



3.3 RADIATED BAND EMISSION MEASUREMENT

3.3.1 TEST REQUIREMENT:

RSS-247 5.5

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

3.3.2 TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel,the Highest channel

Note:

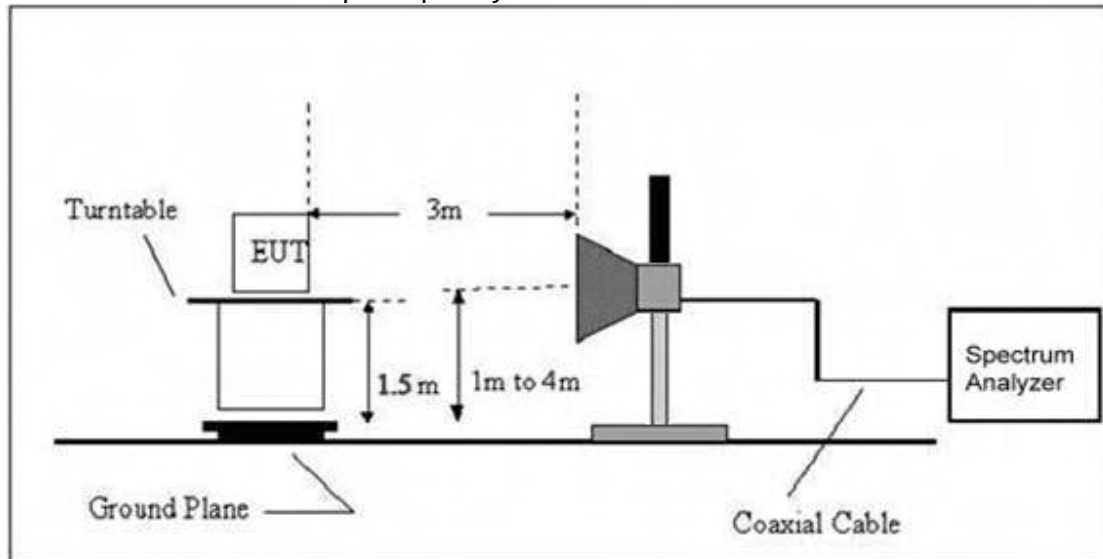
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



3.3.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



3.3.6 TEST RESULT

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
802.11b operation frequency:2412									
V	2390.00	67.86	38.06	7.42	20.15	57.37	74	-16.63	PK
V	2390.00	56.40	38.06	7.42	20.15	45.91	54	-8.09	AV
V	2400.00	68.09	38.06	7.42	20.15	57.60	74	-16.40	PK
V	2400.00	55.95	38.06	7.42	20.15	45.46	54	-8.54	AV
H	2390.00	68.17	38.06	7.42	20.15	57.68	74	-16.32	PK
H	2390.00	56.43	38.06	7.42	20.15	45.94	54	-8.06	AV
H	2400.00	68.02	38.06	7.42	20.15	57.53	74	-16.47	PK
H	2400.00	56.36	38.06	7.42	20.15	45.87	54	-8.13	AV
802.11b operation frequency:2462									
V	2483.50	68.09	38.17	7.42	20.51	57.85	74	-16.15	PK
V	2483.50	56.64	38.17	7.42	20.51	46.40	54	-7.60	AV
V	2500.00	68.01	38.20	7.45	20.54	57.80	74	-16.20	PK
V	2500.00	56.06	38.20	7.45	20.54	45.85	54	-8.15	AV
H	2483.50	68.21	38.17	7.42	20.51	57.97	74	-16.03	PK
H	2483.50	56.68	38.17	7.42	20.51	46.44	54	-7.56	AV
H	2500.00	67.81	38.20	7.45	20.54	57.60	74	-16.40	PK
H	2500.00	56.93	38.20	7.45	20.54	46.72	54	-7.28	AV
802.11g operation frequency:2412									
V	2390.00	67.86	38.06	7.42	20.15	57.37	74	-16.63	PK
V	2390.00	56.38	38.06	7.42	20.15	45.89	54	-8.11	AV
V	2400.00	68.07	38.06	7.42	20.15	57.58	74	-16.42	PK
V	2400.00	55.95	38.06	7.42	20.15	45.46	54	-8.54	AV
H	2390.00	68.15	38.06	7.42	20.15	57.66	74	-16.34	PK
H	2390.00	56.41	38.06	7.42	20.15	45.92	54	-8.08	AV
H	2400.00	68.02	38.06	7.42	20.15	57.53	74	-16.47	PK
H	2400.00	56.34	38.06	7.42	20.15	45.85	54	-8.15	AV
802.11g operation frequency:2462									
V	2483.50	68.07	38.17	7.42	20.51	57.83	74	-16.17	PK
V	2483.50	56.62	38.17	7.42	20.51	46.38	54	-7.62	AV
V	2500.00	68.01	38.20	7.45	20.54	57.80	74	-16.20	PK
V	2500.00	56.06	38.20	7.45	20.54	45.85	54	-8.15	AV
H	2483.50	68.19	38.17	7.42	20.51	57.95	74	-16.05	PK
H	2483.50	56.66	38.17	7.42	20.51	46.42	54	-7.58	AV
H	2500.00	67.81	38.20	7.45	20.54	57.60	74	-16.40	PK
H	2500.00	56.93	38.20	7.45	20.54	46.72	54	-7.28	AV
Remark: 1. Emission Level = Meter Reading + Factor, Margin= Emission Level - Limit 2. If peak below the average limit, the average emission was no test. 3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.									



Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
802.11n(20MHz) operation frequency:2412									
V	2390.00	67.73	38.06	7.42	20.15	57.24	74	-16.76	PK
V	2390.00	56.29	38.06	7.42	20.15	45.80	54	-8.20	AV
V	2400.00	67.96	38.06	7.42	20.15	57.47	74	-16.53	PK
V	2400.00	55.84	38.06	7.42	20.15	45.35	54	-8.65	AV
H	2390.00	68.04	38.06	7.42	20.15	57.55	74	-16.45	PK
H	2390.00	56.32	38.06	7.42	20.15	45.83	54	-8.17	AV
H	2400.00	67.89	38.06	7.42	20.15	57.40	74	-16.60	PK
H	2400.00	56.25	38.06	7.42	20.15	45.76	54	-8.24	AV
802.11n(20MHz) operation frequency:2462									
V	2483.50	67.96	38.17	7.42	20.51	57.72	74	-16.28	PK
V	2483.50	56.53	38.17	7.42	20.51	46.29	54	-7.71	AV
V	2500.00	67.88	38.20	7.45	20.54	57.67	74	-16.33	PK
V	2500.00	55.95	38.20	7.45	20.54	45.74	54	-8.26	AV
H	2483.50	68.08	38.17	7.42	20.51	57.84	74	-16.16	PK
H	2483.50	56.57	38.17	7.42	20.51	46.33	54	-7.67	AV
H	2500.00	67.68	38.20	7.45	20.54	57.47	74	-16.53	PK
H	2500.00	56.82	38.20	7.45	20.54	46.61	54	-7.39	AV
802.11n(40MHz) operation frequency:2422									
V	2390.00	67.60	38.06	7.42	20.15	57.11	74	-16.89	PK
V	2390.00	56.16	38.06	7.42	20.15	45.67	54	-8.33	AV
V	2400.00	67.81	38.06	7.42	20.15	57.32	74	-16.68	PK
V	2400.00	55.73	38.06	7.42	20.15	45.24	54	-8.76	AV
H	2390.00	67.89	38.06	7.42	20.15	57.40	74	-16.60	PK
H	2390.00	56.19	38.06	7.42	20.15	45.70	54	-8.30	AV
H	2400.00	67.76	38.06	7.42	20.15	57.27	74	-16.73	PK
H	2400.00	56.12	38.06	7.42	20.15	45.63	54	-8.37	AV
802.11n(40MHz) operation frequency:2452									
V	2483.50	67.81	38.17	7.42	20.51	57.57	74	-16.43	PK
V	2483.50	56.40	38.17	7.42	20.51	46.16	54	-7.84	AV
V	2500.00	67.75	38.20	7.45	20.54	57.54	74	-16.46	PK
V	2500.00	55.84	38.20	7.45	20.54	45.63	54	-8.37	AV
H	2483.50	67.93	38.17	7.42	20.51	57.69	74	-16.31	PK
H	2483.50	56.44	38.17	7.42	20.51	46.20	54	-7.80	AV
H	2500.00	67.55	38.20	7.45	20.54	57.34	74	-16.66	PK
H	2500.00	56.71	38.20	7.45	20.54	46.50	54	-7.50	AV

Remark:

1. Emission Level = Meter Reading + Factor, Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



5. 6DB BANDWIDTH

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

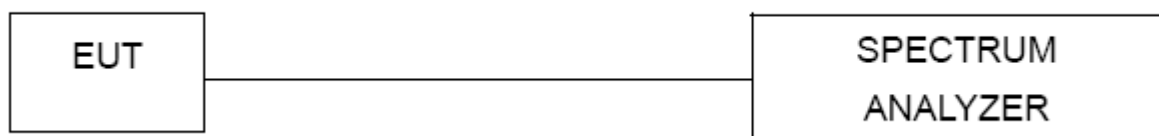
5.1.1 TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.

5.1.2 DEVIATION FROM STANDARD

No deviation.

5.1.3 TEST SETUP



5.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



5.1.5 TEST RESULTS

802.11b Mode

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
Low	2412	10.09	500	Pass
Middle	2437	10.07	500	Pass
High	2462	10.09	500	Pass

802.11g Mode

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.61	500	Pass
Middle	2437	16.61	500	Pass
High	2462	16.60	500	Pass

802.11n20 Mode

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
Low	2412	17.83	500	Pass
Middle	2437	17.85	500	Pass
High	2462	17.85	500	Pass

802.11n40 Mode

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
Low	2422	36.48	500	Pass
Middle	2437	36.51	500	Pass
High	2452	36.51	500	Pass

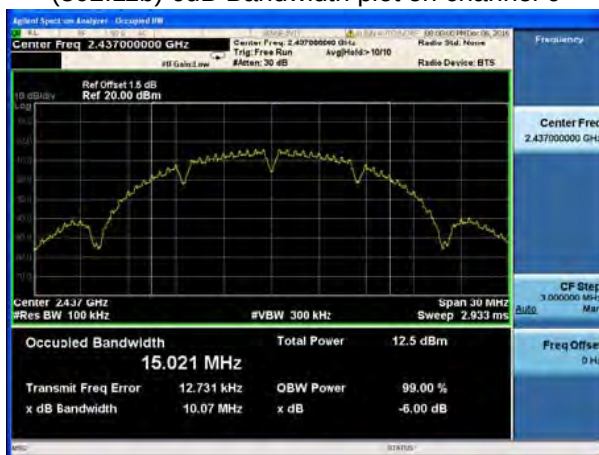
(802.11b) 6dB Bandwidth plot on channel 1



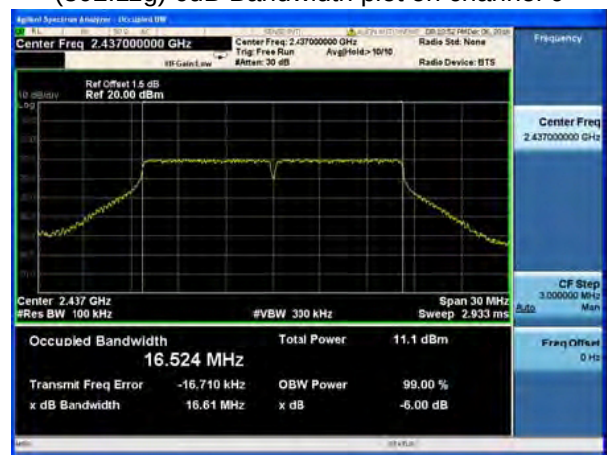
(802.11g) 6dB Bandwidth plot on channel 1



(802.11b) 6dB Bandwidth plot on channel 6



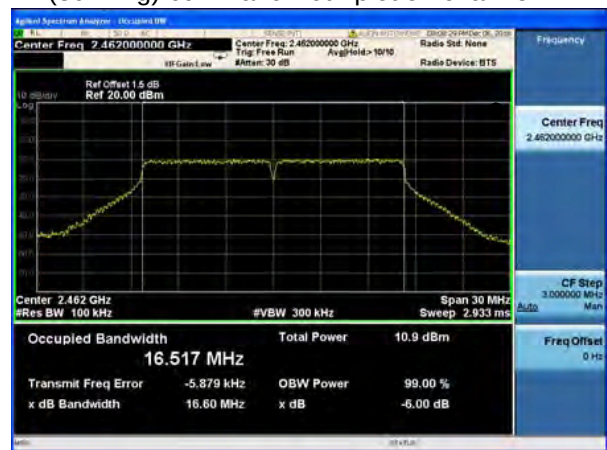
(802.11g) 6dB Bandwidth plot on channel 6



(802.11b) 6dB Bandwidth plot on channel 11



(802.11g) 6dB Bandwidth plot on channel 11





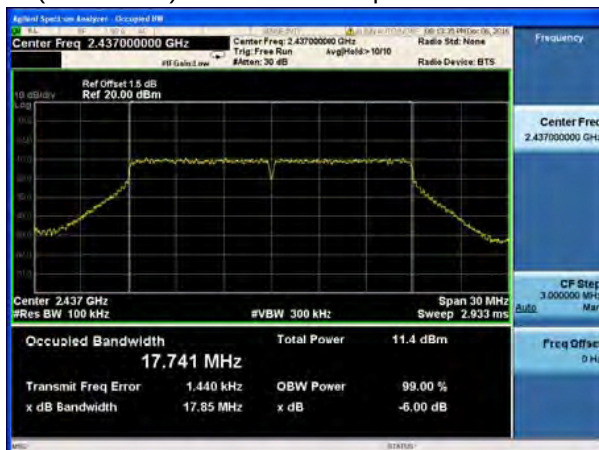
(802.11n20) 6dB Bandwidth plot on channel 1



(802.11n40) 6dB Bandwidth plot on channel 3



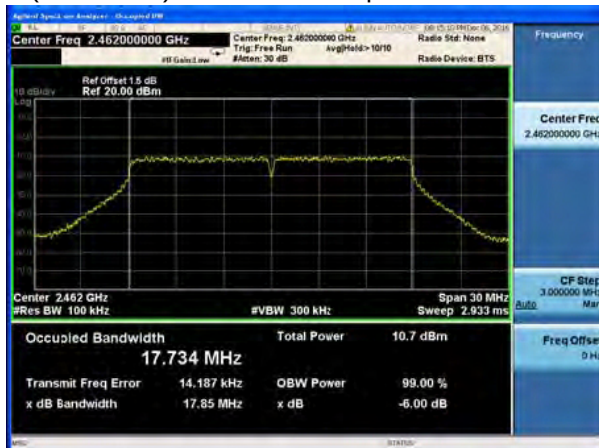
(802.11n20) 6dB Bandwidth plot on channel 6



(802.11n40) 6dB Bandwidth plot on channel 6



(802.11n20) 6dB Bandwidth plot on channel 11



(802.11n40) 6dB Bandwidth plot on channel 9





6. DUTY CYCLE

6.1 APPLICABLE STANDARD

According to KDB 558074(6)b), issued 06/09/2015

6.2 CONFORMANCE LIMIT

No limit requirement.

6.3 MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

6.4 TEST SETUP

Please refer to Section 6.1 of this test report.

6.5 TEST PROCEDURE

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW \geq RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0)b) in KDB 558074(issued 06/09/2015)

The largest available value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if $T \leq 6.25$ microseconds. ($50/6.25 = 8$)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are $> 50/T$.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz(the largest available value)

VBW = 8MHz ($\geq RBW$)

Number of points in Sweep > 100

Detector function = peak

Trace = Clear write

Measure T_{total} and T_{on}

Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$

6.6 TEST RESULTS

Mode	Data rate	Channel	T_{on}	T_{total}	Duty Cycle %	Duty Cycle Factor (dB)	1/T Minimum VBW (kHz)
802.11b	1Mbps	6	10	10	100	0.00	0.01
802.11g	6Mbps	6	10	10	100	0.00	0.01
802.11n HT20	MCS0	6	10	10	100	0.00	0.01
802.11n HT40	MCS0	6	10	10	100	0.00	0.01



7. POWER SPECTRAL DENSITY TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

7.1.1 TEST PROCEDURE

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.

7.1.2 DEVIATION FROM STANDARD

No deviation.

7.1.3 TEST SETUP



7.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.



7.1.5 TEST RESULTS

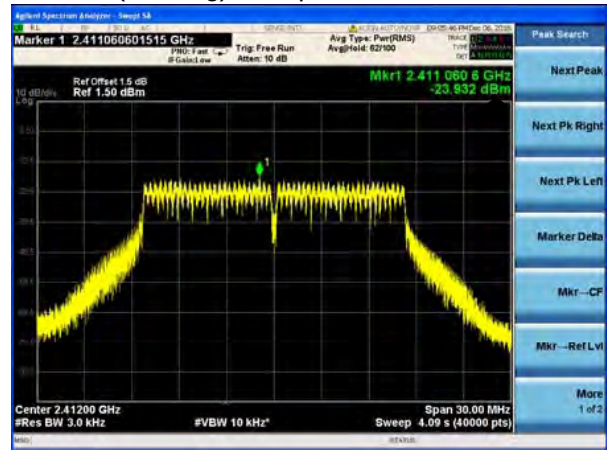
Temperature :	25℃	Relative Humidity :	60%
Pressure :	1015 hPa	Test Voltage :	DC 3.7V
Test Mode :	TX Mode		

Frequency	Power Spectral Density(dBm)	Limit (dBm)	Result
802.11b			
2412 MHz	-22.60	8	PASS
2437 MHz	-24.33	8	PASS
2462 MHz	-23.52	8	PASS
802.11g			
2412 MHz	-23.93	8	PASS
2437 MHz	-22.62	8	PASS
2462 MHz	-23.16	8	PASS
802.11n(20MHz)			
2412 MHz	-24.04	8	PASS
2437 MHz	-21.90	8	PASS
2462 MHz	-23.46	8	PASS
802.11n(40MHz)			
2422 MHz	-27.49	8	PASS
2437 MHz	-26.24	8	PASS
2452 MHz	-27.12	8	PASS

(802.11b) PSD plot on channel 1



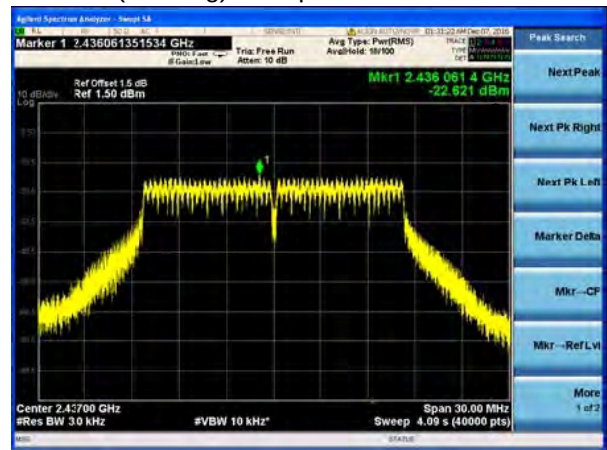
(802.11g) PSD plot on channel 1



(802.11b) PSD plot on channel 6



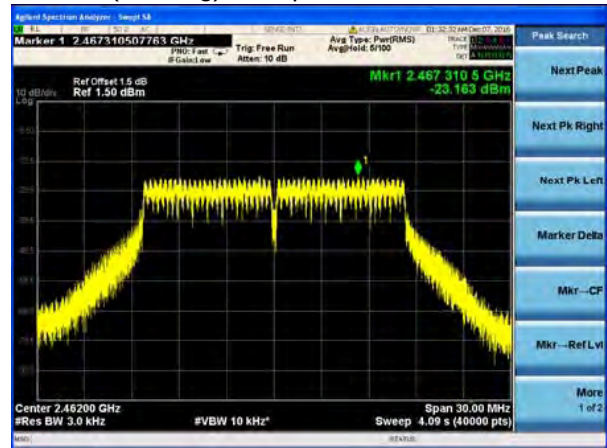
(802.11g) PSD plot on channel 6



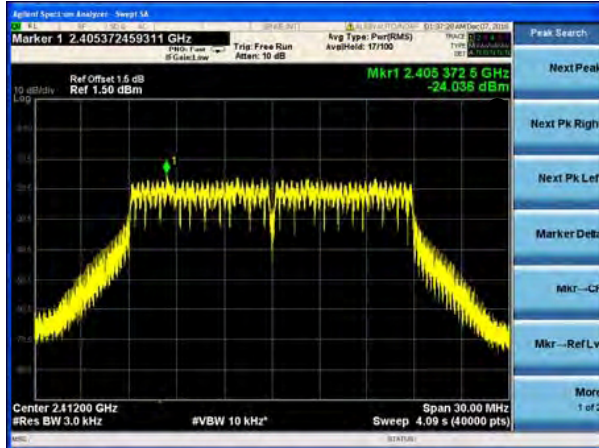
(802.11b) PSD plot on channel 11



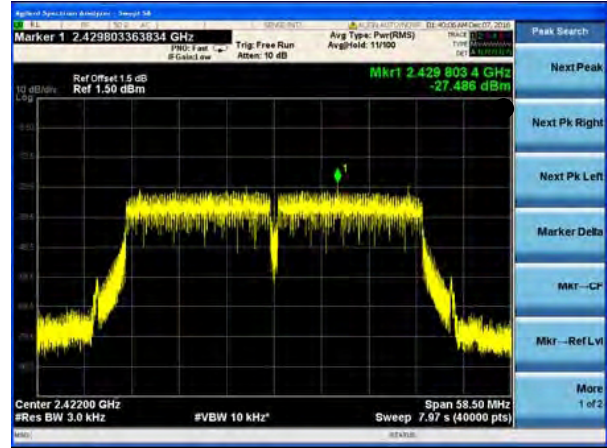
(802.11g) PSD plot on channel 11



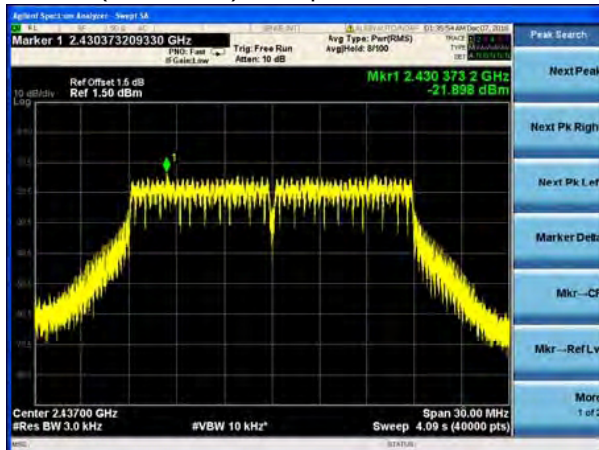
(802.11n20) PSD plot on channel 1



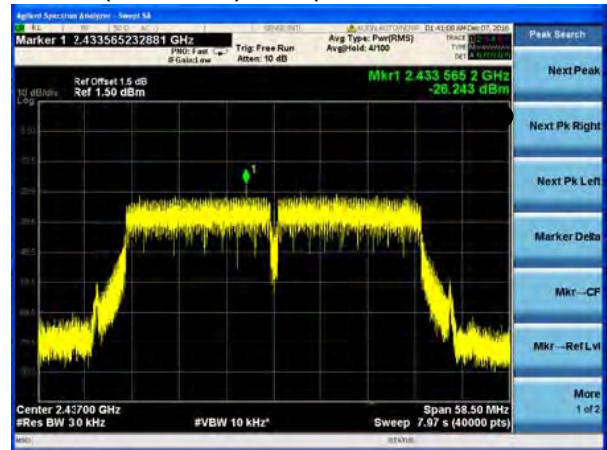
(802.11n40) PSD plot on channel 3



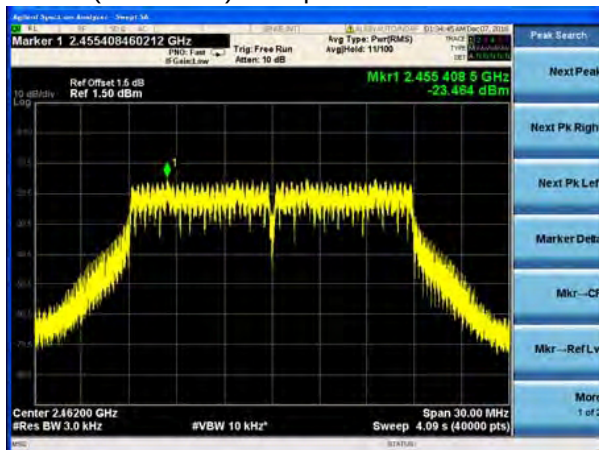
(802.11n20) PSD plot on channel 6



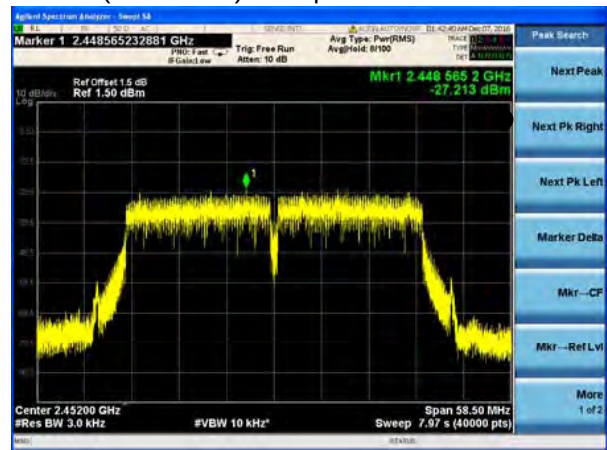
(802.11n40) PSD plot on channel 6



(802.11n20) PSD plot on channel 11



(802.11n40) PSD plot on channel 9





8. PEAK OUTPUT POWER TEST

8.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

8.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the Power meter

8.1.2 DEVIATION FROM STANDARD

No deviation.

8.1.3 TEST SETUP



8.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

**8.1.5 TEST RESULTS**

	Frequency	Maximum Conducted Output Power(PK)	LIMIT
	(MHz)	(dBm)	dBm
802.11b	2412	8.85	30
	2437	8.76	30
	2462	8.79	30
802.11g	2412	7.69	30
	2437	7.55	30
	2462	7.59	30
802.11n20	2412	7.52	30
	2437	7.58	30
	2462	7.76	30
802.11n40	2422	7.34	30
	2437	7.28	30
	2452	7.32	30

9. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

7.1 APPLICABLE STANDARD

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

7.2 TEST PROCEDURE

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- Set RBW to 100 kHz and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- Repeat above procedures until all measured frequencies were complete.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP

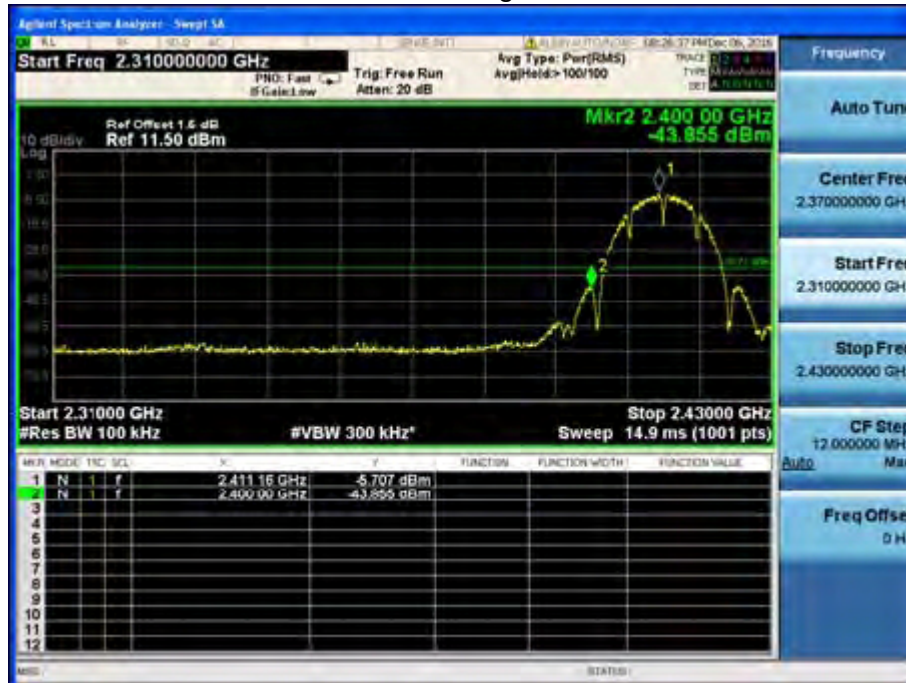


7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

9.1 TEST RESULTS

802.11b: Band Edge, Left Side

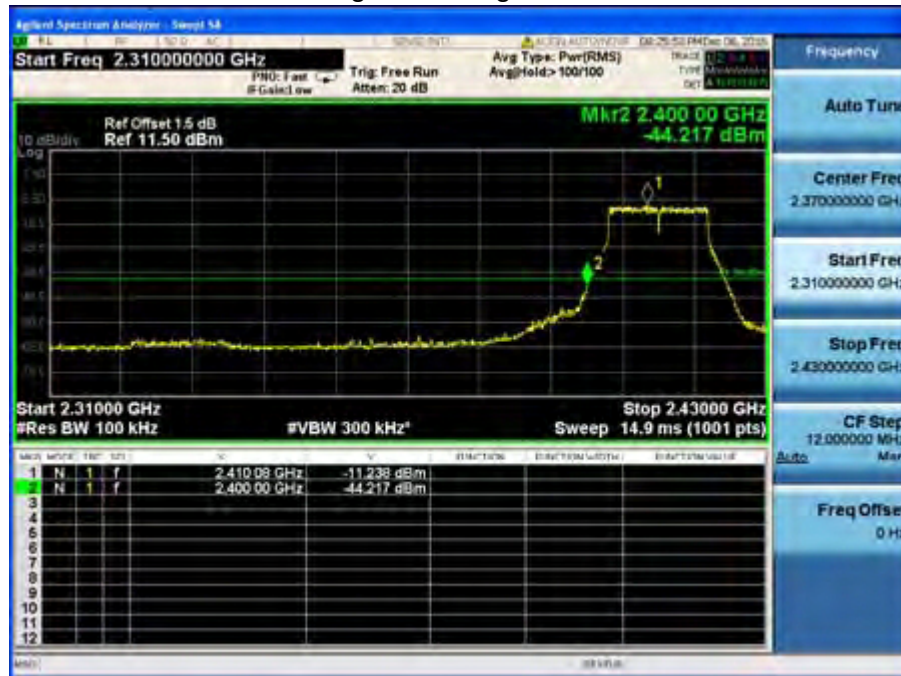


802.11b: Band Edge, Right Side





802.11g: Band Edge, Left Side



802.11g: Band Edge, Right Side



802.11n-HT20: Band Edge, Left Side



802.11n-HT20: Band Edge, Right Side



802.11n-HT40: Band Edge, Left Side



802.11n-HT40: Band Edge, Right Side





10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

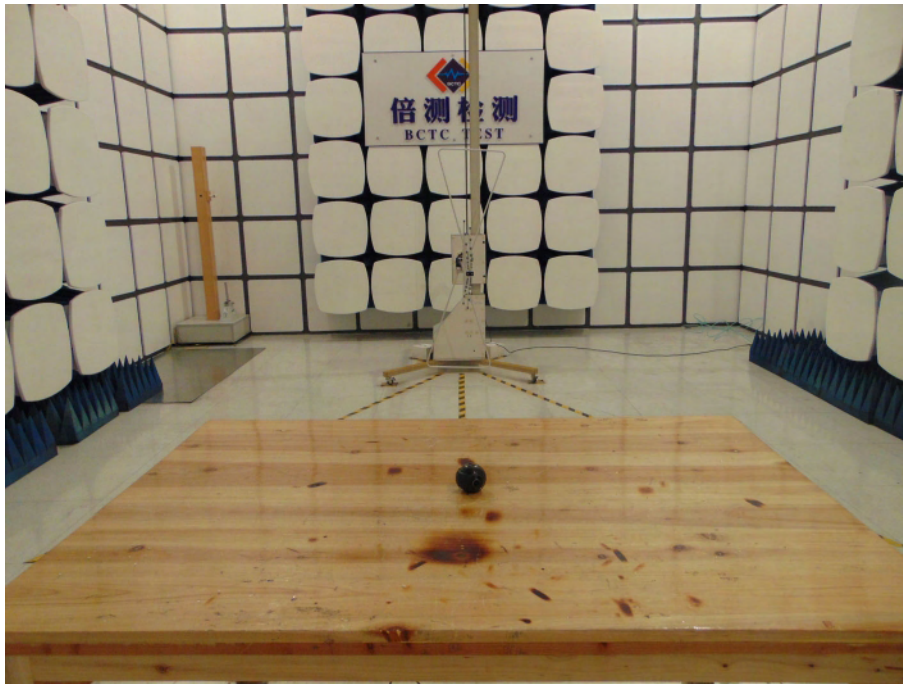
15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

10.2 EUT ANTENNA

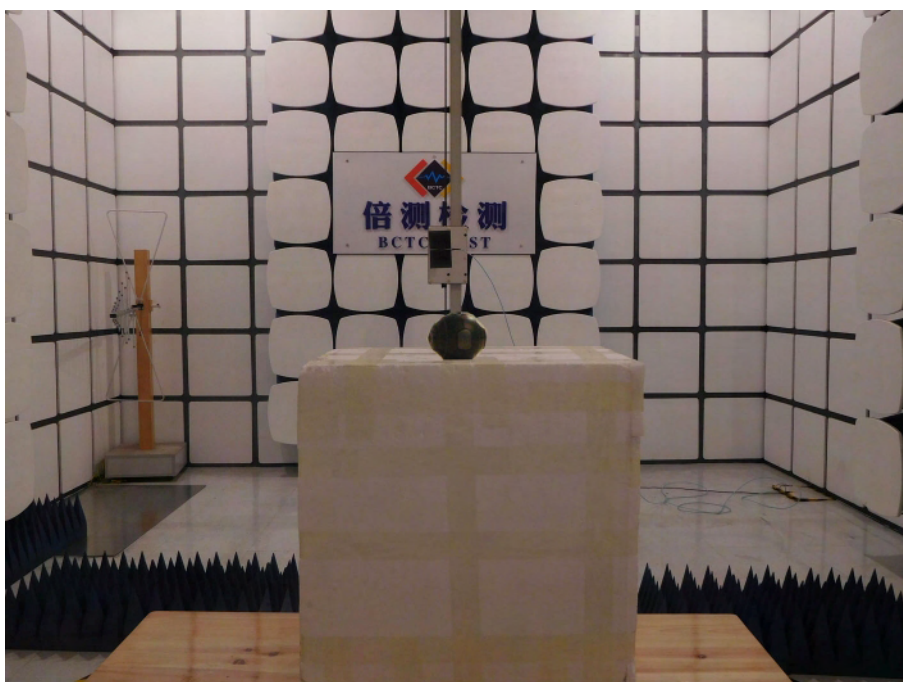
The EUT antenna is internal antenna, It comply with the standard requirement.

11. EUT TEST PHOTO

Radiated Measurement Photos



Radiated Measurement Photos



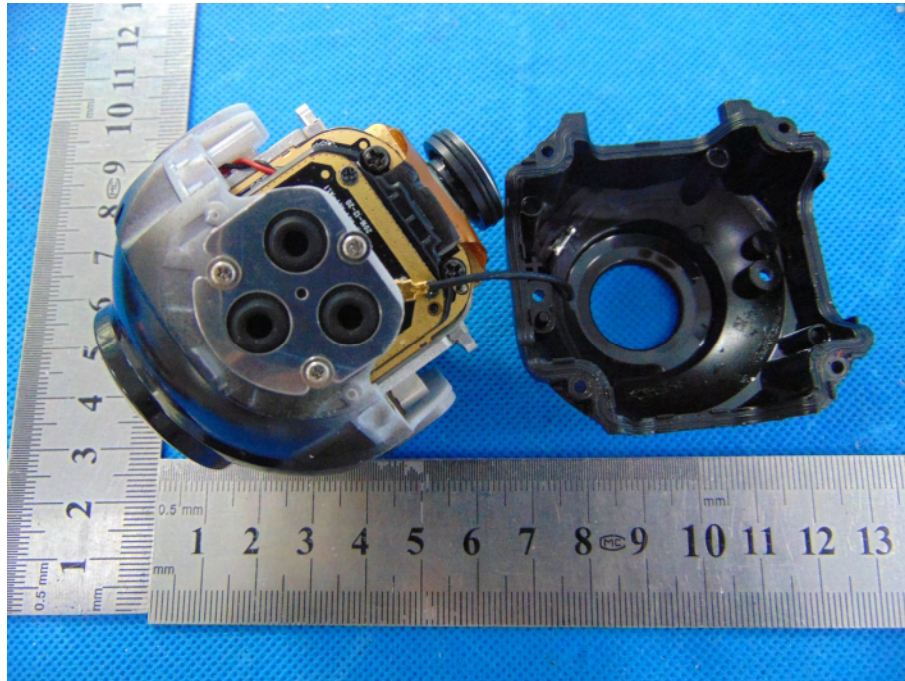
Conducted Emission



12. EUT PHOTO







***** END OF REPORT *****