



FCC 47 CFR PART 15 SUBPART C

RF Test Report

Applicant : ZyXEL Communications Corporation
Product Type : Wireless N VDSL2 Gateway with USB
Trade Name : ZYXEL
Model Number : VMG1312-B10D
Applicable Standard : FCC 47 CFR PART 15 SUBPART C
ANSI C63.10:2013
Receive Date : Aug. 26, 2016
Test Period : Sep. 05 ~ Oct. 05, 2016
Issue Date : Nov. 29, 2016

Issue by

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Taiwan Accreditation Foundation accreditation number: 1330

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Nov. 29, 2016	Initial Issue	Snow Wang



Verification of Compliance

Issued Date: Nov. 29, 2016

Applicant : ZyXEL Communications Corporation
Product Type : Wireless N VDSL2 Gateway with USB
Trade Name : ZYXEL
Model Number : VMG1312-B10D
FCC ID : I88VMG1312B10D
EUT Rated Voltage : DC 12V, 1.0A
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.
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<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. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By
(Manager)

: Fly Lu
(Fly Lu)

Reviewed By

(Testing Engineer)

: Eric Ou Yang
(Eric Ou Yang)

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1 General Information

1.1 Summary of Test Result

Standard	Item	Result	Remark
15.247			
15.207	AC Power Conducted Emission	PASS	-----
Standard	Item	Result	Remark
15.247			
15.247(d)	Transmitter Radiated Emissions	PASS	-----
15.247(b)(3)	Max. Output Power	PASS	-----
15.247(a)(2)	6dB RF Bandwidth	PASS	-----
15.247(e)	Power Spectral Density	PASS	-----
15.247(d)	Out of Band Conducted Spurious Emission	PASS	-----
15.203	Antenna Requirement	PASS	-----

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

1.2 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9kHz ~ 150KHz	2.7
	150kHz ~ 30MHz	2.7
Radiated Emission	9kHz ~ 30MHz	1.7
	30MHz ~ 1000MHz	5.7
	1000MHz ~ 18000MHz	5.5
	18000MHz ~ 26500MHz	4.8
	26500MHz ~ 40000MHz	4.8
Conducted Output Power	+0.27 dB / -0.28 dB	
RF Bandwidth	4.96%	
Power Spectral Density	+0.71 dB / -0.77 dB	

2 EUT Description

Applicant	ZyXEL Communications Corporation No.2, Industry East Road IX, Science Park ,Hsinchu,Taiwan			
Manufacturer	ZyXEL Communications Corporation No.2, Industry East Road IX, Science Park ,Hsinchu,Taiwan			
Product Type	Wireless N VDSL2 Gateway with USB			
Trade Name	ZYXEL			
Model Number	VMG1312-B10D			
FCC ID	I88VMG1312B10D			
Firmware Version	V5.11(AAXA.3)C0			
RF Chip use	BCM43217T			
Operate Freq. Band	Frequency Range (MHz)	Modulation	Channel Bandwidth	Data Rate 400 GI (ns)
IEEE 802.11b	2412 ~ 2462	DSSS	20MHz	Up to 11Mbps
IEEE 802.11g	2412 ~ 2462	OFDM	20MHz	Up to 54Mbps
IEEE 802.11n 2.4GHz 20MHz	2412 ~ 2462	OFDM	20MHz	Up to 144.4Mbps
IEEE 802.11n 2.4GHz 40MHz	2422 ~ 2452	OFDM	40MHz	Up to 300Mbps
Antenna information	Antenna	Model	Type	Max. Gain (dBi)
	ANT-0	3101500652	Dipole Antenna	3
	ANT-1	3101500653	Dipole Antenna	3
Antenna Delivery	See section 3.1			

Frequency Band	Max. RF Output Power (W)
IEEE 802.11b	0.064
IEEE 802.11g	0.170
IEEE 802.11n 2.4GHz 20MHz	0.143
IEEE 802.11n 2.4GHz 40MHz	0.029

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:

Test Mode
Mode 1: Continuous TX mode
Mode 2: IEEE 802.11b link mode
Mode 3: IEEE 802.11g link mode
Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode
Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

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

Test Mode	ANT-0	ANT-1	ANT-0+1
Mode 2: IEEE 802.11b link mode	V	---	---
Mode 3: IEEE 802.11g link mode	V	V	V
Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode	V	V	V
Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode	V	V	V

Test Mode	Antenna Delivery	Test Channel	Data Rate (Mbps)
Mode 2: IEEE 802.11b link mode	1TX / 1RX (ANT-0)	1, 6, 11	1
Mode 3: IEEE 802.11g link mode	2TX / 2RX (CDD)	1, 6, 11	6
Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode	2TX / 2RX (CDD)	1, 6, 11	13
Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode	2TX / 2RX (CDD)	3, 6, 9	27

Duty cycle

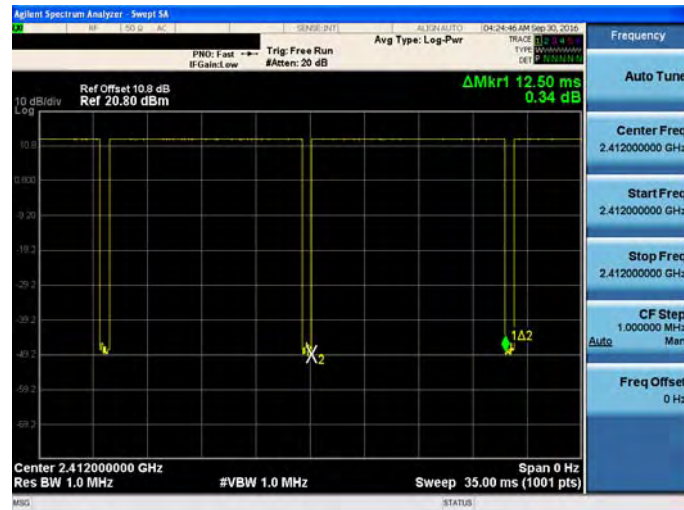
Test Mode	Frequency (MHz)	on time (ms)	on+off time (ms)	Duty cycle	Duty Factor (dB)	1/T Minimum VBW (kHz)
Mode 2: IEEE 802.11b link mode	2412.0	12.500	13.060	0.957	0.190	0.080
Mode 3: IEEE 802.11g link mode	2412.0	2.080	2.170	0.959	0.184	0.481
Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode	2412.0	1.004	1.080	0.930	0.317	0.996
Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode	2422.0	0.508	0.594	0.855	0.679	1.969



Duty Cycle Graphs

Mode 2: IEEE 802.11b link mode

On time



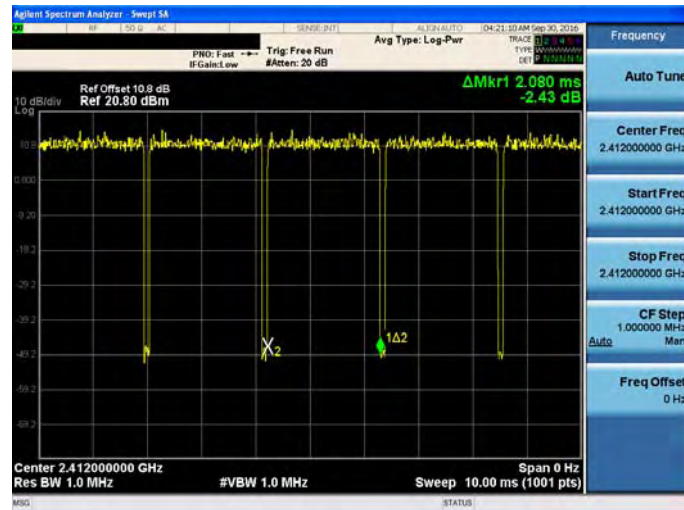
On+off time



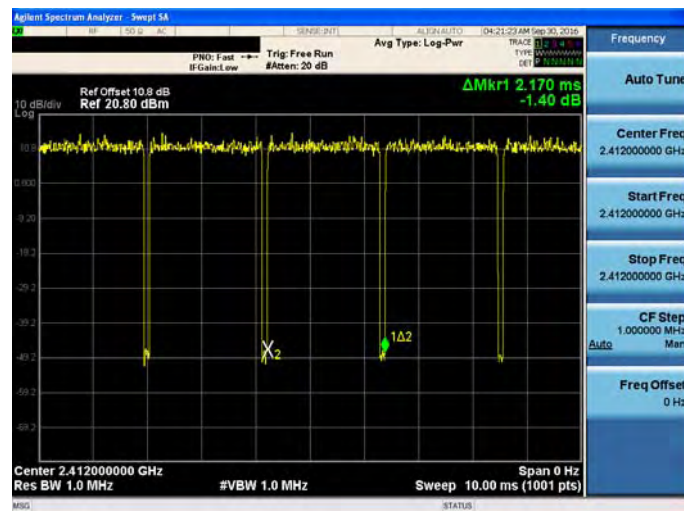


Mode 3: IEEE 802.11g Mode

On time



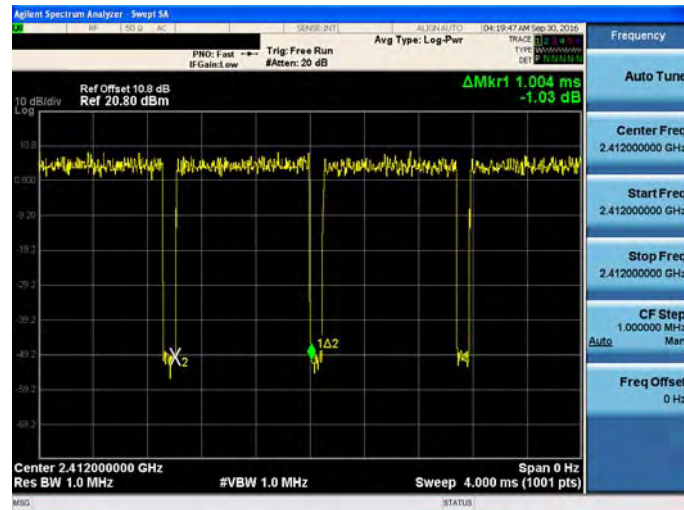
On+off time



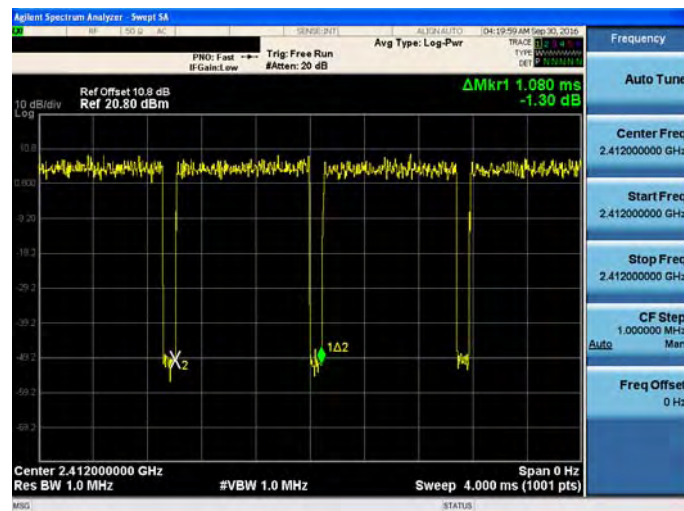


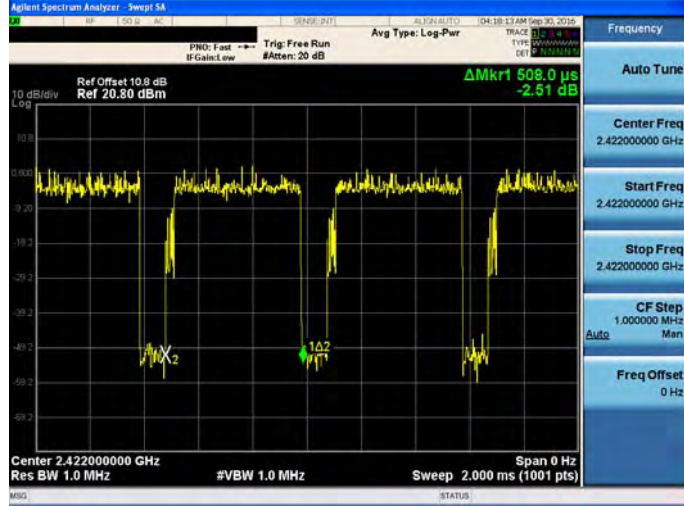
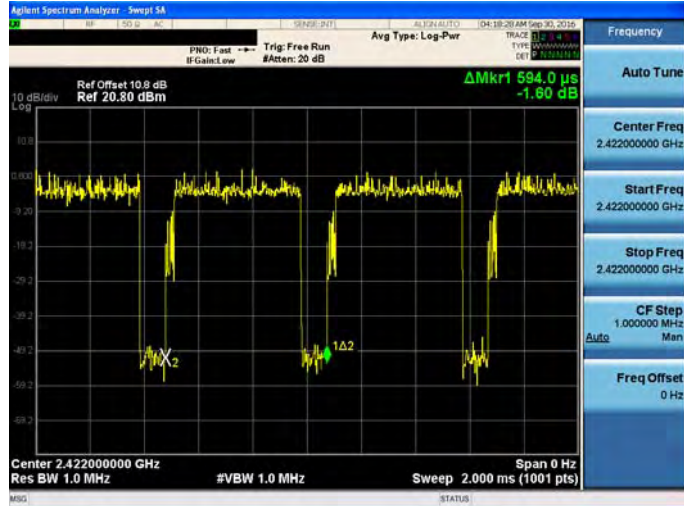
Mode 4: IEEE 802.11n 2.4GHz 20MHz Mode

On time



On+off time



Mode 5: IEEE 802.11n 2.4GHz 40MHz Mode	
On time	
On+off time	

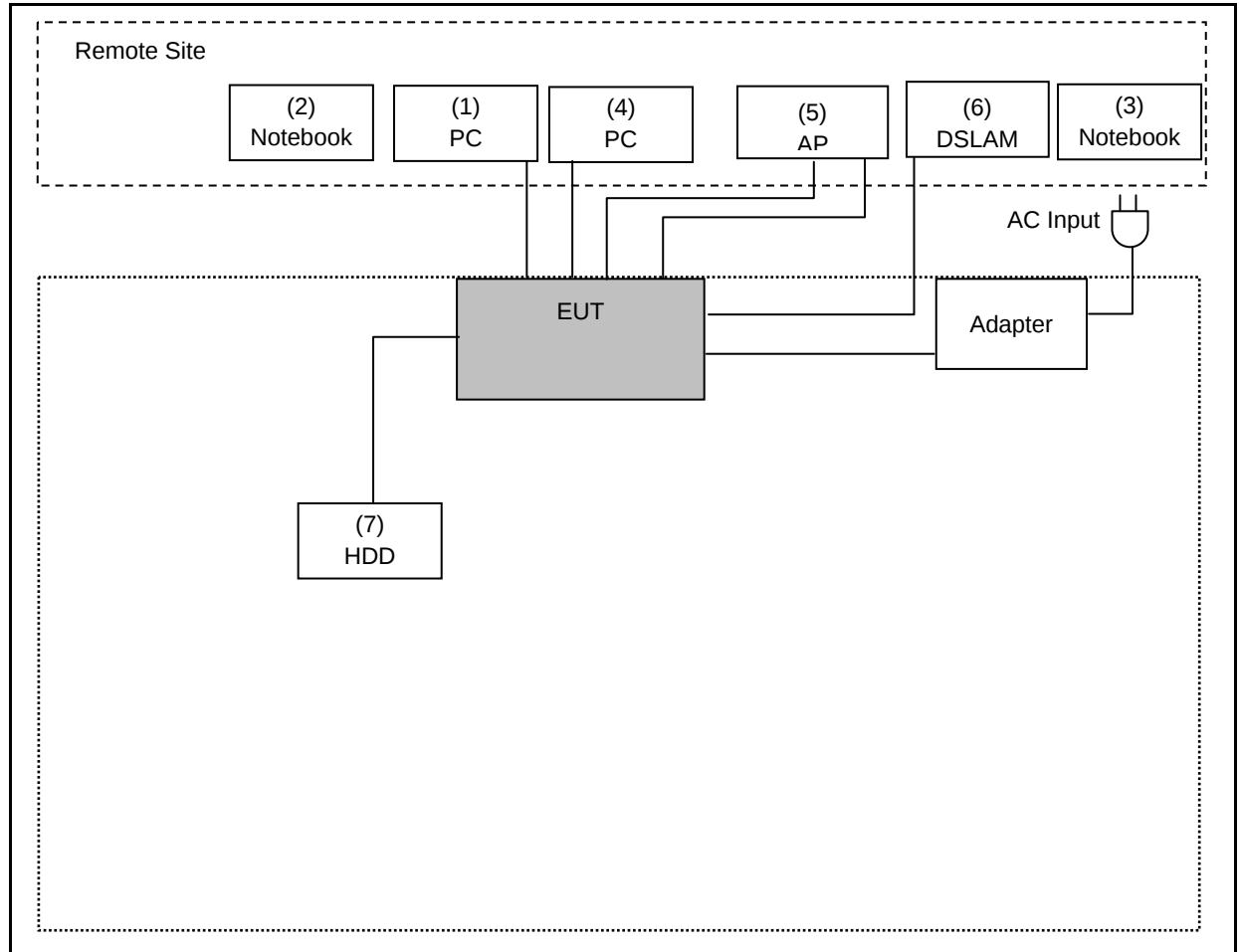
3.2. EUT Exercise Software

1.	Setup the EUT shown on 3.3.
2.	Turn on the power of all equipment.
3.	Turn Wi-Fi function link to Notebook
4.	EUT run test program.

Measurement Software	
1	EZ-EMC Ver. ATL-03A1-1
2	EZ-EMC Ver ATL-ITC-3A1-1

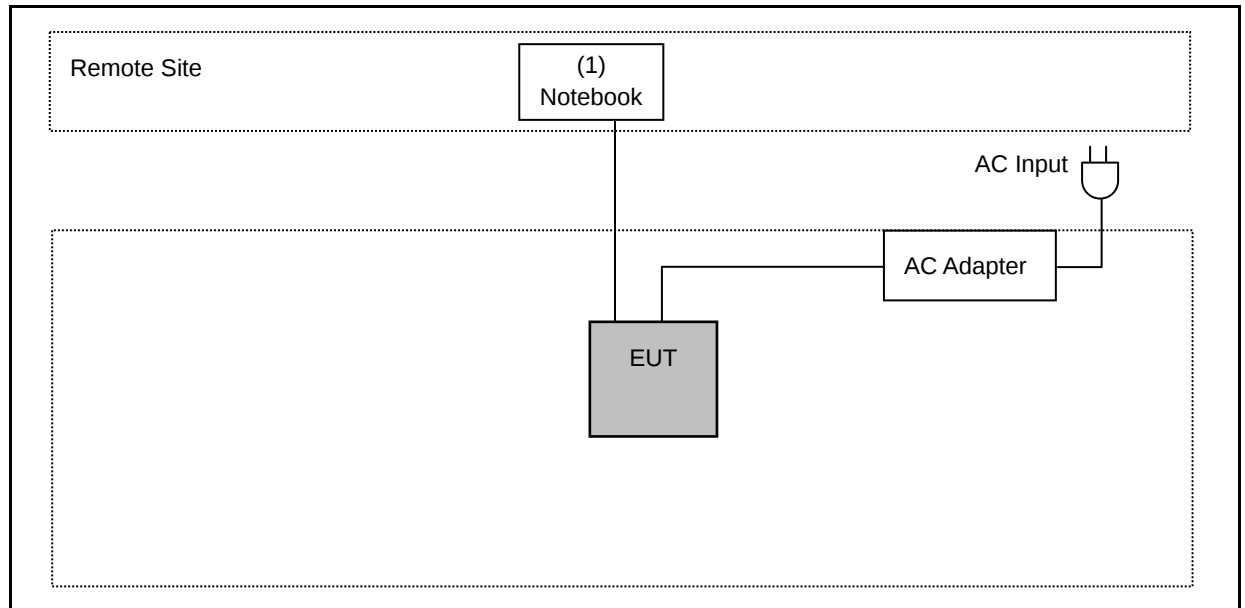
3.3. Configuration of Test System Details

Conducted Emissions



Devices Description					
	Product	Manufacturer	Model Number	Serial Number	Power Cord
(1)	PC	DELL	T3610	F5XBW02	Non-Shielded, 1.8m
(2)	Notebook	DELL	LAPTITU	25627158361	Non-Shielded, 1.8m
(3)	Notebook	DELL	LAPTITU	6699565657	Non-Shielded, 1.8m
(4)	PC	DELL	9020	HJMBW02	Non-Shielded, 1.8m
(5)	AP	ASUS	MSQ-RTAC66U	D1IAGG000126	Non-Shielded, 1.8m
(6)	DSLAM	Draytek	VigorAccess	N/A	Non-Shielded, 1.8m
(7)	HDD	WD	My Passport	WX71A8241990	Power by EUT

Radiated Emissions



Devices Description					
	Product	Manufacturer	Model Number	Serial Number	Power Cord
(1)	Notebook	DELL	LAPTITU	6699565657	Non-Shielded, 1.8m

3.4. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

4 AC Power Line Conducted Emission Measurement

4.1. Limit

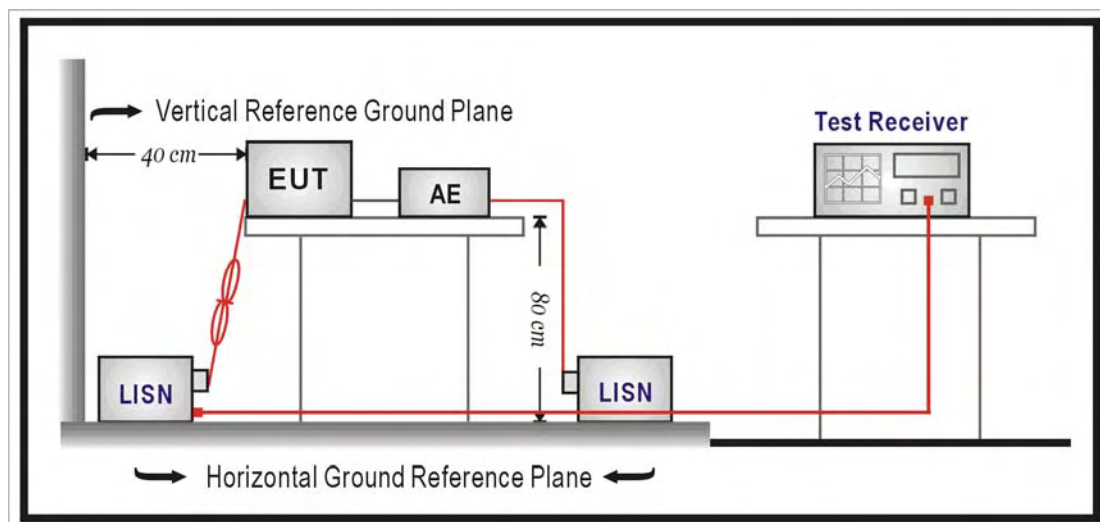
Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

4.2. Test Instruments

Describe	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Test Receiver	R&S	ESCI	100367	05/31/2016	1 year
LISN	R&S	ENV216	101040	03/15/2016	1 year
LISN	R&S	ENV216	101041	03/07/2016	1 year
RF Cable	Woken	00100D1380194M	TE-02-02	05/31/2016	1 year
Test Site	ATL	TE02	TE02	N.C.R.	-----

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

4.3. Test Setup



4.4. 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 $50\Omega // 50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega // 50\mu\text{H}$ coupling impedance with 50ohm 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 40cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12mm insulating material.

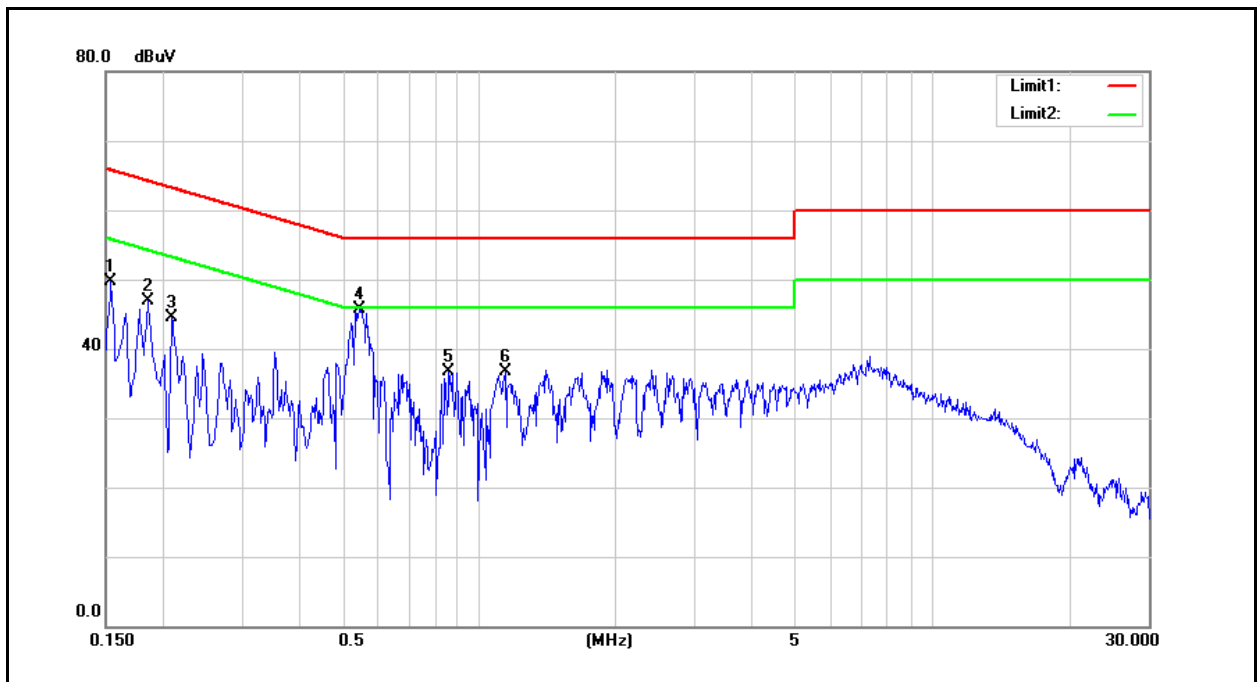
Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average 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 150kHz to 30MHz 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 1m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4m. All of interconnecting cables that hang closer than 40cm 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 0.1m. All 50 Ω ports of the LISN shall be resistively terminated into 50 Ω 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.

4.5. Test Result

Standard:	FCC Part 15C	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 1	Date:	09/05/2016
		Test By:	Eric Ou Yang
Description:			



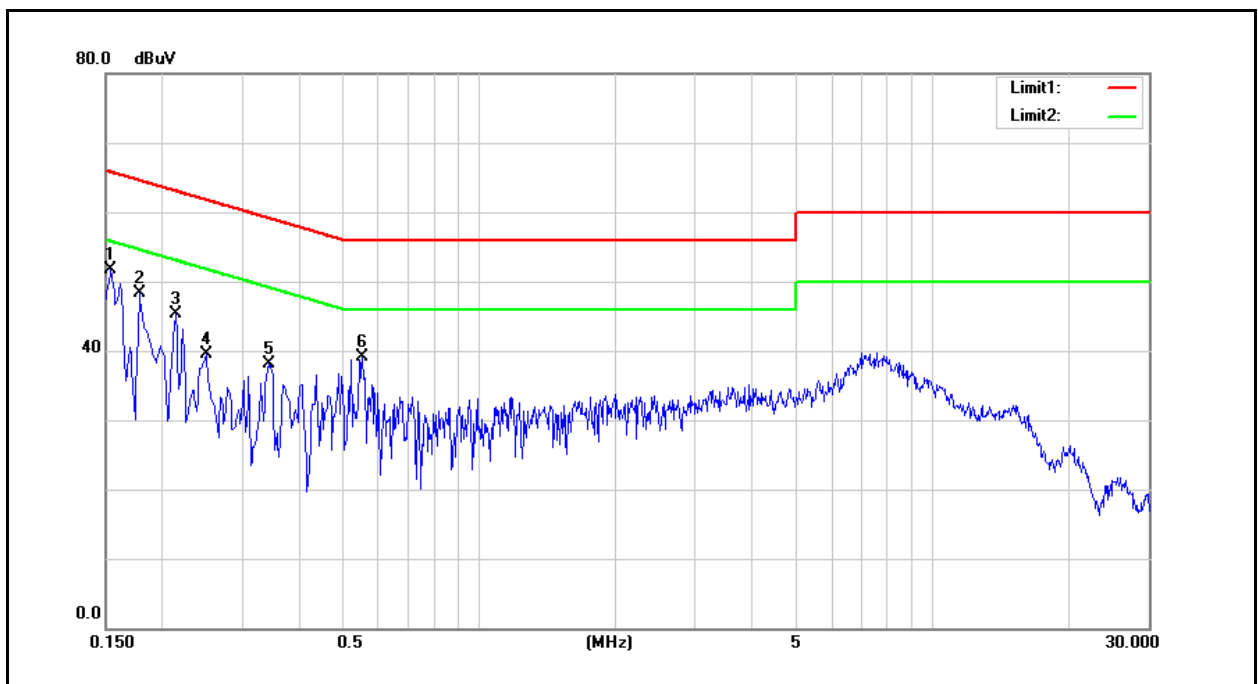
No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1540	40.01	29.64	9.60	49.61	39.24	65.78	55.78	-16.17	-16.54	Pass
2	0.1860	34.13	22.63	9.59	43.72	32.22	64.21	54.21	-20.49	-21.99	Pass
3	0.2100	27.05	16.88	9.59	36.64	26.47	63.21	53.21	-26.57	-26.74	Pass
4	0.5460	34.82	25.10	9.61	44.43	34.71	56.00	46.00	-11.57	-11.29	Pass
5	0.8580	25.40	15.92	9.64	35.04	25.56	56.00	46.00	-20.96	-20.44	Pass
6	1.1420	24.30	13.62	9.65	33.95	23.27	56.00	46.00	-22.05	-22.73	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 15C	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	Mode 1	Date:	09/05/2016
		Test By:	Eric Ou Yang
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	0.1540	33.00	28.37	9.59	42.59	37.96	65.78	55.78	-23.19	-17.82	Pass
2	0.1780	32.53	17.08	9.58	42.11	26.66	64.58	54.58	-22.47	-27.92	Pass
3	0.2140	33.79	23.27	9.58	43.37	32.85	63.05	53.05	-19.68	-20.20	Pass
4	0.2500	26.60	15.50	9.59	36.19	25.09	61.76	51.76	-25.57	-26.67	Pass
5	0.3460	23.59	8.81	9.59	33.18	18.40	59.06	49.06	-25.88	-30.66	Pass
6	0.5540	28.90	21.39	9.60	38.50	30.99	56.00	46.00	-17.50	-15.01	Pass

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

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



5 Radiated Emission Measurement

5.1. 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 ($\mu\text{V}/\text{m}$ 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.

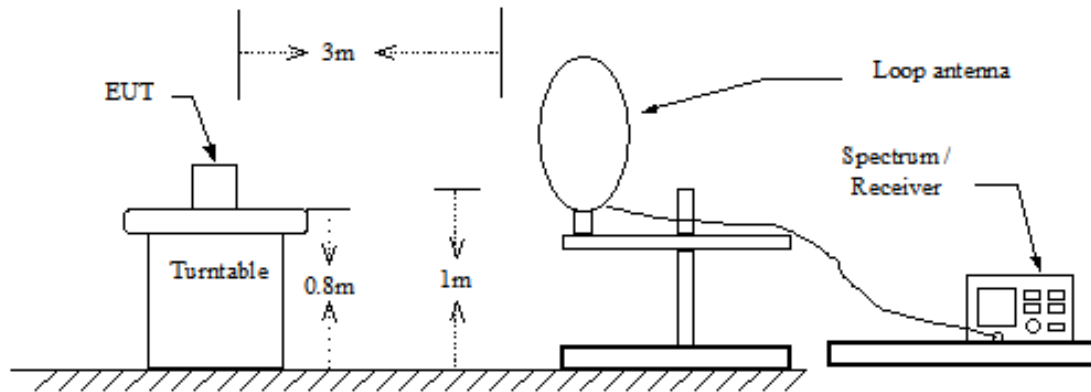
5.2. Test Instruments

3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
RF Pre-selector	Agilent	N9039A	MY46520256	01/08/2016	1 year
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/08/2016	1 year
Pre Amplifier	Agilent	8449B	3008A02237	10/07/2015	1 year
Pre Amplifier	Agilent	8447D	2944A11119	01/11/2016	1 year
Broadband Antenna	SCHWARZBECK	VVULB 9168	419	10/28//2015	1 year
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/06/2016	1 year
Horn Antenna (18~40GHz)	ETS	3116	86467	09/05/2016	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	02/01/2016	1 year
Microwave Cable	EMCI	EMC102-KM-KM-14000	151001	10/15/2015	1 year
Microwave Cable	EMCI	EMC-104-SM-SM-14000	140202	10/15/2015	1 year
Microwave Cable	EMCI	EMC104-SM-SM-600	140301	10/15/2015	1 year
Test Site	ATL	TE01	888001	08/29/2016	1 year

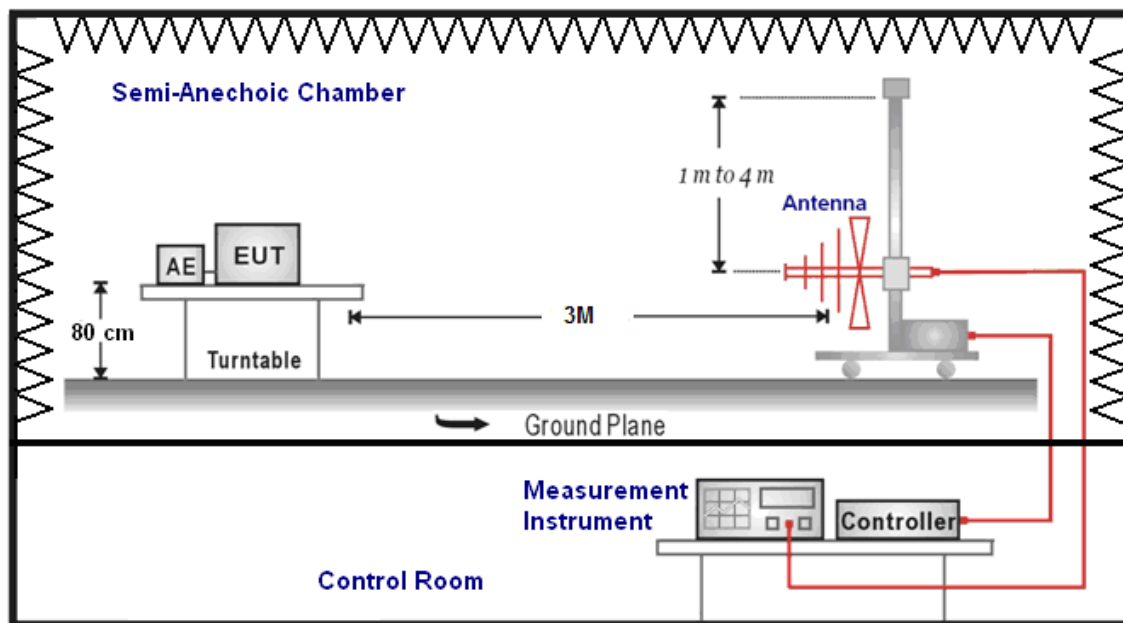
Note: N.C.R. = No Calibration Request.

5.3. Setup

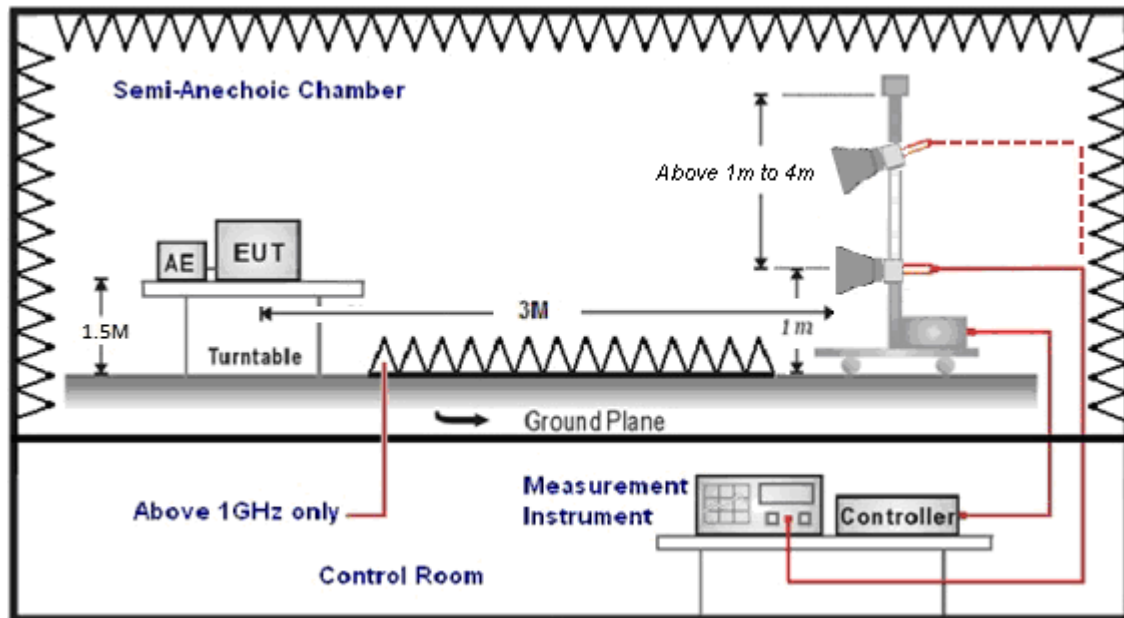
9kHz ~ 30MHz



Below 1GHz



Above 1GHz





5.4. 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 (below 1GHz use 0.8m turntable / above 1GHz use 1.5m turntable), 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 1 MHz for peak measurements and 10 Hz for average measurements when Duty cycle >0.98 / $1/T$ for average measurements when Duty cycle <0.98 . A nonconductive material surrounded the EUT to supporting the EUT for standing on three 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 3 meter. The antenna at an angle toward the source of the emission. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20dB/decade).

For testing above 1GHz, the emission level of the EUT in peak mode was 20dB 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 per meter (uV/m).

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



The actual field 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 < +30dBm

(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 20dB below the permissible limits or the field strength is too small to be measured.



5.5. Test Result

Below 1GHz

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 1		Date:		10/05/2016	
				Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
181.0000	41.29	-12.33	28.96	43.50	-14.54	QP	H
292.5000	33.81	-9.55	24.26	46.00	-21.74	QP	H
479.0000	30.88	-5.65	25.23	46.00	-20.77	QP	H
552.5000	45.32	-4.36	40.96	46.00	-5.04	QP	H
689.0000	25.67	-1.51	24.16	46.00	-21.84	QP	H
873.5000	29.18	2.09	31.27	46.00	-14.73	QP	H
181.0000	42.25	-12.33	29.92	43.50	-13.58	QP	V
297.0000	33.36	-9.44	23.92	46.00	-22.08	QP	V
537.0000	35.98	-4.65	31.33	46.00	-14.67	QP	V
568.5000	40.55	-3.86	36.69	46.00	-9.31	QP	V
602.5000	36.52	-2.84	33.68	46.00	-12.32	QP	V
800.0000	31.44	0.78	32.22	46.00	-13.78	QP	V

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

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

3.No emission found between lowest internal used/generated frequencies to 30MHz (9 kHz~30MHz).

**Above 1GHz**

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 2		Date:		10/01/2016	
Frequency:		2412MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4824.000	52.61	-7.96	44.65	74.00	-29.35	peak	H
4824.000	59.95	-7.96	51.99	74.00	-22.01	peak	V

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 2		Date:		10/01/2016	
Frequency:		2437MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874.000	51.59	-7.80	43.79	74.00	-30.21	peak	H
4874.000	58.94	-7.80	51.14	74.00	-22.86	peak	V

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Mode:		Mode 2		Date:		10/01/2016	
Frequency:		2462MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4924.000	49.87	-7.65	42.22	74.00	-31.78	peak	H
4924.000	54.92	-7.65	47.27	74.00	-26.73	peak	V

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

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



Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	VMG1312-B10D			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Mode:	Mode 3			Date:	10/01/2016		
Frequency:	2412MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4824.000	50.39	-7.96	42.43	74.00	-31.57	peak	H
4824.000	50.77	-7.96	42.81	74.00	-31.19	peak	V

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 3		Date:		10/01/2016	
Frequency:		2437MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874.000	51.13	-7.80	43.33	74.00	-30.67	peak	H
4874.000	58.38	-7.80	50.58	74.00	-23.42	peak	V

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Mode:		Mode 3		Date:		10/01/2016	
Frequency:		2462MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4924.000	49.84	-7.65	42.19	74.00	-31.81	peak	H
4924.000	50.46	-7.65	42.81	74.00	-31.19	peak	V

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

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



Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 4		Date:		10/01/2016	
Frequency:		2412MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4824.000	52.31	-7.96	44.35	74.00	-29.65	peak	H
4824.000	49.81	-7.96	41.85	74.00	-32.15	peak	V

Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Mode:		Mode 4		Date:		10/01/2016	
Frequency:		2437MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874.000	50.83	-7.80	43.03	74.00	-30.97	peak	H
4874.000	57.69	-7.80	49.89	74.00	-24.11	peak	V

Standard:	FCC Part 15C		Test Distance:	3m			
Test item:	Radiated Emission		Power:	AC 120V/60Hz			
Model Number:	VMG1312-B10D		Temp.(℃)/Hum.(%RH):	26(℃)/60%RH			
Mode:	Mode 4		Date:	10/01/2016			
Frequency:	2462MHz		Test By:	Eric Ou Yang			
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4924.000	51.22	-7.65	43.57	74.00	-30.43	peak	H
4924.000	51.24	-7.65	43.59	74.00	-30.41	peak	V

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

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



Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 5		Date:		10/01/2016	
Frequency:		2422MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4844.000	50.32	-7.88	42.44	74.00	-31.56	peak	H
4844.000	50.65	-7.88	42.77	74.00	-31.23	peak	V

Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	VMG1312-B10D			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Mode:	Mode 5			Date:	10/01/2016		
Frequency:	2437MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874.000	50.80	-7.80	43.00	74.00	-31.00	peak	H
4874.000	51.53	-7.80	43.73	74.00	-30.27	peak	V

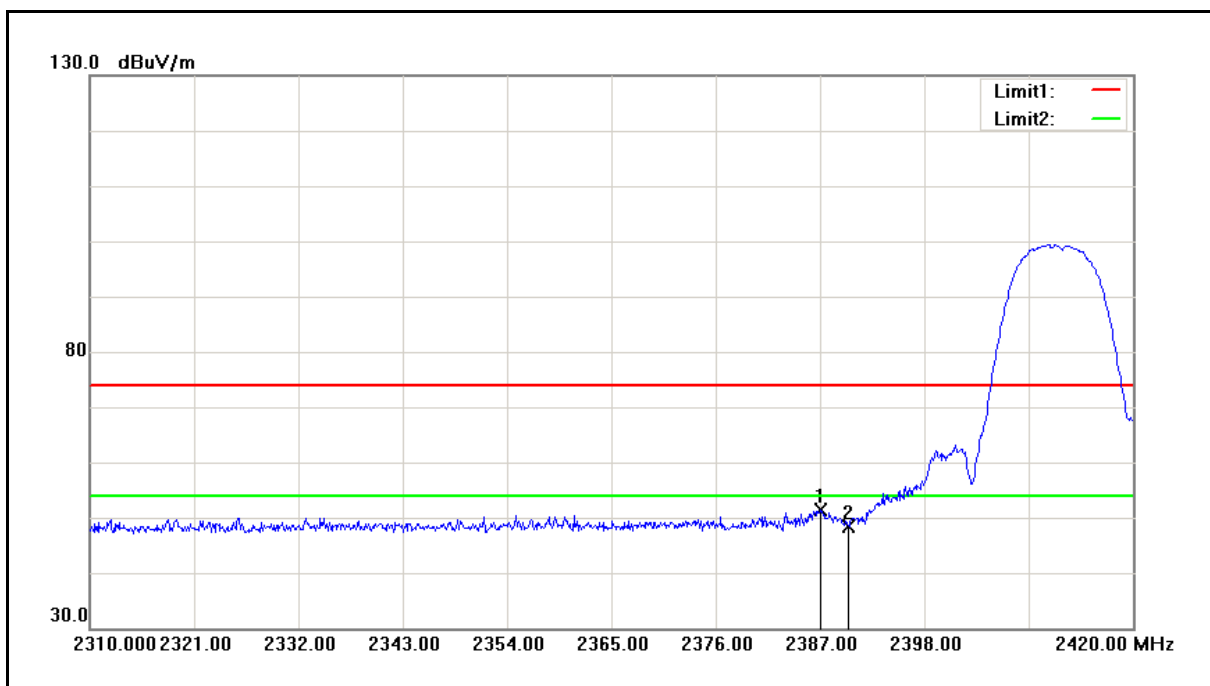
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Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		VMG1312-B10D		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Mode:		Mode 5		Date:		10/01/2016	
Frequency:		2452MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4904.000	50.55	-7.70	42.85	74.00	-31.15	peak	H
4904.000	49.52	-7.70	41.82	74.00	-32.18	peak	V

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

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

Band Edge

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	10/01/2016
Frequency:	2412 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		

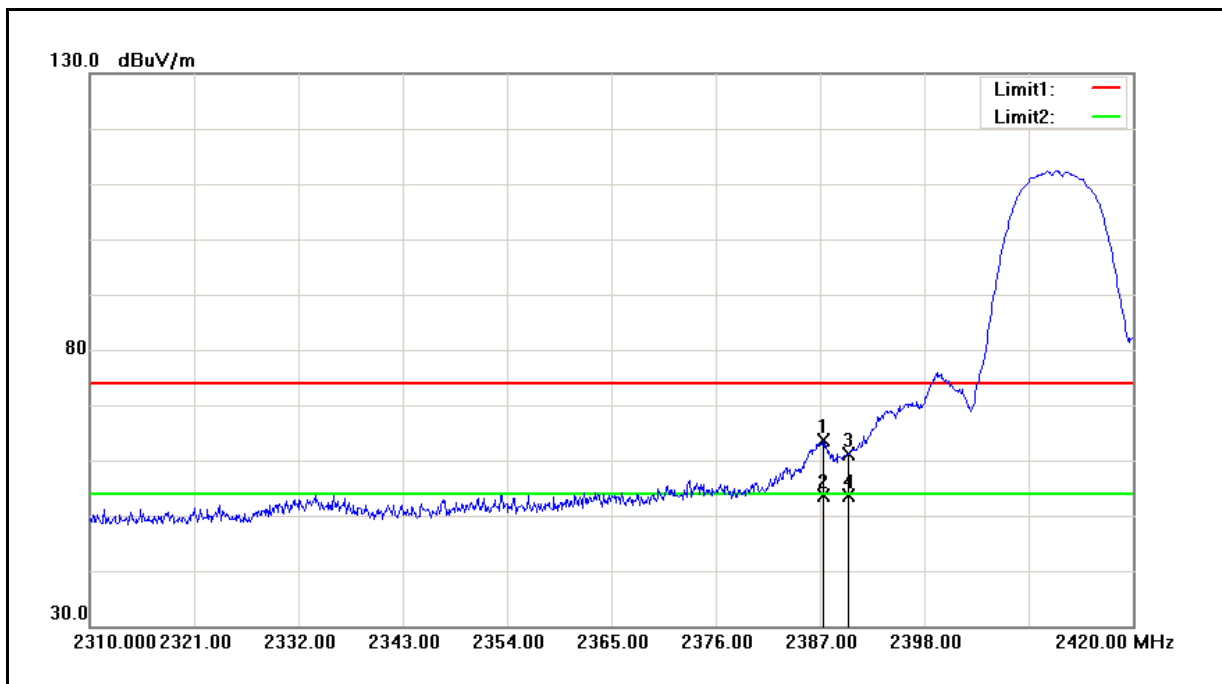


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2387.110	51.61	-0.35	51.26	74.00	-22.74	peak
2	2390.000	48.83	-0.34	48.49	74.00	-25.51	peak

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

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

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	10/01/2016
Frequency:	2412 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



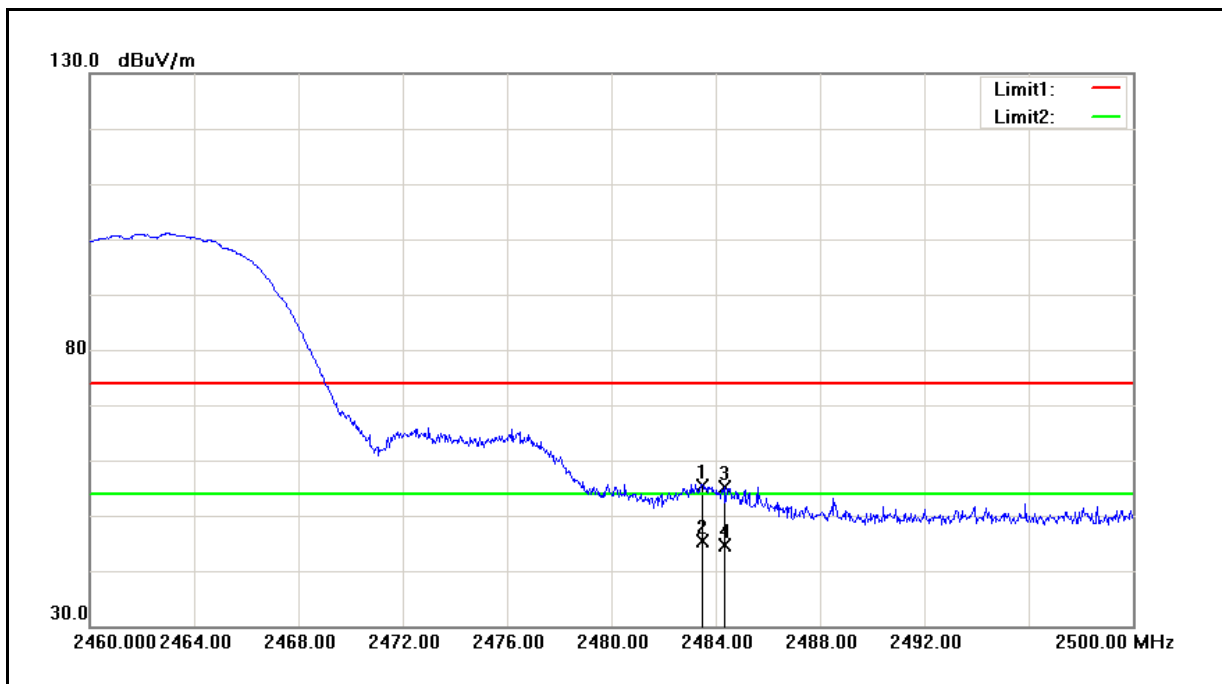
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2387.330	63.88	-0.35	63.53	74.00	-10.47	peak
2	2387.330	54.08	-0.35	53.73	54.00	-0.27	AVG
3	2390.000	61.54	-0.34	61.20	74.00	-12.80	peak
4	2390.000	53.90	-0.34	53.56	54.00	-0.44	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	10/01/2016
Frequency:	2462 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		

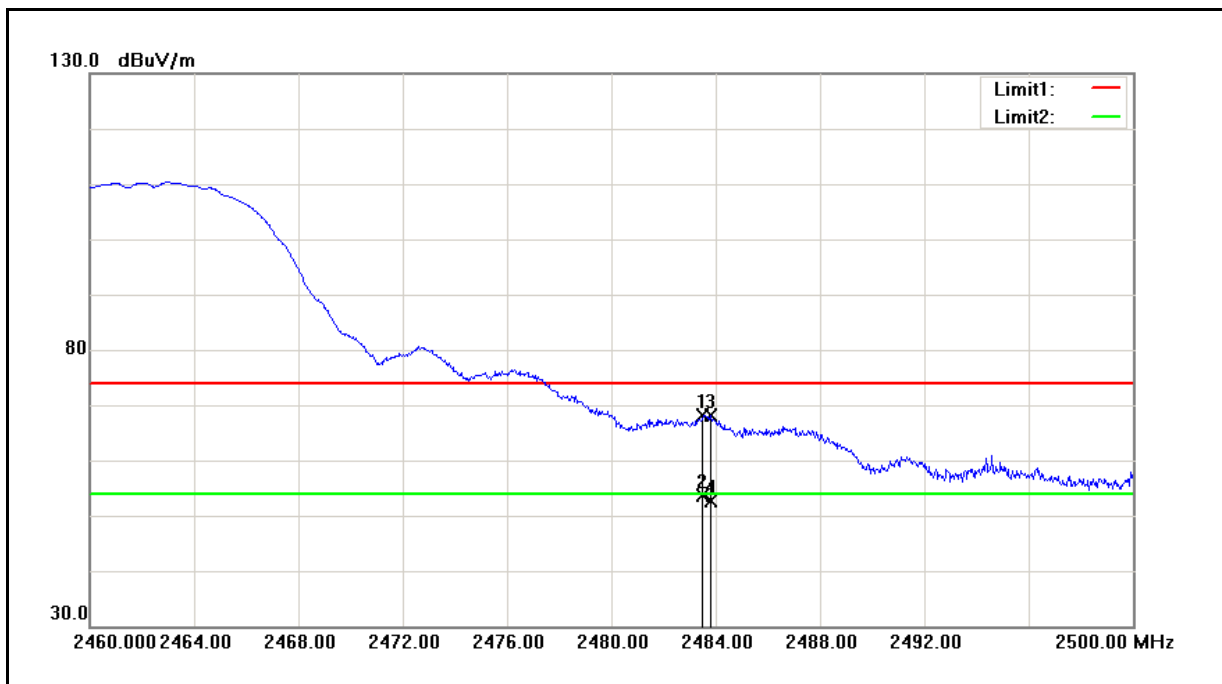


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	55.29	0.03	55.32	74.00	-18.68	peak
2	2483.500	45.33	0.03	45.36	54.00	-8.64	AVG
3	2484.320	55.19	0.04	55.23	74.00	-18.77	peak
4	2484.320	44.70	0.04	44.74	54.00	-9.26	AVG

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

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

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	2	Date:	10/01/2016
Frequency:	2462 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		

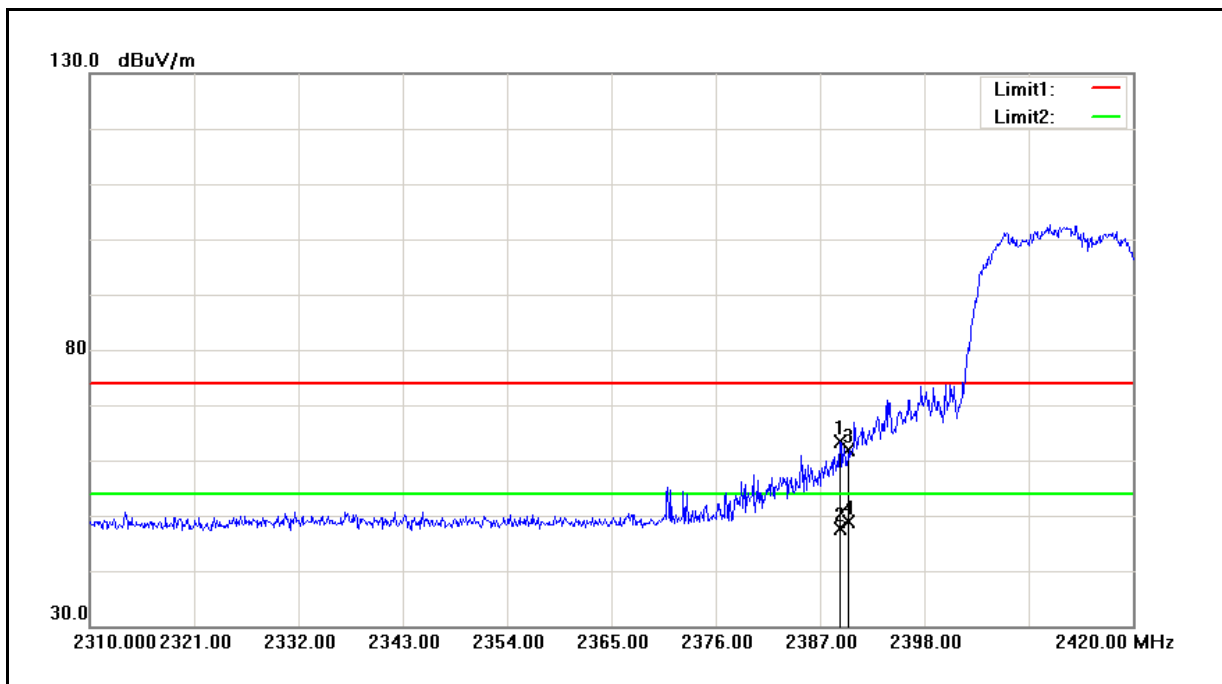


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	68.19	0.03	68.22	74.00	-5.78	peak
2	2483.500	53.60	0.03	53.63	54.00	-0.37	AVG
3	2483.800	68.17	0.03	68.20	74.00	-5.80	peak
4	2483.800	52.61	0.03	52.64	54.00	-1.36	AVG

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

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

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	3	Date:	10/01/2016
Frequency:	2412 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		

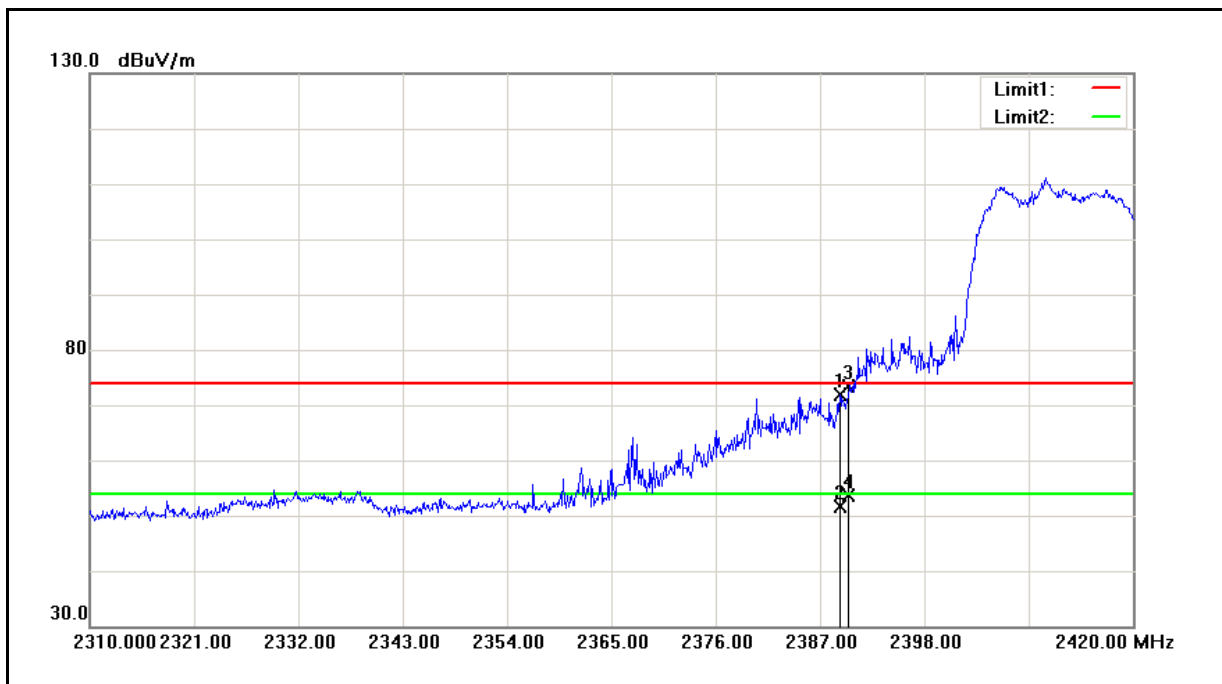


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.090	63.79	-0.34	63.45	74.00	-10.55	peak
2	2389.090	47.86	-0.34	47.52	54.00	-6.48	AVG
3	2390.000	62.24	-0.34	61.90	74.00	-12.10	peak
4	2390.000	49.18	-0.34	48.84	54.00	-5.16	AVG

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

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

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	3	Date:	10/01/2016
Frequency:	2412 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



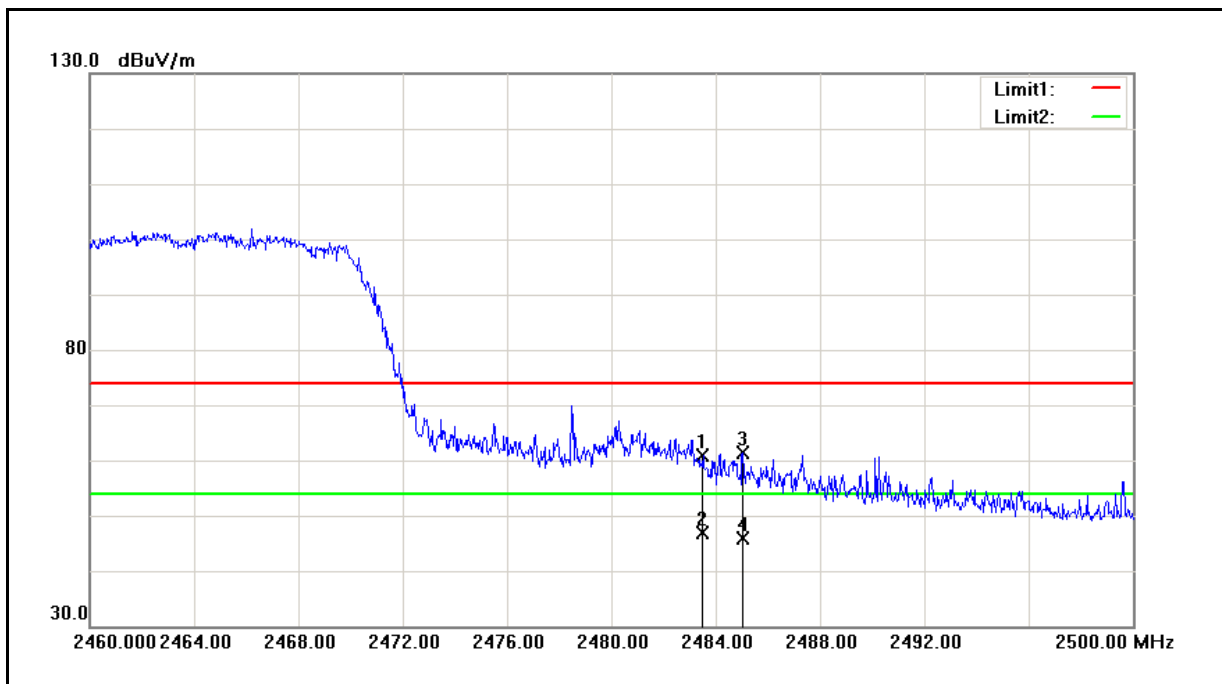
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.090	72.33	-0.34	71.99	74.00	-2.01	peak
2	2389.090	52.04	-0.34	51.70	54.00	-2.30	AVG
3	2390.000	73.77	-0.34	73.43	74.00	-0.57	peak
4	2390.000	53.90	-0.34	53.56	54.00	-0.44	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	3	Date:	10/01/2016
Frequency:	2462 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		



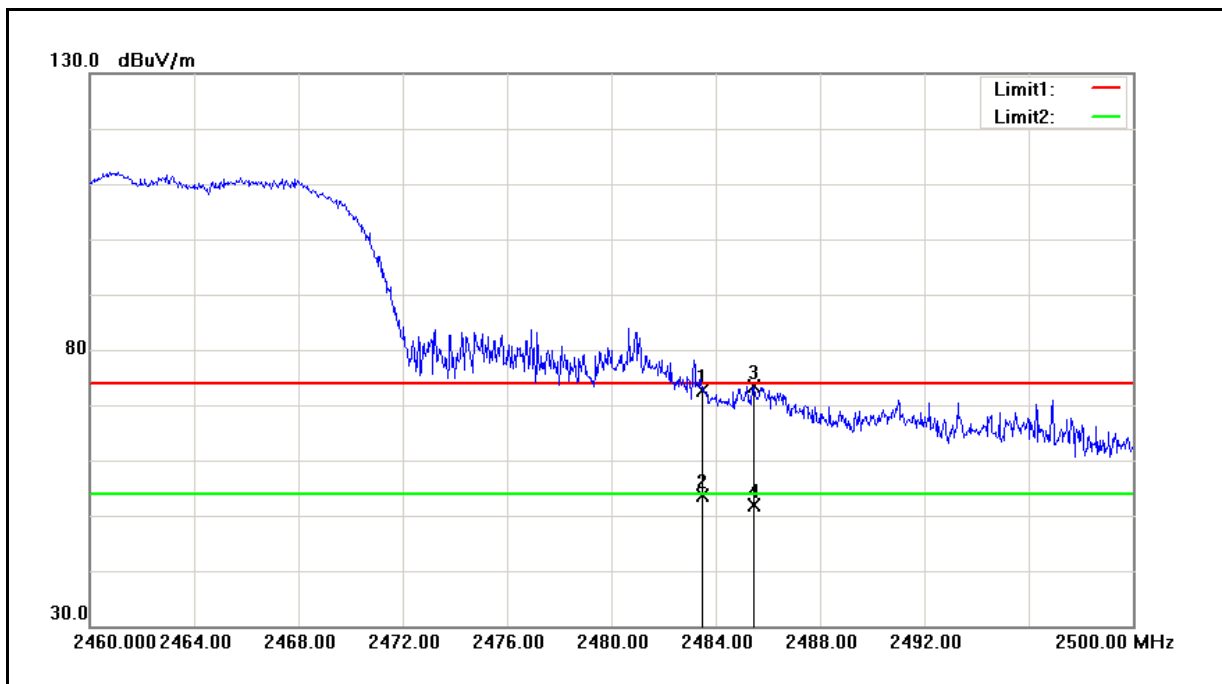
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	60.79	0.03	60.82	74.00	-13.18	peak
2	2483.500	46.73	0.03	46.76	54.00	-7.24	AVG
3	2485.040	61.25	0.04	61.29	74.00	-12.71	peak
4	2485.040	45.77	0.04	45.81	54.00	-8.19	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	3	Date:	10/01/2016
Frequency:	2462 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



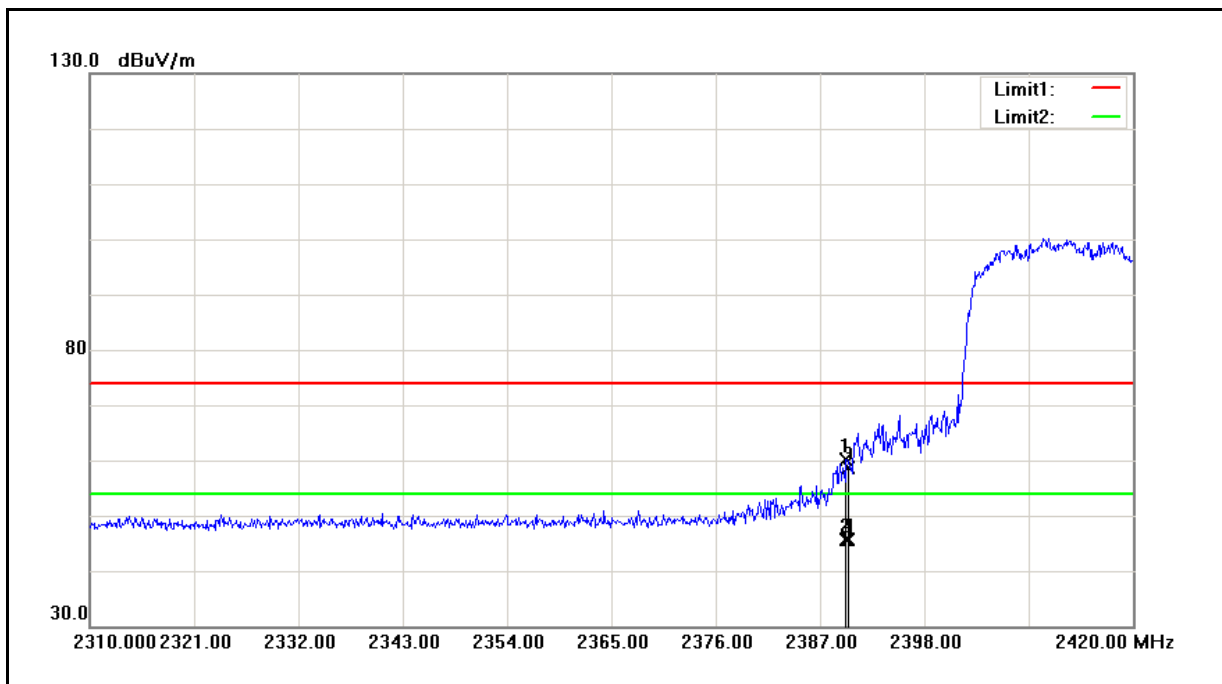
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	72.55	0.03	72.58	74.00	-1.42	peak
2	2483.500	53.71	0.03	53.74	54.00	-0.26	AVG
3	2485.440	73.26	0.04	73.30	74.00	-0.70	peak
4	2485.440	51.82	0.04	51.86	54.00	-2.14	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	4	Date:	10/01/2016
Frequency:	2412 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		



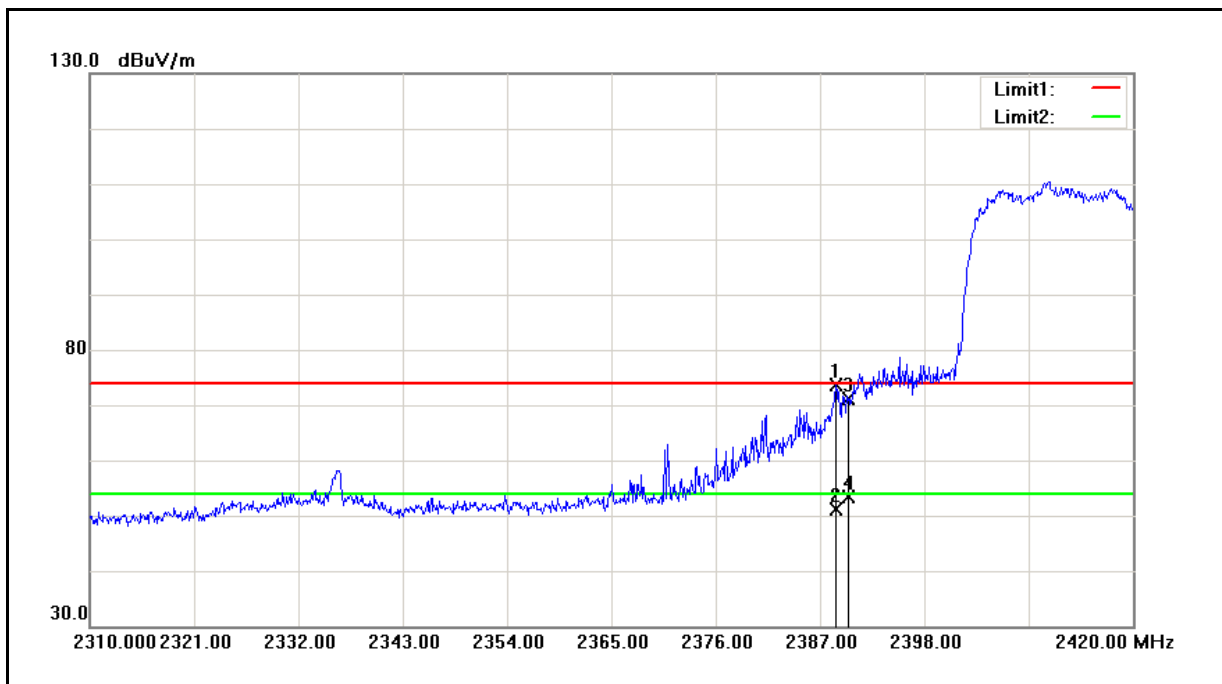
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.750	60.40	-0.34	60.06	74.00	-13.94	peak
2	2389.750	45.89	-0.34	45.55	54.00	-8.45	AVG
3	2390.000	58.93	-0.34	58.59	74.00	-15.41	peak
4	2390.000	45.98	-0.34	45.64	54.00	-8.36	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	4	Date:	10/01/2016
Frequency:	2412 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		

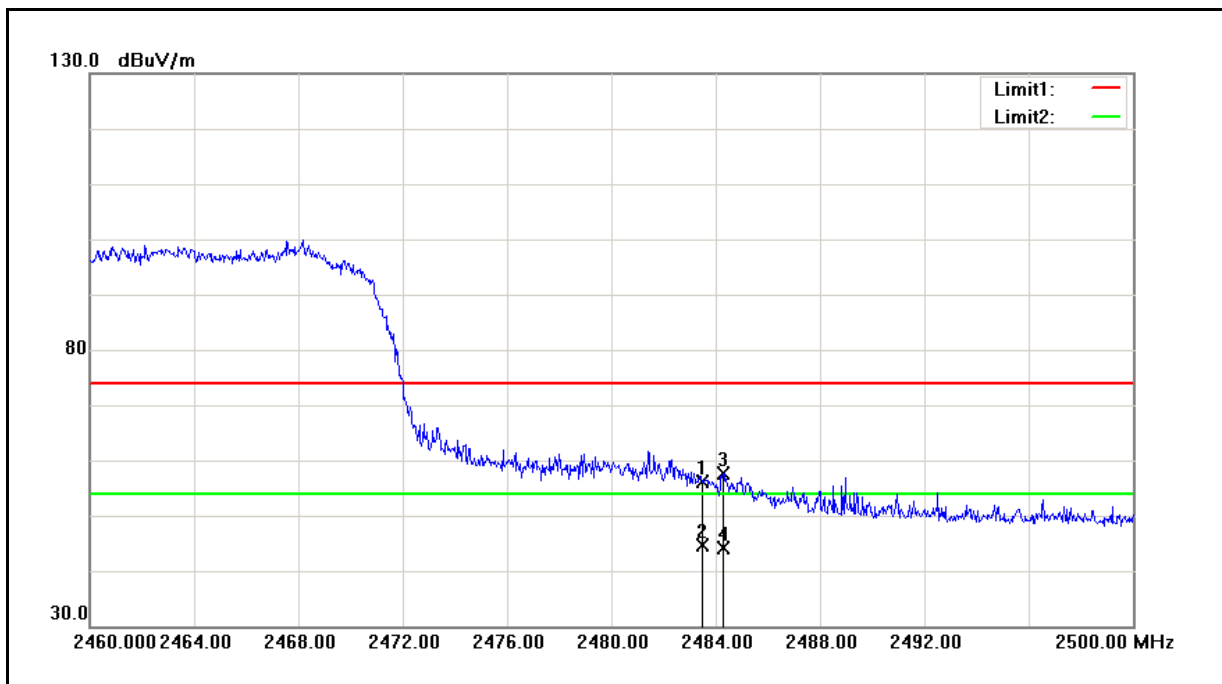


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.650	73.85	-0.34	73.51	74.00	-0.49	peak
2	2388.650	51.43	-0.34	51.09	54.00	-2.91	AVG
3	2390.000	71.59	-0.34	71.25	74.00	-2.75	peak
4	2390.000	53.83	-0.34	53.49	54.00	-0.51	AVG

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

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

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	4	Date:	10/01/2016
Frequency:	2462 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		

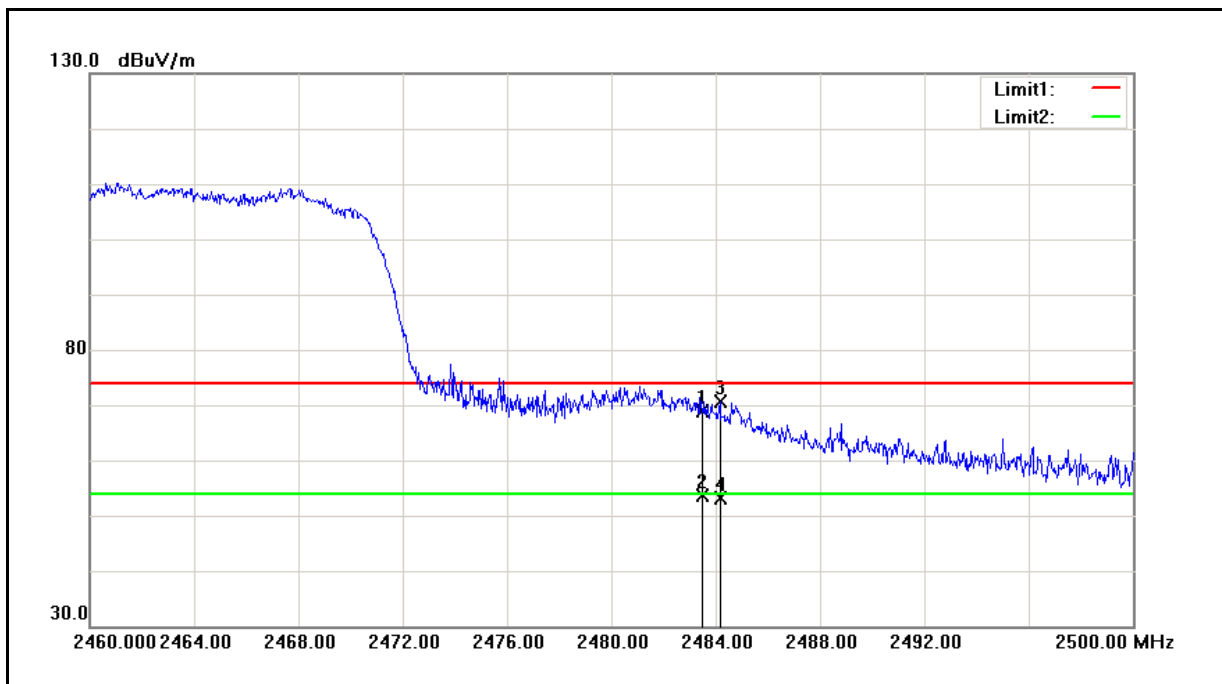


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	56.21	0.03	56.24	74.00	-17.76	peak
2	2483.500	44.68	0.03	44.71	54.00	-9.29	AVG
3	2484.280	57.68	0.04	57.72	74.00	-16.28	peak
4	2484.280	44.21	0.04	44.25	54.00	-9.75	AVG

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

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

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	4	Date:	10/01/2016
Frequency:	2462 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



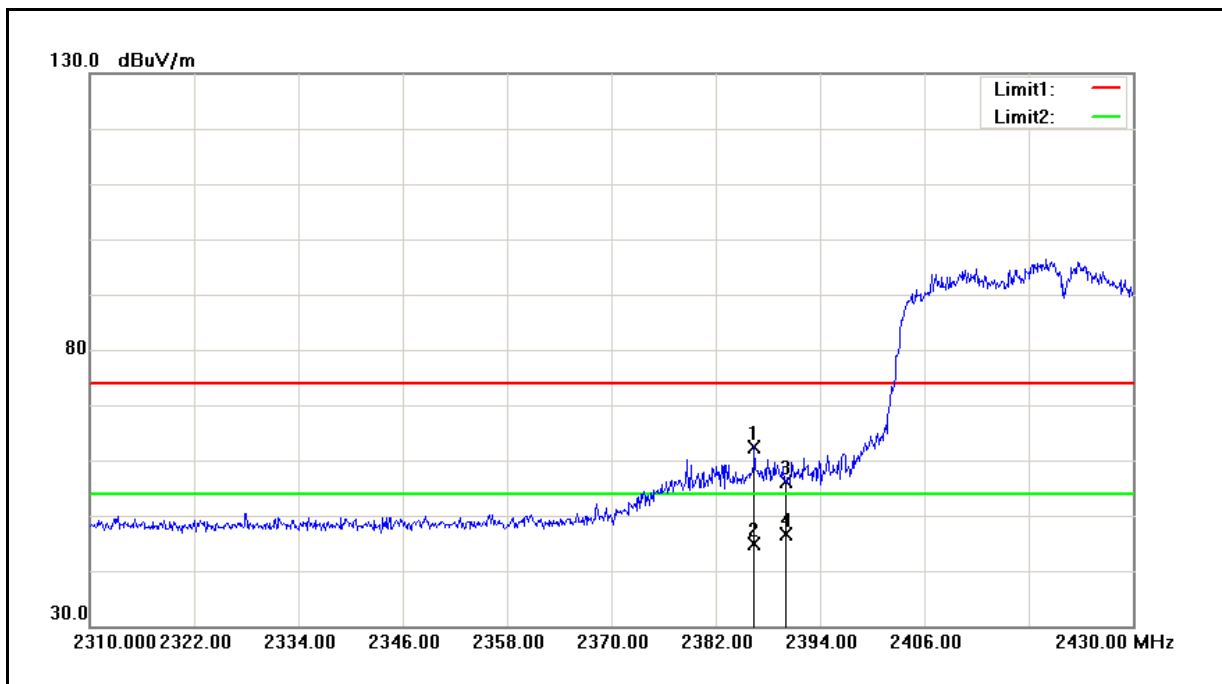
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	68.89	0.03	68.92	74.00	-5.08	peak
2	2483.500	53.51	0.03	53.54	54.00	-0.46	AVG
3	2484.160	70.58	0.04	70.62	74.00	-3.38	peak
4	2484.160	53.12	0.04	53.16	54.00	-0.84	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	5	Date:	01/22/2015
Frequency:	2422 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		



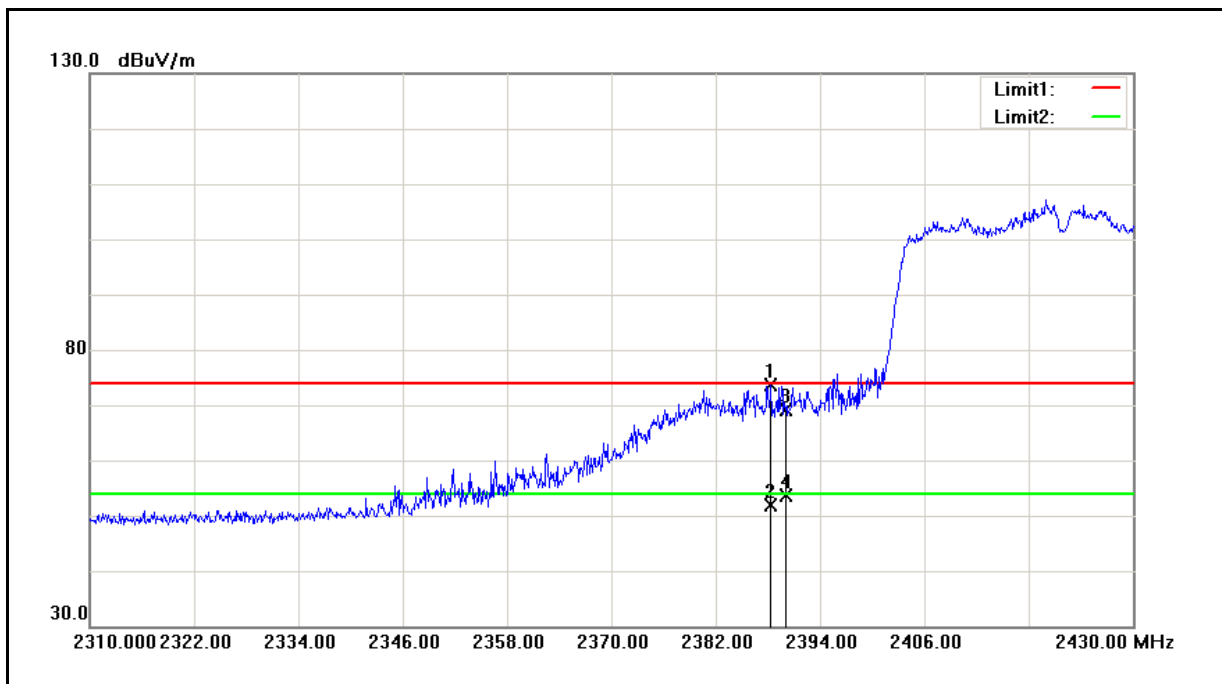
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2386.440	62.86	-0.36	62.50	74.00	-11.50	peak
2	2386.440	45.19	-0.36	44.83	54.00	-9.17	AVG
3	2390.000	56.38	-0.34	56.04	74.00	-17.96	peak
4	2390.000	47.09	-0.34	46.75	54.00	-7.25	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	5	Date:	01/22/2015
Frequency:	2422 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



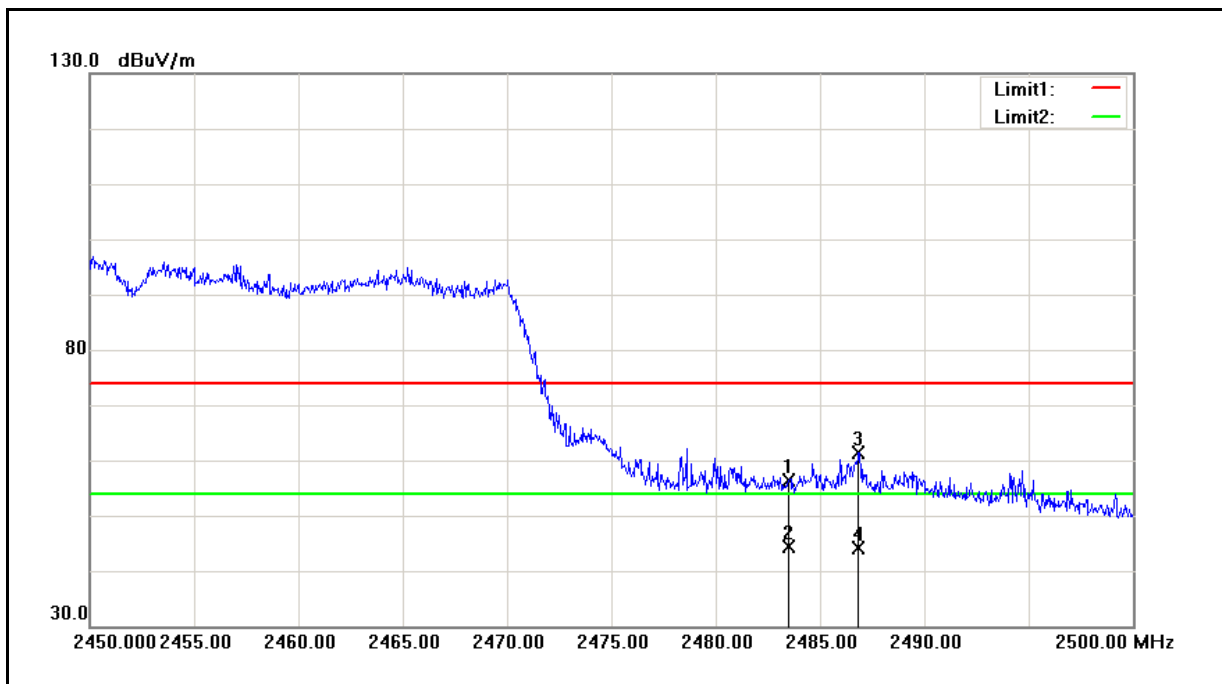
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.360	74.04	-0.34	73.70	74.00	-0.30	peak
2	2388.360	52.32	-0.34	51.98	54.00	-2.02	AVG
3	2390.000	69.47	-0.34	69.13	74.00	-4.87	peak
4	2390.000	54.01	-0.34	53.67	54.00	-0.33	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	5	Date:	01/22/2015
Frequency:	2452 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		



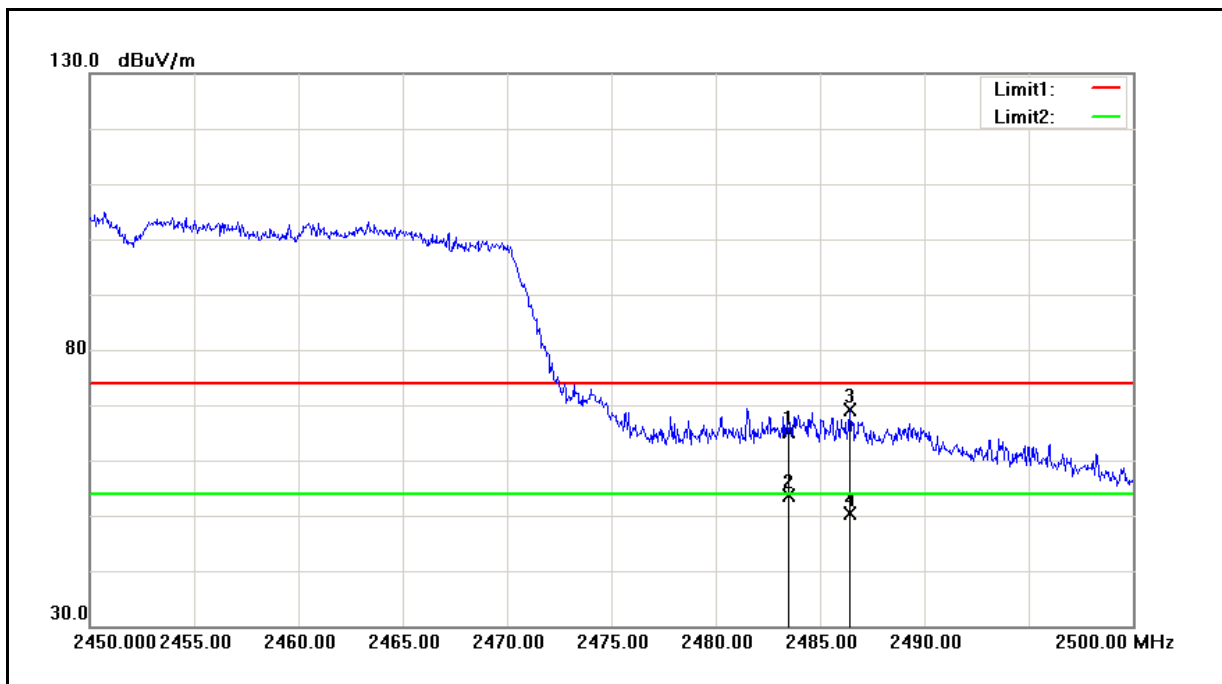
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	56.31	0.03	56.34	74.00	-17.66	peak
2	2483.500	44.32	0.03	44.35	54.00	-9.65	AVG
3	2486.850	61.37	0.04	61.41	74.00	-12.59	peak
4	2486.850	44.06	0.04	44.10	54.00	-9.90	AVG

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

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



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	VMG1312-B10D	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Mode:	5	Date:	01/22/2015
Frequency:	2452 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	65.11	0.03	65.14	74.00	-8.86	peak
2	2483.500	53.67	0.03	53.70	54.00	-0.30	AVG
3	2486.450	69.03	0.04	69.07	74.00	-4.93	peak
4	2486.450	50.37	0.04	50.41	54.00	-3.59	AVG

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

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

6 Maximum Conducted Output Power Measurement

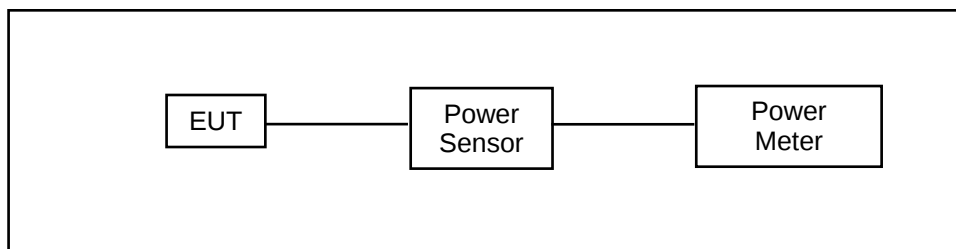
6.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for maximum output power is 30dBm.

And According to 15.247 (b), 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 6dBi.

- * SISO mode for ANT-0 : Directional Gain = Max. Gain = 3 dBi < 6 dBi.
- * CDD mode : $10 \cdot \log\{[10^{(G1/10)} + 10^{(G2/10)} + \dots + 10^{(Gn/10)}] / N_{ANT}\} = 3 \text{ dBi} < 6 \text{ dBi}$
- * Power Limit = 30 dBm

6.2. Test Setup



6.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Power Sensor	Anritsu	MA2411B	1126022	08/29/2016	1 year
Power Meter	Anritsu	ML2495A	1135009	08/29/2016	1 year
Microwave Cable	EMCI	EMC104-SM-SM-1500	140303	02/23/2016	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

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

6.4. Test Procedure

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.



6.5. Test Result

Test Mode	Frequency (MHz)	RF Power setting in Test Software		Test Software Version
		ANT-0	ANT-1	
Mode 2	2412	76.0	---	MTool Version 2.0.1.1
	2437	76.0	---	
	2462	67.0	---	
Mode 3	2412	51.0	51.0	
	2437	74.0	74.0	
	2462	45.0	45.0	
Mode 4	2412	44.0	44.0	
	2437	71.0	71.0	
	2462	38.0	38.0	
Mode 5	2422	38.0	38.0	
	2437	42.0	42.0	
	2452	37.0	37.0	

Model Number	VMG1312-B10D						
Test Item	Maximum Conducted Output Power						
Date of Test	09/05/2016						
Test Mode	Frequency (MHz)	Data Rate	Average Output Power				
			Measurement Results				Limit
			ANT-0		ANT-1		
			dBm	W	dBm	W	
Mode 2	2412	1M	18.08	0.064	---	---	< 30
	2437		18.01	0.063	---	---	< 30
	2462		14.79	0.030	---	---	< 30
Mode 3	2412	6M	12.86	0.019	14.94	0.031	< 30
	2437		17.85	0.061	20.39	0.109	< 30
	2462		9.46	0.009	12.99	0.020	< 30
Mode 4	2412	13M	10.36	0.011	13.18	0.021	< 30
	2437		17.03	0.050	19.64	0.092	< 30
	2462		8.75	0.007	11.58	0.014	< 30
Mode 5	2422	27M	8.46	0.007	11.41	0.014	< 30
	2437		10.43	0.011	12.50	0.018	< 30
	2452		8.29	0.007	10.33	0.011	< 30

Note:1. The relevant measured result has the offset with cable loss already.

2. Evaluated high and low data rate, the report record worst case low data rate measurement results.



Model Number	VMG1312-B10D				
Test Item	Maximum Conducted Output Power				
Date of Test	09/05/2016				
Test Mode	Frequency (MHz)	Data Rate	Average Output Power		
			Measurement Results		Limit
			ANT-0+1		
			dBm	W	dBm
Mode 3	2412	6M	17.03	0.051	< 30
	2437		22.31	0.170	< 30
	2462		14.58	0.029	< 30
Mode 4	2412	13M	15.01	0.032	< 30
	2437		21.54	0.143	< 30
	2462		13.40	0.022	< 30
Mode 5	2422	27M	13.19	0.021	< 30
	2437		14.60	0.029	< 30
	2452		12.44	0.018	< 30

Note:1. The relevant measured result has the offset with cable loss already.

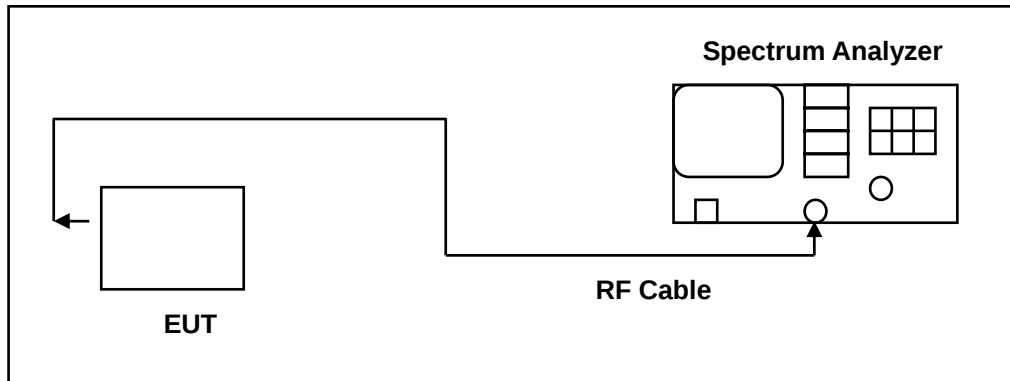
2. Evaluated high and low data rate, the report record worst case low data rate measurement results.

7 6dB RF Bandwidth Measurement

7.1. Limit

6dB RF Bandwidth: Systems using digital modulation techniques may operate in the 2400–2483.5 MHz bands. The minimum 6 dB band-width shall be at least 500 kHz.

7.2. Test Setup



7.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	1 year
Microwave Cable	EMCI	EMC104-SM-SM-1500	140303	02/23/2016	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

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

7.4. Test Procedure

The EUT tested to DTS test procedure of KDB558074D01 for compliance to FCC 47CFR 15.247 requirements.

6dB RF Bandwidth: The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A peak output reading was taken, a DISPLAY line was drawn 6 dB lower than peak level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

The test was performed at 3 channels (Channel low, middle, high)



7.5. Test Result

Model Number	VMG1312-B10D			
Test Item	6dB RF Bandwidth			
Date of Test	09/30/2016			
Test Mode	Frequency (MHz)	Measurement (kHz)		Limit (kHz)
		ANT-0	ANT-1	
Mode 2	2412	857.7	---	> 500
	2437	811.7	---	> 500
	2462	807.8	---	> 500
Mode 3	2412	15110	15050	> 500
	2437	15090	14720	> 500
	2462	13830	15130	> 500
Mode 4	2412	15100	14490	> 500
	2437	15050	15090	> 500
	2462	13790	15090	> 500
Mode 5	2422	35150	35150	> 500
	2437	35140	35730	> 500
	2452	35330	35770	> 500



7.6. Test Graphs

Mode 2: IEEE 802.11b link mode_ANT-0

2412 MHz



2437 MHz



2462 MHz





Mode 3: IEEE 802.11g link mode_ANT-0

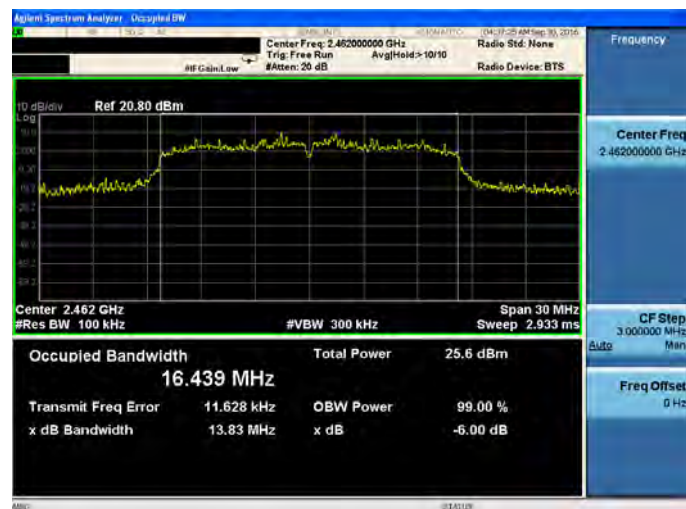
2412 MHz



2437 MHz



2462 MHz





Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-0

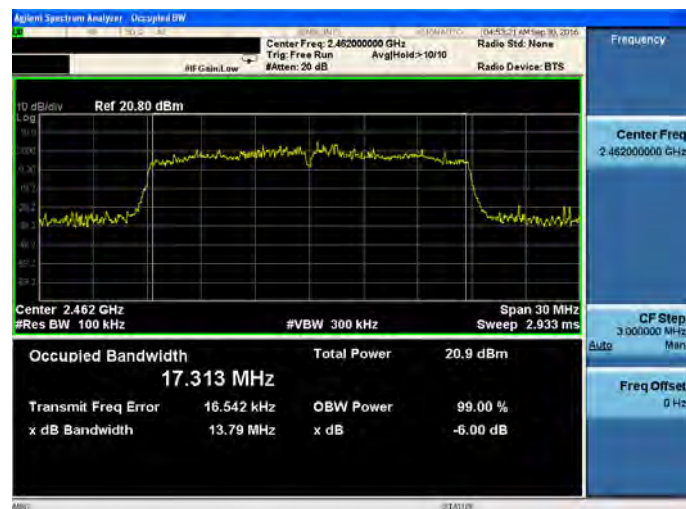
2412 MHz



2437 MHz



2462 MHz



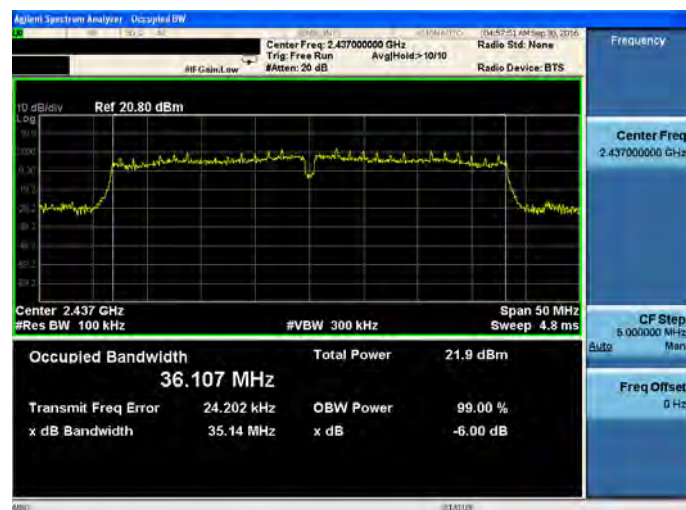


Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode_ANT-0

2422 MHz



2437 MHz



2452 MHz





Mode 3: IEEE 802.11g link mode_ANT-1

2412 MHz



2437 MHz



2462 MHz



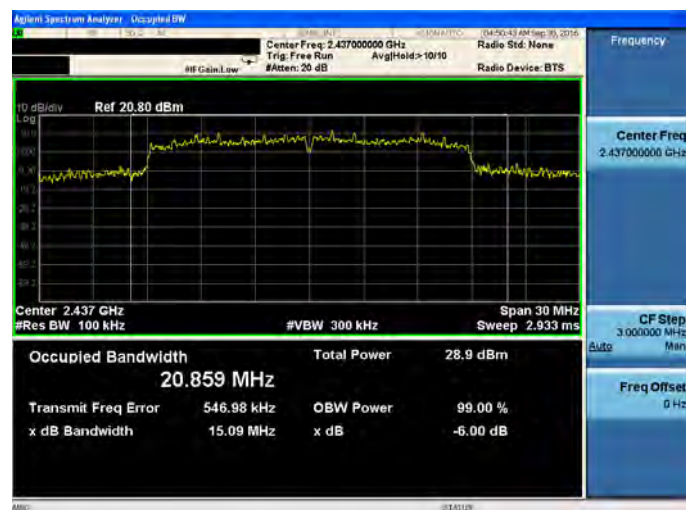


Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode_ANT-1

2412 MHz



2437 MHz



2462 MHz



57 of 89

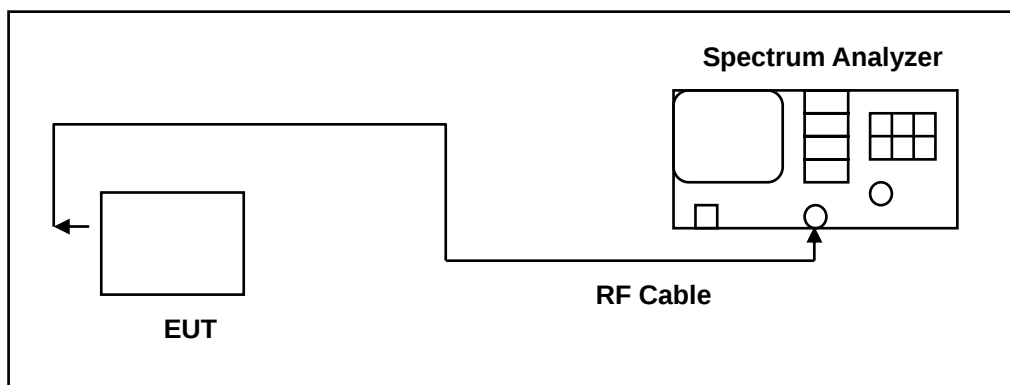
8 Maximum Power Density Measurement

8.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

- * SISO mode for ANT-0 : Directional Gain = Max. Gain = 3 dBi < 6 dBi.
- * CDD mode : Directional Gain = $10 \cdot \log\{[10^{(G1/20)} + 10^{(G2/20)} + \dots + 10^{(Gn/20)}]^2 / N_{ANT}\} = 6.01 \text{ dBi} > 6 \text{ dBi}$;
- * Conducted Power Spectral Density Limit = $8 - 0.01 = 7.99 \text{ dBm/MHz}$

8.2. Test Setup



8.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	1 year
Microwave Cable	EMCI	EMC104-SM-SM-1500	140303	02/23/2016	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

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

8.4. Test Procedure

The EUT tested to DTS test procedure of KDB558074D01 for compliance to FCC 47CFR 15.247 requirements.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

8.5. Test Result

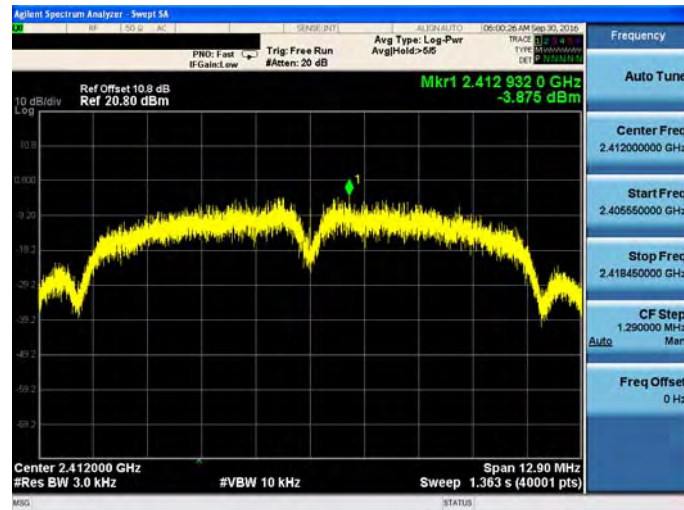
Model Number	VMG1312-B10D				
Test Item	Maximum Power Density				
Date of Test	10/03/2016				
Test Mode	Frequency (MHz)	Measurement (dBm/3KHz)			Limit (dBm/3KHz)
		ANT-0	ANT-1	ANT-0+1	
Mode 2	2412	-3.875	---	---	< 8
	2437	-3.190	---	---	< 8
	2462	-5.395	---	---	< 8
Mode 3	2412	-11.480	-10.584	-7.999	< 7.99
	2437	-6.986	-3.646	-1.992	< 7.99
	2462	-11.542	-11.128	-8.320	< 7.99
Mode 4	2412	-14.429	-10.580	-9.081	< 7.99
	2437	-7.819	-5.195	-3.301	< 7.99
	2462	-15.755	-12.236	-10.638	< 7.99
Mode 5	2422	-17.939	-16.309	-14.038	< 7.99
	2437	-17.952	-15.652	-13.641	< 7.99
	2452	-17.883	-16.498	-14.125	< 7.99



8.6. Test Graphs

Mode 2: IEEE 802.11b link mode_ANT-0

2412 MHz



2437 MHz



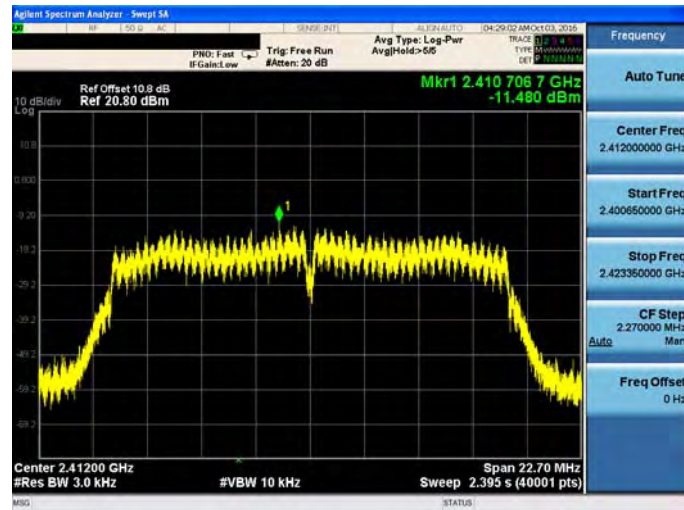
2462 MHz





Mode 3: IEEE 802.11g link mode_ANT-0

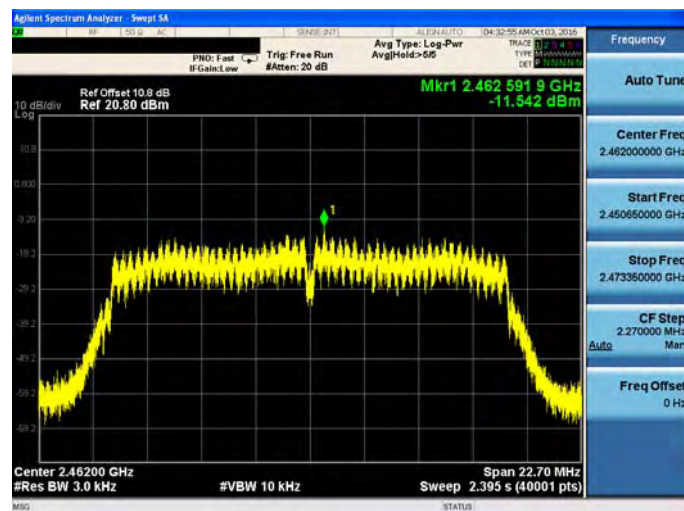
2412 MHz



2437 MHz



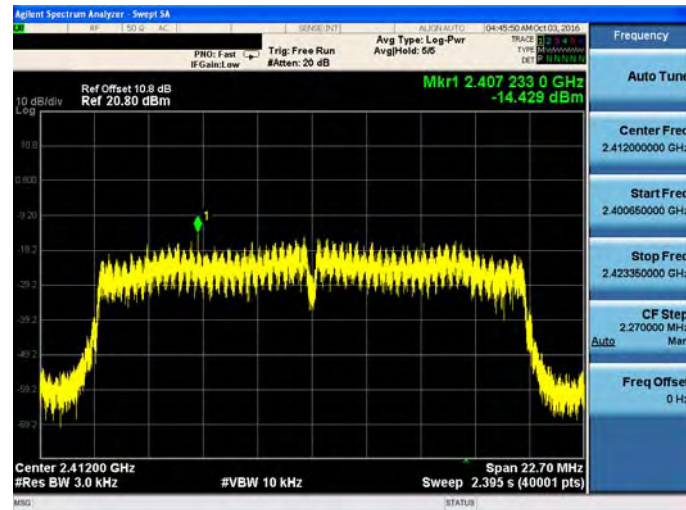
2462 MHz



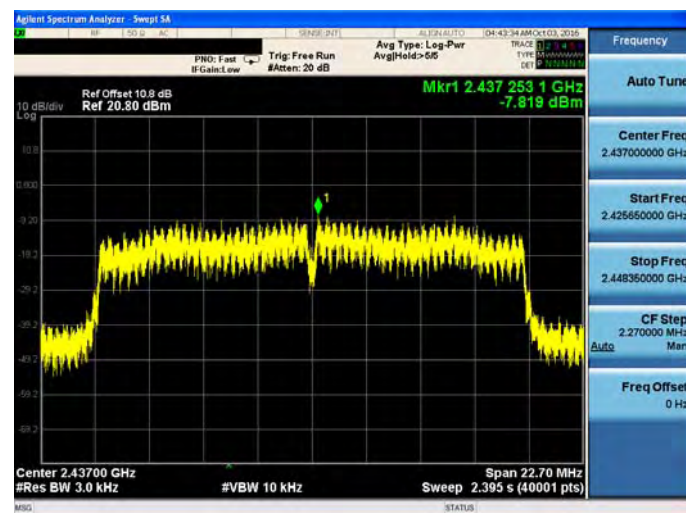


Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-0

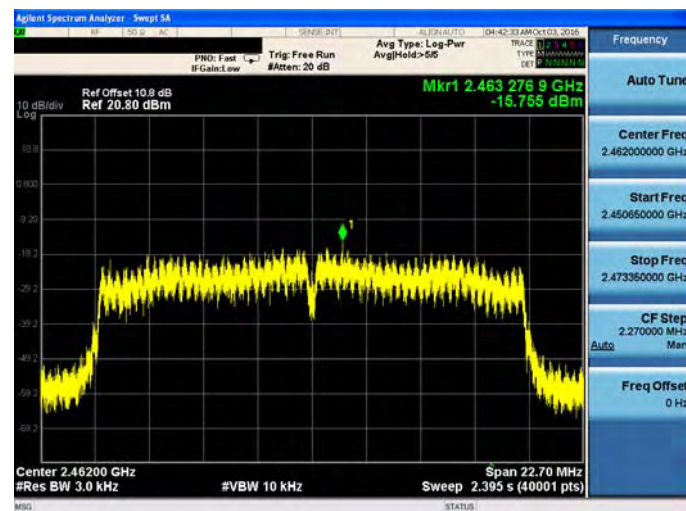
2412 MHz



2437 MHz



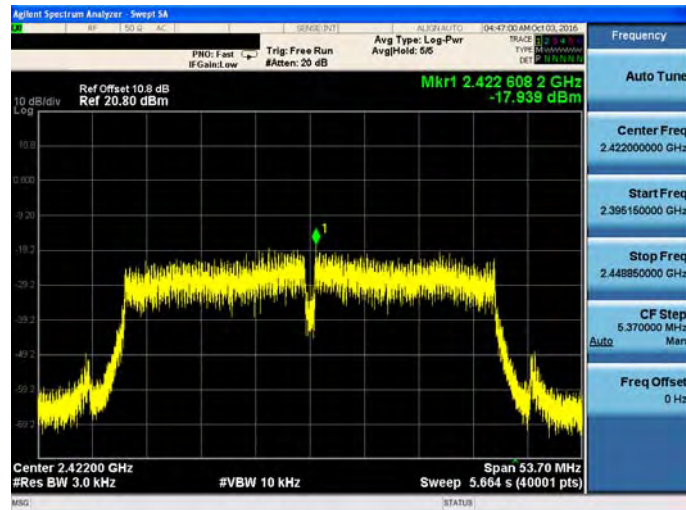
2462 MHz



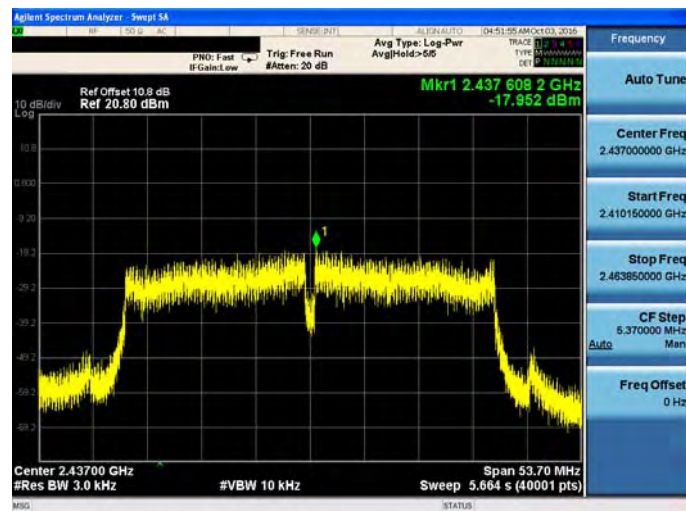


Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode _ANT-0

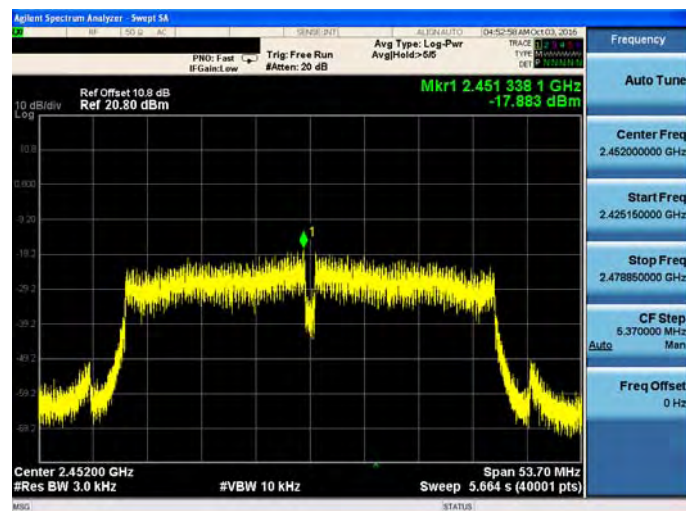
2422 MHz



2437 MHz



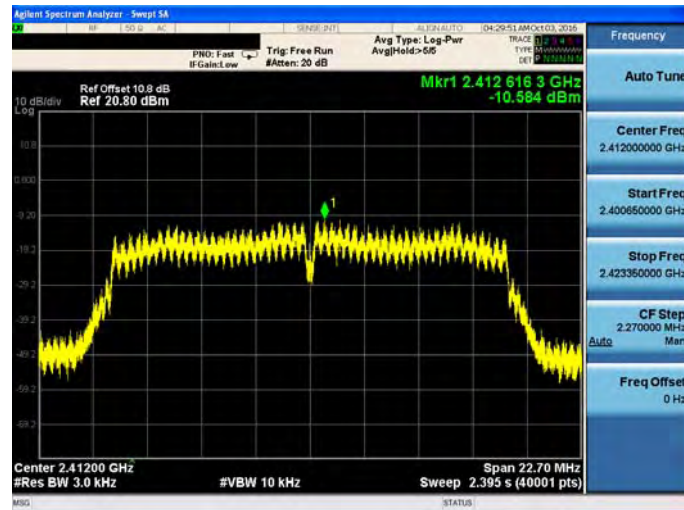
2452 MHz



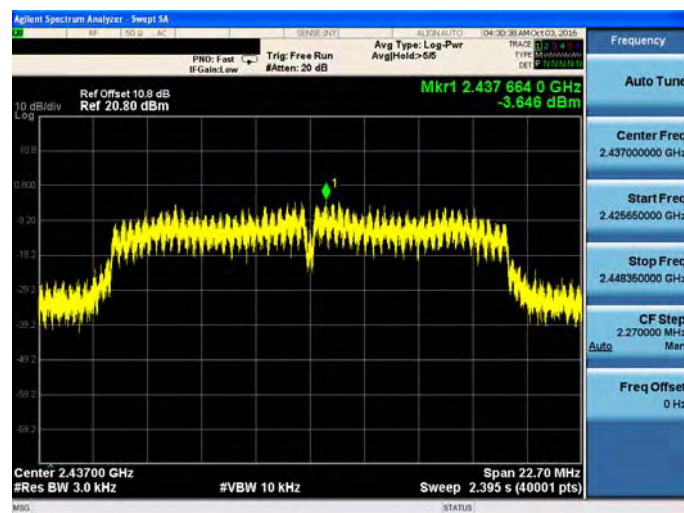


Mode 3: IEEE 802.11g link mode_ANT-1

2412 MHz



2437 MHz



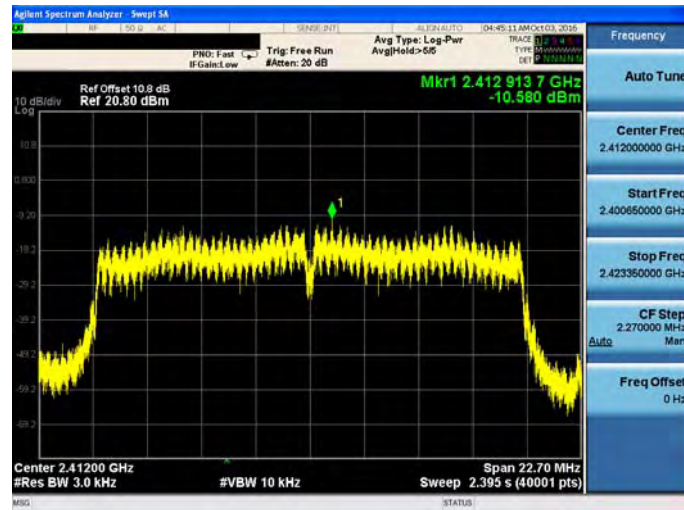
2462 MHz





Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-1

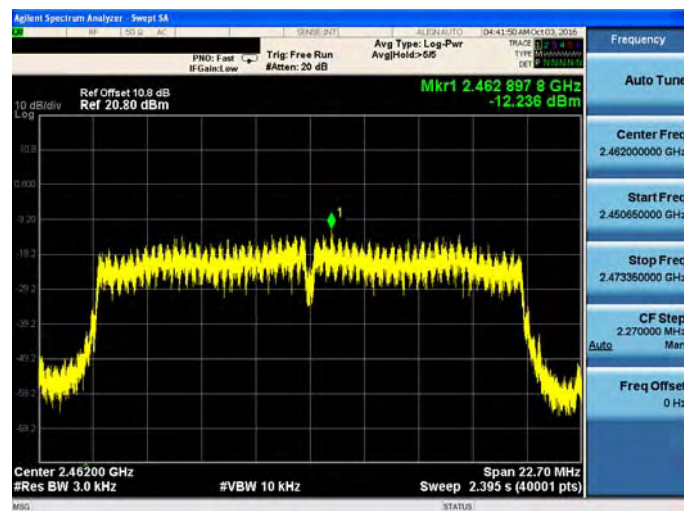
2412 MHz



2437 MHz



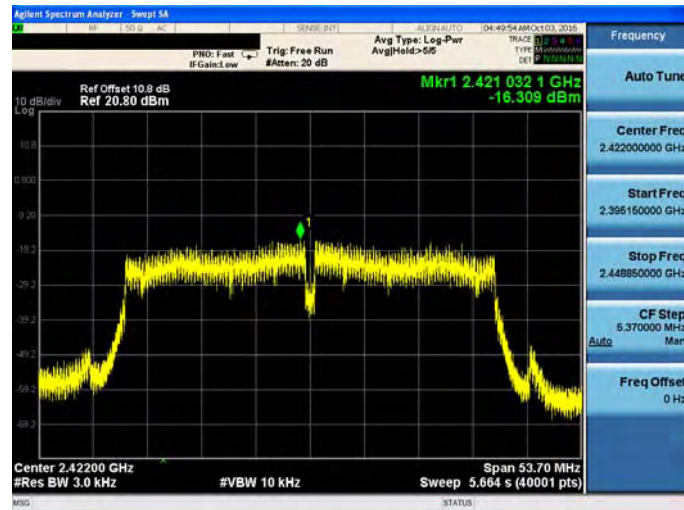
2462 MHz



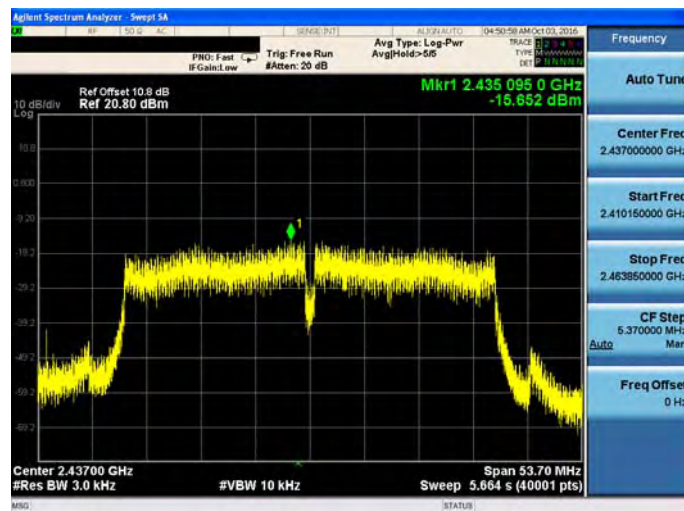


Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode _ANT-1

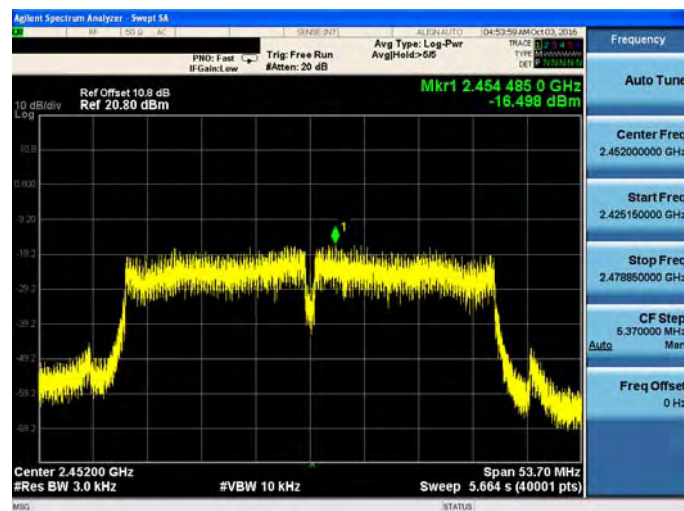
2422 MHz



2437 MHz



2452 MHz

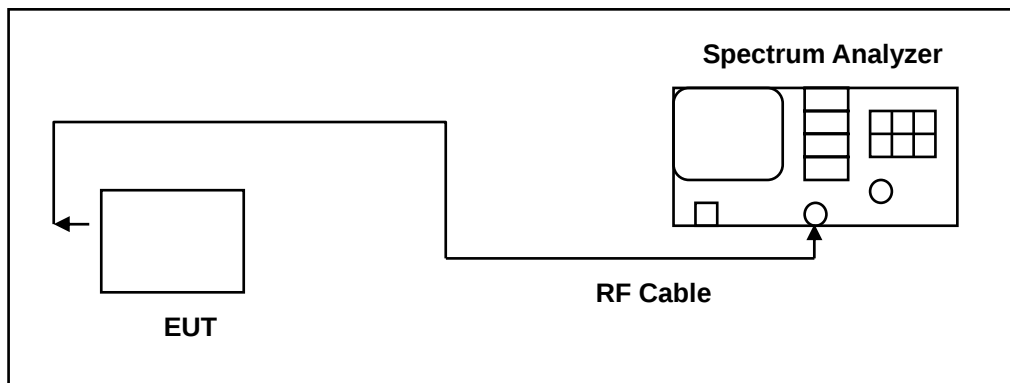


9 Out of Band Conducted Emissions Measurement

9.1. 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 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

9.2. Test Setup



9.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	1 year
Spectrum Analyzer	Agilent	E4408B	MY45107753	08/08/2016	1 year
Microwave Cable	EMCI	EMC104-SM-SM-1500	140303	02/23/2016	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

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

9.4. Test Procedure

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 30 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.



9.5. Test Graphs

Reference level

Mode 2: IEEE 802.11b link mode_ANT-0

2412 MHz



2437 MHz



2462 MHz





Mode 3: IEEE 802.11g link mode_ANT-0

2412 MHz



2437 MHz



2462 MHz





Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-0

2412 MHz



2437 MHz



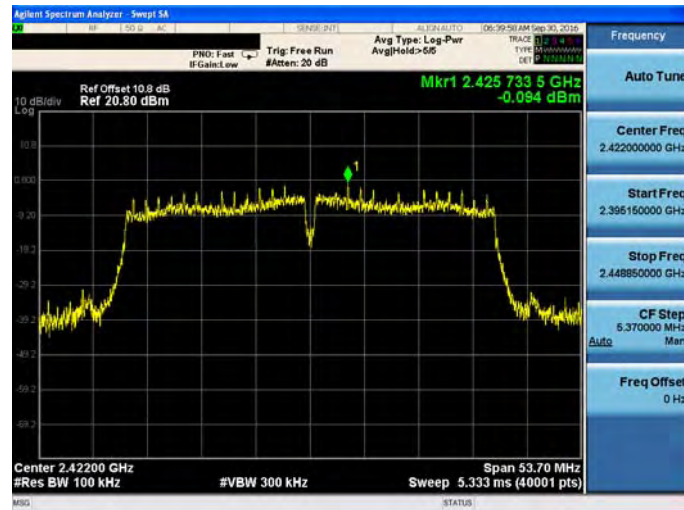
2462 MHz





Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode _ANT-0

2422 MHz



2437 MHz



2452 MHz





Mode 3: IEEE 802.11g link mode_ANT-1

2412 MHz



2437 MHz



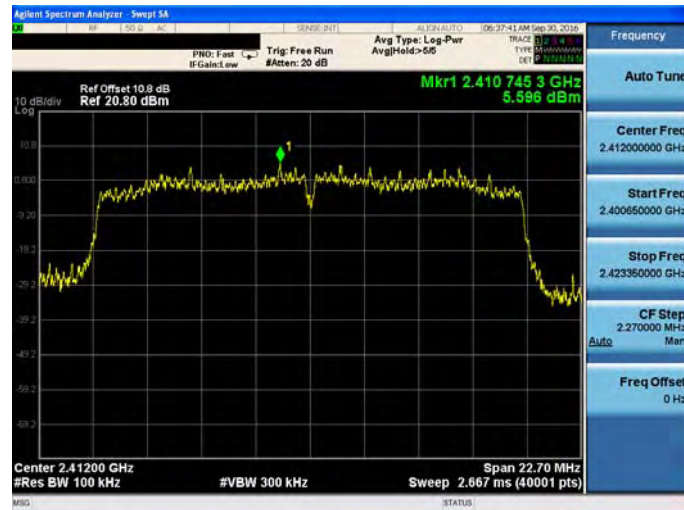
2462 MHz





Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-1

2412 MHz



2437 MHz



2462 MHz



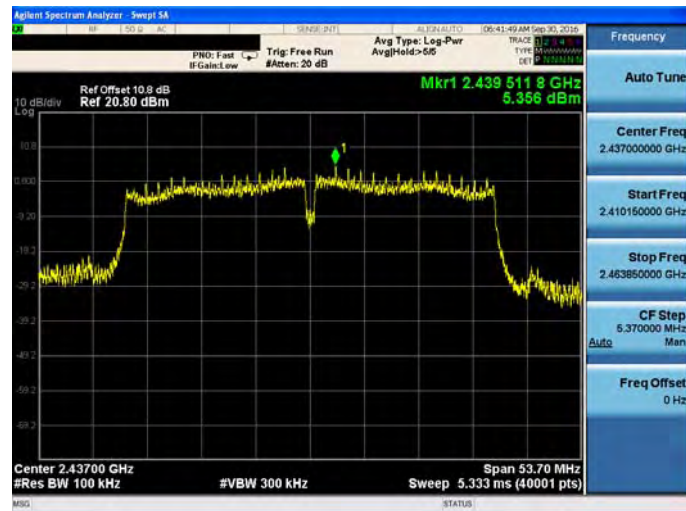


Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode _ANT-1

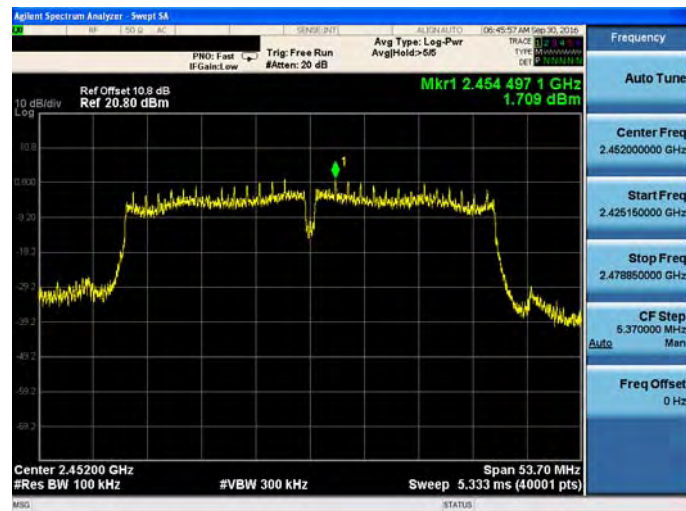
2422 MHz



2437 MHz



2452 MHz

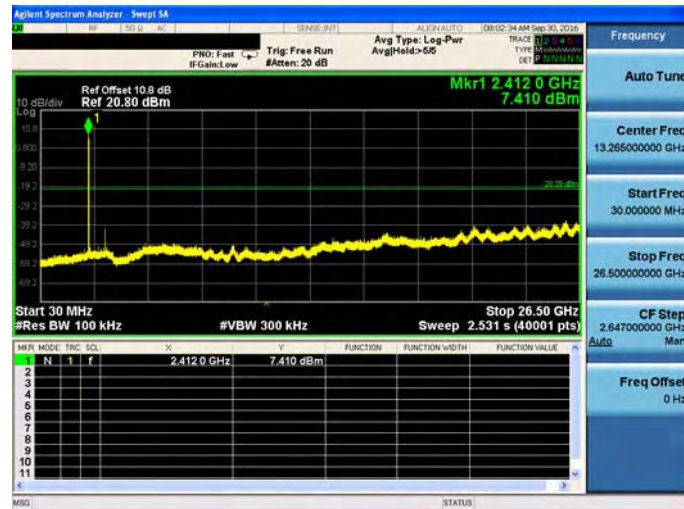




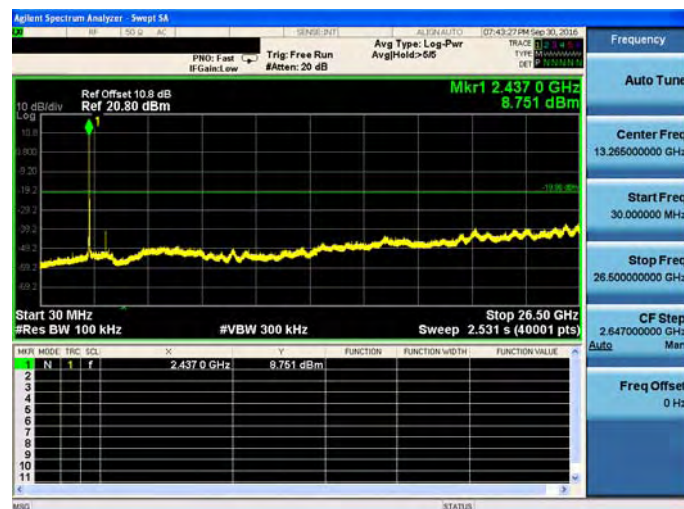
Out of Band Conducted Emissions

Mode 2: IEEE 802.11b link mode_ANT-0

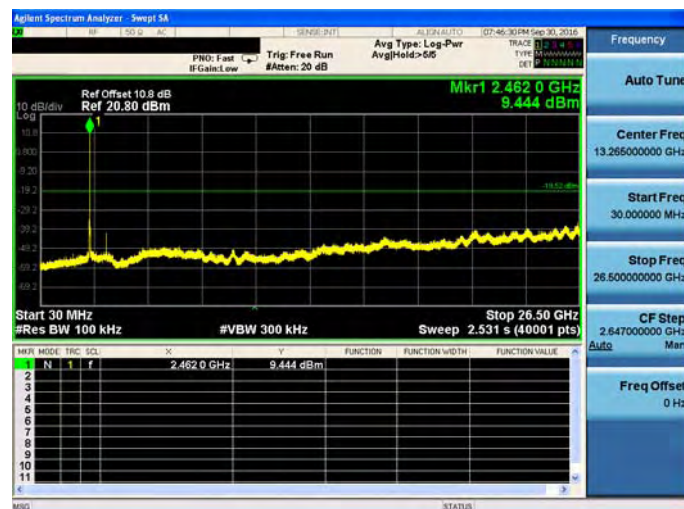
2412 MHz



2437 MHz



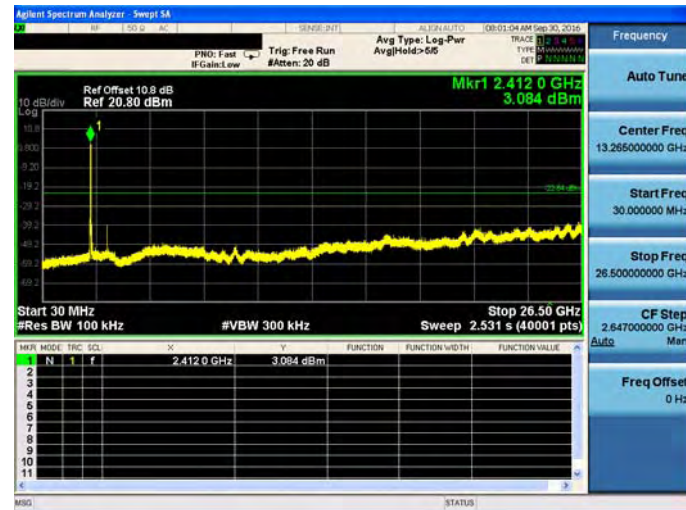
2462 MHz



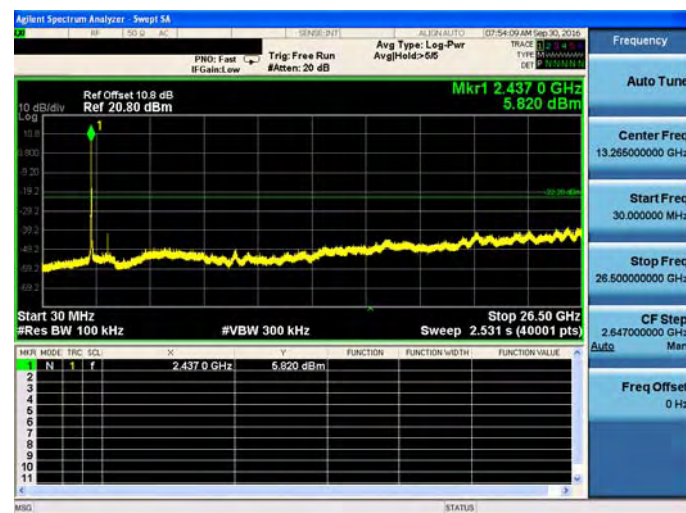


Mode 3: IEEE 802.11g link mode_ANT-0

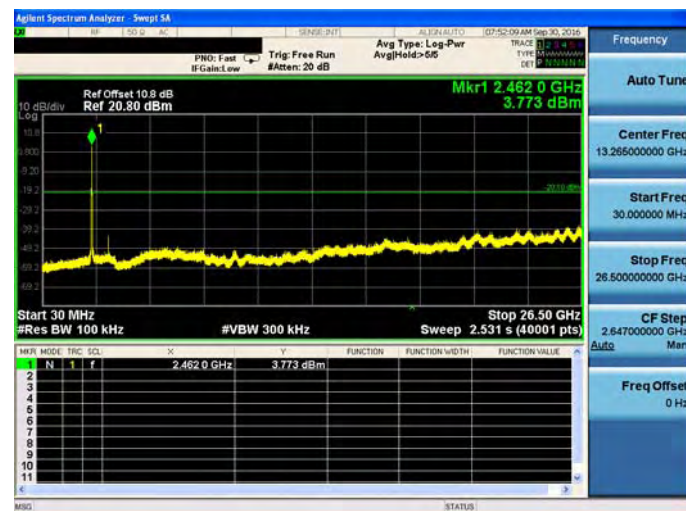
2412 MHz



2437 MHz



2462 MHz



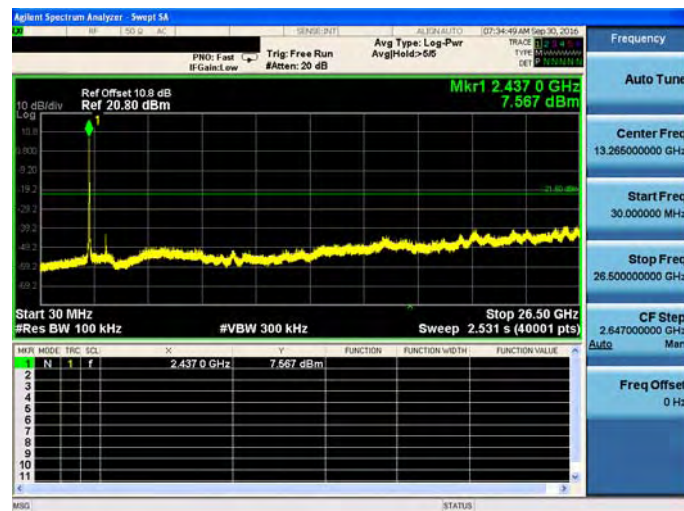


Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-0

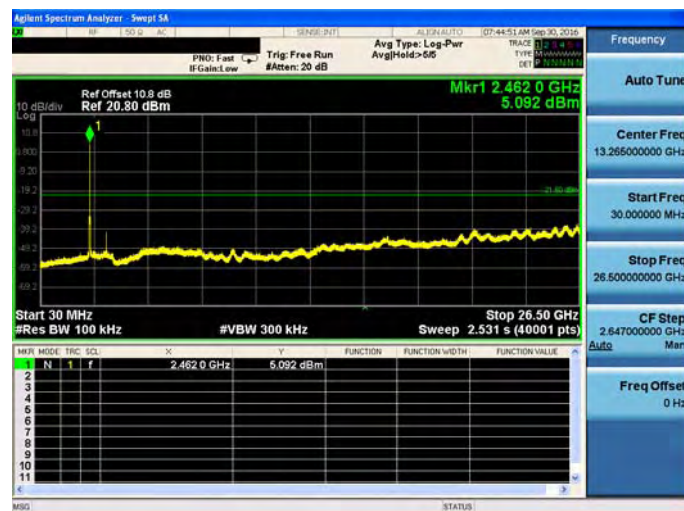
2412 MHz



2437 MHz



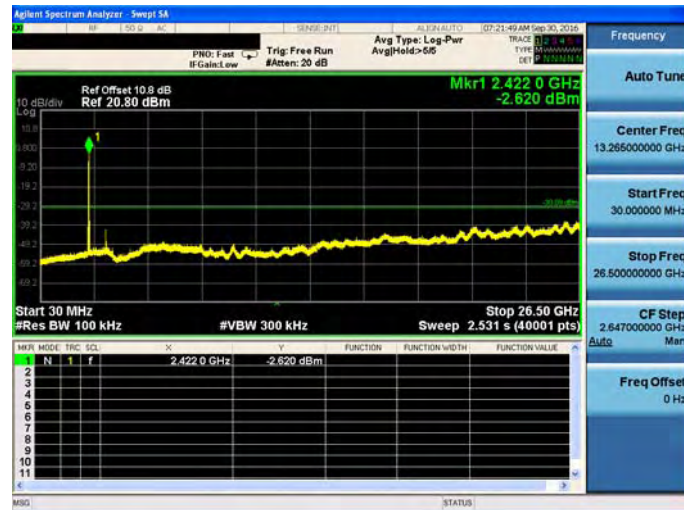
2462 MHz





Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode _ANT-0

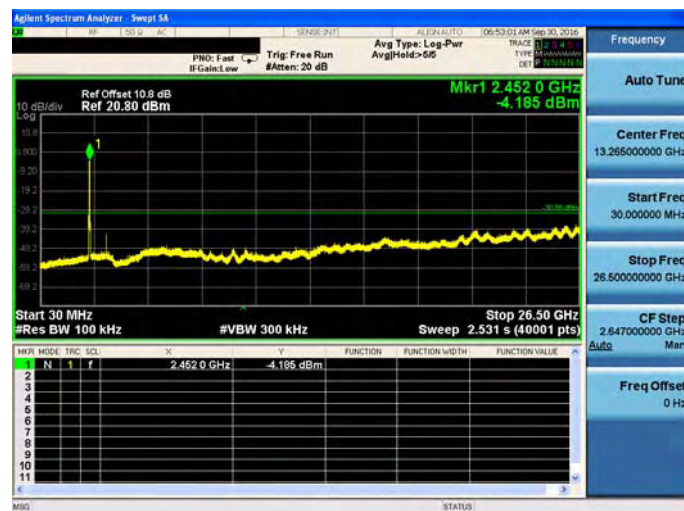
2422 MHz



2437 MHz



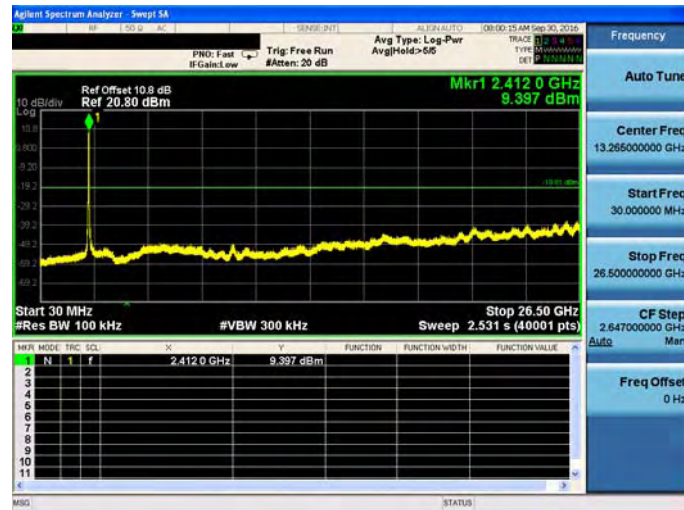
2452 MHz





Mode 3: IEEE 802.11g link mode_ANT-1

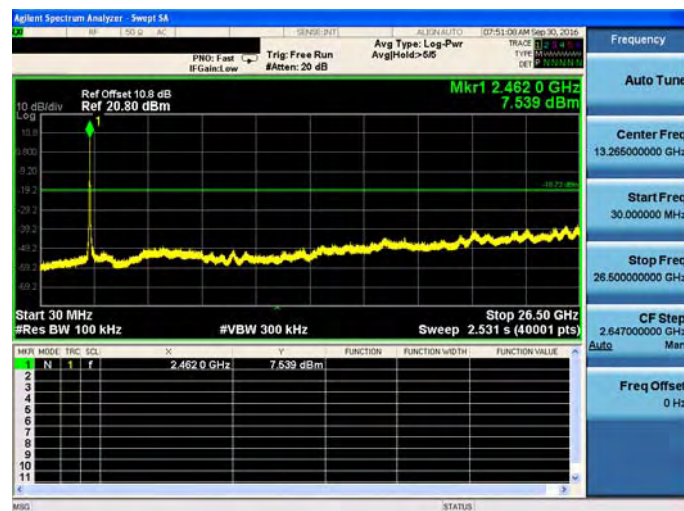
2412 MHz



2437 MHz



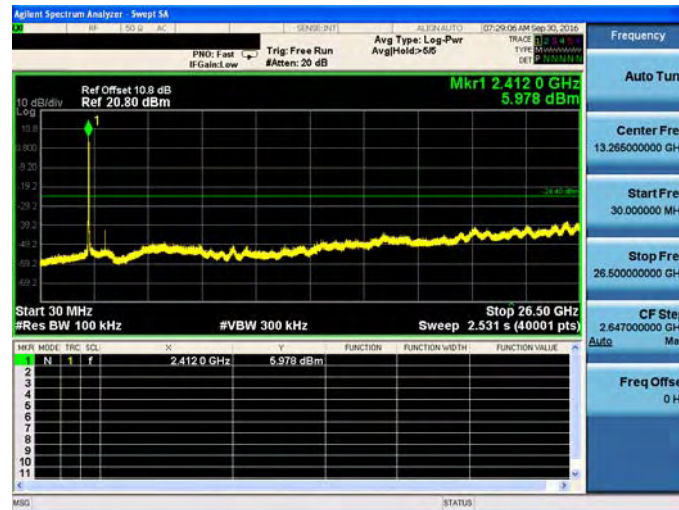
2462 MHz



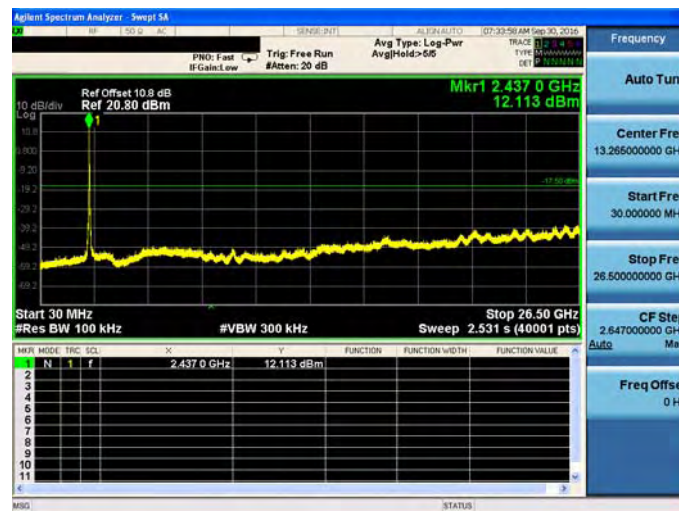


Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode _ANT-1

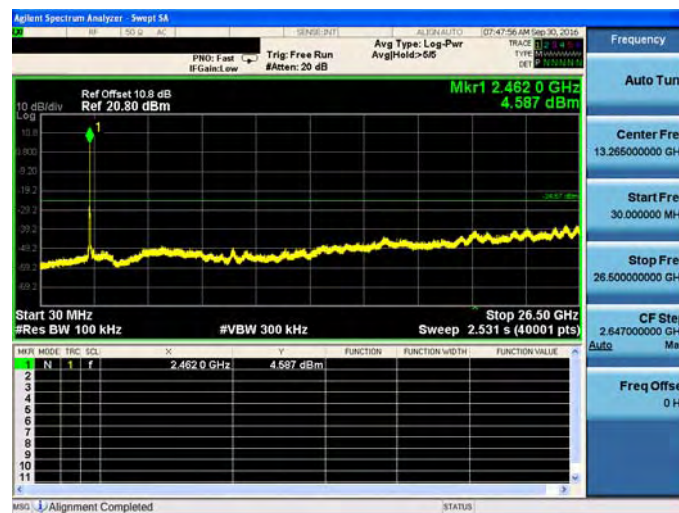
2412 MHz



2437 MHz



2462 MHz





Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode _ANT-1

2422 MHz



2437 MHz



2452 MHz

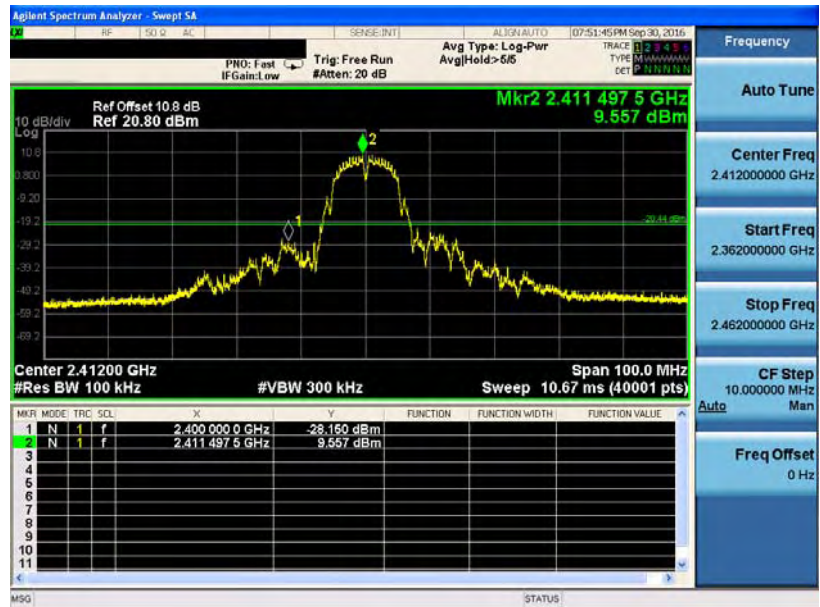




Conducted Band Edge

Mode 2: IEEE 802.11b link mode_ANT-0

2412 MHz



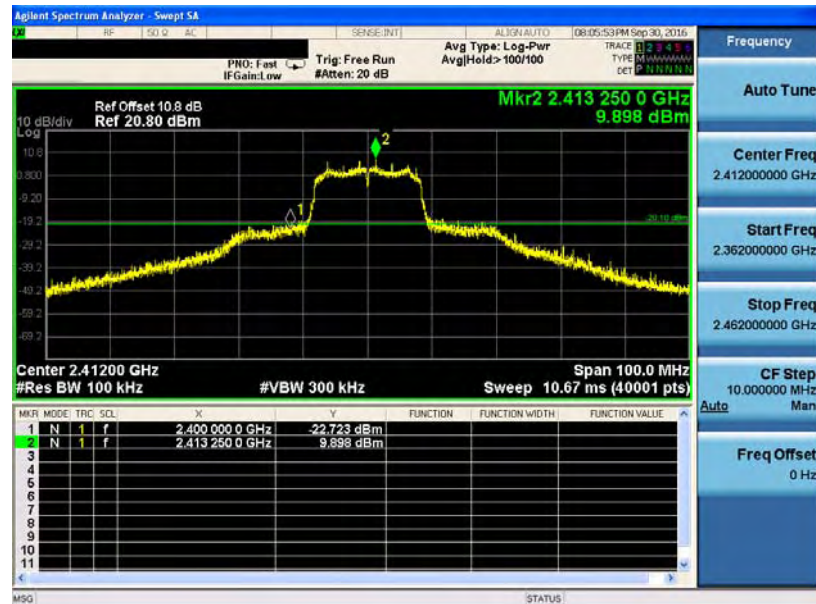
2462 MHz



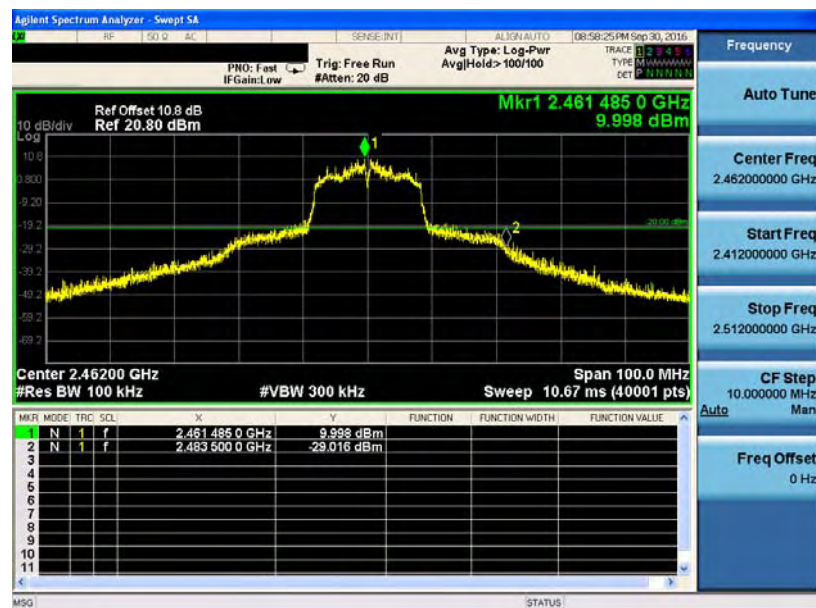


Mode 3: IEEE 802.11g link mode _ANT-0

2412 MHz



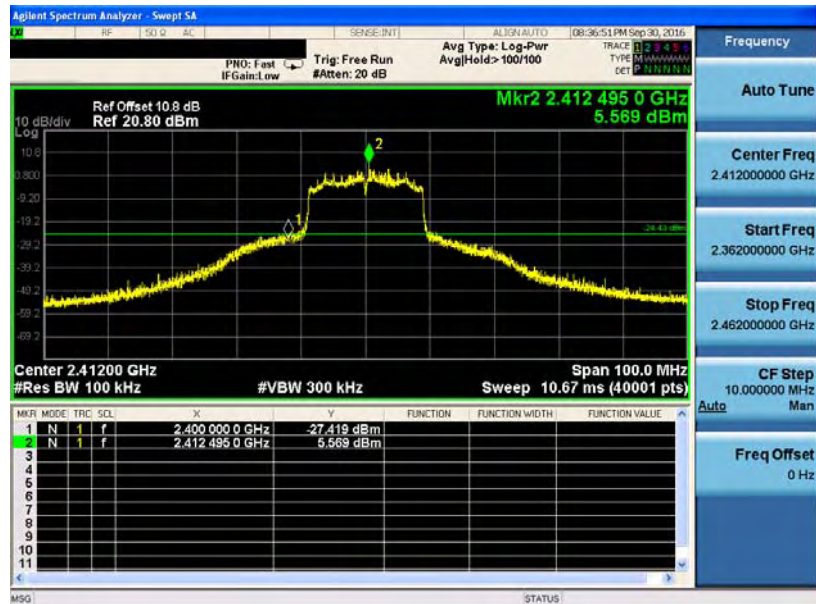
2462 MHz





Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode_ANT-0

2412 MHz



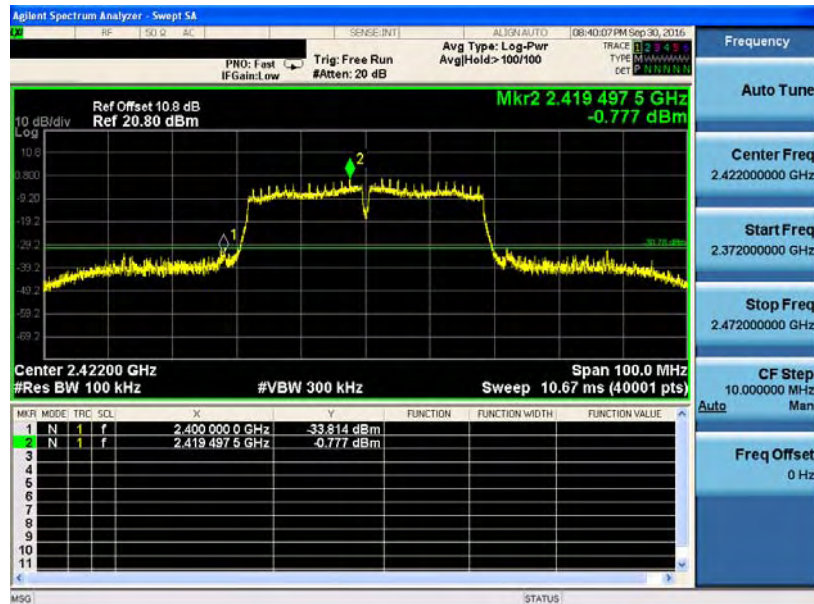
2462 MHz





Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode_ANT-0

2422 MHz



2452 MHz





Mode 3: IEEE 802.11g link mode_ANT-1

2412 MHz



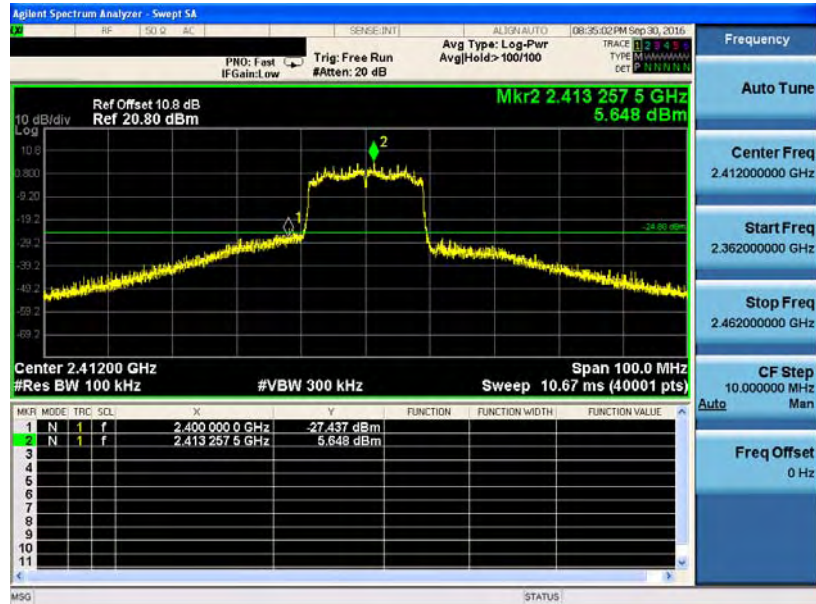
2462 MHz



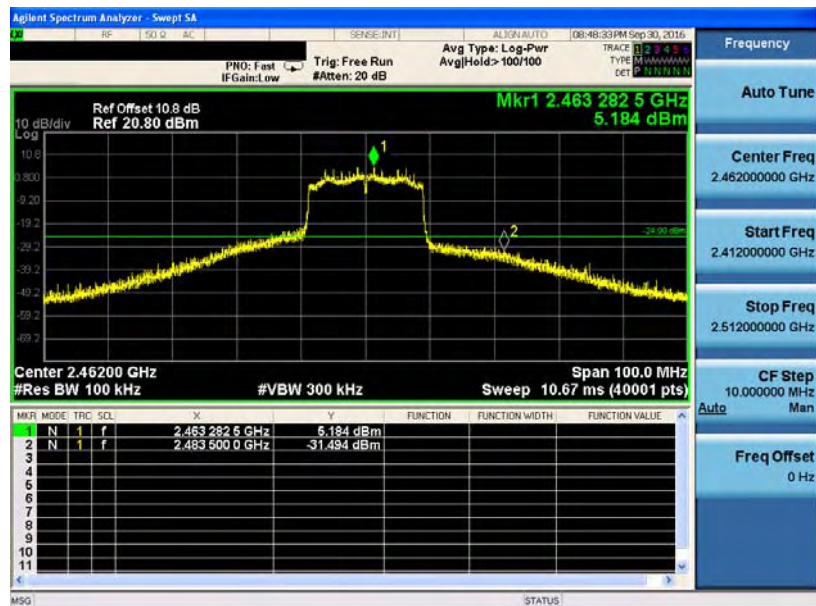


Mode 4: IEEE 802.11n 2.4GHz 20MHz link mode_ANT-1

2412 MHz



2462 MHz





Mode 5: IEEE 802.11n 2.4GHz 40MHz link mode_ANT-1

2422 MHz



2452 MHz





10 Antenna Measurement

10.1.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), 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 6dBi.

10.2.Antenna Description

See section 2 – antenna information.

10.3.Directiona Gain Calculated

For Maximum Conducted Output Power

$$\text{Directional Gain} = 10 \cdot \log\{[10^{(G1/10)} + 10^{(G2/10)} + \dots + 10^{(Gn/10)}] / NANT\}$$

Operate Freq. Band	Directional Gain (dBi)
IEEE 802.11g	3
IEEE 802.11n 2.4GHz 20MHz	3
IEEE 802.11n 2.4GHz 40MHz	3

For Maximum Power Density

$$\text{Directional Gain} = 10 \cdot \log\{[10^{(G1/20)} + 10^{(G2/20)} + \dots + 10^{(Gn/20)}]^2 / NANT\}$$

Operate Freq. Band	Directional Gain (dBi)
IEEE 802.11g	6.01
IEEE 802.11n 2.4GHz 20MHz	6.01
IEEE 802.11n 2.4GHz 40MHz	6.01