EMC
TEST REPORT

Report No. : **141200112TWN-001**
Model No. : **APM 6998 WiFi Module**
Issued Date : **Apr. 11, 2015**

Applicant: **Remote Technologies Incorporated**
5775 12th Avenue East, Suite 180, Shakopee, MN 55379
USA

Test Method/ Standard: **47 CFR FCC Part 15.247 & ANSI C63.4 2003**
KDB 558074 D01 v03r02

Test Site : **93910**
Test By: **Intertek Testing Services Taiwan Ltd.**
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

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Title Senior Engineer

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1. Summary of Test Data

Test Requirement	Applicable Rule (Section 15.247)	Result
Minimum 6 dB Bandwidth	15.247(a)(2)	Pass
Maximum Peak Conducted Output Power	15.247(b)(3)	Pass
Power Spectral Density	15.247(e)	Pass
Emissions In Non-Restricted Frequency Bands	15.247(d)	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.247(d), 15.205, 15.209	Pass
Emission On The Band Edge	15.247(d), 15.205	Pass
AC Power Line Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass

2. General Information

2.1 Identification of the EUT

Product:	APM 6998 WiFi Module
Model No:	APM 6998 WiFi Module
FCC ID:	MMURTI2100
Operating Frequency:	2412 MHz ~ 2462 MHz for 802.11b, 802.11g, 802.11n (HT20)
Channel Number:	11 channels for 2412 MHz ~ 2462 MHz
Frequency of Each Channel:	2412+5 k MHz, k＝0~10 for 802.11b, 802.11g, 802.11n HT20
Access scheme:	DSSS, OFDM
Rated Power:	DC 1.8 and 3.3V from HOST
Power Cord:	N/A
Sample Received:	Dec. 10, 2014
Sample condition:	Workable
Test Date(s):	Dec. 23, 2014 ~ Apr. 10, 2015
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.2 Description of EUT

Modulation mode	Transmit path	
	Chain 0/Main	Chain 1/Aux
802.11b	V	X
802.11g	V	X
802.11 n (HT20)	V	X

2.3 Antenna description

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain : 2.2 dBi
Antenna Type : Chip antenna
Connector Type : Fixed

2.4 Additional information of Host and Module

The model of the host: T3x
Host Hardware Revision: T3x Rev D1
Host-Module Driver Version: v8.1.4.4
Module Hardware Revision: 001E

2.5 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
Adapter	N/A	KTPS05-03315U	N/A	N/A
Host	RTI	T3x	N/A	N/A

2.6 Operation mode

The EUT was supplied with DC 1.8 and 3.3V from HOST.
TX-MODE was based on a specific test program “PDA UniTest”, and the program could select different frequency and modulation.
With individual verifying, the maximum output power was found out 1 Mbps data rate for 802.11b mode, 6 Mbps data rate for 802.11g mode, 6.5 Mbps data rate for 802.11n HT 20 mode.

The final tests were executed under these conditions recorded in this report individually.

802.11b ch6 chain0		**802.11g ch6 chain0**		**802.11n HT20 ch6 chain0**	
Data rate (Mbps)	**AV (dBm)**	**Data rate (Mbps)**	**AV (dBm)**	**Data rate (Mbps)**	**AV (dBm)**
1	12.46	6	10.8	6.5	10.76
2	12.33	9	10.75	13	10.7
5.5	12.24	12	10.75	19.5	10.58
11	12.19	18	10.73	26	10.52
-		24	10.72	39	10.48
-		36	10.7	52	9.54
-		48	10.68	58.5	9.52
-		54	10.63	65	9.46

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

2.7 Applied test modes and channels

Test items	Mode	Data Rate (Mbps)	Channel	Antenna
Minimum 6 dB Bandwidth	802.11 b	1	1, 6 , 11	Chain0
	802.11 g	6	1, 6, 11	Chain0
	802.11 n (HT20)	6.5	1, 6, 11	Chain0
Maximum peak conducted output power	802.11 b	1	1, 6 , 11	Chain0
	802.11 g	6	1, 6, 11	Chain0
	802.11 n (HT20)	6.5	1, 6, 11	Chain0
Power Spectral Density	802.11 b	1	1, 6 , 11	Chain0
	802.11 g	6	1, 6, 11	Chain0
	802.11 n (HT20)	6.5	1, 6, 11	Chain0
RF Antenna Conducted Spurious	802.11 b	1	1, 6 , 11	Chain0
	802.11 g	6	1, 6, 11	Chain0
	802.11 n (HT20)	6.5	1, 6, 11	Chain0
Radiated spurious Emission 9kHz~1GHz	802.11 b	1	11	Chain0
Radiated Spurious Emission 1GHz~10th Harmonic	802.11 b	1	1, 6 , 11	Chain0
	802.11 g	6	1, 6, 11	Chain0
	802.11 n (HT20)	6.5	1, 6, 11	Chain0
Emission on the Band Edge	802.11 b	1	1, 11	Chain0
	802.11 g	6	1, 11	Chain0
	802.11 n (HT20)	6.5	1, 11	Chain0
AC Power Line Conducted Emission	802.11 b	1	11	Chain0

2.8 Power setting of test software

Channels & power setting software provided by the client was used to change the operating channels as well as the output power level and is going to be installed in the final end product.

Mode	Software Version: N/A		
	Channel	Frequency(MHz)	Power setting(dBm)
802.11b	1	2412	1
	6	2437	1
	11	2462	1
802.11g	1	2412	1
	6	2437	1
	11	2462	1
802.11n (HT 20)	1	2412	1
	6	2437	1
	11	2462	1

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

3. Minimum 6 dB Bandwidth

3.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(a)(2) KDB 558074 D01 v03r02	

3.2 Limit for minimum 6dB bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

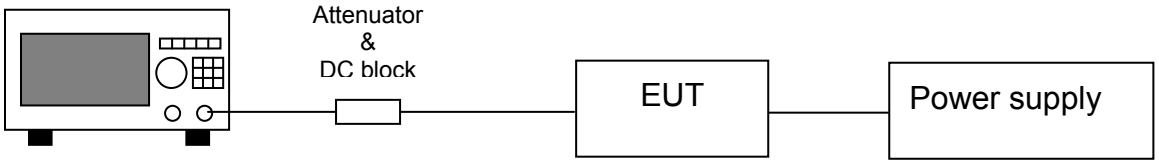
3.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	100kHz
VBW	≧3 x RBW
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	Between two times and five times the occupied bandwidth
Attenuation	Auto

3.4 Test procedure

1. The transmitter output was connected to the spectrum analyzer.
2. Test was performed in accordance with clause 8.1 option1 of KDB 558074 D01
3. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

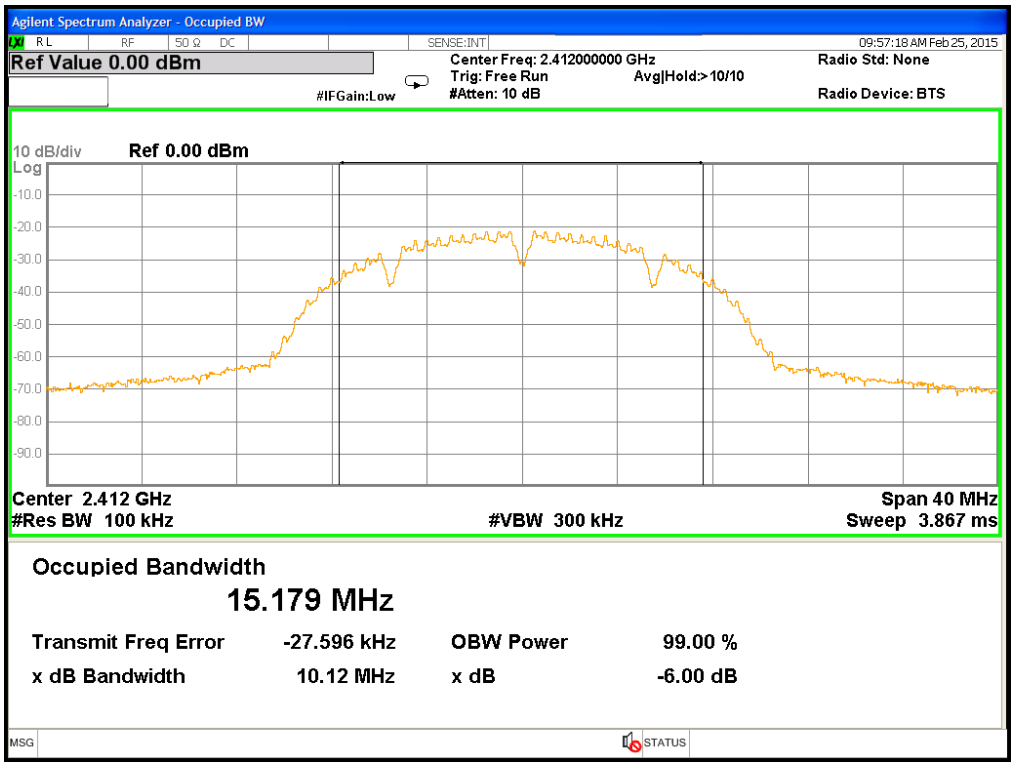
3.5 Test diagram



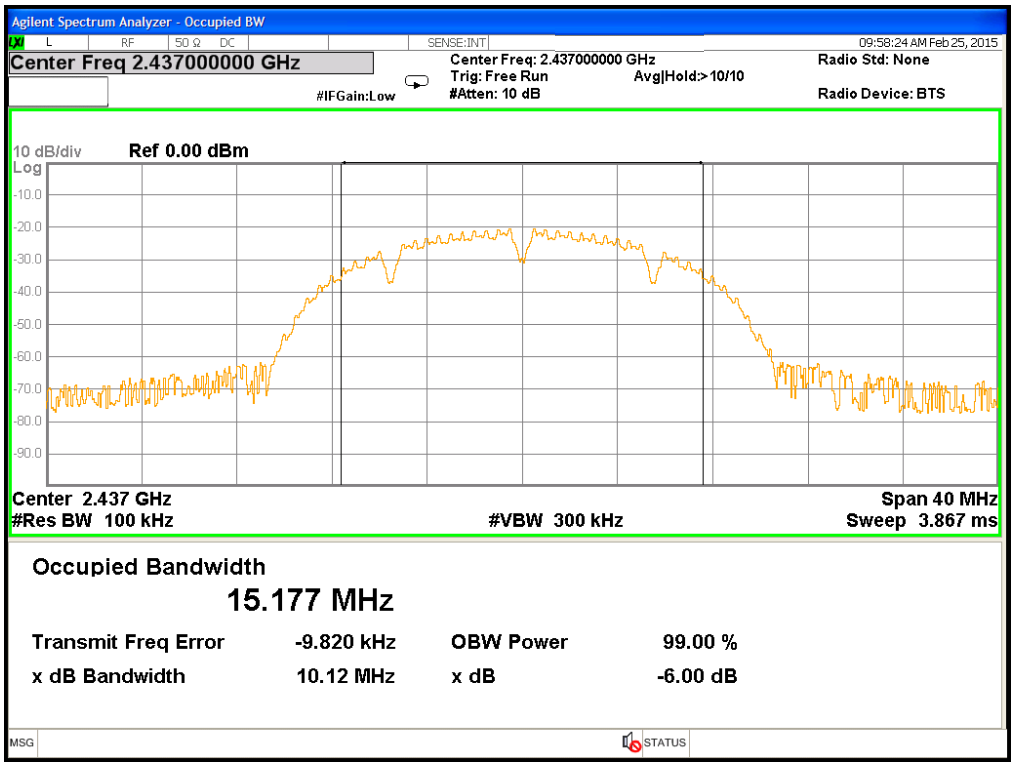
3.6 Test results

Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Pass/Fail
802.11b	1	2412	10.12	0.5	Pass
	6	2437	10.12	0.5	Pass
	11	2462	10.13	0.5	Pass
802.11g	1	2412	16.32	0.5	Pass
	6	2437	16.33	0.5	Pass
	11	2462	16.35	0.5	Pass
802.11n (HT20)	1	2412	16.98	0.5	Pass
	6	2437	17.01	0.5	Pass
	11	2462	16.99	0.5	Pass

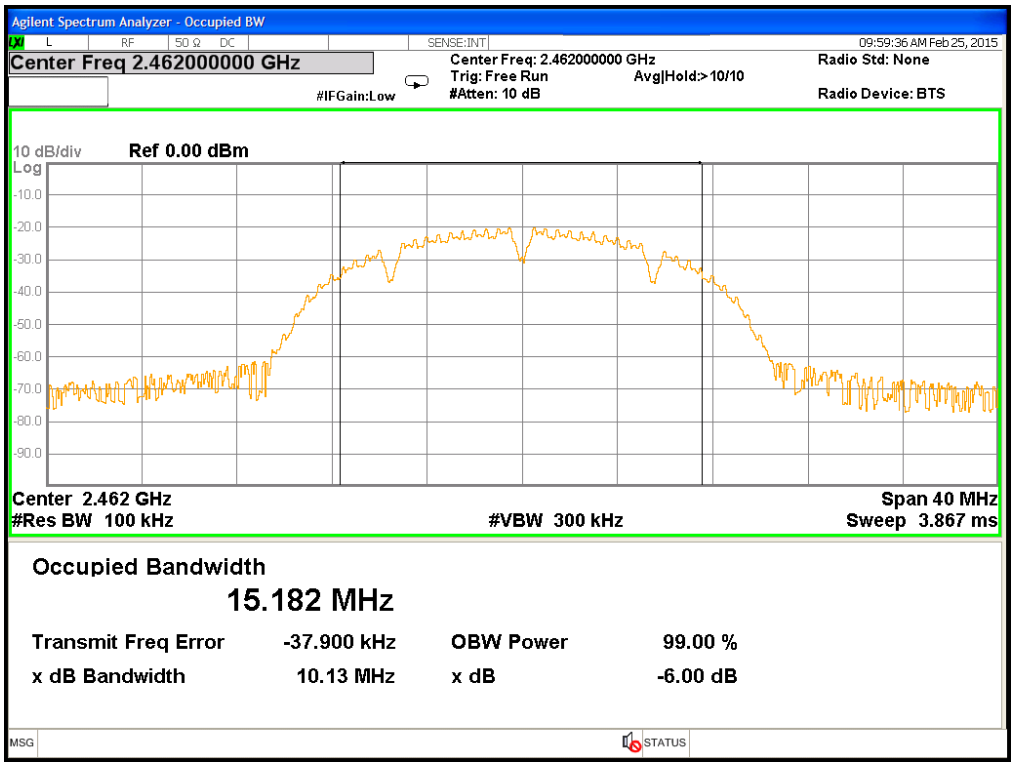
6dB Occupied Bandwidth @ 802.11b mode Ch 1



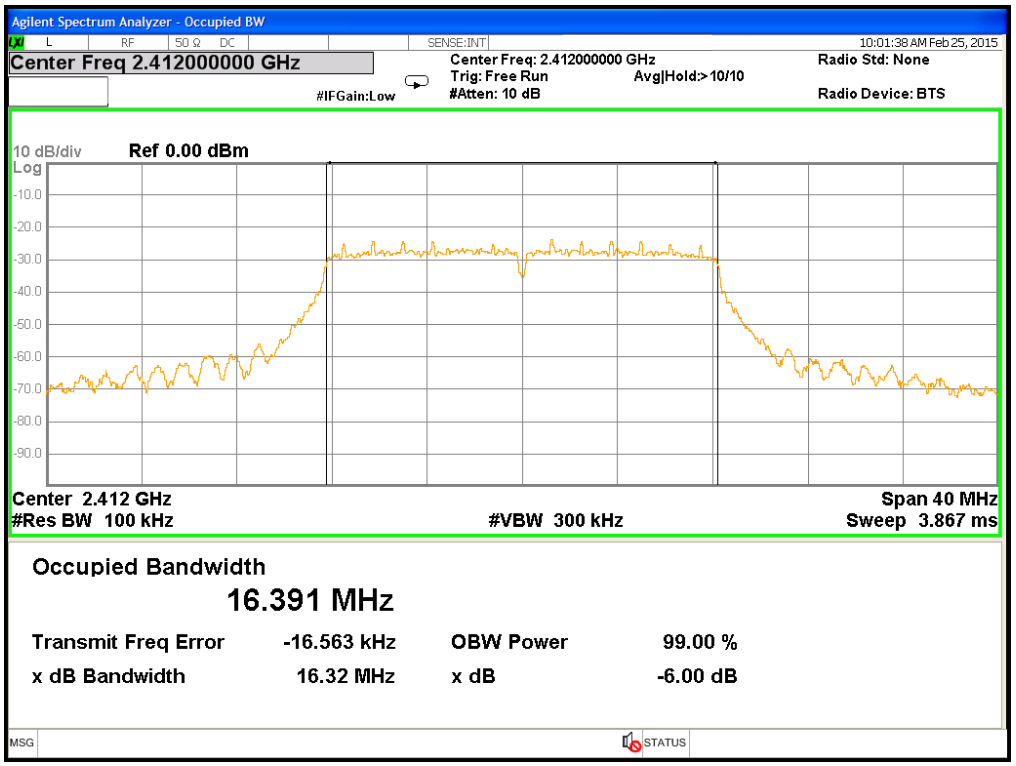
6dB Occupied Bandwidth @ 802.11b mode Ch6



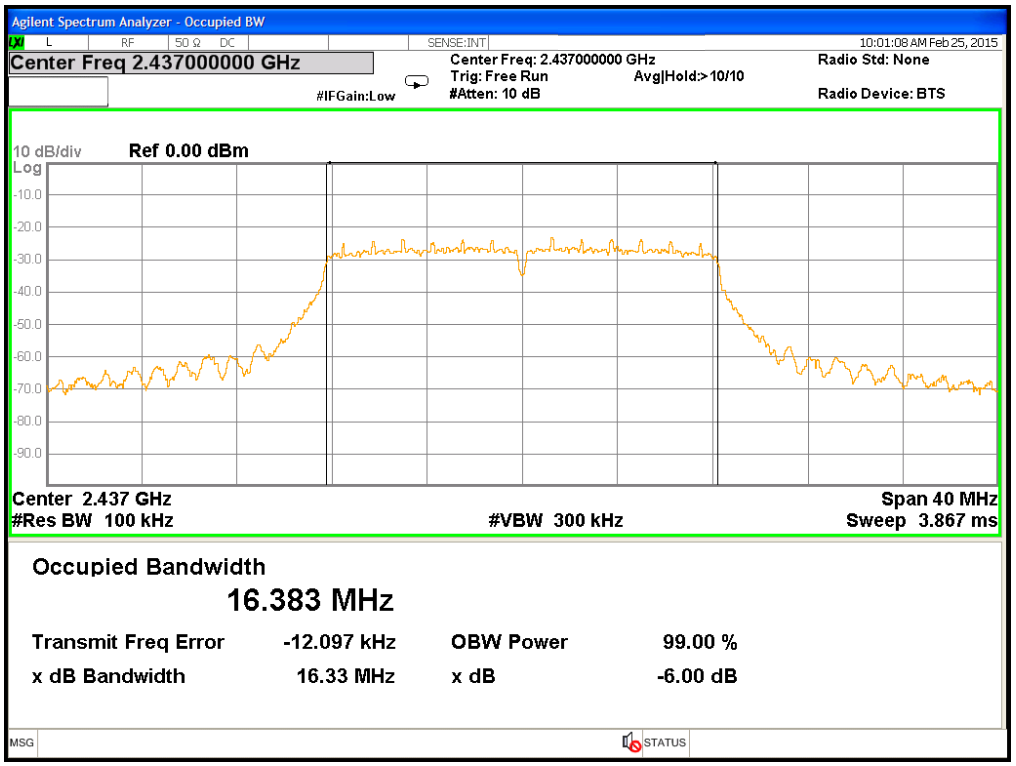
6dB Occupied Bandwidth @ 802.11b mode Ch11



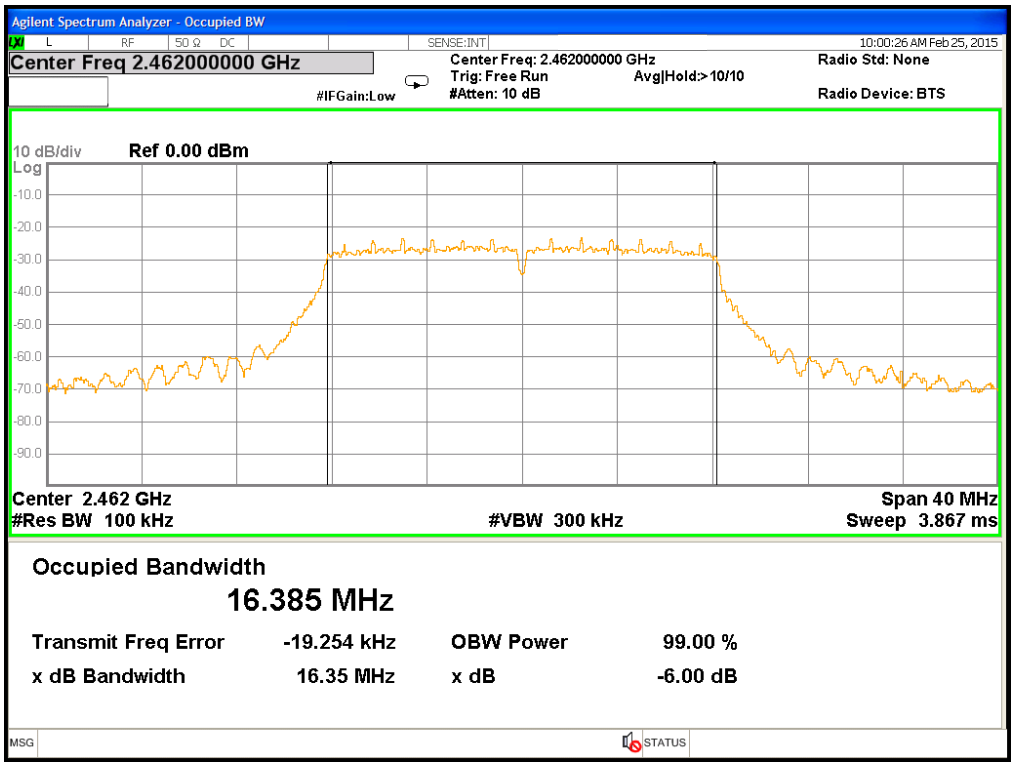
6dB Occupied Bandwidth @ 802.11g mode Ch1



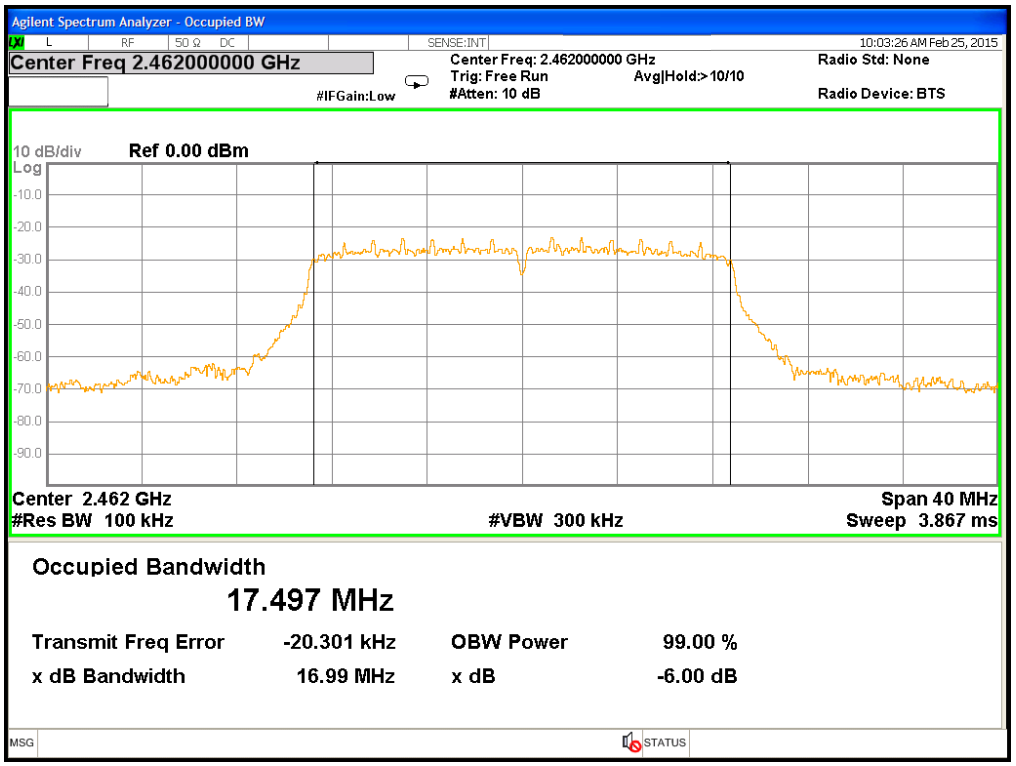
6dB Occupied Bandwidth @ 802.11g mode Ch6



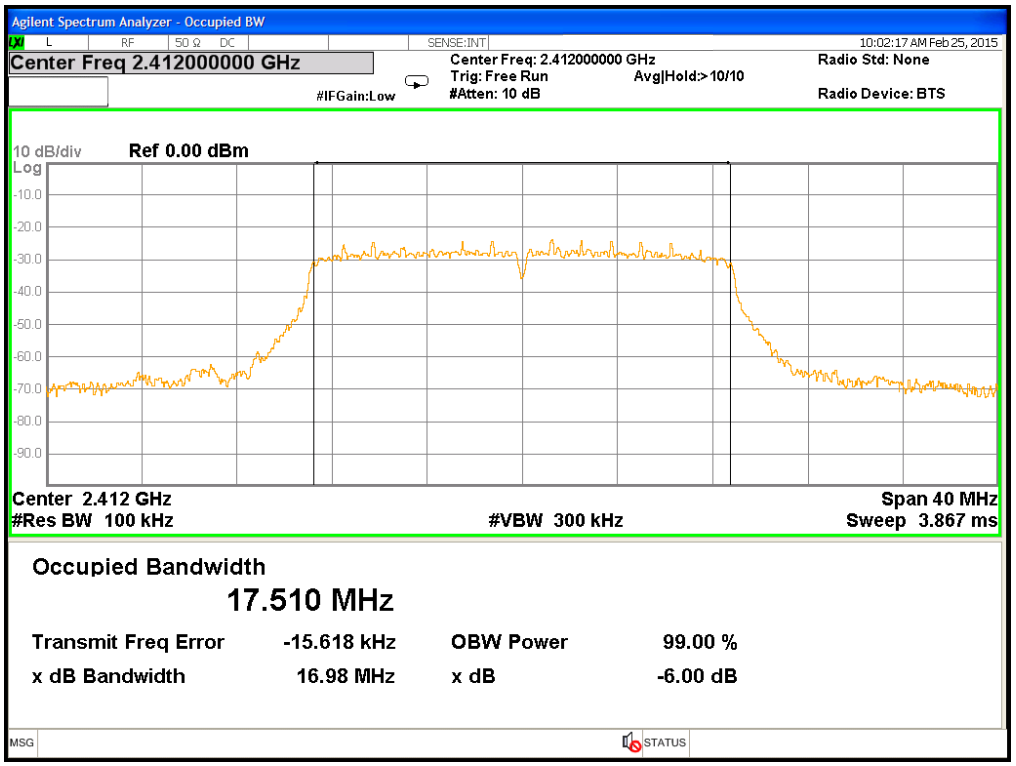
6dB Occupied Bandwidth @ 802.11g mode Ch11



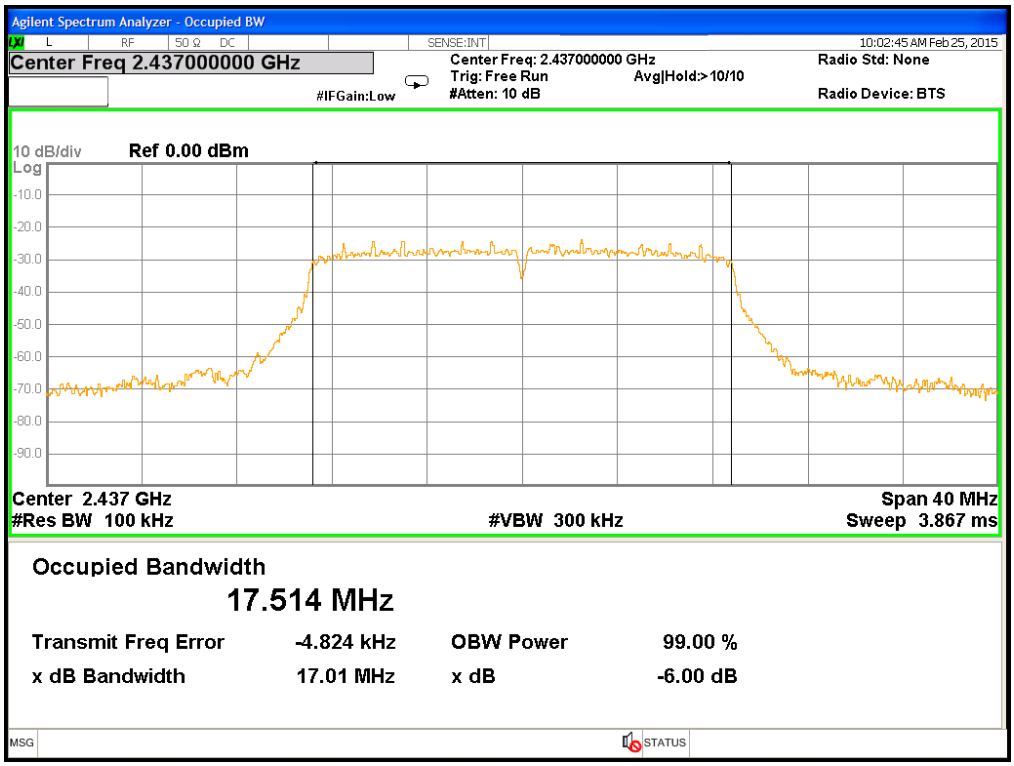
6dB Occupied Bandwidth @ 802.11n (HT20) mode Ch1



6dB Occupied Bandwidth @ 802.11n (HT20) mode Ch6



6dB Occupied Bandwidth @ 802.11n (HT20) mode Ch11



4. Maximum Peak Conducted Output Power

4.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(b)(3) KDB 558074 D01 v03r02	

4.2 Limit for maximum peak conducted output power

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

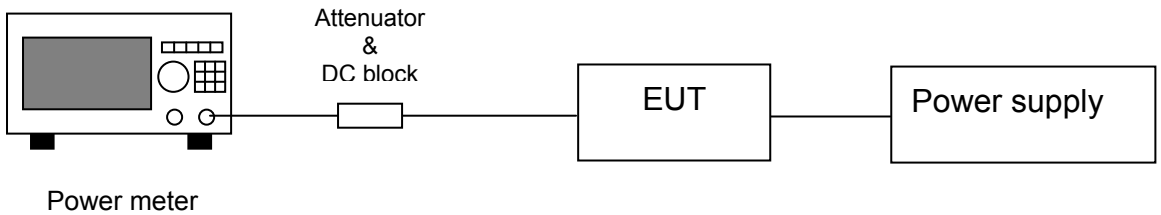
4.3 Measuring instrument setting

Power meter	
Power meter	**Setting**
Bandwidth	65MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak & Average

4.4 Test procedure

Test procedures refer to clause 9.1.3 peak power meter method and clause 9.2.3.2 measurement using a gated RF average power meter of KDB 558074 D01.

4.5 Test diagram



4.6 Test result

Mode	Ch	Freq. (MHz)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximun power (PK) (dBm)	Maximun power (PK) (mW)	Limit (dBm)	Margin (dB)
802.11b	1	2412	12.32	17.06	14.35	27.227	30	-15.65
	6	2437	12.46	17.62	14.47	27.990	30	-15.53
	11	2462	12.69	18.58	14.65	29.174	30	-15.35
802.11g	1	2412	10.38	10.91	18.79	75.683	30	-11.21
	6	2437	10.8	12.02	19.92	98.175	30	-10.08
	11	2462	10.77	11.94	19.01	79.616	30	-10.99
802.11n (HT20)	1	2412	9.83	9.62	17.84	60.814	30	-12.16
	6	2437	10.76	11.91	18.82	76.208	30	-11.18
	11	2462	10.57	11.40	19.48	88.716	30	-10.52

5. Power Spectral Density

5.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(e) KDB 558074 D01 v03r02	

5.2 Limit for power spectrum density

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

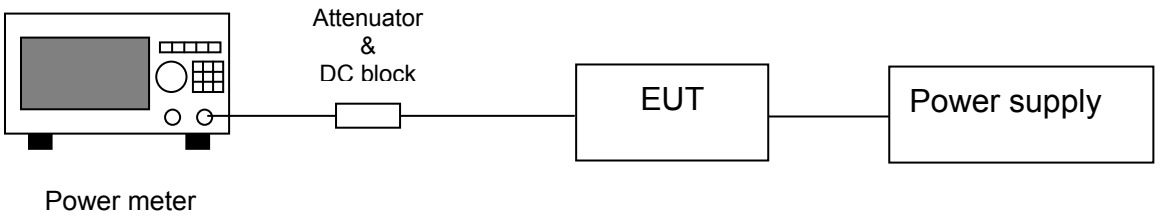
5.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	≧3 kHz
VBW	≧3 x RBW
Sweep	Auto couple
Trace	Max hold
Span	1.5 times x 6dB bandwidth
Attenuation	Auto

5.4 Test procedure

1. Test procedure refer to clause 10.2 method PKPSD (peak PSD) of KDB 558074 D01 and clause E) 2) b) measure and sum spectral maxima across the outputs.
2. Using the maximum conducted output power in the fundamental emission demonstrates compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Use the peak marker function to determine the maximum amplitude level within the RBW.

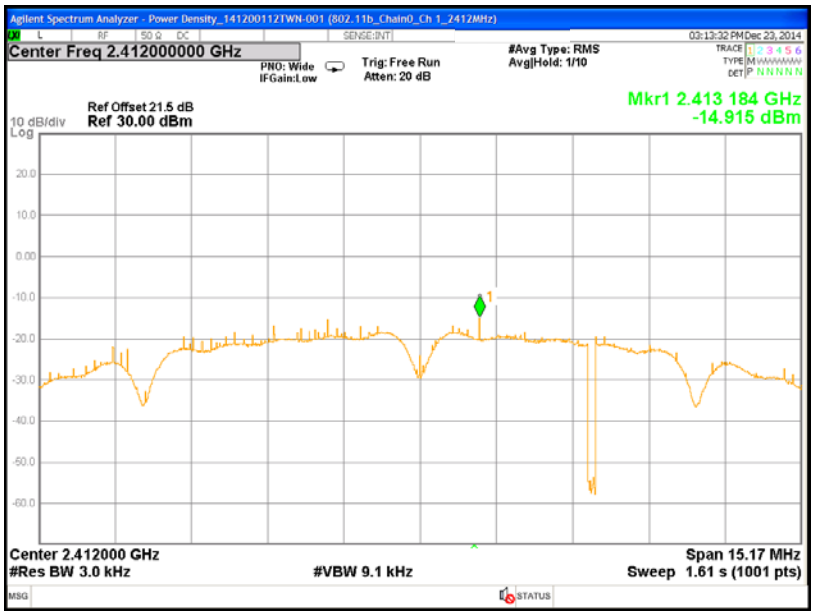
5.5 Test diagram



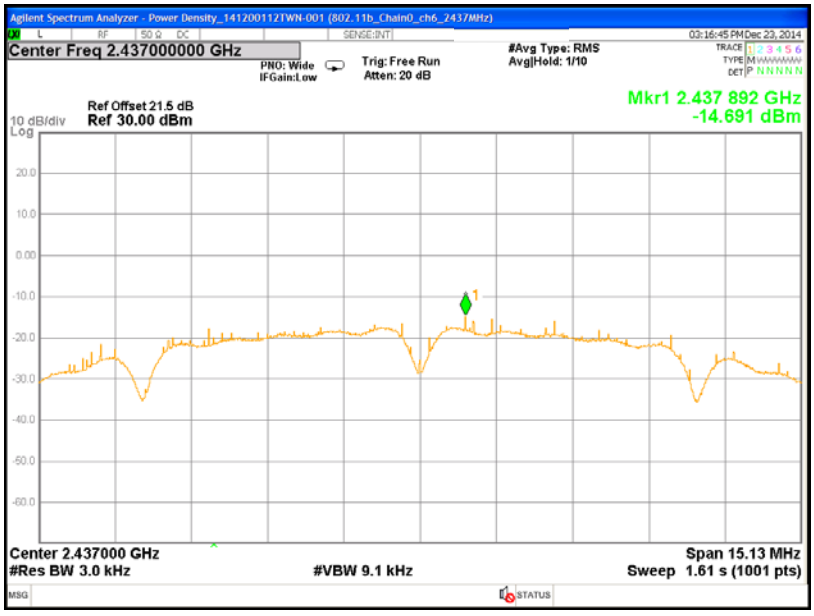
5.6 Test results

Mode	Channel	Frequency (MHz)	PSD		Limit (dBm/3kHz)	Margin (dB)
			(dBm/3kHz)	(mw)		
802.11b	1	2412	-14.92	0.03	8	-22.92
	6	2437	-14.69	0.03	8	-22.69
	11	2462	-15.10	0.03	8	-23.10
802.11g	1	2412	-18.39	0.01	8	-26.39
	6	2437	-17.23	0.02	8	-25.23
	11	2462	-17.38	0.02	8	-25.38
802.11n (HT20)	1	2412	-17.75	0.02	8	-25.75
	6	2437	-16.76	0.02	8	-24.76
	11	2462	-16.66	0.02	8	-24.66

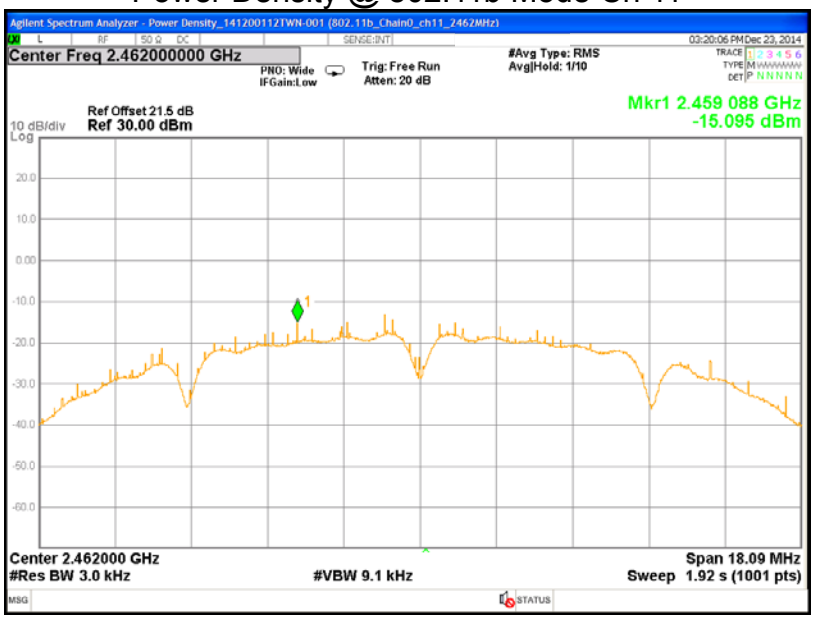
Power Density @ 802.11b Mode Ch 1



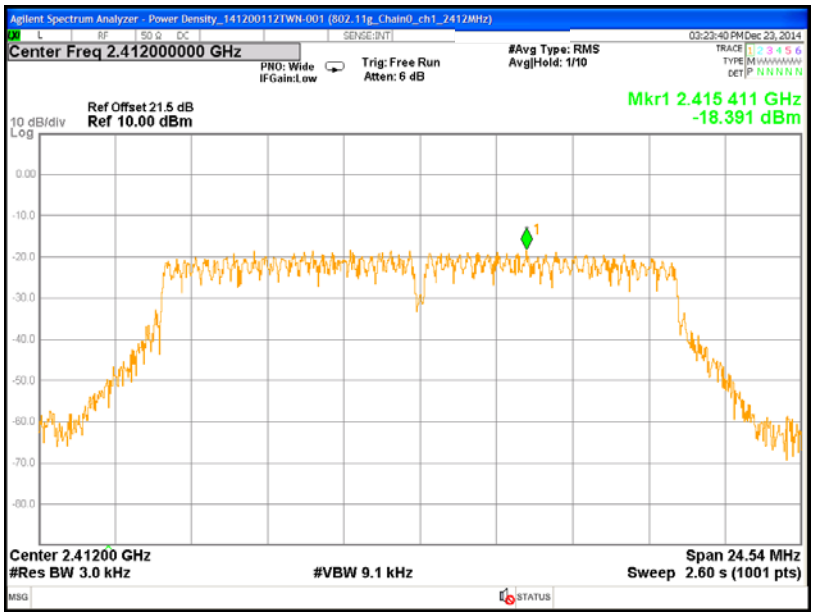
Power Density @ 802.11b Mode Ch 6



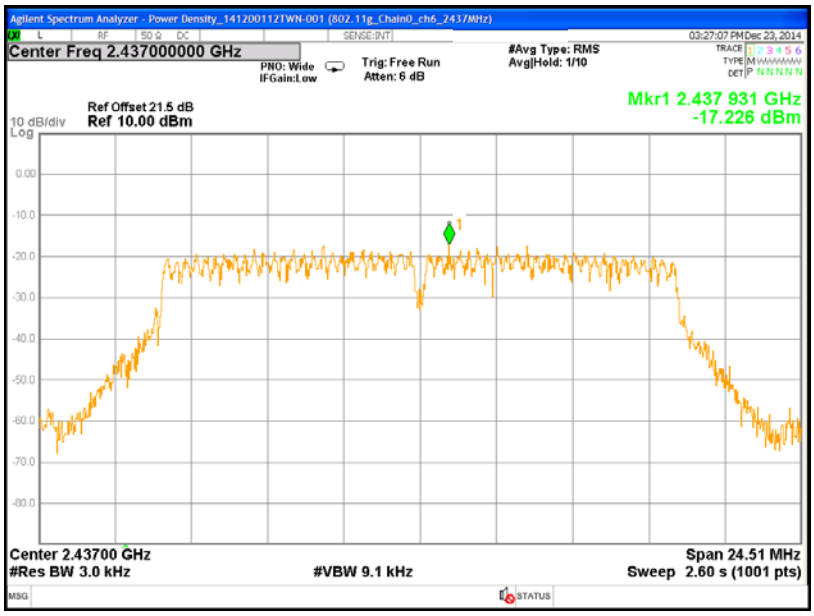
Power Density @ 802.11b Mode Ch 11



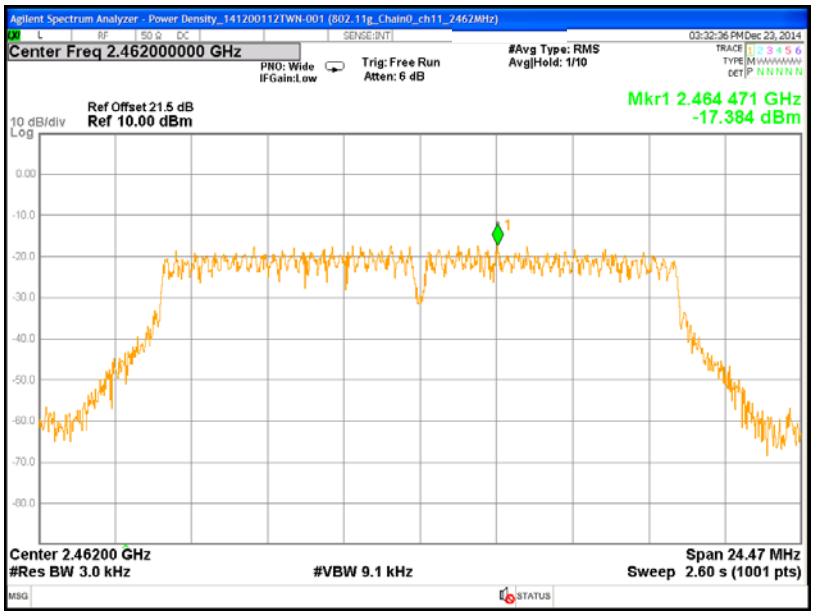
Power Density @ 802.11g Mode Ch 1



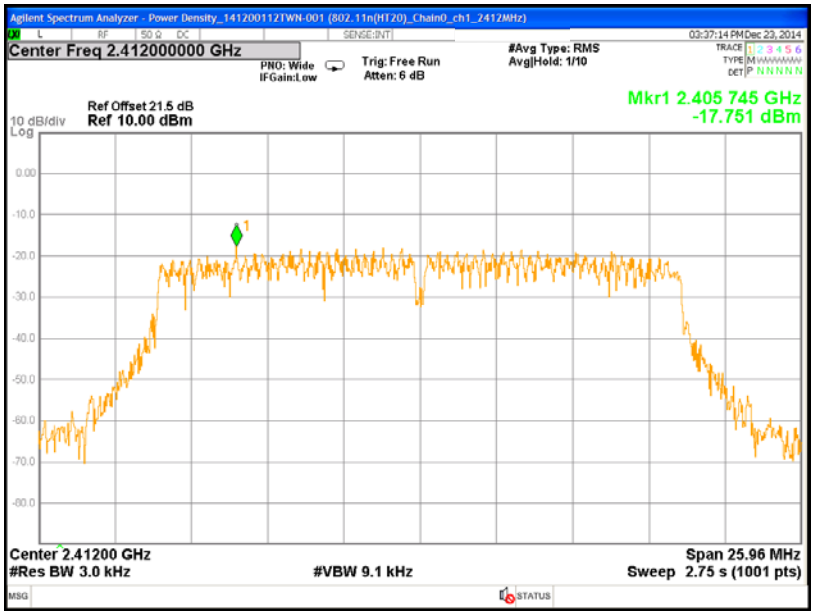
Power Density @ 802.11g Mode Ch 6



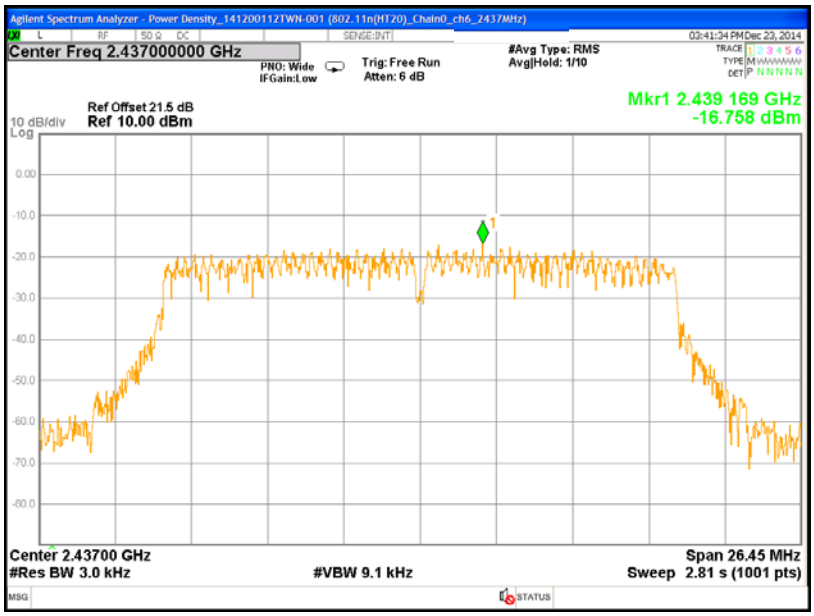
Power Density @ 802.11g Mode Ch 11



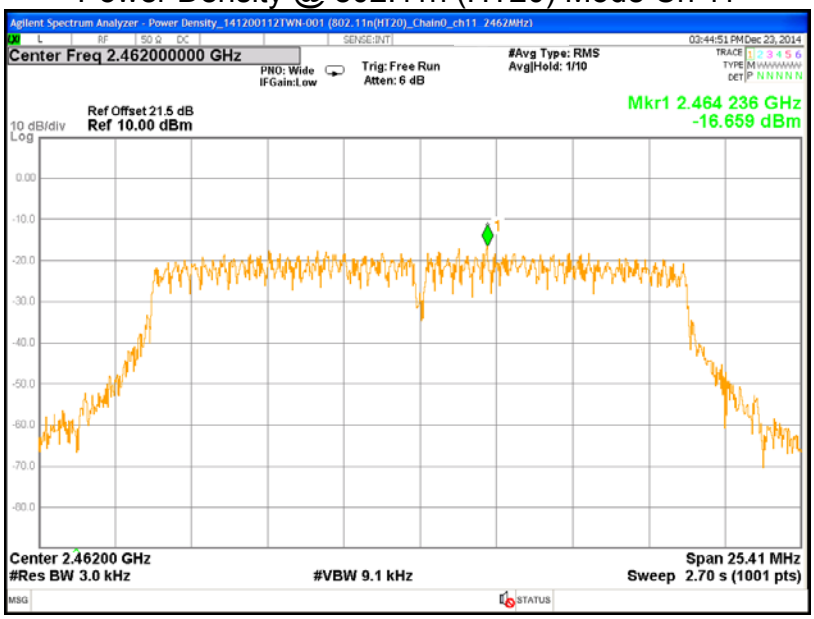
Power Density @ 802.11n (HT20) Mode Ch 1



Power Density @ 802.11n (HT20) Mode Ch 6



Power Density @ 802.11n (HT20) Mode Ch 11



6. Emissions In Non-Restricted Frequency Bands

6.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d)	
Channel number	1、6、11	

6.2 Limit for emissions in non-restricted frequency bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

6.3 Measuring instruments setting

Reference level measurement

Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	≧100 kHz
VBW	≧3 x RBW
Sweep	Auto couple
Trace	Max hold
Span	≧1.5 time 6dB bandwidth
Attenuation	Auto

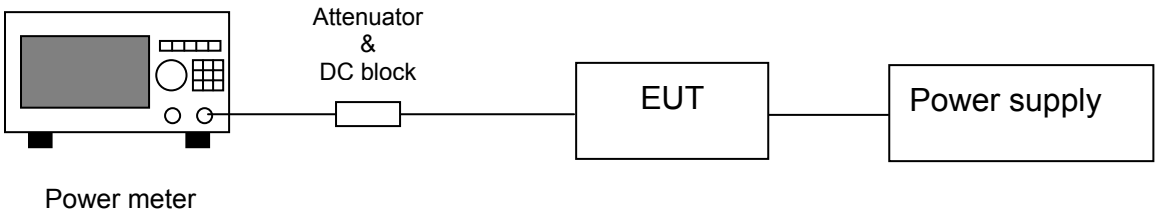
Emission level measurement

Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	≧100 kHz
VBW	≧3 x RBW
Sweep	Auto couple
Trace	Max hold
Attenuation	Auto

6.4 Test procedure

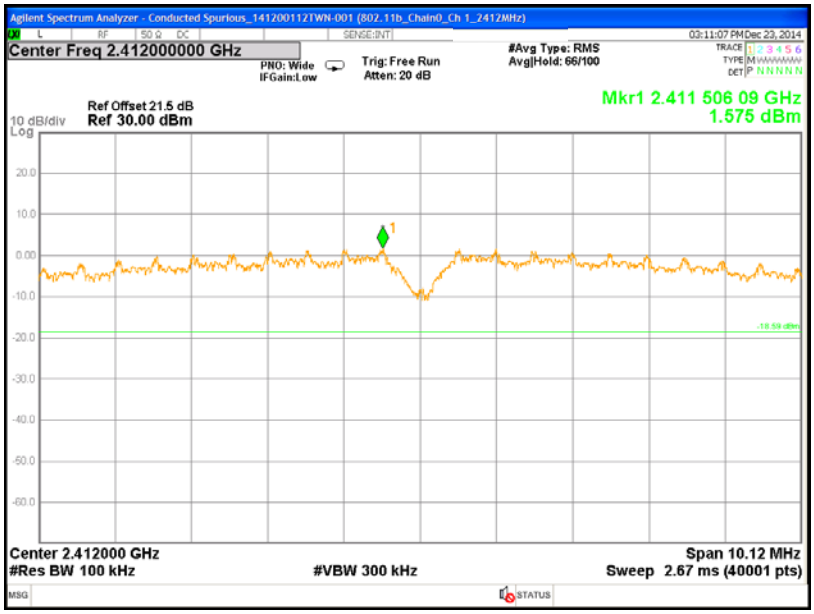
1. The procedure was used in antenna-port conducted and connected to the spectrum analyzer.
2. Set instrument center frequency to center frequency
3. Use the parameter configured in clause 6.3 to measure
4. Use the peak marker function to determine the maximum amplitude level.

6.5 Test diagram

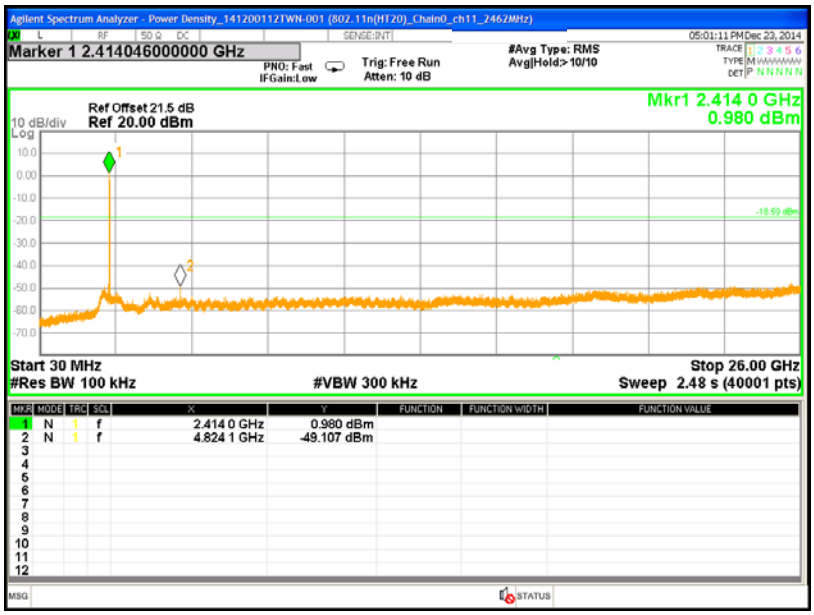


6.6 Test results

Conducted Spurious @ 802.11b mode Ch 1

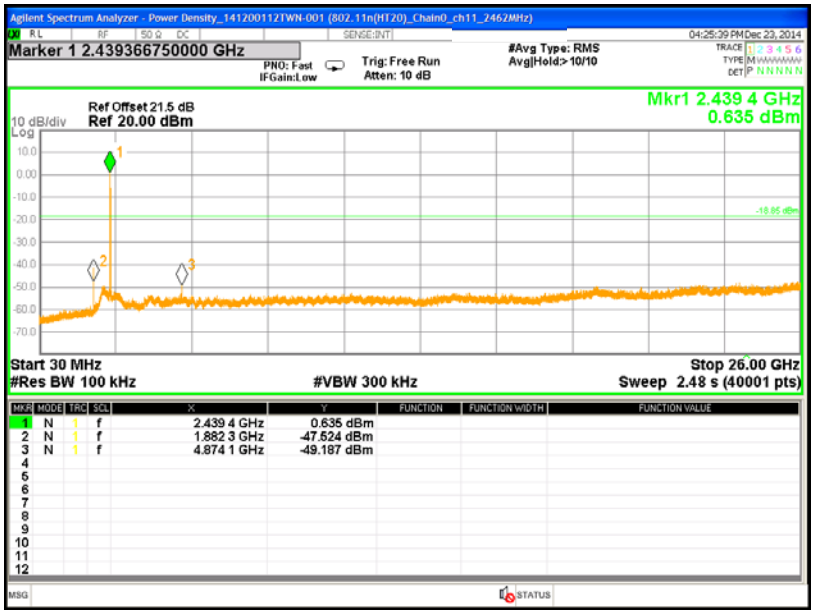


Conducted Spurious @ 802.11b mode Ch 1 (30M-26G)

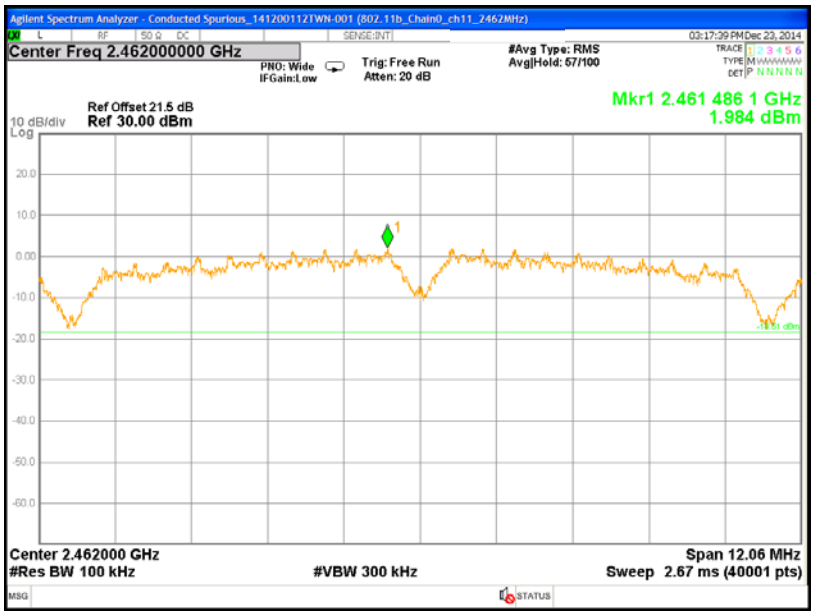


Conducted Spurious @ 802.11b mode Ch 6

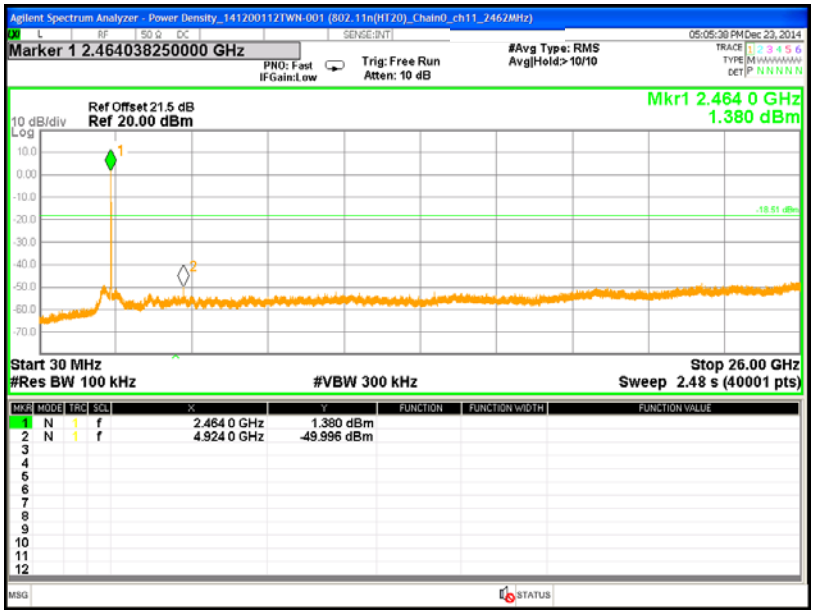
Conducted Spurious @ 802.11b mode Ch 6 (30M-26G)



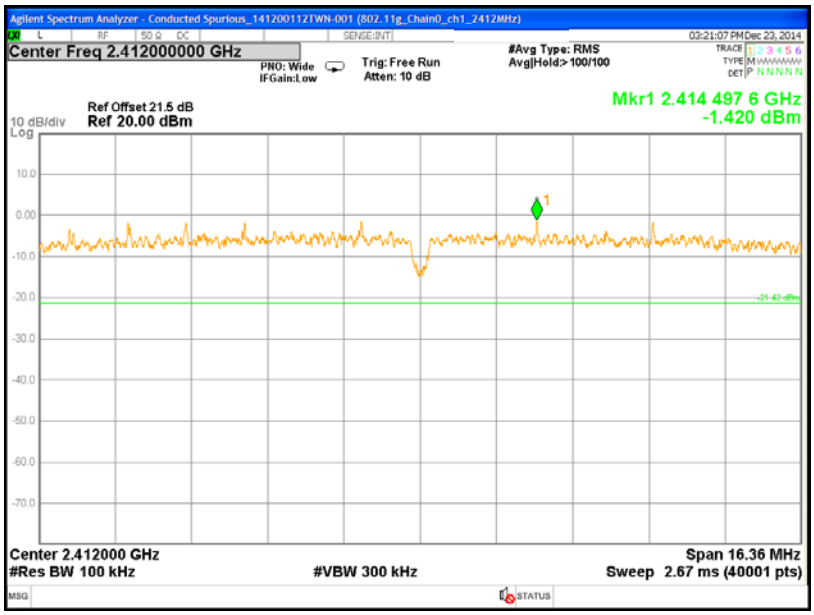
Conducted Spurious @ 802.11b mode Ch 11



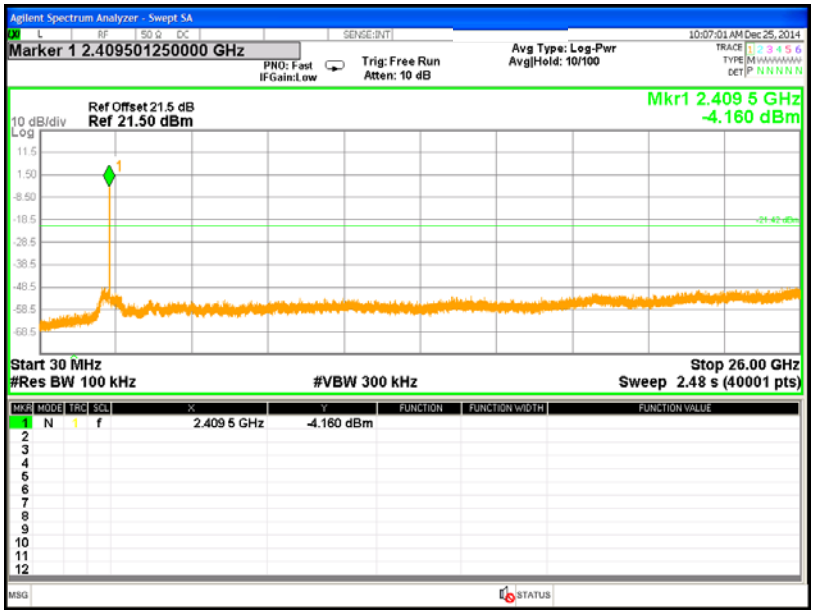
Conducted Spurious @ 802.11b mode Ch 11 (30M-26G)



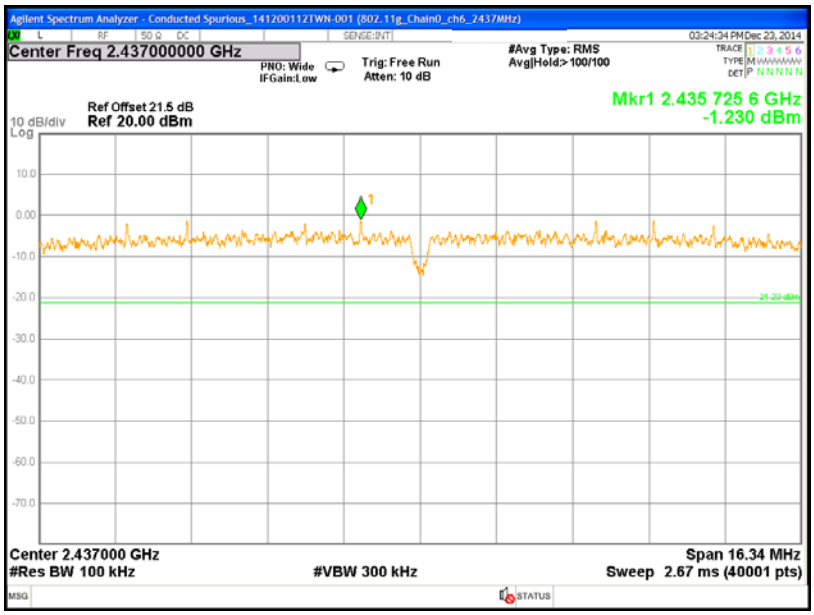
Conducted Spurious @ 802.11g mode Ch 1



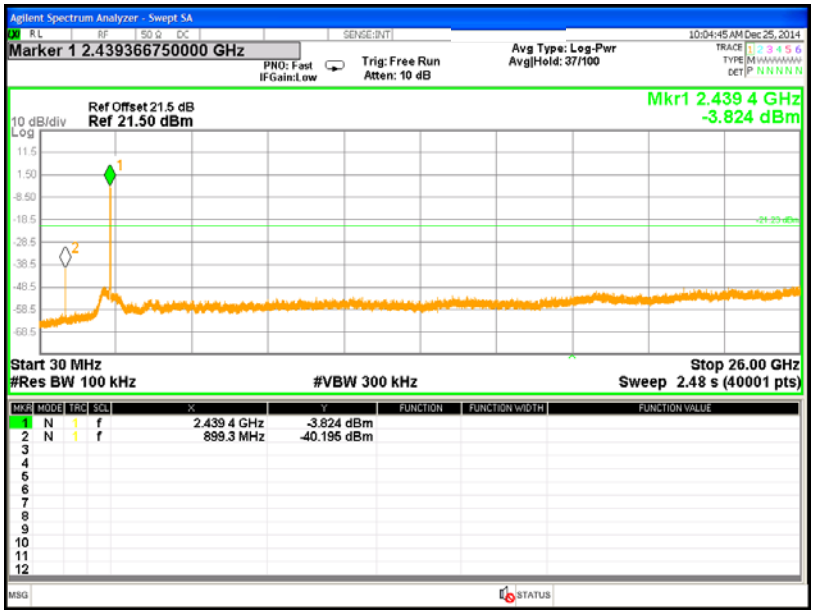
Conducted Spurious @ 802.11g mode Ch 1 (30M-26G)



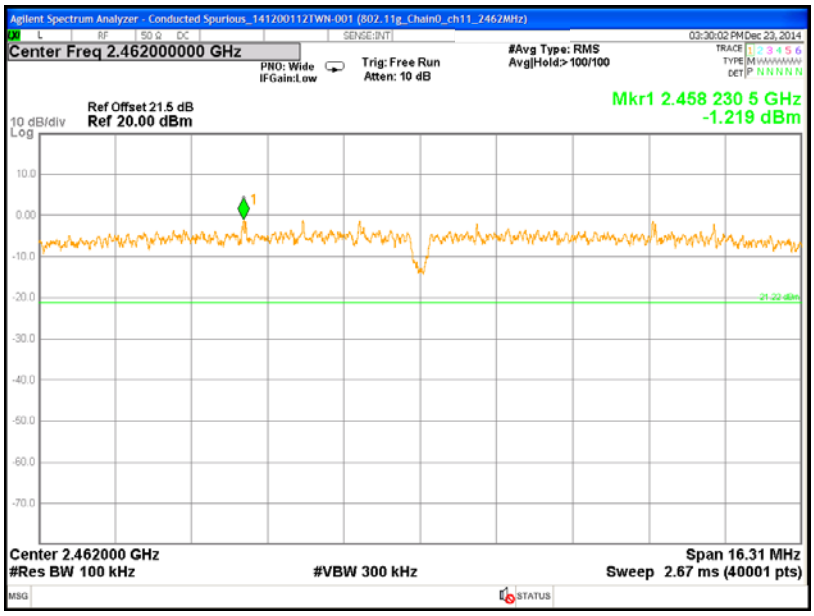
Conducted Spurious @ 802.11g mode Ch 6



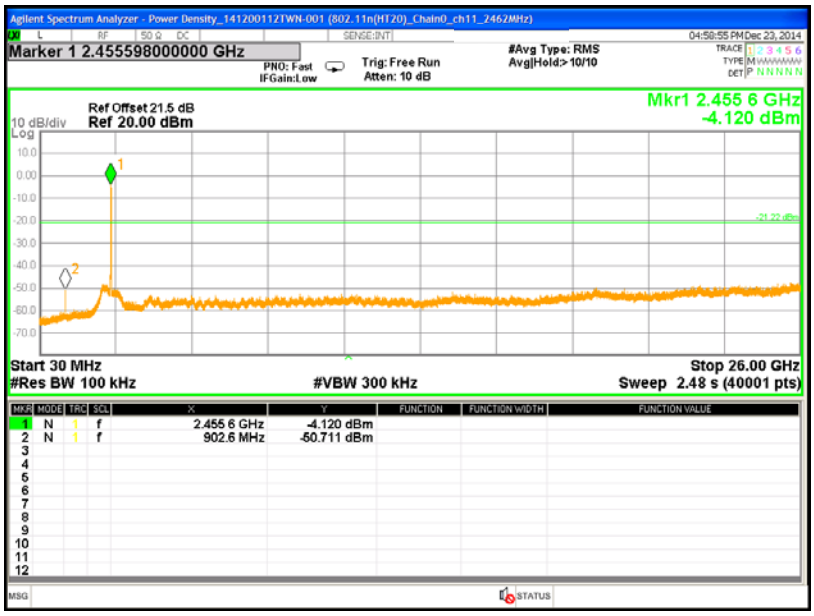
Conducted Spurious @ 802.11g mode Ch 6 (30M-26G)



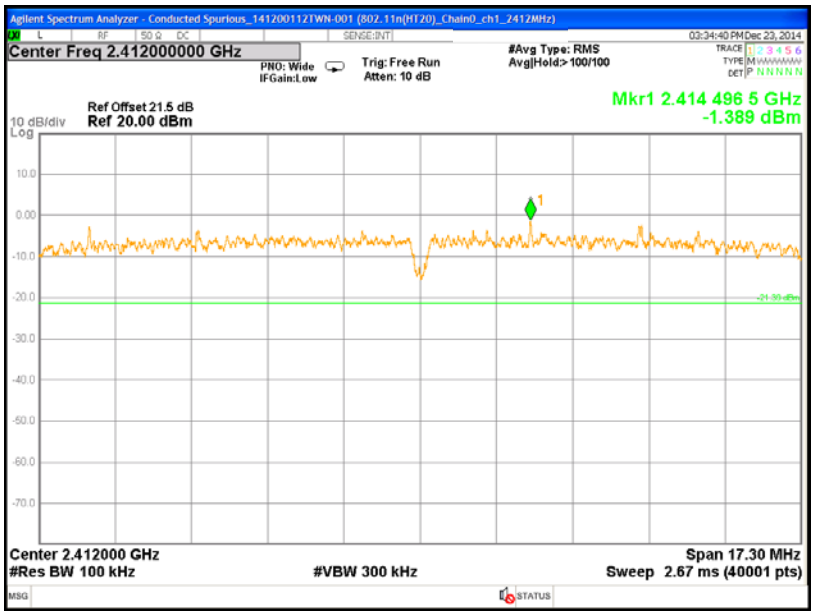
Conducted Spurious @ 802.11g mode Ch 11



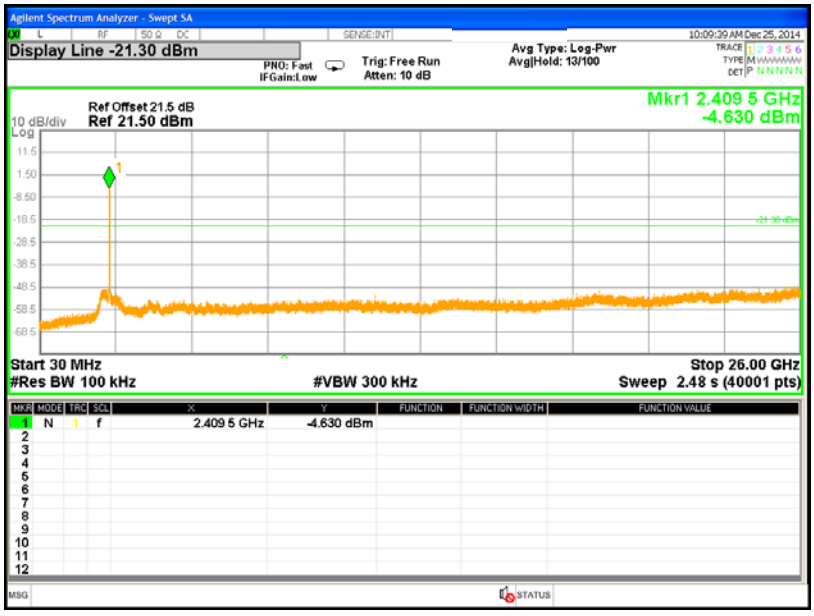
Conducted Spurious @ 802.11g mode Ch 11 (30M-26G)



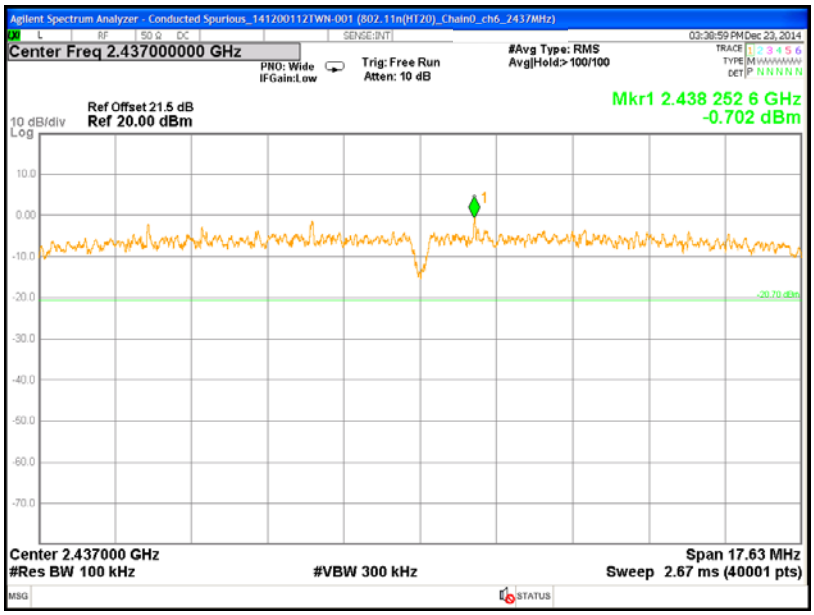
Conducted Spurious @ 802.11n HT20 mode Ch 1



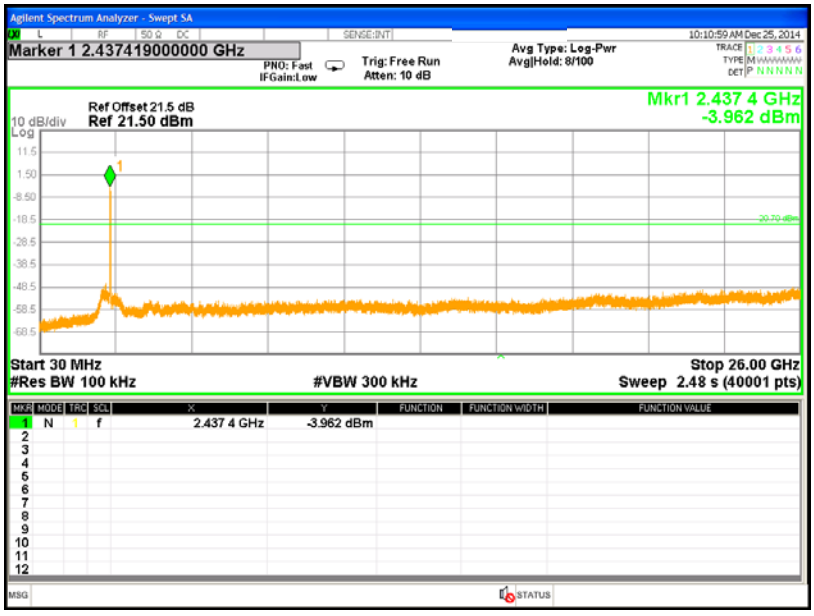
Conducted Spurious @ 802.11n HT20 mode Ch 1 (30M-26G)



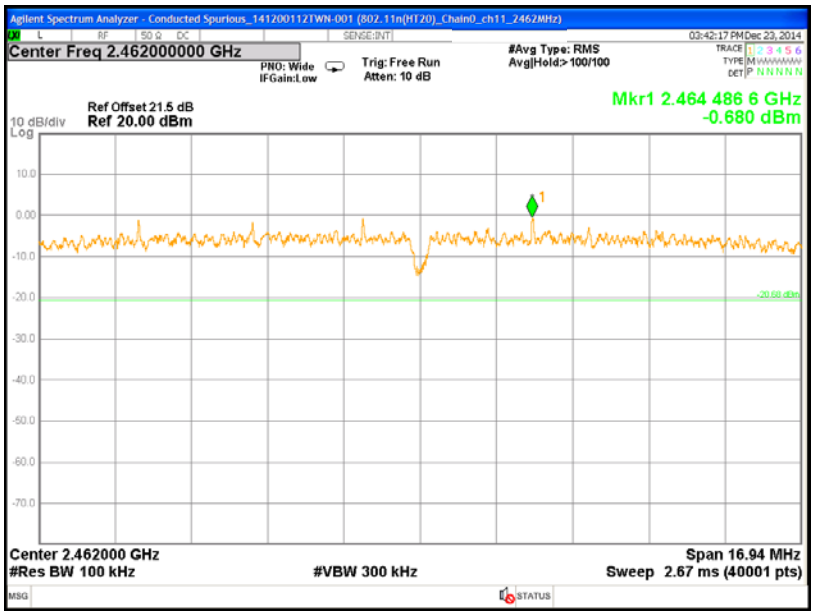
Conducted Spurious @ 802.11n HT20 mode Ch 6



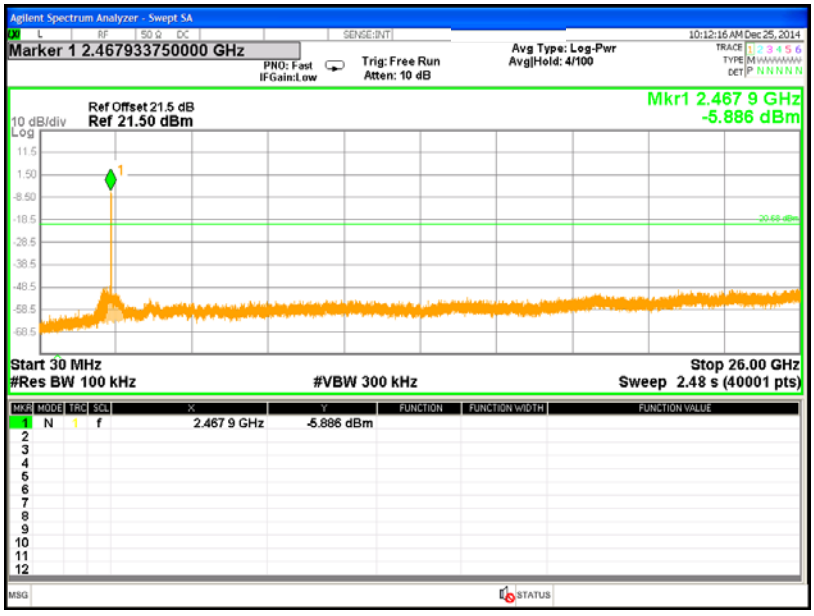
Conducted Spurious @ 802.11n HT20 mode Ch 6 (30M-26G)



Conducted Spurious @ 802.11n HT20 mode Ch 11



Conducted Spurious @ 802.11n HT20 mode Ch 11 (30M-26G)



7. Emissions In Restricted Frequency Bands (Radiated emission measurements)

7.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d), 15.205, 15.209	

7.2 Limit for emission in restricted frequency bands (Radiated emission measurement)

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

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

7.3 Measuring instrument setting

Below 1GHz measurement

Receiver settings	
Receiver function	**Setting**
Detector	QP
RBW	30-1000 MHz; 100-120 kHz
VBW	≧3 x RBW
Sweep	Auto couple
Attenuation	Auto

Above 1GHz measurement

Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	1MHz
VBW	3MHz for Peak; 10Hz for Average
Sweep	Auto couple
Start Frequency	1GHz
Stop Frequency	Tenth harmonic
Attenuation	Auto

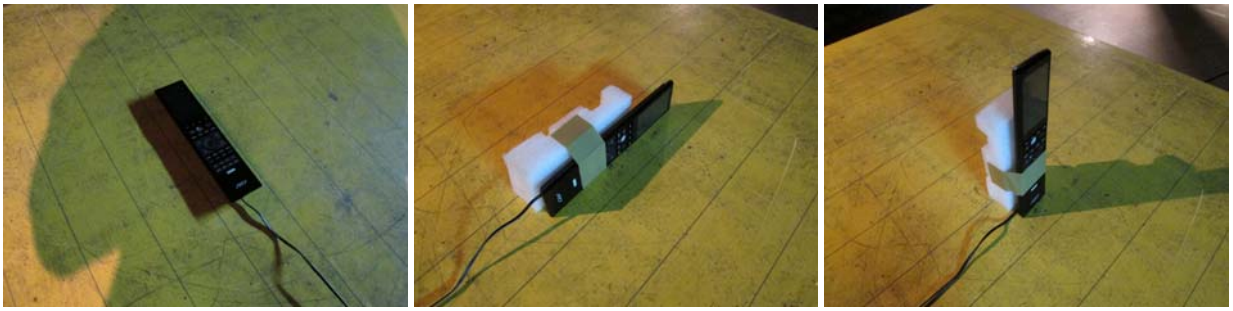
7.4 Test procedure

1. The EUT was placed on the top of the turntable 0.8 meter above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization
4. If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
5. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

7.5 Test diagram

The signal is maximized through rotation and placement in the three orthogonal axes.

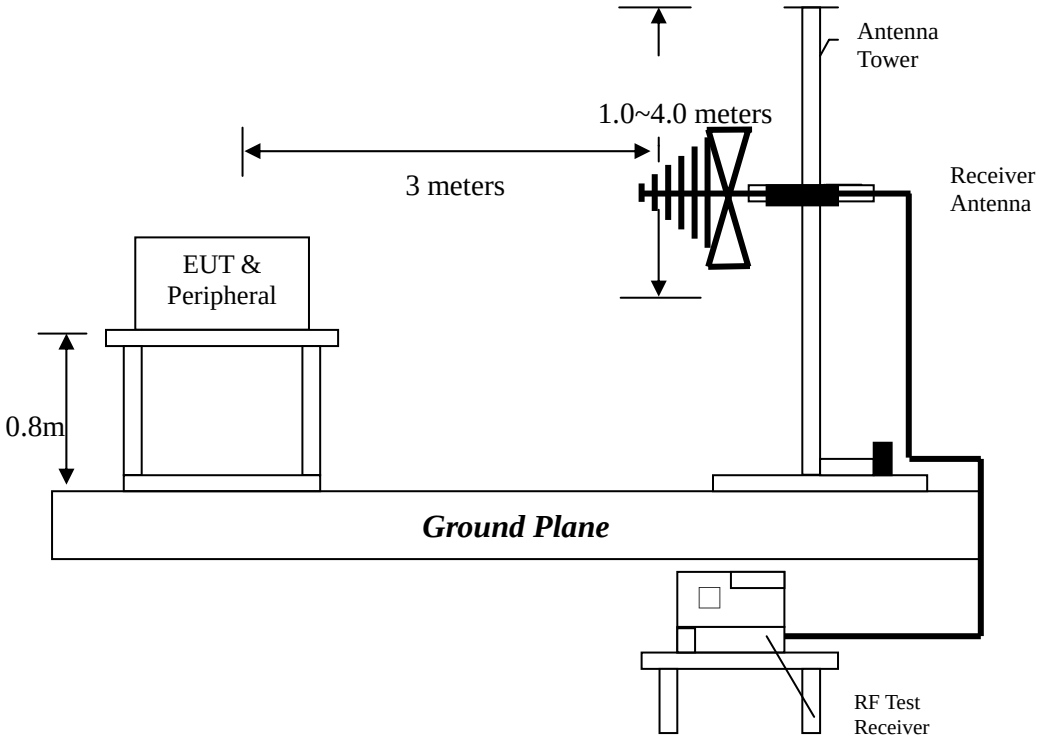
X- axis Y- axis Z- axis



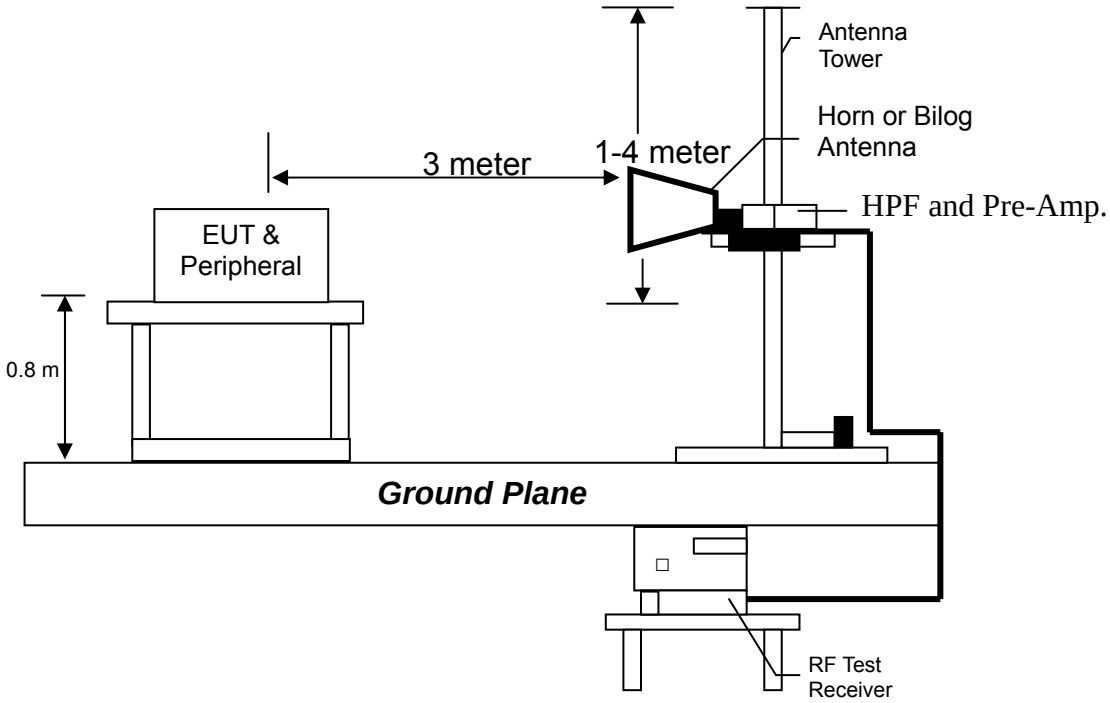
After verifying three axes, we found the maximum electromagnetic field was occurred at Z-axis configuration. The final test data was executed under this configuration.

7.6 Test configuration

7.6.1 Radiated emission below 1GHz using Bilog Antenna



7.6.2 Radiated emission above 1GHz using Horn Antenna



7.7 Test result

7.7.1 Measurement results: frequencies below 1 GHz

The test was performed on EUT under 802.11b/g/n continuously transmitting mode. The worst case occurred at chain 0: 802.11b Tx channel 11.

EUT : APM 6998 WiFi Module
Worst Case : 802.11b Tx channel 11

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBμV)	Corrected Level (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	61.04	QP	16.01	21.88	37.76	40.00	-2.24
Vertical	156.10	QP	16.46	23.17	39.58	43.50	-3.92
Vertical	253.10	QP	15.98	20.44	36.73	46.00	-9.27
Vertical	423.82	QP	20.52	14.32	34.59	46.00	-11.41
Vertical	507.24	QP	22.17	12.22	34.79	46.00	-11.21
Vertical	689.60	QP	25.50	7.85	33.57	46.00	-12.43
Horizontal	253.10	QP	15.98	22.65	38.44	46.00	-7.56
Horizontal	278.32	QP	16.82	20.78	37.81	46.00	-8.19
Horizontal	373.38	QP	19.29	16.87	36.49	46.00	-9.51
Horizontal	423.82	QP	20.52	17.46	37.71	46.00	-8.29
Horizontal	507.24	QP	22.17	14.19	36.92	46.00	-9.08
Horizontal	798.24	QP	27.28	8.43	35.81	46.00	-10.19

Remark: Corr. Factor = Antenna Factor + Cable Loss

7.7.2 Measurement results: frequency above 1GHz

EUT : APM 6998 WiFi Module

Mode	Freq. (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
802.11b, Ch1, 2412MHz	4824	PK	V	40.10	0.03	43.07	43.10	74.00	-30.90
	4824	PK	H	40.10	0.03	41.62	41.65	74.00	-32.35
802.11b, Ch6,2437MHz	4874	PK	V	40.00	0.19	44.09	44.28	74.00	-29.72
	4874	PK	H	40.00	0.19	43.29	43.48	74.00	-30.52
802.11b, Ch11,2462MHz	4924	PK	V	39.91	0.35	44.20	44.55	74.00	-29.45
	4924	PK	H	39.91	0.35	43.30	43.65	74.00	-30.35
802.11g, Ch1,2412MHz	4824	PK	V	40.10	0.03	41.54	41.57	74.00	-32.43
	4824	PK	H	40.10	0.03	39.57	39.60	74.00	-34.40
802.11g, Ch6,2437MHz	4874	PK	V	40.00	0.19	40.53	40.72	74.00	-33.28
	4874	PK	H	40.00	0.19	40.97	41.16	74.00	-32.84
802.11g, Ch11,2462MHz	4924	PK	V	39.91	0.35	41.28	41.63	74.00	-32.37
	4924	PK	H	39.91	0.35	40.07	40.42	74.00	-33.58
802.11n (HT20), Ch1,2412MHz	4824	PK	V	40.10	0.03	42.10	42.13	74.00	-31.87
	4824	PK	H	40.10	0.03	39.59	39.62	74.00	-34.38
802.11n (HT20), Ch6,2437MHz	4874	PK	V	40.00	0.19	41.36	41.55	74.00	-32.45
	4874	PK	H	40.00	0.19	39.68	39.87	74.00	-34.13
802.11n (HT20), Ch11,2462MHz	4924	PK	V	39.91	0.35	41.69	42.04	74.00	-31.96
	4924	PK	H	39.91	0.35	41.43	41.78	74.00	-32.22

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

8. Emission On Band Edge

8.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d), 15.205,	

8.2 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	1MHz
VBW	3MHz for Peak; 10Hz for Average
Sweep	Auto couple
Restrict bands	2310~2390MHz
	2483.5 ~2500MHz
Attenuation	Auto

8.3 Test procedure

The test procedure is the same as clause 7.4

8.4 Test results

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
802.11b	2388.00	PK	H	33.84	33.84	67.68	74	-6.32	2310~2390
	2390.00	AV	H	33.85	14.33	48.18	54	-5.82	
	2486.58	PK	H	34.32	38.26	72.58	74	-1.42	2483.5~2500
	2483.50	AV	H	34.30	14.90	49.20	54	-4.80	
802.11g	2388.32	PK	H	33.84	29.16	63.00	74	-11.00	2310~2390
	2390.00	AV	H	33.85	14.75	48.60	54	-5.40	
	2484.38	PK	H	34.31	38.29	72.60	74	-1.40	2483.5~2500
	2483.50	AV	H	34.30	16.33	50.63	54	-3.37	
802.11n HT 20	2389.52	PK	H	33.85	33.44	67.29	74	-6.71	2310~2390
	2390.00	AV	H	33.85	14.93	48.78	54	-5.22	
	2485.59	PK	H	34.31	36.67	70.98	74	-3.02	2483.5~2500
	2483.50	AV	H	34.30	16.01	50.31	54	-3.69	

9. AC Power Line Conducted Emission

9.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Test Voltage	120V, 60Hz	
Requirement	15.207	
Date of test	Apr. 10, 2015	

9.2 Limit for AC power line conducted emission

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

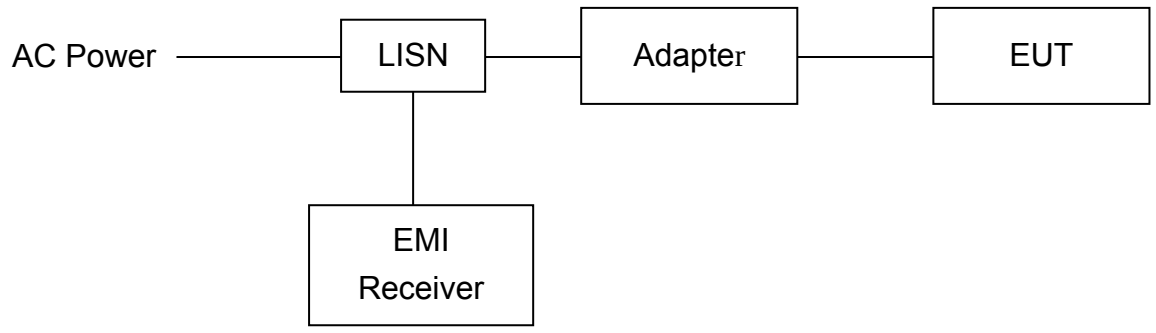
9.3 Measuring instrument setting

Receiver settings	
Receiver function	**Setting**
Detector	QP
Start frequency	0.15MHz
Stop frequency	30MHz
IF bandwidth	9 kHz
Attenuation	10dB

9.4 Test procedure

1. Configure the EUT according to ANSI C63.10. The EUT or host of EHT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network.
3. All the companion devices are connected to the other LISN. The LISN should provide 50Uh/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30MHz was searched
5. Set the test-receiver system to peak detector and specified bandwidth with maximum hold mode.
6. The measurement has to be done between each power line and ground at the power terminal.

9.5 Test diagram



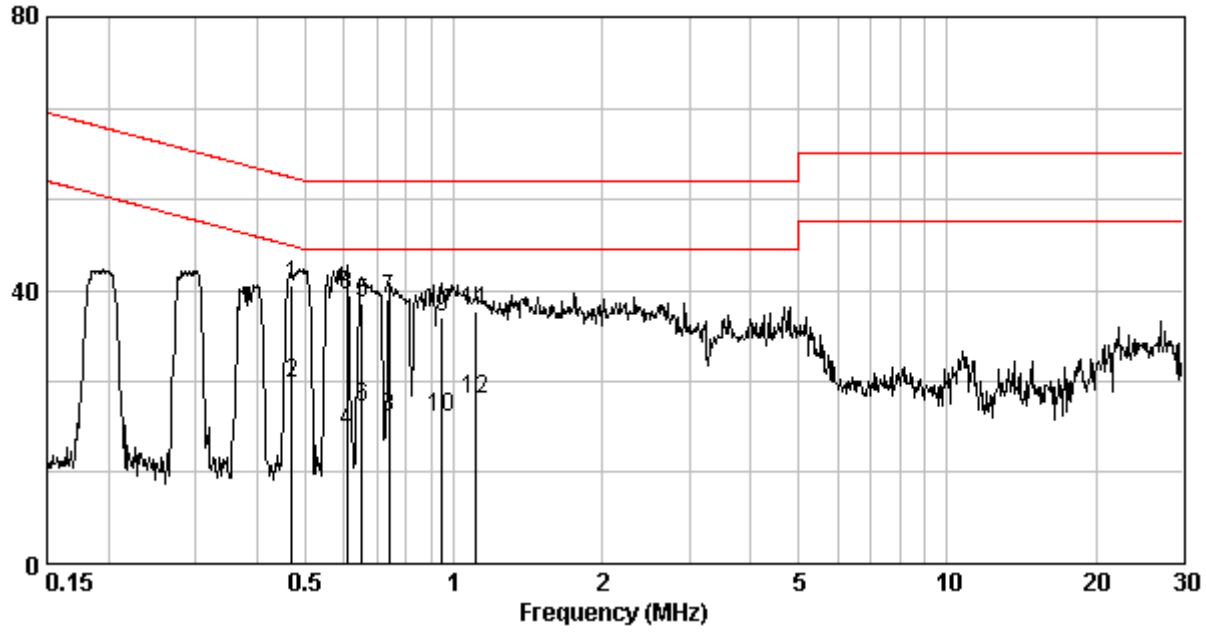
Note: The EUT was tested while in normal communication mode.

9.6 Test results

Phase : Line
EUT : APM 6998 WiFi Module
Test Condition : TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Over Limit (dB) Qp	Av
0.471	9.73	40.76	56.49	26.51	46.49	-15.74	-19.99
0.608	9.76	39.26	56.00	19.35	46.00	-16.74	-26.65
0.651	9.77	38.23	56.00	22.95	46.00	-17.77	-23.05
0.739	9.79	38.82	56.00	21.28	46.00	-17.18	-24.72
0.948	9.83	36.13	56.00	21.49	46.00	-19.87	-24.51
1.111	9.84	37.07	56.00	24.10	46.00	-18.93	-21.90

Remark:
1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Over Limit (dB) = Level (dBuV) – Limit (dBuV)

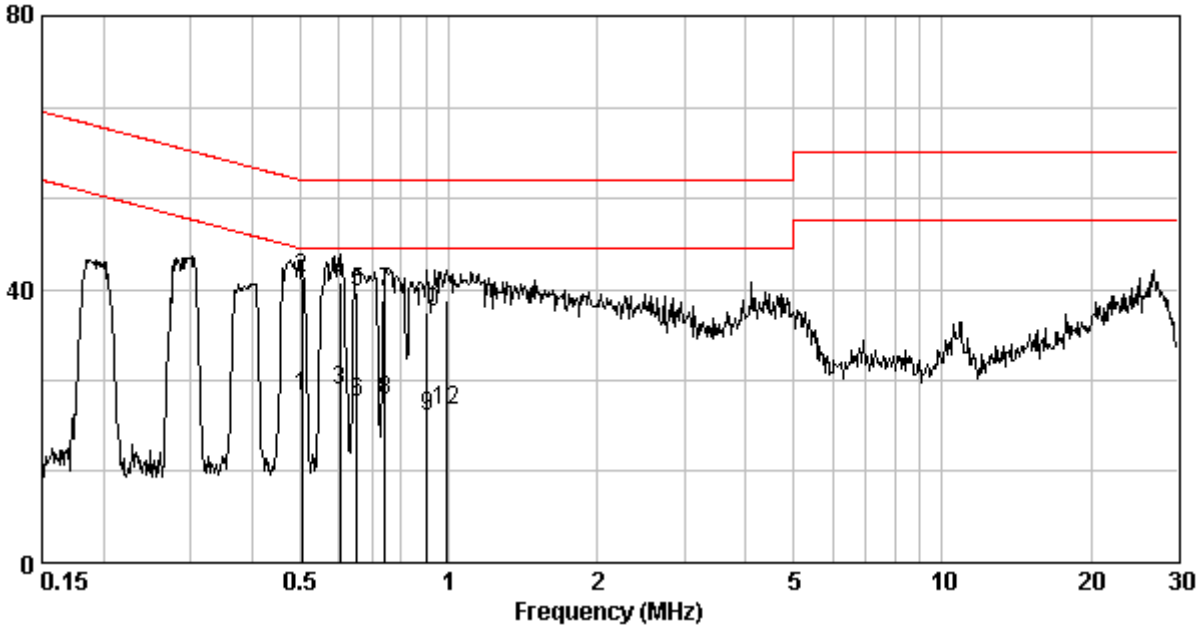


Phase	: Neutral
EUT	: APM 6998 WiFi Module
Test Condition	: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Over Limit (dB) Qp	Av
0.505	9.73	41.71	56.00	24.43	46.00	-14.29	-21.57
0.601	9.76	41.11	56.00	25.32	46.00	-14.89	-20.68
0.651	9.77	39.53	56.00	23.56	46.00	-16.47	-22.44
0.743	9.79	39.57	56.00	23.80	46.00	-16.43	-22.20
0.904	9.82	36.56	56.00	21.46	46.00	-19.44	-24.54
0.994	9.84	38.43	56.00	22.29	46.00	-17.57	-23.71

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Over Limit (dB) = Level (dBuV) – Limit (dBuV)



Appendix A: Test equipment list

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2014/12/02	2015/12/01
Spectrum Analyzer	Rohde & Schwarz	FSP30	100137	2014/6/16	2015/06/15
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100186	2015/1/13	2016/01/13
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2014/08/29	2017/08/27
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2014/09/16	2017/09/14
Broadband Antenna	Schwarzbeck	VULB 9168	9168-172	2013/08/08	2015/08/07
Loop Antenna	RolfHeine	LA-285	02/10033	2014/3/18	2016/03/16
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2014/09/15	2015/09/14
Power Meter	Anritsu	ML2495A	0844001	2014/11/12	2015/11/11
Power Senor	Anritsu	MA2411B	0738452	2014/11/12	2015/11/11
Temperature & Humidity Test Chamber	TERCHY	MHU-225LRU (SA)	950838	2014/6/12	2015/06/11
Two-Line V-Network	Rohde & Schwarz	ESH3-Z5	838979/014	2014/10/05	2015/10/04
Singal Analyzer	Agilent	N9030A	MY51380492	2014/09/19	2015/09/18
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2014/5/6	2015/5/5
966-2(B) Cable	JUNFLON	SMA / J12J100880-00	AUG-26-08-002	2014/5/6	2015/5/5
RF Cable	SUHNER	SUCOFLEX 102	CB0006	2014/5/6	2015/5/5

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.15 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.23 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.19 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.3 dB
Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	4.19 dB
Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	4.3 dB
Conducted Output power	0.86 dB
Radiated electromagnetic disturbances in the frequency range from 9kHz to 30MHz	2.92 dB
Conducted disturbance measurements at a mains port from 9 kHz to 30 MHz using a 50 Ω/50 μH +5Ω artificial mains network (AMN)	2.5dB