



FCC 47 CFR PART 15 SUBPART C

Product Type : Media Gateway
Applicant : MobiRoam Pty Ltd
Address : 5 Learoyd Street, Mt Lawley, Perth, Australia
Trade Name : SmartBox
Model Number : PMG-005
Test Specification : FCC 47 CFR PART 15 SUBPART C: Oct., 2013
ANSI C63.4:2009
Receive Date : December 09, 2014
Test Period : December 15, 2014 ~ January 19, 2015
Issue Date : January 27, 2015

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	January 27, 2015	Initial Issue	

Verification of Compliance

Issued Date: 01/27/2015

Product Type : Media Gateway
Applicant : MobiRoam Pty Ltd
Address : 5 Learoyd Street, Mt Lawley, Perth, Australia
Trade Name : SmartBox
Model Number : PMG-005
FCC ID : 2ADXTPMG-005
EUT Rated Voltage : DC 5V,2000mA from adapter, AC120V/60Hz from mains
Test Voltage : DC5V, AC 120
Applicable Standard : FCC 47 CFR PART 15 SUBPART C: Oct., 2013
ANSI C63.4:2009
Test Result : Complied
Performing Lab. : A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade City,
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Taiwan Accreditation Foundation accreditation number: 1330
<http://www.atl-lab.com.tw/e-index.htm>



The above equipment was tested by A Test Lab Techno Corp. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2009 and the energy emitted by the sample tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247 .

The test results of this report relate only to the tested sample identified in this report.

Approved By :  Reviewed By : 
(Manager) (Murphy Wang) (Testing Engineer) (Fly Lu)

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1 General Information

1.1 Summary of Test Result

Standard	Item	Result	Remark
15.207	AC Power Conducted Emission	PASS	-----
15.209 & 15.247(d)	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	-----
15.247(d)	Band Edge Measurement	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 ~ 30MHz		± 2.02
Radiated Emission	30MHz ~ 1000MHz	Horizontal	± 3.98
		Vertical	± 3.62
	1000MHz ~ 18000MHz	Horizontal	± 3.11
		Vertical	± 3.07
	18000MHz ~ 40000MHz	Horizontal	± 3.66
		Vertical	± 3.54

2 EUT Description

Product Type	Media Gateway
Trade Name	SmartBox
Model No.	PMG-005
Applicant	MobiRoam Pty Ltd 5 Learoyd Street, Mt Lawley, Perth, Australia
Manufacturer	NA
FCC ID	2ADXTPMG-005
Frequency Range	IEEE 802.11b / 802.11g / 802.11n 2.4GHz 20MHz: 2412 ~ 2462 MHz IEEE 802.11n 2.4GHz 40MHz: 2422 ~ 2452 MHz
Modulation Type	IEEE 802.11b:DSSS IEEE 802.11g:DSSS + OFDM IEEE 802.11n 2.4GHz 20MHz: OFDM IEEE 802.11n 2.4GHz 40MHz: OFDM
Antenna Type	Internal Antenna
Antenna Gain	0dBi
Antenna Delivery	TX + RX
RF Output Power	IEEE 802.11b: 0.101W / 20.04dBm IEEE 802.11g: 0.212W / 23.26dBm IEEE 802.11n 2.4GHz 20MHz: 0.203W / 23.07 dBm IEEE 802.11n 2.4GHz 40MHz: 0.153 W / 21.85 dBm
-6dB Bandwidth	IEEE 802.11b: 12.13 MHz IEEE 802.11g: 16.31 MHz IEEE 802.11n 2.4GHz 20MHz: 17.11MHz IEEE 802.11n 2.4GHz 40MHz: 35.45 MHz
Adapter information	Model: ICP12-050-2000D Input:100-240V~50/60Hz 0.3A Output:5V,2000A

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: Normal Operation 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
--

PC Software is used to control the EUT for staying in continuous transmitting mode with a 100% duty cycle.

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.

IEEE 802.11b mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate and cyclic delay diversity were chosen for full testing.

IEEE 802.11g mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate and cyclic delay diversity were chosen for full testing.

IEEE 802.11n 2.4GHz 20MHz mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with MCS0 data rate were chosen for full testing.

IEEE 802.11n 2.4GHz 40MHz mode:

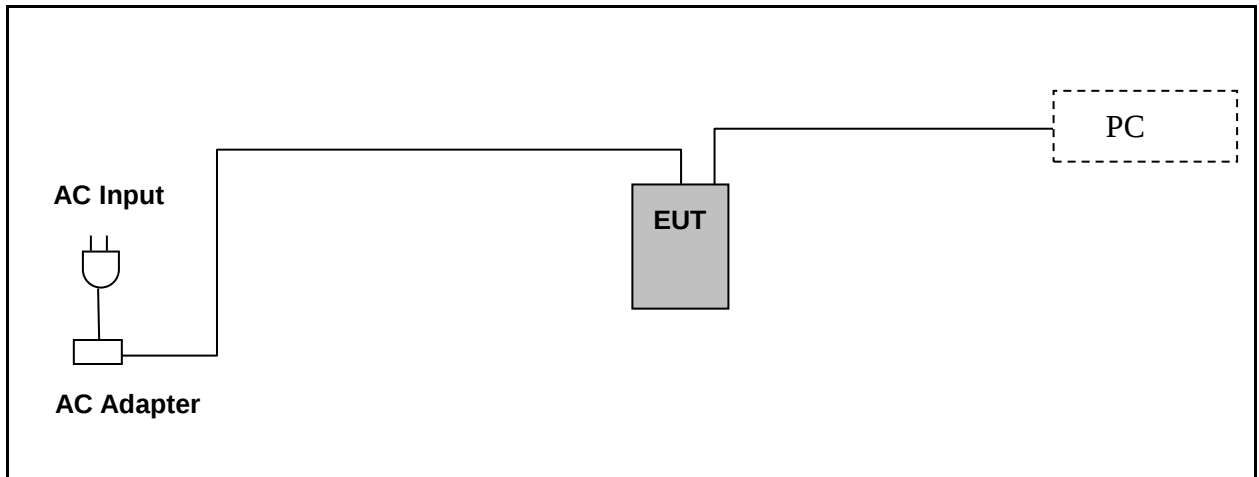
Channel Low (2422MHz), Channel Mid (2437MHz) and Channel High (2452MHz) with 13.5Mbps data rate were chosen for full testing.

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.

3.2. EUT Exercise Software

1. Setup the EUT shown on 3.3, PC and EUT were linked with a network cable.
2. Turn on the power of all equipment.
3. PC run test program to make EUT in continue transmitting.
--

3.3. Configuration of Test System Details



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 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

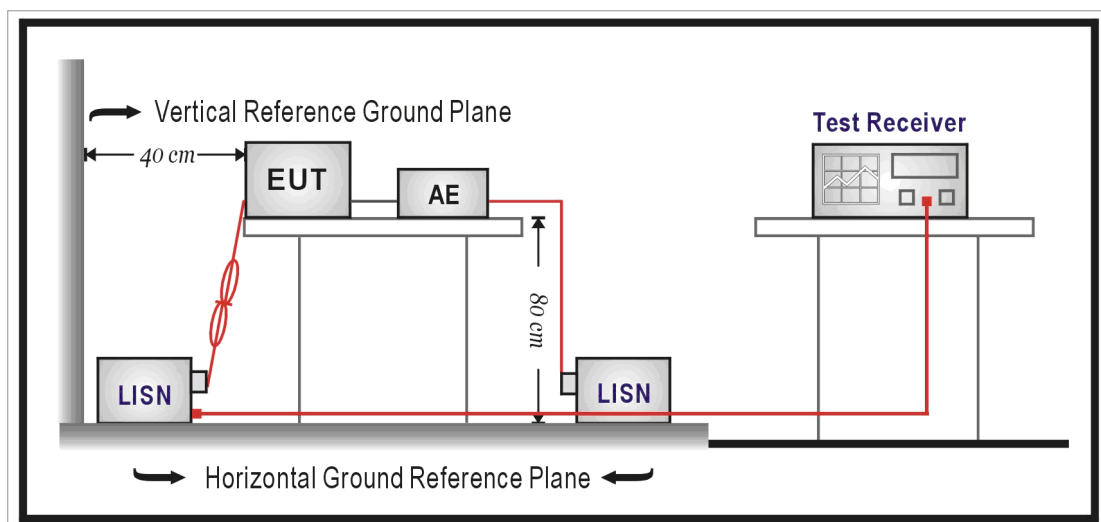
4.2. Test Instruments

Describe	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Test Receiver	R&S	ESCI	100367	06/12/2014	(1)
LISN	R&S	ENV216	101040	03/07/2014	(1)
LISN	R&S	ENV216	101041	03/07/2014	(1)
Cable	--	--	CB2452-2		
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

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

4.3. Test Setup





4.4. Test Procedure

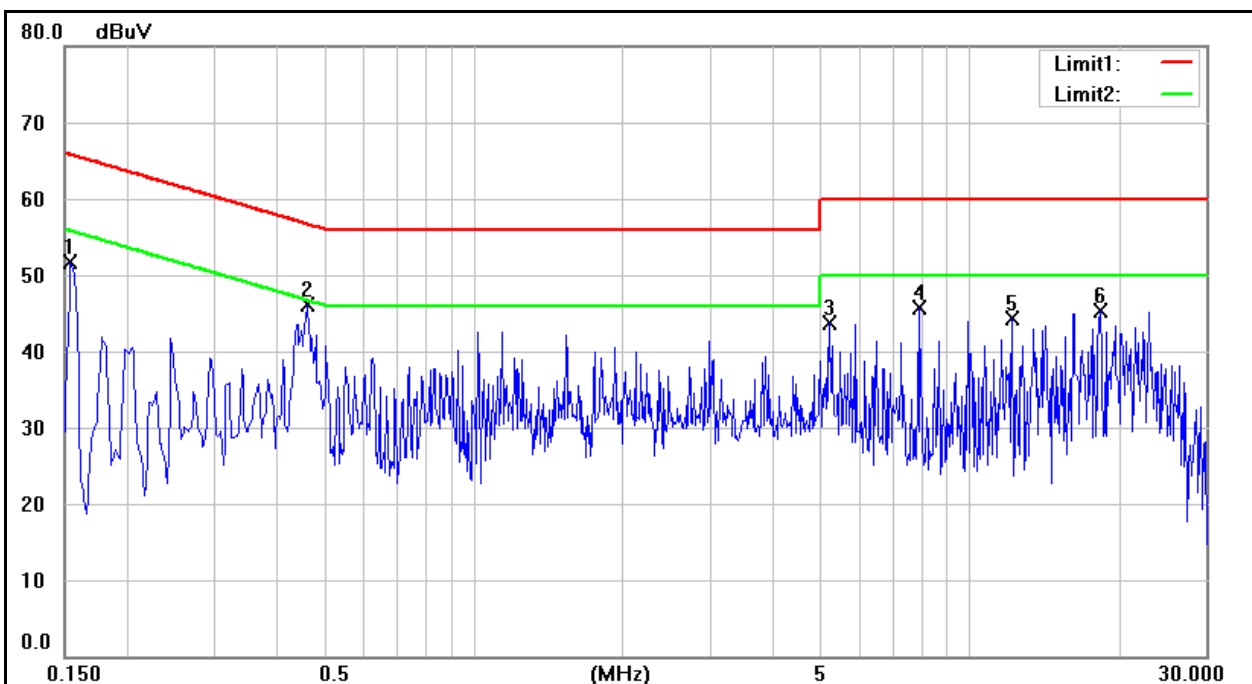
The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and EMCO Model 3162/2 SH Line Impedance Stabilization Networks (LISN). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 4.1.

4.5. Test Result

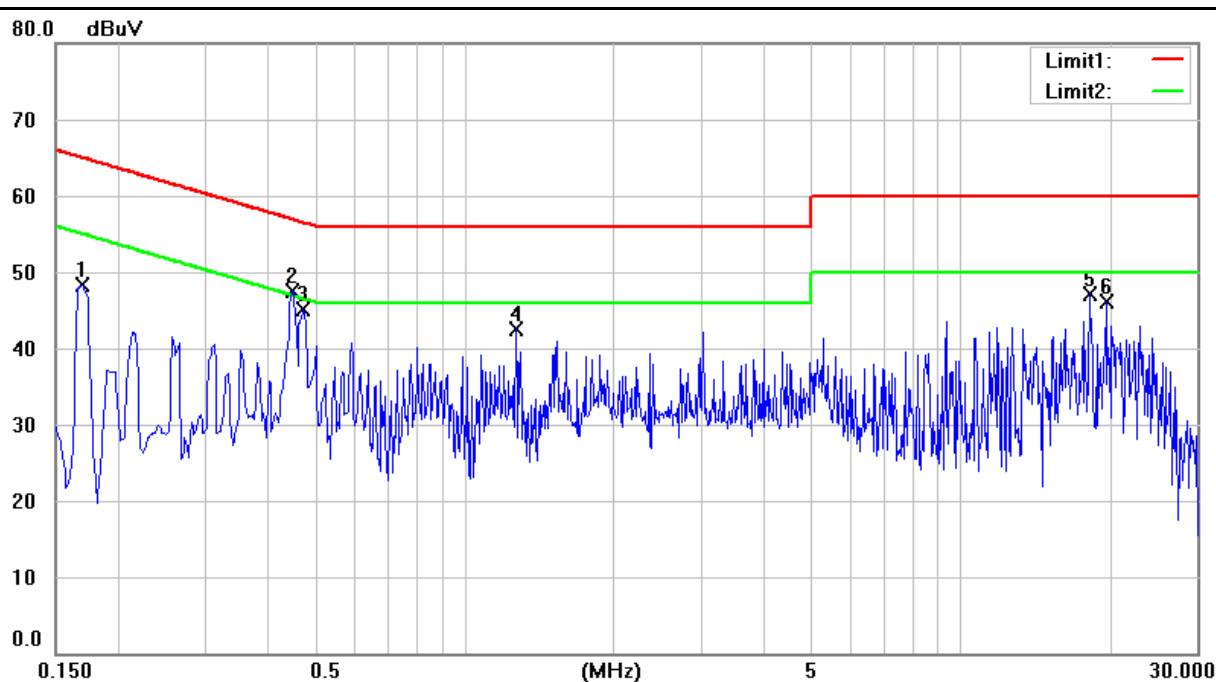
Standard:	FCC Part 15C	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(°C)/Hum.(%RH):	25(°C)/59%RH
Mode:	1	Date:	2014-12-17
		Test By:	Fly
Description:			



No.	Frequency	QP reading	AVG reading	Correction factor	QP result	AVG result	QP limit	AVG limit	QP margin	AVG margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1540	33.82	13.27	9.60	43.42	22.87	65.78	55.78	-22.36	-32.91	Pass
2	0.4620	35.03	26.08	9.62	44.65	35.70	56.66	46.66	-12.01	-10.96	Pass
3	5.2340	32.76	22.30	9.80	42.56	32.10	60.00	50.00	-17.44	-17.90	Pass
4	7.9260	32.63	22.59	9.88	42.51	32.47	60.00	50.00	-17.49	-17.53	Pass
5	12.1980	32.59	24.48	10.02	42.61	34.50	60.00	50.00	-17.39	-15.50	Pass
6	18.3660	32.03	27.29	10.20	42.23	37.49	60.00	50.00	-17.77	-12.51	Pass

Standard:	FCC Part 15C	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(°C)/Hum.(%RH):	25(°C)/59%RH
Mode:	1	Date:	2014-12-17
		Test By:	Fly

Description:



No.	Frequency	QP reading	AVG reading	Correction factor	QP result	AVG result	QP limit	AVG limit	QP margin	AVG margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1700	32.81	17.10	9.60	42.41	26.70	64.96	54.96	-22.55	-28.26	Pass
2	0.4500	33.70	25.28	9.62	43.32	34.90	56.88	46.88	-13.56	-11.98	Pass
3	0.4740	33.14	25.32	9.62	42.76	34.94	56.44	46.44	-13.68	-11.50	Pass
4	1.2700	30.49	18.47	9.66	40.15	28.13	56.00	46.00	-15.85	-17.87	Pass
5	18.2420	33.85	29.41	10.20	44.05	39.61	60.00	50.00	-15.95	-10.39	Pass
6	19.7100	33.47	28.43	10.24	43.71	38.67	60.00	50.00	-16.29	-11.33	Pass

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

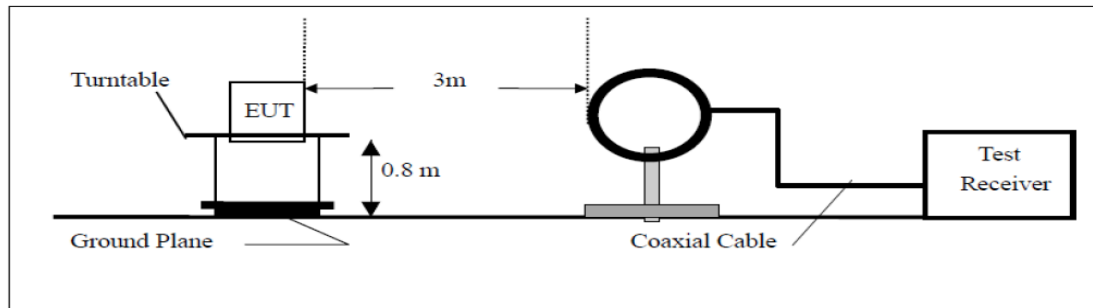
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/10/2014	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/10/2014	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/21/2014	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/21/2014	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	07/22/2014	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/11/2014	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/02/2014	(1)
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	08/14/2014	(3)
RF cable	WOKEN	--	S02-140409-026	07/14/2014	(1)
RF cable	WOKEN	--	S02-140409-027	07/14/2014	(1)
RF cable	WOKEN	--	S02-140409-028	07/14/2014	(1)
RF cable	WOKEN	--	S02-140409-052	07/14/2014	(1)
Test Site	ATL	TE01	888001	08/28/2014	(1)



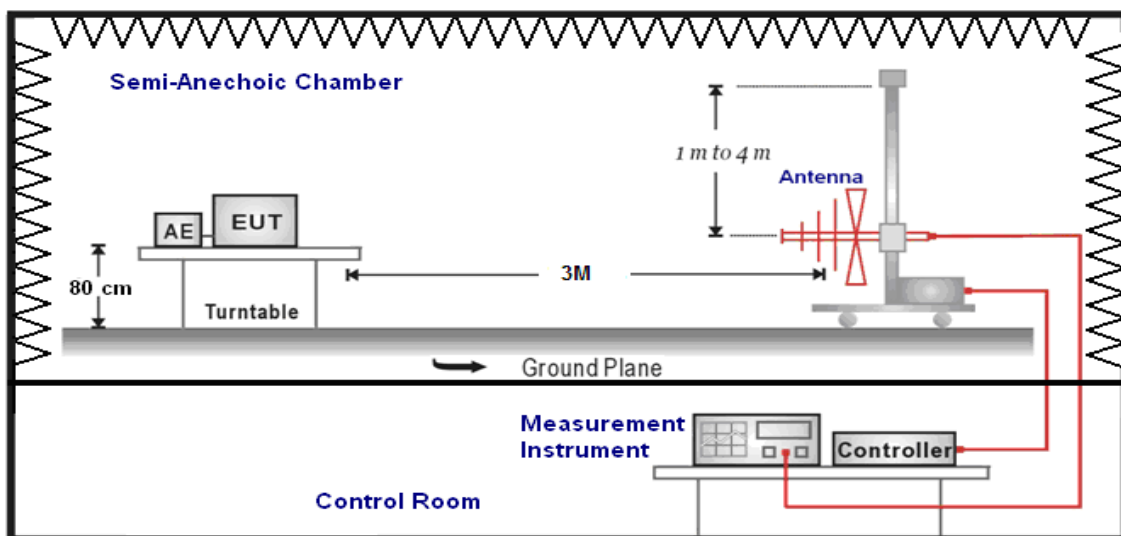
Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

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

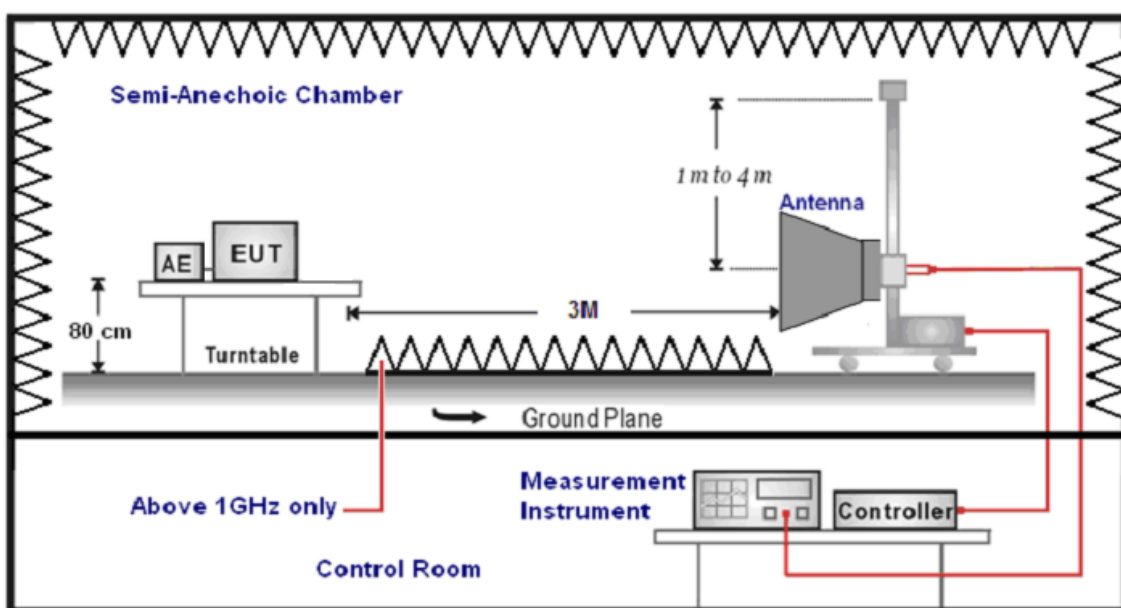
9kHz-30MHz



Below 1GHz



Above 1GHz





5.3. 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 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 1 MHz for peak measurements and 10 Hz for average measurements.

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 (model VULB9163) at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna (model BBHA9120D&9170) 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 (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 pre 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.

5.4. Test Result

Below 1GHz

Standard:	FCC Part 15C	Test Distance:	3m				
Test item:	Radiated Emission	Power:	AC 120V/60Hz				
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH				
Mode:	1	Date:	2014-12-17				
		Test By:					
Description:							
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
30.00	63.0	-35.9	27.1	40.0	12.9	QP	H
72.77	61.0	-38.7	22.3	40.0	17.7	QP	H
175.79	62.9	-38.4	24.5	43.5	19.0	QP	H
249.66	60.8	-34.4	26.4	46.0	19.6	QP	H
397.40	60.2	-30.8	29.4	46.0	16.6	QP	H
961.12	56.4	-21.8	34.6	54.0	19.4	QP	H
30.00	70.3	-37.3	33.0	40.0	7.0	QP	V
72.77	64.7	-39.4	25.3	40.0	14.7	QP	V
175.79	65.3	-38.2	27.1	43.5	16.4	QP	V
249.66	62.7	-34.5	28.2	46.0	17.8	QP	V
397.40	57.8	-31.2	26.6	46.0	19.4	QP	V
961.12	55.4	-22.6	32.8	54.0	21.2	QP	V

Note: No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).



Above 1GHz

Standard:	FCC Part 15C		Test Distance:	3m			
Test item:	Radiated Emission		Power:	AC 120V/60Hz			
Model Number:	PMG-005		Temp.(℃)/Hum.(%RH):	26(℃)/60%RH			
Mode:	2		Date:	2014-12-17			
Frequency:	2412MHz		Test By:	Fly			
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4824	47.4	5.8	53.2	74.0	20.8	peak	H
4824	41.3	5.8	47.1	54.0	6.9	Average	H
4824	50.1	5.8	55.9	74.0	18.1	peak	V
4824	43.8	5.8	49.6	54.0	4.4	Average	V

Standard:	FCC Part 15C		Test Distance:	3m			
Test item:	Radiated Emission		Power:	AC 120V/60Hz			
Model Number:	PMG-005		Temp.(℃)/Hum.(%RH):	26(℃)/60%RH			
Mode:	2		Date:	2014-12-17			
Frequency:	2437MHz		Test By:	Fly			
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874	45.7	5.9	51.6	74.0	22.4	peak	H
4874	39.8	5.9	45.7	54.0	8.3	Average	H
4874	48.0	5.9	53.9	74.0	20.1	peak	V
4874	41.3	5.9	47.2	54.0	6.8	Average	V

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Standard:	FCC Part 15C		Test Distance:	3m			
Test item:	Radiated Emission		Power:	AC 120V/60Hz			
Model Number:	PMG-005		Temp.(℃)/Hum.(%RH):	26(℃)/60%RH			
Mode:	2		Date:	2014-12-17			
Frequency:	2462MHz		Test By:	Fly			
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4924	46.5	5.9	52.4	74.0	21.6	peak	H
4924	40.9	5.9	46.8	54.0	7.2	Average	H
4924	49.6	5.9	55.5	74.0	18.5	peak	V
4924	43.4	5.9	49.3	54.0	4.7	Average	V

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2020

Standard:	FCC Part 15C	Test Distance:	3m				
Test item:	Radiated Emission	Power:	AC 120V/60Hz				
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH				
Mode:	3	Date:	2014-12-17				
Frequency:	2412MHz	Test By:	Fly				
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4824	46.0	5.8	51.8	74.0	22.2	peak	H
4824	42.6	5.8	48.4	54.0	5.6	Average	H
4824	49.1	5.8	54.9	74.0	19.1	peak	V
4824	42.5	5.8	48.3	54.0	5.7	Average	V

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	3	Date:	2014-12-17
Frequency:	2437MHz	Test By:	Fly

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874	47.4	5.9	53.3	74.0	20.7	peak	H
4874	40.5	5.9	46.4	54.0	7.6	Average	H
4874	49.2	5.9	55.1	74.0	18.9	peak	V
4824	40.8	5.9	46.7	54.0	7.3	Average	V

20202020

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	3	Date:	2014-12-17
Frequency:	2462MHz	Test By:	Fly

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4924	44.4	5.9	50.3	74.0	23.7	peak	H
4924	39.5	5.9	45.4	54.0	8.6	Average	H
4924	46.7	5.9	52.6	74.0	21.4	peak	V
4924	40.2	5.9	46.1	54.0	7.9	Average	V

Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PMG-005			Temp.(℃)/Hum.(%RH):	26(℃)/60%RH		
Mode:	4			Date:	2014-12-17		
Frequency:	2412MHz			Test By:	Fly		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4824	44.3	5.8	50.1	74.0	23.9	peak	H
4824	37.8	5.8	43.6	54.0	10.4	Average	H
4824	46.8	5.8	52.6	74.0	21.4	peak	V
4824	36.9	5.8	42.7	54.0	11.3	Average	V

Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PMG-005			Temp.(℃)/Hum.(%RH):	26(℃)/60%RH		
Mode:	4			Date:	2014-12-17		
Frequency:	2437MHz			Test By:	Fly		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874	45.4	5.9	51.3	74.0	22.7	peak	H
4874	38.6	5.9	44.5	54.0	9.5	Average	H
4874	47.5	5.9	53.4	74.0	20.6	peak	V
4824	36.9	5.9	42.8	54.0	11.2	Average	V

21212121

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	4	Date:	2014-12-17
Frequency:	2462MHz	Test By:	Fly

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4924	44.6	5.9	50.5	74.0	23.5	peak	H
4924	37.8	5.9	43.7	54.0	10.3	Average	H
4924	45.7	5.9	51.6	74.0	22.4	peak	V
4924	38.2	5.9	44.1	54.0	9.9	Average	V



Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PMG-005			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Mode:	5			Date:	2014-12-17		
Frequency:	2422MHz			Test By:	Fly		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4844	44.6	5.8	50.4	74.0	23.6	peak	H
4844	35.9	5.8	41.7	54.0	12.3	Average	H
4844	43.8	5.8	49.6	74.0	24.4	peak	V
4844	34.4	5.8	40.2	54.0	13.8	Average	V

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	5	Date:	2014-12-17
Frequency:	2437MHz	Test By:	Fly

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4874	43.7	5.8	49.5	74.0	24.5	peak	H
4874	35.4	5.8	41.2	54.0	12.8	Average	H
4874	45.6	5.8	51.4	74.0	22.6	peak	V
4874	37.0	5.8	42.8	54.0	11.2	Average	V

22222222

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PMG-005	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	5	Date:	2014-12-17
Frequency:	2452MHz	Test By:	Fly

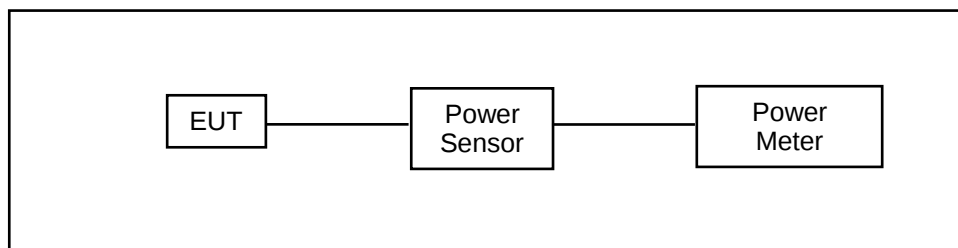
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4904	44.7	5.9	50.6	74.0	23.4	peak	H
4904	36.9	5.9	42.8	54.0	11.2	Average	H
4904	43.8	5.9	49.7	74.0	24.3	peak	V
4904	35.4	5.9	41.3	54.0	12.7	Average	V

6 Maximum Conducted Output Power Measurement

6.1. Limit

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

6.2. Test Setup



6.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Power Sensor	Anritsu	MA2411B	1126022	08/21/2014	(1)
Power Meter	Anritsu	ML2495A	1135009	08/21/2014	(1)
RF cable	WOKEN	--	S02-140428-049	07/14/2014	(1)
RF cable	WOKEN	--	S02-140428-041	07/14/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

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. 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.



6.5. Test Result

Model Number	PMG-005		
Test Item	Maximum Conducted Output Power		
Test Mode	Mode 2: IEEE 802.11b Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	Peak Power (dBm)		Limit (dBm)
2412	20.04		< 30
2437	19.63		< 30
2462	19.02		< 30

Model Number	PMG-005		
Test Item	Maximum Conducted Output Power		
Test Mode	Mode 3: IEEE 802.11g Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	Peak Power (dBm)		Limit (dBm)
2412	23.22		< 30
2437	23.26		< 30
2462	23.21		< 30

Model Number	PMG-005		
Test Item	Maximum Conducted Output Power		
Test Mode	Mode 4: IEEE 802.11n 2.4GHz 20MHz Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	Peak Power (dBm)		Limit (dBm)
2412	22.88		< 30
2437	23.03		< 30
2462	23.07		< 30

Model Number	PMG-005		
Test Item	Maximum Conducted Output Power		
Test Mode	Mode 5: IEEE 802.11n 2.4GHz 40MHz Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	Peak Power (dBm)		Limit (dBm)
2422	21.85		< 30
2437	21.65		< 30
2452	21.81		< 30

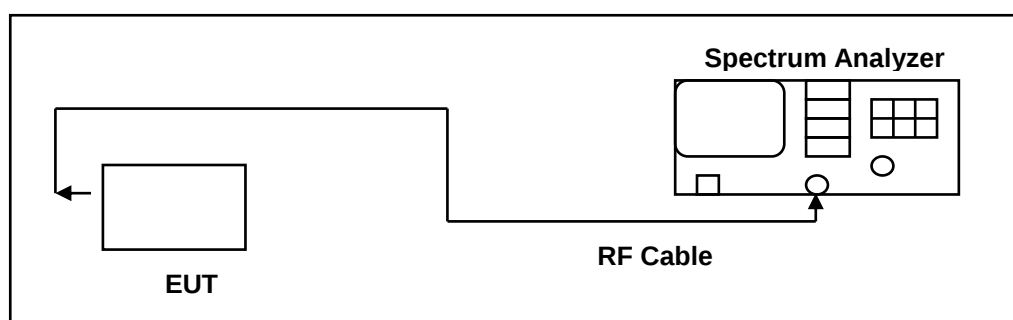
7 6dB RF Bandwidth and 99 % Occupied Bandwidth Measurement

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.

99 % Occupied Bandwidth: N/A

7.2. Test Setup



7.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	N9020A	MY53420615	05/13/2014	(1)
RF cable	WOKEN	--	S02-140428-041	07/14/2014	(1)
RF cable	WOKEN	--	S02-140428-041	07/14/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

dRemark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

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

7.4. Test Procedure

The EUT was setup to ANSI C63.4, 2009; 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 RES BW 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)

99 % Occupied Bandwidth: The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.



7.5. Test Result

Model Number	PMG-005		
Test Item	6dB RF Bandwidth and 99 % Occupied Bandwidth		
Test Mode	Mode 2: IEEE 802.11b Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	6dB RF Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	6dB RF Bandwidth Limit (MHz)
2412	11.12	15.17	> 0.500
2437	12.09	15.08	> 0.500
2462	12.13	15.06	> 0.500

Model Number	PMG-005		
Test Item	6dB RF Bandwidth and 99 % Occupied Bandwidth		
Test Mode	Mode 3: IEEE 802.11g Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	6dB RF Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	6dB RF Bandwidth Limit (MHz)
2412	16.35	16.51	> 0.500
2437	16.36	16.48	> 0.500
2462	16.37	16.48	> 0.500

Model Number	PMG-005		
Test Item	6dB RF Bandwidth and 99 % Occupied Bandwidth		
Test Mode	Mode 4: IEEE 802.11n 2.4GHz 20MHz Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	6dB RF Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	6dB RF Bandwidth Limit (MHz)
2412	17.10	17.61	> 0.500
2437	17.11	17.59	> 0.500
2462	17.11	17.59	> 0.500

Model Number	PMG-005		
Test Item	6dB RF Bandwidth and 99 % Occupied Bandwidth		
Test Mode	Mode 5: IEEE 802.11n 2.4GHz 40MHz Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency (MHz)	6dB RF Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	6dB RF Bandwidth Limit (MHz)
2422	35.39	36.02	> 0.500
2437	35.41	35.98	> 0.500
2452	35.40	35.99	> 0.500



7.6. Test Graphs

6dB RF Bandwidth & 99 % Occupied Bandwidth

Mode 2: IEEE 802.11b Link Mode

2412



2437



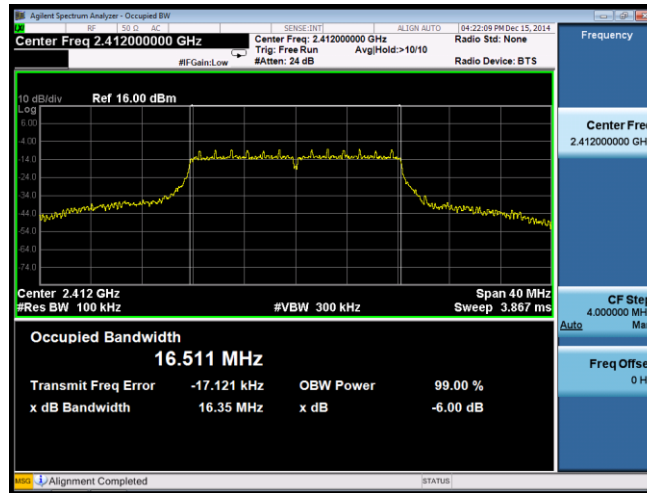
2462



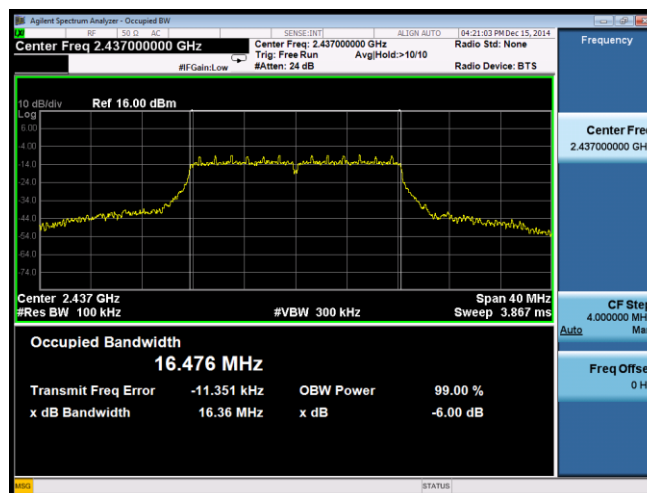


Mode 3: IEEE 802.11g Link Mode

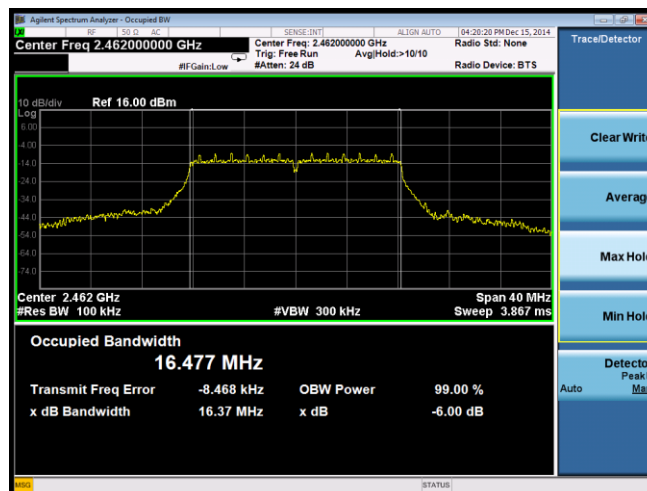
2412



2437



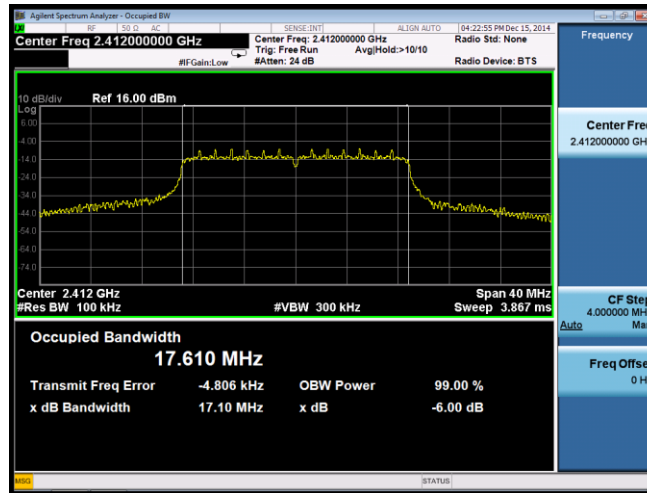
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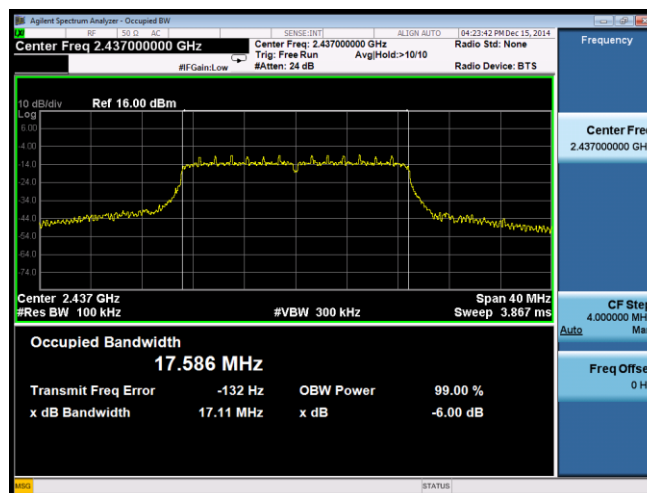


Mode 4: IEEE 802.11n 2.4GHz 20MHz Link Mode

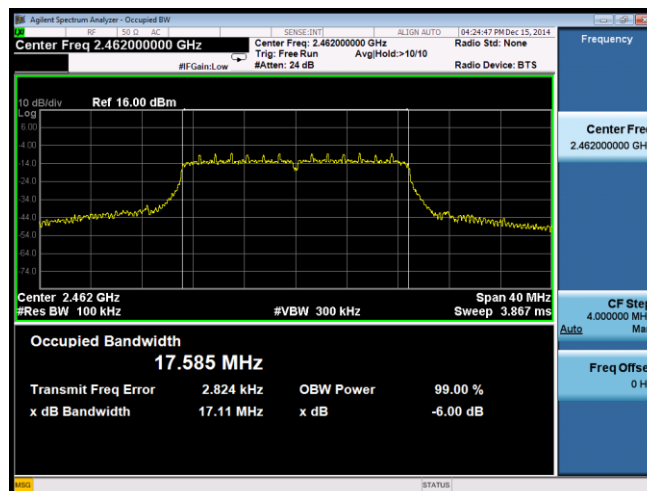
2412



2437



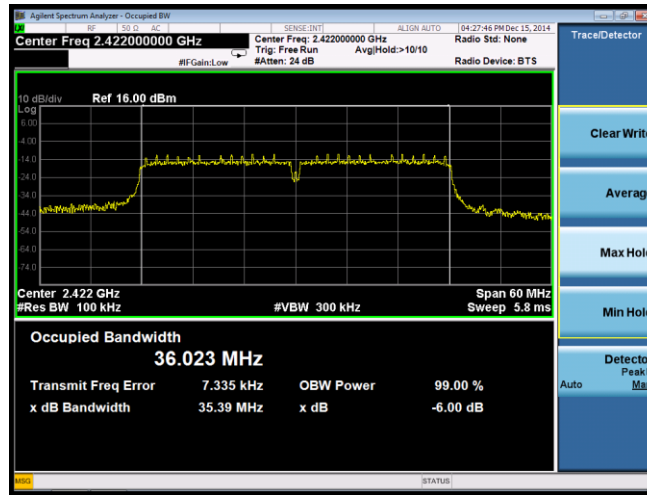
2462



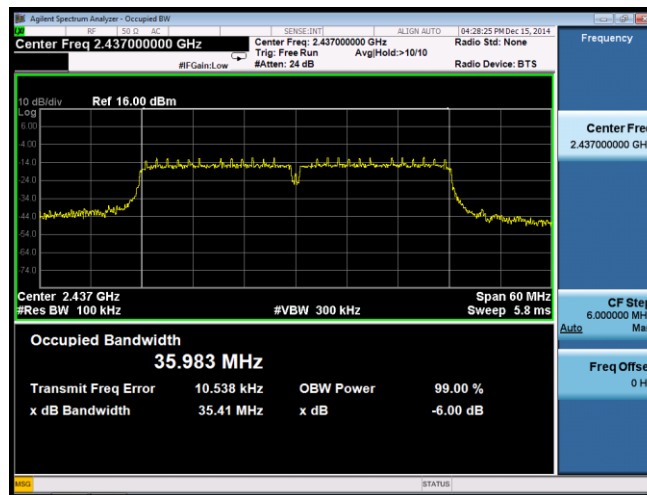


Mode 5: IEEE 802.11n 2.4GHz 40MHz Link Mode

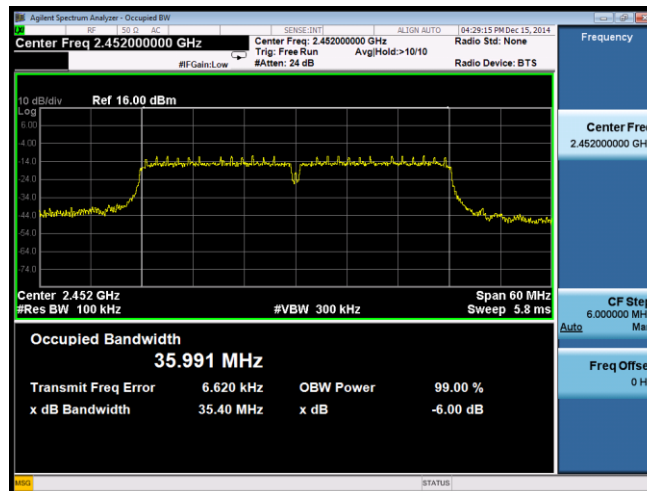
2422



2437



2452

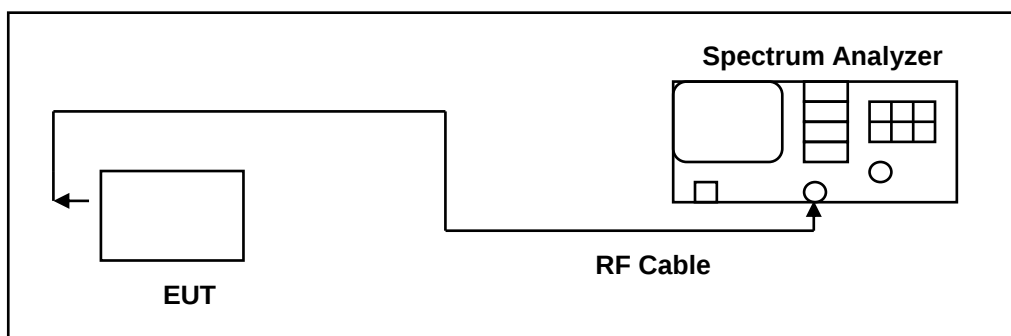


8 Maximum Power Density Measurement

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.

8.2. Test Setup



8.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	N9020A	MY53420615	05/13/2014	(1)
RF cable	WOKEN	--	S02-140428-041	07/14/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

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

8.4. Test Procedure

The EUT was setup to ANSI C63.4, 2009; 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	PMG-005		
Test Item	Maximum Power Density		
Test Mode	Mode 2: IEEE 802.11b Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency(MHz)	Reading (dBm/100kHz)		Limit(dBm/3kHz)
2412	7.403		< 8
2437	6.463		< 8
2462	6.650		< 8

Model Number	PMG-005		
Test Item	Maximum Power Density		
Test Mode	Mode 3: IEEE 802.11g Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency(MHz)	Reading (dBm/100kHz)		Limit(dBm/3kHz)
2412	4.554		< 8
2437	3.785		< 8
2462	3.791		< 8

Model Number	PMG-005		
Test Item	Maximum Power Density		
Test Mode	Mode 4: IEEE 802.11n 2.4GHz 20MHz Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency(MHz)	Reading (dBm/100kHz)		Limit(dBm/3kHz)
2412	4.574		< 8
2437	3.817		< 8
2462	3.926		< 8

Model Number	PMG-005		
Test Item	Maximum Power Density		
Test Mode	Mode 5: IEEE 802.11n 2.4GHz 40MHz Link Mode		
Date of Test	2014-12-15	Test Site	TE05
Frequency(MHz)	Reading (dBm/100kHz)		Limit(dBm/3kHz)
2422	1.744		< 8
2437	1.180		< 8
2452	1.469		< 8

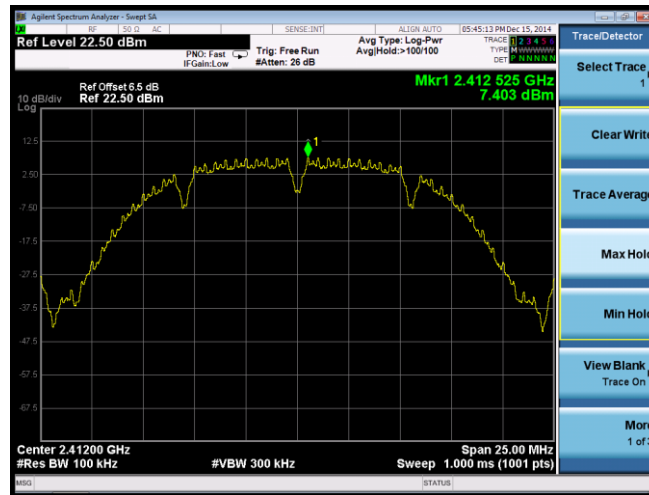
Note: A 100 kHz RBW is used during test, if the result compliance with 8dBm/3kHz, it must also compliance with 8dBm/3kHz when a 3kHz RBW is used.



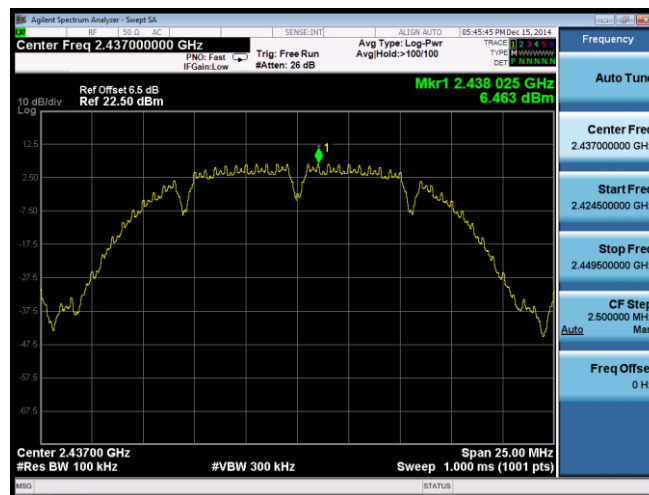
8.6. Test Graphs

Mode 2: IEEE 802.11b Link Mode

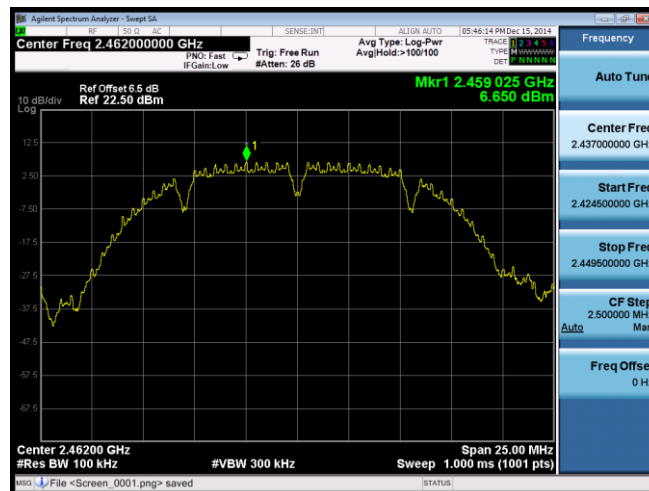
2412



2437



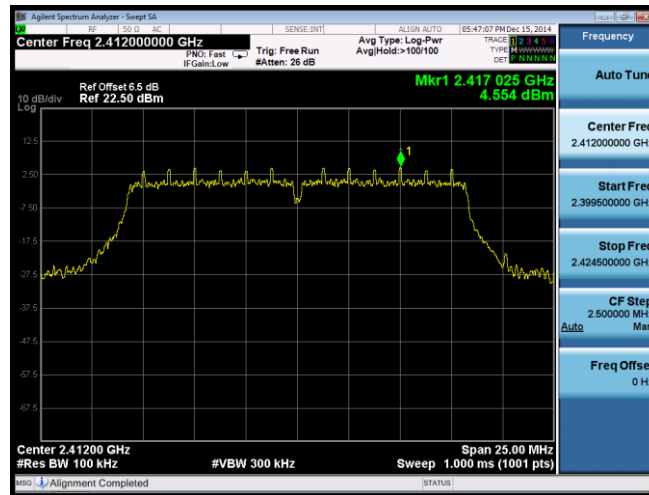
2462



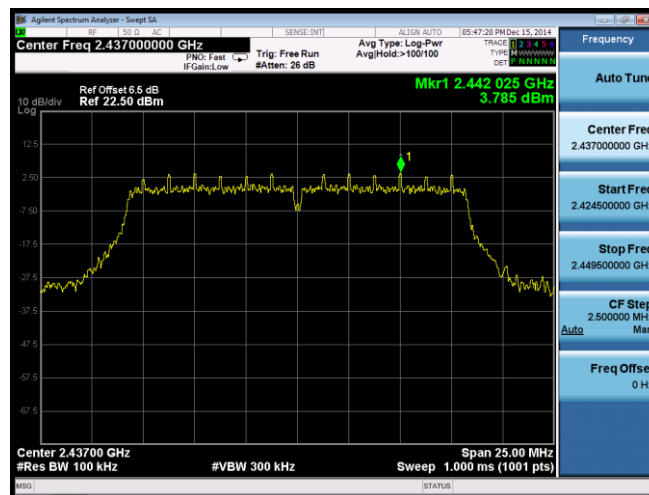


Mode 3: IEEE 802.11g Link Mode

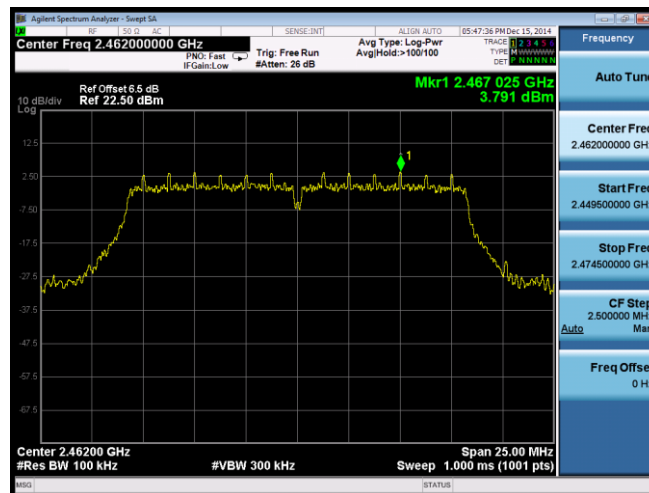
2412



2437



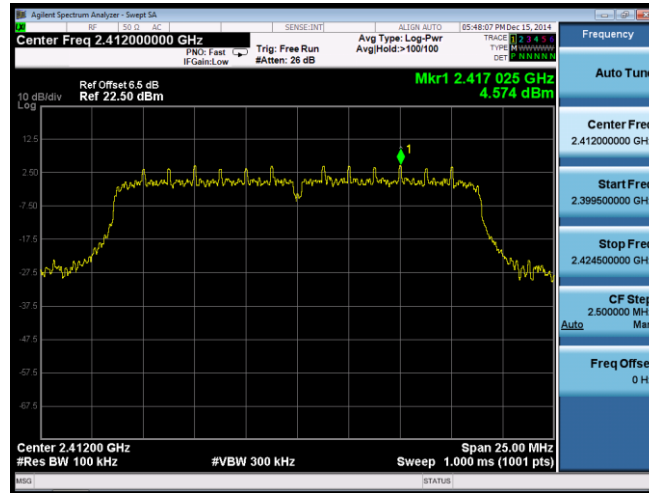
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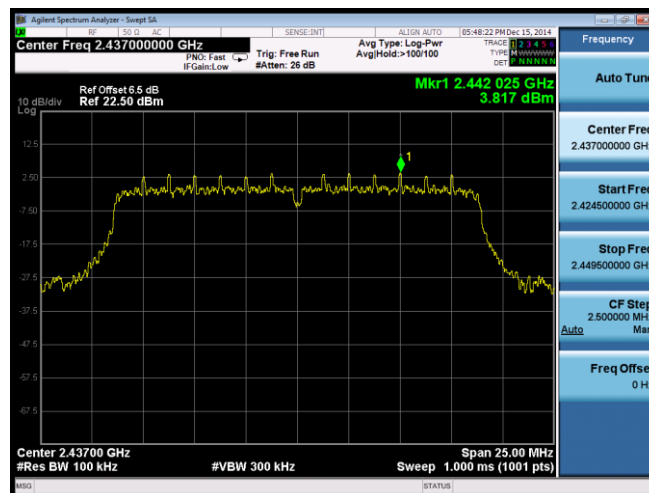


Mode 4: IEEE 802.11n 2.4GHz 20MHz Link Mode

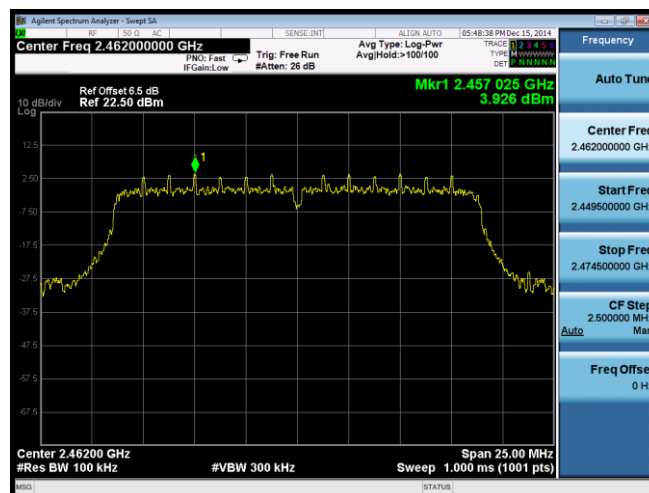
2412



2437

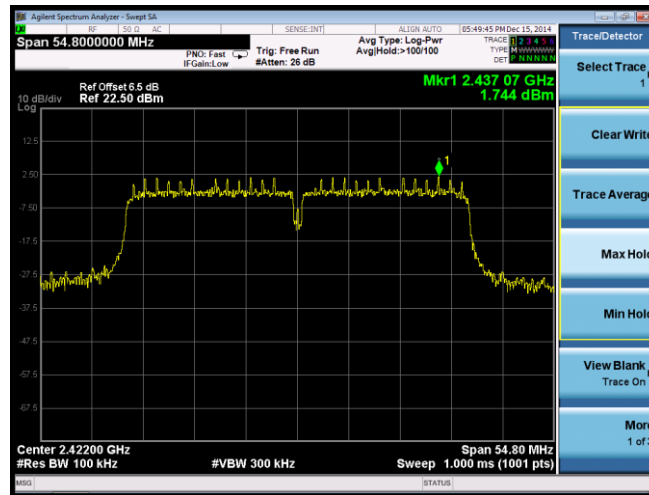


2462

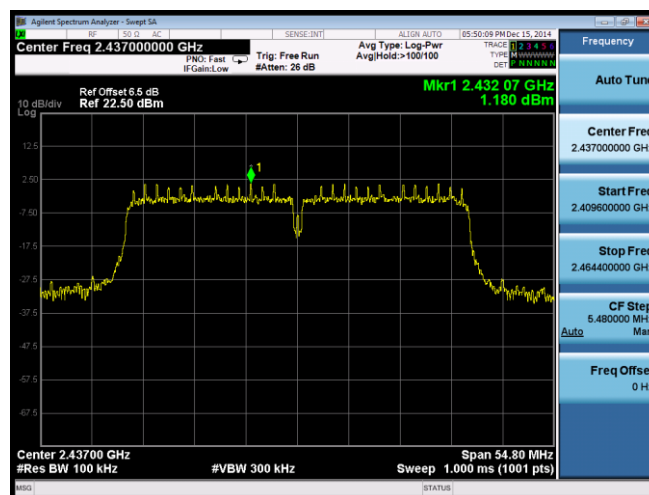


Mode 5: IEEE 802.11n 2.4GHz 40MHz Link Mode

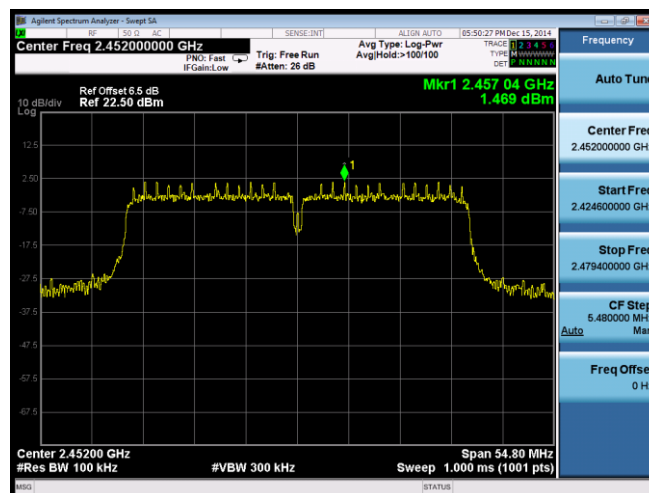
2422



2437



2452

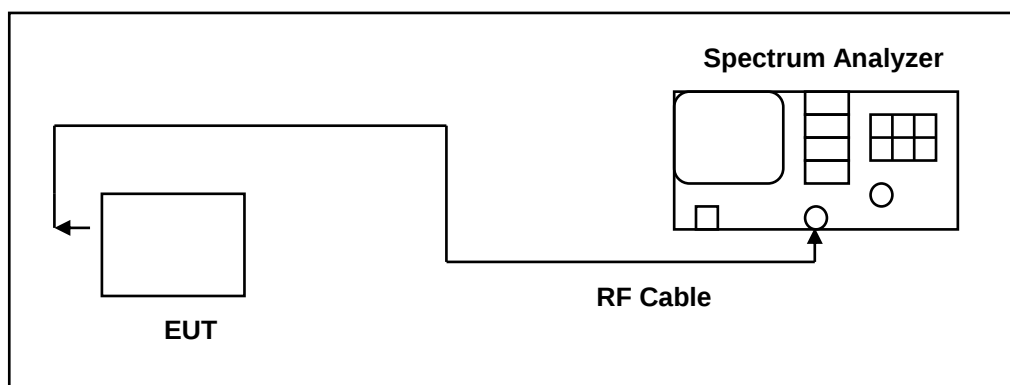


9 Out of Band Conducted Emissions Measurement

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 20 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	Remark
Spectrum Analyzer	Agilent	N9020A	MY53420615	05/13/2014	(1)
Spectrum Analyzer	Agilent	E4408B	MY45107753	07/24/2014	(1)
RF cable	WOKEN	--	S02-140428-041	07/14/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

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 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.



9.5. Test Graphs

Reference level

Mode 2: IEEE 802.11b Link Mode

2412



2437



2462





Mode 3: IEEE 802.11g Link Mode

2412



2437



2462





Mode 4: IEEE 802.11n 2.4GHz 20MHz Link Mode

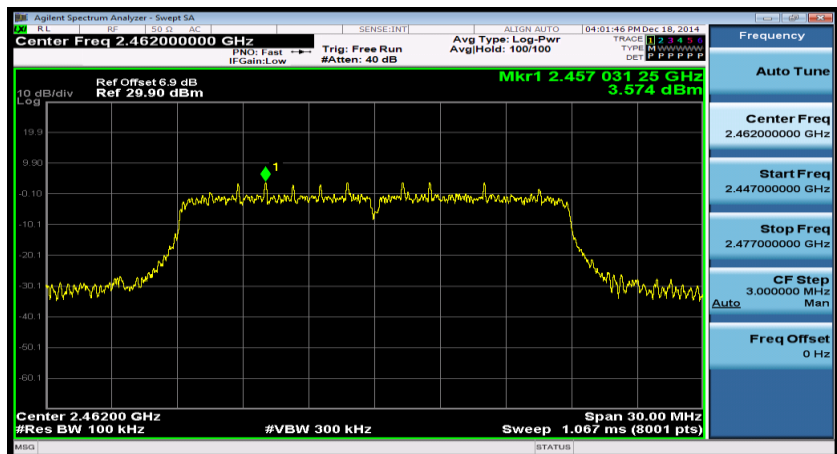
2412



2437



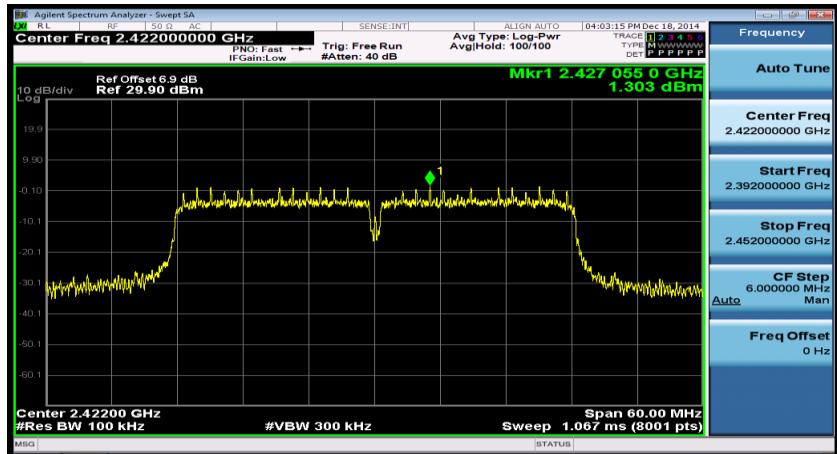
2462



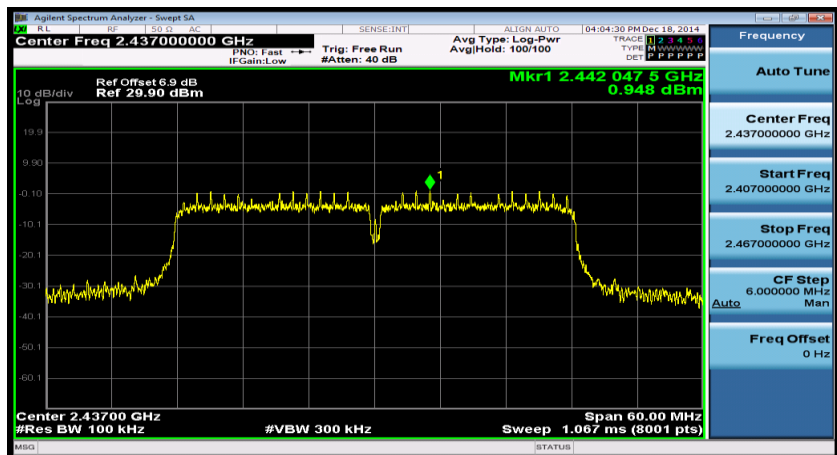


Mode 5: IEEE 802.11n 2.4GHz 40MHz Link Mode

2422



2437



2452

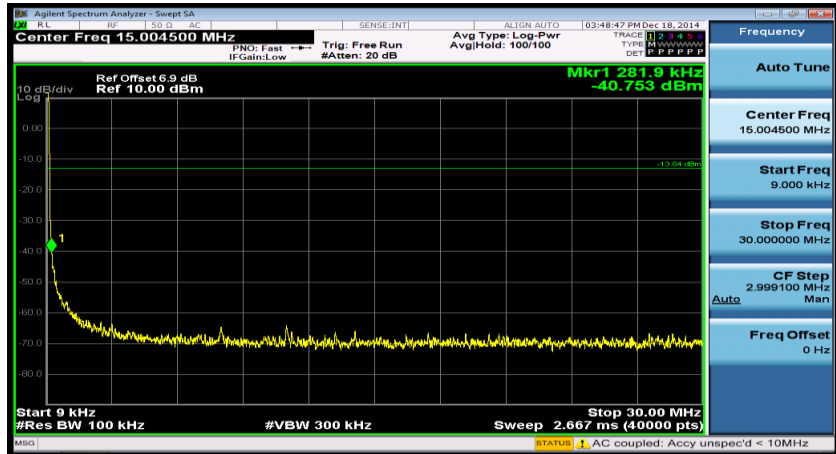




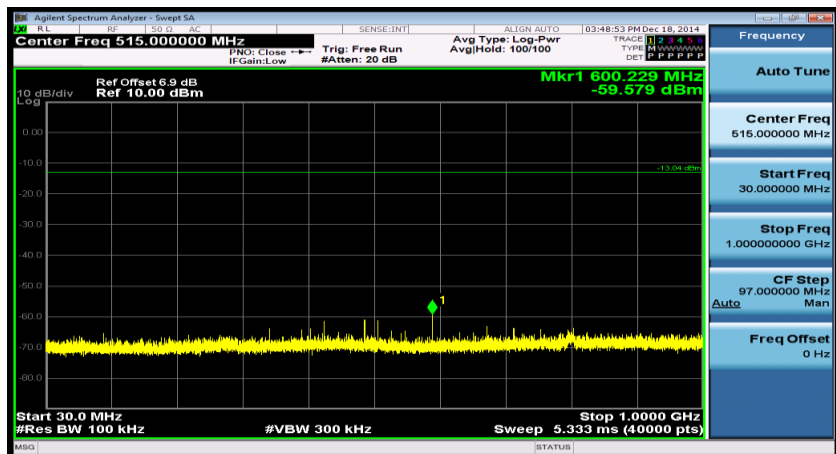
Out of Band Conducted Emissions

Mode 2: IEEE 802.11b Link Mode-2412

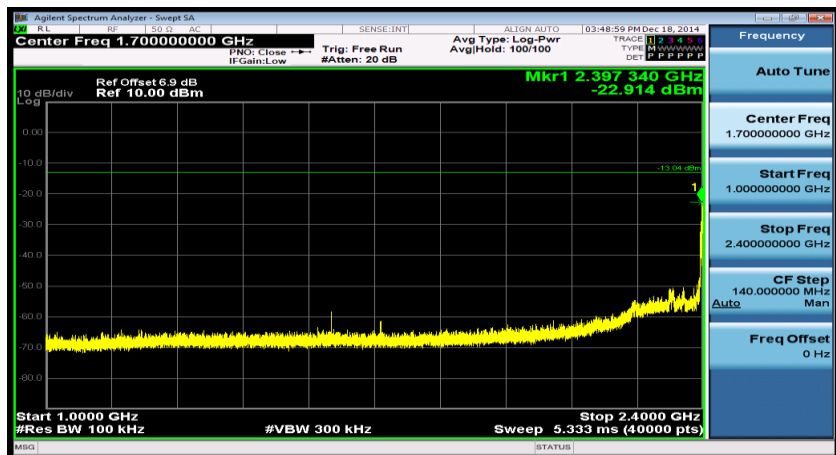
9kHz-30MHz



30MHz-1GHz

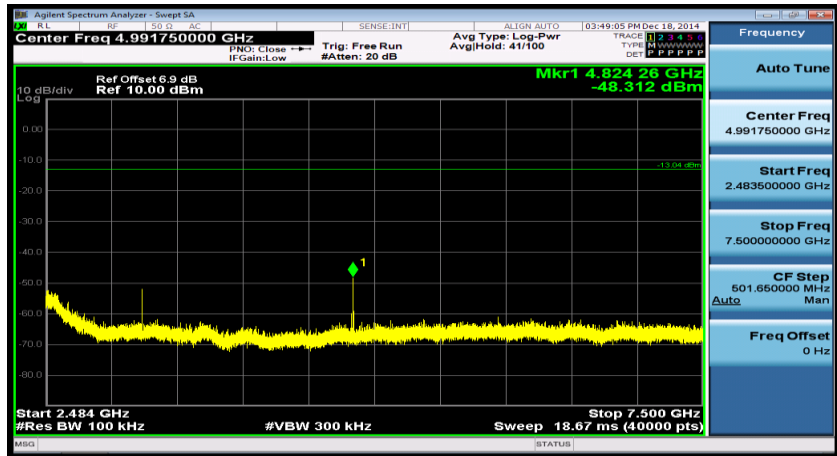


1GHz-2.4GHz

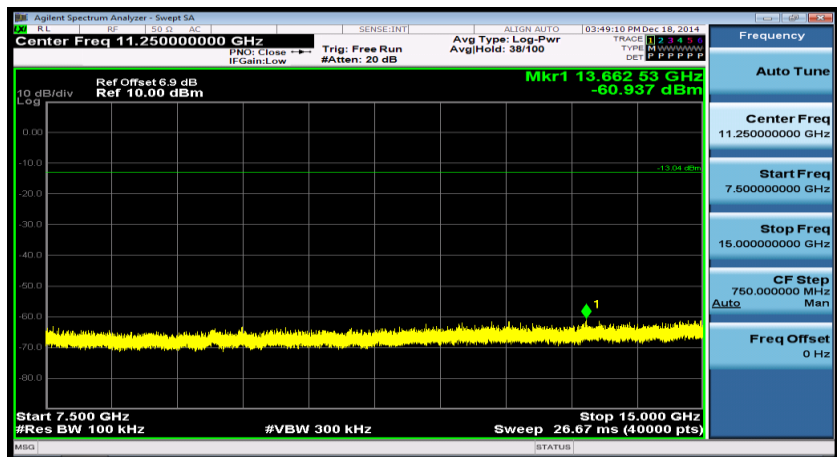




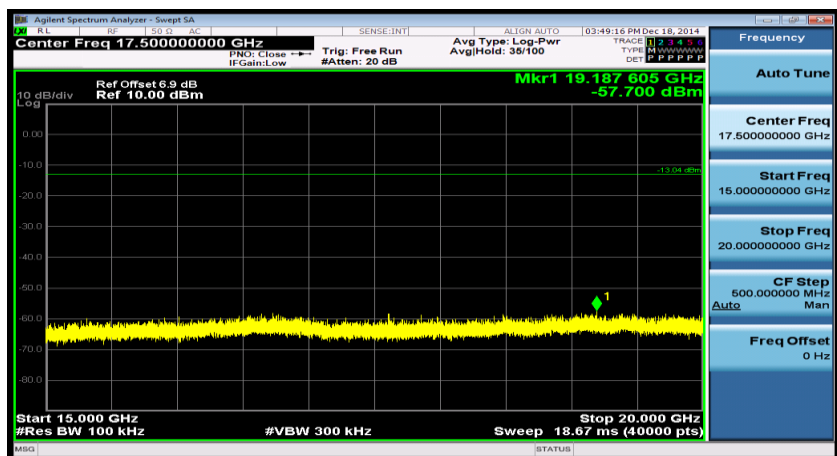
2.4835GHz-7.5GHz



7.5GHz-15GHz

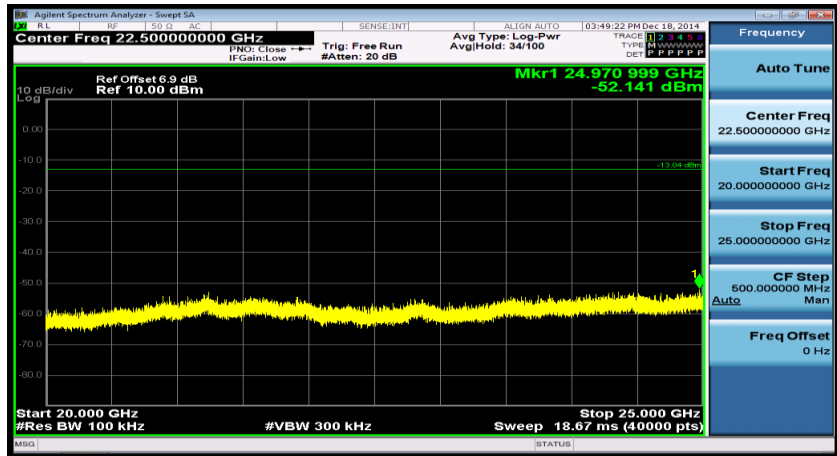


15GHz-20GHz



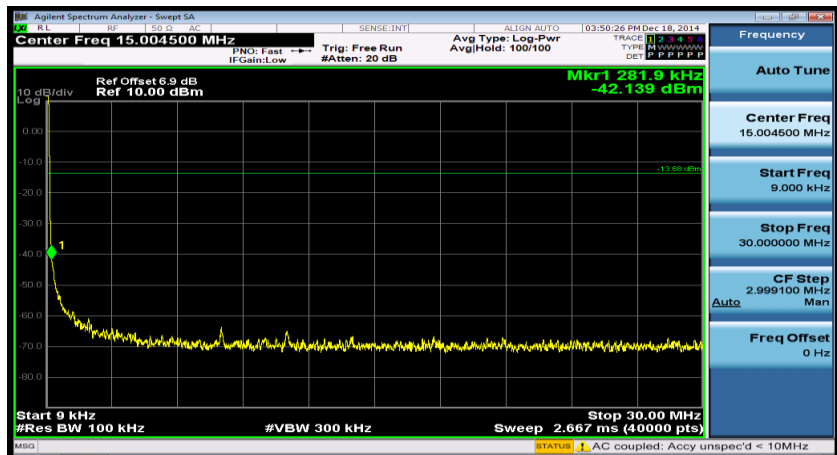


20GHz-25GHz

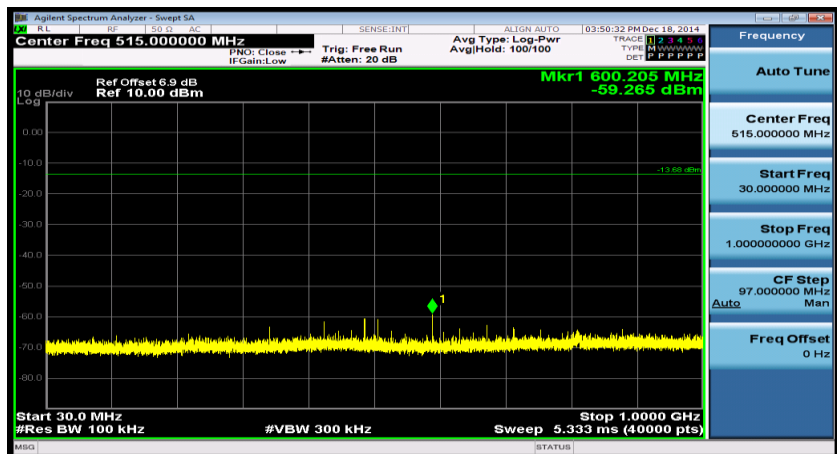


Mode 2: IEEE 802.11b Link Mode-2437

9kHz-30MHz

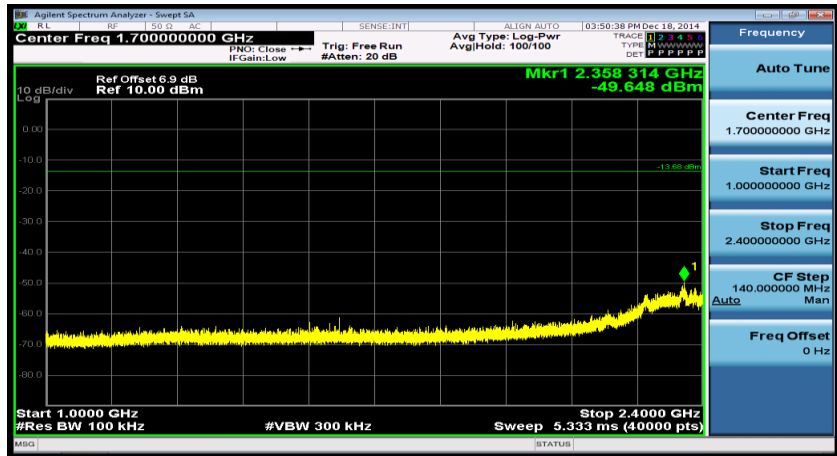


30MHz-1GHz

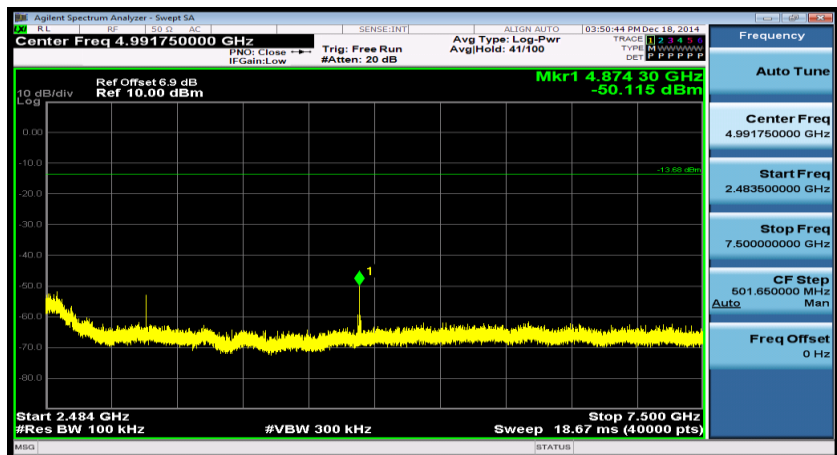




1GHz-2.4GHz



2.4835GHz-7.5GHz



7.5GHz-15GHz

