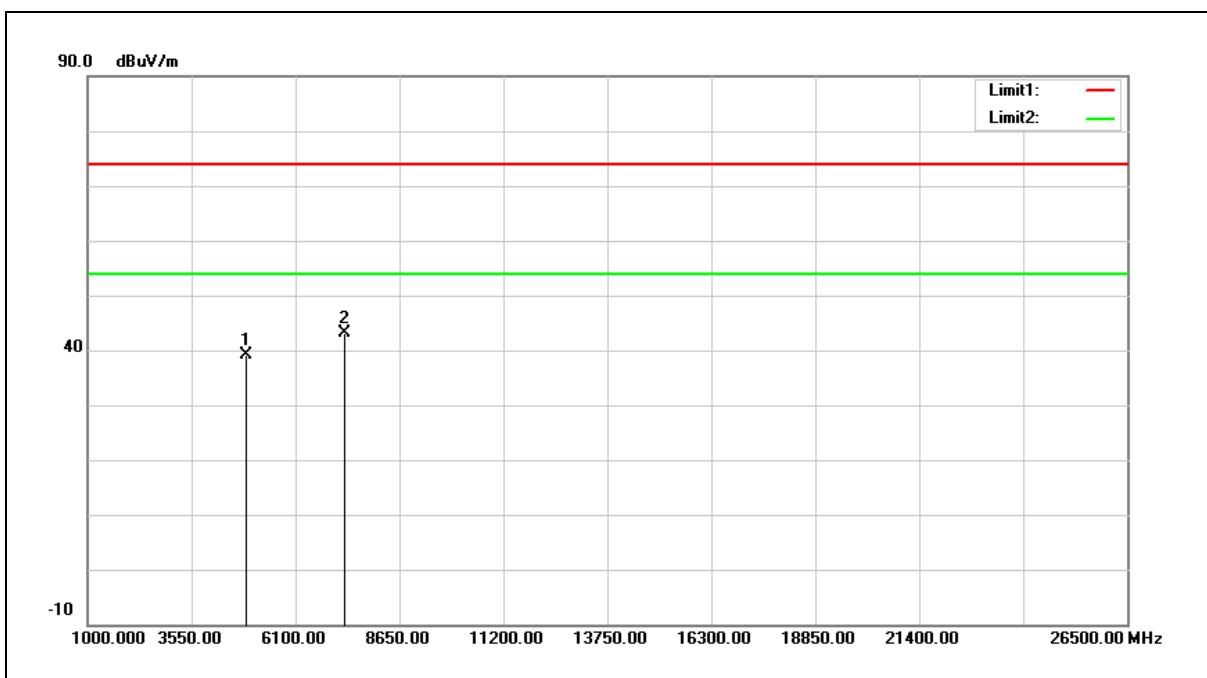
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4804.000	39.88	-1.04	38.84	74.00	-35.16	peak
2	7206.000	37.50	6.04	43.54	74.00	-30.46	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2441 MHz		
Mode:	Mode 4		
Ant.Polar.:	Horizontal		



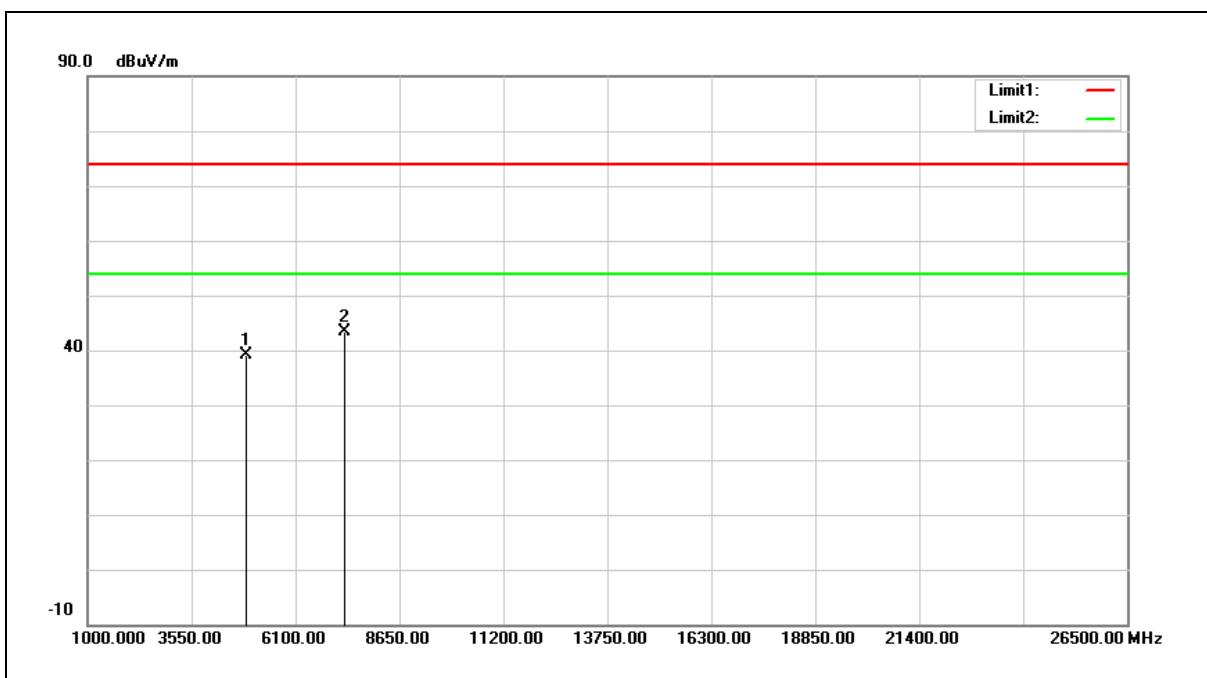
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4882.000	39.79	-0.77	39.02	74.00	-34.98	peak
2	7323.000	36.52	6.50	43.02	74.00	-30.98	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2441 MHz		
Mode:	Mode 4		
Ant.Polar.:	Vertical		



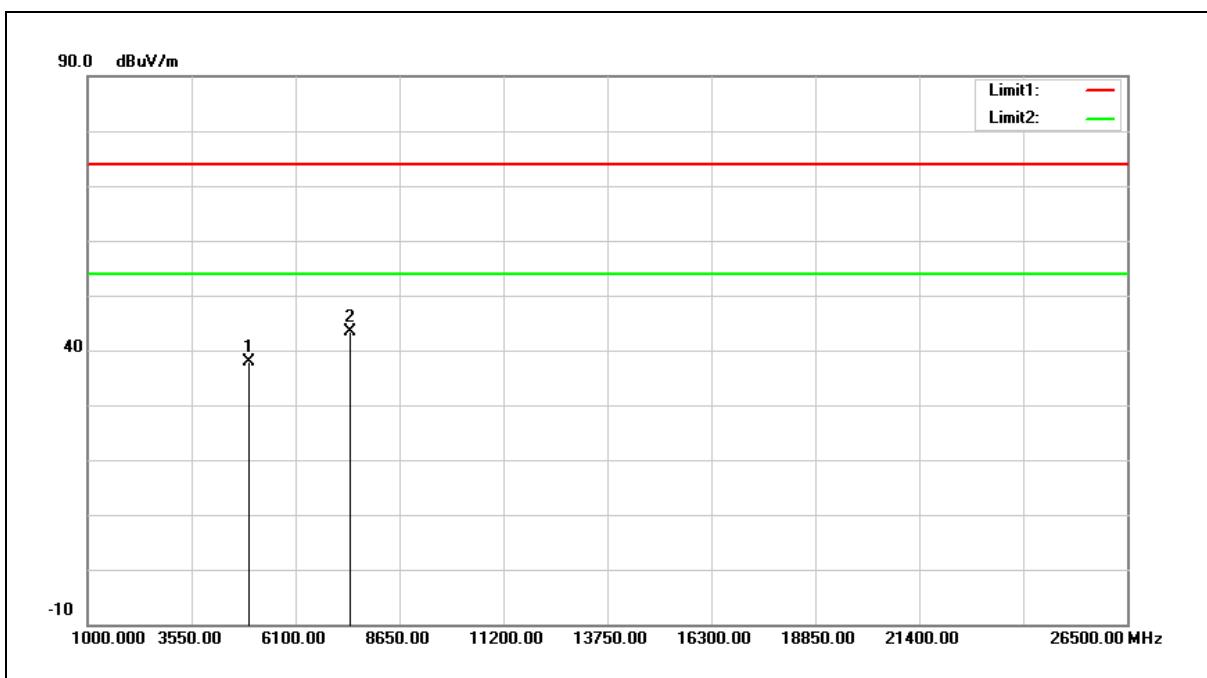
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4882.000	39.78	-0.77	39.01	74.00	-34.99	peak
2	7323.000	36.76	6.50	43.26	74.00	-30.74	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2480 MHz		
Mode:	Mode 4		
Ant.Polar.:	Horizontal		



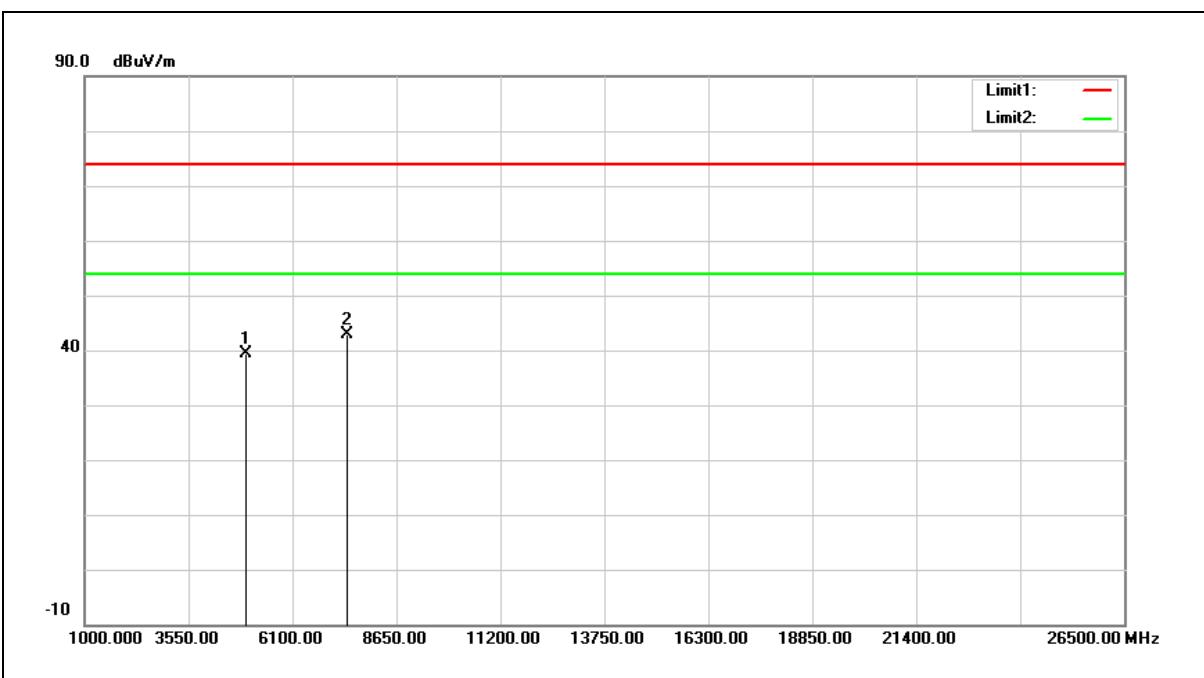
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	38.45	-0.50	37.95	74.00	-36.05	peak
2	7440.000	36.48	6.95	43.43	74.00	-30.57	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Frequency:	2480 MHz		
Mode:	Mode 4		
Ant.Polar.:	Vertical		



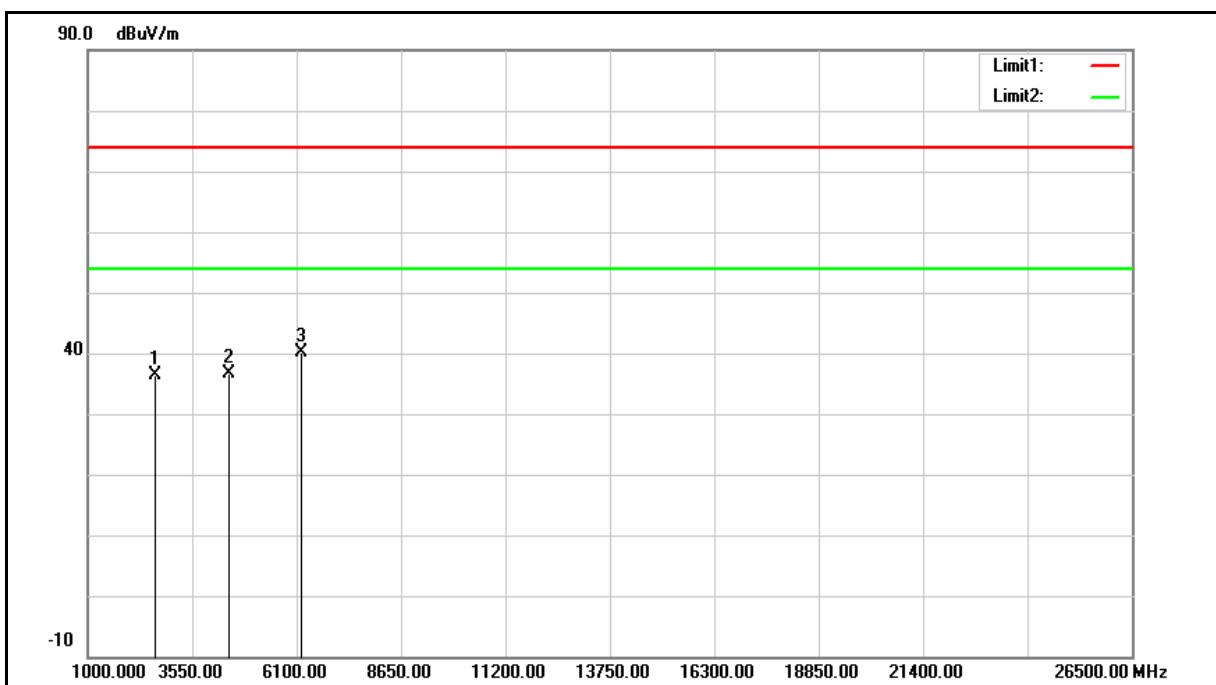
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.000	39.76	-0.50	39.26	74.00	-34.74	peak
2	7440.000	35.83	6.95	42.78	74.00	-31.22	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Simultaneous Transmitting (Bluetooth + WLAN 2.4 GHz)		
Ant.Polar.:	Horizontal		



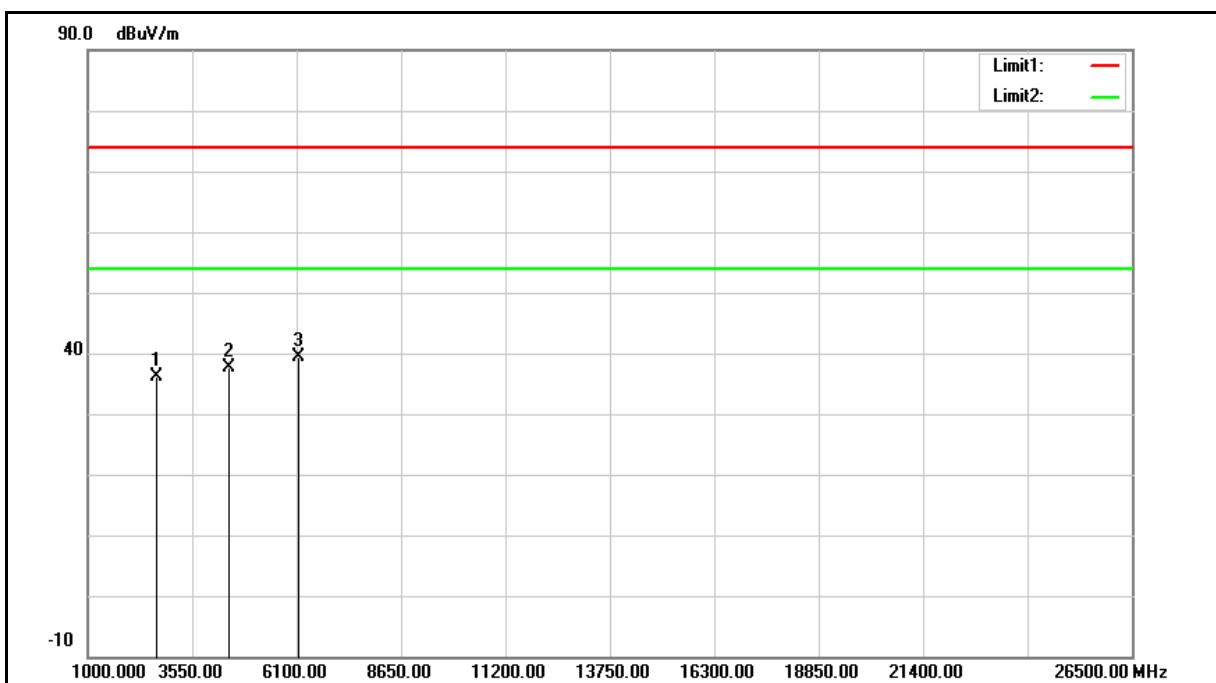
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2649.000	42.88	-6.40	36.48	74.00	-37.52	peak
2	4451.000	38.95	-2.25	36.70	74.00	-37.30	peak
3	6185.000	37.45	2.64	40.09	74.00	-33.91	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Simultaneous Transmitting (Bluetooth + WLAN 2.4 GHz)		
Ant.Polar.:	Vertical		



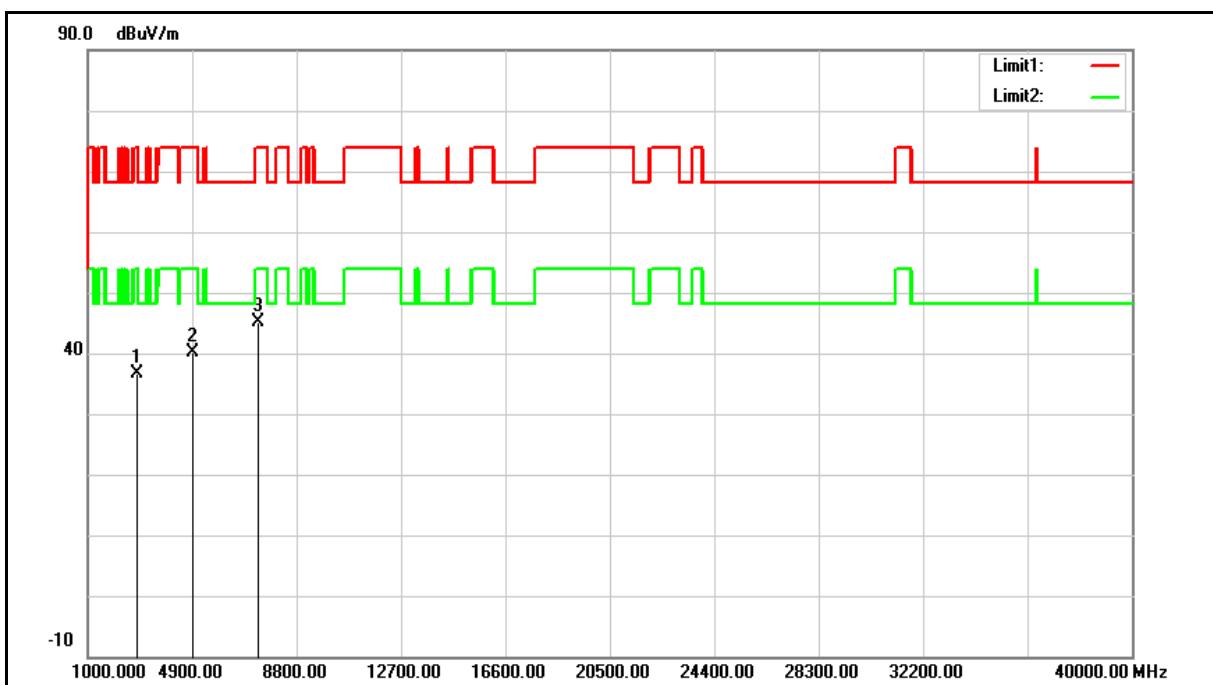
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2666.000	42.60	-6.36	36.24	74.00	-37.76	peak
2	4451.000	39.78	-2.25	37.53	74.00	-36.47	peak
3	6151.000	36.89	2.49	39.38	74.00	-34.62	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Simultaneous Transmitting (Bluetooth + WLAN 5 GHz)		
Ant.Polar.:	Horizontal		



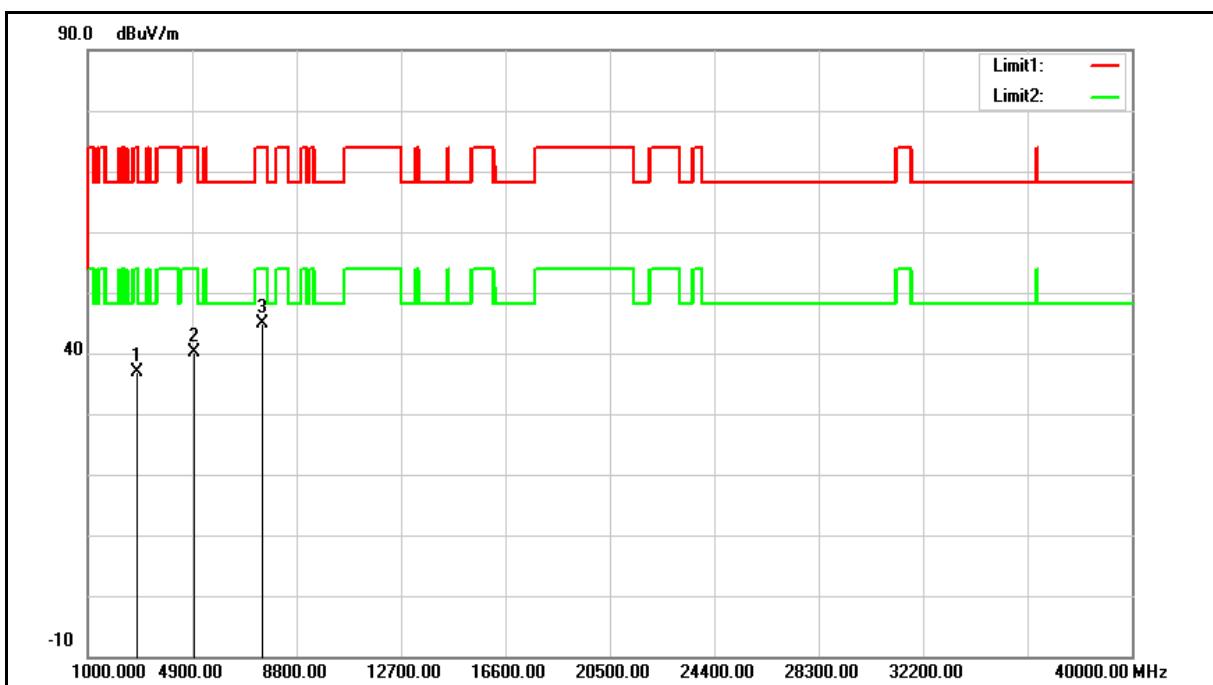
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2819.000	42.53	-5.89	36.64	74.00	-37.36	peak
2	4893.000	40.97	-0.73	40.24	74.00	-33.76	peak
3	7341.000	38.66	6.56	45.22	74.00	-28.78	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Simultaneous Transmitting (Bluetooth + WLAN 5 GHz)		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2802.000	42.76	-5.94	36.82	74.00	-37.18	peak
2	4978.000	40.59	-0.44	40.15	74.00	-33.85	peak
3	7477.000	37.71	7.11	44.82	74.00	-29.18	peak

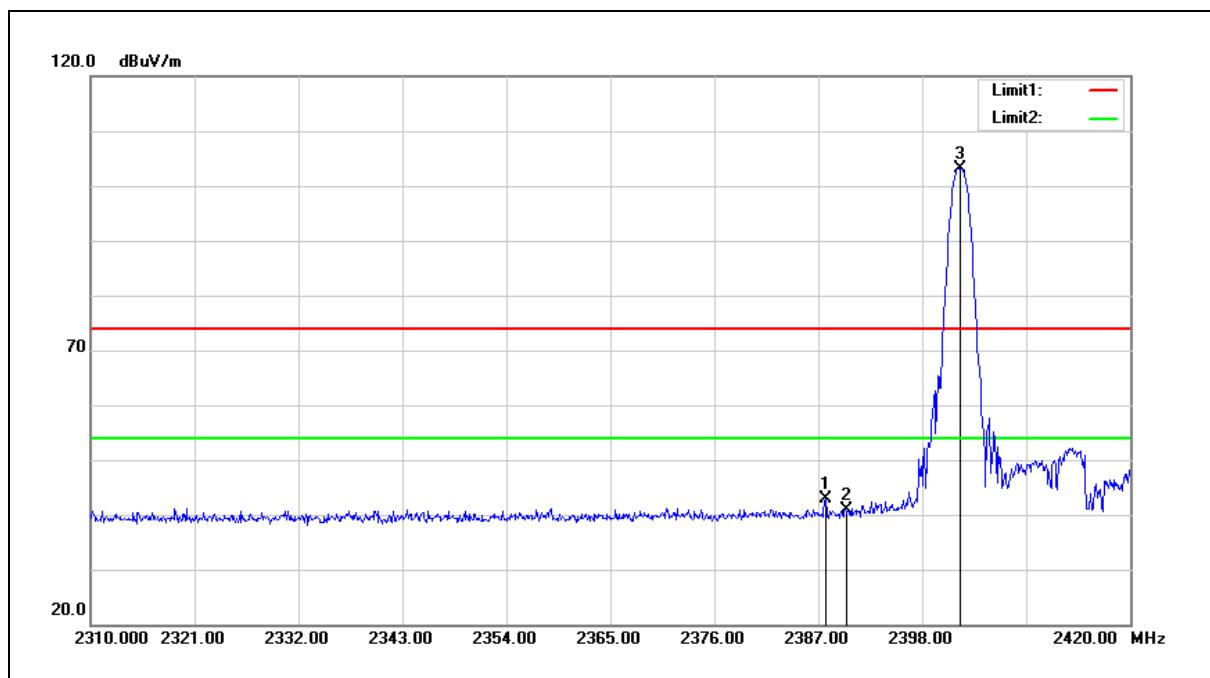
Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Band Edge
Peak

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2402 MHz		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



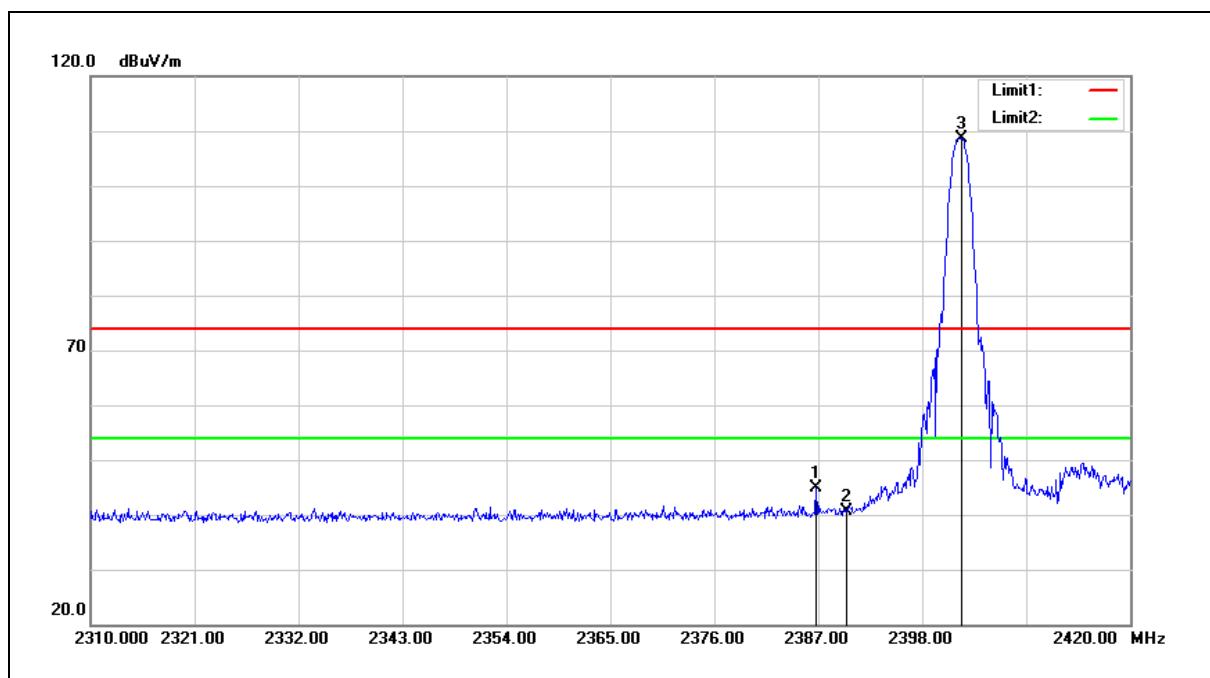
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2387.770	50.23	-7.32	42.91	74.00	-31.09	peak
2	2390.000	48.17	-7.30	40.87	74.00	-33.13	peak
3	2402.070	110.47	-7.25	103.22	74.00	29.22	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2402 MHz		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



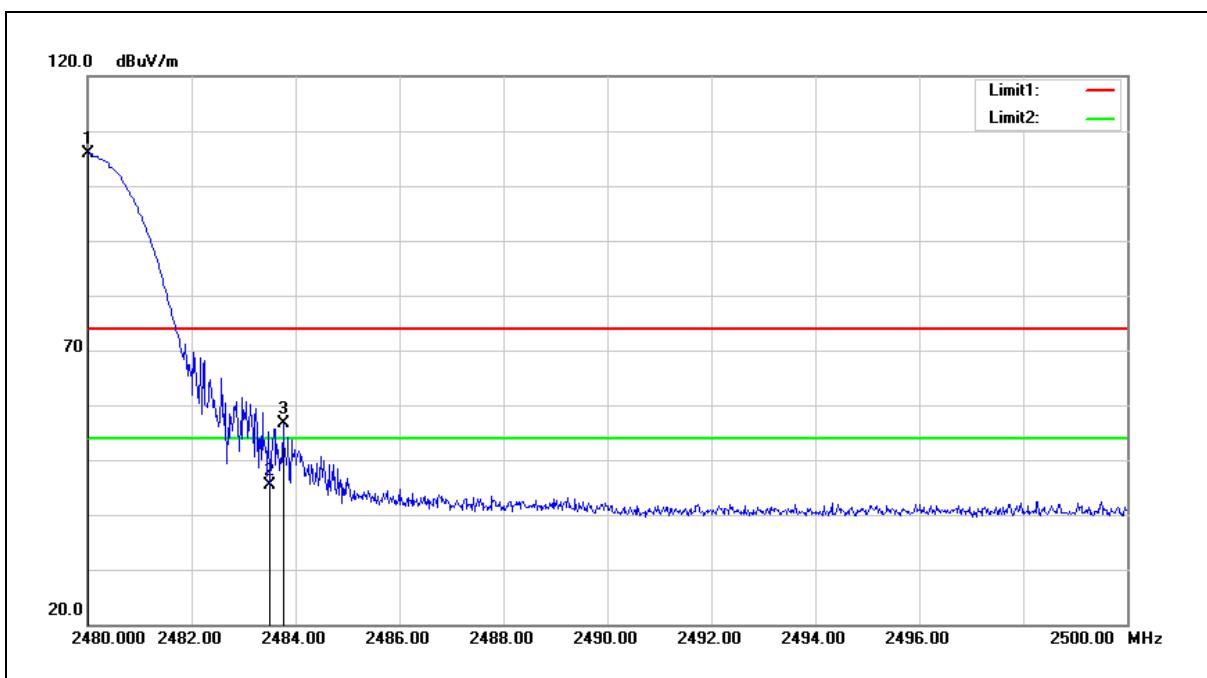
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2386.780	52.16	-7.33	44.83	74.00	-29.17	peak
2	2390.000	48.01	-7.30	40.71	74.00	-33.29	peak
3	2402.180	115.98	-7.25	108.73	74.00	34.73	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2480 MHz		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



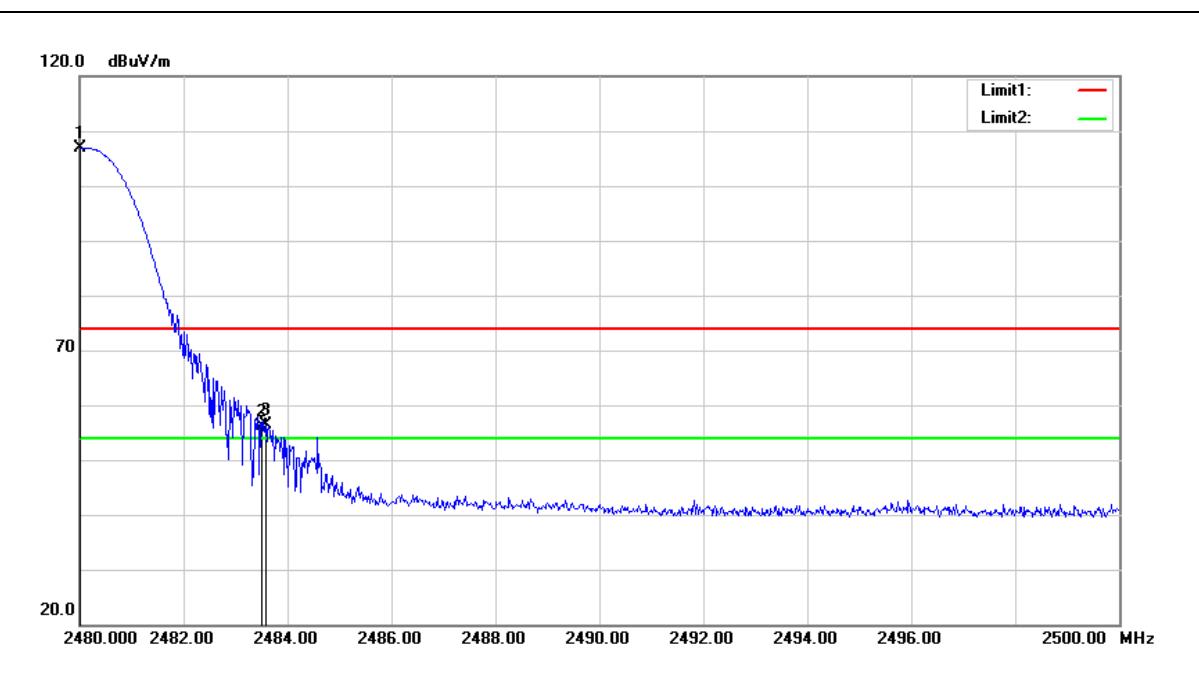
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.020	112.94	-6.95	105.99	74.00	31.99	peak
2	2483.500	52.43	-6.94	45.49	74.00	-28.51	peak
3	2483.760	63.58	-6.94	56.64	74.00	-17.36	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2480 MHz		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



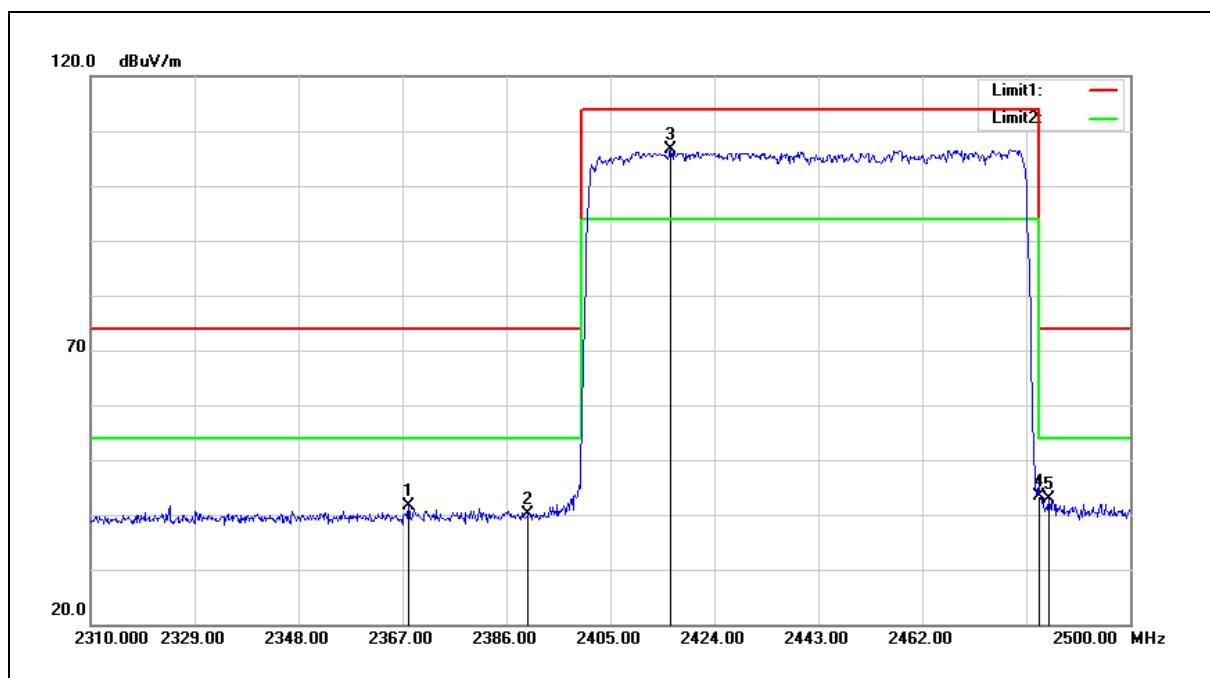
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.020	113.82	-6.95	106.87	74.00	32.87	peak
2	2483.500	63.05	-6.94	56.11	74.00	-17.89	peak
3	2483.580	63.34	-6.94	56.40	74.00	-17.60	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	Hopping		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



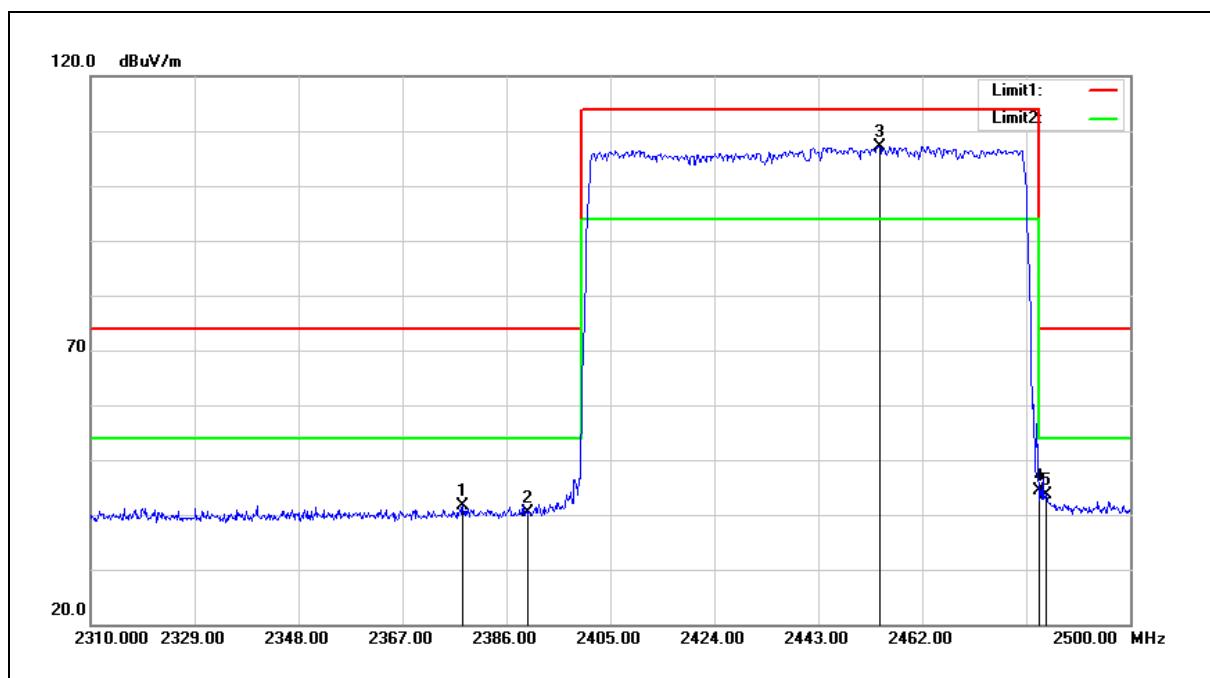
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2368.140	49.14	-7.39	41.75	74.00	-32.25	peak
2	2390.000	47.51	-7.30	40.21	74.00	-33.79	peak
3	2416.020	113.88	-7.21	106.67	114.00	-7.33	peak
4	2483.500	50.29	-6.94	43.35	74.00	-30.65	peak
5	2485.180	49.82	-6.92	42.90	74.00	-31.10	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	Hopping		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



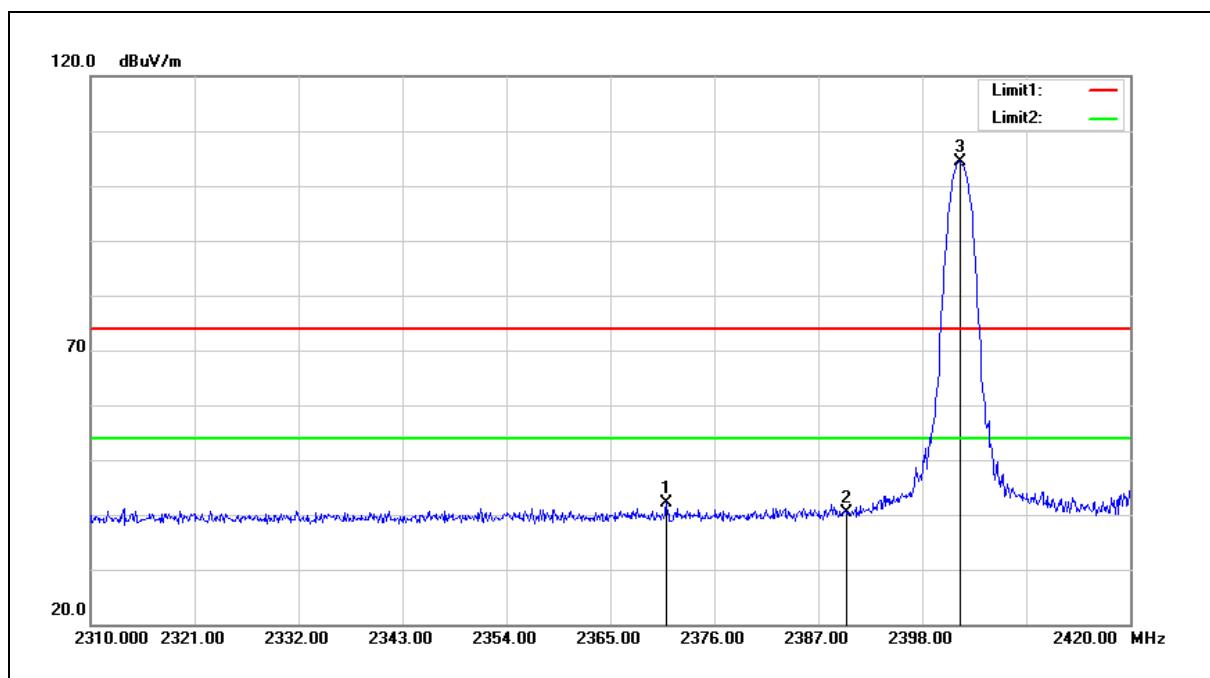
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2378.020	48.96	-7.35	41.61	74.00	-32.39	peak
2	2390.000	47.80	-7.30	40.50	74.00	-33.50	peak
3	2454.210	114.19	-7.05	107.14	114.00	-6.86	peak
4	2483.500	51.38	-6.94	44.44	74.00	-29.56	peak
5	2484.610	50.67	-6.92	43.75	74.00	-30.25	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2402 MHz		
Mode:	Mode 4		
Ant.Polar.:	Horizontal		



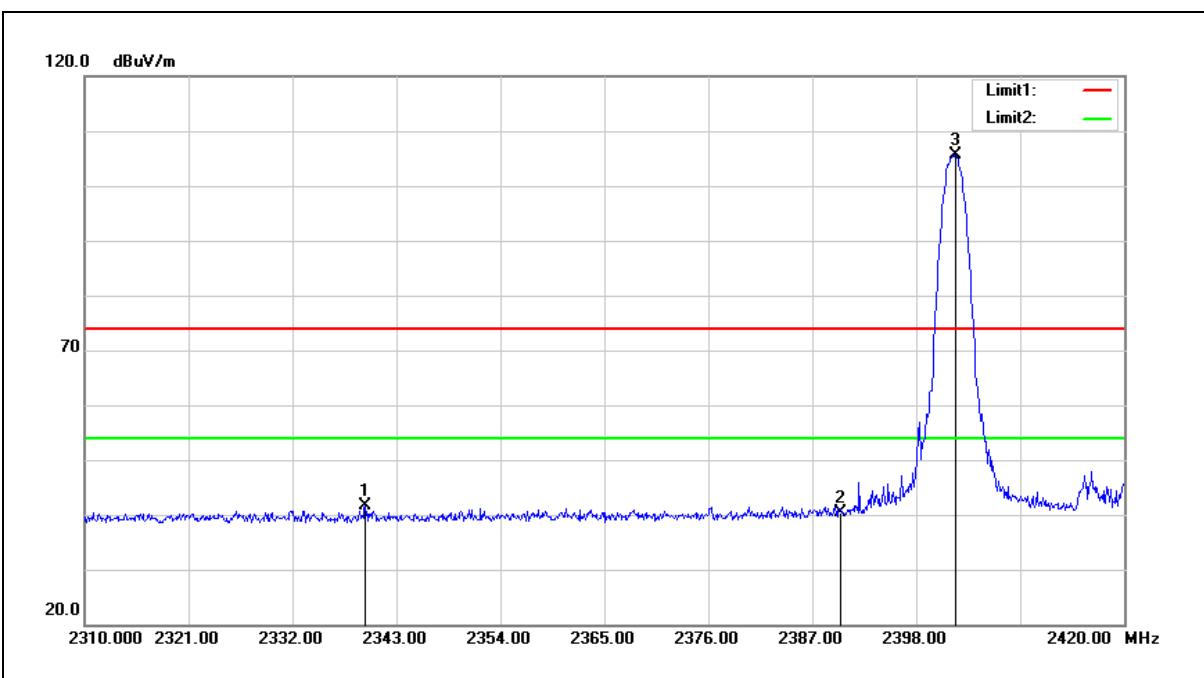
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2370.940	49.60	-7.38	42.22	74.00	-31.78	peak
2	2390.000	47.71	-7.30	40.41	74.00	-33.59	peak
3	2402.070	111.66	-7.25	104.41	74.00	30.41	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2402 MHz		
Mode:	Mode 4		
Ant.Polar.:	Vertical		



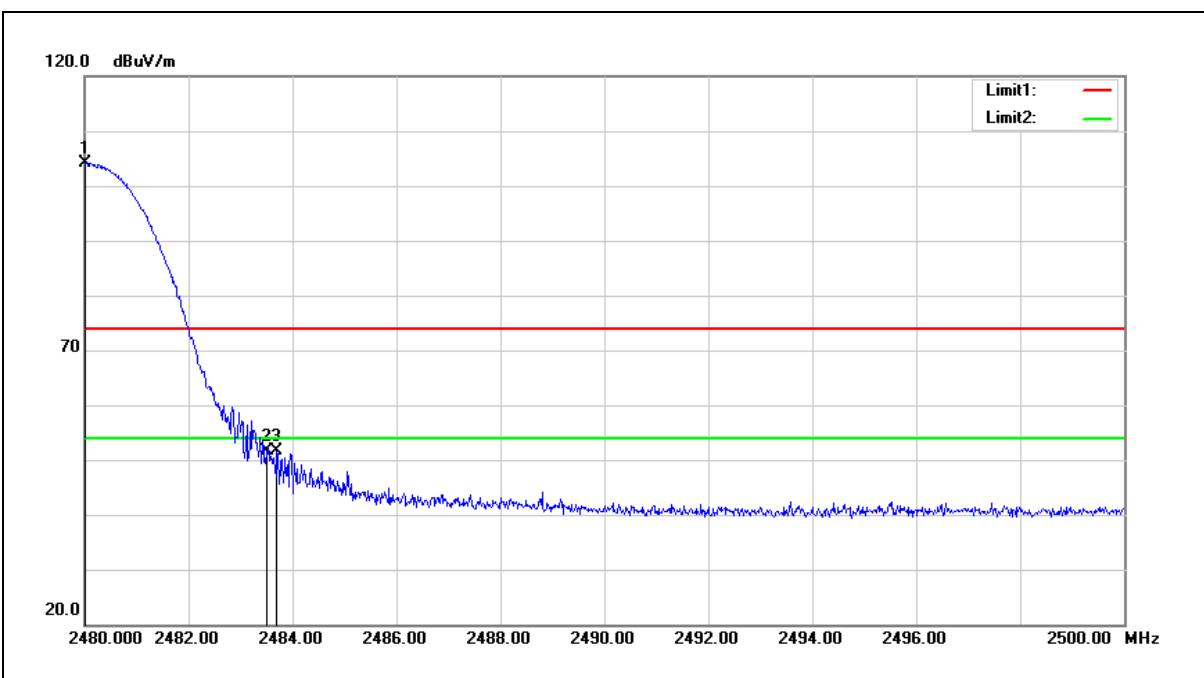
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2339.700	49.11	-7.51	41.60	74.00	-32.40	peak
2	2390.000	47.58	-7.30	40.28	74.00	-33.72	peak
3	2402.180	112.87	-7.25	105.62	74.00	31.62	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2480 MHz		
Mode:	Mode 4		
Ant.Polar.:	Horizontal		



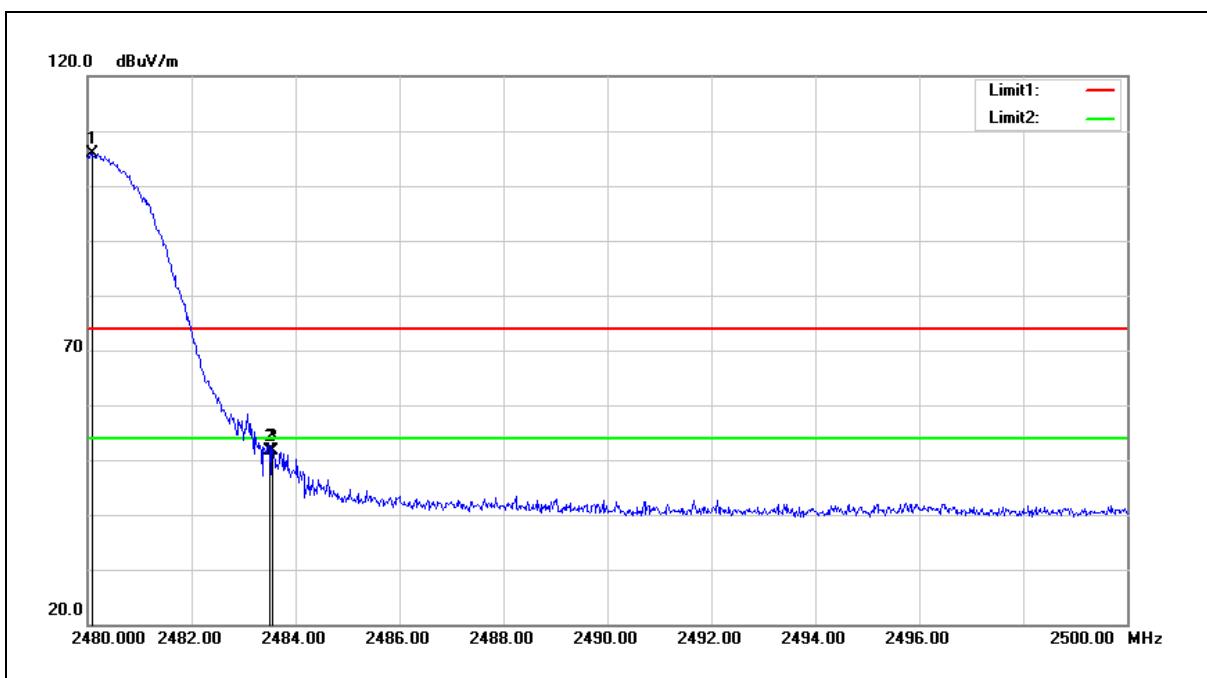
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.000	111.03	-6.95	104.08	74.00	30.08	peak
2	2483.500	58.65	-6.94	51.71	74.00	-22.29	peak
3	2483.700	58.55	-6.94	51.61	74.00	-22.39	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2480 MHz		
Mode:	Mode 4		
Ant.Polar.:	Vertical		



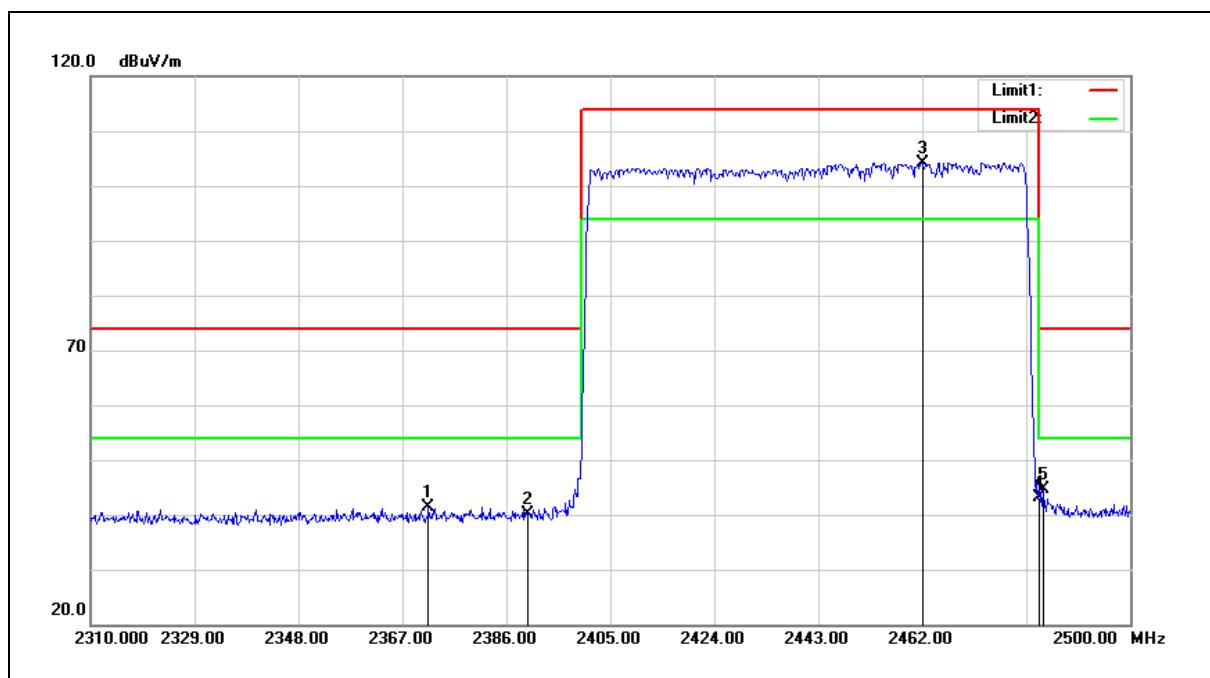
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.080	112.80	-6.95	105.85	74.00	31.85	peak
2	2483.500	58.52	-6.94	51.58	74.00	-22.42	peak
3	2483.560	58.52	-6.94	51.58	74.00	-22.42	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	Hopping		
Mode:	Mode 4		
Ant.Polar.:	Horizontal		



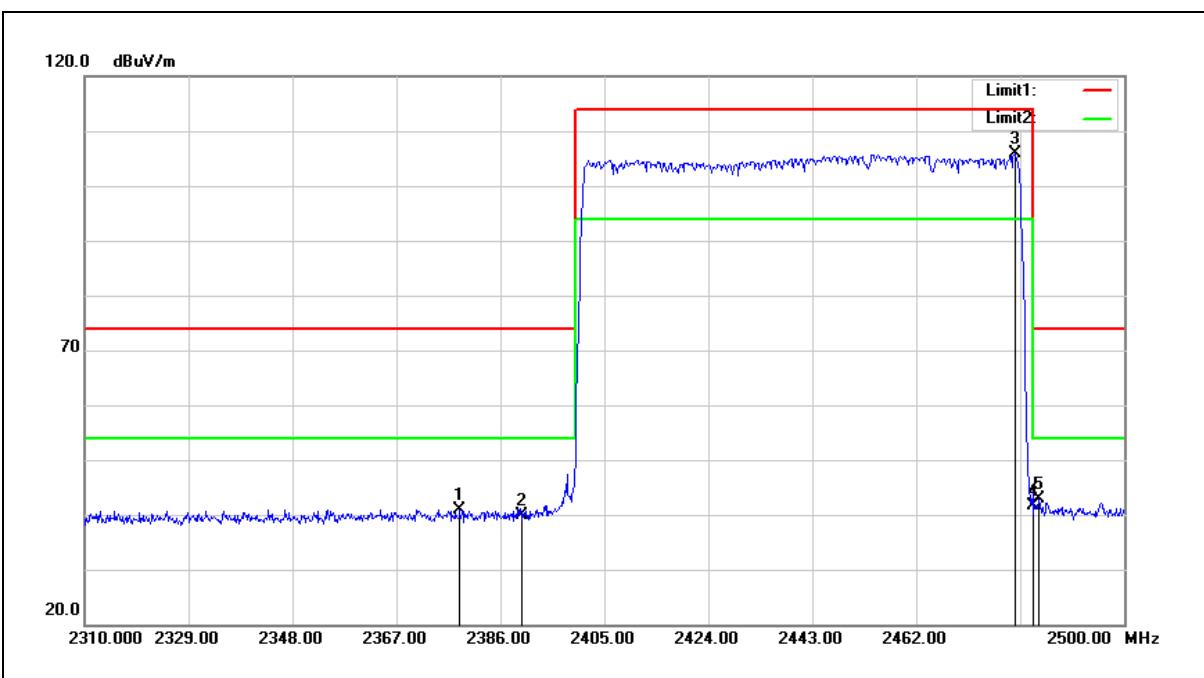
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2371.750	48.75	-7.38	41.37	74.00	-32.63	peak
2	2390.000	47.39	-7.30	40.09	74.00	-33.91	peak
3	2462.000	111.23	-7.03	104.20	114.00	-9.80	peak
4	2483.500	50.18	-6.94	43.24	74.00	-30.76	peak
5	2484.040	51.52	-6.93	44.59	74.00	-29.41	peak

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	Hopping		
Mode:	Mode 4		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2378.590	48.35	-7.35	41.00	74.00	-33.00	peak
2	2390.000	47.16	-7.30	39.86	74.00	-34.14	peak
3	2480.050	112.71	-6.95	105.76	114.00	-8.24	peak
4	2483.500	48.61	-6.94	41.67	74.00	-32.33	peak
5	2484.420	49.78	-6.92	42.86	74.00	-31.14	peak

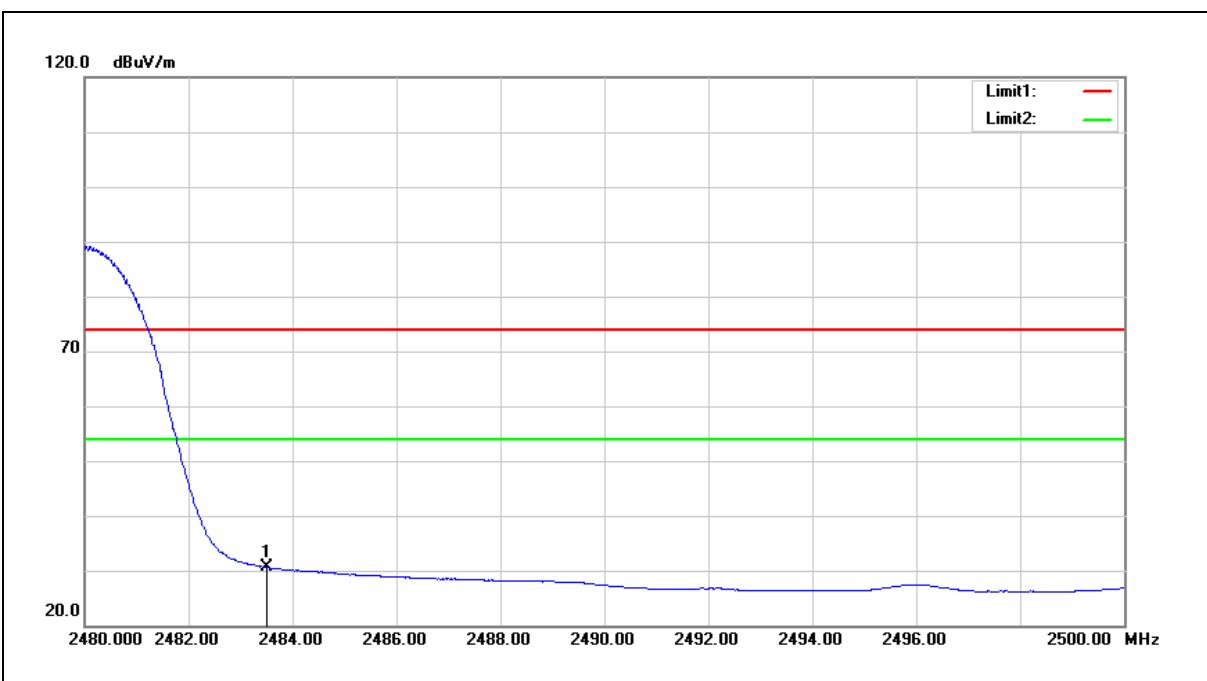
Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Average

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2480 MHz		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



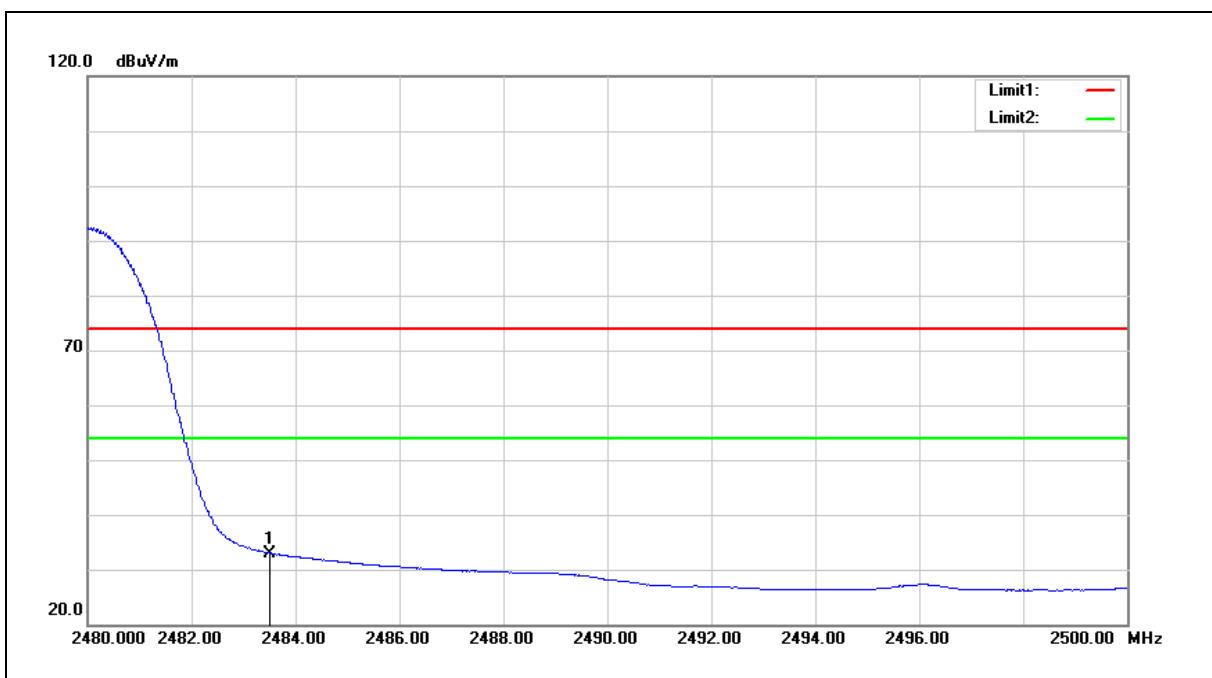
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	37.59	-6.94	30.65	54.00	-23.35	AVG

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.247	Test Distance:	3 m
Test item:	Band edge		
Frequency:	2480 MHz		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	39.90	-6.94	32.96	54.00	-21.04	AVG

Note: 1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

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