

Test Report

FCC Part15 Subpart C

Product Name : Q Light Engine
Model No. : QPI-1
FCC ID : 2AA45-QPI-1

Applicant : Q-Point Technology Inc
Address : 4F., No.90, XinHu 1st Rd., NeiHu Dist., Taipei City
11494, Taiwan

Date of Receipt : Sep. 15, 2013
Test Date : Sep. 15, 2013~ Mar. 28, 2014
Issued Date : Apr. 02, 2014
Report No. : 1430403R-RF-US-P05V01
Report Version : V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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Test Report Certification

Issued Date : Apr. 02, 2014

Report No. : 1430403R-RF-US-P05V01



Product Name : Q Light Engine

Applicant : Q-Point Technology Inc

Address : 4F., No.90, XinHu 1st Rd., NeiHu Dist., Taipei City 11494, Taiwan

Manufacturer : Q-Point Technology Inc

Address : 4F., No.90, XinHu 1st Rd., NeiHu Dist., Taipei City 11494, Taiwan

Model No. : QPI-1

FCC ID : 2AA45-QPI-1

EUT Voltage : DC 5V

Brand Name : Q-Point

Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2012
ANSI C63.4: 2009 ANSI C63.10:2009
KDB 558074 D01 DTS Meas Guidance v03r01

Test Result : Complied

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Laboratory Information

We, **Quietek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

Taiwan R.O.C.	:	BSMI, NCC, TAF
Germany	:	TUV Rheinland
Norway	:	Nemko, DNV
USA	:	FCC
Japan	:	VCCI
China	:	CNAS

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site :<http://www.quietek.com/tw/ctg/cts/accreditations.htm>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site :
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1. General Information

1.1. EUT Description

Product Name	Q Light Engine
Brand Name	Q-Point
Model No.	QPI-1
Working Voltage	DC 5V
Antenna Type	PIFA antenna
Bluetooth	
Frequency Range	2402 - 2480 MHz
Channel Number	79
Type of Modulation	FHSS
Bluetooth Version	4.0+HS
Type of modulation	V3.0+HS: GFSK, Pi/4 DQPSK, 8DPSK V4.0: GFSK
Data Rate	V3.0+HS: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK) V4.0: 1Mbps(GFSK)
Antenna Gain	2.6dBi
Wi-Fi	
Frequency Range	802.11b/g/n(20MHz): 2412 ~ 2462 MHz 802.11n(40MHz): 2422 ~ 2452 MHz
Channel Number	802.11b/g/n(20MHz): 13 802.11n(40MHz): 9
Type of modulation	802.11b: DSSS; 802.11g/n: OFDM
Data Rate	802.11b: 1/2/5.5/11 Mbps
	802.11g: 6/9/12/18/24/36/48/54 Mbps
	802.11n: up to 150 Mbps
Channel Control	Auto
Antenna Gain	2.6dBi
Components	
Adapter	Brand Name: DVE M/N: DSA-20PFE-05 FUS 050300 Input: 100-240V~50/60Hz 0.7A Output: 5V, 3A

For 2.4GHz Band

802.11b/g/n(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz	04	2427 MHz
05	2432 MHz	06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	10	2457 MHz	11	2462 MHz	N/A	N/A
802.11n(40MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Duty Cycle

Test Mode	Duty Cycle
802.11b	100%
802.11g	100%
802.11n(20MHz)	100%
802.11n(40MHz)	100%

1.2. Mode of Operation

Quietek 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: Transmit by 802.11b
Mode 2: Transmit by 802.11g
Mode 3: Transmit by 802.11n(20MHz)
Mode 4: Transmit by 802.11n(40MHz)

Note:

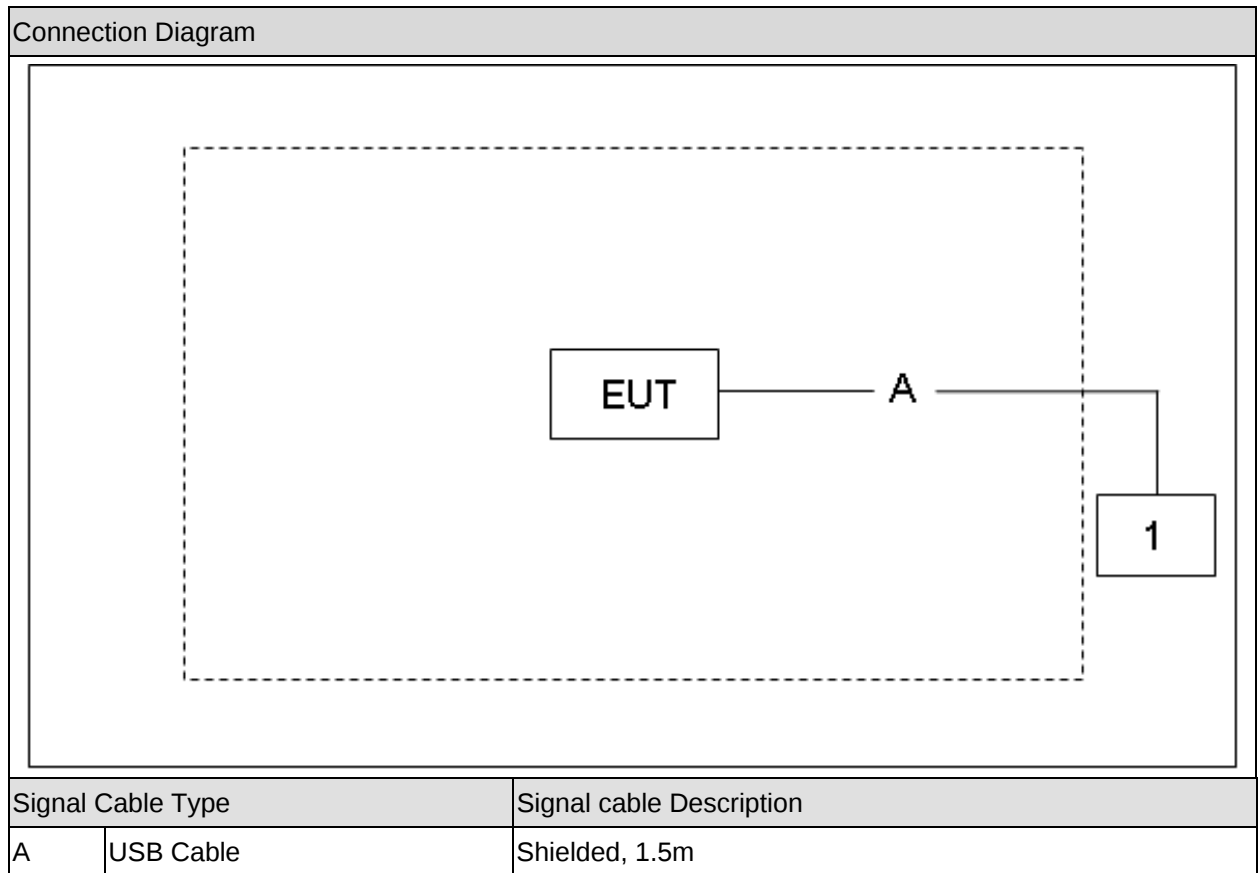
1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. This device is a composite device in accordance with Part 15 Subpart B regulations. The function for the receiver was measured and made a test report that the report number is 1430403R-RF-US-P01V02.

1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook	DELL	E520	N/A	Non-Shielded, 1.8m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of equipment.
3	Run the RF test software "REALTEK ", and set the test mode and channel, then press OK to start continue transmit or receive.

2. Technical Test

2.1. Summary of Test Result

- ☒ No deviations from the test standards
- ☐ Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.207	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.209	Yes	No
RF Antenna Conducted Spurious	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2012 15.247(d)	Yes	No
Operation Frequency Range of 20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2012 15.215(c)	Yes	No
Occupied Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(a)(2)	Yes	No
Power Output	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(b)(3)	Yes	No
Power Spectral Density	FCC CFR Title 47 Part 15 Subpart C: 2012 Section 15.247(e)	Yes	No

2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

3. Conducted Emission

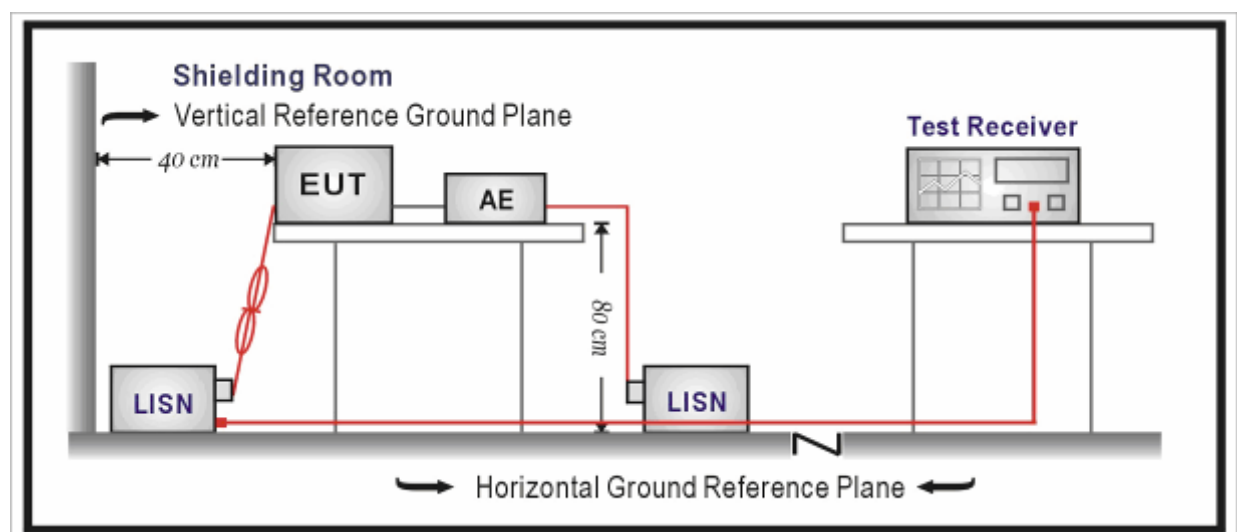
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100726	2015.03.30
Two-Line V-Network	R&S	ENV216	100043	2015.03.30
Two-Line V-Network	R&S	ENV216	100044	2014.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2015.03.01
50ohm Termination	SHX	TF2	07081401	2014.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2015.01.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

3.2. Test Setup



3.3. Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 – 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

3.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to ANSI C63.10: 2009 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

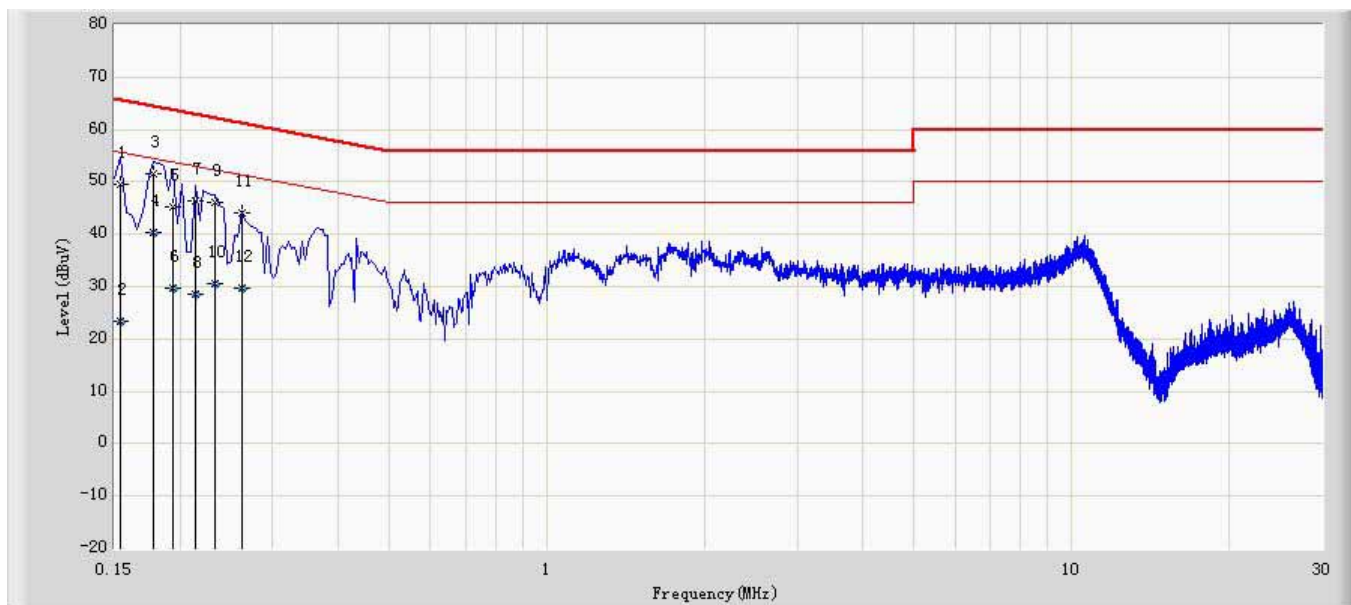
The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

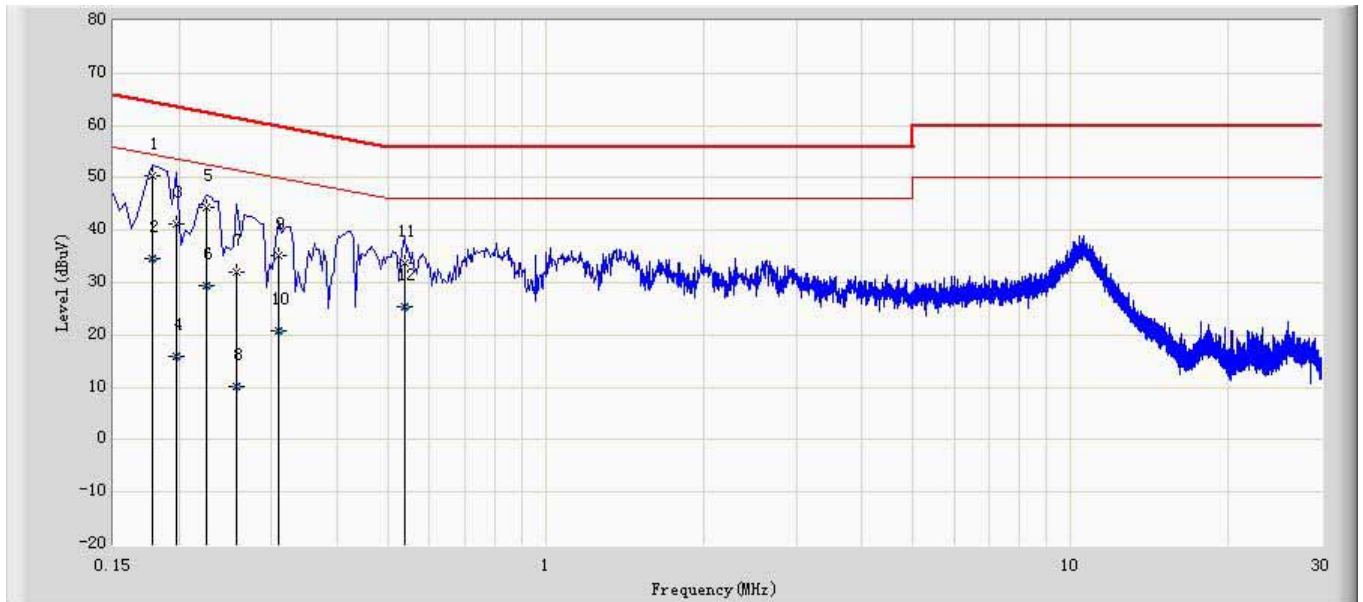
3.6. Test Result

Engineer: Toms	
Limit: FCC_Part15.207_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.154	49.533	39.660	-16.248	65.781	9.873	QP
2		0.154	23.433	13.560	-32.348	55.781	9.873	AV
3	*	0.178	51.502	41.645	-13.076	64.578	9.857	QP
4		0.178	40.355	30.498	-14.223	54.578	9.857	AV
5		0.194	45.269	35.419	-18.595	63.864	9.850	QP
6		0.194	29.599	19.749	-24.265	53.864	9.850	AV
7		0.214	46.264	36.414	-16.785	63.049	9.850	QP
8		0.214	28.609	18.759	-24.440	53.049	9.850	AV
9		0.234	46.192	36.342	-16.115	62.307	9.850	QP
10		0.234	30.593	20.743	-21.714	52.307	9.850	AV
11		0.262	44.054	34.208	-17.314	61.368	9.846	QP
12		0.262	29.700	19.854	-21.668	51.368	9.846	AV

Engineer: Toms	
Limit: FCC_Part15.207_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1	*	0.178	50.354	40.490	-14.224	64.578	9.864	QP
2		0.178	34.501	24.637	-20.077	54.578	9.864	AV
3		0.198	41.173	31.313	-22.521	63.694	9.860	QP
4		0.198	16.003	6.143	-37.691	53.694	9.860	AV
5		0.226	44.429	34.569	-18.166	62.595	9.860	QP
6		0.226	29.430	19.570	-23.165	52.595	9.860	AV
7		0.258	31.985	22.128	-29.511	61.496	9.857	QP
8		0.258	10.225	0.368	-41.271	51.496	9.857	AV
9		0.310	35.178	25.328	-24.792	59.970	9.850	QP
10		0.310	20.691	10.841	-29.279	49.970	9.850	AV
11		0.538	33.624	23.794	-22.376	56.000	9.830	QP
12		0.538	25.516	15.686	-20.484	46.000	9.830	AV

4. Radiated Emission

4.1. Test Equipment

Radiated Emission / AC-2

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100573	2015.03.30
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Chainenna	Teseq GmbH	CBL6112D	27611	2014.10.15
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2015.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2015.01.08

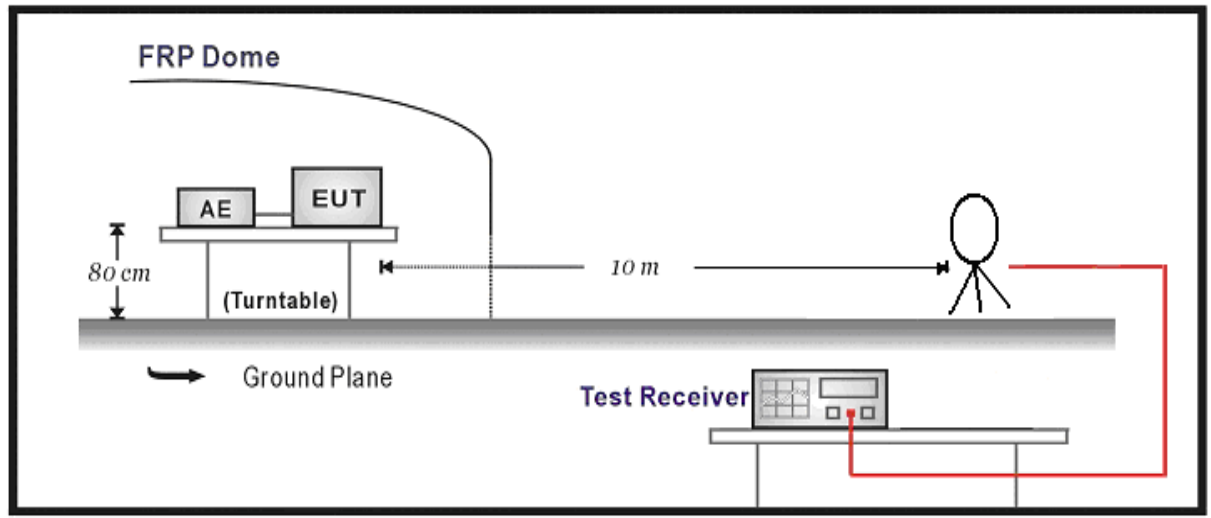
Radiated Emission / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2015.03.30
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Preamplifier	Miteq	NSP1800-25	1364185	2014.05.04
Preamplifier	Quietek	AP-040G	CHM-0906001	2014.05.04
DRG Horn	ETS-Lindgren	3117	00123988	2015.01.21
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2014.11.24
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2014.06.09
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2015.01.08

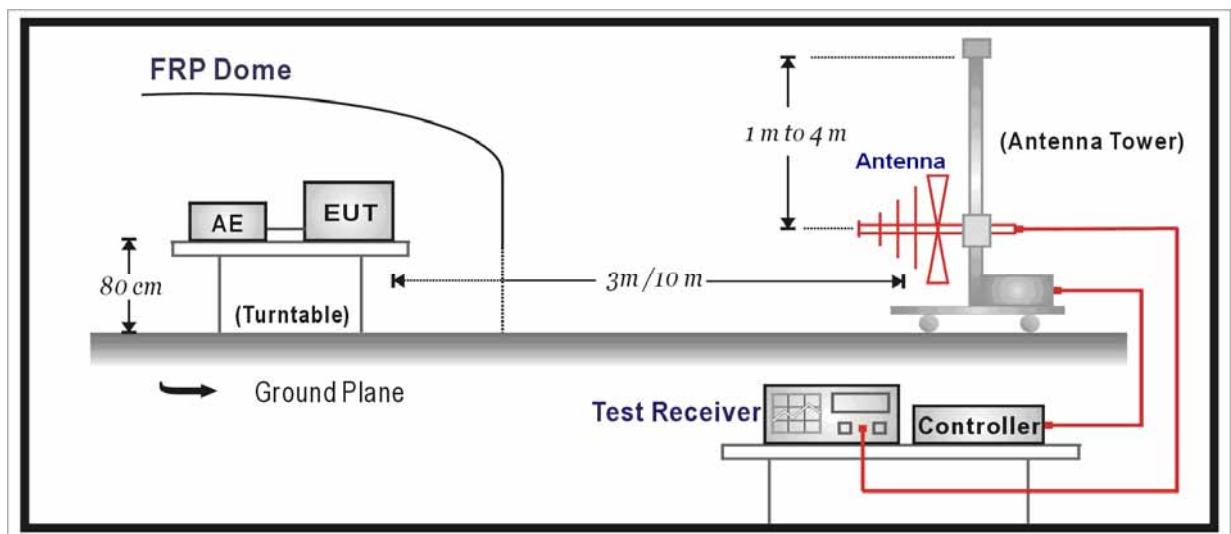
Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

4.2. Test Setup

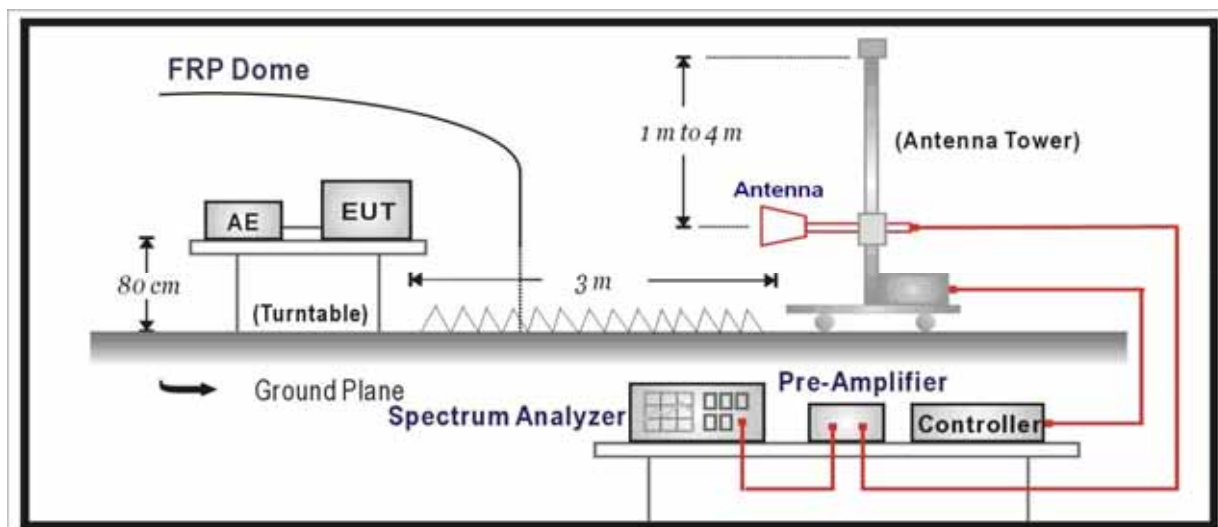
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 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.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

4.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from Antenna to the EUT was 3 meters.

The Antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This

is repeated for both horizontal and vertical polarization of the Antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn Antenna will be bended down a little (as horn Antenna has the narrow beamwidth) in order to keeping the Antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

4.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB
below 1G is defined as ± 3.8 dB

4.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

Mode1: Transmit at 802.11b

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	4824.0	43.6	-8.3	35.3	54(Note3)	-18.7	PK
	V	4824.0	43.7	-8.4	35.3	54(Note3)	-18.7	PK
	H	7236.0	39.9	-3.4	36.5	54(Note3)	-17.5	PK
	V	7236.0	39.6	-3.4	36.2	54(Note3)	-17.8	PK
	H	9648.0	33.9	2.6	36.5	54(Note3)	-17.5	PK
	V	9648.0	34.0	2.6	36.6	54(Note3)	-17.4	PK
6	H	4874.0	43.6	-8.3	35.3	54(Note3)	-18.7	PK
	V	7311.0	41.4	-3.3	38.1	54(Note3)	-15.9	PK
	H	9748.0	35.3	2.8	38.1	54(Note3)	-15.9	PK
	V	4874.0	44.0	-8.3	35.7	54(Note3)	-18.3	PK
	H	7311.0	40.7	-3.3	37.4	54(Note3)	-16.6	PK
	V	9748.0	35.8	2.7	38.5	54(Note3)	-15.5	PK
11	H	4924.0	45.3	-8.4	36.9	54(Note3)	-17.1	PK
	V	4924.0	44.0	-8.3	35.7	54(Note3)	-18.3	PK
	H	7386.0	40.4	-3.0	37.4	54(Note3)	-16.6	PK
	V	7386.0	43.1	-3.0	40.1	54(Note3)	-13.9	PK
	H	9848.0	34.7	3.1	37.8	54(Note3)	-16.2	PK
	V	9848.0	34.6	3.2	37.8	54(Note3)	-16.2	PK

Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Mode2: Transmit at 802.11g

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	4824.0	43.3	-8.3	35.0	54(Note3)	-19.0	PK
	V	4824.0	42.7	-8.4	34.3	54(Note3)	-19.7	PK
	H	7236.0	41.6	-3.4	38.2	54(Note3)	-15.8	PK
	V	7236.0	43.0	-3.4	39.6	54(Note3)	-14.4	PK
	H	9648.0	33.7	2.6	36.3	54(Note3)	-17.7	PK
	V	9648.0	34.5	2.6	37.1	54(Note3)	-16.9	PK
6	H	4874.0	44.2	-8.3	35.9	54(Note3)	-18.1	PK
	V	4874.0	44.4	-8.3	36.1	54(Note3)	-17.9	PK
	H	7311.0	40.8	-3.3	37.5	54(Note3)	-16.5	PK
	V	7311.0	41.1	-3.3	37.8	54(Note3)	-16.2	PK
	H	9748.0	35.2	2.7	37.9	54(Note3)	-16.1	PK
	V	9748.0	35.6	2.8	38.4	54(Note3)	-15.6	PK
11	H	4924.0	42.5	-8.4	34.1	54(Note3)	-19.9	PK
	V	4924.0	42.6	-8.3	34.3	54(Note3)	-19.7	PK
	H	7386.0	40.1	-3.0	37.1	54(Note3)	-16.9	PK
	V	7386.0	42.0	-3.0	39.0	54(Note3)	-15.0	PK
	H	9848.0	35.0	3.1	38.1	54(Note3)	-15.9	PK
	V	9848.0	35.2	3.2	38.4	54(Note3)	-15.6	PK

Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Mode3: Transmit at 802.11n (20MHz)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	4824.0	42.9	-8.3	34.6	54(Note3)	-19.4	PK
	V	4824.0	43.6	-8.4	35.2	54(Note3)	-18.8	PK
	H	7230.5	49.2	-3.4	45.8	54(Note3)	-8.2	PK
	V	7230.5	46.0	-3.4	42.6	54(Note3)	-11.4	PK
	H	9648.0	34.3	2.6	36.9	54(Note3)	-17.1	PK
	V	9648.0	34.2	2.6	36.8	54(Note3)	-17.2	PK
6	H	4874.0	44.1	-8.3	35.8	54(Note3)	-18.2	PK
	V	4874.0	44.4	-8.3	36.1	54(Note3)	-17.9	PK
	H	7311.0	40.7	-3.3	37.4	54(Note3)	-16.6	PK
	V	7311.0	40.5	-3.3	37.2	54(Note3)	-16.8	PK
	H	9748.0	35.9	2.7	38.6	54(Note3)	-15.4	PK
	V	9748.0	35.8	2.8	38.6	54(Note3)	-15.4	PK
11	H	4924.0	42.9	-8.4	34.5	54(Note3)	-19.5	PK
	V	4924.0	42.3	-8.3	34.0	54(Note3)	-20.0	PK
	H	7386.0	41.0	-3.0	38.0	54(Note3)	-16.0	PK
	V	7266.0	39.5	-3.3	36.2	54(Note3)	-17.8	PK
	H	9848.0	34.4	3.1	37.5	54(Note3)	-16.5	PK
	V	9688.0	33.7	2.8	36.5	54(Note3)	-17.5	PK

Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Mode4: Transmit at 802.11n (40MHz)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
3	H	4844.0	43.5	-8.3	35.2	54(Note3)	-18.8	PK
	V	4844.0	44.1	-8.4	35.7	54(Note3)	-18.3	PK
	H	7266.0	39.9	-3.3	36.6	54(Note3)	-17.4	PK
	V	7266.0	42.5	-3.3	39.2	54(Note3)	-14.8	PK
	H	9688.0	34.6	2.7	37.3	54(Note3)	-16.7	PK
	V	9688.0	33.9	2.8	36.7	54(Note3)	-17.3	PK
6	H	4874.0	43.6	-8.3	35.3	54(Note3)	-18.7	PK
	V	4874.0	44.2	-8.3	35.9	54(Note3)	-18.1	PK
	H	7311.0	40.7	-3.3	37.4	54(Note3)	-16.6	PK
	V	7311.0	40.8	-3.3	37.5	54(Note3)	-16.5	PK
	H	9748.0	35.2	2.8	38.0	54(Note3)	-16.0	PK
	V	9748.0	35.1	2.8	37.9	54(Note3)	-16.1	PK
9	H	4904.0	42.6	-8.3	34.3	54(Note3)	-19.7	PK
	V	4904.0	42.7	-8.3	34.4	54(Note3)	-19.6	PK
	H	7356.0	40.7	-3.1	37.6	54(Note3)	-16.4	PK
	V	7356.0	40.9	-3.1	37.8	54(Note3)	-16.2	PK
	H	9808.0	36.1	3.0	39.1	54(Note3)	-14.9	PK
	V	9808.0	35.9	3.0	38.9	54(Note3)	-15.1	PK

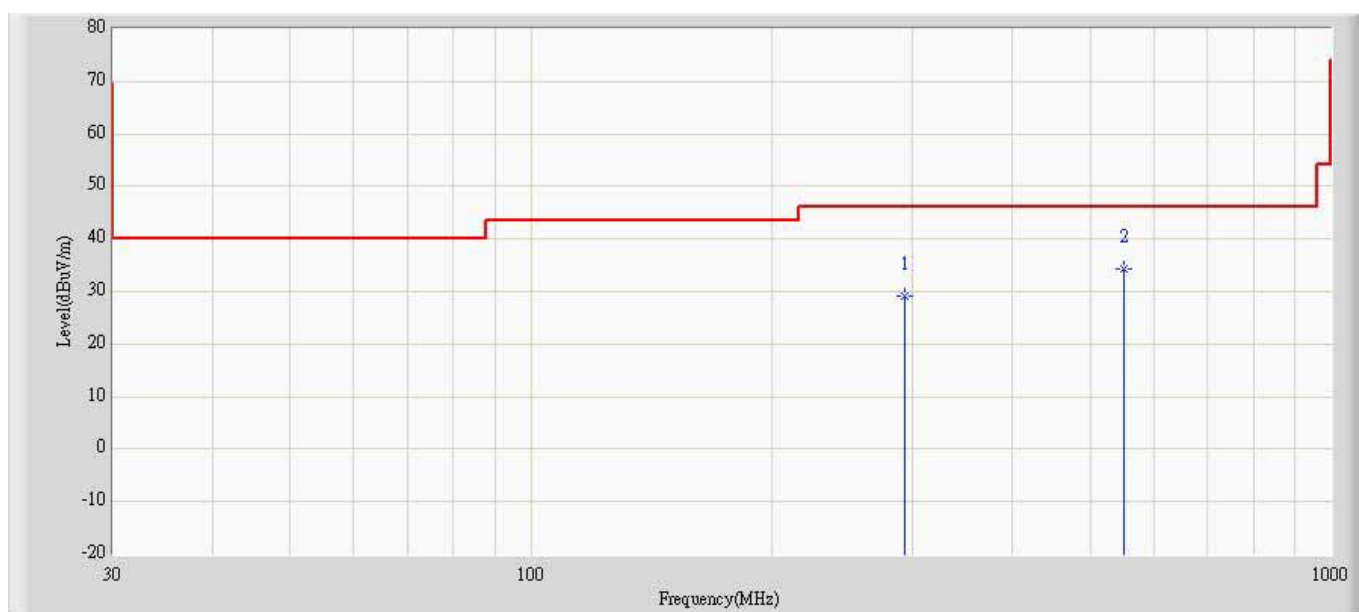
Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

The worst case of Radiated Emission below 1GHz:

Engineer: Toms	
Site: AC2	Time: 2013/09/23 - 20:05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: CBL6112D_27613(30-1000MHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit at channel 2437MHz by 802.11b	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		293.840	29.280	14.497	-16.720	46.000	14.783	QP
2	*	551.375	34.398	13.165	-11.602	46.000	21.233	QP

Engineer: Toms

Site: AC2

Time: 2013/09/23 - 20:05

Limit: FCC_Part15.209_RE(3m)

Margin: 0

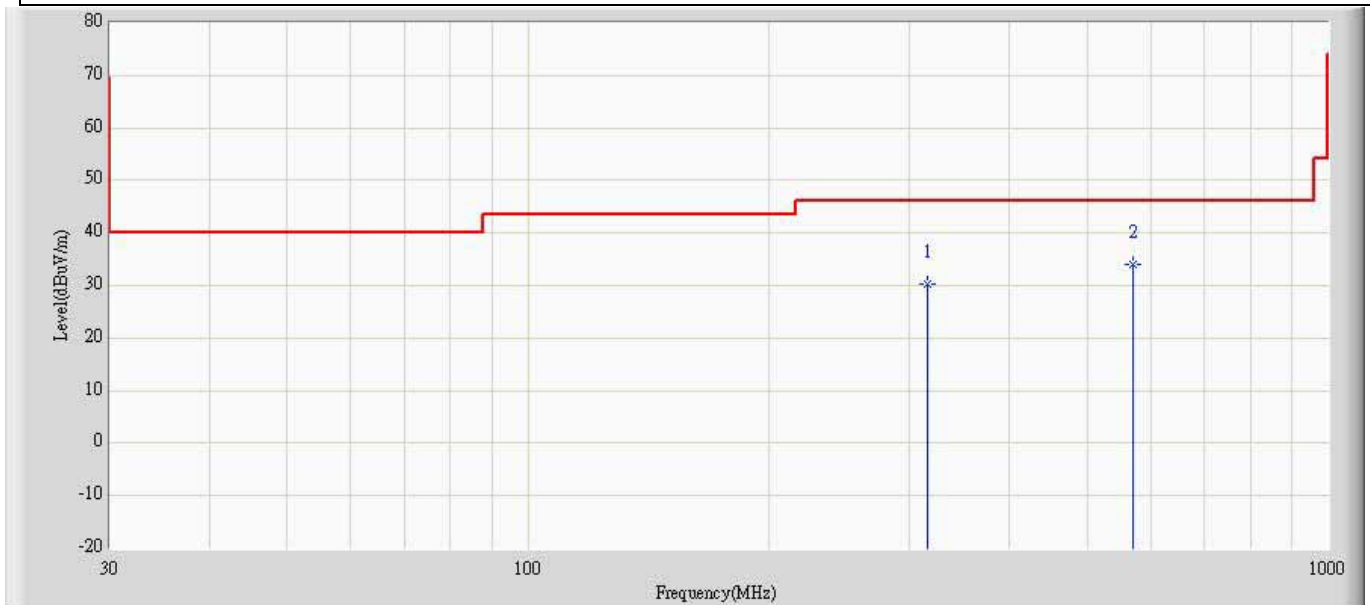
Probe: CBL6112D_27613(30-1000MHz)

Polarity: Vertical

EUT: Q Light Engine

Power: AC 120V/60Hz

Note: Mode1: Transmit at channel 2437MHz by 802.11b



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		316.150	30.418	15.244	-15.582	46.000	15.174	QP
2	*	571.745	34.109	12.877	-11.891	46.000	21.232	QP

5. RF Antenna Conducted Spurious

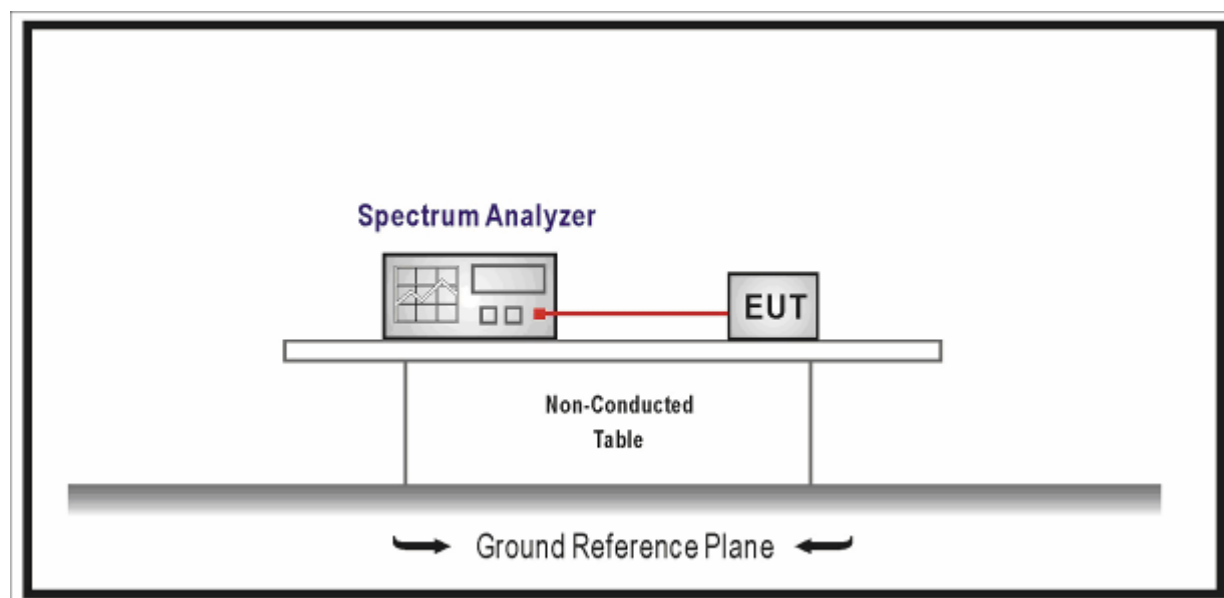
5.1. Test Equipment

RF Antenna Conducted Spurious / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2015.03.30
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2014.05.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

5.2. Test Setup



5.3. Limit

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.

5.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW $\geq$ 3* RBW, scan up through 10th harmonic.

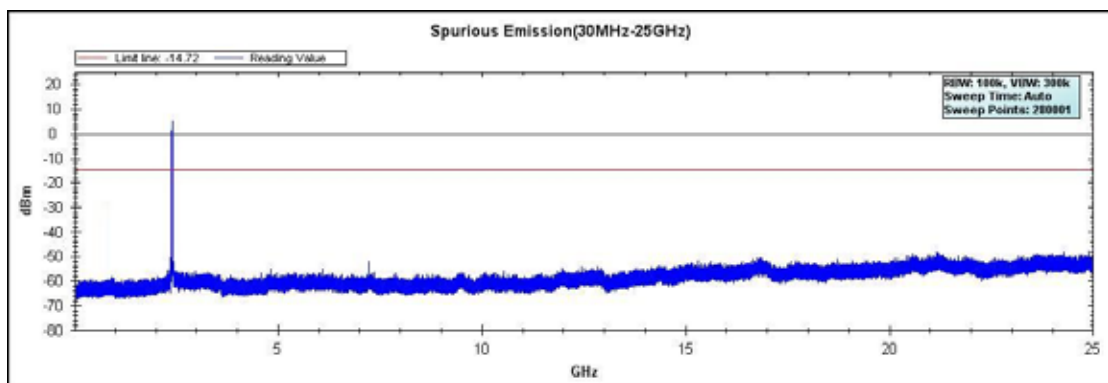
5.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

5.6. Test Result

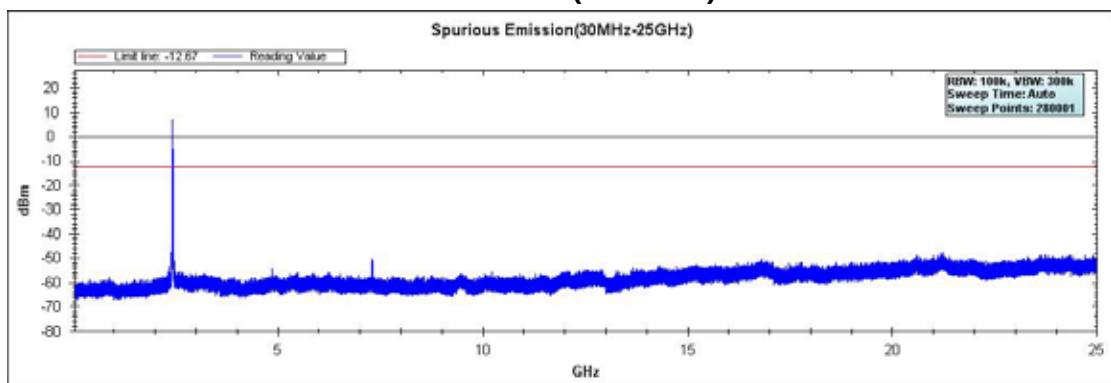
Product	:	Q Light Engine
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit by 802.11b

Channel 01 (2412MHz)



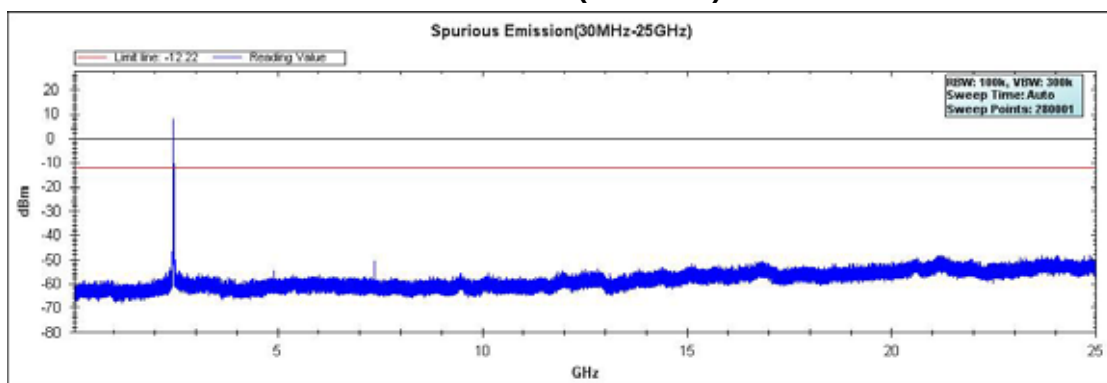
Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 06 (2437MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

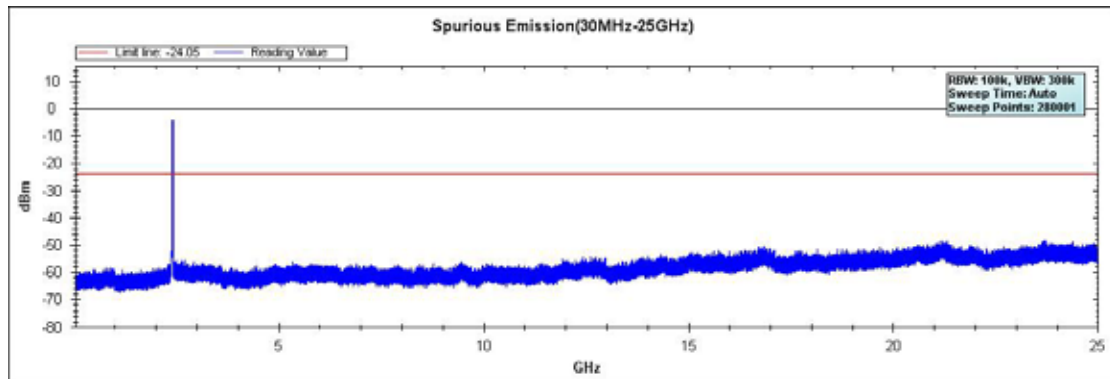
Channel 11 (2462MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

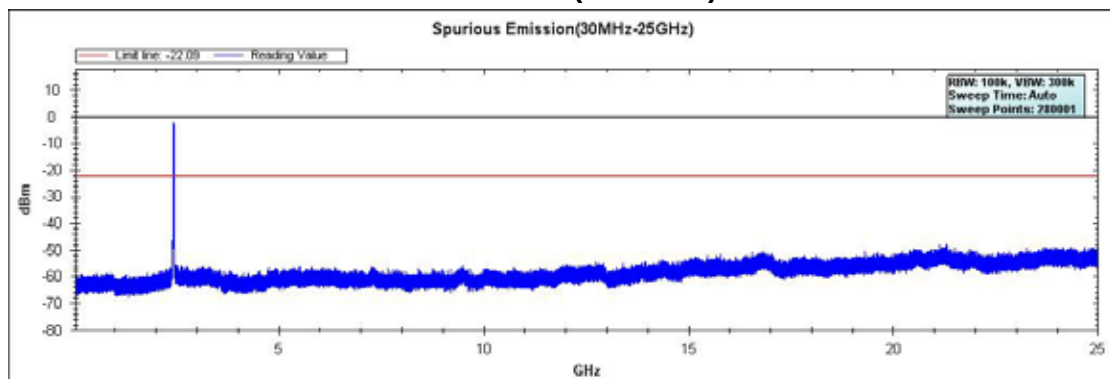
Product	:	Q Light Engine
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmit by 802.11g

Channel 01 (2412MHz)



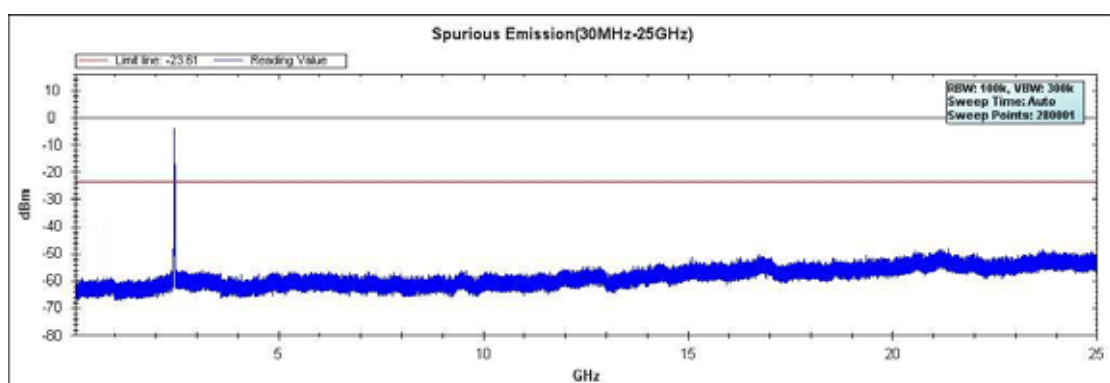
Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 06 (2437MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

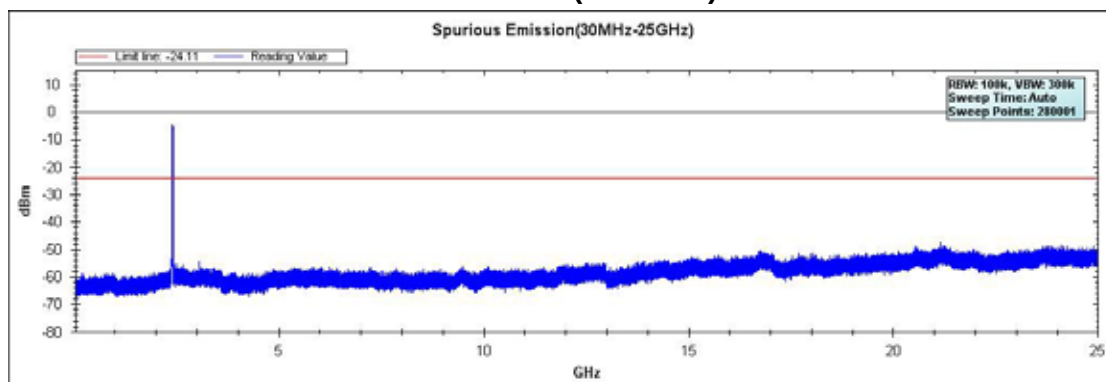
Channel 11 (2462MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

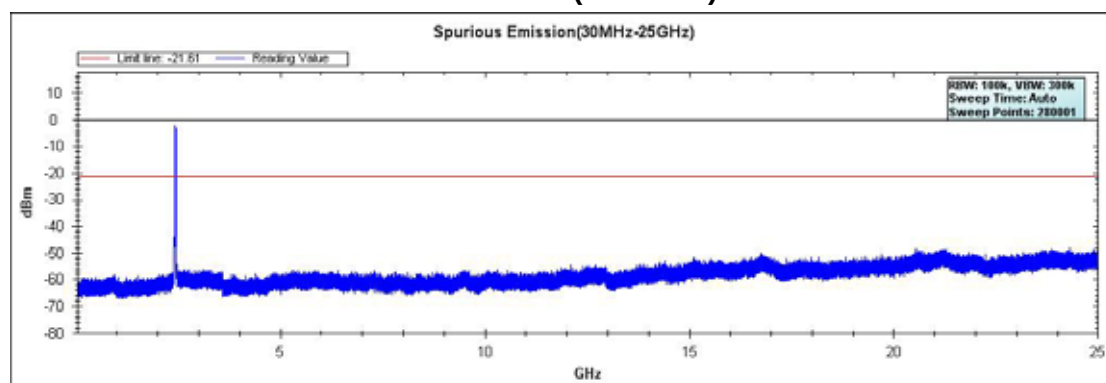
Product	:	Q Light Engine
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel 01 (2412MHz)



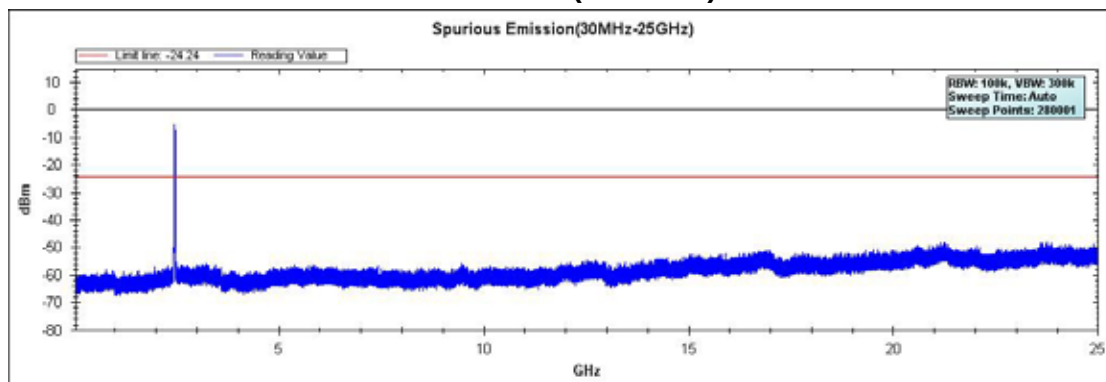
Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 06 (2437MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

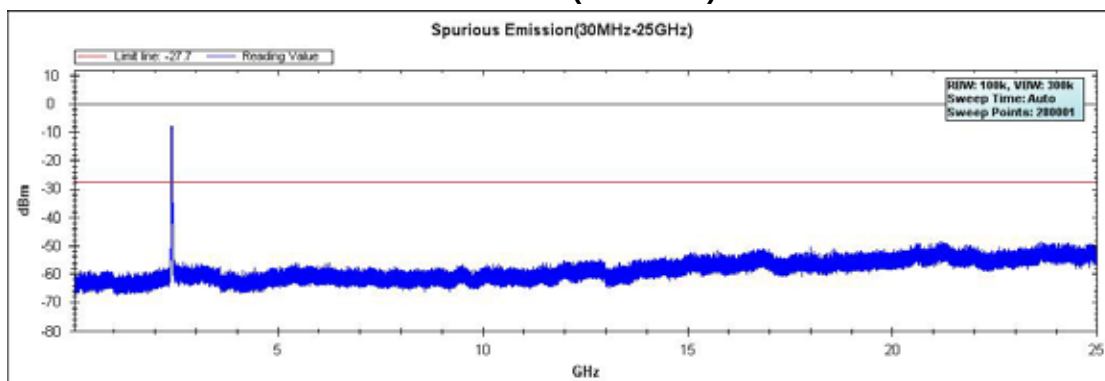
Channel 11 (2462MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

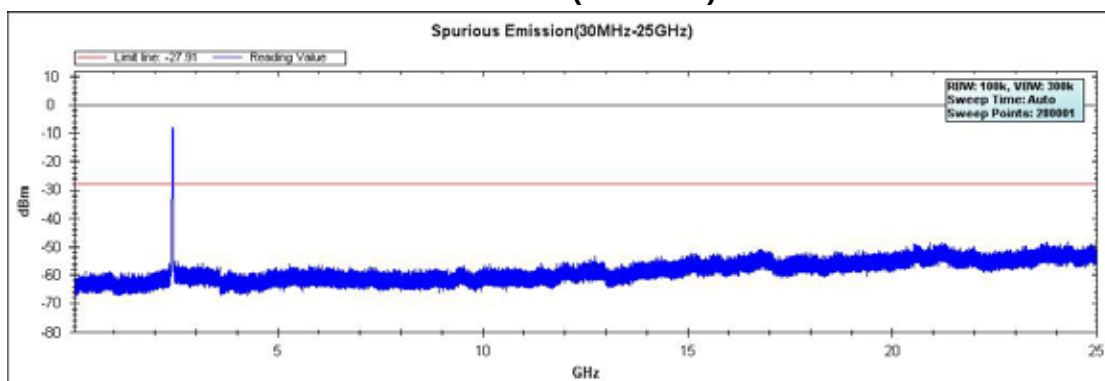
Product	:	Q Light Engine
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Channel 03 (2422MHz)



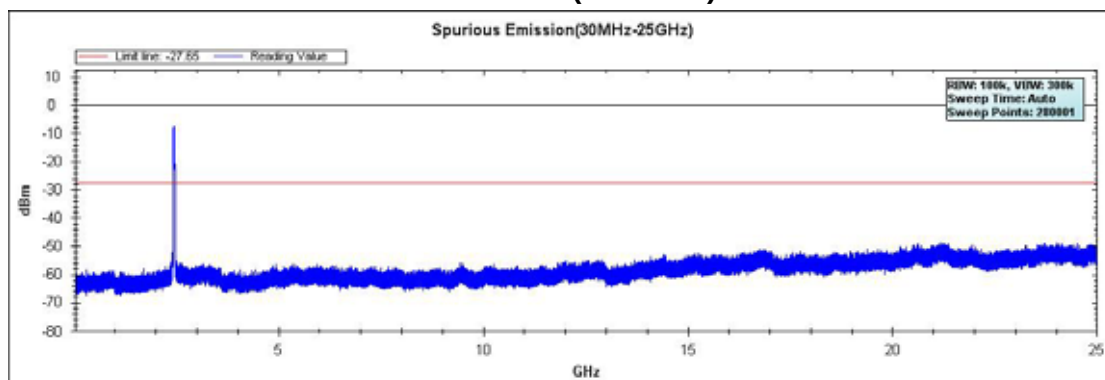
Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 06 (2437MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

Channel 09 (2452MHz)



Note: The above test pattern is synthesized by multiple of the frequency range.

6. Radiated Emission Band Edge

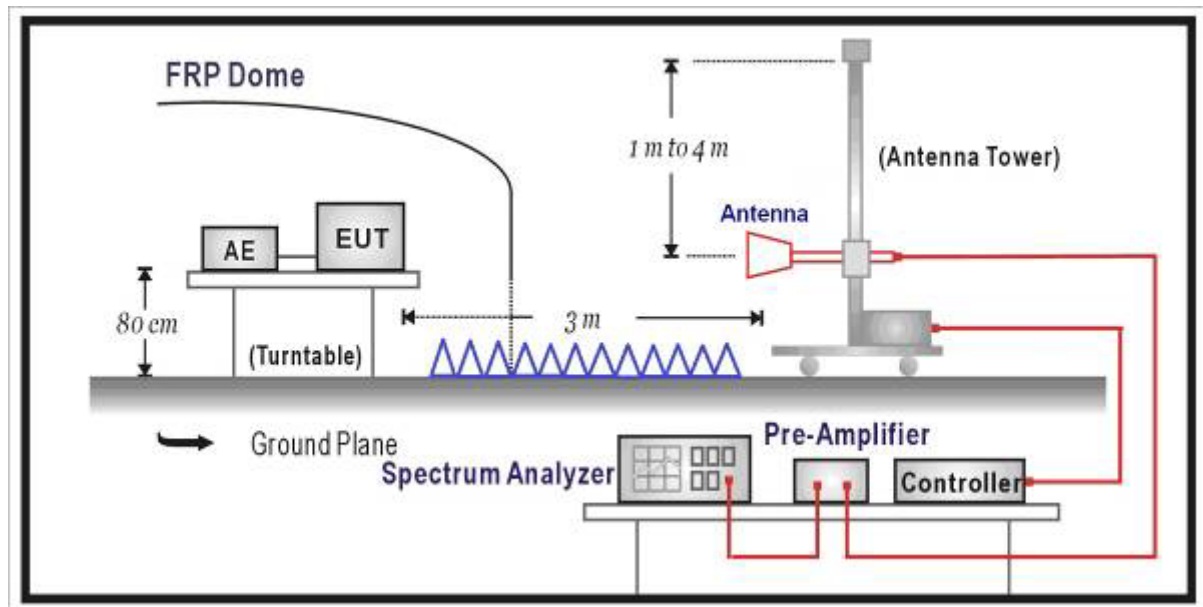
6.1. Test Equipment

☒ Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2015.03.30
Preamplifier	Miteq	NSP1800-25	1364185	2014.05.04
Preamplifier	Quietek	AP-040G	CHM-0906001	2014.05.04
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2014.10.15
DRG Horn	ETS-Lindgren	3117	00123988	2015.01.21
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2015.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2014.06.09
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2015.01.08

Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

6.2. Test Setup



6.3. Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2009 on radiated measurement.

6.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB

6.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

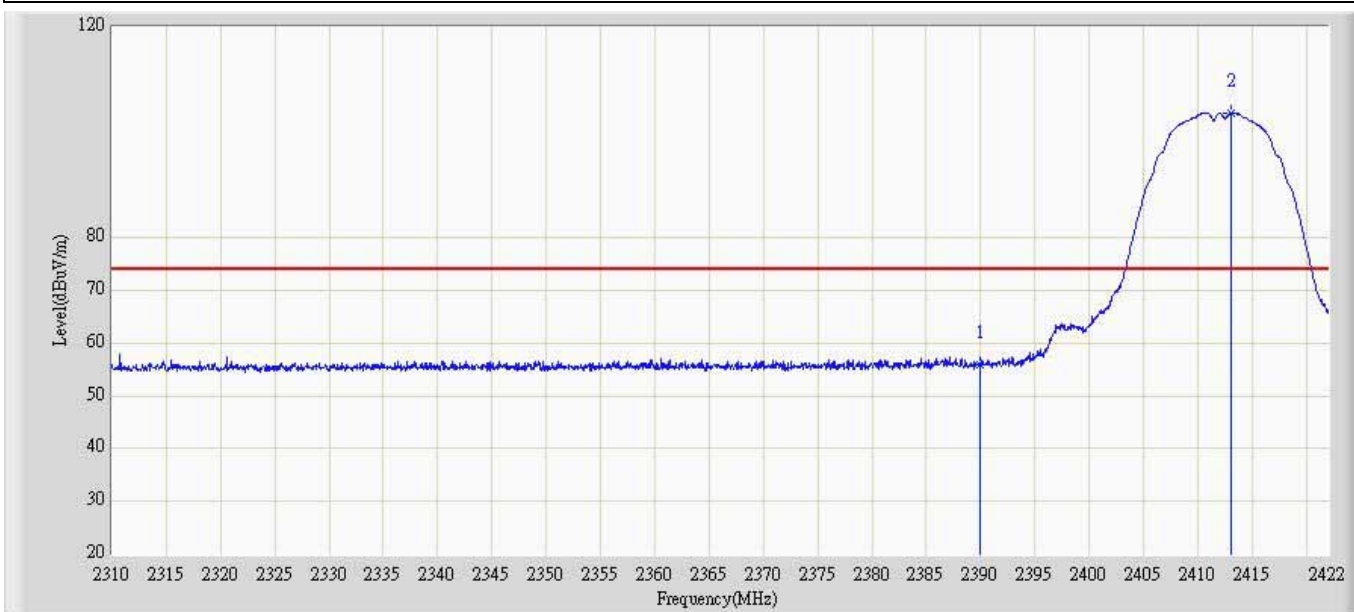
Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

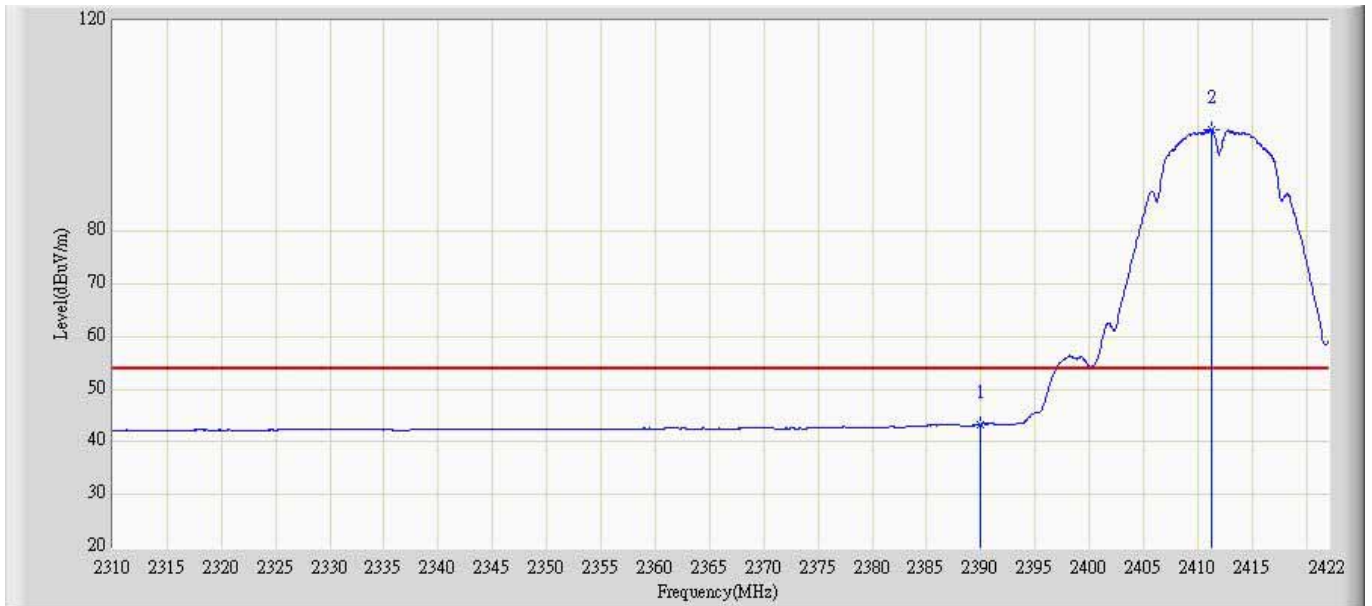
In case the emission is fail due to the used RB/VB is too wide, marker-delta method of FCC Public Notice will be followed.

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 15:49
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit channel 2412MHz by 802.11b	



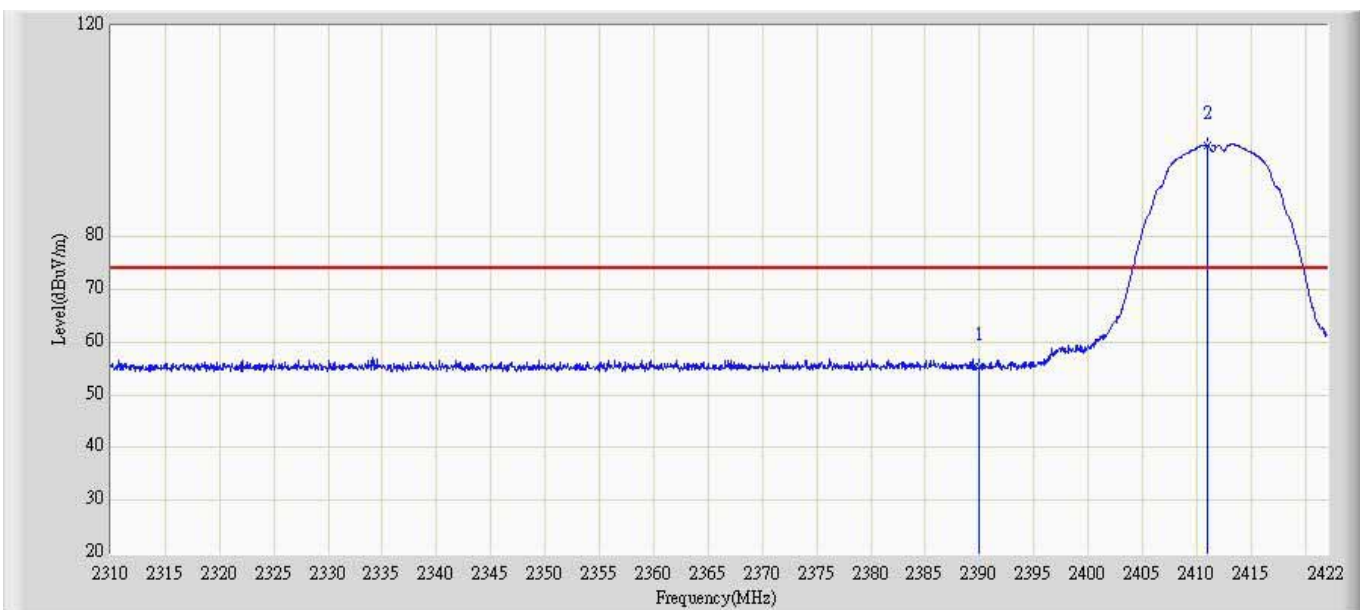
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	55.966	24.878	-18.034	74.000	31.088	PK
2	*	2413.040	103.698	72.458	N/A	N/A	31.240	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:01
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit channel 2412MHz by 802.11b	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	43.323	12.235	-10.677	54.000	31.088	AV
2	*	2411.248	99.397	68.174	N/A	N/A	31.223	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:04
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit channel 2412MHz by 802.11b	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	55.369	24.281	-18.631	74.000	31.088	PK
2	*	2411.024	97.238	66.017	N/A	N/A	31.221	PK

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:07

Limit: FCC_Part15.209_RE(3m)

Margin: 0

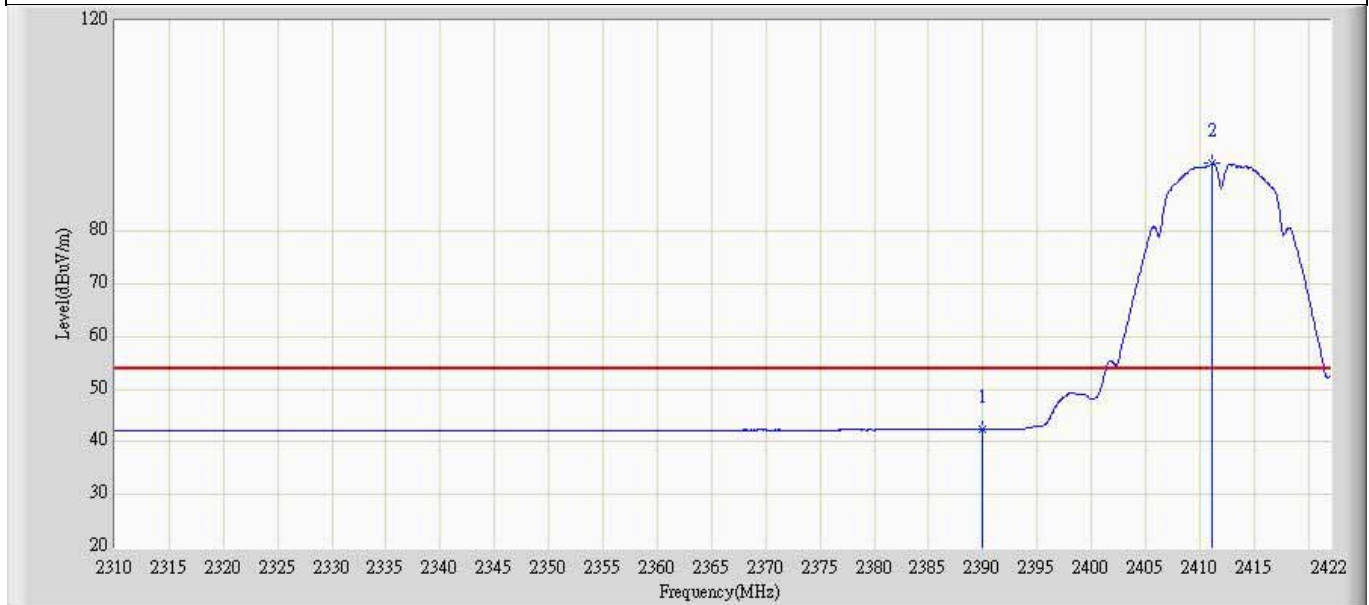
Probe: Horn_3117_988(1-18GHz)

Polarity: Vertical

EUT: Q Light Engine

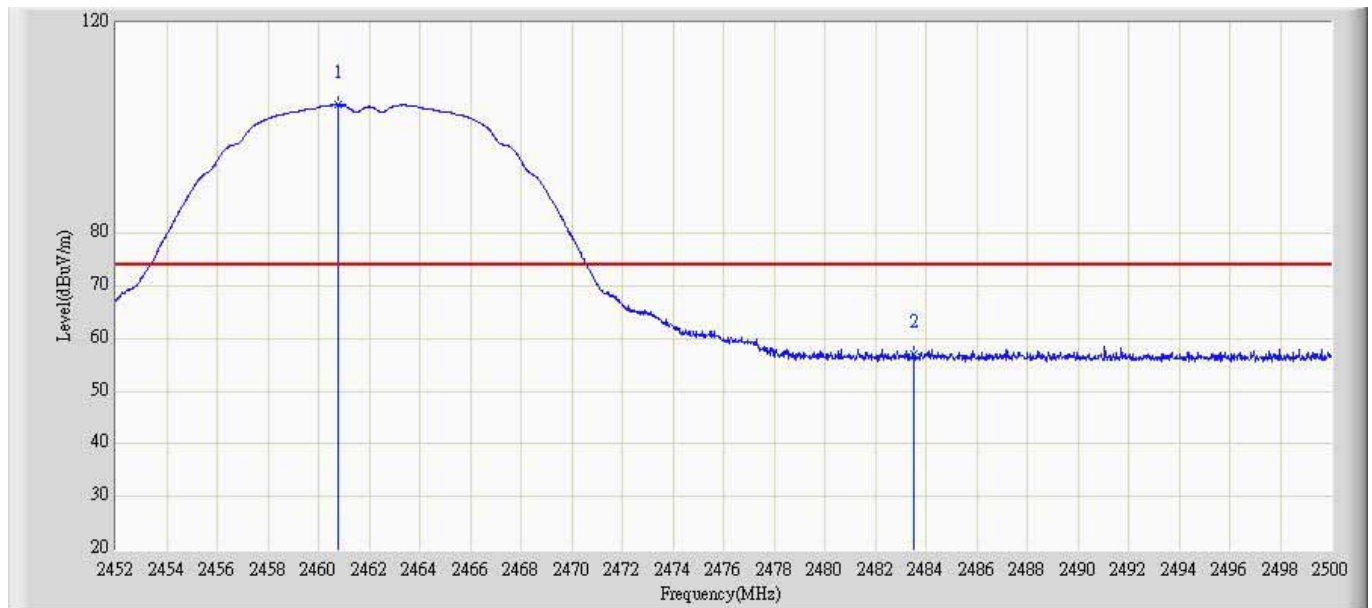
Power: AC 120V/60Hz

Note: Mode1: Transmit channel 2412MHz by 802.11b



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	42.418	11.330	-11.582	54.000	31.088	AV
2	*	2411.192	92.918	61.695	N/A	N/A	31.223	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:09
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit channel 2462MHz by 802.11b	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2460.760	104.374	72.786	N/A	N/A	31.588	PK
2		2483.500	57.018	25.405	-16.982	74.000	31.613	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:13
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit channel 2462MHz by 802.11b	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2461.216	99.987	68.398	N/A	N/A	31.589	AV
2		2483.500	43.624	12.011	-10.376	54.000	31.613	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:14

Limit: FCC_Part15.209_RE(3m)

Margin: 0

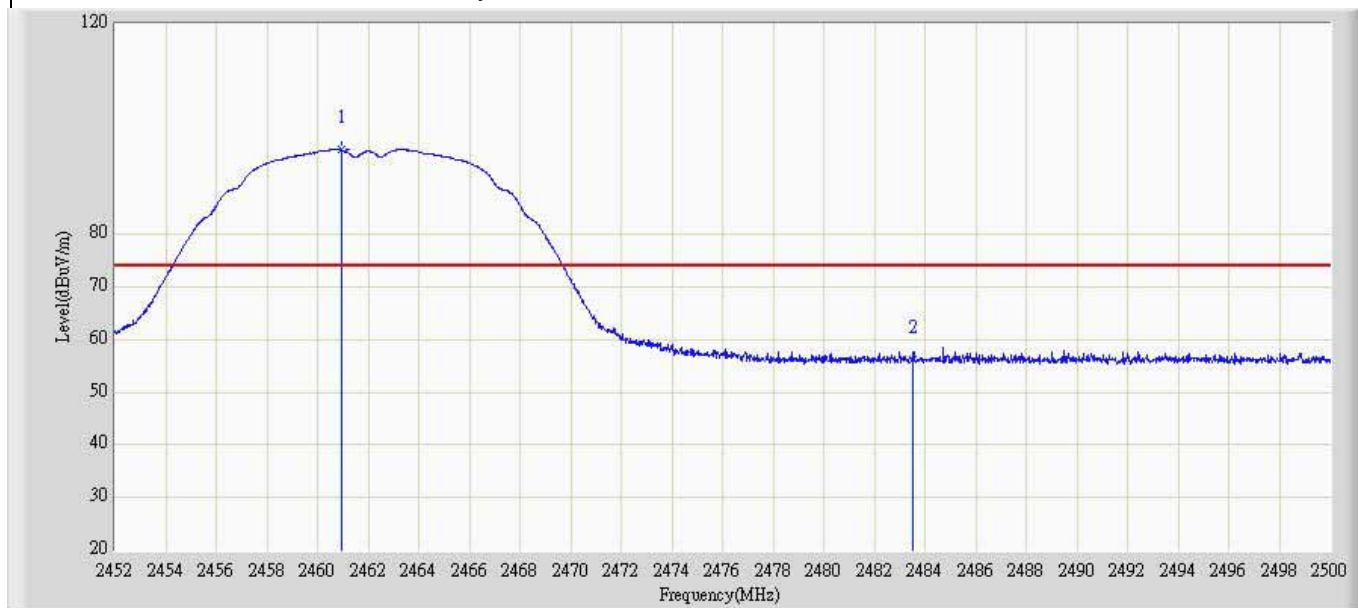
Probe: Horn_3117_988(1-18GHz)

Polarity: Vertical

EUT: Q Light Engine

Power: AC 120V/60Hz

Note: Mode1: Transmit channel 2462MHz by 802.11b



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2460.928	96.011	64.423	N/A	N/A	31.588	PK
2		2483.500	56.074	24.460	-17.926	74.000	31.613	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:17
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode1: Transmit channel 2462MHz by 802.11b	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2461.288	91.294	59.704	N/A	N/A	31.589	AV
2		2483.500	43.170	11.557	-10.830	54.000	31.613	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:20

Limit: FCC_Part15.209_RE(3m)

Margin: 0

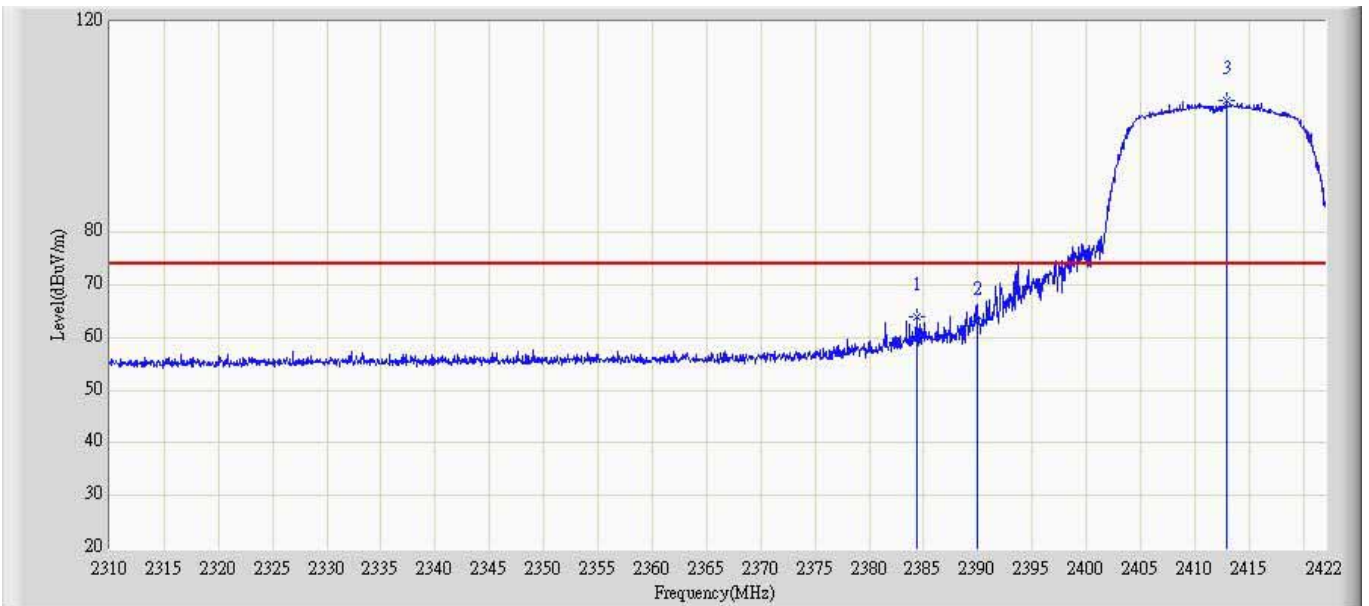
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

Power: AC 120V/60Hz

Note: Mode2: Transmit channel 2412MHz by 802.11g



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2384.424	63.840	32.769	-10.160	74.000	31.071	PK
2		2390.000	63.243	32.155	-10.757	74.000	31.088	PK
3	*	2412.928	105.071	73.832	N/A	N/A	31.238	PK

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:24

Limit: FCC_Part15.209_RE(3m)

Margin: 0

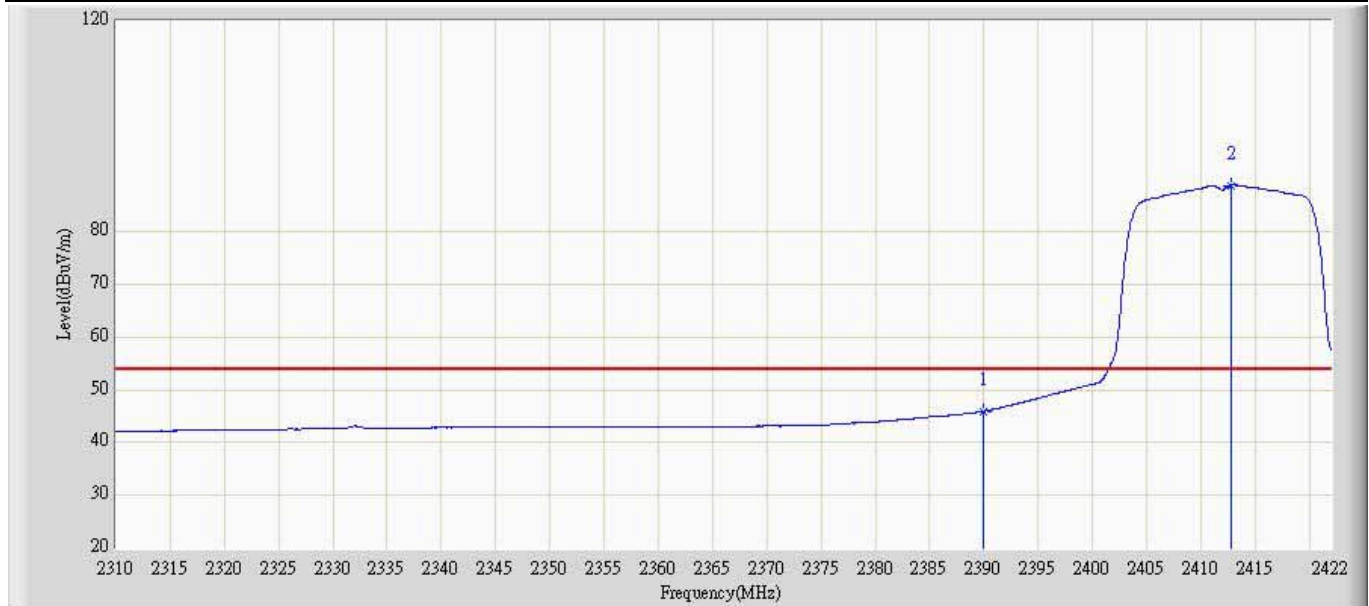
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

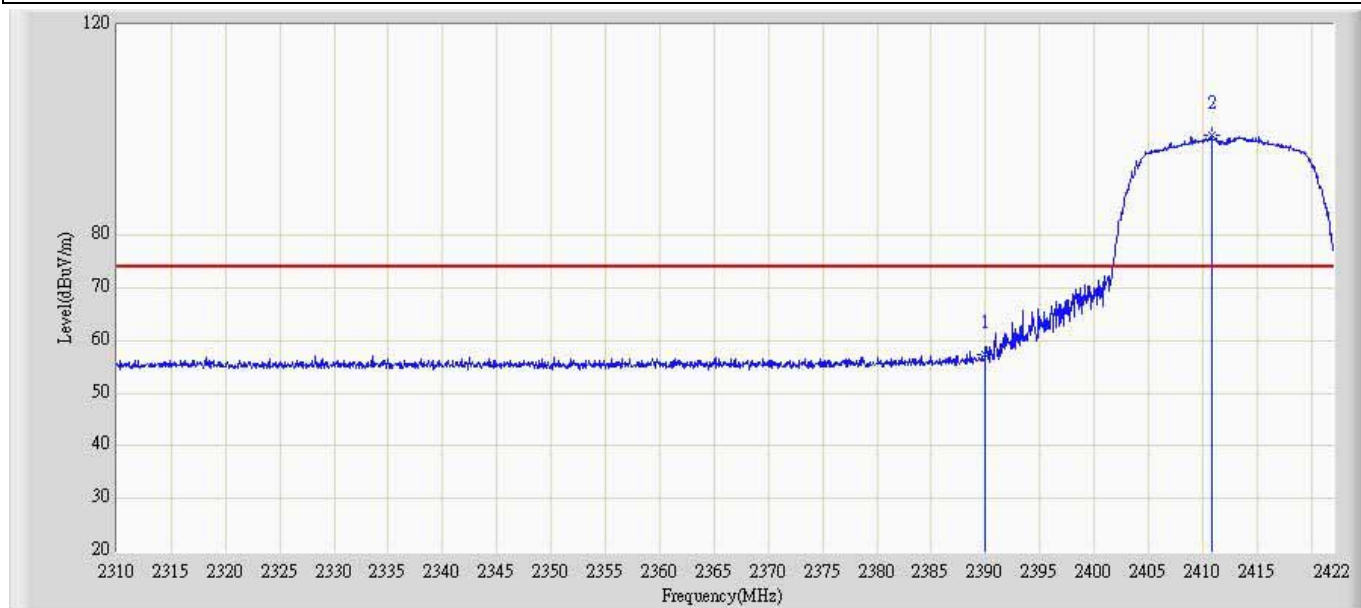
Power: AC 120V/60Hz

Note: Mode2: Transmit channel 2412MHz by 802.11g



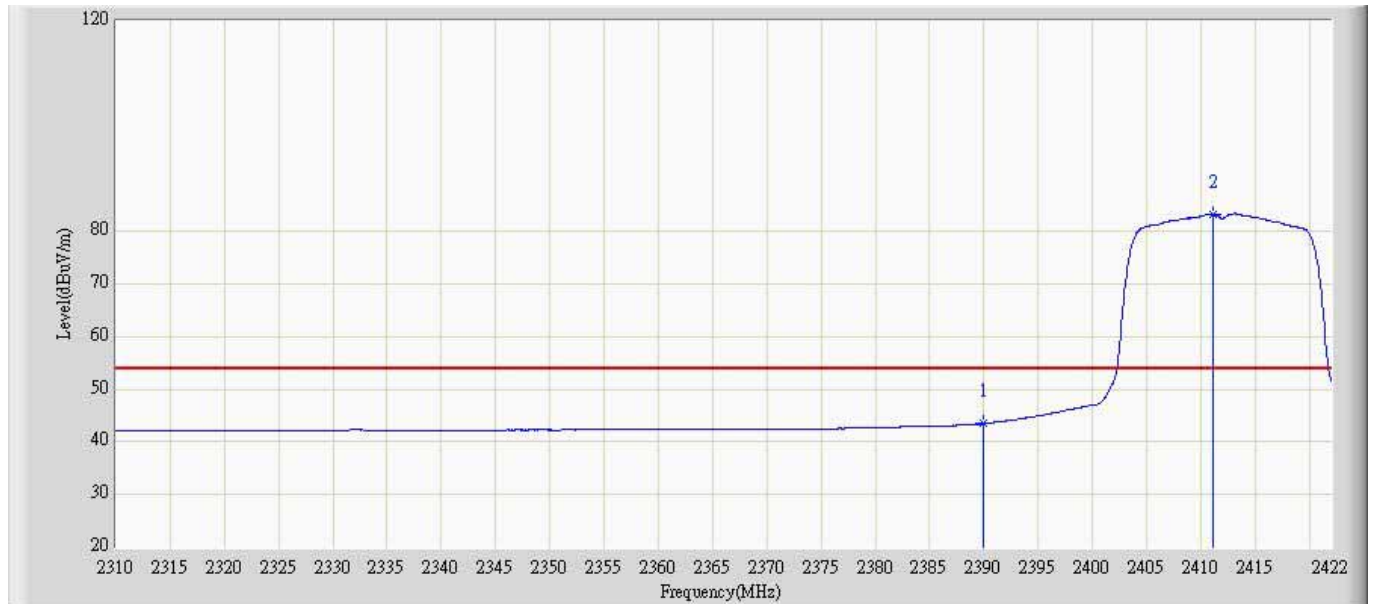
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	45.961	14.873	-8.039	54.000	31.088	AV
2	*	2412.760	88.804	57.567	N/A	N/A	31.238	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:25
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode2: Transmit channel 2412MHz by 802.11g	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	57.365	26.277	-16.635	74.000	31.088	PK
2	*	2410.856	99.125	67.905	N/A	N/A	31.220	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:29
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode2: Transmit channel 2412MHz by 802.11g	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	43.484	12.396	-10.516	54.000	31.088	AV
2	*	2411.192	83.285	52.062	N/A	N/A	31.223	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:30

Limit: FCC_Part15.209_RE(3m)

Margin: 0

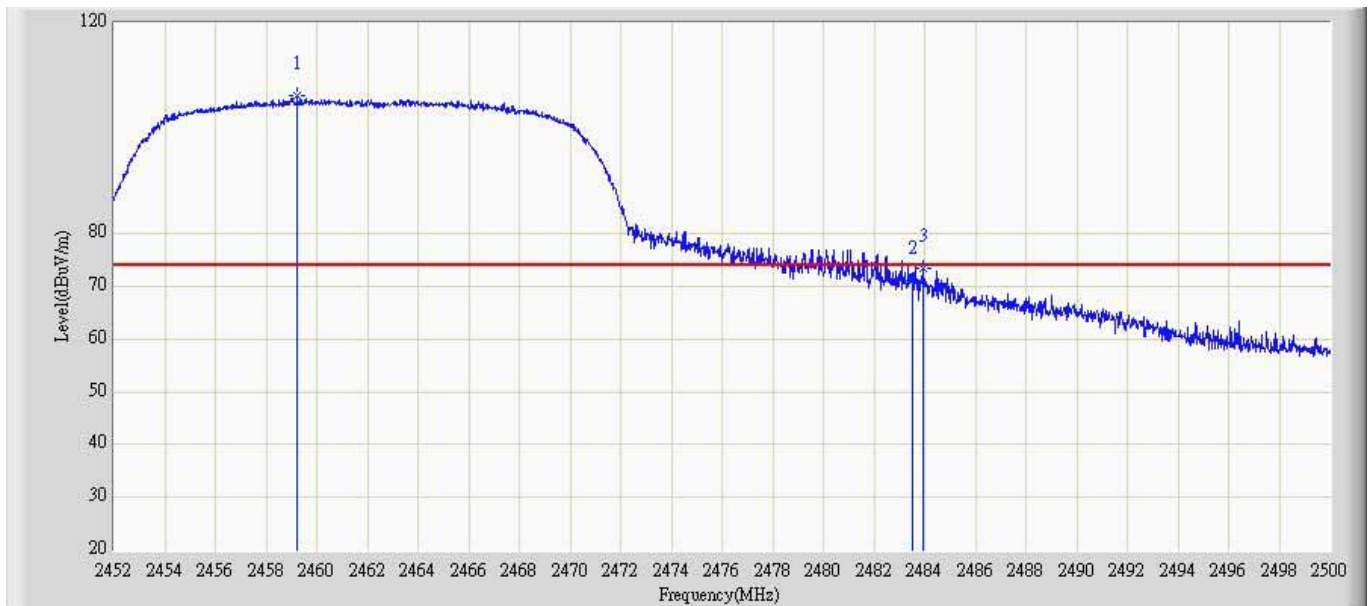
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

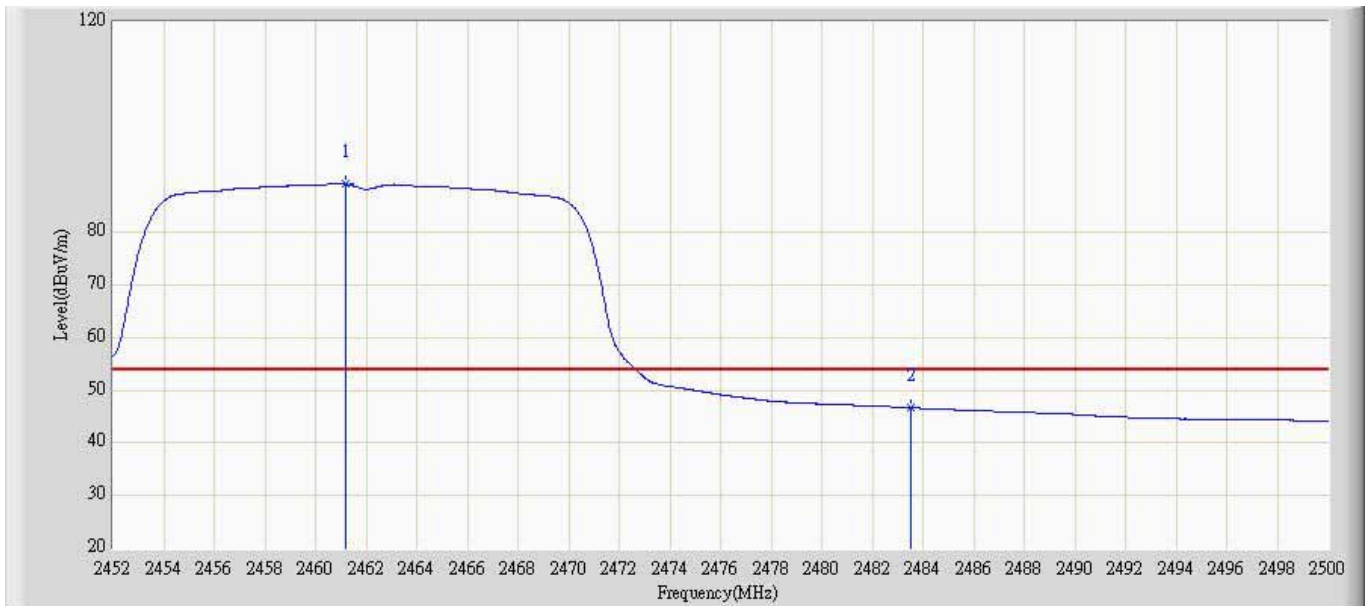
Power: AC 120V/60Hz

Note: Mode2: Transmit channel 2462MHz by 802.11g



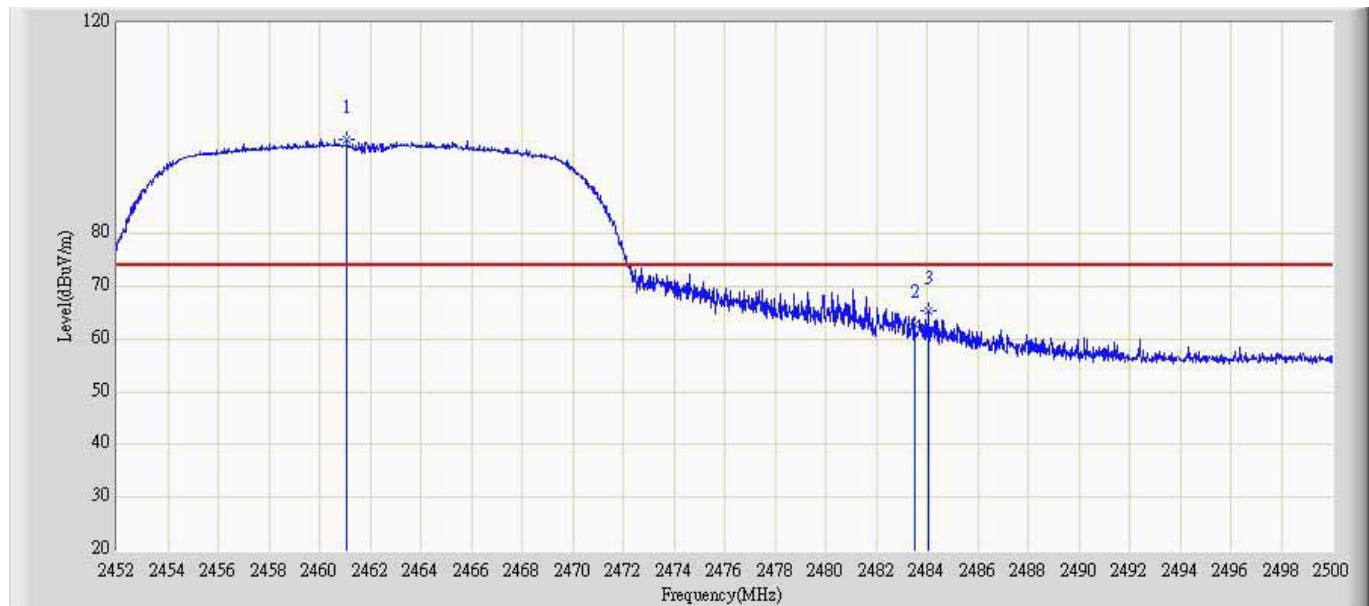
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2459.248	106.090	74.507	N/A	N/A	31.582	PK
2		2483.500	71.219	39.605	-2.781	74.000	31.613	PK
3		2483.920	73.446	41.832	-0.554	74.000	31.614	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:38
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode2: Transmit channel 2462MHz by 802.11g	



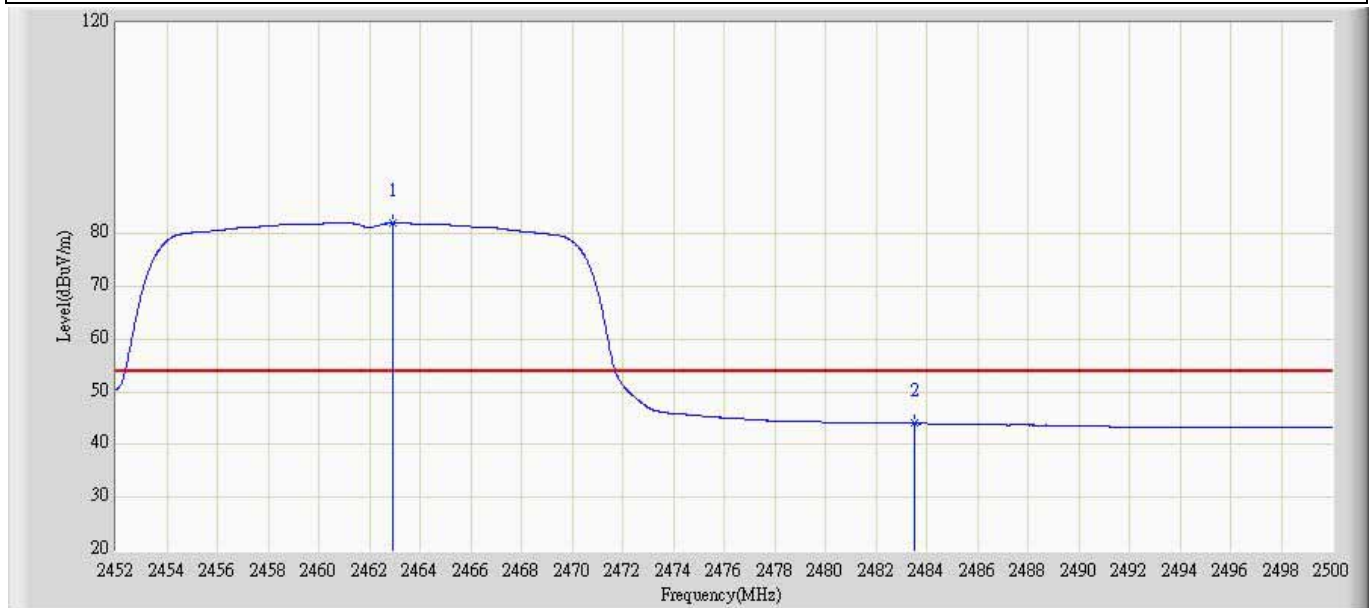
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2461.216	89.125	57.536	N/A	N/A	31.589	AV
2		2483.500	46.657	15.043	-7.343	54.000	31.613	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:39
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode2: Transmit channel 2462MHz by 802.11g	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2461.072	97.843	66.254	N/A	N/A	31.588	PK
2		2483.500	62.767	31.153	-11.233	74.000	31.613	PK
3		2484.040	65.359	33.745	-8.641	74.000	31.614	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:41
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode2: Transmit channel 2462MHz by 802.11g	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2462.944	82.049	50.456	N/A	N/A	31.593	AV
2		2483.500	44.044	12.431	-9.956	54.000	31.613	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:42

Limit: FCC_Part15.209_RE(3m)

Margin: 0

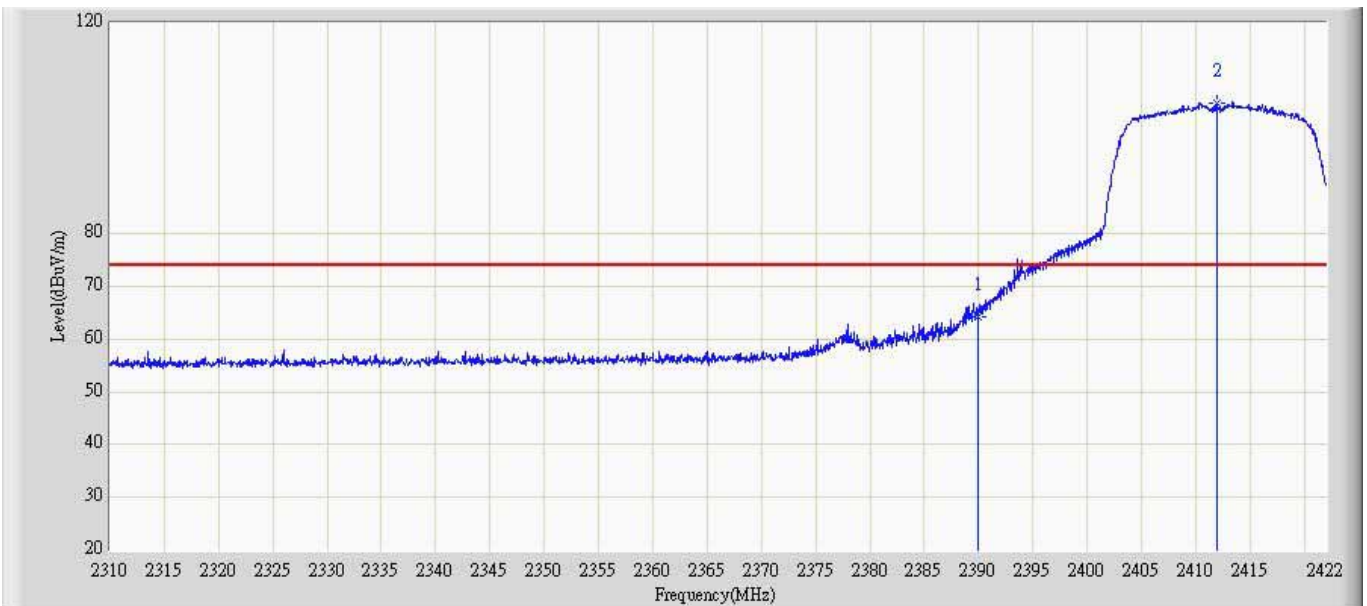
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

Power: AC 120V/60Hz

Note: Mode3: Transmit channel 2412MHz by 802.11n20MHz



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	64.303	33.215	-9.697	74.000	31.088	PK
2	*	2411.976	104.631	73.401	N/A	N/A	31.230	PK

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:47

Limit: FCC_Part15.209_RE(3m)

Margin: 0

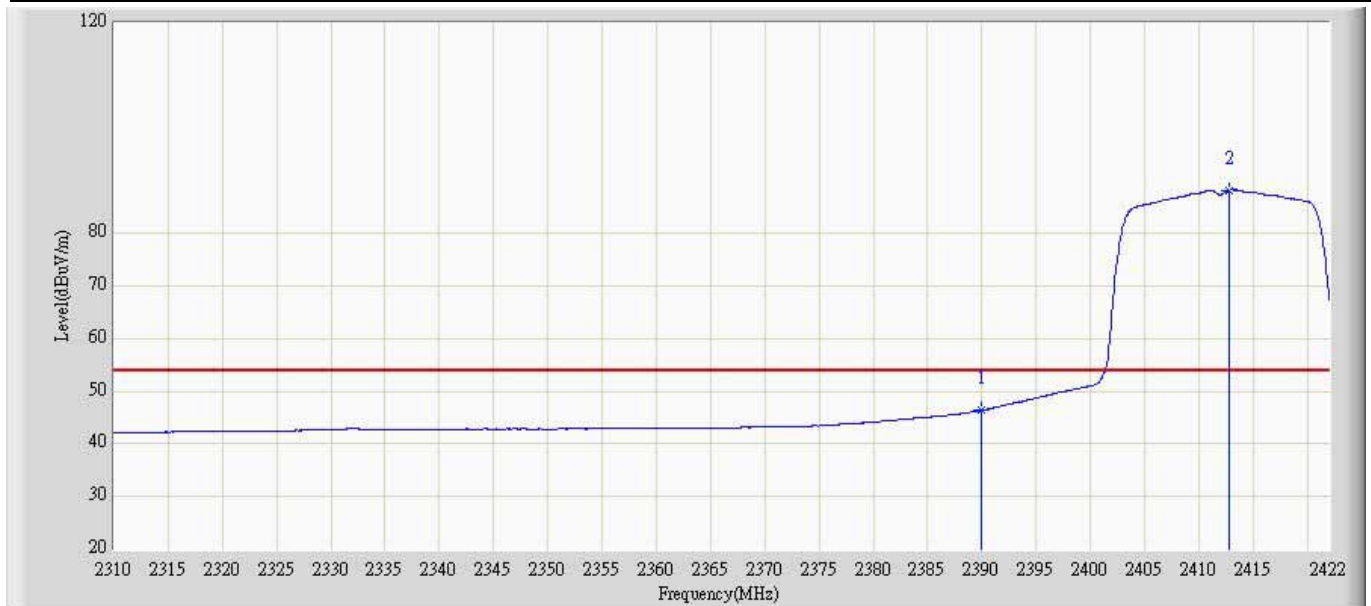
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

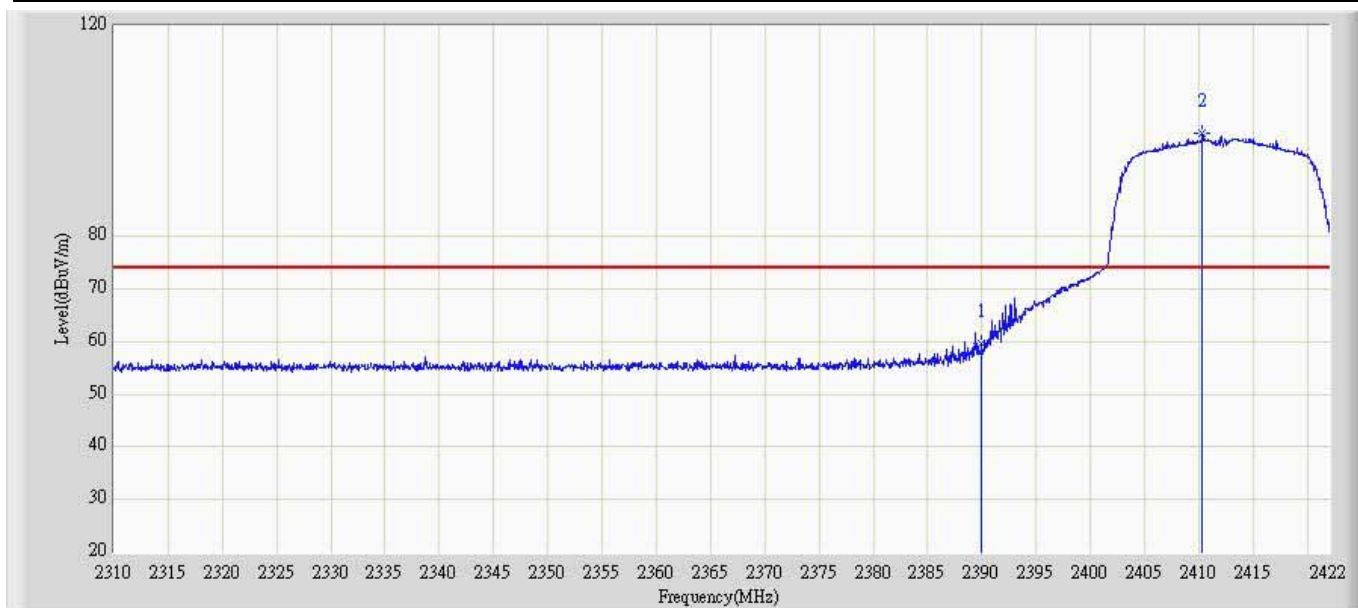
Power: AC 120V/60Hz

Note: Mode3: Transmit channel 2412MHz by 802.11n20MHz



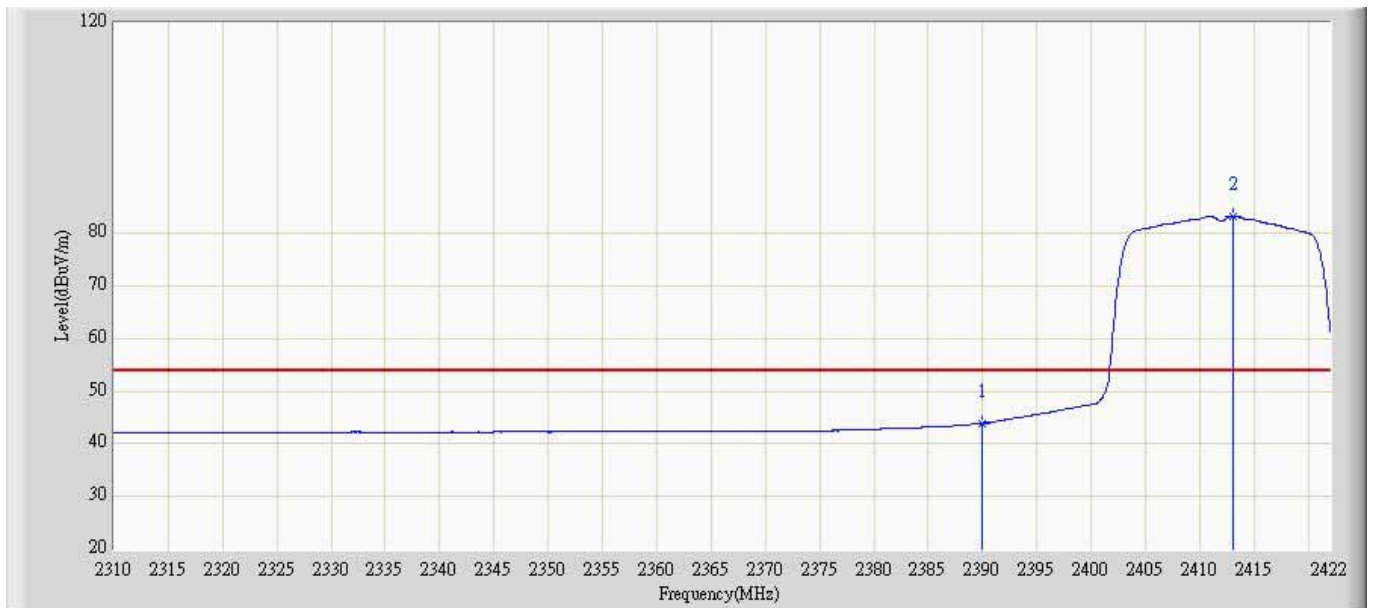
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	46.385	15.297	-7.615	54.000	31.088	AV
2	*	2412.816	88.188	56.950	N/A	N/A	31.238	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:47
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode3: Transmit channel 2412MHz by 802.11n20MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	59.578	28.490	-14.422	74.000	31.088	PK
2	*	2410.296	99.494	68.278	N/A	N/A	31.216	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:50
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode3: Transmit channel 2412MHz by 802.11n20MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	43.916	12.828	-10.084	54.000	31.088	AV
2	*	2413.152	83.246	52.005	N/A	N/A	31.241	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:51

Limit: FCC_Part15.209_RE(3m)

Margin: 0

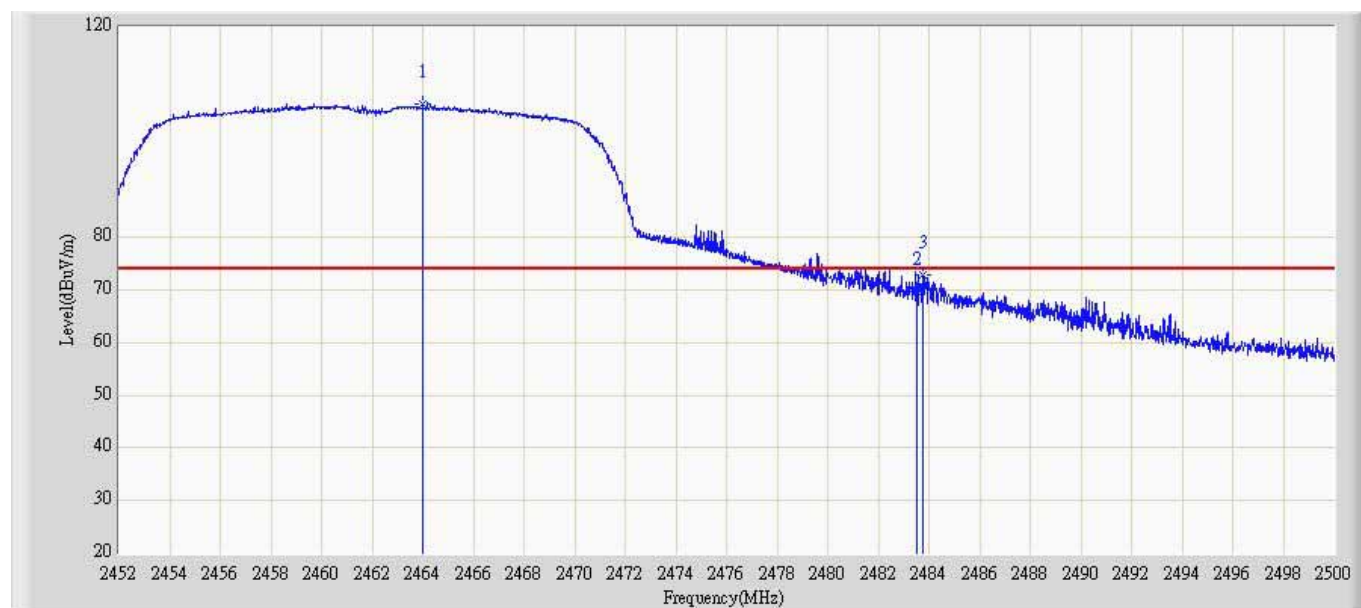
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

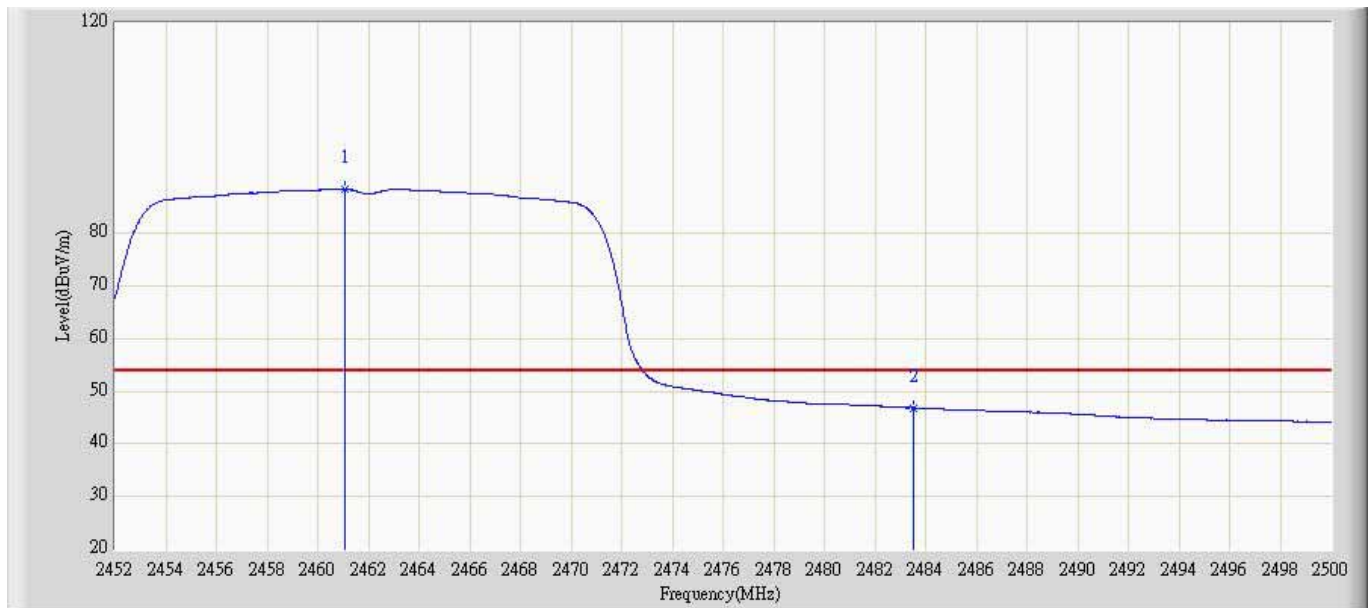
Power: AC 120V/60Hz

Note: Mode3: Transmit channel 2462MHz by 802.11n20MHz



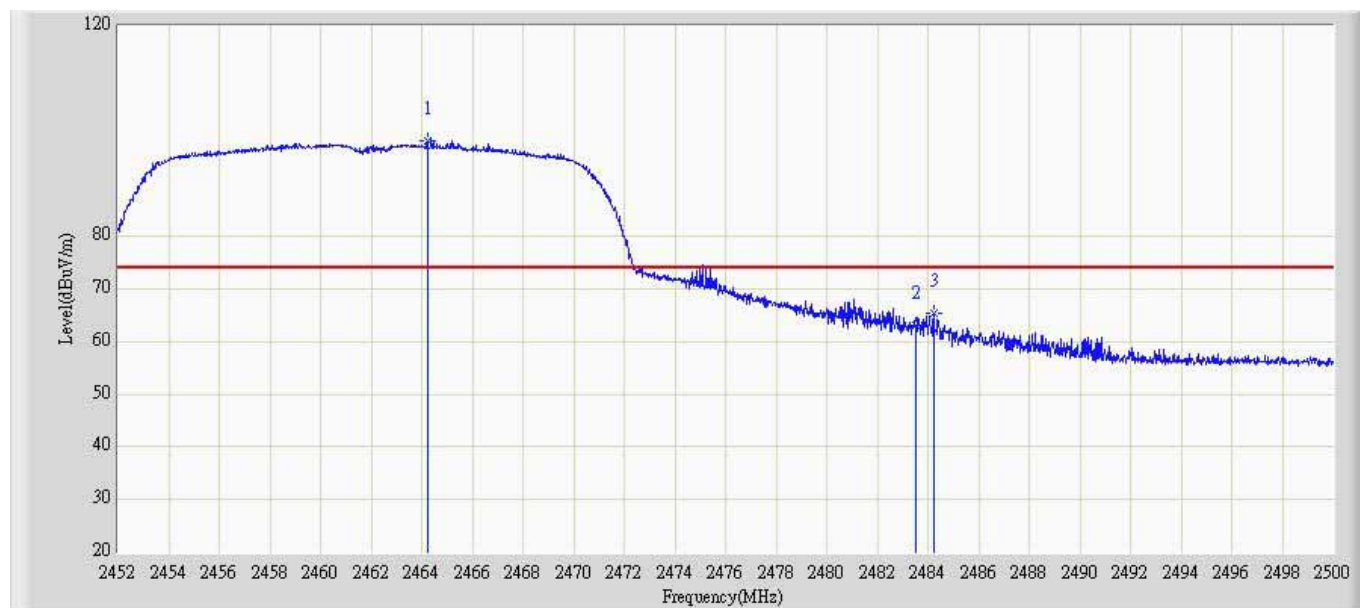
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2464.000	105.432	73.838	N/A	N/A	31.594	PK
2		2483.500	69.620	38.006	-4.380	74.000	31.613	PK
3		2483.752	72.945	41.331	-1.055	74.000	31.614	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:54
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode3: Transmit channel 2462MHz by 802.11n20MHz	



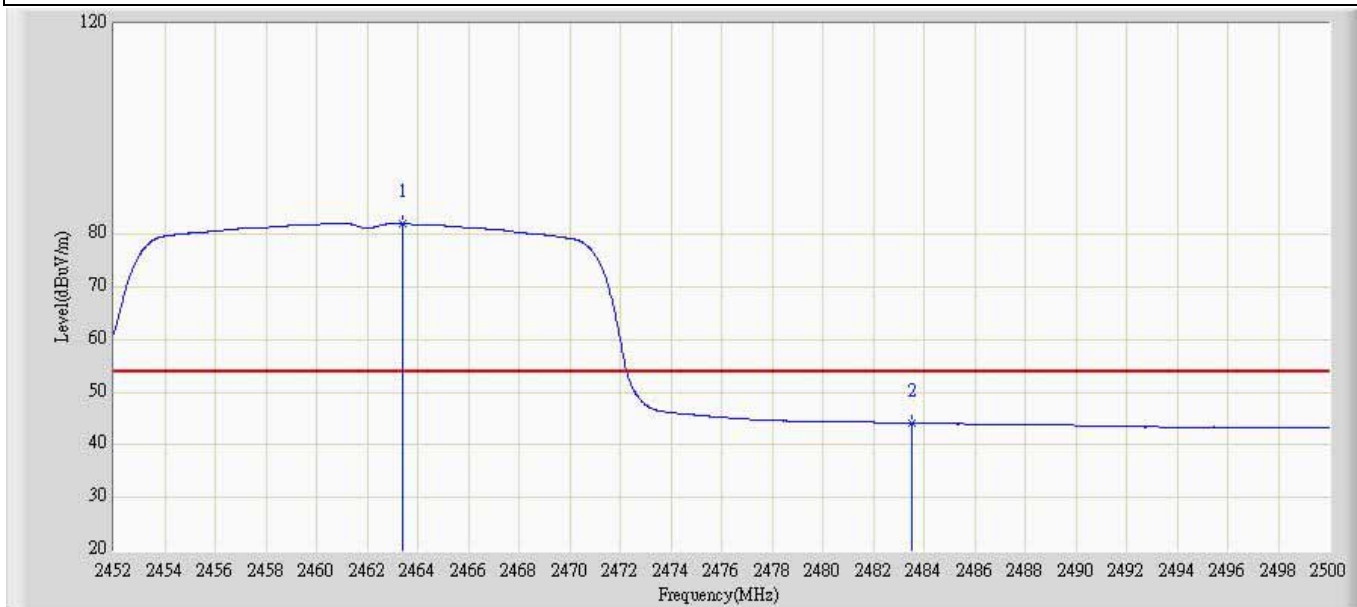
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2461.072	88.495	56.906	N/A	N/A	31.588	AV
2		2483.500	46.865	15.252	-7.135	54.000	31.613	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode3: Transmit channel 2462MHz by 802.11n20MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2464.216	98.136	66.542	N/A	N/A	31.594	PK
2		2483.500	63.193	31.579	-10.807	74.000	31.613	PK
3		2484.232	65.476	33.862	-8.524	74.000	31.614	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 16:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode3: Transmit channel 2462MHz by 802.11n20MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2463.376	82.048	50.455	N/A	N/A	31.593	AV
2		2483.500	44.137	12.524	-9.863	54.000	31.613	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 16:58

Limit: FCC_Part15.209_RE(3m)

Margin: 0

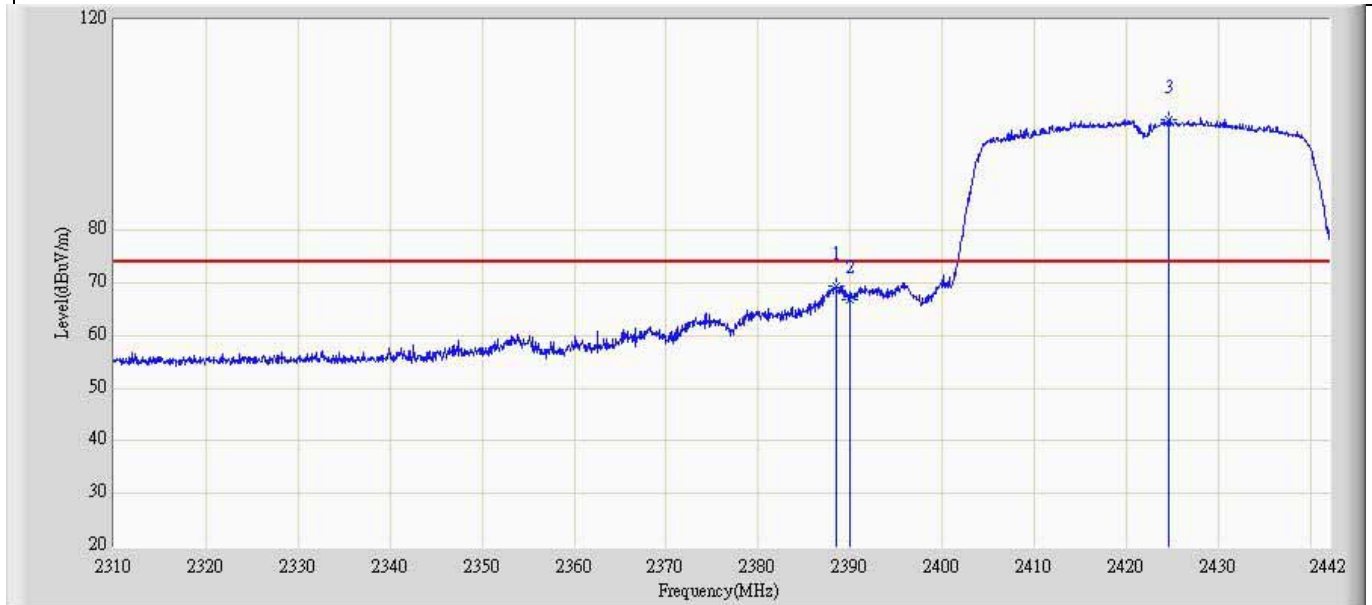
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

Power: AC 120V/60Hz

Note: Mode4: Transmit channel 2422MHz by 802.11n40MHz



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2388.540	69.537	38.453	-4.463	74.000	31.083	PK
2		2390.000	66.911	35.823	-7.089	74.000	31.088	PK
3	*	2424.642	101.015	69.669	N/A	N/A	31.346	PK

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 17:02

Limit: FCC_Part15.209_RE(3m)

Margin: 0

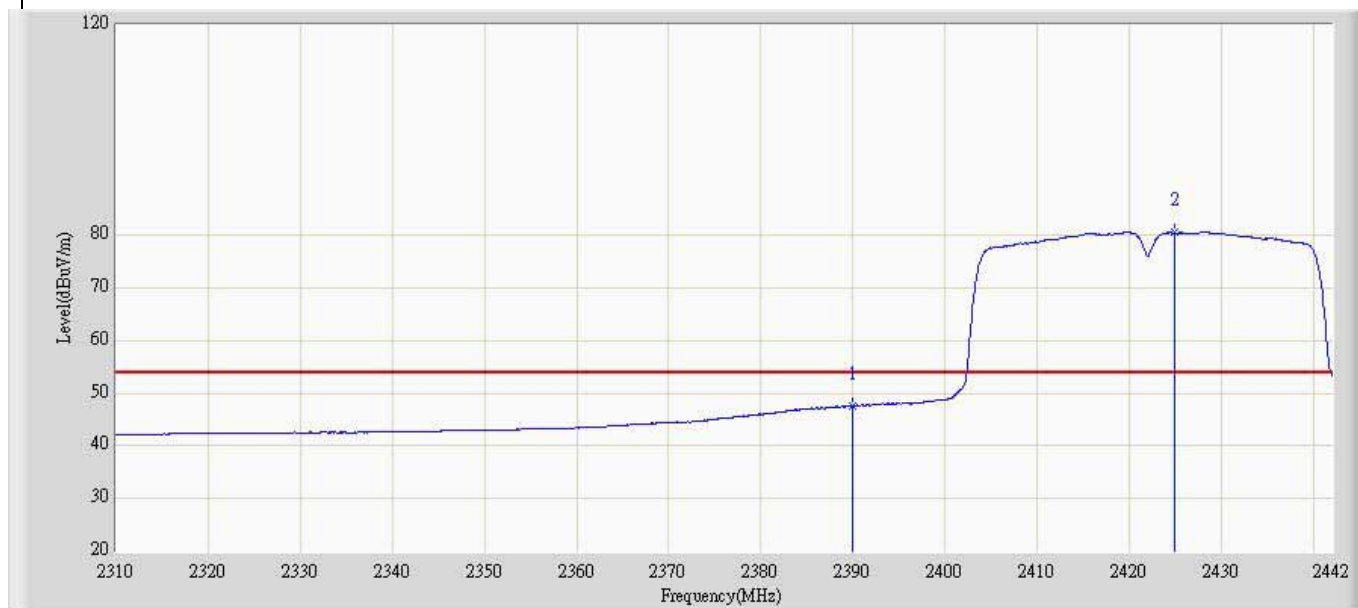
Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

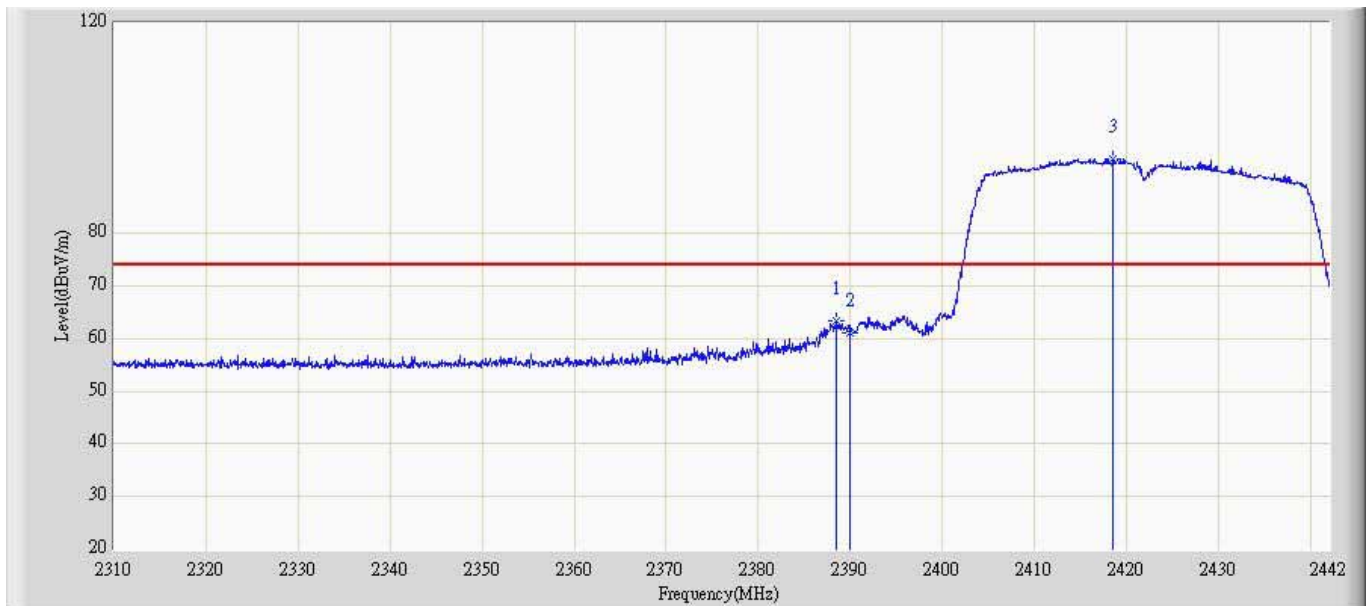
Power: AC 120V/60Hz

Note: Mode4: Transmit channel 2422MHz by 802.11n40MHz



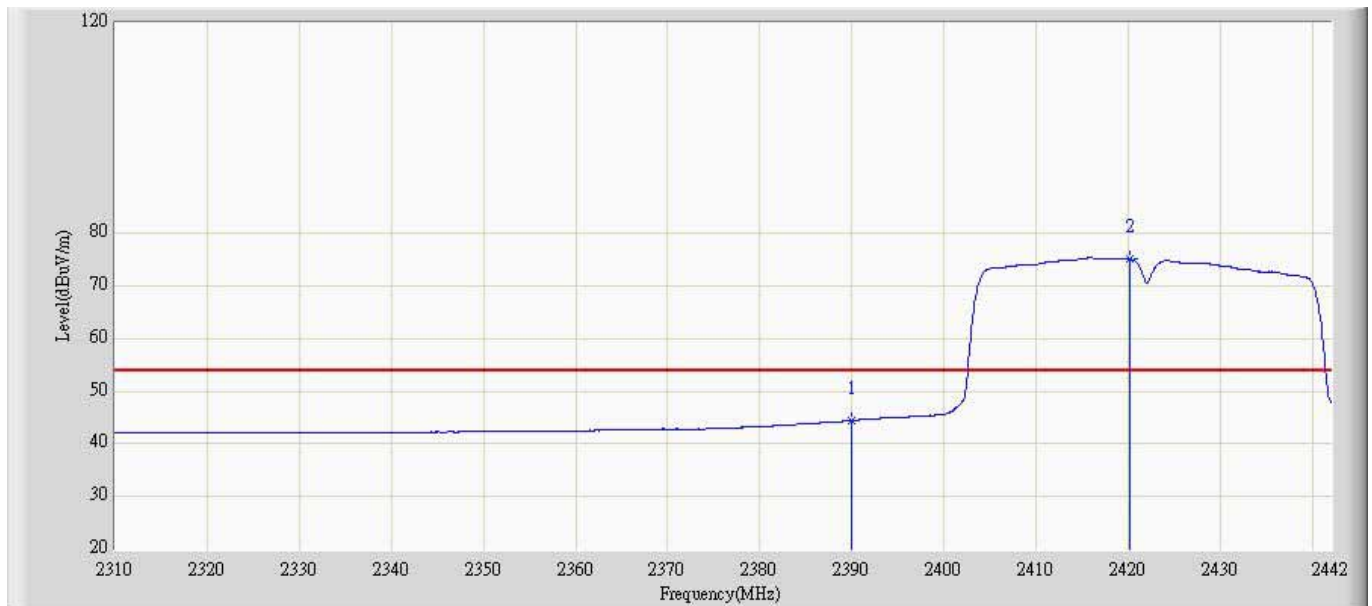
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	47.599	16.511	-6.401	54.000	31.088	AV
2	*	2424.972	80.502	49.153	N/A	N/A	31.350	AV

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 17:03
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode4: Transmit channel 2422MHz by 802.11n40MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2388.474	63.348	32.265	-10.652	74.000	31.083	PK
2		2390.000	61.044	29.956	-12.956	74.000	31.088	PK
3	*	2418.570	94.115	62.825	N/A	N/A	31.290	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 17:05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode4: Transmit channel 2422MHz by 802.11n40MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	44.442	13.354	-9.558	54.000	31.088	AV
2	*	2420.154	75.202	43.897	N/A	N/A	31.305	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 17:07

Limit: FCC_Part15.209_RE(3m)

Margin: 0

Probe: Horn_3117_988(1-18GHz)

Polarity: Horizontal

EUT: Q Light Engine

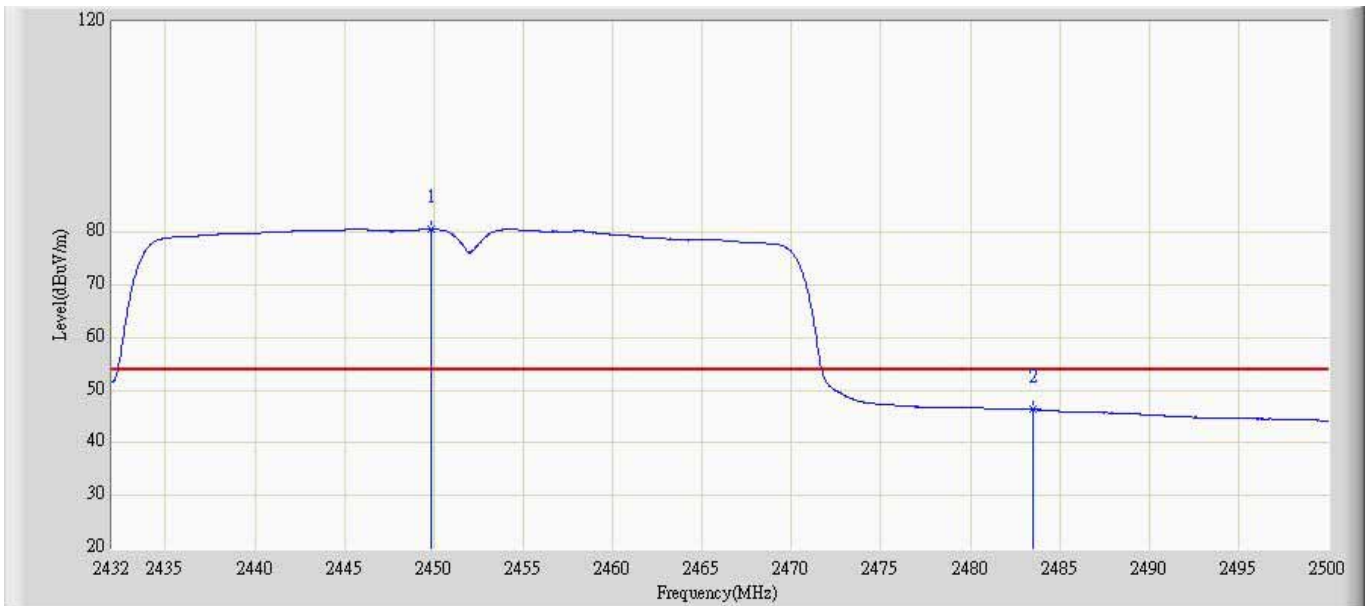
Power: AC 120V/60Hz

Note: Mode4: Transmit channel 2452MHz by 802.11n40MHz



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2443.118	101.788	70.271	N/A	N/A	31.517	PK
2		2483.500	70.944	39.330	-3.056	74.000	31.613	PK
3		2486.978	71.749	40.132	-2.251	74.000	31.617	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 17:11
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Horizontal
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode4: Transmit channel 2452MHz by 802.11n40MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2449.884	80.577	49.026	N/A	N/A	31.551	AV
2		2483.500	46.300	14.686	-7.700	54.000	31.613	AV

Engineer: Milo

Site: AC5

Time: 2013/09/23 - 17:13

Limit: FCC_Part15.209_RE(3m)

Margin: 0

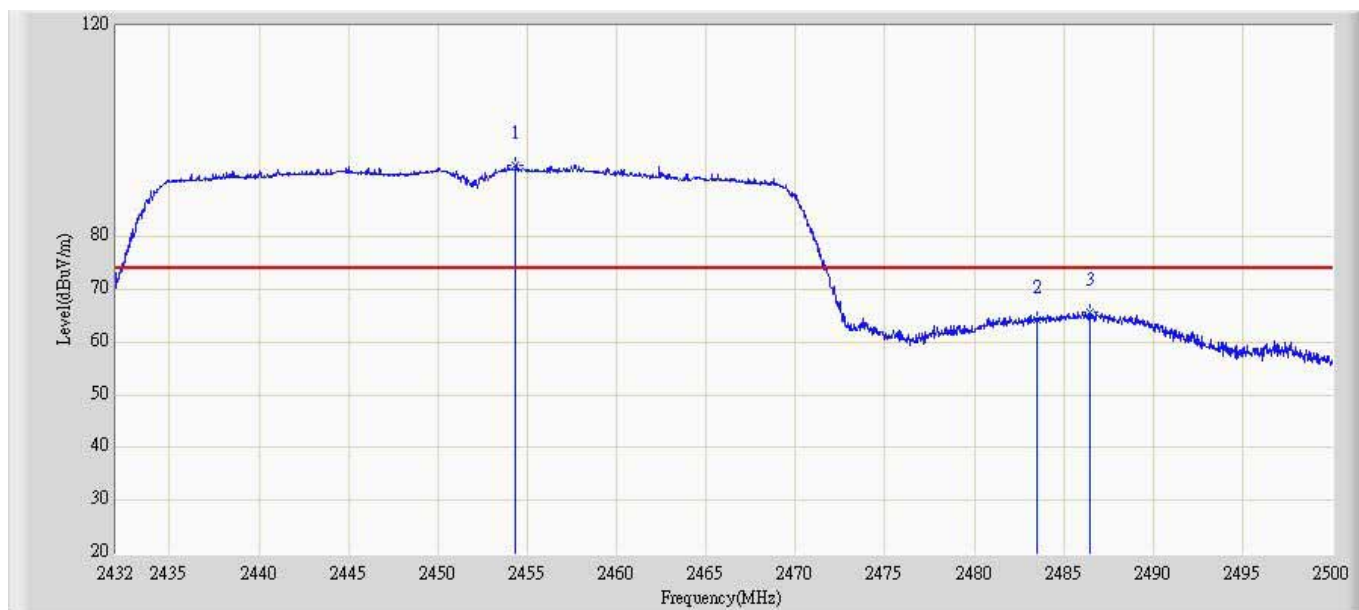
Probe: Horn_3117_988(1-18GHz)

Polarity: Vertical

EUT: Q Light Engine

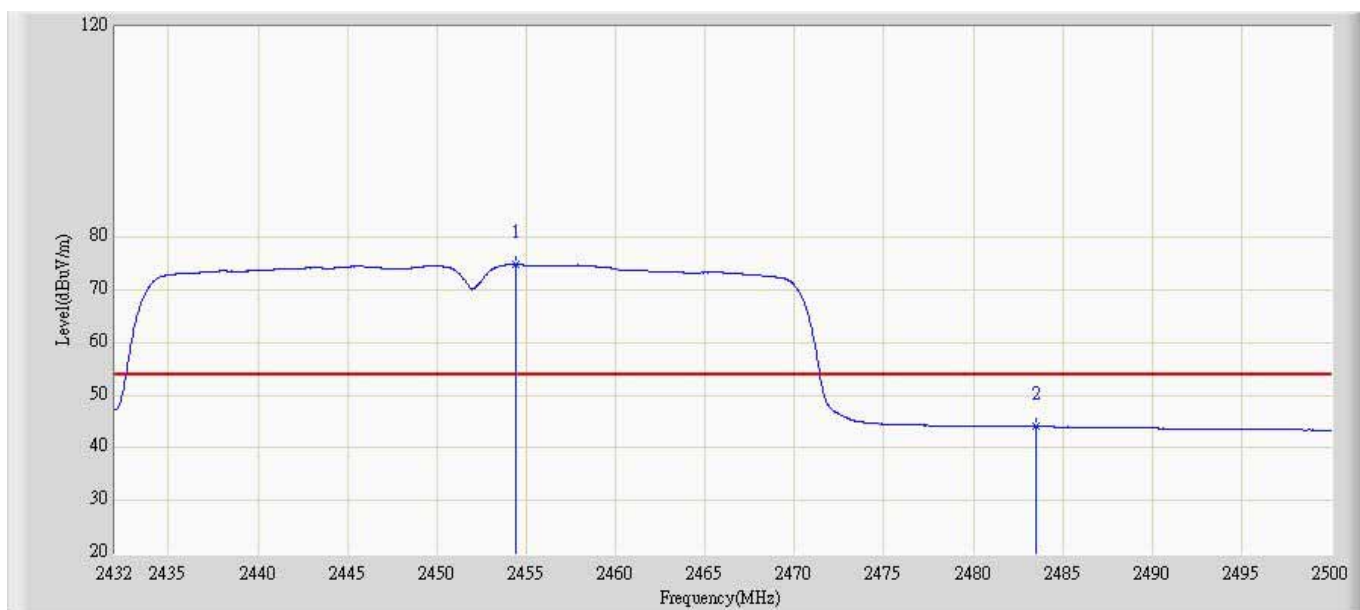
Power: AC 120V/60Hz

Note: Mode4: Transmit channel 2452MHz by 802.11n40MHz



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2454.338	93.507	61.941	N/A	N/A	31.566	PK
2		2483.500	64.229	32.615	-9.771	74.000	31.613	PK
3		2486.502	65.749	34.132	-8.251	74.000	31.617	PK

Engineer: Milo	
Site: AC5	Time: 2013/09/23 - 17:15
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_988(1-18GHz)	Polarity: Vertical
EUT: Q Light Engine	Power: AC 120V/60Hz
Note: Mode4: Transmit channel 2452MHz by 802.11n40MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2454.406	74.823	43.257	N/A	N/A	31.566	AV
2		2483.500	44.088	12.475	-9.912	54.000	31.613	AV

7. Operation Frequency Range of 20dB Bandwidth

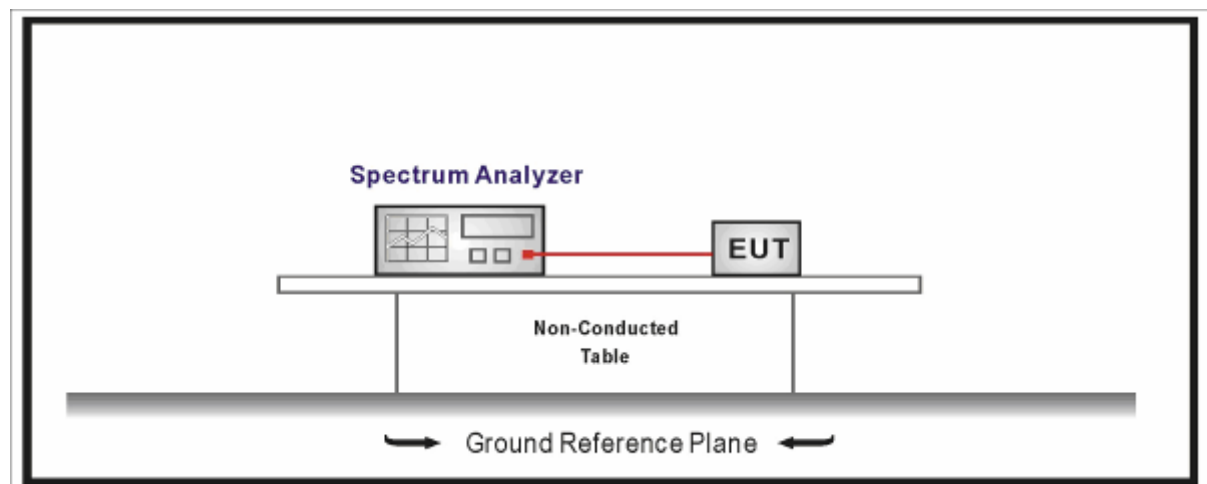
7.1. Test Equipment

Operation Frequency Range of 20dB Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2014.05.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

7.2. Test Setup



7.3. Limit

20 dB bandwidth of the emission is contained within the operation frequency band.

7.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Span greater than RBW.

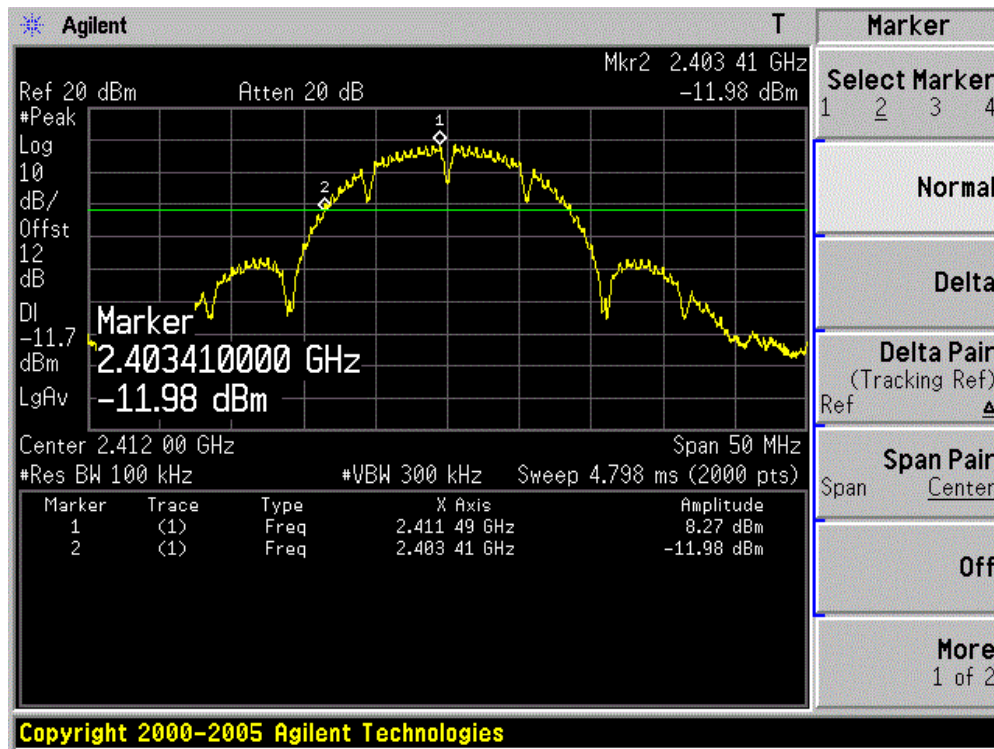
7.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

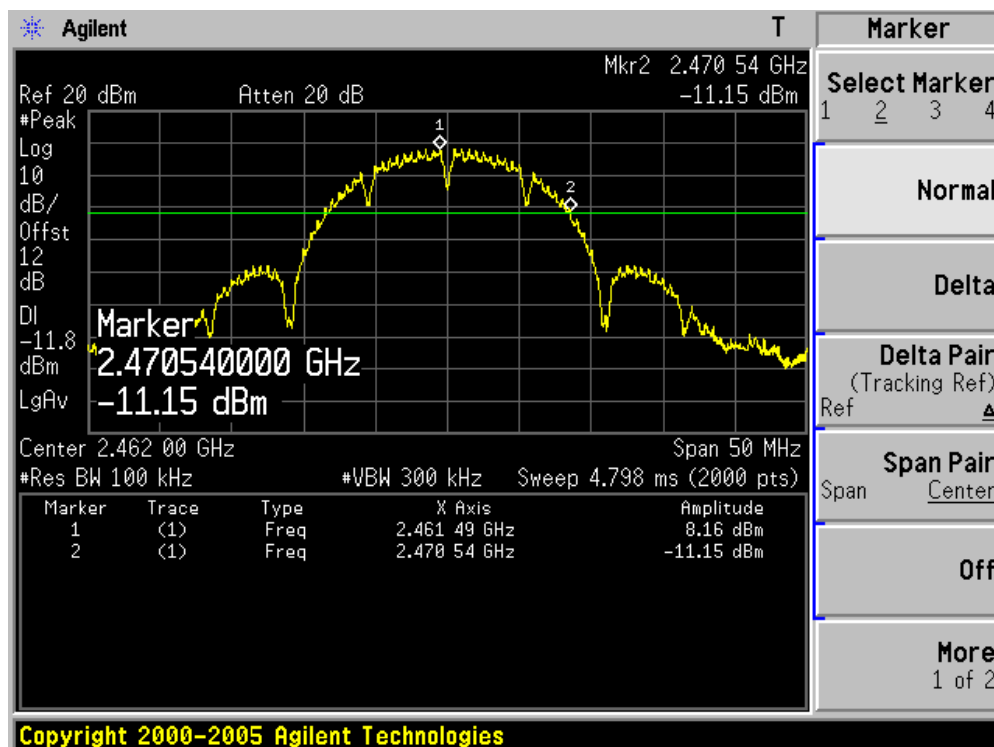
7.6. Test Result

Product	:	Q Light Engine
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit by 802.11b

Channel 01 (2412MHz)

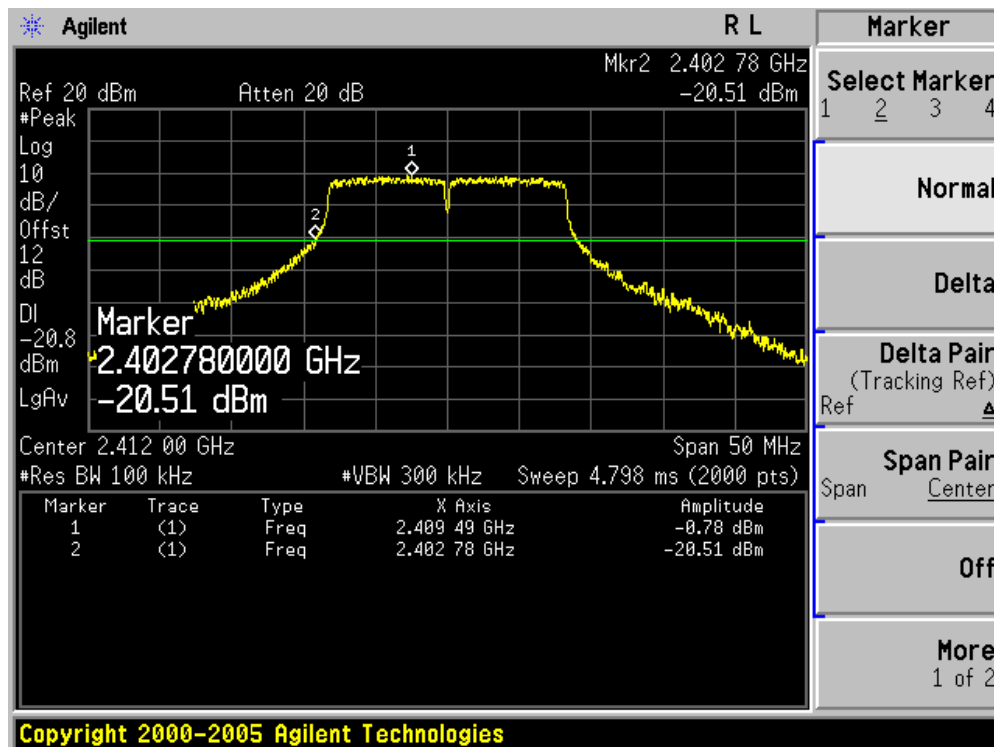


Channel 11 (2462MHz)

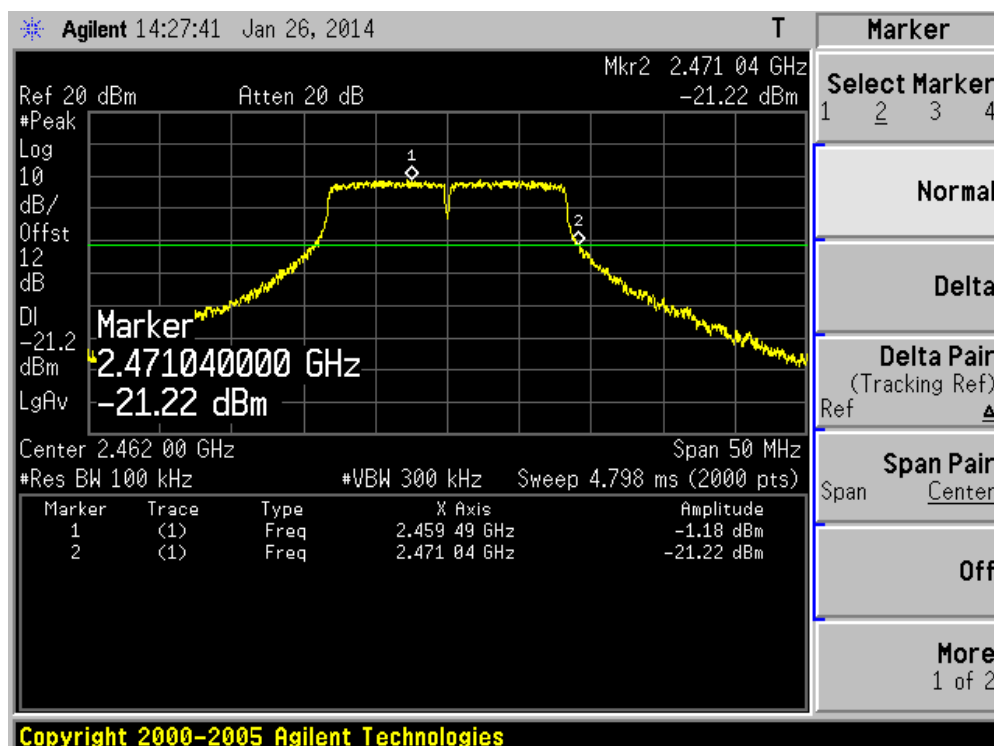


Product	:	Q Light Engine
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmit by 802.11g

Channel 01 (2412MHz)

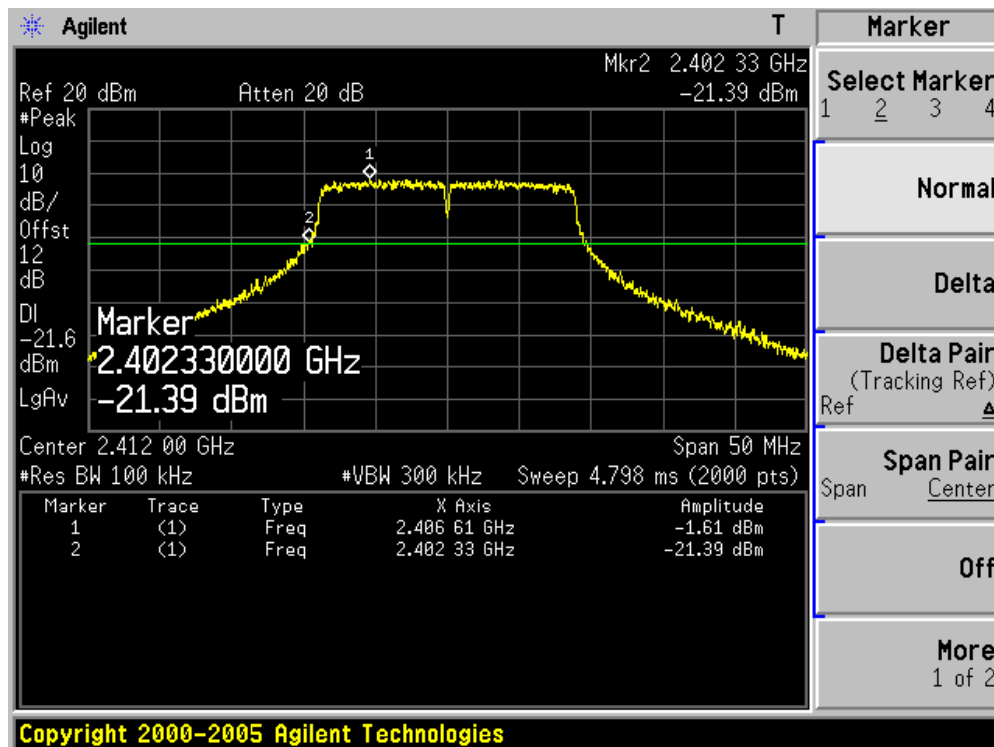


Channel 11 (2462MHz)

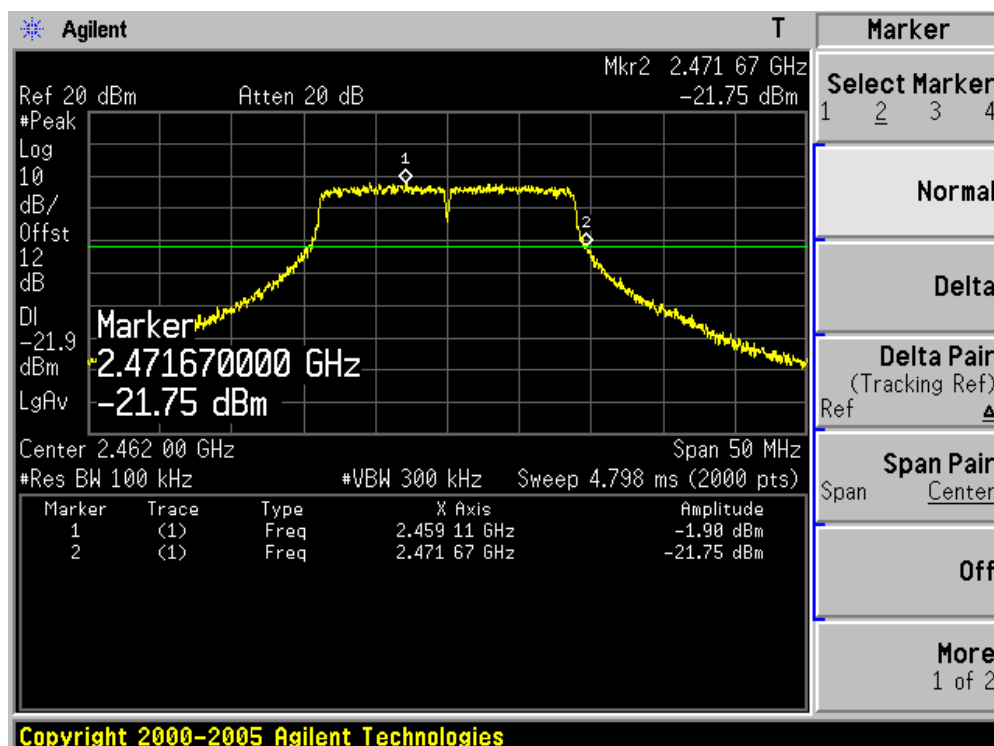


Product	:	Q Light Engine
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel 01 (2412MHz)

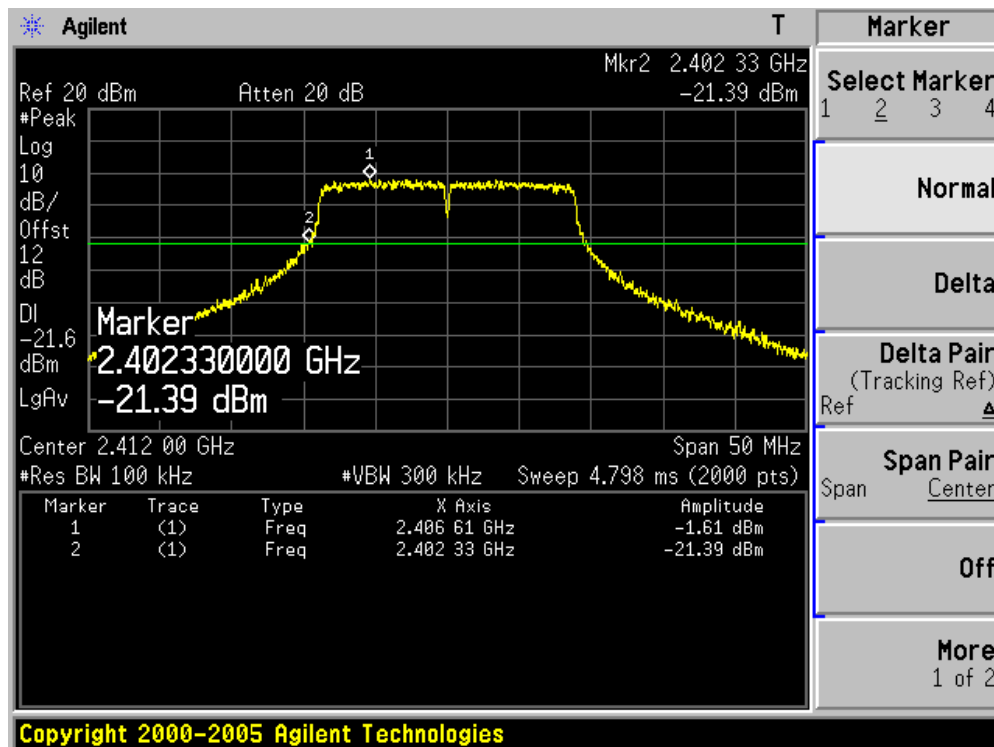


Channel 11 (2462MHz)

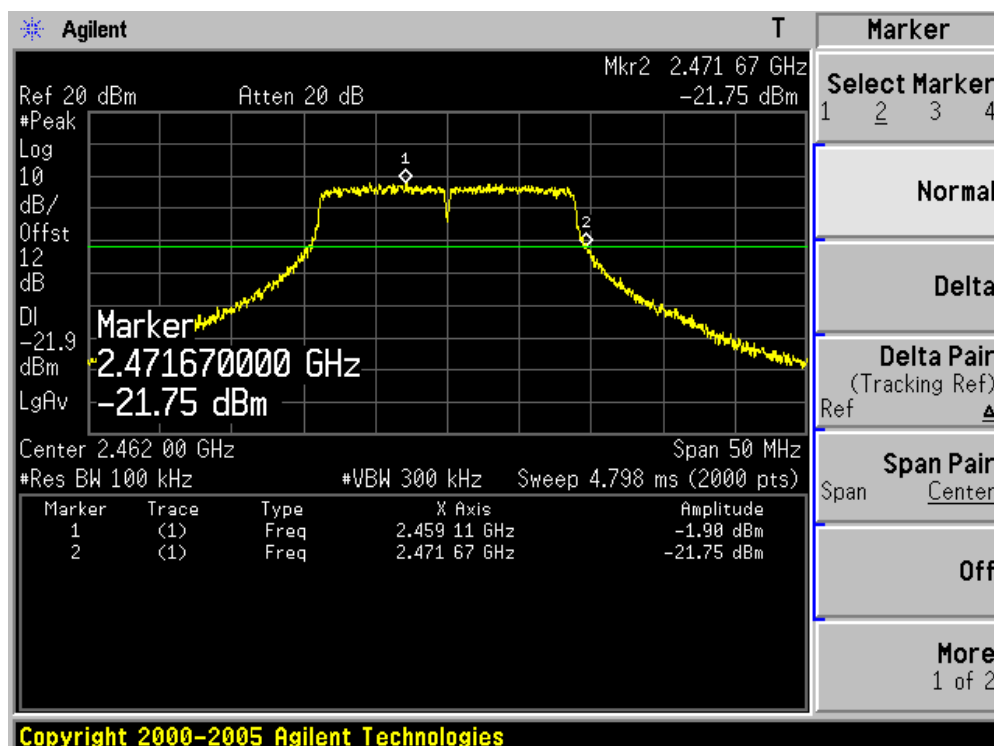


Product	:	Q Light Engine
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel 01 (2412MHz)

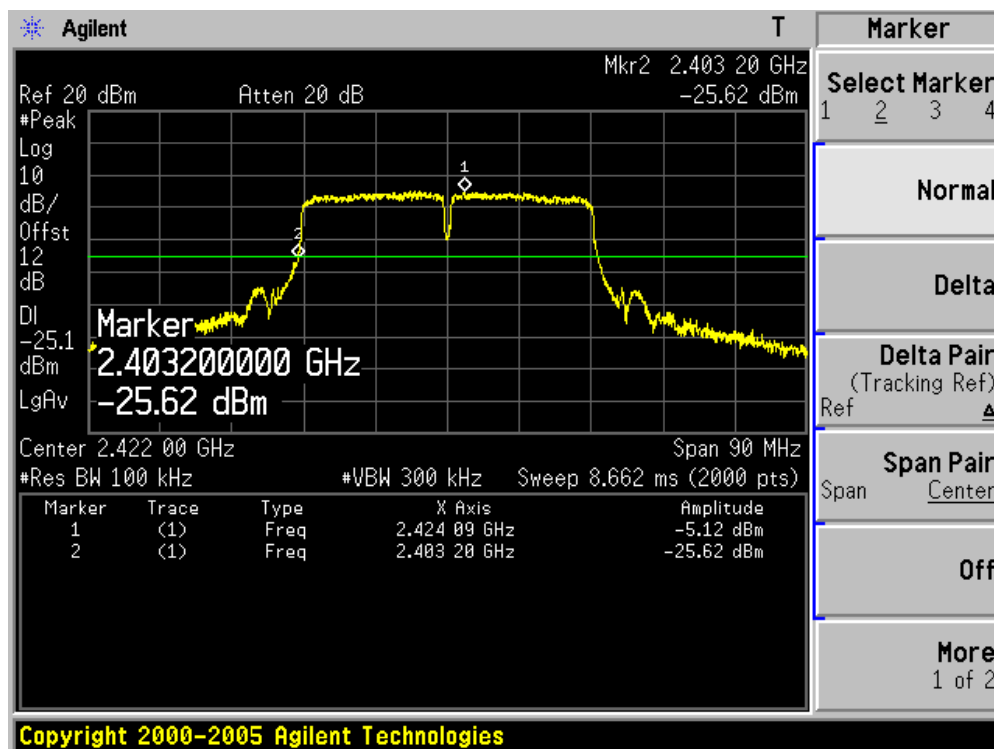


Channel 11 (2462MHz)

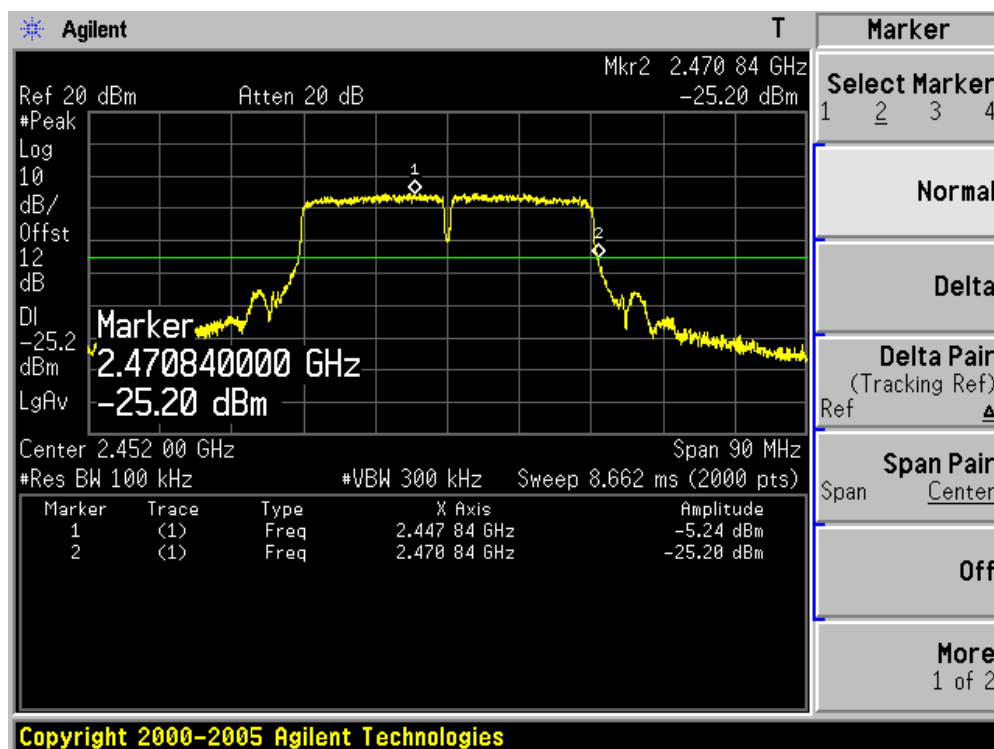


Product	:	Q Light Engine
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Channel 03 (2422MHz)



Channel 09 (2452MHz)



8. Occupied Bandwidth

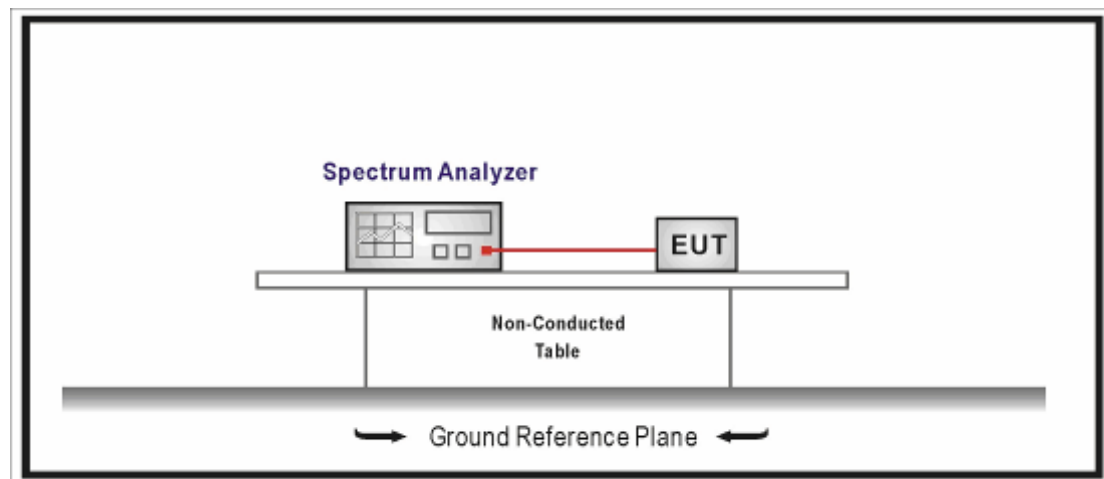
8.1. Test Equipment

Occupied Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2015.01.07
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2014.05.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

8.2. Test Setup



8.3. Limit

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

8.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq$ 3*RBW, peak detector with maximum hold) is implemented by the instrument function.

8.5. Uncertainty

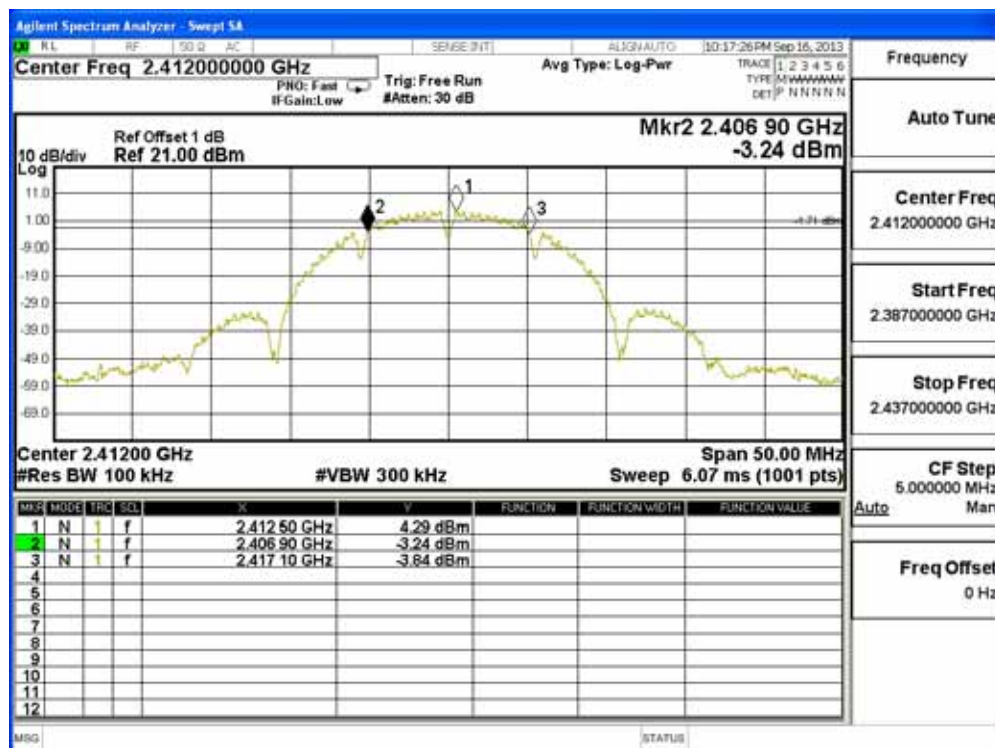
The measurement uncertainty is defined as ± 1 kHz

8.6. Test Result

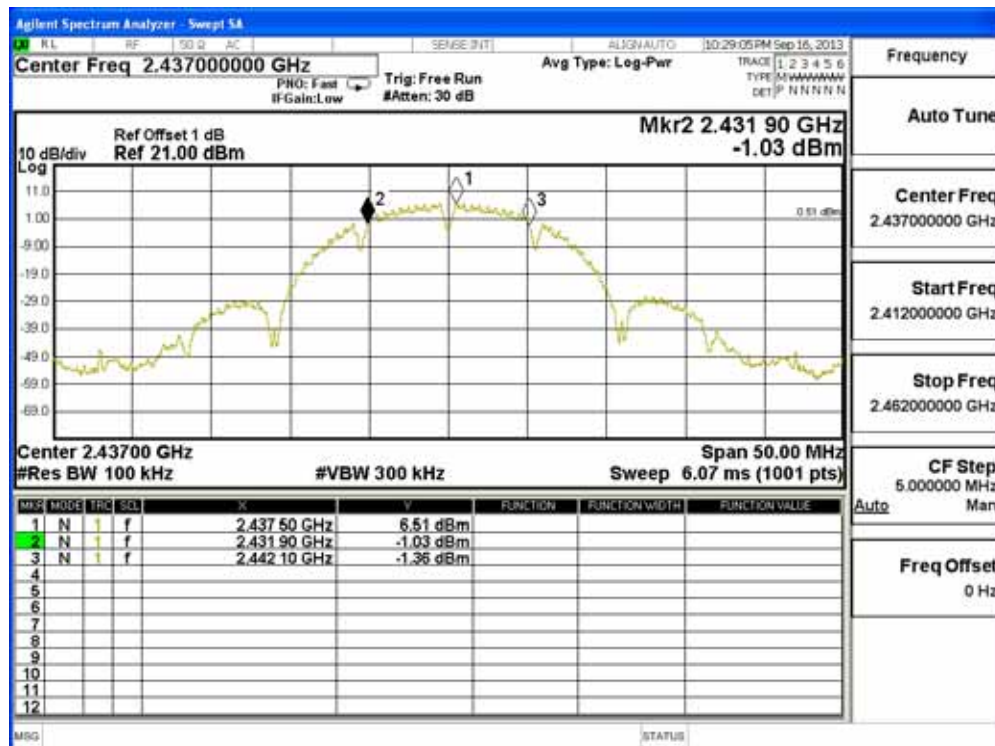
Product	:	Q Light Engine
Test Item	:	6dB Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit by 802.11b

Channel No.	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
01	2412	10200	500	Pass
06	2437	10200	500	Pass
11	2462	10200	500	Pass

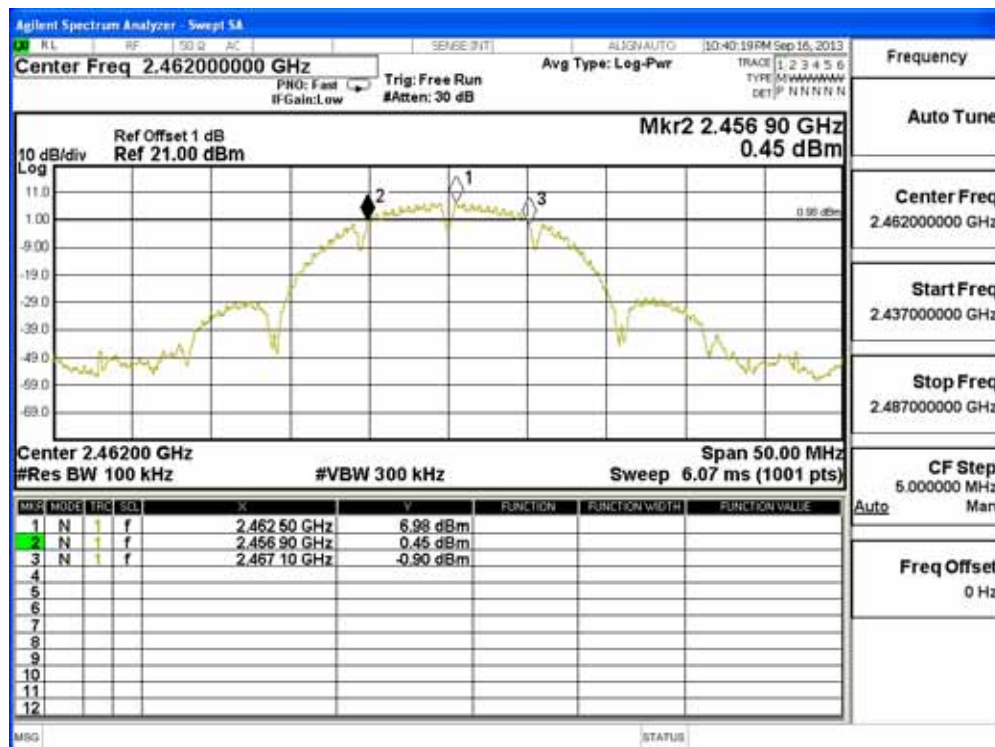
Channel 01 (2412MHz)



Channel 06 (2437MHz)



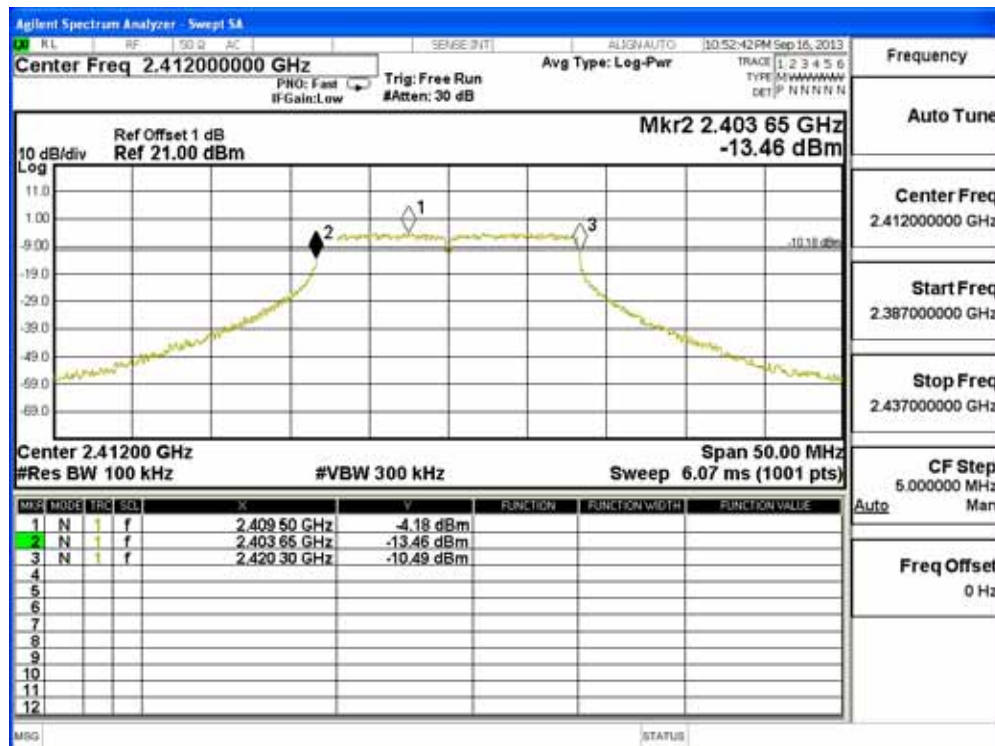
Channel 11 (2462MHz)



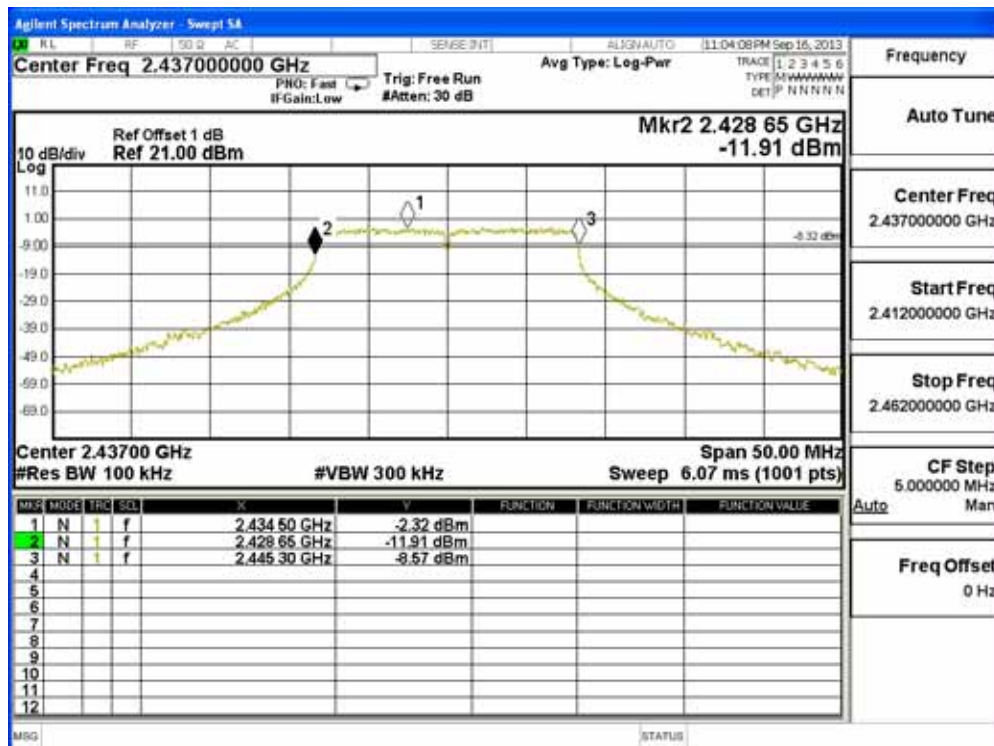
Product	:	Q Light Engine
Test Item	:	6dB Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmit by 802.11g

Channel No.	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
01	2412	16650	500	Pass
06	2437	16650	500	Pass
11	2462	16650	500	Pass

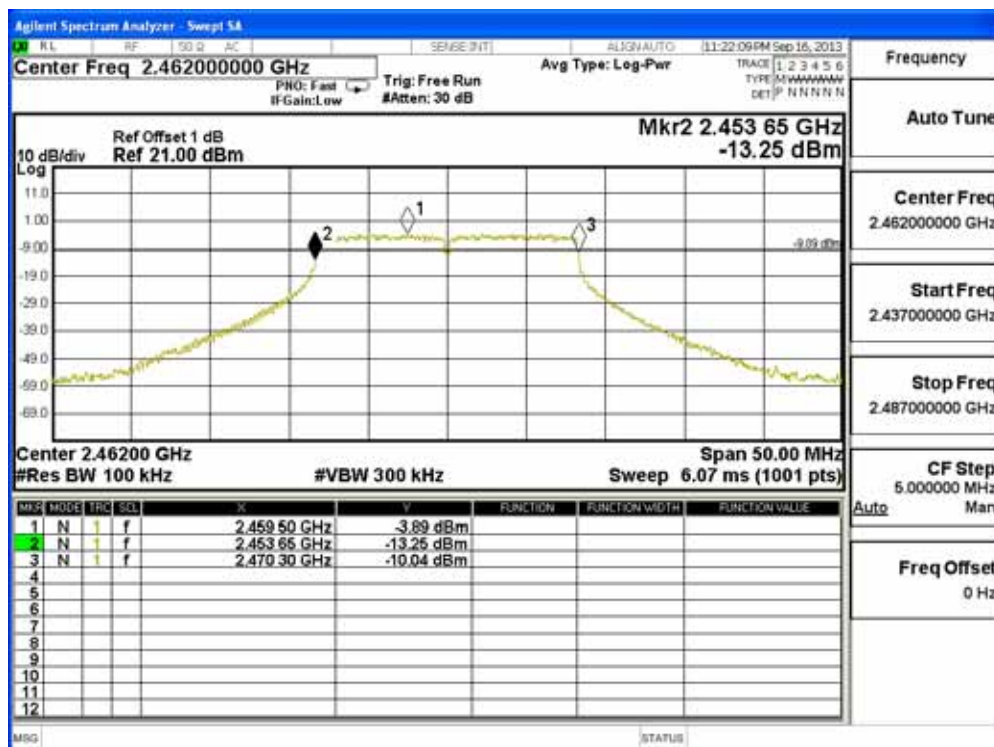
Channel 01 (2412MHz)



Channel 06 (2437MHz)



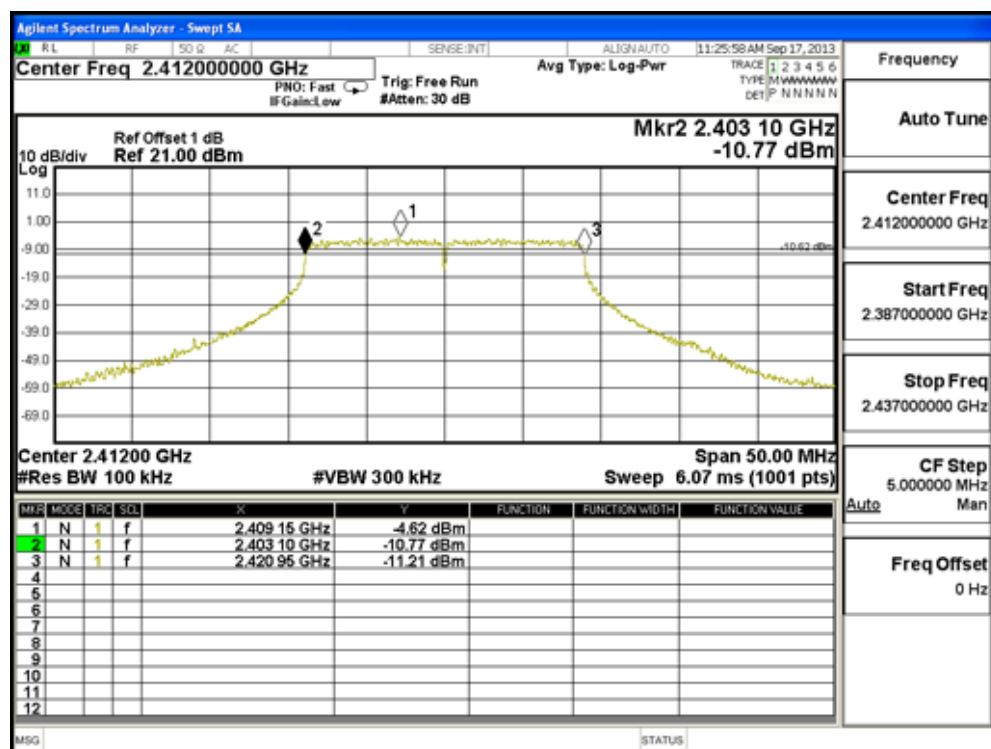
Channel 11 (2462MHz)



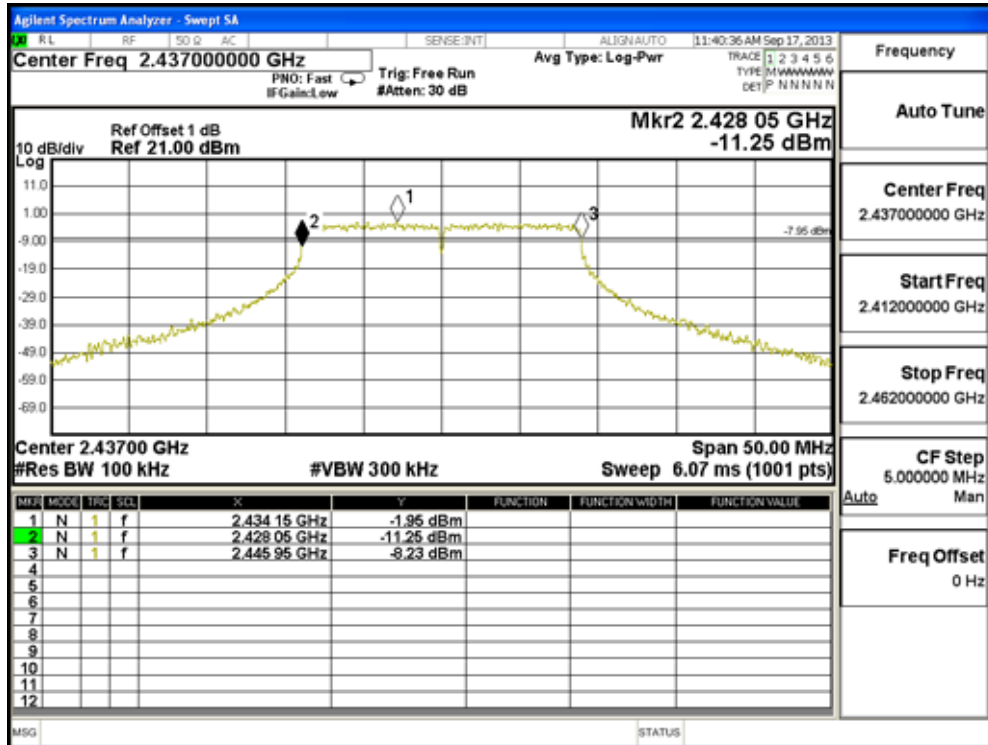
Product	:	Q Light Engine
Test Item	:	6dB Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel No.	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
01	2412	17850	500	Pass
06	2437	17900	500	Pass
11	2462	17850	500	Pass

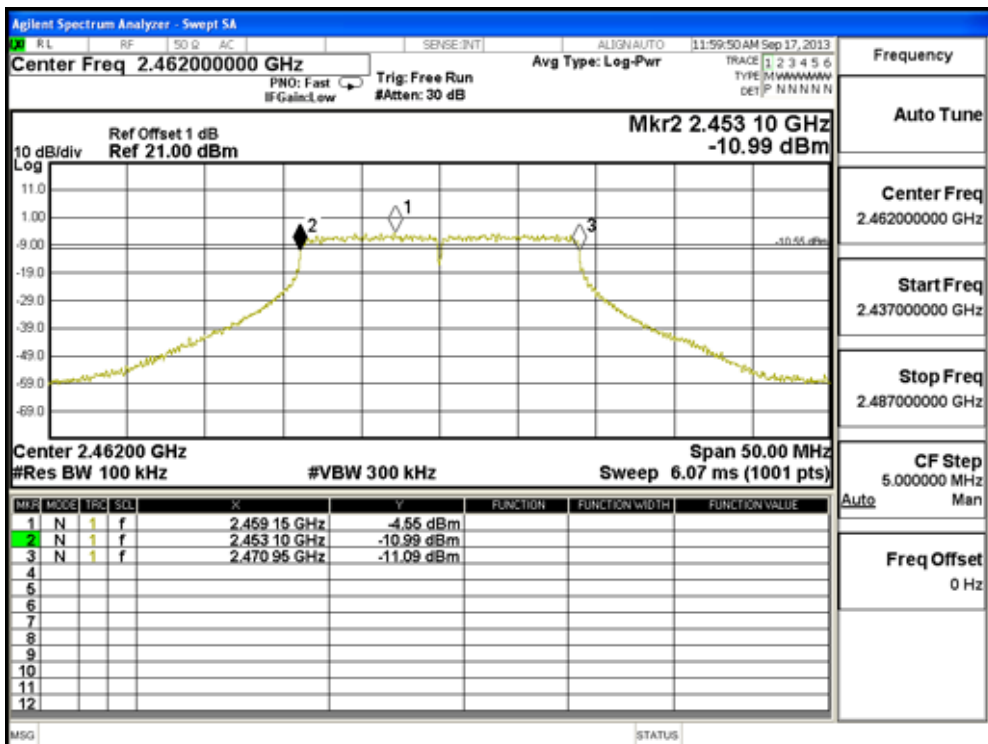
Channel 01 (2412MHz)



Channel 06 (2437MHz)



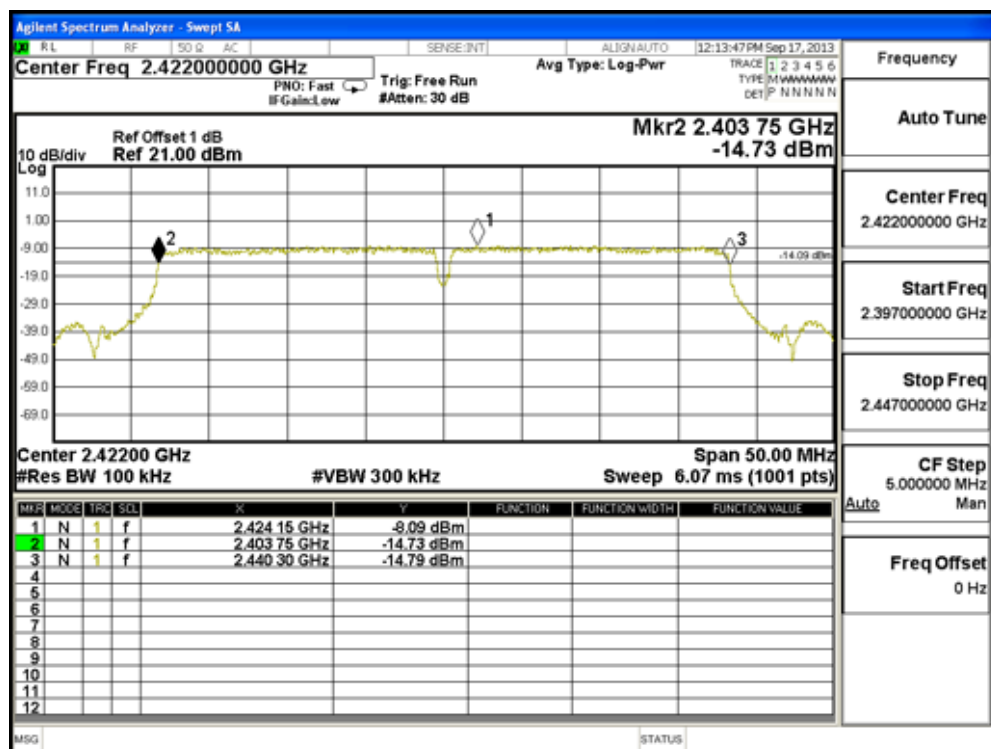
Channel 11 (2462MHz)



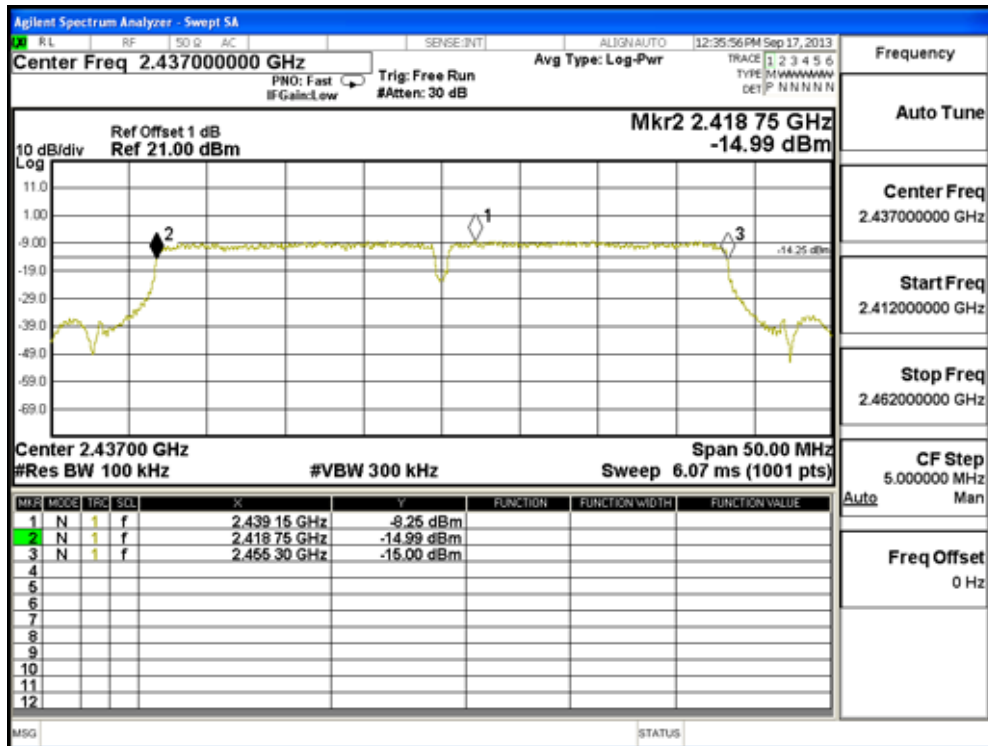
Product	:	Q Light Engine
Test Item	:	6dB Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(40MHz)

Channel No.	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
03	2422	36550	500	Pass
06	2437	36550	500	Pass
09	2452	36550	500	Pass

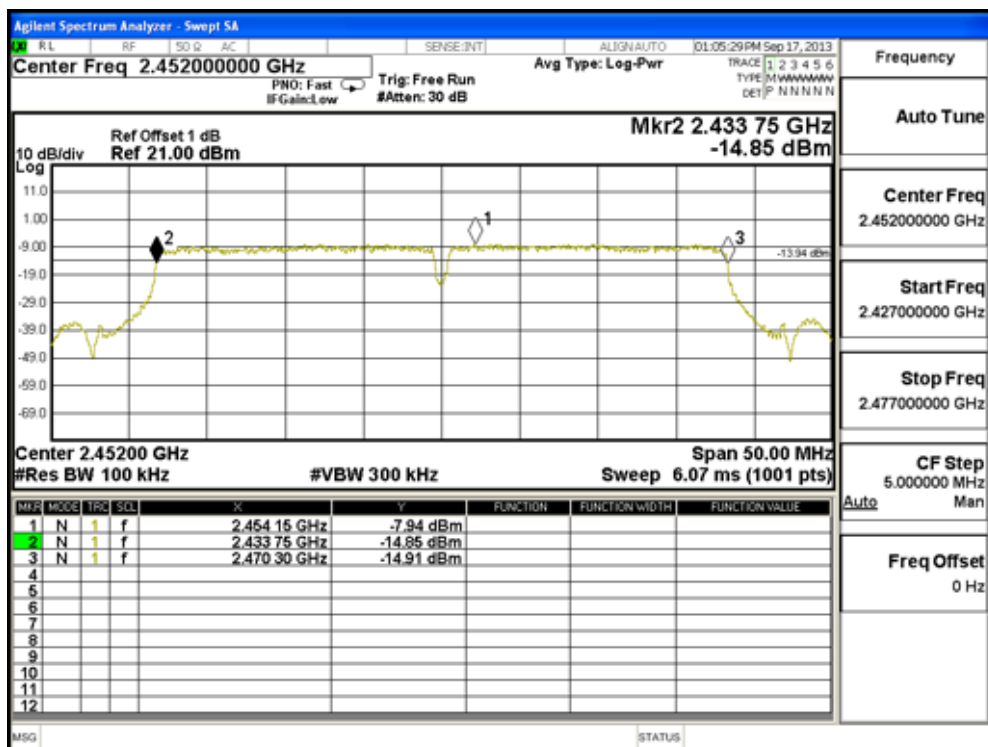
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



9. Power Output

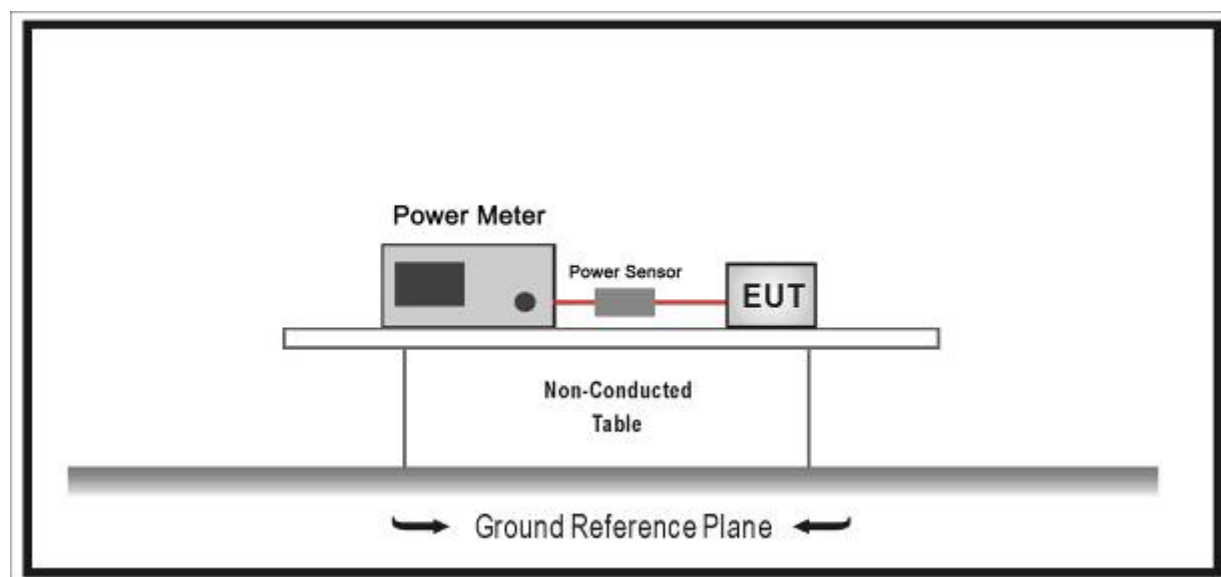
9.1. Test Equipment

Power Output / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Wideband Peak Power Meter	Anritsu	ML2495A	0905006	2014.11.01
Power Sensor	Anritsu	MA2411B	0846014	2014.11.01
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2014.05.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

9.2. Test Setup



9.3. Limit

The maximum peak power shall be less 1 Watt (30dBm).

Note: the conducted output power limit specified above is based on the use the antennas with directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.

9.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Use the broadband peak RF power meter to test peak power and record the result.

9.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

9.6. Test Result

Power output test was verified over all data rates of each mode, and then choose the maximum power output (blue marker) for final test of each channel.

MCS Index for 802.11n	Spatial Streams	Data Rate (Mbps)					
		802.11b	802.11g	20MHz Bandwidth		40MHz Bandwidth	
				800ns GI	400ns GI	800ns GI	400ns GI
0	1	1	6	6.5	7.2	13.5	15.0
1	1	2	9	13.0	14.4	27.0	30.0
0	1	5.5	12	19.5	21.7	40.5	45.0
1	1	11	18	26.0	28.9	54.0	60.0
4	1	---	24	39.0	43.3	81.0	90.0
5	1	---	36	52.0	57.8	108.0	120.0
6	1	---	48	58.5	65.0	121.5	135.0
7	1	---	54	65.0	72.2	135.0	150.0

Power output at various data rates:

Test Mode	Bandwidth	Frequency (MHz)	Channel	Data Rate	Average Power (dBm)	Peak Power (dBm)
802.11b	20	2437	6	1M	18.69	19.82
				5.5M	18.52	19.81
				11M	18.49	19.64
802.11g	20	2437	6	6M	14.52	19.45
				24M	14.40	19.75
				54M	14.31	19.30
802.11n(20MHz)	20	2437	6	MCS0	14.65	20.28
				MCS4	14.52	20.42
				MCS7	14.31	20.34
802.11n(40MHz)	40	2437	6	MCS0	11.53	17.37
				MCS4	11.36	17.73
				MCS7	11.12	17.22

Product	:	Q Light Engine
Test Item	:	Power Output
Test Site	:	TR8
Test Mode	:	Mode 1: Transmit by 802.11b

Channel No.	Frequency (MHz)	Average Power Output Value (dBm)	Peak Power Output Value (dBm)	Limit (dBm)	Result
		Data Rate(1M)	Data Rate(1M)		
1	2412	18.78	19.92	30	Pass
6	2437	18.69	19.82	30	Pass
11	2462	18.33	19.64	30	Pass

Product	:	Q Light Engine
Test Item	:	Power Output
Test Site	:	TR8
Test Mode	:	Mode 2: Transmit by 802.11g

Channel No.	Frequency (MHz)	Average Power Output Value (dBm)	Peak Power Output Value (dBm)	Limit (dBm)	Result
		Data Rate(6M)	Data Rate(6M)		
1	2412	12.52	18.37	30	Pass
6	2437	14.52	19.75	30	Pass
11	2462	12.36	18.32	30	Pass

Product	:	Q Light Engine
Test Item	:	Power Output
Test Site	:	TR8
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel No.	Frequency (MHz)	Average Power Output Value (dBm)	Peak Power Output Value (dBm)	Limit (dBm)	Result
		Data Rate(MCS0)	Data Rate(MCS0)		
1	2412	11.78	17.45	30	Pass
6	2437	14.65	20.42	30	Pass
11	2462	11.35	17.38	30	Pass

Product	:	Q Light Engine
Test Item	:	Power Output
Test Site	:	TR8
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Channel No.	Frequency (MHz)	Average Power Output Value (dBm)	Peak Power Output Value (dBm)	Limit (dBm)	Result
		Data Rate(MCS0)	Data Rate(MCS0)		
1	2422	11.71	17.63	30	Pass
6	2437	11.53	17.73	30	Pass
11	2462	11.31	17.55	30	Pass

10. Power Spectral Density

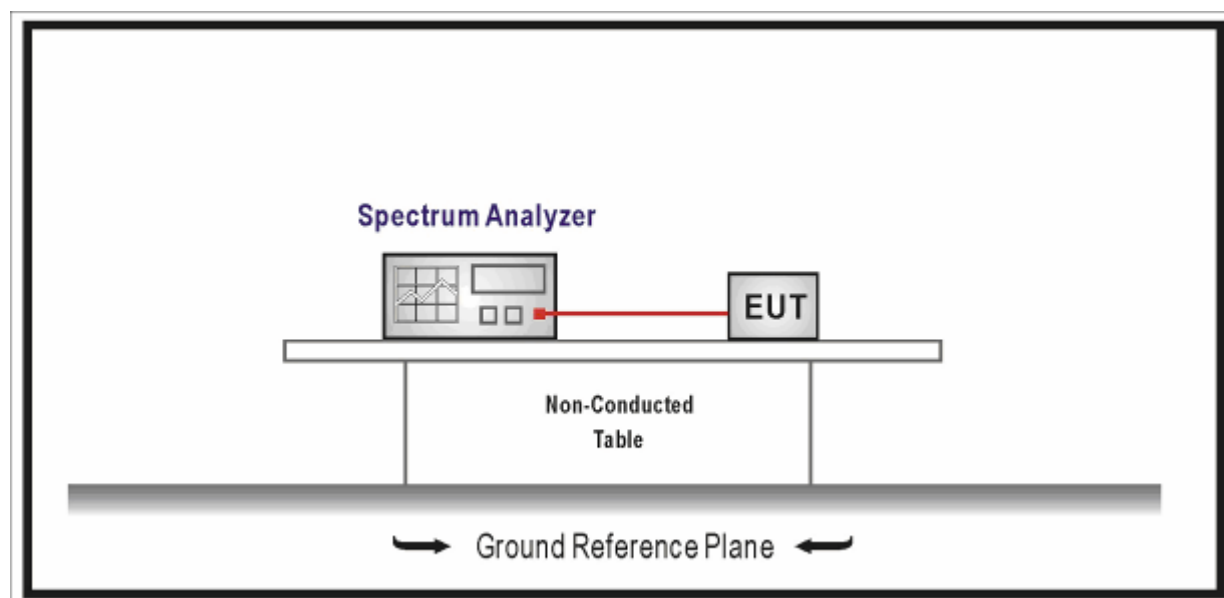
10.1. Test Equipment

Power Spectral Density / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2015.03.30
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2014.05.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

10.2. Test Setup



10.3. Limit

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

10.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set analyzer center frequency to DTS channel center frequency, the span to 1.5 times the DTS channel bandwidth, Set $100 \text{ kHz} \geq \text{RBW} \geq 3 \text{ kHz}$, Set $\text{VBW} \geq 3 * \text{RBW}$, Sweep time = auto couple, Detector = peak, Trace mode = max hold, Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level. If measured value exceed limit reduce RBW (no less than 3kHz) and repeat.

10.5. Uncertainty

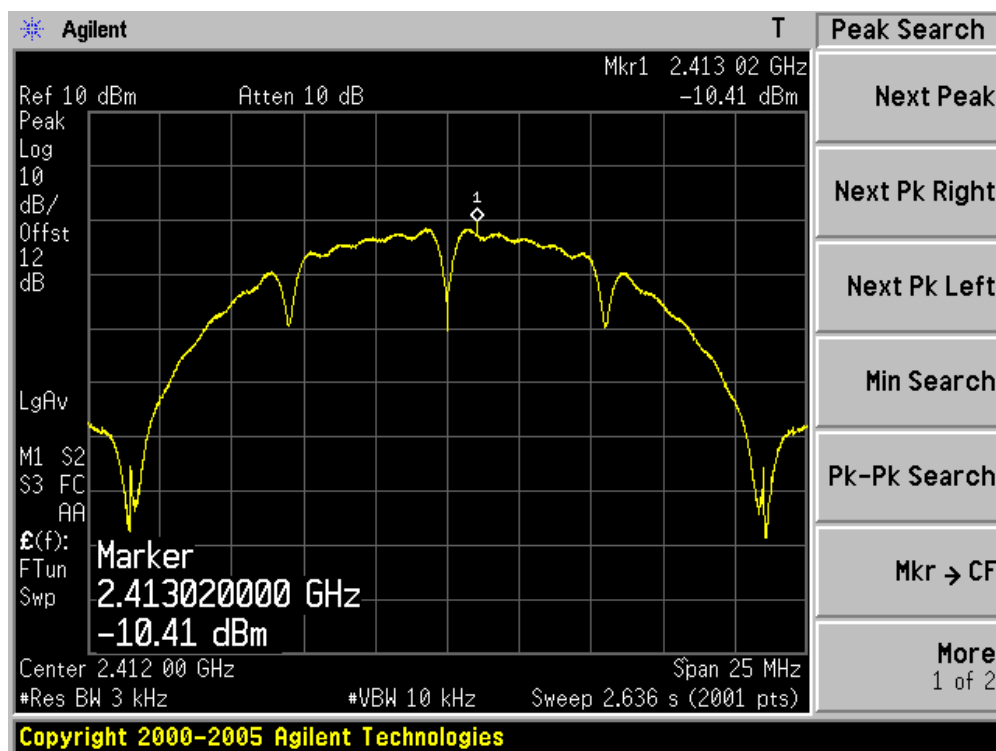
The measurement uncertainty is defined as $\pm 1.27 \text{ dB}$

10.6. Test Result

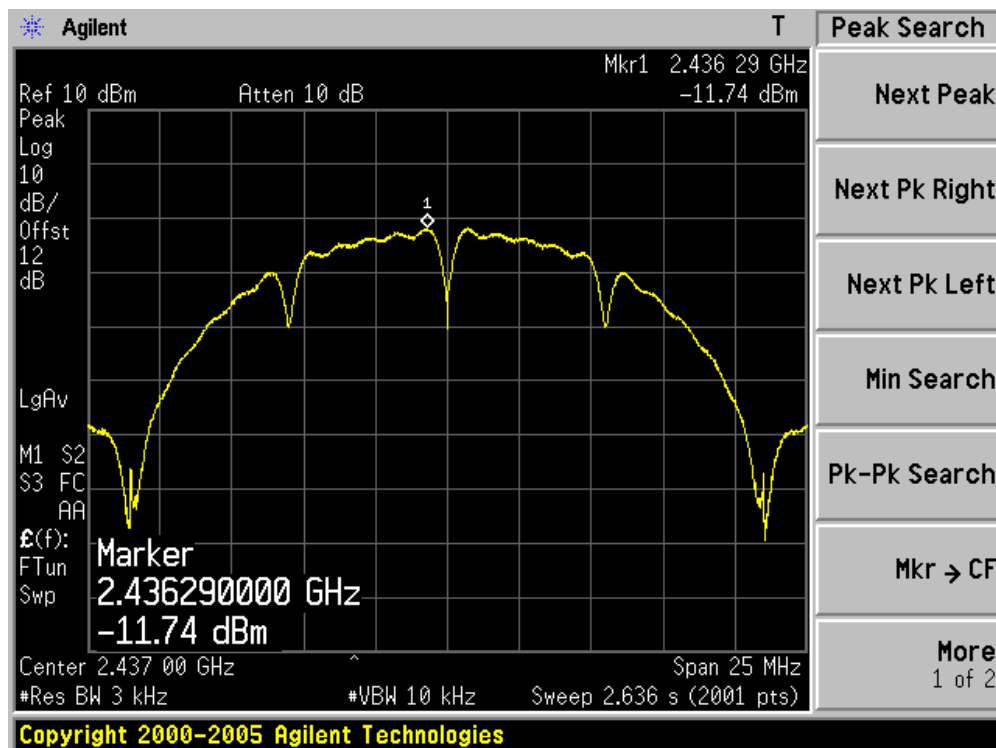
Product	:	Q Light Engine
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit by 802.11b

Channel No.	Frequency (MHz)	Measurement PPSP (dBm)	Total PPSP (dBm)	Limit (dBm)	Result
01	2412	-10.41	-10.41	8	Pass
06	2437	-11.74	-11.74	8	Pass
11	2462	-11.93	-11.93	8	Pass

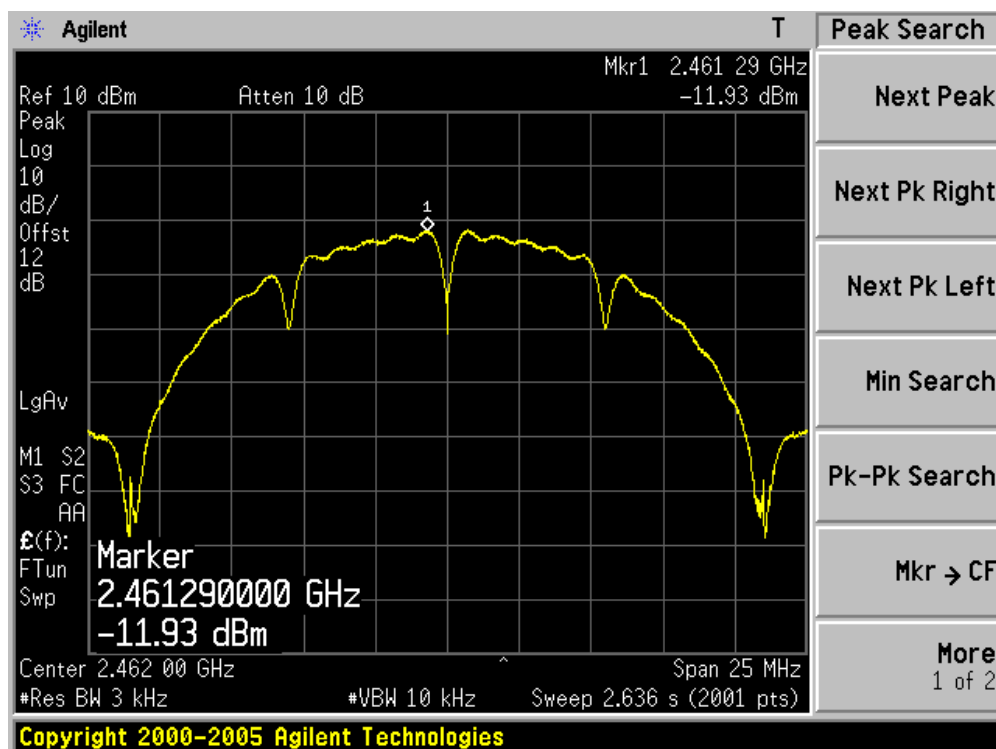
Channel 01 (2412MHz)



Channel 06 (2437MHz)



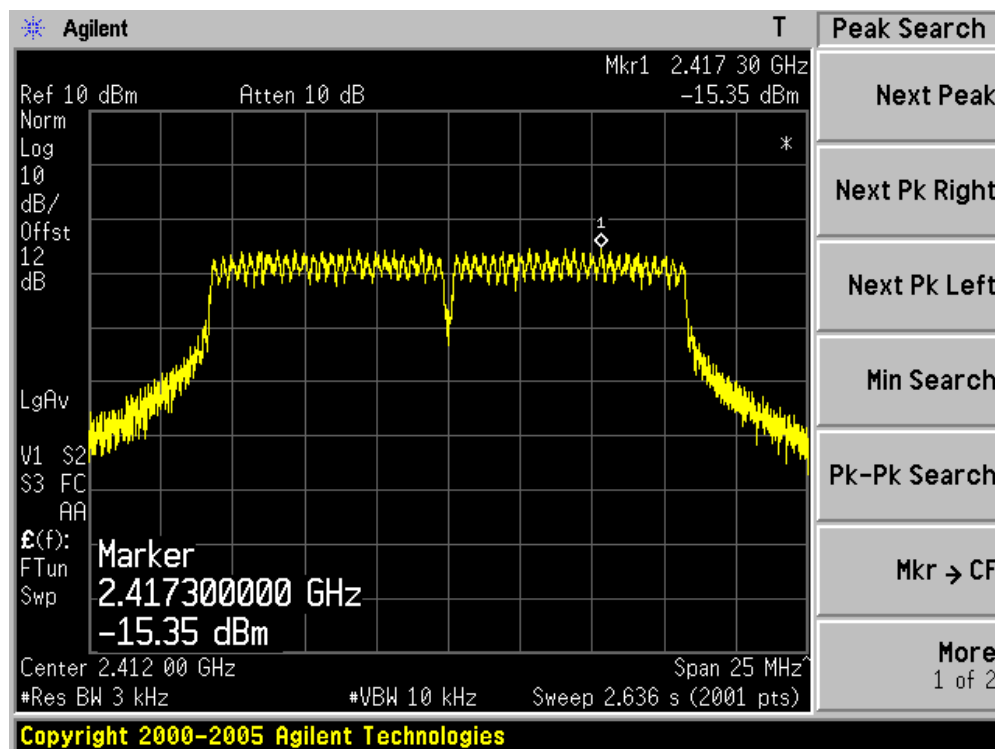
Channel 11 (2462MHz)



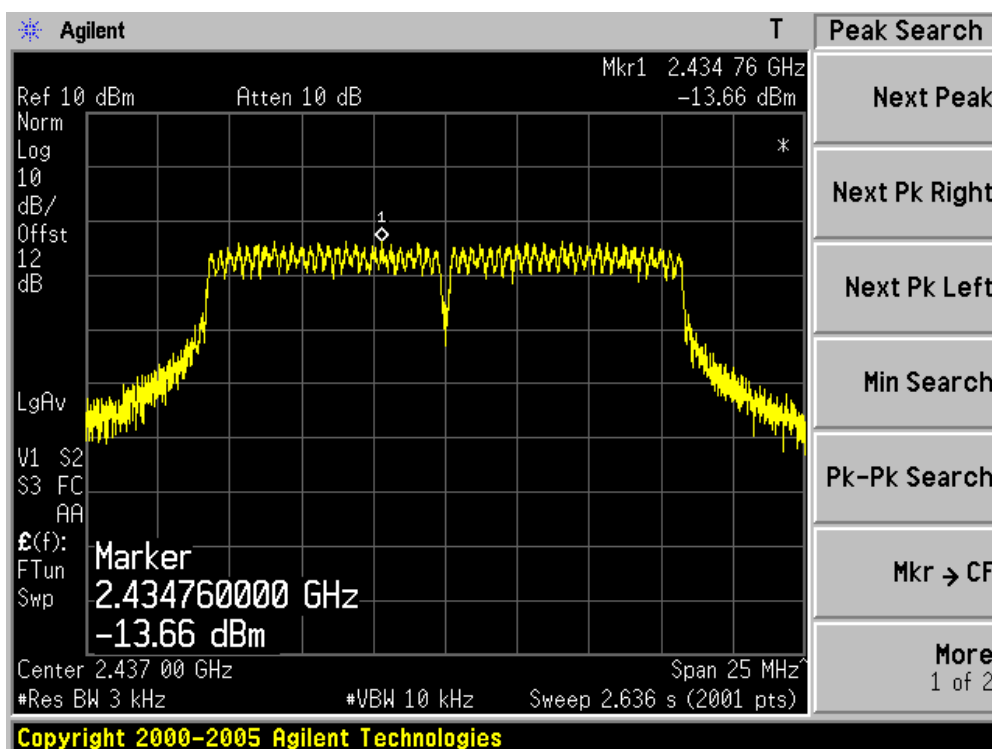
Product	:	Q Light Engine
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmit by 802.11g

Channel No.	Frequency (MHz)	Measurement PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
01	2412	-15.35	-15.35	8	Pass
06	2437	-13.66	-13.66	8	Pass
11	2462	-15.66	-15.66	8	Pass

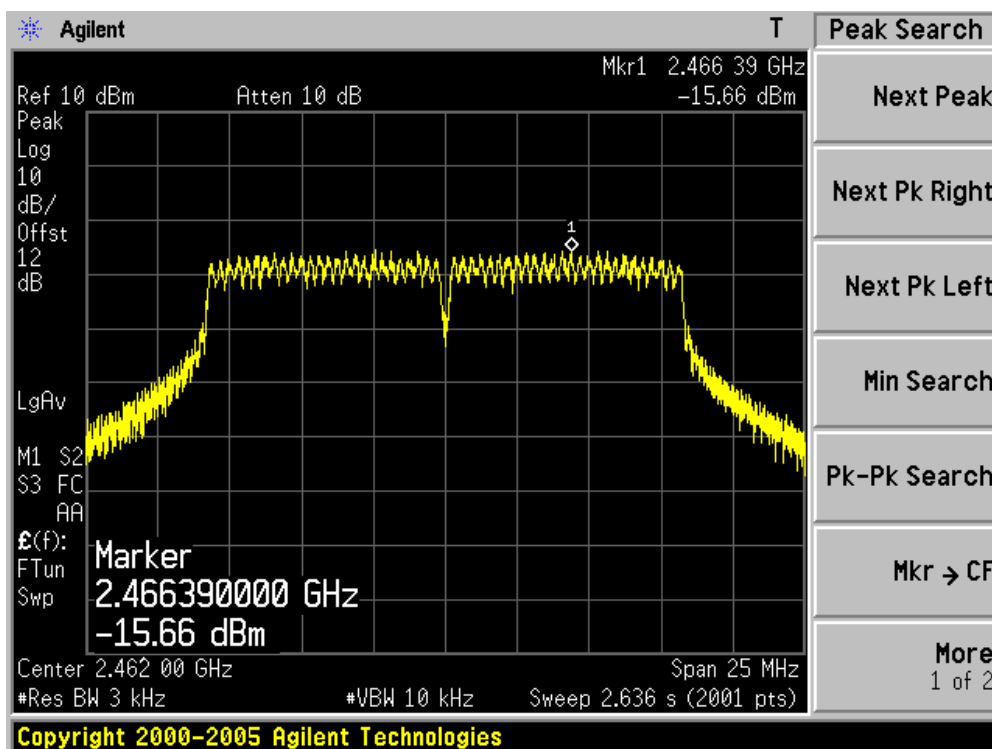
Channel 01 (2412MHz)



Channel 06 (2437MHz)



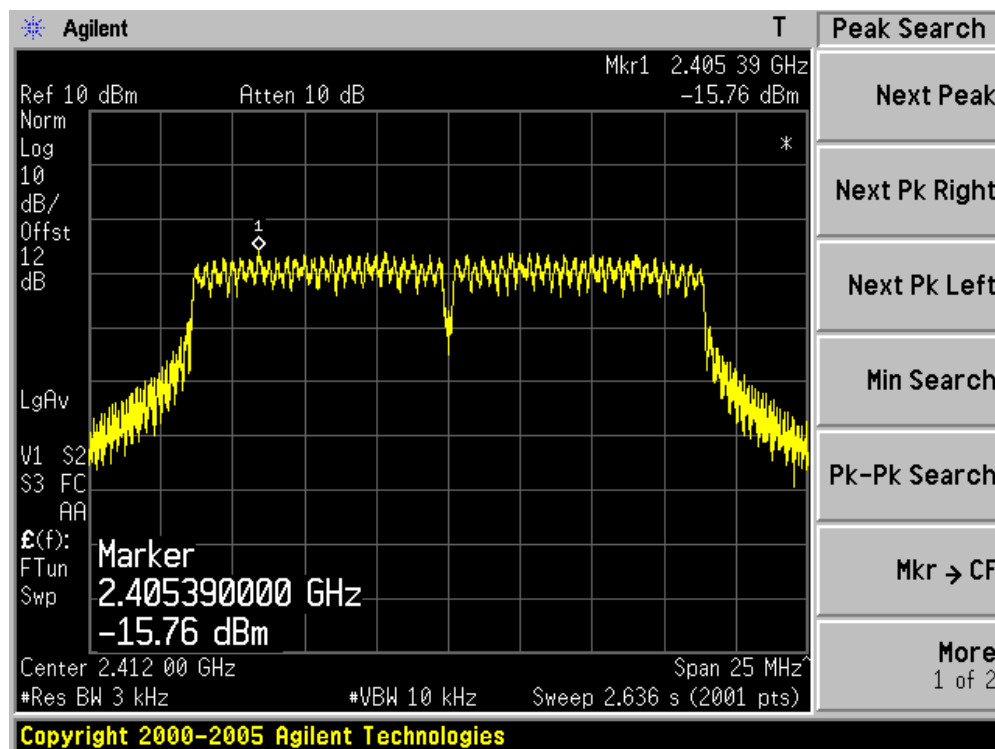
Channel 11 (2462MHz)



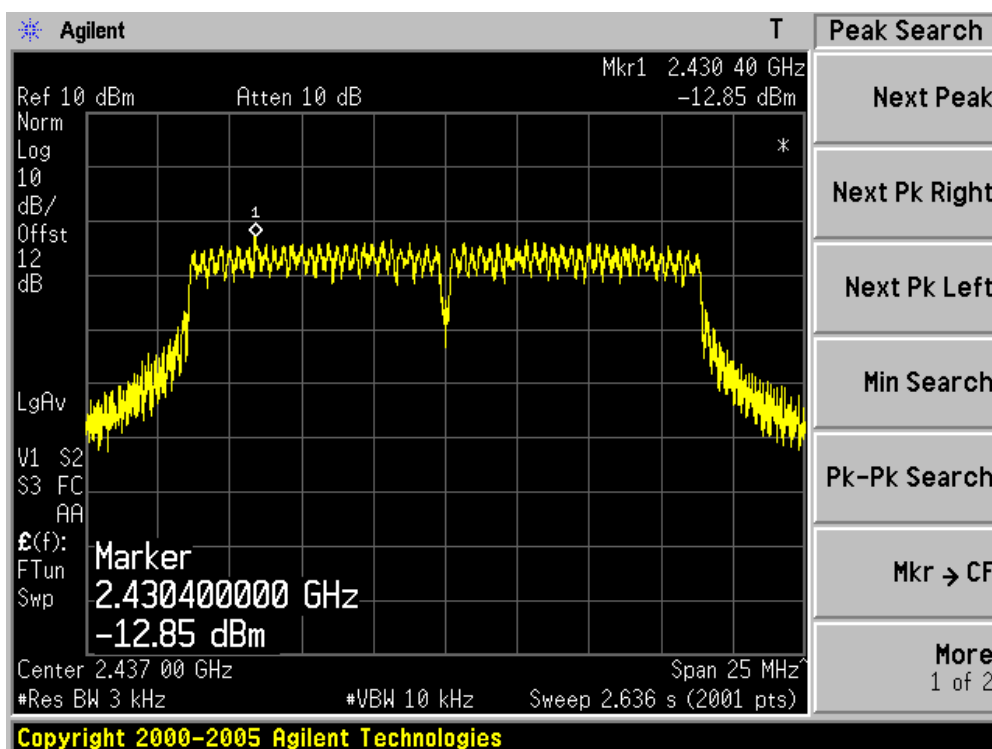
Product	:	Q Light Engine
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel No.	Frequency (MHz)	Measurement PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
01	2412	-15.76	-15.76	8	Pass
06	2437	-12.85	-12.85	8	Pass
11	2462	-16.11	-16.11	8	Pass

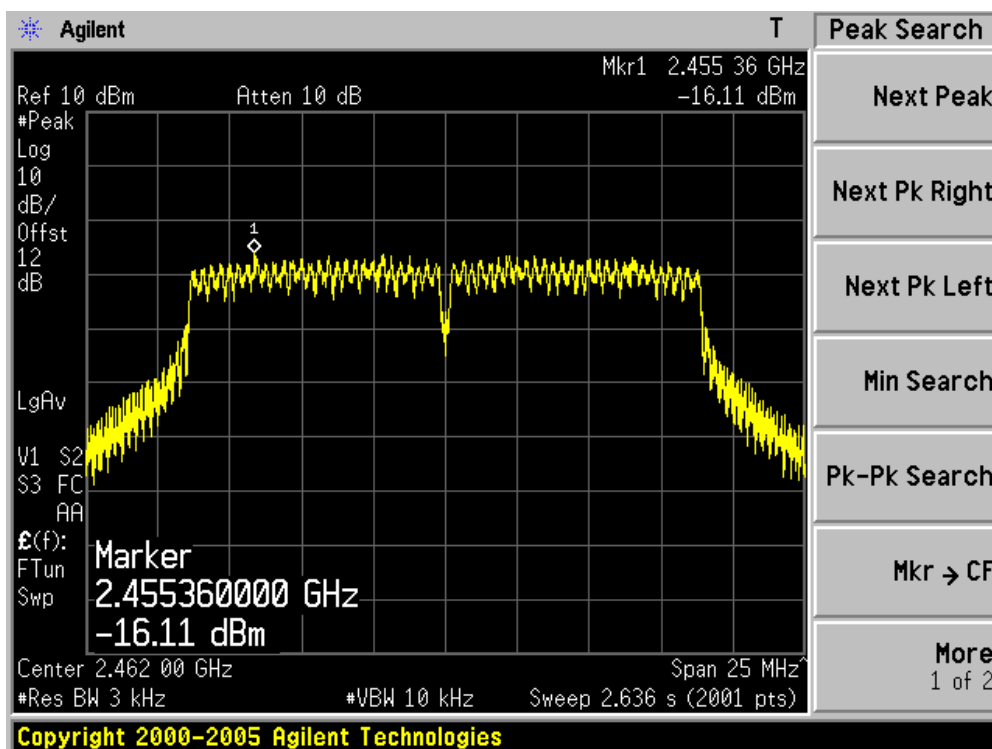
Channel 01 (2412MHz)



Channel 06 (2437MHz)



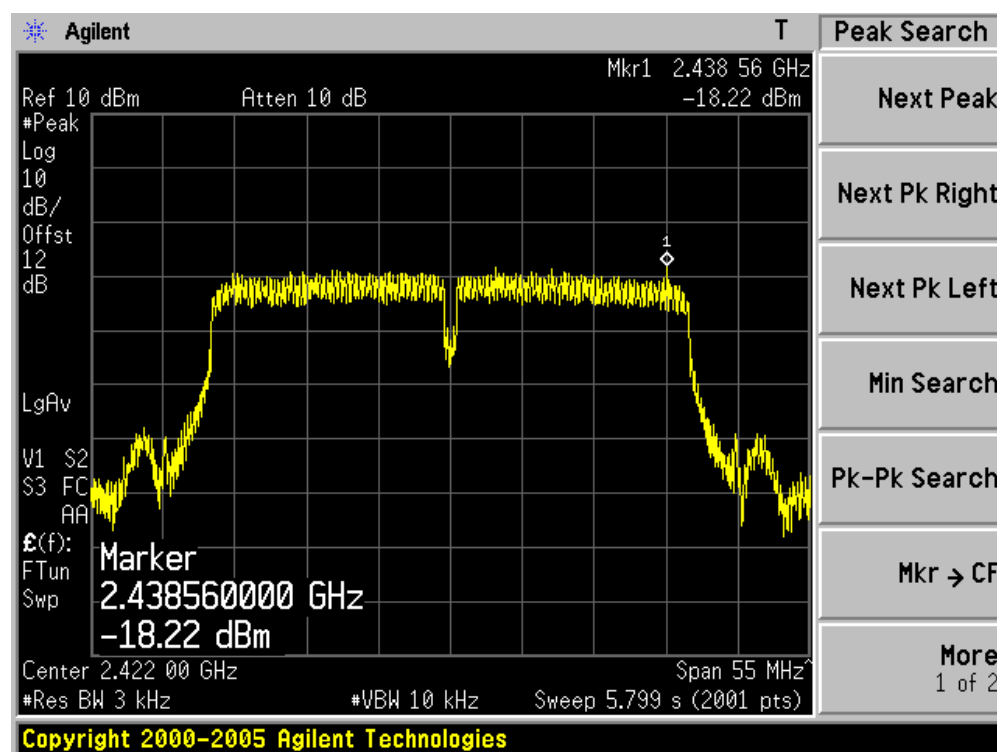
Channel 11 (2462MHz)



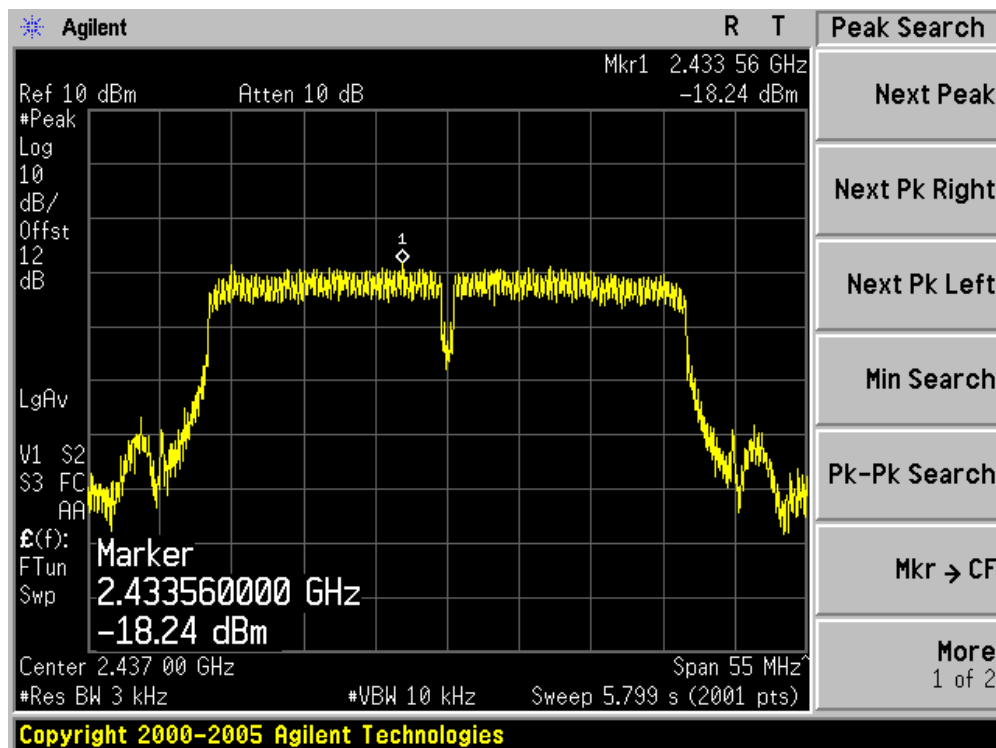
Product	:	Q Light Engine
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmit by 802.11n(40MHz)

Channel No.	Frequency (MHz)	Measurement PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
01	2412	-18.22	-18.22	8	Pass
06	2437	-18.24	-18.24	8	Pass
11	2462	-15.73	-15.73	8	Pass

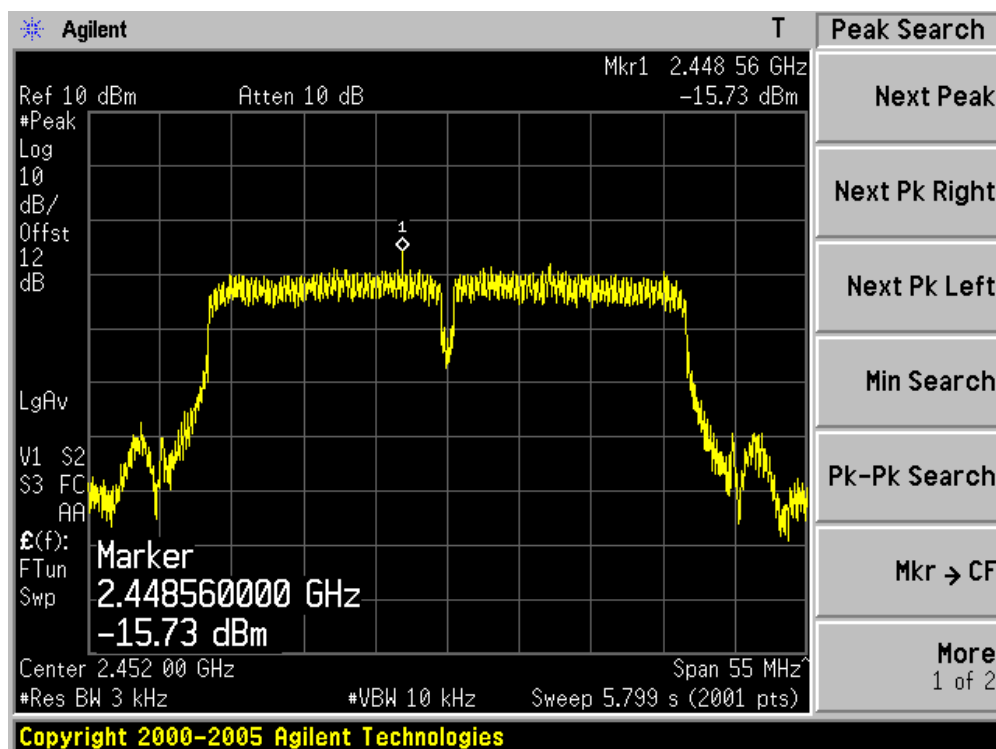
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



The End