



Report No.SH16030058W01

FCC RF TEST REPORT

Issued to

Zylight, LLC

For

IS3

Model Name : IS3
Trade Name : IS3
Brand Name : Zylight
Standard : 47 CFR Part 15, Subpart C
ANSI C63.10-2013
RSS 247 Issue1
RSS GEN Issue 4
FCC ID : T3YIS3
IC ID : 6423A-IS3
Test date : May.27,2016 to Aug.31,2016
Issue date : Sep.1,2016

by
Shanghai Skylabs Co., Ltd.

Tested by

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**Change History**

Issue	Date	Reason for change
1.0	Jul.22,2016	First edition
2.0	Sep.1,2016	Second edition



1. General Information

1.1 Applicant

Zylight, LLC

10718 McCune Ave., Los Angeles, CA. 90034

1.2 Manufacturer

Zylight, LLC

10718 McCune Ave., Los Angeles, CA. 90034

1.3 Description of EUT

EUT Name..... : IS3
Model Name : IS3
Brand Name..... : Zylight
Trade Name : IS3
Hardware Version : 4
Software Version : 1.11
Modulation Type : OQPSK (DSSS technique)
Frequency Range..... : 2.405GHz - 2.450GHz (at interval of 5MHz)
Channel Number..... : 10
EUT Stage : Production Unit
Antenna Type..... : Dipole antenna
Antenna Gain..... : 2.0 dBi
EUT Adapter : Manufacturer: FSP GROUP INC.
Model No.: FSP180-AFAN1
AC Input: 100-240V, 2.5A, 50-60Hz
DC Output: 48V

NOTE 1:

*The EUT is a LED light. The EUT contains Communication Module operating at 2.4GHz ISM band; the frequencies allocated for the Communication Module is $F(\text{MHz})=2400+5*n$ ($1 \leq n \leq 10$). The lowest, middle, highest channel numbers of the Communication Module used and tested in this report are separately 1 (2405MHz), 5 (2425MHz) and 10 (2450MHz).*

NOTE 2:

For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacture.



2. Facilities and Accreditations

2.1 Test Facility

Shanghai Skylabs Co., Ltd. Skylabs Laboratory is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6644. A 9*6*6(m) fully anechoic chamber was used for the radiated spurious emissions test.

FCC test site(s) registration number: 196218

IC test site(s) registration number: 21609

2.2 Environmental Conditions

Ambient temperature: 15~35°C

Relative humidity: 30~60%

Atmosphere pressure: 86-106kPa

2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission: $\pm 1.76\text{dB}$

Uncertainty of Radiated Emission: $\pm 3.16\text{dB}$



2.4 List of Equipments Used

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU26	200880	2016.2.25	1year
Power Splitter	Weinschel	1506A	NW521	(n.a.)	(n.a.)
Power Splitter	Mini-Circuits	ZFRSC-183-S+	765001016	(n.a.)	(n.a.)
Attenuator 1	Resnet	10dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 2	Resnet	3dB	(n.a.)	(n.a.)	(n.a.)
Full/Semi-Anechoic Chamber	CHENGYU	9.2×6.25×6.15m	SAR	2015.9.14	3year
EMI Test Receiver	R&S	ESCI7	100787	2016.2.25	1year
LISN	TESEQ	NNB 51	33285	2016.2.25	1year
Personal Computer	HP	6300P	CNG24296YW	(n.a.)	(n.a.)
Test Antenna-Horn	Schwarzbeck	BBHA9170	BBHA91970171	2015.9.22	1year
Test Antenna-Horn	Schwarzbeck	BBHA 9120D	9120D-1033	2016.7.24	1year
Test Antenna-Log	Schwarzbeck	VULB 9163	9163-561	2015.9.25	1year
Test Antenna-Loop	Rohde&Schwarz	HFH2-Z2	860004/001	2015.9.22	1year
Power supplier	NF	ES2000S	9087735	2015.9.25	1year
EPM Series Power Meter	Agilent	E4418B	GB43318055	2016.5.24	1year
Power Sensor	Agilent	8482A	MY41091706	2016.5.24	1year
RF Cable	(n.a.)	0~18GHz	(n.a.)	(n.a.)	(n.a.)
RF Cable	(n.a.)	0~25GHz	(n.a.)	(n.a.)	(n.a.)

NOTE:

Equipments listed above have been calibrated and are in the period of validation.



3. Test Standards and Results

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

FCC Part 15 Subpart C §15.247

ANSI C63.10-2013

April 2016 KDB558074

INDUSTRY CANADA RSS 247 Issue 1

INDUSTRY CANADA RSS GEN Issue 4

NOTE:

(1) All test items were verified and recorded according to the standards and without any deviation during the test.

(2) This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart C and RSS-247, recorded in a separate test report.

Test items and the results are as bellow:

No.	FCC Rules	IC Rules	Description	Result
1	15.203	RSS-GEN 8.3	Antenna Requirement	Pass
2	15.247(b)	RSS-247 5.4(4)	Peak Output power	Pass
3	15.247(b)	RSS-247 5.4(4)	Average Power	Pass
4	15.247(a)	RSS-247 5.2(1)	20dB/6dB Bandwidth	Pass
5	15.247(d)	RSS-247 5.5 RSS-GEN 8.10	Conducted Spurious Emission	Pass
6	15.247(d)	RSS-247 5.5 RSS-GEN 8.10	Band Edge	Pass
7	15.207	RSS-GEN 8.8	Conducted Emission	Pass
8	15.247(d) 15.209	RSS-247 5.5 RSS-GEN 8.9	Radiated Emission	Pass
9	15.247(e)	RSS-247 5.2(2)	Power Spectral Density (PSD)	Pass



4. Test Conditions Setting

4.1 Test Mode

The EUT configuration is EUT + Charger.

Mode 1: Continuous Transmitting Mode

During the measurement, EUT is working in the continuous transmitting mode. Duty cycle > 98%.

Continuous transmitting mode is modified into the EUT by manufacturer. When EUT is power on and choose wireless on, it will start transmitting at maximum power. Press some buttons on the EUT to change channel.



5. 47 CFR Part 15C

5.1 Antenna requirement

5.1.1 Applicable standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

5.1.2 Result: Compliant

The antenna connector on the EUT is external thread and female SMA connector (Type: SMA-K). Only the authorized antenna by manufacturer can be installed on the EUT. Please refer to internal photo file/external photo file.



6. Test Result

6.1 Peak Output Power

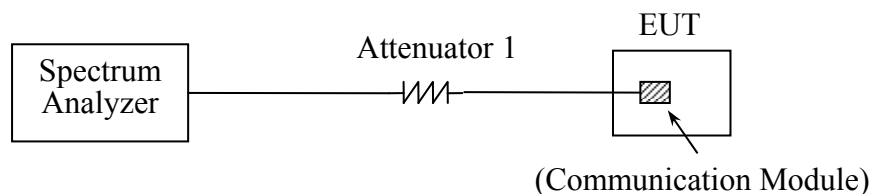
6.1.1 Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

6.1.2 Test Description

The measured output power was calculated by the reading of the spectrum analyzer and calibration.

A. Test Setup:



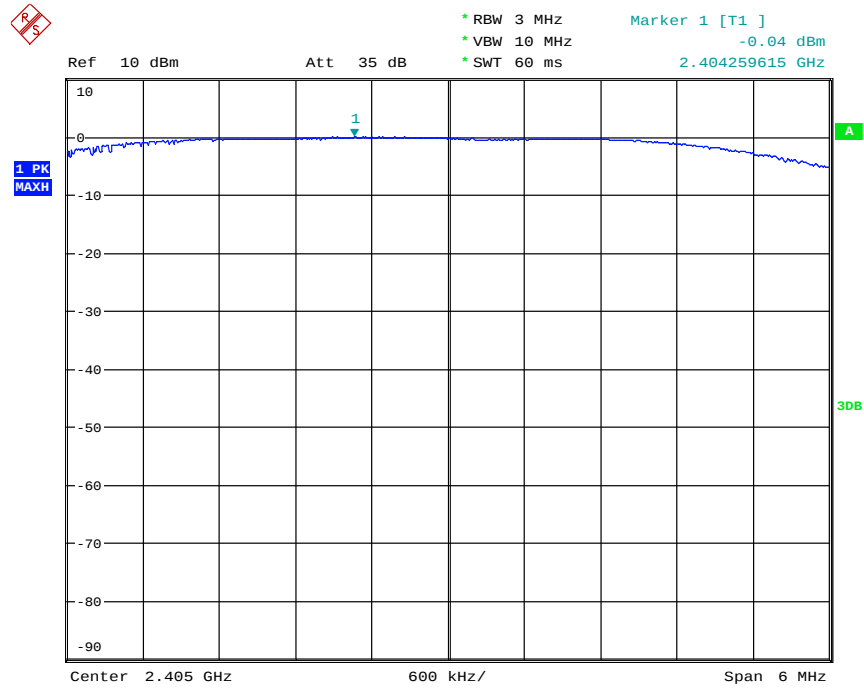
The Communication Module of the EUT, is coupled to the Spectrum Analyzer (SA) with Attenuators; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factories calibrated to correct the reading.

6.1.3 Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module. (Duty cycle > 98%)

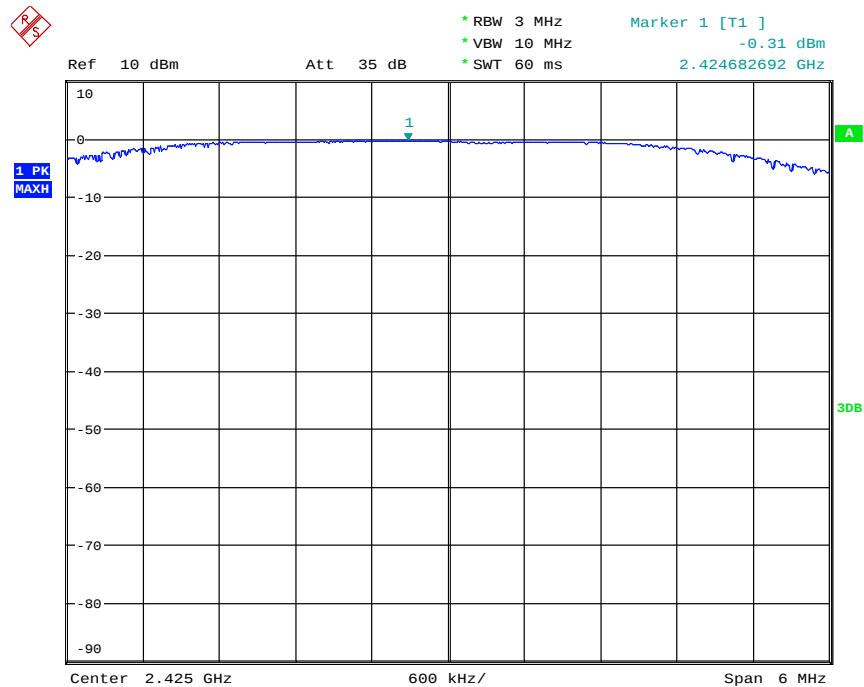
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Refer to plot	Limit		Verdict
		dBm	W		dBm	W	
1	2405	-0.04	0.00099	Plot A	30	1	Pass
5	2425	-0.31	0.00093	Plot B			Pass
10	2450	-0.56	0.00088	Plot C			Pass

**B. Test Plots:**

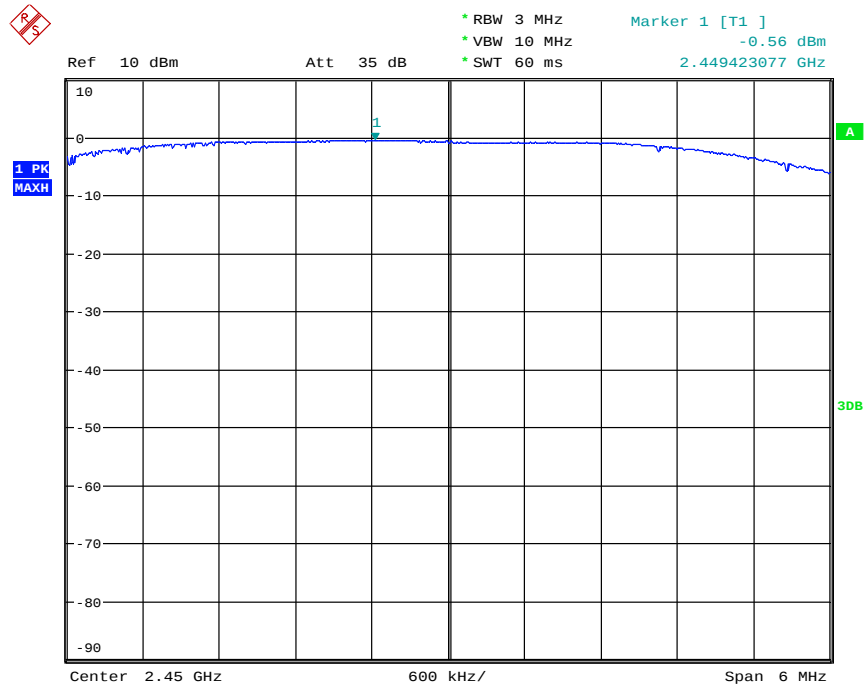
Date: 27.MAY.2016 14:24:44

(Plot A: Channel 1:2405MHz)



Date: 27.MAY.2016 14:25:14

(Plot B:Channel 5: 2425MHz)



Date: 27.MAY.2016 14:25:50

(Plot C: Channel 10:2450MHz)



6.2 Average Power

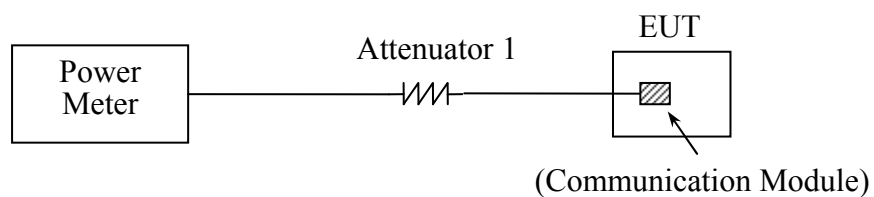
6.2.1 Requirement

None; for reporting purposes only.

6.2.2 Test Description

The Communication Module of the EUT is coupled to the Power Meter with Attenuators. The path loss as the factories calibrated to correct the reading.

(Duty cycle > 98%)



6.2.3 Results

Channel	Frequency (MHz)	Measured Output Average Power	
		dBm	W
1	2405	-0.25	0.00094
5	2425	-0.42	0.00091
10	2450	-0.70	0.00085



6.3 6dB & 20dB Bandwidth

6.3.1 Requirement

According to FCC section 15.247(a) (2), Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.3.2 Test Description

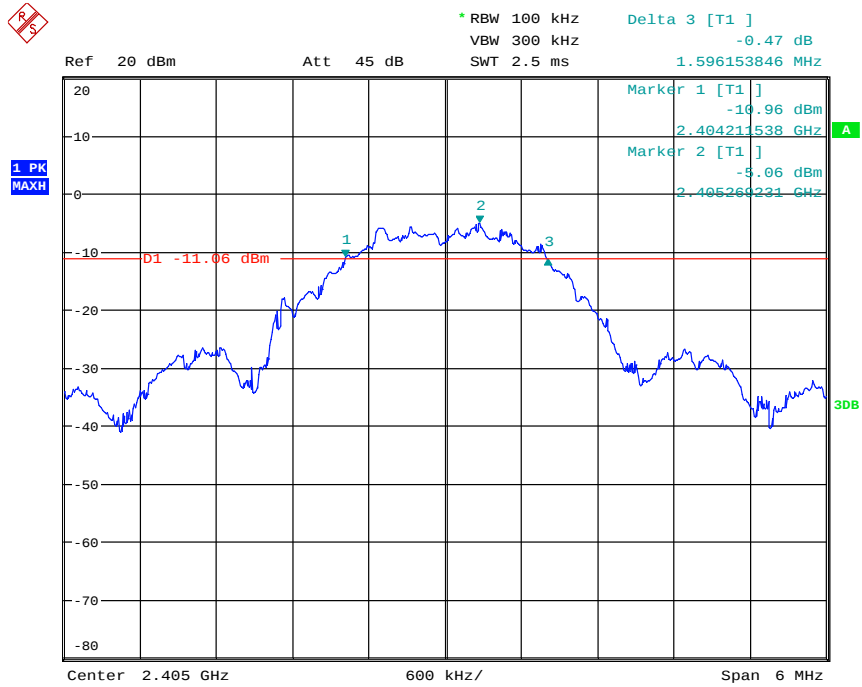
See section 5.1.2 of this report.

6.3.3 Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the Module.

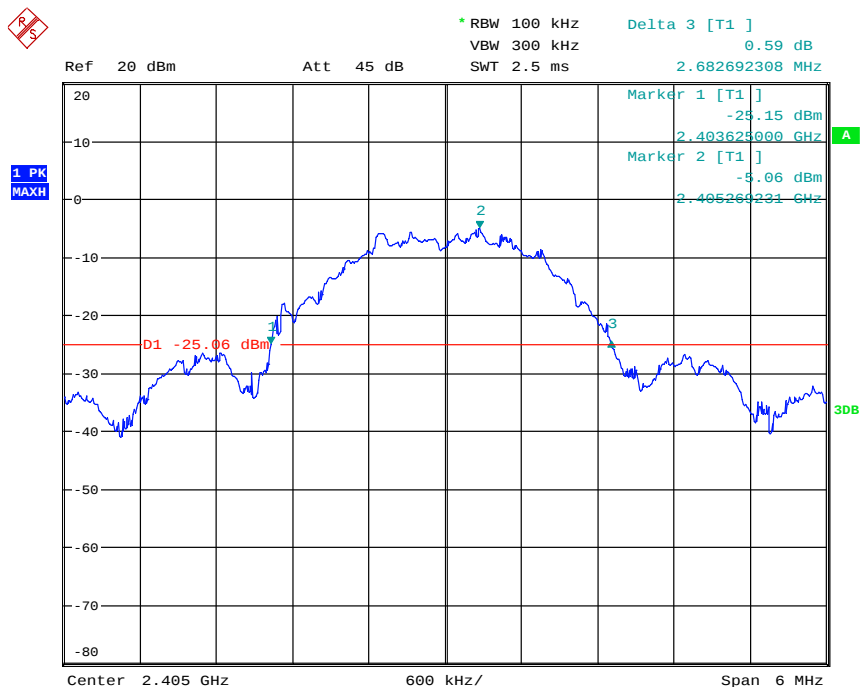
A. Test Verdict:

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Refer to plot	20dB Bandwidth (MHz)	Refer to plot	Limit (KHz)	Result
1	2405	1.596	Plot A1	2.682	Plot A2	≥ 500	Pass
5	2425	1.605	Plot B1	2.721	Plot B2	≥ 500	Pass
10	2450	1.538	Plot C1	2.692	Plot C2	≥ 500	Pass

**B. Test Plots:**

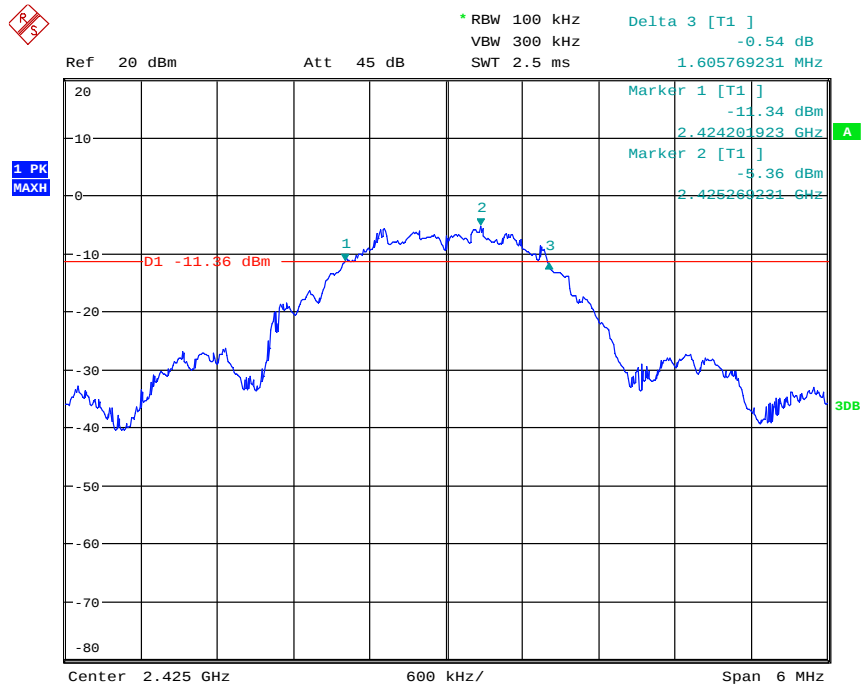
Date: 31.AUG.2016 18:39:25

(Plot A1:Channel 1:2405MHz)



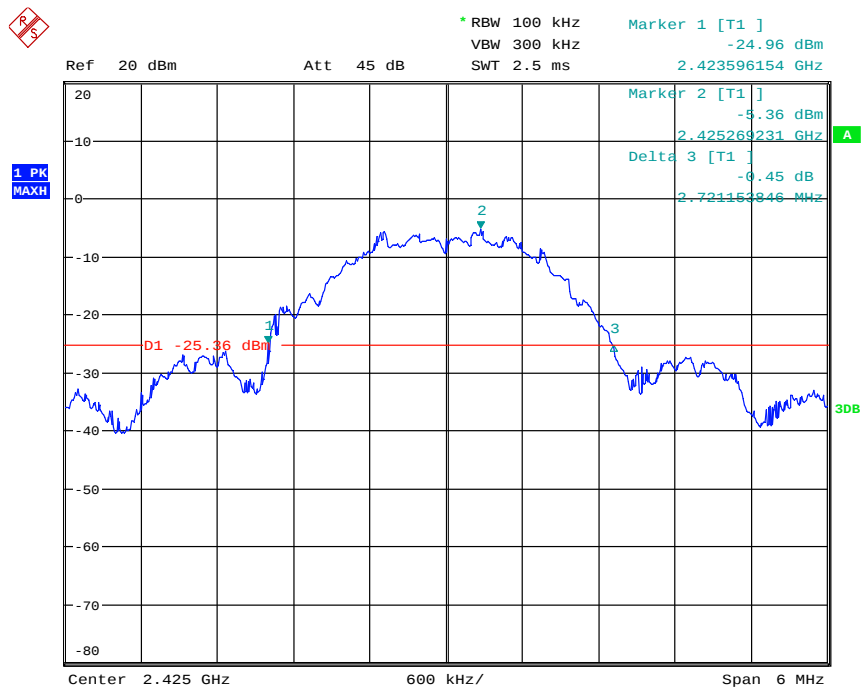
Date: 31.AUG.2016 18:40:08

(Plot A2:Channel 1:2405MHz)



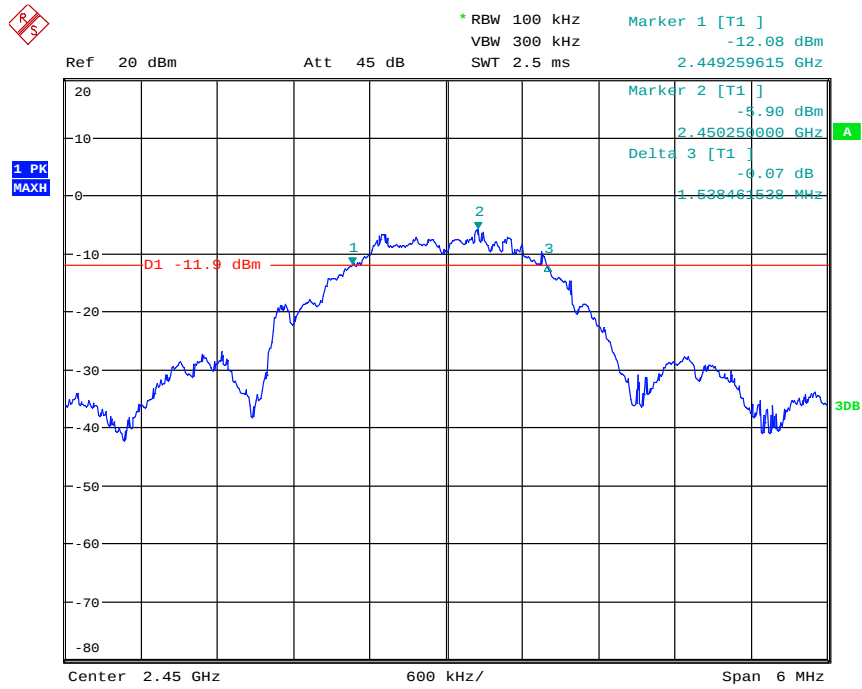
Date: 31.AUG.2016 18:35:06

(Plot B1:Channel 5:2425MHz)



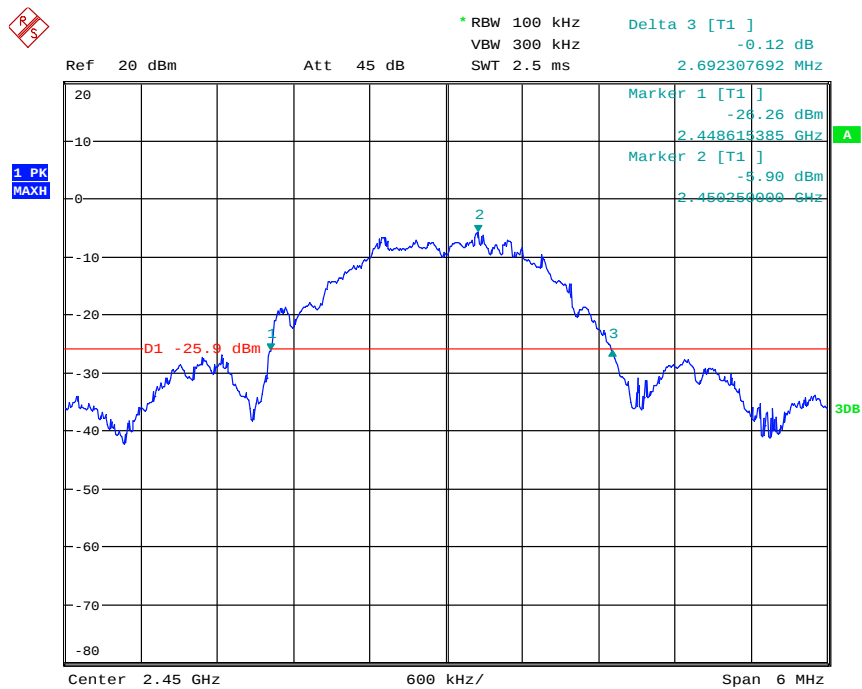
Date: 31.AUG.2016 18:36:04

(Plot B2:Channel 5:2425MHz)



Date: 31.AUG.2016 18:37:49

(Plot C1:Channel 10:2450MHz)



Date: 31.AUG.2016 18:37:12

(Plot C2:Channel 10:2450MHz)



6.4 Conducted Spurious Emissions

6.4.1 Requirement

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

6.4.2 Test Description

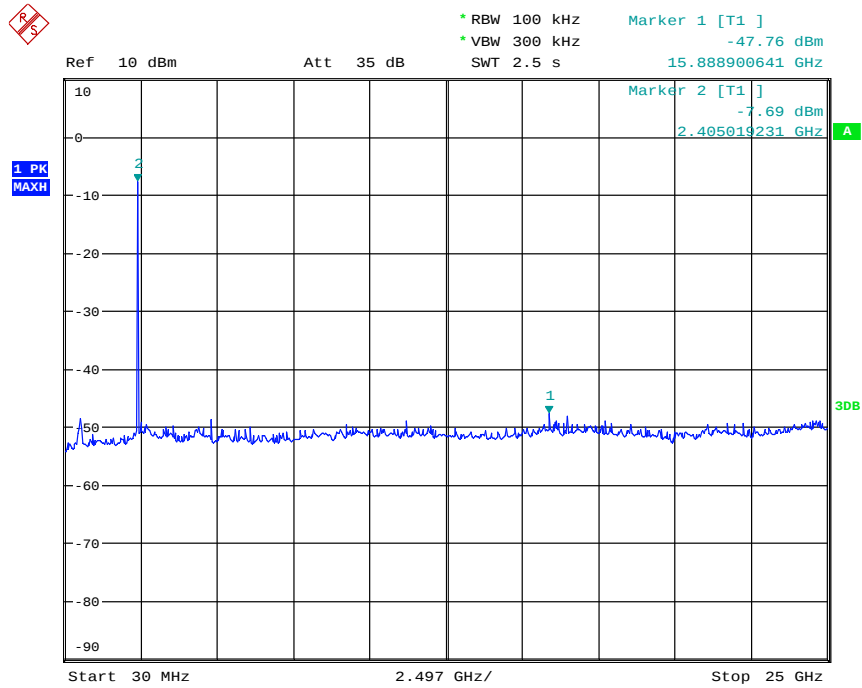
See section 5.1.2 of this report.

6.4.3 Test Result

The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

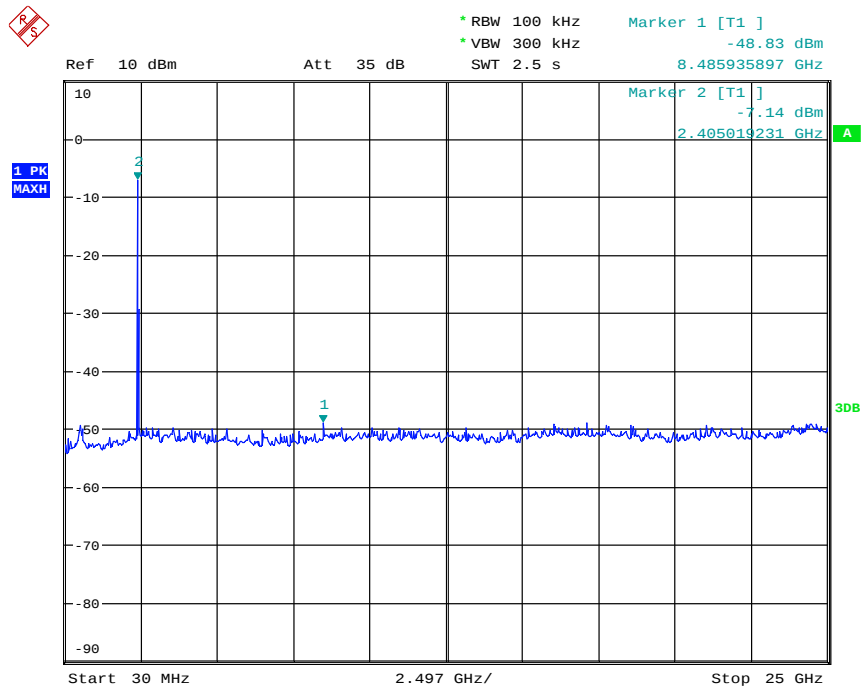
A. Test Verdict:

Channel	Frequency (MHz)	Measured max out of band emission(dBm)	Refer to plot	Limit(dBm)		Result
				Carrier level	Calculated 20dBc limit	
1	2405	-47.76	Plot A	-7.69	-27.69	Pass
5	2425	-48.83	Plot B	-7.14	-27.14	Pass
10	2450	-49.42	Plot C	-9.15	-29.15	Pass

**B. Test Plot:**

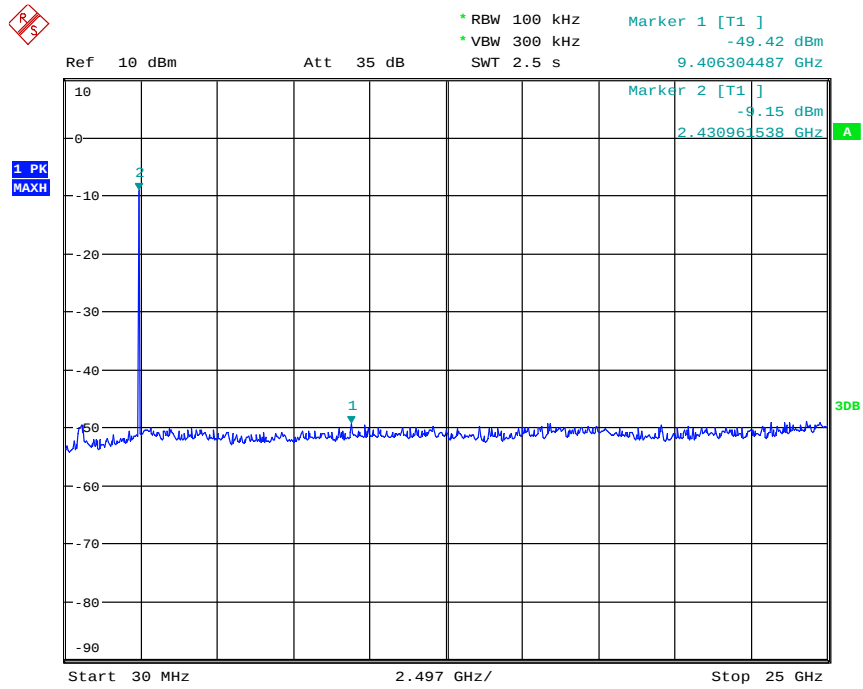
Date: 27.MAY.2016 14:40:04

(Plot A:Channel 1:2405MHz 30MHz~25GHz)



Date: 27.MAY.2016 14:41:11

(PlotB: Channel 5:2425MHz 30MHz~25GHz)



Date: 27.MAY.2016 14:42:37

(PlotC: Channel 10:2450MHz 30MHz~25GHz)



6.5 Power Spectral Density (PSD)

6.5.1 Requirement

According to FCC section 15.247(e), the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used

6.5.2 Test Description

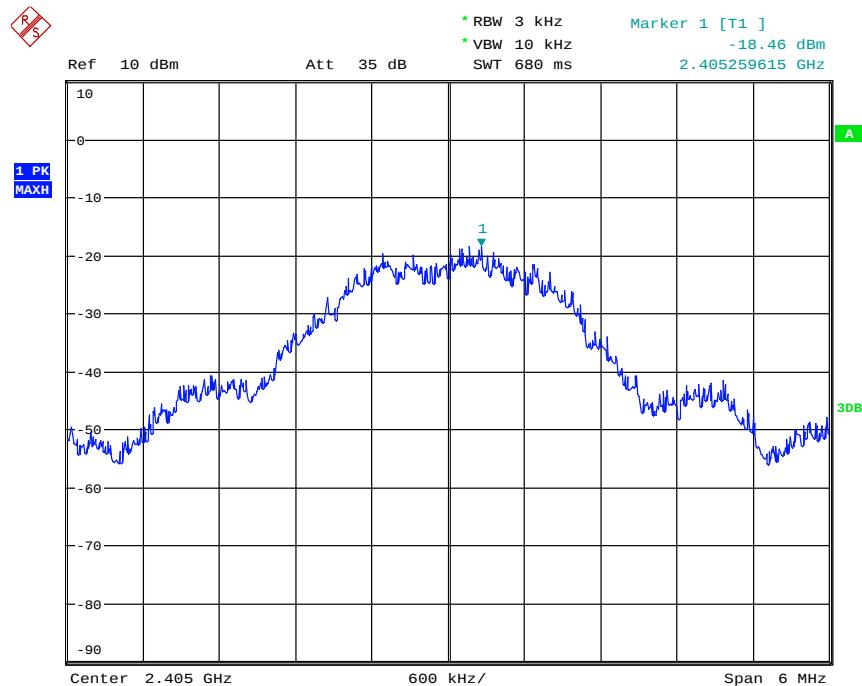
See section 5.1.2 of this report.

6.5.3 Test Result

A. Test Verdict

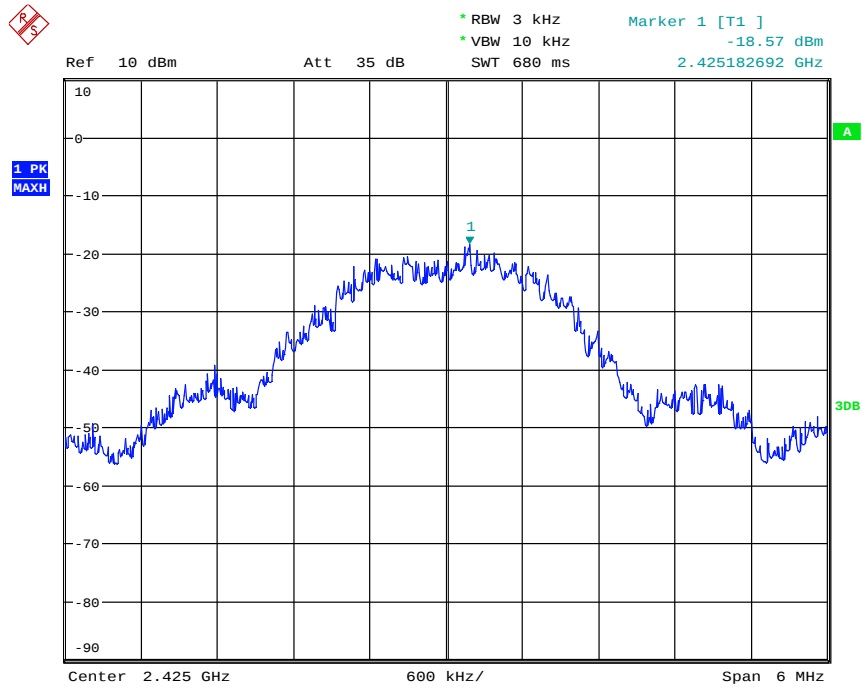
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to plot	Limit (dBm/3kHz)	Result
0	2405	-18.46	Plot A	8	Pass
19	2425	-18.57	Plot B	8	Pass
39	2450	-18.66	Plot C	8	Pass

B. Test Plot



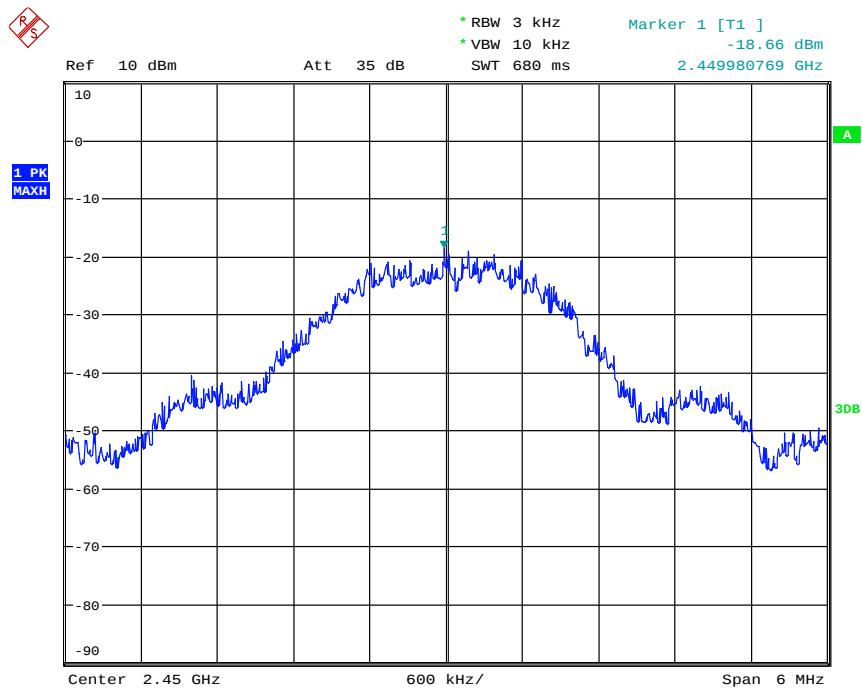
Date: 27.MAY.2016 14:44:43

(Plot A: Channel 1, 2405MHz)



Date: 27.MAY.2016 14:45:19

(Plot B: Channel 5, 2425MHz)



Date: 27.MAY.2016 14:43:50

(Plot C: Channel 10, 2450MHz)



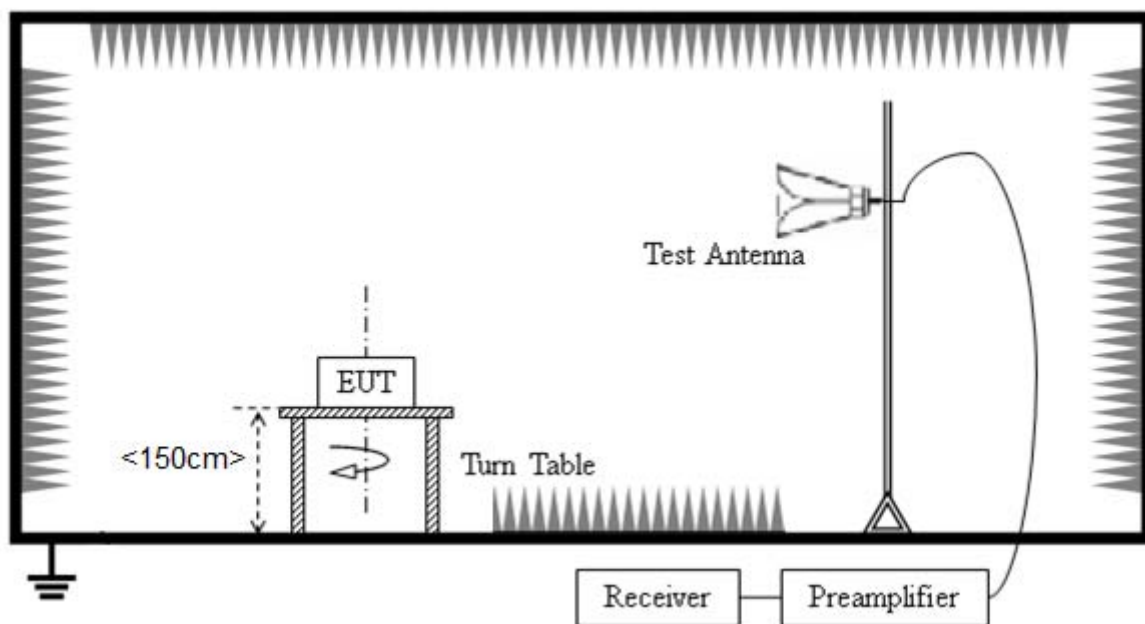
6.6 Band Edge

6.6.1 Requirement

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

6.6.2 Test Description

A. Test Setup



The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

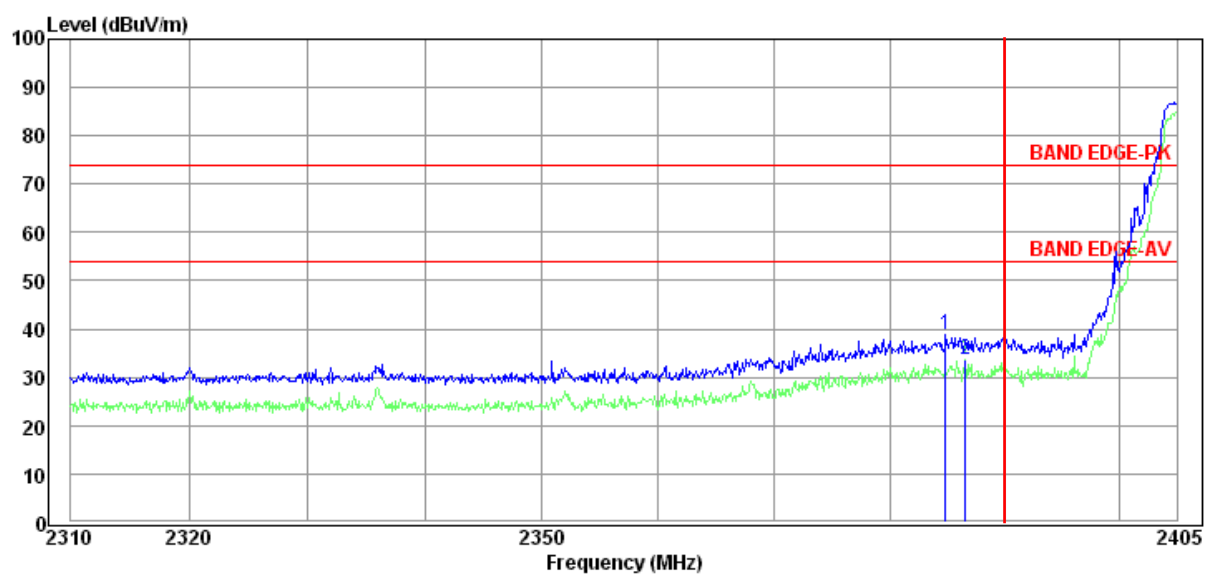
For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

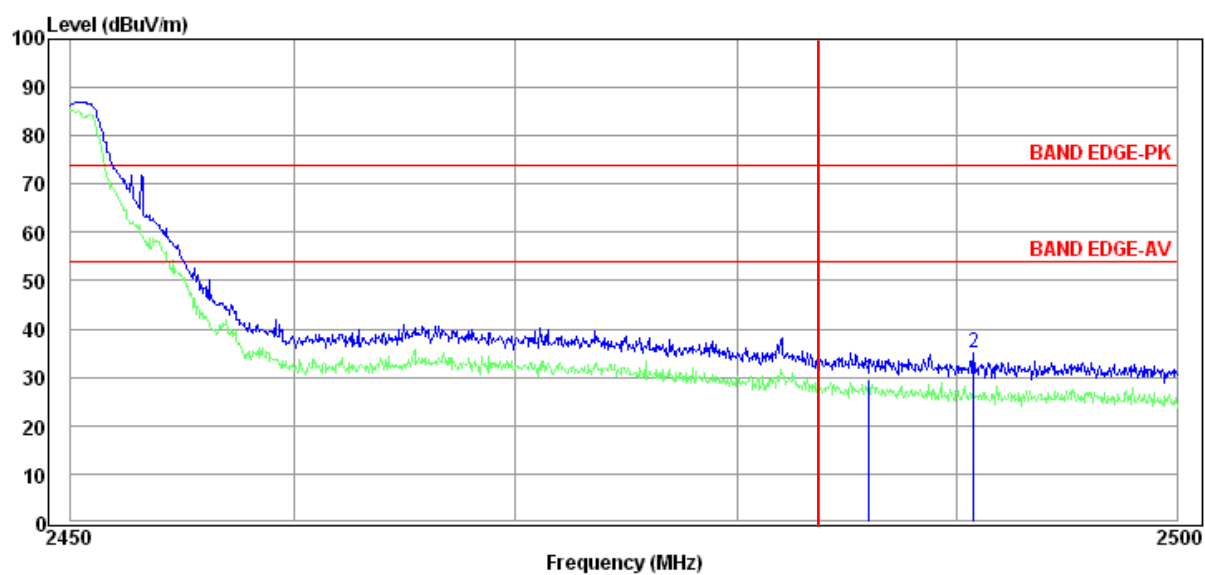


6.6.3 Test Result

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2384.83	PK	38.82	74	Plot A	Pass
1	2386.56	AV	33.59	54		Pass
10	2490.72	PK	35.05	74	Plot B	Pass
10	2486.00	AV	29.41	54		Pass



(Plot A Channel 1)



(Plot B Channel 10)



6.7 Conducted Emission

6.7.1 Requirement

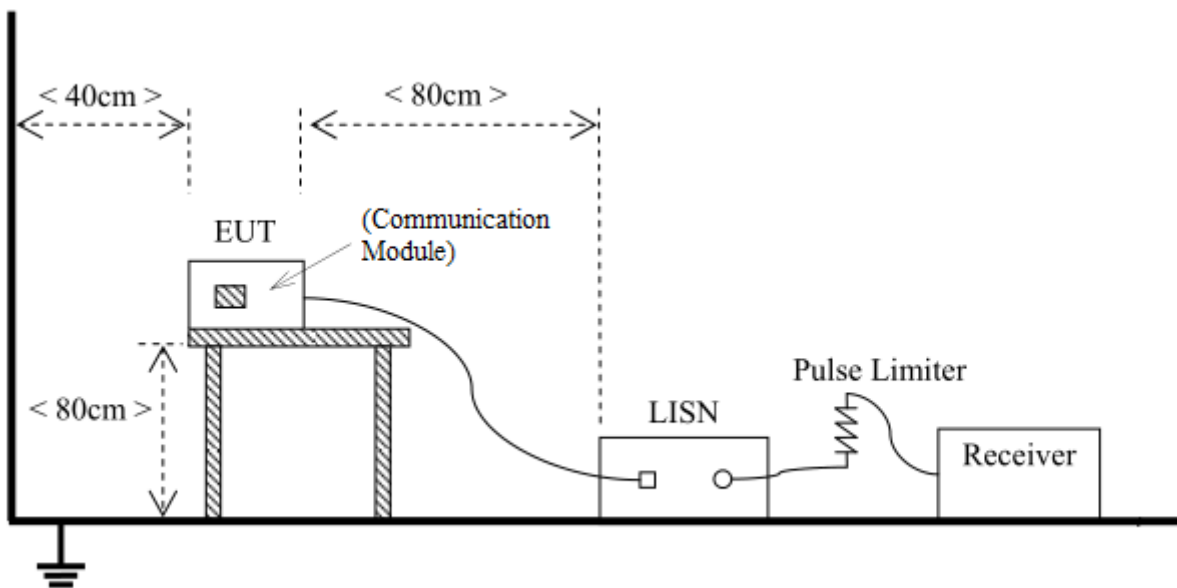
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network(LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

6.7.2 Test Description



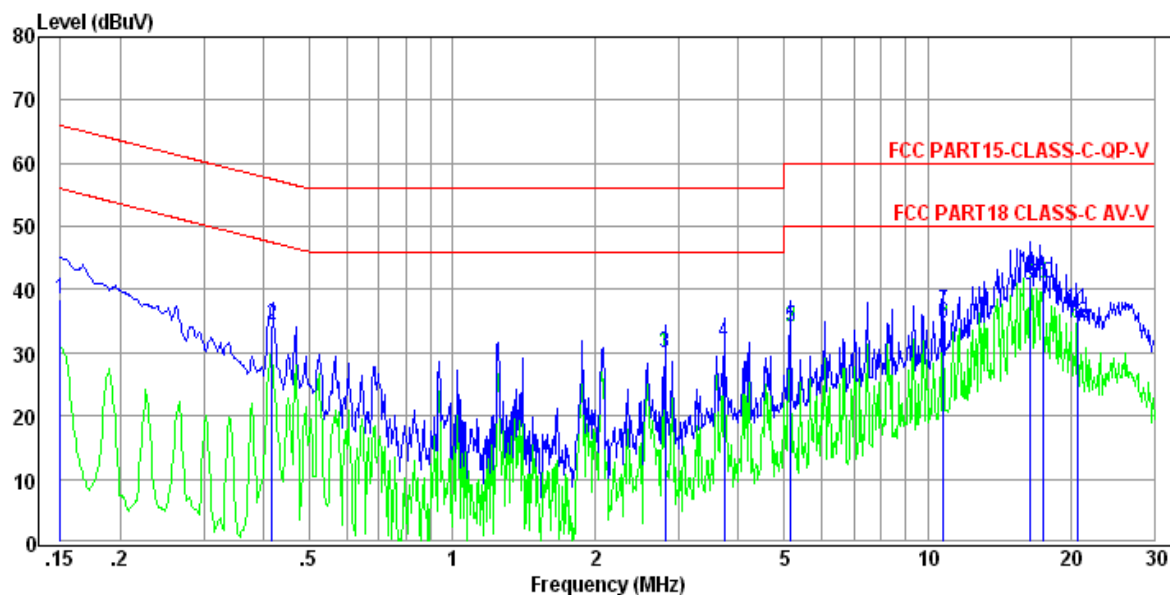
The EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. Power supplier is setting to 120V/60Hz. EUT is setting to continuous transmission mode. The set-up and test methods were according to ANSI C63.10:2013



6.7.3 Test result

1) Test Result of “L” line-120V:

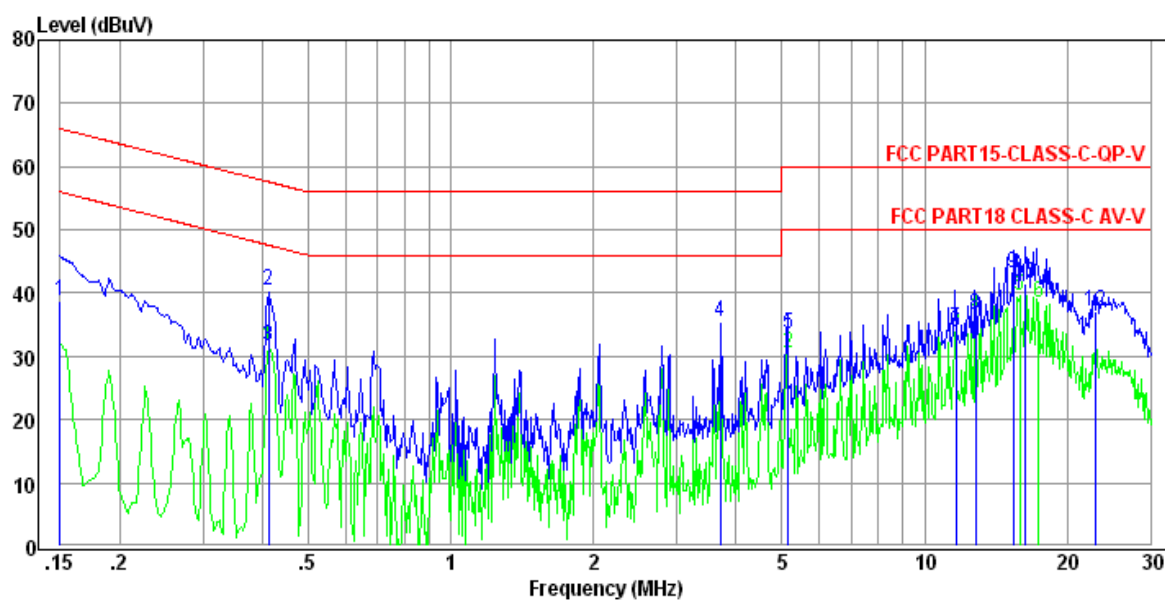
No.	Freq MHz	Level dB μ V	Limit dB μ V	Margin dB	Detector
1	0.15	38.53	66.00	27.47	QP
2	0.42	34.43	57.49	23.06	QP
3	2.81	30.04	46.00	15.96	Average
4	3.75	31.63	56.00	24.37	QP
5	5.16	34.02	50.00	15.98	Average
6	10.79	34.59	50.00	15.41	Average
7	10.82	36.50	60.00	23.50	QP
8	16.38	42.81	60.00	17.19	QP
9	16.45	40.12	50.00	5.88	Average
10	17.52	40.89	50.00	9.11	Average
11	20.63	36.86	60.00	23.14	QP
12	20.63	34.74	50.00	15.26	Average





2) Test Result of “N” line-120V:

No.	Freq MHz	Level dB μ V	Limit dBuV	Margin dB	Detector
1	0.15	38.83	66.00	27.17	QP
2	0.41	40.51	57.58	17.07	QP
3	0.41	31.56	47.57	16.01	Average
4	3.71	35.58	56.00	20.42	QP
5	5.16	33.65	50.00	16.35	Average
6	11.64	33.75	50.00	16.25	Average
7	11.66	34.44	60.00	25.56	QP
8	12.80	36.55	50.00	13.45	Average
9	15.39	43.22	50.00	6.78	Average
10	16.30	39.54	50.00	10.46	Average
11	16.35	41.81	60.00	19.19	QP
12	23.04	37.24	60.00	22.76	QP



Note:

The worst case (Channel 1:2405MHz) is recorded in the report.



6.8 Radiated Emission

6.8.1 Requirement

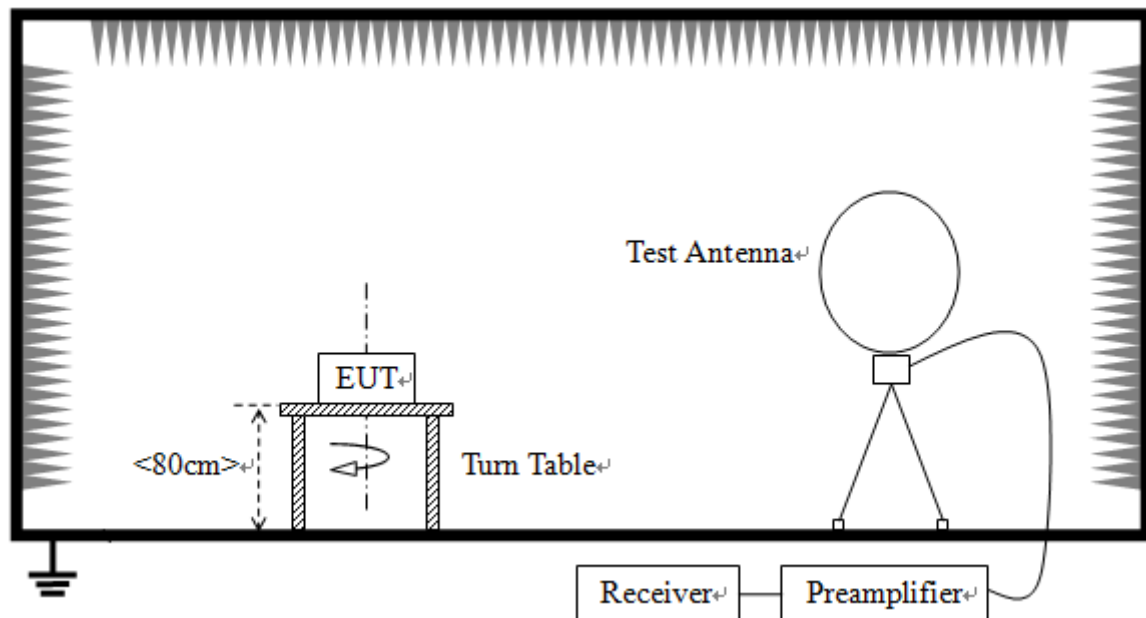
According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

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

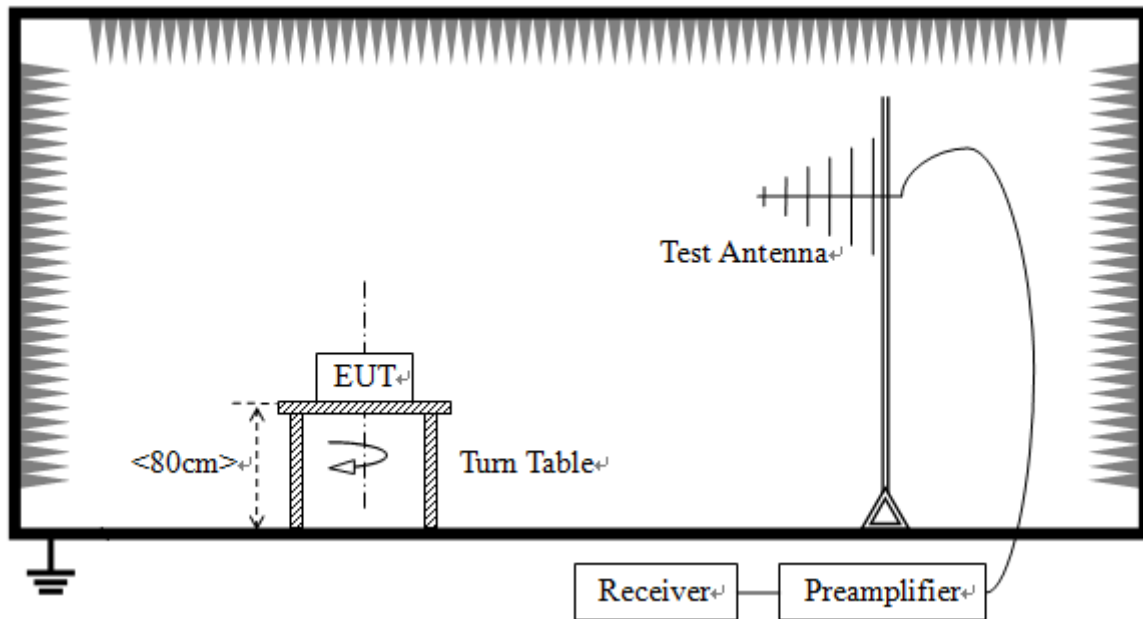
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)	Limit($\text{dB}\mu\text{V/m}$)	Detector
0.009-0.490	2400/F(kHz)	300	/	/
0.490-1.705	24000/F(kHz)	30	/	/
1.705-30	30	30	/	/
30 - 88	100	3	40	QP
88 - 216	150	3	43.5	QP
216 - 960	200	3	46	QP
960 - 1000	500	3	54	QP
Above 1000	500	3	54	AV

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

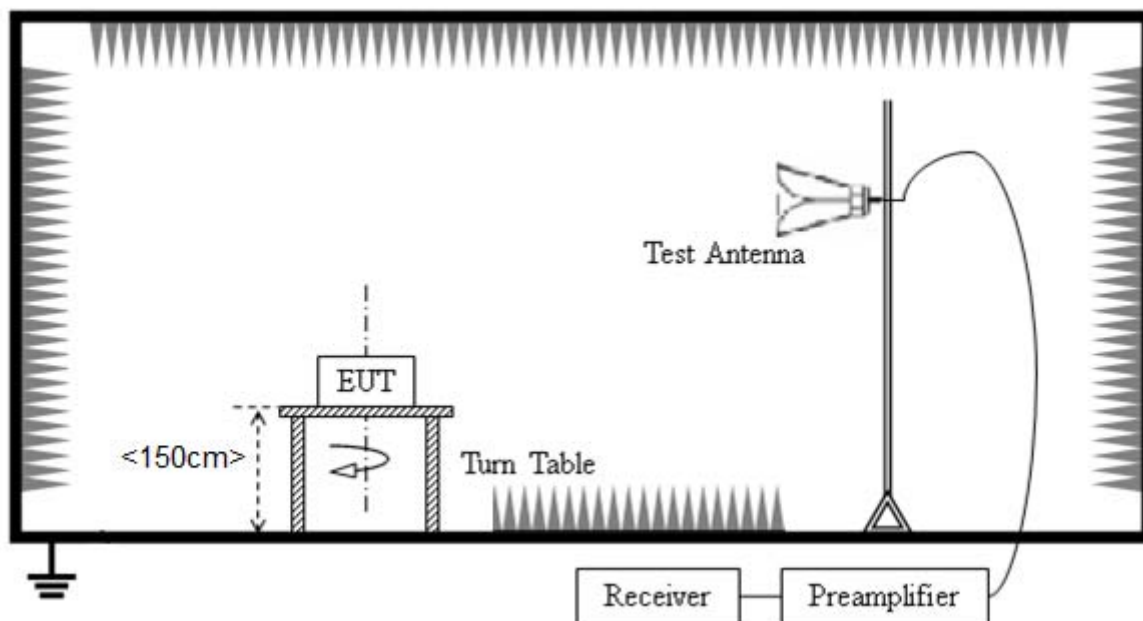
6.8.2 Test setup



Radiated Emissions Below 30MHz



Radiated Emissions 30-1000MHz



Radiated Emissions above 1000MHz

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For 30 to 1000MHz, the EUT was set-up on insulator 80cm above the Ground Plane. For above 1000MHz, the EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the EUT set to transmit at maximum power.

For the Test Antenna: In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz)



and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength, the azimuth range of turntable was 0o to 360o, the receive antenna has two polarizations horizontal and vertical. When doing measurements above 1GHz, the EUT was placed within the 3dB beam width range of the horn antenna, and the EUT was tested in 3 orthogonal positions as recommended in ANSI C63.10 for Radiated Emissions and the worst-case data was presented.

6.8.3 Test Result Test Result

A. Test Result for 9kHz~30MHz

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
--	--	20	--	See Note

Note:

- The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.*
- Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);*
- Limit line = specific limits (dBuV) + distance extrapolation factor.*

B. Test Result for above 30MHz ~ 10th Harmonic

Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector	Result
97.46	31.26	43.50	12.24	Horizontal	PK	PASS
176.27	38.94	43.50	4.56	Horizontal	PK	PASS
251.18	29.98	46.00	16.02	Horizontal	PK	PASS
1166.60	30.68	54.00	23.32	Horizontal	AV	PASS
1231.02	34.01	54.00	19.99	Horizontal	AV	PASS
1423.30	28.16	54.00	25.84	Horizontal	AV	PASS
1551.13	23.75	54.00	30.25	Horizontal	AV	PASS
4810.32	31.82	54.00	22.18	Horizontal	AV	PASS
7215.66	33.63	54.00	20.37	Horizontal	AV	PASS
98.14	35.99	43.50	7.51	Vertical	PK	PASS
176.27	39.96	43.50	3.54	Vertical	PK	PASS
279.04	27.91	46.00	18.09	Vertical	PK	PASS
1135.66	30.15	54.00	23.85	Vertical	AV	PASS
1231.02	32.49	54.00	21.51	Vertical	AV	PASS
1327.24	29.91	54.00	24.09	Vertical	AV	PASS
1454.23	26.88	54.00	27.12	Vertical	AV	PASS
1616.38	25.10	54.00	28.90	Vertical	AV	PASS
4810.32	38.51	54.00	15.49	Vertical	AV	PASS
7215.66	33.57	54.00	20.43	Vertical	AV	PASS

Note:

The worst case (Channel 1:2405MHz) is recorded in the report.

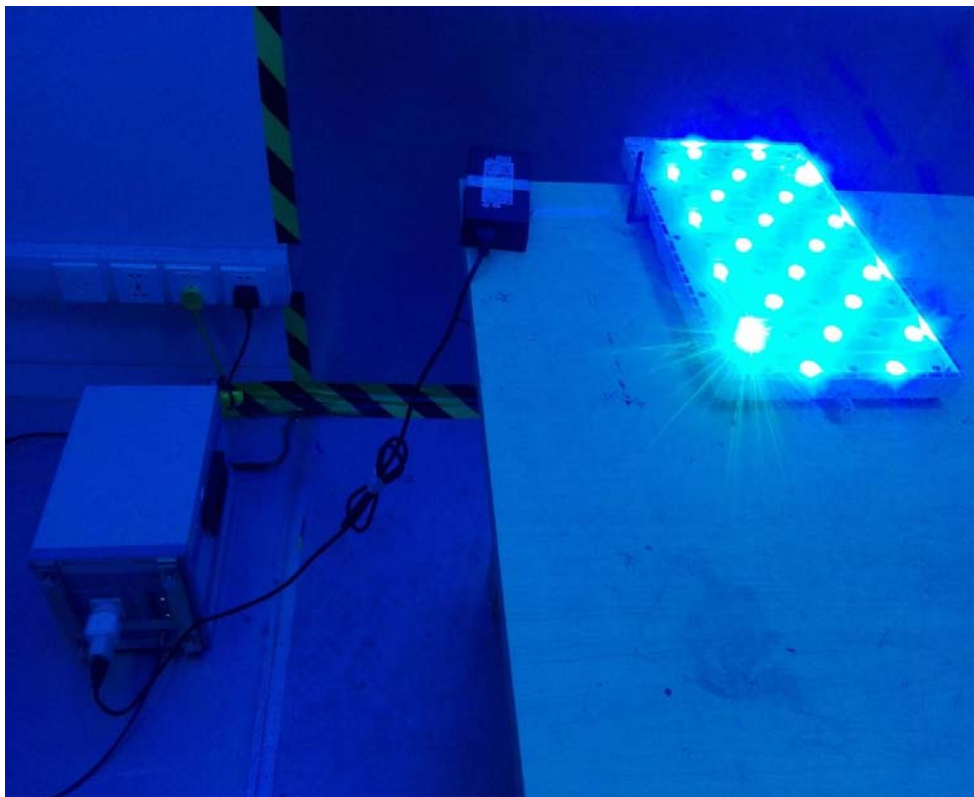
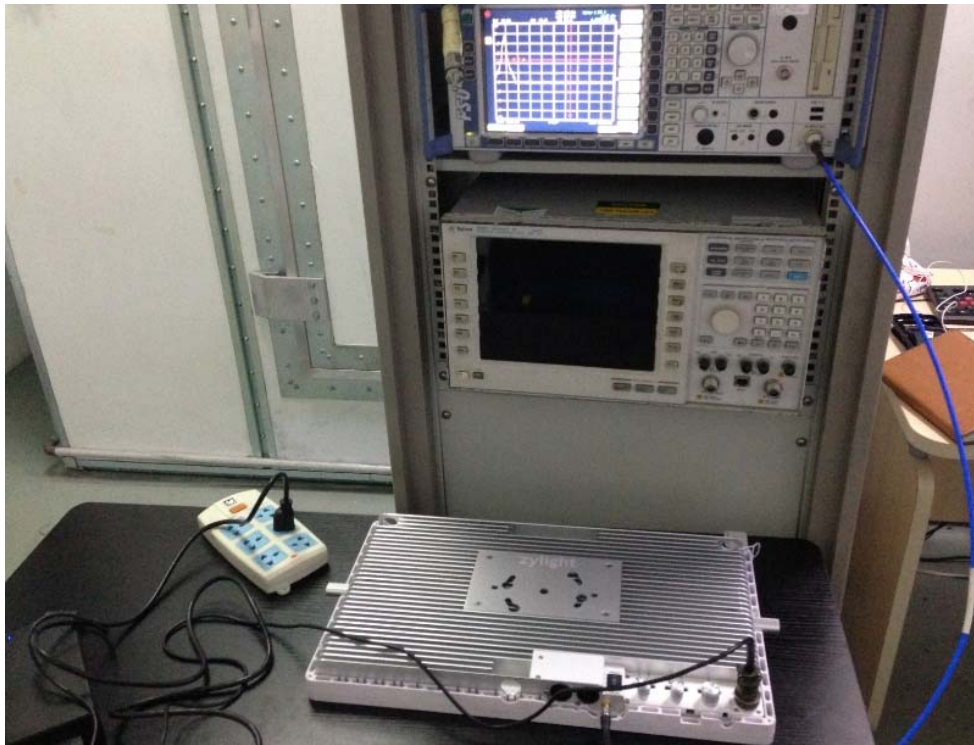


Annex A Photos of the EUT





Annex B Photos of Setup





**** END OF REPORT ****