FCC 47 CFR PART 15 SUBPART C

Product Type	:	Wink Relay
Applicant	:	Quirky, Inc.
Address	:	606 W 28th St, Floor 7 New York NY 10001 United States
Trade Name	:	Wink
Model Number	:	PRLAY-WH01
Test Specification	:	FCC 47 CFR PART 15 SUBPART C: Oct., 2013 Canada RSS-210 ISSUE 8: Dec., 2010 Canada RSS-Gen ISSUE 3: Dec., 2010 ANSI C63.4:2009
Receive Date	:	Aug. 15, 2014
Test Period	:	Aug. 23 ~ Aug. 26, 2014
Issue Date	:	Aug. 29, 2014

Issue by

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade City,
Taoyuan County 334, Taiwan R.O.C.
Tel：+886-3-2710188 / Fax：+886-3-2710190

Taiwan Accreditation Foundation accreditation number: 1330

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Aug. 29, 2014	Initial Issue	

Verification of Compliance

Issued Date: 08/29/2014

Product Type	:	Wink Relay
Applicant	:	Quirky, Inc.
Address	:	606 W 28th St, Floor 7 New York NY 10001 United States
Trade Name	:	Wink
Model Number	:	PRLAY-WH01
FCC ID	:	2AAAH-WR001
EUT Rated Voltage	:	AC 120V, 8A
Test Voltage	:	120 Vac / 60 Hz
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C: Oct., 2013 Canada RSS-210 ISSUE 8: Dec., 2010 Canada RSS-Gen ISSUE 3: Dec., 2010 ANSI C63.4:2009
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade City, Taoyuan County 334, Taiwan R.O.C. Tel：+886-3-2710188 / Fax：+886-3-2710190 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	: Fly Lu	Reviewed By	: Eric Ou Yang	
(Manager)	(Fly Lu)	(Testing Engineer)	(Eric Ou Yang)	

TABLE OF CONTENTS

1 General Information

1.1 Summary of Test Result

Standard		Item	Result	Remark
15.247	RSS-GEN			
15.207	7.2.2	AC Power Conducted Emission	PASS	-----
-----	6	Receiver Radiated Emissions	PASS	-----
Standard		Item	Result	Remark
15.247	RSS-210			
15.247(d)	A8.5	Transmitter Radiated Emissions	PASS	-----
15.247(b)(3)	A8.4	Max. Output Power	PASS	-----
15.247(a)(2)	A8.2 (a)	6dB RF Bandwidth	PASS	-----
15.247(e)	A8.2 (b)	Power Spectral Density	PASS	-----
15.247(c)	A8.5	Out of Band Conducted Spurious Emission	PASS	-----
15.247(d)	A8.5	Band Edge Measurement	PASS	-----
15.247(c)	A8.5	Occupied Bandwidth 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	Wink Relay
Trade Name	Wink
Model No.	PRLAY-WH01
Applicant	Quirky, Inc. 606 W 28th St, Floor 7 New York NY 10001 United States
Manufacturer	FLEXComputing（suzhou）Co.Ltd No.1 Guanpu Road, Guoxiang Street, Wuzhong District, Suzhou, Jiangsu, China
FCC ID	2AAAH-WR001
Frequency Range	2405 MHz ~ 2470 MHz
Modulation Type	O-QPSK
Channel Number	14CH
Antenna Type	PCB Antenna
Antenna Gain	3.07 dBi
RF Output Power	0.010 W / 9.86 dBm
99 % Occupied Bandwidth	2.4387 MHz
Emission Designator	2M44G1D

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: ZigBee Link Mode
Mode 3: Receiver Mode

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

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

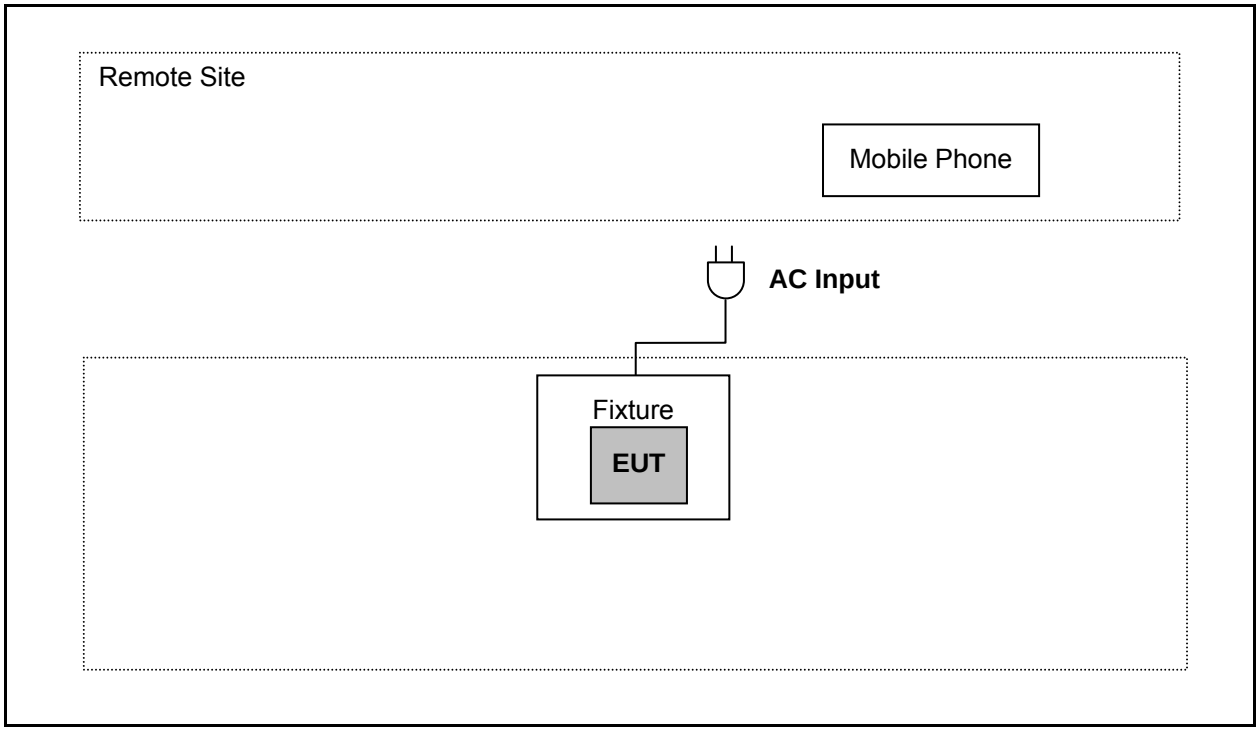
ZigBee Link Mode:
Channel Low (2405MHz), Channel Mid (2440MHz) and Channel High (2470MHz) were chosen for full testing.

3.2. EUT Exercise Software

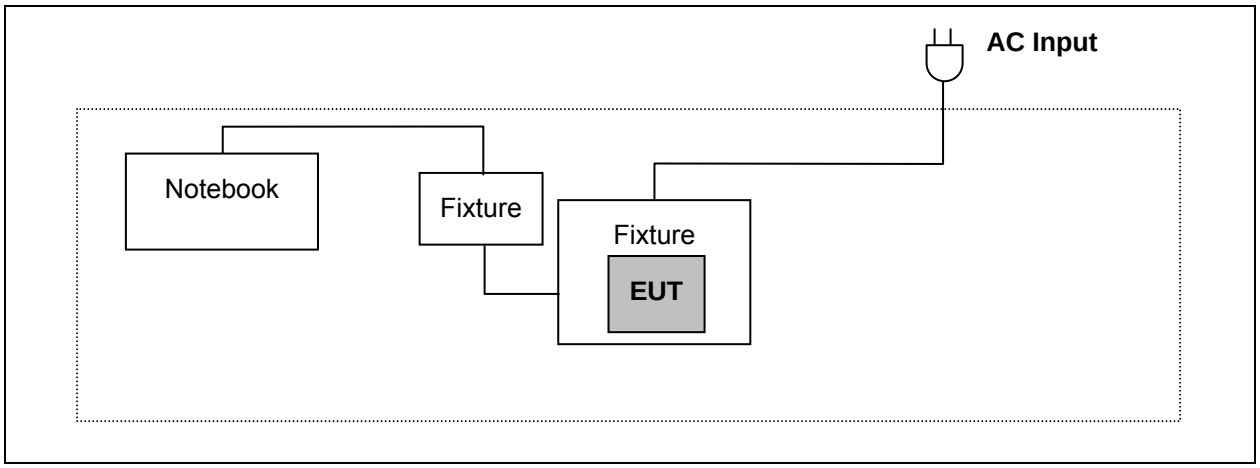
1. Setup the EUT shown on 3.3.
2. Turn on the power of all equipment.
3. EUT run test program.

3.3. Configuration of Test System Details

Conducted Emissions



Radiated Emissions



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

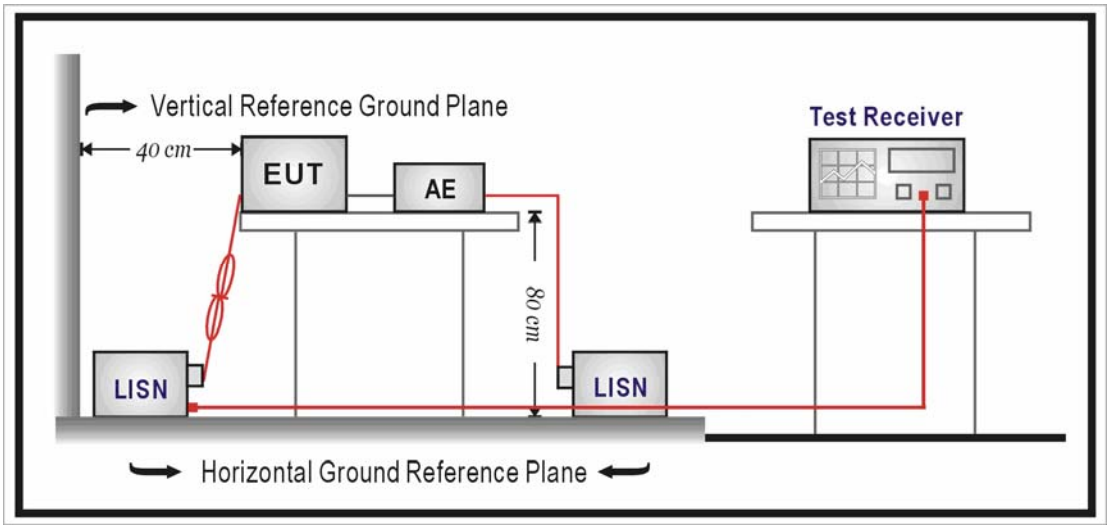
Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

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)
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

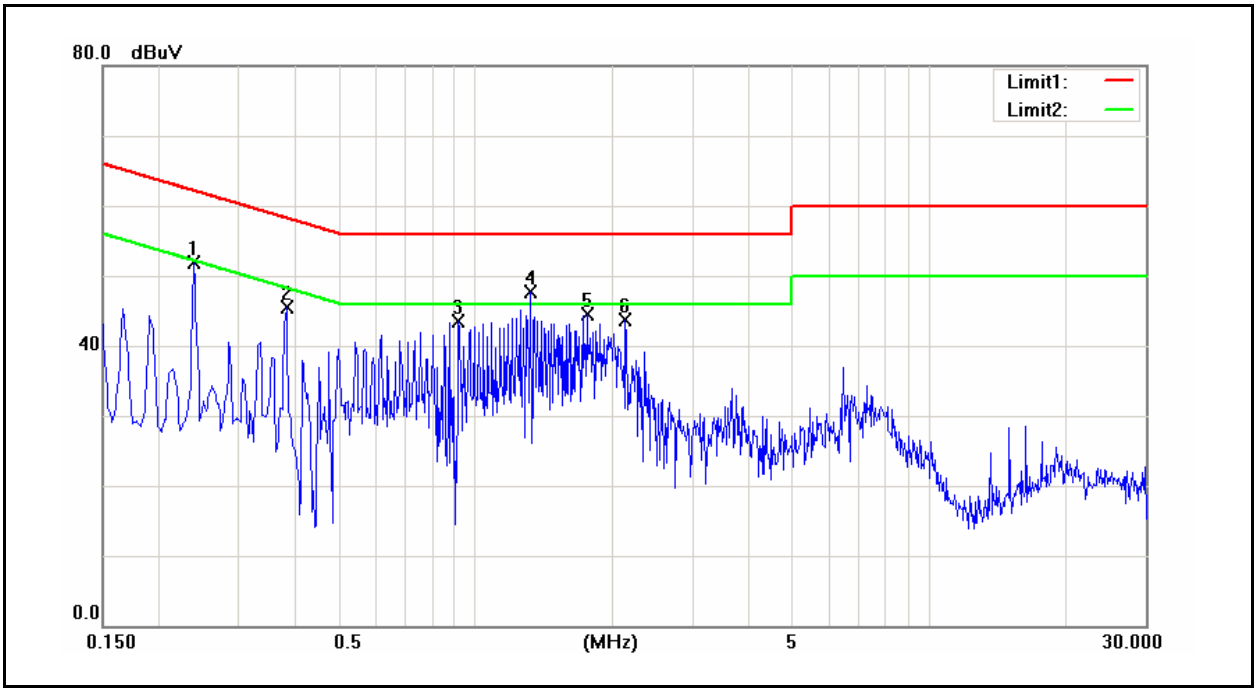
The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

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

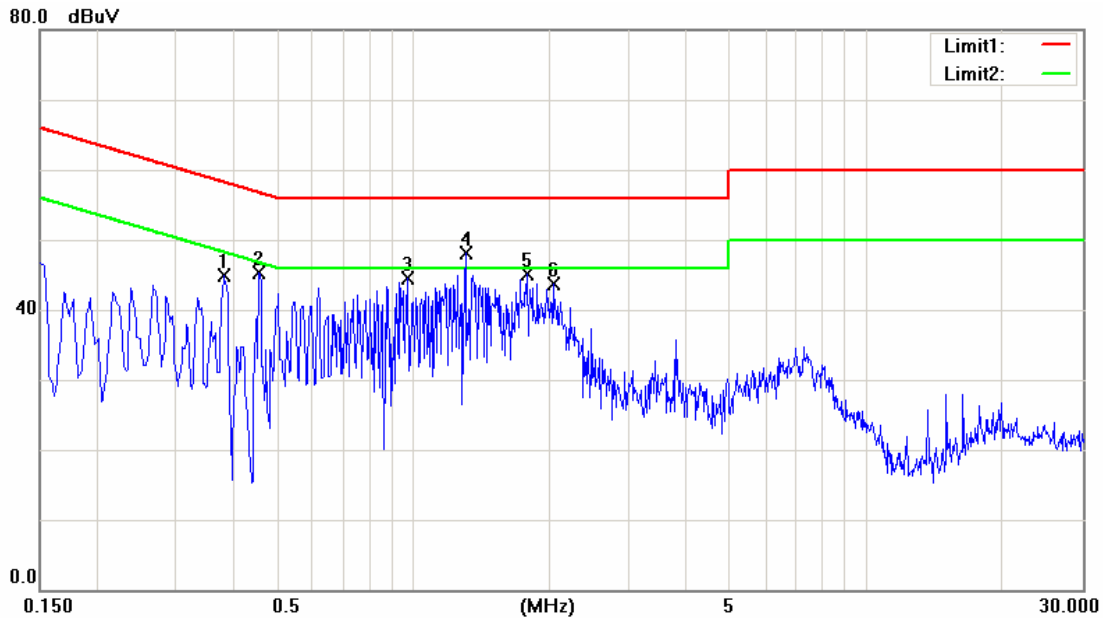
Standard:	FCC Part 15C	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	1	Date:	08/25/2014
		Test By:	Eric Ou Yang
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.2380	29.96	17.78	9.60	39.56	27.38	62.17	52.17	-22.61	-24.79	Pass
2	0.3820	32.75	21.31	9.61	42.36	30.92	58.24	48.24	-15.88	-17.32	Pass
3	0.9180	30.50	20.21	9.64	40.14	29.85	56.00	46.00	-15.86	-16.15	Pass
4	1.3220	27.90	8.38	9.66	37.56	18.04	56.00	46.00	-18.44	-27.96	Pass
5	1.7620	29.25	20.56	9.68	38.93	30.24	56.00	46.00	-17.07	-15.76	Pass
6	2.1340	24.88	14.41	9.70	34.58	24.11	56.00	46.00	-21.42	-21.89	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).
2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Standard:	FCC Part 15C	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	1	Date:	08/25/2014
		Test By:	Eric Ou Yang
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.3820	32.63	21.15	9.61	42.24	30.76	58.24	48.24	-16.00	-17.48	Pass
2	0.4580	33.82	22.56	9.62	43.44	32.18	56.73	46.73	-13.29	-14.55	Pass
3	0.9780	28.36	16.59	9.65	38.01	26.24	56.00	46.00	-17.99	-19.76	Pass
4	1.3060	33.62	20.72	9.66	43.28	30.38	56.00	46.00	-12.72	-15.62	Pass
5	1.7860	31.16	19.28	9.69	40.85	28.97	56.00	46.00	-15.15	-17.03	Pass
6	2.0420	25.09	17.06	9.70	34.79	26.76	56.00	46.00	-21.21	-19.24	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).
2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

5 Radiated Emission Measurement

5.1. Limit

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

Frequency (MHz)	Field Strength (μV/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.

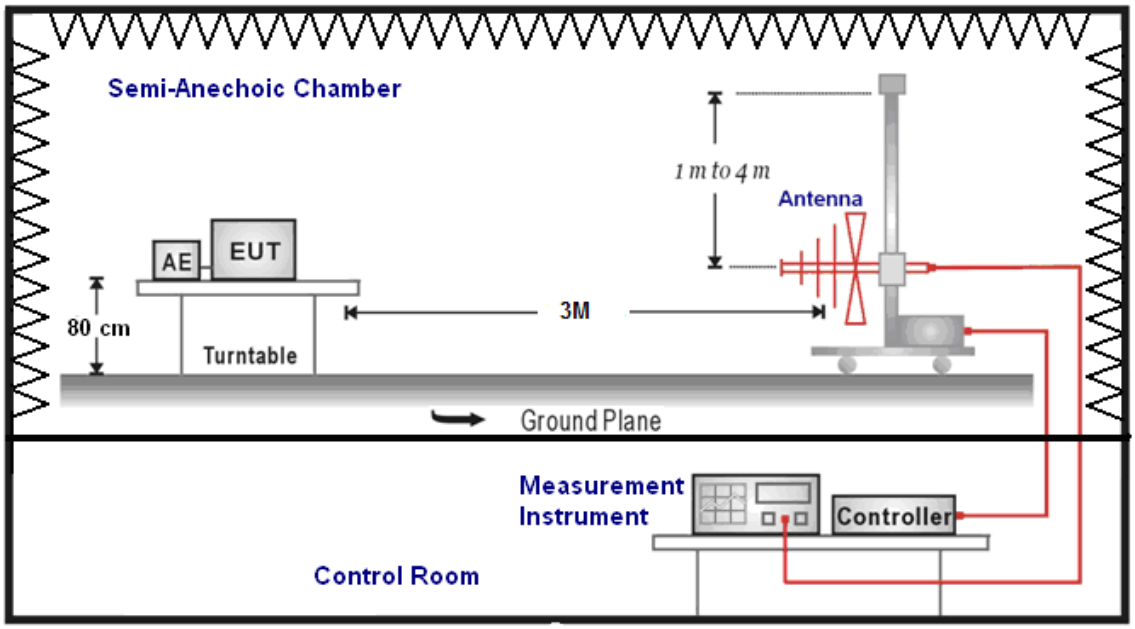
5.2. Test Instruments

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	08/14/2012	(3)
Test Site	ATL	TE01	888001	08/28/2013	(1)

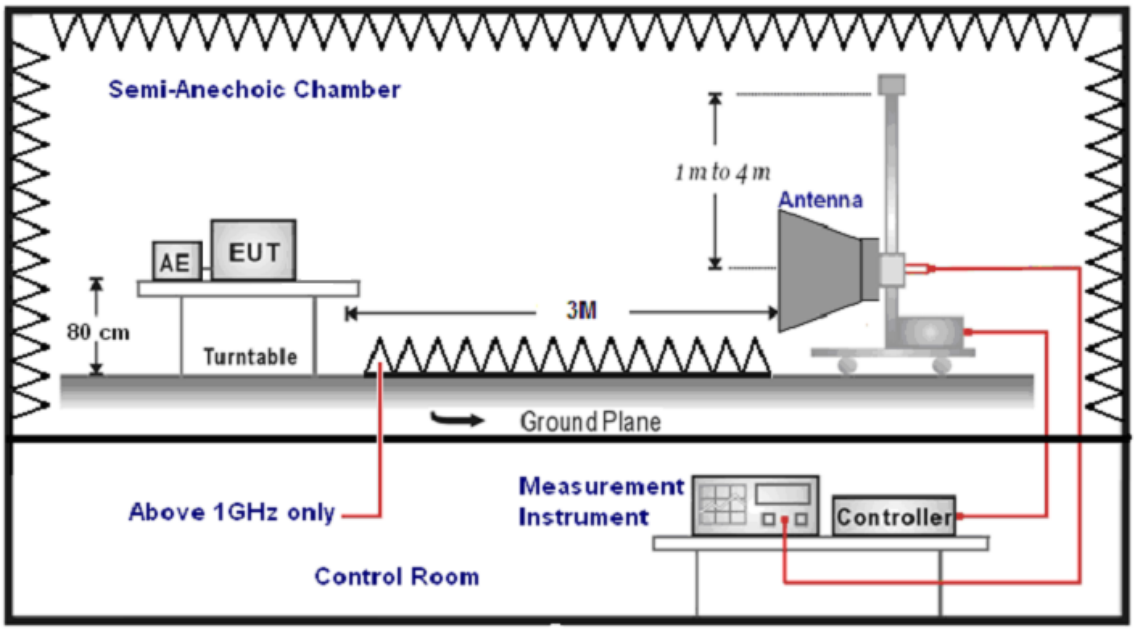
Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.
Note: N.C.R. = No Calibration Request.

5.3. Setup

Below 1GHz



Above 1GHz



5.4. Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 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 tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna (mode 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 colts per meter (dBuV/m).

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

(1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)
FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.
P.S Amplitude is auto calculate in spectrum analyzer.

(2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)
The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:
(a) For fundamental frequency : Transmitter Output < +30dBm
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

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

5.5. Test Result

Below 1GHz

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	1	Date:	08/23/2014
		Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
240.0000	51.09	-12.35	38.74	46.00	-7.26	QP	H
384.0000	46.63	-8.56	38.07	46.00	-7.93	QP	H
480.0000	44.31	-6.62	37.69	46.00	-8.31	QP	H
672.0000	40.72	-2.90	37.82	46.00	-8.18	QP	H
768.0000	39.87	-0.85	39.02	46.00	-6.98	QP	H
864.0000	38.06	0.85	38.91	46.00	-7.09	QP	H
288.0000	47.85	-10.59	37.26	46.00	-8.74	QP	V
384.0000	46.11	-8.56	37.55	46.00	-8.45	QP	V
528.0000	44.84	-5.82	39.02	46.00	-6.98	QP	V
672.0000	40.69	-2.90	37.79	46.00	-8.21	QP	V
768.0000	38.61	-0.85	37.76	46.00	-8.24	QP	V
864.0000	37.69	0.85	38.54	46.00	-7.46	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:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/23/2014
Frequency:	2405 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
3009.000	38.36	-0.17	38.19	74.00	-35.81	peak	H
4591.000	34.66	4.43	39.09	74.00	-34.91	peak	H
6670.000	33.46	9.95	43.41	74.00	-30.59	peak	H
3002.000	37.33	-0.20	37.13	74.00	-36.87	peak	V
4619.000	35.44	4.51	39.95	74.00	-34.05	peak	V
6670.000	34.21	9.95	44.16	74.00	-29.84	peak	V

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/23/2014
Frequency:	2440 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
3058.000	37.28	-0.04	37.24	74.00	-36.76	peak	H
4563.000	34.20	4.36	38.56	74.00	-35.44	peak	H
6705.000	33.10	10.05	43.15	74.00	-30.85	peak	H
3023.000	36.48	-0.14	36.34	74.00	-37.66	peak	V
4633.000	34.42	4.54	38.96	74.00	-35.04	peak	V
6677.000	33.75	9.97	43.72	74.00	-30.28	peak	V

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/23/2014
Frequency:	2470 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
3037.000	37.17	-0.10	37.07	74.00	-36.93	peak	H
4591.000	34.83	4.43	39.26	74.00	-34.74	peak	H
6698.000	33.13	10.03	43.16	74.00	-30.84	peak	H
3023.000	37.20	-0.14	37.06	74.00	-36.94	peak	V
4591.000	34.33	4.43	38.76	74.00	-35.24	peak	V
6698.000	34.22	10.03	44.25	74.00	-29.75	peak	V

Standard:	RSS-Gen	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	3	Date:	08/23/2014
Frequency:	2440 MHz	Test By:	Eric Ou Yang

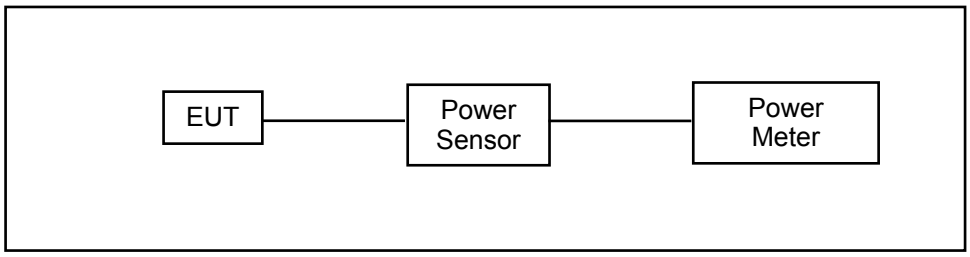
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/	Peak (dBuV/m)	AVG. (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
3037.000	36.57	-0.10	36.47	74.00	54.00	-37.53	peak	H
4570.000	33.92	4.38	38.30	74.00	54.00	-35.70	peak	H
6698.000	34.79	10.03	44.82	74.00	54.00	-29.18	peak	H
3023.000	37.57	-0.14	37.43	74.00	54.00	-36.57	peak	V
4598.000	33.94	4.45	38.39	74.00	54.00	-35.61	peak	V
6698.000	33.42	10.03	43.45	74.00	54.00	-30.55	peak	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
Single Channel PK Power Sensor	Agilent	N1911A	MY45101619	12/21/2013	(1)
Wideband Power Meter	Agilent	N1921A	MY45241957	12/21/2013	(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

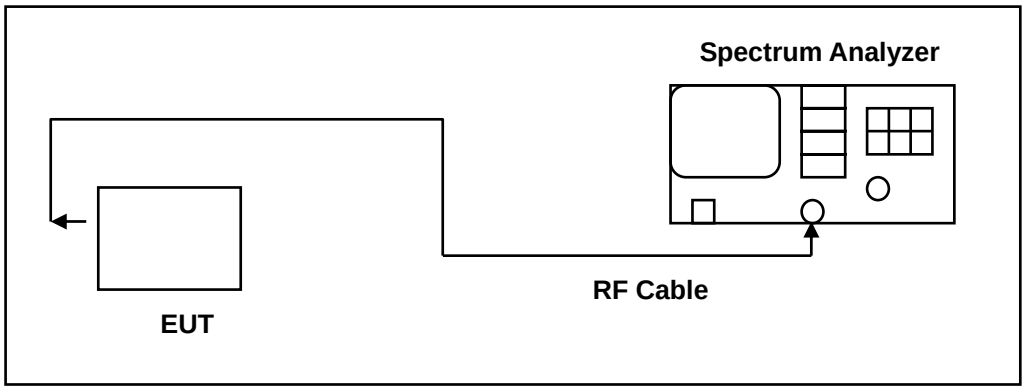
Model Number	PRLAY-WH01				
Test Item	Maximum Conducted Output Power				
Test Mode	Mode 2: ZigBee Link Mode				
Date of Test	08/23/2014			Test Site	TE05
Frequency (MHz)	Average Power		Peak Power		Limit (dBm)
	(dBm)	(W)	(dBm)	(W)	
2405	7.95	0.006	8.07	0.006	< 30
2440	7.97	0.006	8.10	0.006	< 30
2470	9.74	0.009	**9.86**	**0.010**	< 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	E4445A	MY45300744	12/19/2012	(2)
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

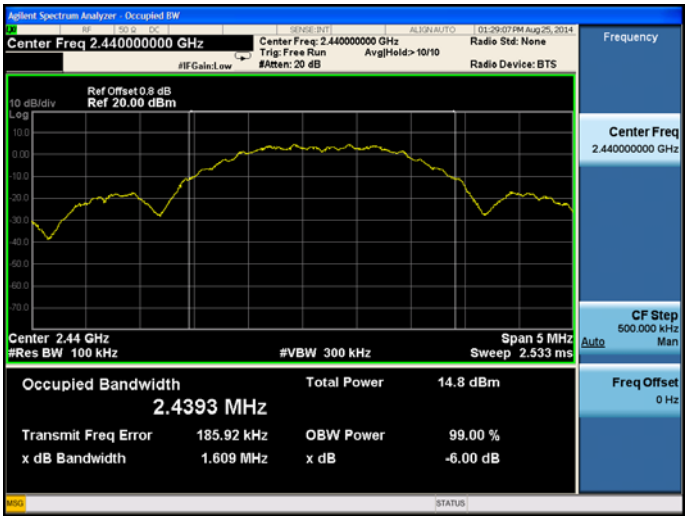
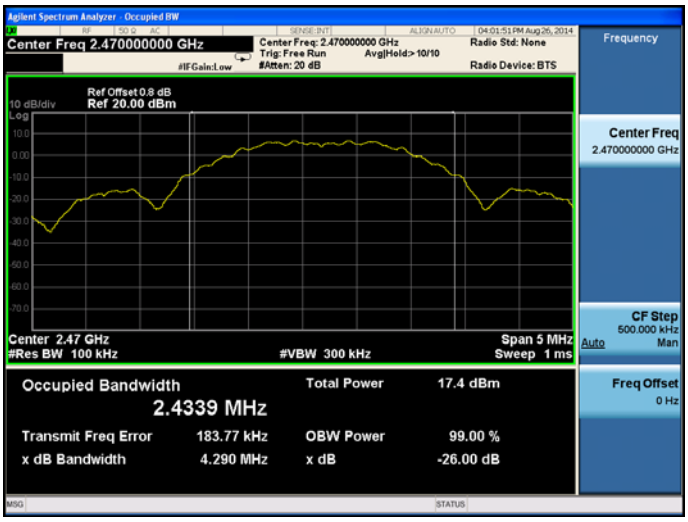
The EUT was setup to ANSI C63.4, 2009; tested to DTS test procedure of Oct 2012 KDB558074 for compliance to FCC 47CFR 15.247 requirements.
6dB RF Bandwidth: The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, 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 span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. 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

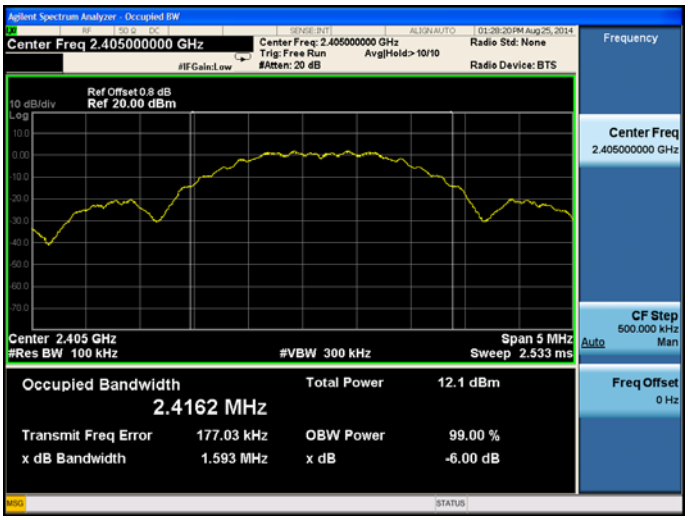
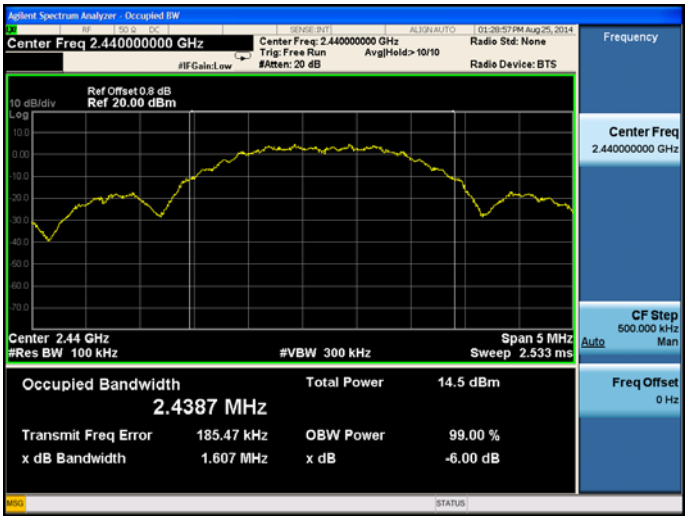
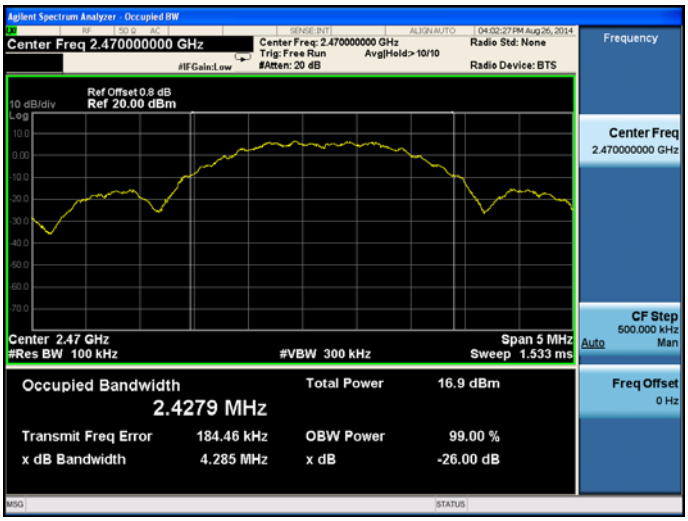
Model Number	PRLAY-WH01			
Test Item	6dB RF Bandwidth and 99 % Occupied Bandwidth			
Test Mode	Mode 2: ZigBee Link Mode			
Date of Test	08/26/2014		Test Site	TE05
Frequency (MHz)	6dB RF Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	6dB RF Bandwidth Limit (MHz)	
2405	1.593	2.4162	> 0.500	
2440	1.609	2.4387	> 0.500	
2470	4.290	2.4279	> 0.500	

7.6. Test Graphs

6dB RF Bandwidth

Mode 2: ZigBee Link Mode	
2405	
2440	
2470	

99 % Occupied Bandwidth

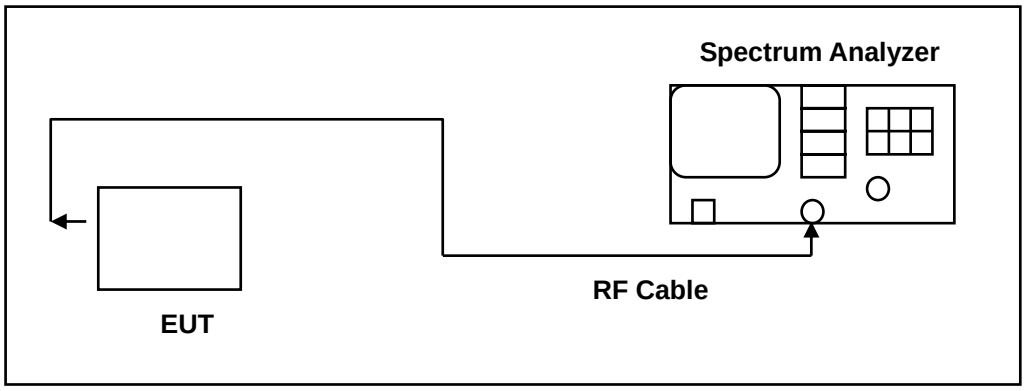
Mode 2: ZigBee Link Mode	
2405	
2440	
2470	

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	E4445A	MY45300744	12/19/2012	(2)
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

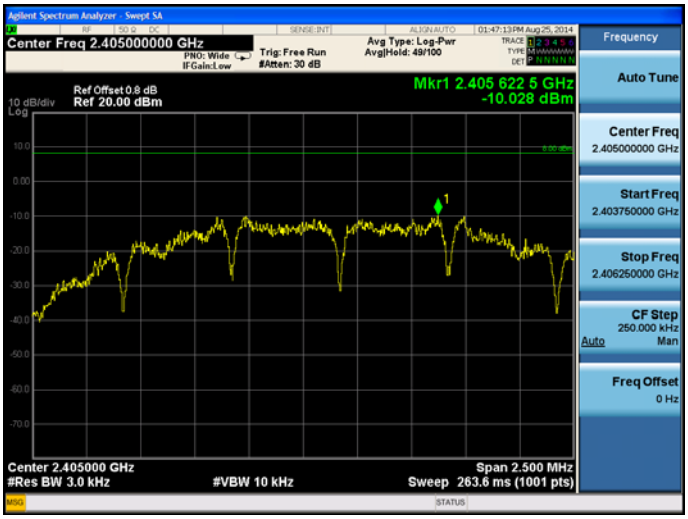
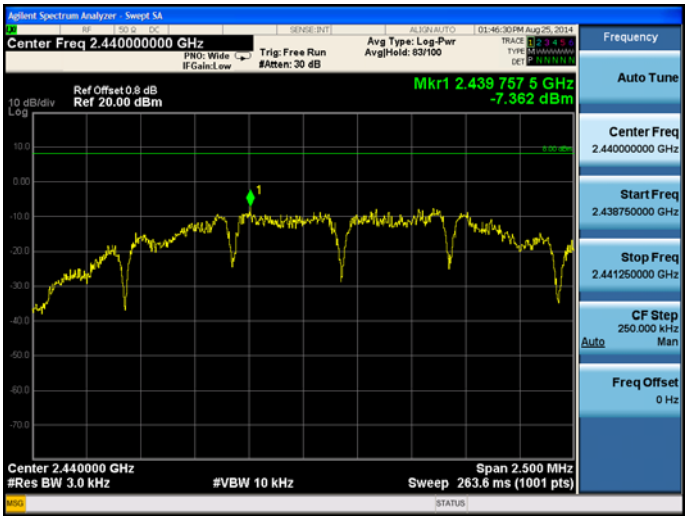
The EUT was setup to ANSI C63.4, 2009; tested to DTS test procedure of KDB558074D01 for compliance to FCC 47CFR 15.247 requirements.

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 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 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	PRLAY-WH01		
Test Item	Maximum Power Density		
Test Mode	Mode 2: ZigBee Link Mode		
Date of Test	08/26/2014	Test Site	TE05
Frequency (MHz)	Reading (dBm/3KHz)		Limit (dBm)
2405	-10.028		< 8
2440	-7.362		< 8
2470	-4.890		< 8

8.6. Test Graphs

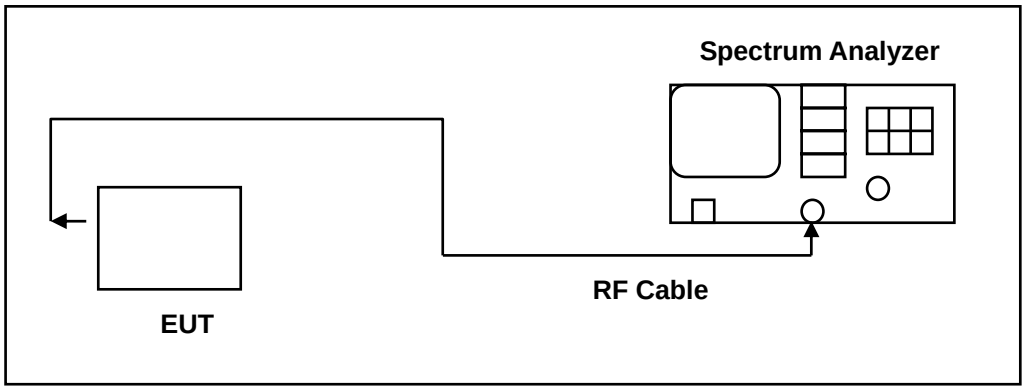
Mode 2: ZigBee Link Mode	
2405	
2440	
2470	

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	E4445A	MY45300744	12/19/2012	(2)
Spectrum Analyzer	Agilent	E4408B	MY45107753	07/24/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

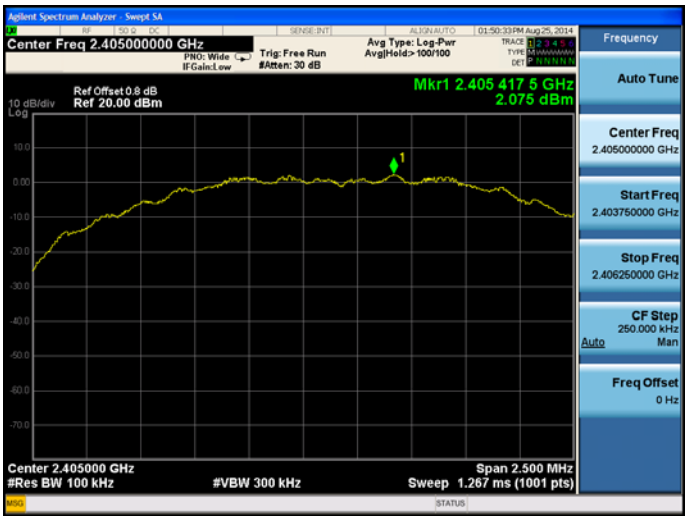
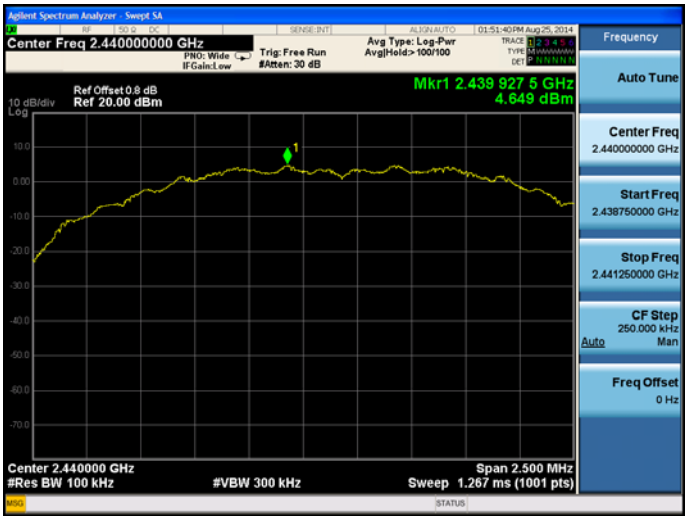
Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.
Note: N.C.R. = No Calibration Request.

9.4. Test Procedure

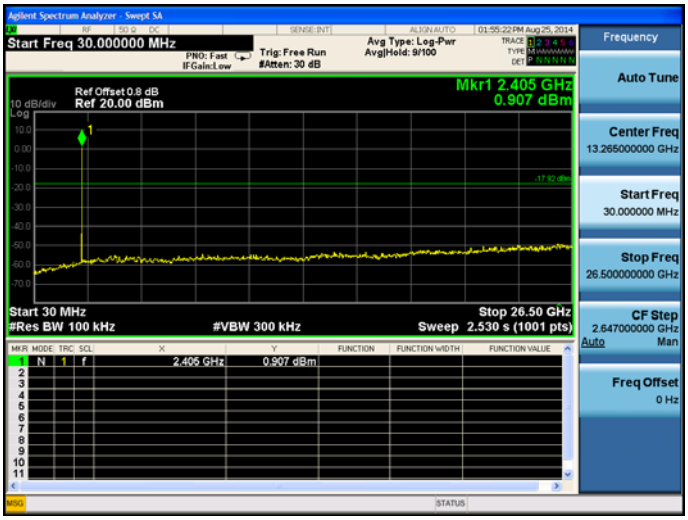
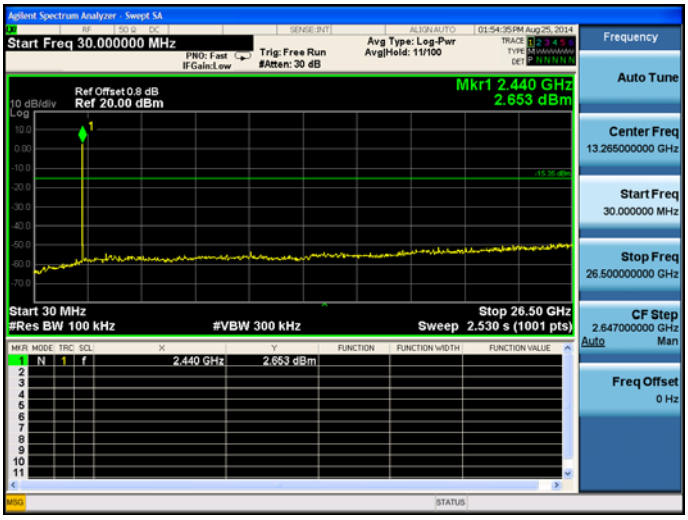
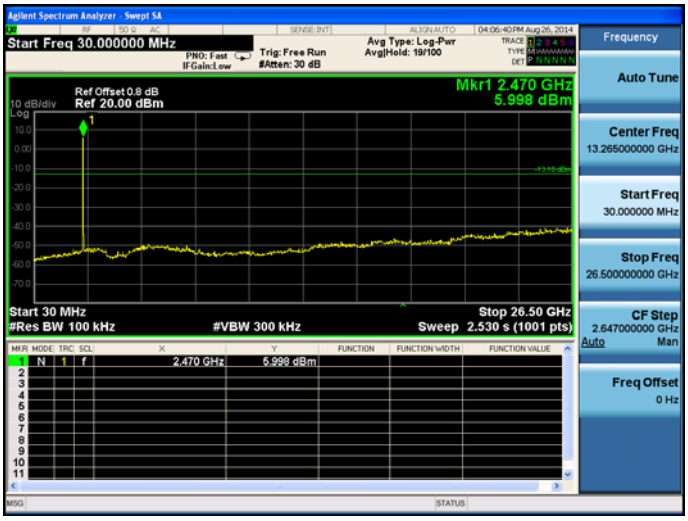
In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly 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 (Channel 1, 6, 11)

9.5. Test Graphs

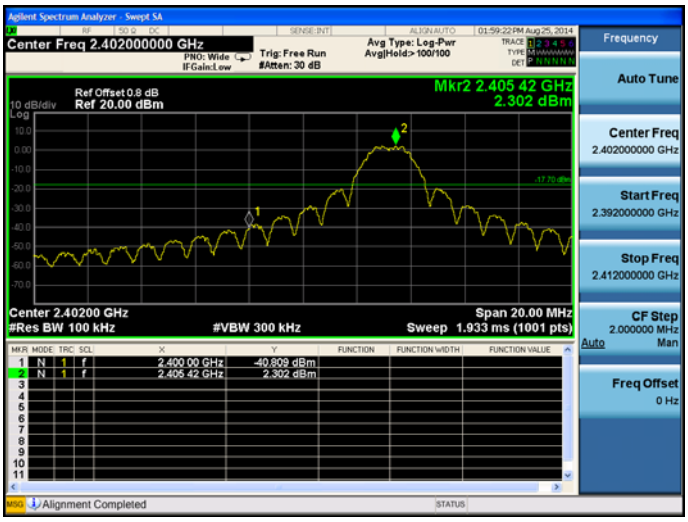
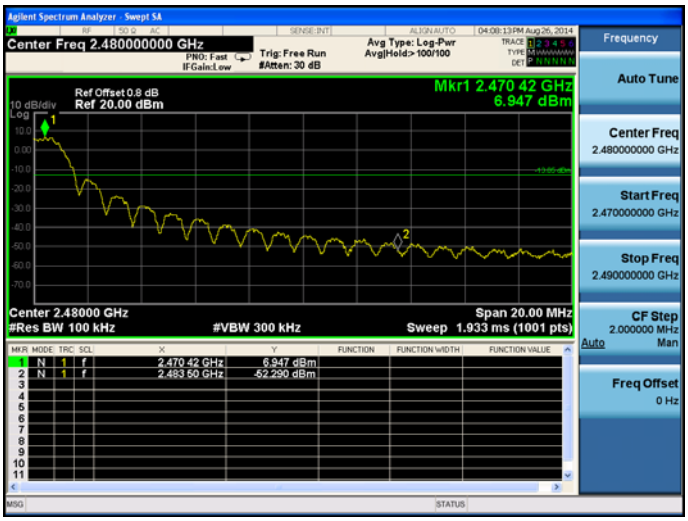
Reference level

Mode 2: ZigBee Link Mode	
2405	
2440	
2470	

Out of Band Conducted Emissions

Mode 2: ZigBee Link Mode	
2405	
2440	
2470	

Conducted Band Edge

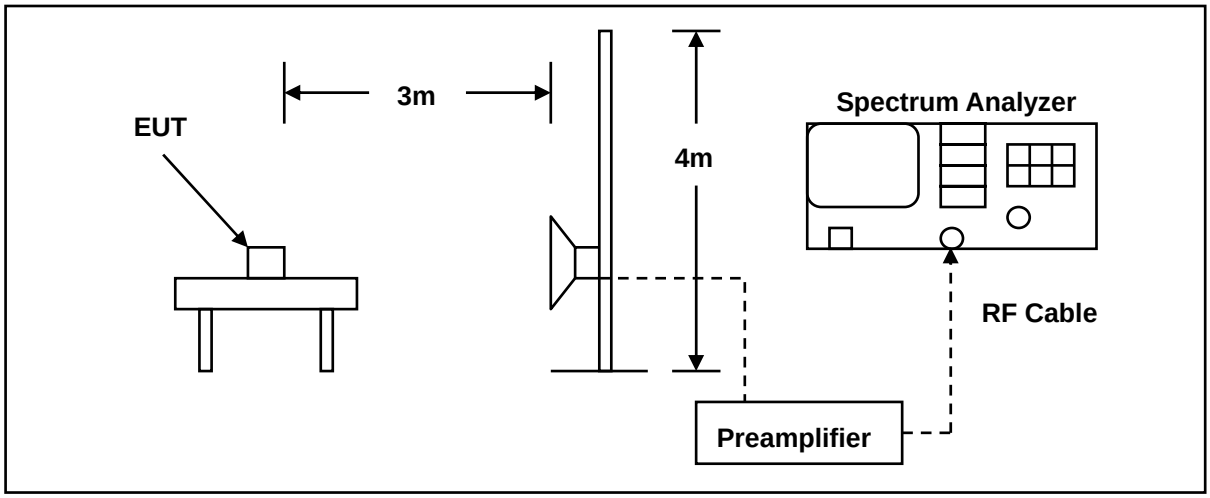
Mode 2: ZigBee Link Mode	
2405	
2470	

10 Band Edges Measurement

10.1.Limit

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

10.2.Test Setup



10.3.Test Instruments

3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/10/2014	(2)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/21/2014	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/21/2014	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/21/2014	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/11/2014	(1)
Test Site	ATL	TE01	888001	08/28/2013	(1)

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.
Note: N.C.R. = No Calibration Request.

10.4. Test Procedure

The EUT was setup to ANSI C63.4, 2009; tested to DTS test procedure of Oct 2012 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The emissions on the harmonics frequencies, the limits, and the margin of compliance are presented. These tests were made when the transmitter was in full radiated power. The additional test was performed to show compliance with the requirement at the band-edge frequency 2483.5 MHz and up to 2500 MHz and at 2390.0 MHz.

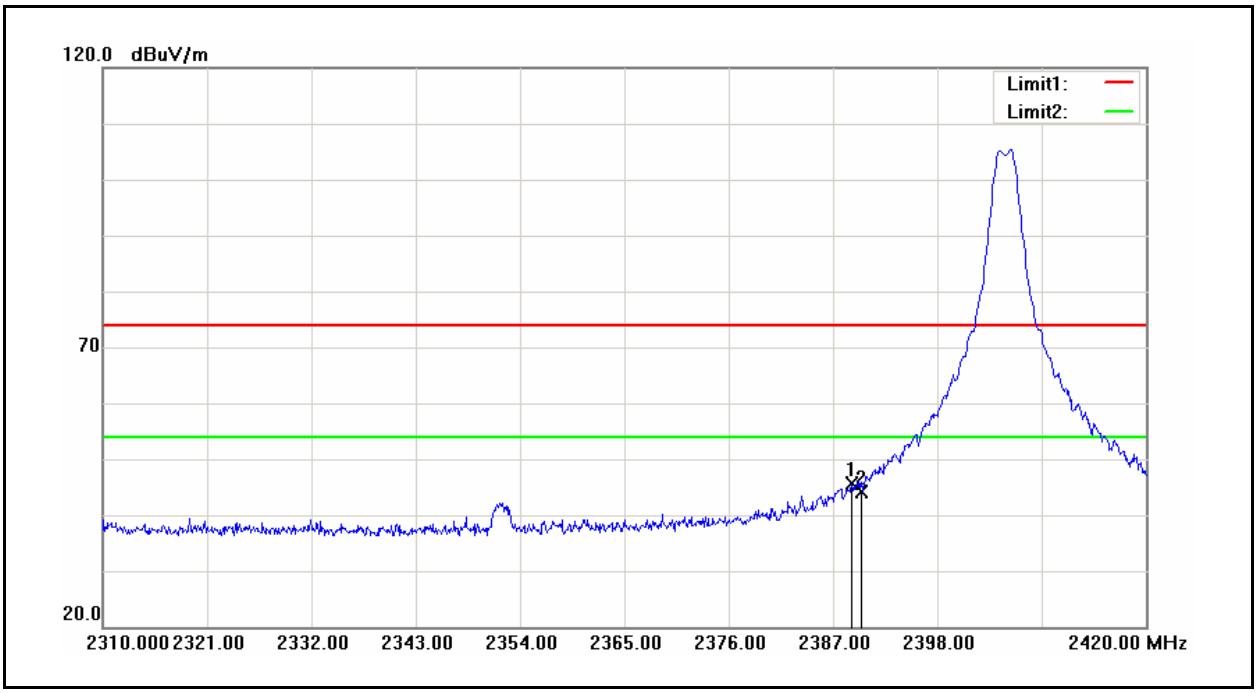
The transmitter was configured with the worst case antenna and setup to transmit at the highest channel. Then the field strength was measured at 2483.5 MHz.

The transmitter was then configured with the worst case antenna and setup to transmit at the lowest channel. Then the field strength was measured at 2390.0 MHz. These tests were performed at 4 different bit rates.

For measurements 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.

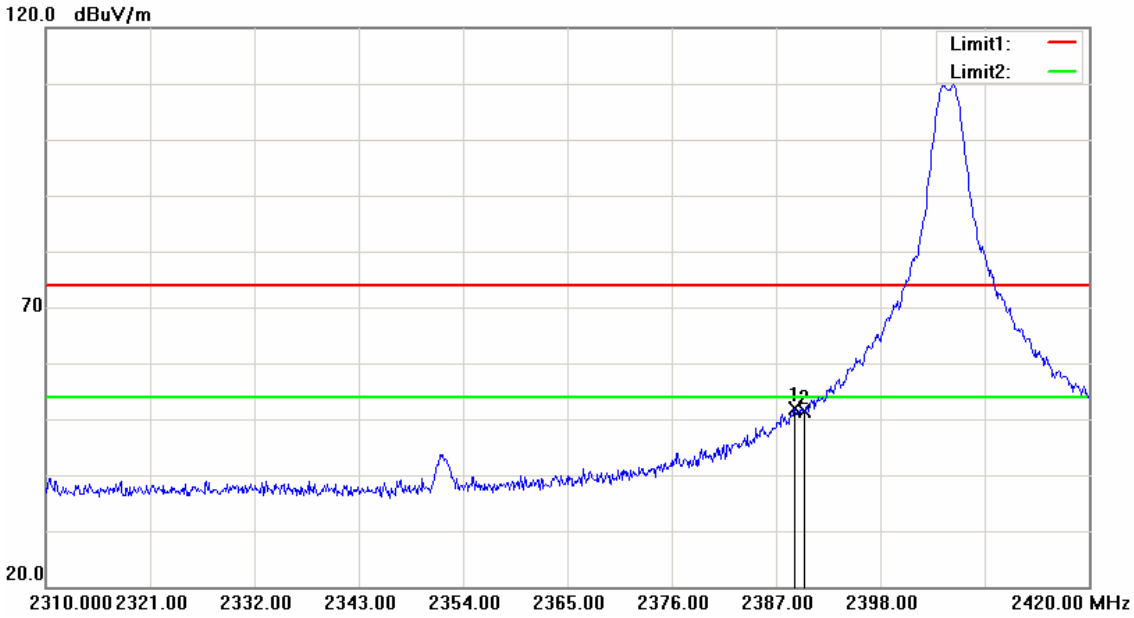
10.5.Test Result

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/26/2014
Frequency:	2405 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		



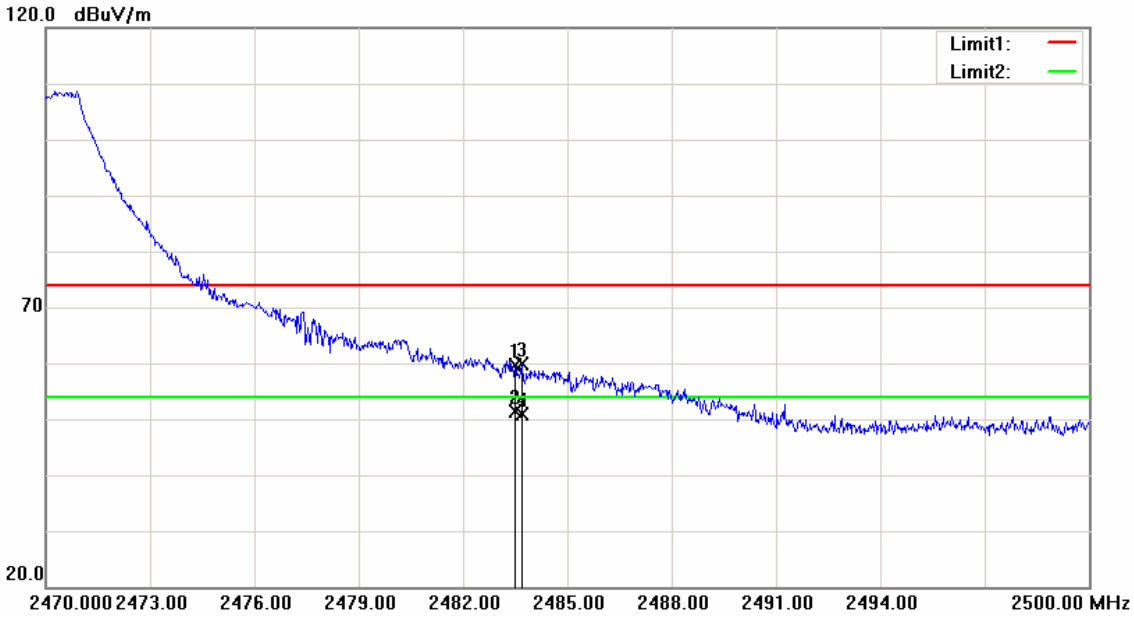
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.980	47.48	-1.96	45.52	74.00	-28.48	peak
2	2390.000	45.99	-1.94	44.05	74.00	-29.95	peak

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/26/2014
Frequency:	2405 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



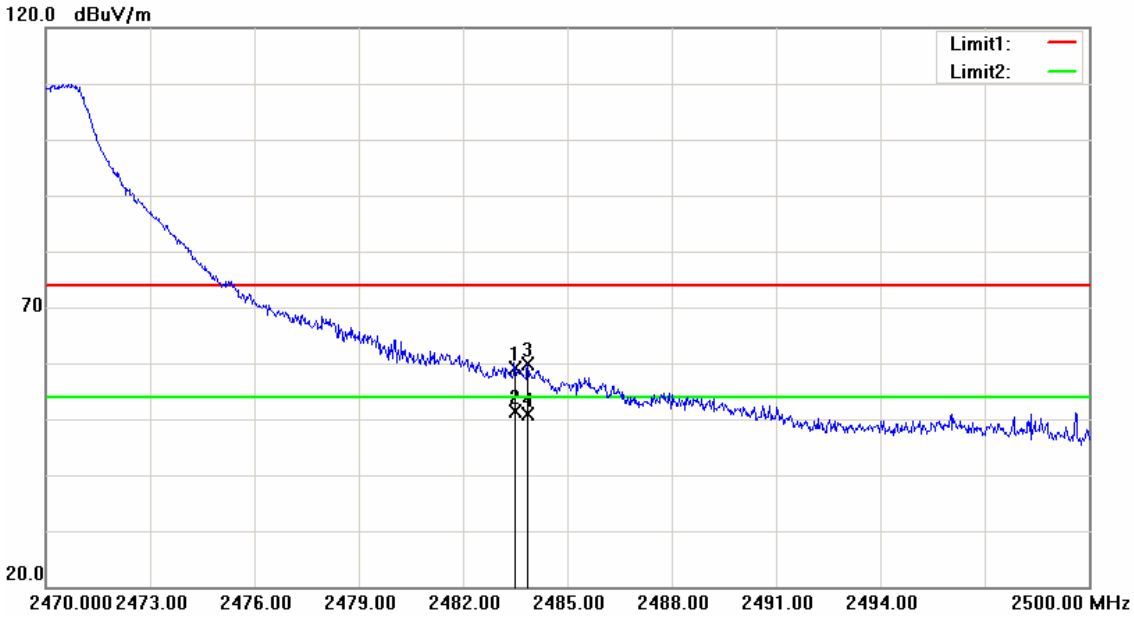
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.980	53.92	-1.96	51.96	74.00	-22.04	peak
2	2390.000	53.30	-1.94	51.36	74.00	-22.64	peak

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/26/2014
Frequency:	2470 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	61.07	-1.52	59.55	74.00	-14.45	peak
2	2483.500	52.79	-1.52	51.27	54.00	-2.73	AVG
3	2483.680	61.34	-1.52	59.82	74.00	-14.18	peak
4	2483.680	52.34	-1.52	50.82	54.00	-3.18	AVG

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Model Number:	PRLAY-WH01	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	2	Date:	08/26/2014
Frequency:	2470 MHz	Test By:	Eric Ou Yang
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	60.62	-1.52	59.10	74.00	-14.90	peak
2	2483.500	52.86	-1.52	51.34	54.00	-2.66	AVG
3	2483.860	61.48	-1.51	59.97	74.00	-14.03	peak
4	2483.860	52.28	-1.51	50.77	54.00	-3.23	AVG

11 Antenna Measurement

11.1. Limit

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

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

11.2. Antenna Connector Construction

The antenna used in this product is PCB Antenna. And the maximum Gain of this antenna is 3.07 dBi.