FCC PART 15.247

TEST REPORT

For

LUCIS TECHNOLOGIES (SHANG HAI) CO., LTD

No.57.East Caohejing.Building Lucis XuHui District, Shanghai.200235.China

FCC ID: 2AEONNUBRYTELINK

Report Type:	**Product Type:**
Original Report	Nubryte Link

Test Engineer:	Chris Wang
Report Number:	RKS170228002-00C
Report Date:	2017-03-15
Reviewed By:	Oscar Ye RF Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Manufacturer	LUCIS TECHNOLOGIES (SHANG HAI) CO., LTD
Tested Model	NUBRYTE
Product Type	Nubryte Link
Dimension	84.0 mm(L)×59.1 mm(W)×50.5 mm(H)
Power Supply	AC 120V

**All measurement and test data in this report was gathered from production sample serial number: 20170302002. (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-03-02)*

Objective

This report is prepared on behalf of LUCIS TECHNOLOGIES (SHANG HAI) CO., LTD in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB558074 D01 DTS Meas Guidance v03r05.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road,Kunshan,Jiangsu province,China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For Zigbee mode, 3 channels are provided for testing:

Low Channel: 2405MHz, Middle Channel: 2445MHz, High Channel: 2480 MHz

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Dbgview

The worst case was performed under:
Zigbee : Power level: 4

Support Equipment List and Details

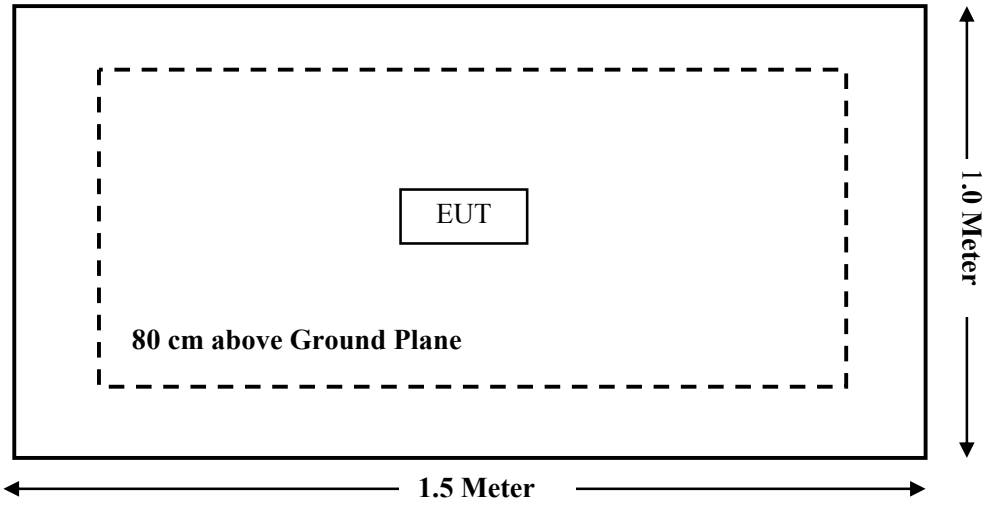
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

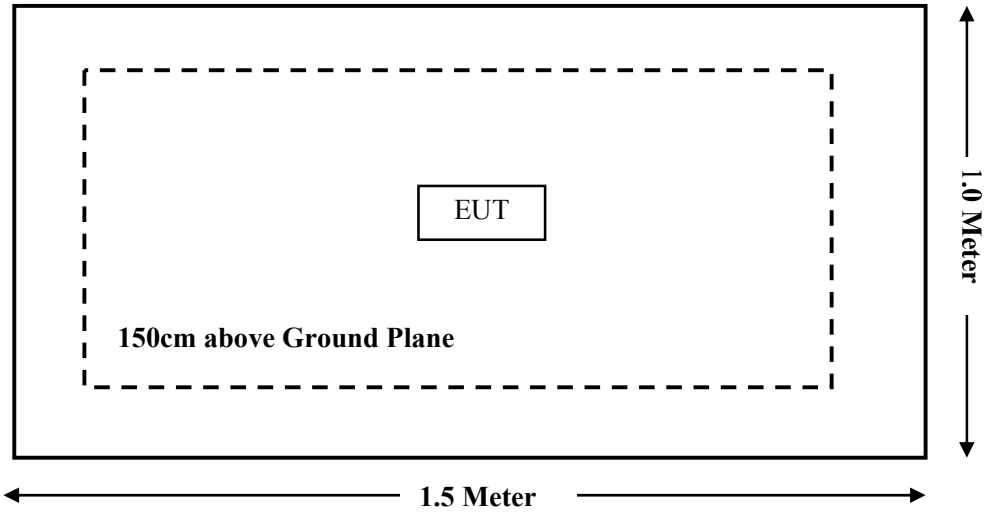
Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
R&S	Auto test Software	EMC32	100361	/	/
Haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-11
RF Conducted Test					
Rohde & Schwarz	OSP120 Base Unit	OSP120	101247	2016-07-04	2017-07-03
BACL	EMC32 Version	EMC32	09106	--	--
Rohde & Schwarz	SMBV100A Vector Signal Generator	SMBV100A	261558	2016-07-04	2017-07-03
Rohde & Schwarz	SMB 100A Signal Generator	SMB100A	110390	2016-07-04	2017-07-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-20
Agilent	Power Meter	N1912A	MY5000492	2016-11-18	2017-11-17
Agilent	Power Sensor	N1921A	MY54210024	2016-11-18	2017-11-17
LUCIS	RF Cable	N/A	N/A	2017-03-09	2018-03-08
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2016-11-25	2017-11-24
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-09
Rohde & Schwarz	LISN	ENV216	3560655016	2016-11-25	2017-11-24
Rohde & Schwarz	CE Test software	EMC32	100357	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2016-09-08	2017-09-07

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1310& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/		f/1500	30
1500-100,000	/		1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;
According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency Range	Antenna Gain		Output Power		Evaluation Distance	Power Density	MPE Limit
	(MHz)	(dBi)	(numeric)	(dBm)	(mW)	(cm)	(mW/cm^2)	(mW/cm^2)
802.11b	2412-2462	0.0	1.00	24.00	251.19	20	0.0500	1.0
802.11g	2412-2462	0.0	1.00	22.50	177.83	20	0.0354	1.0
802.11n HT20	2412-2462	0.0	1.00	22.00	158.49	20	0.0315	1.0
Zigbee	2405-2480	0.0	1.00	5.00	3.16	20	0.0006	1.0

Note: (1) The target output power:

802.11b: 23.5±0.5dBm, which declared by the Manufacturer.

802.11g: 22±0.5dBm, which declared by the Manufacturer.

802.11n HT20: 21.5±0.5dBm, which declared by the Manufacturer.

Zigbee: 4±1dBm, which declared by the Manufacturer.

(2) The EUT has the 2.4G Wi-Fi, Zigbee functions, they can transmitting simultaneously. According to KDB 447498 D01 General RF Exposure Guidance v06 and test data, the 2.4G Wi-Fi (802.11b), Zigbee mode is the worst case, their sum of MPE ratio is 0.0506 which is less than 1.0,so the collocation exposure exclusion applies.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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. 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has a microstrip antenna arrangement for Zigbee, which the antenna gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

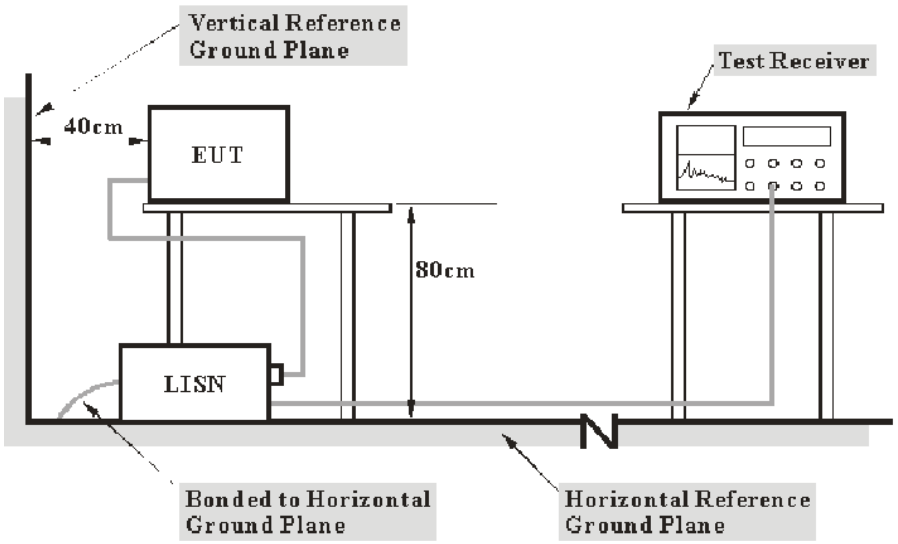
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

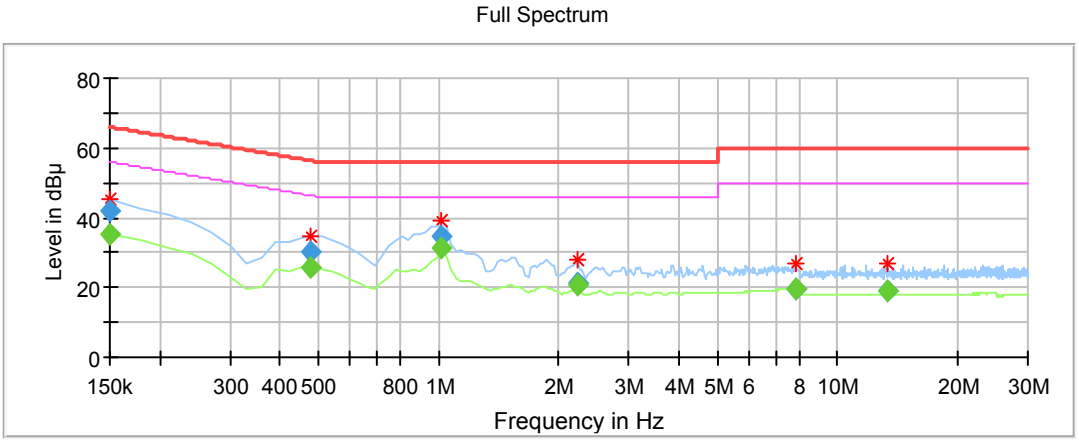
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	55 %
ATM Pressure:	101.1kPa

The testing was performed by Chris Wang on 2017-03-13.

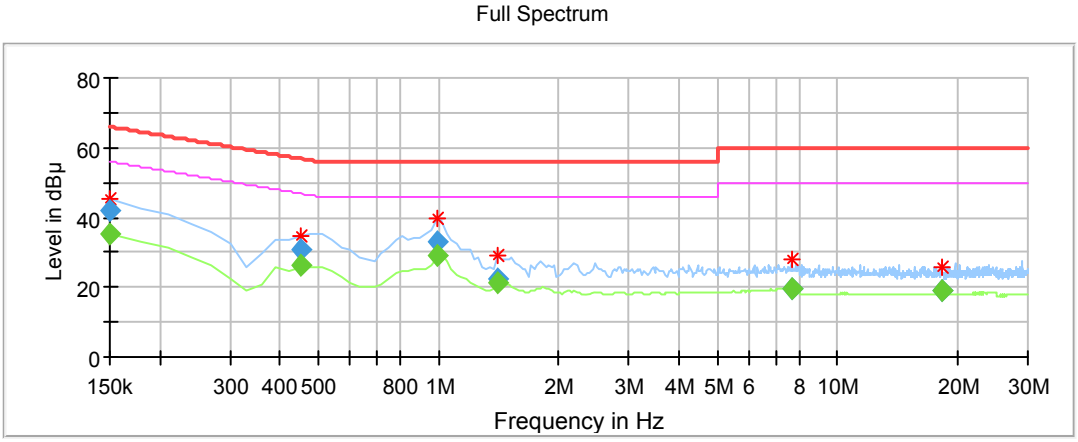
EUT operation mode: Transmitting in middle channel(Worst case).

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	---	35.23	9.000	L1	10.0	20.77	56.00	Compliance
0.150000	41.71	---	9.000	L1	10.0	24.29	66.00	Compliance
0.480000	---	25.95	9.000	L1	9.9	20.39	46.34	Compliance
0.480000	30.48	---	9.000	L1	9.9	25.86	56.34	Compliance
1.020000	---	31.13	9.000	L1	9.8	14.87	46.00	Compliance
1.020000	34.61	---	9.000	L1	9.8	21.39	56.00	Compliance
2.220000	---	20.52	9.000	L1	9.8	25.48	46.00	Compliance
2.220000	21.41	---	9.000	L1	9.8	34.59	56.00	Compliance
7.830000	---	19.60	9.000	L1	9.9	30.40	50.00	Compliance
7.830000	19.73	---	9.000	L1	9.9	40.27	60.00	Compliance
13.320000	---	19.13	9.000	L1	10.1	30.87	50.00	Compliance
13.320000	19.06	---	9.000	L1	10.1	40.94	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	---	35.29	9.000	N	10.0	20.71	56.00	Compliance
0.150000	41.85	---	9.000	N	10.0	24.15	66.00	Compliance
0.450000	---	26.09	9.000	N	9.9	20.79	46.88	Compliance
0.450000	30.82	---	9.000	N	9.9	26.06	56.88	Compliance
0.990000	---	29.13	9.000	N	9.8	16.87	46.00	Compliance
0.990000	32.97	---	9.000	N	9.8	23.03	56.00	Compliance
1.410000	---	21.04	9.000	N	9.8	24.96	46.00	Compliance
1.410000	22.61	---	9.000	N	9.8	33.39	56.00	Compliance
7.650000	---	19.74	9.000	N	9.8	30.26	50.00	Compliance
7.650000	19.66	---	9.000	N	9.8	40.34	60.00	Compliance
18.270000	---	18.95	9.000	N	10.1	31.05	50.00	Compliance
18.270000	19.08	---	9.000	N	10.1	40.92	60.00	Compliance

Note:

1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
2) Corrected Amplitude = Reading + Corr.
3) Margin = Limit –Corrected Amplitude

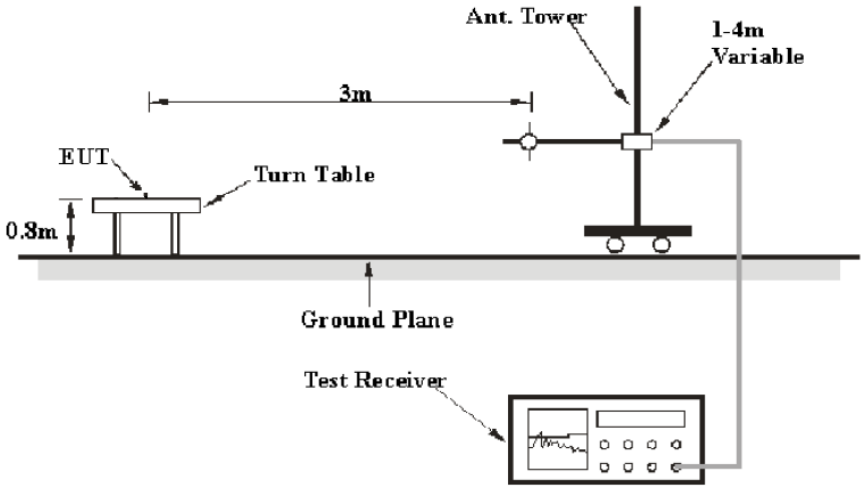
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

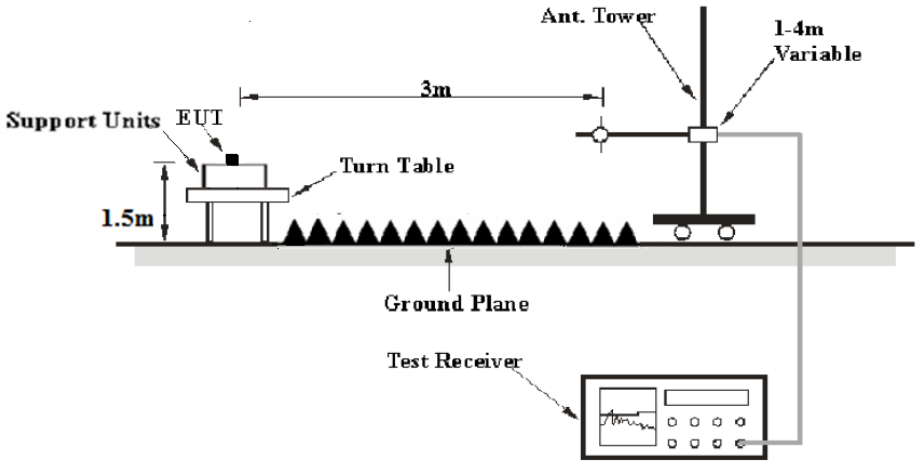
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Frequency Range	RBW	Video B/W	Duty cycle	Detector
1GHz – 25GHz	1MHz	3 MHz	Any	PK
	1MHz	10 Hz	>98%	Ave.
	1MHz	1/T	<98%	

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	54 %
ATM Pressure:	101.2kPa

The testing was performed by Chris Wang on 2017-03-09.

EUT operation mode: Transmitting

30MHz-25GHz

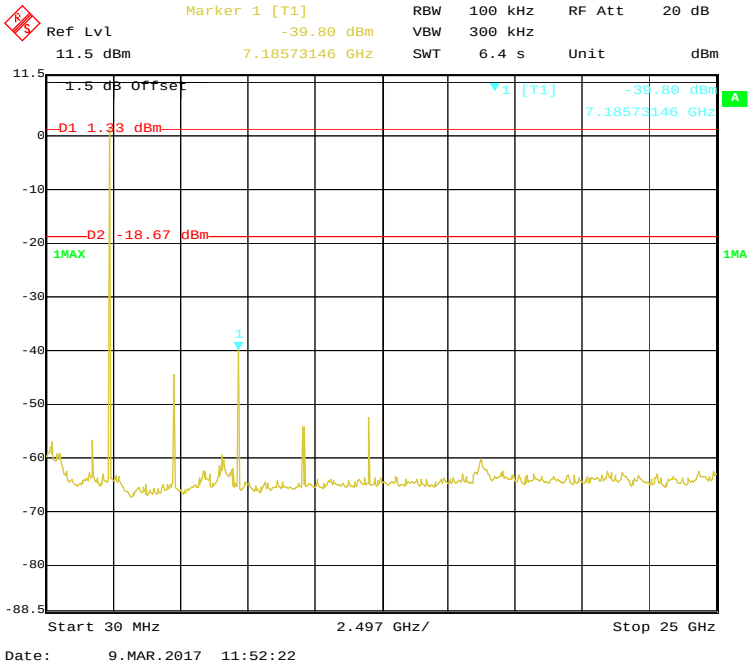
Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2405 MHz)									
50.49	26.59	PK	316	158	V	-16.55	10.04	40.00	29.96
2405.00	105.65	PK	9	219	V	-6.18	99.47	/	/
2405.00	104.23	Ave	316	158	V	-6.18	98.05	/	/
2405.00	100.64	PK	174	228	H	-6.18	94.46	/	/
2405.00	99.23	Ave	174	228	H	-6.18	93.05	/	/
2390.00	50.64	PK	7	139	V	-6.22	44.42	74.00	29.58
2390.00	37.83	Ave	7	139	V	-6.22	31.61	54.00	22.39
2400.00	62.23	PK	334	157	V	-6.19	56.04	74.00	17.96
2400.00	49.50	Ave	334	157	V	-6.19	43.31	54.00	10.69
3991.79	49.62	PK	117	209	H	-0.33	49.29	74.00	24.71
3991.79	29.73	Ave	117	209	H	-0.33	29.40	54.00	24.60
4810.00	63.85	PK	5	238	V	1.63	65.48	74.00	8.52
4810.00	49.32	Ave	5	238	V	1.63	50.95	54.00	3.05
7215.00	47.07	PK	155	111	V	7.56	54.63	74.00	19.37
7215.00	37.14	Ave	155	111	V	7.56	44.70	54.00	9.30

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBµV/m)	(dB µ V/m)	(dB)
Middle Channel (2445 MHz)									
50.49	26.68	PK	83	223	V	-16.55	10.13	40.00	29.87
2445.00	106.19	PK	314	194	V	-6.09	100.10	/	/
2445.00	104.70	Ave	83	223	V	-6.09	98.61	/	/
2445.00	98.82	PK	240	124	H	-6.09	92.73	/	/
2445.00	97.79	Ave	240	124	H	-6.09	91.70	/	/
3006.01	48.30	PK	262	188	H	-3.22	45.08	74.00	28.92
3006.01	35.92	Ave	262	188	H	-3.22	32.70	54.00	21.30
3623.25	52.20	PK	194	194	V	-1.54	50.66	74.00	23.34
3623.25	39.60	Ave	194	194	V	-1.54	38.06	54.00	15.94
4890.00	62.82	PK	307	161	V	1.81	64.63	74.00	9.37
4890.00	48.34	Ave	307	161	V	1.81	50.15	54.00	3.85
5993.99	50.17	PK	115	114	H	4.05	54.22	74.00	19.78
5993.99	33.90	Ave	115	114	H	4.05	37.95	54.00	16.05
7335.00	47.14	PK	292	219	V	7.68	54.82	74.00	19.18
7335.00	37.00	Ave	292	219	V	7.68	44.68	54.00	9.32

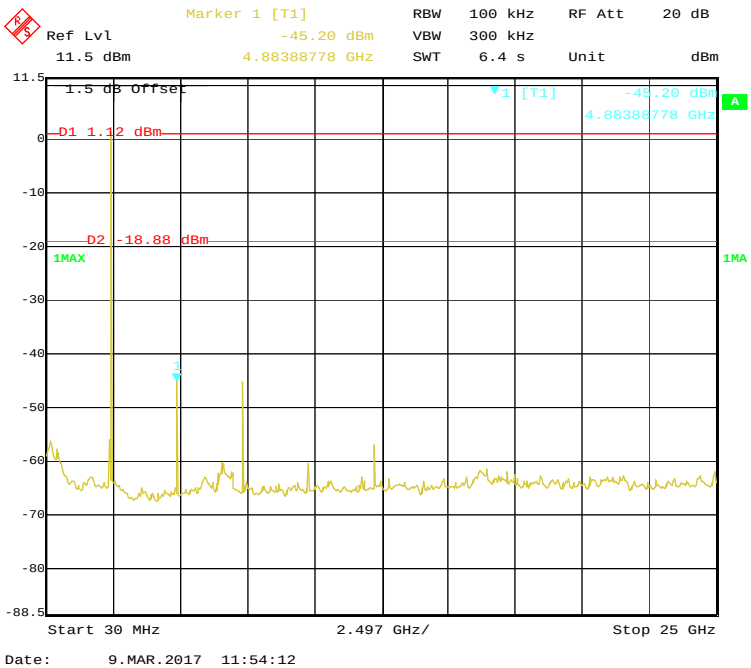
Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBµV/m)	(dB µ V/m)	(dB)
High Channel (2480MHz)									
50.49	26.72	PK	304	178	V	-16.55	10.17	40.00	29.83
2480.00	107.16	PK	56	135	V	-6.01	101.15	/	/
2480.00	105.75	Ave	304	178	V	-6.01	99.74	/	/
2480.00	100.82	PK	29	211	H	-6.01	94.81	/	/
2480.00	99.77	Ave	29	211	H	-6.01	93.76	/	/
2483.50	60.16	PK	34	237	V	-6.01	54.15	74.00	19.85
2483.50	51.99	Ave	34	237	V	-6.01	45.98	54.00	8.02
3637.27	51.61	PK	149	234	V	-1.49	50.12	74.00	23.88
3637.27	39.28	Ave	149	234	V	-1.49	37.79	54.00	16.21
4960.00	59.80	PK	299	125	V	1.97	61.77	74.00	12.23
4960.00	46.80	Ave	299	125	V	1.97	48.77	54.00	5.23
5993.99	49.73	PK	305	174	H	4.05	53.78	74.00	20.22
5993.99	33.90	Ave	305	174	H	4.05	37.95	54.00	16.05
7440.00	47.43	PK	246	149	V	7.79	55.22	74.00	18.78
7440.00	37.69	Ave	246	149	V	7.79	45.48	54.00	8.52

Conducted Spurious Emissions at Antenna Port

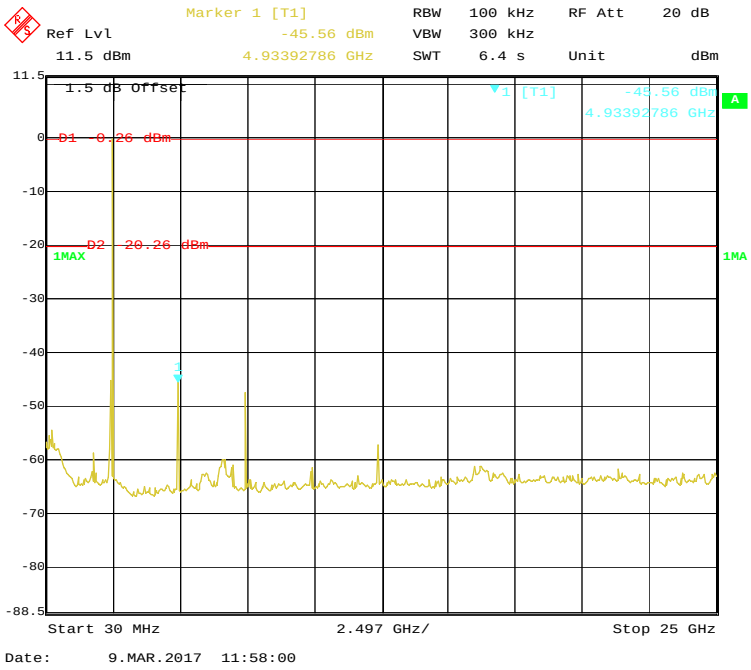
Low Channel



Middle Channel



High Channel



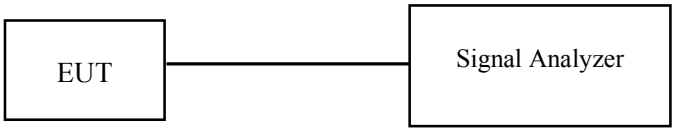
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

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.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2017-03-09.

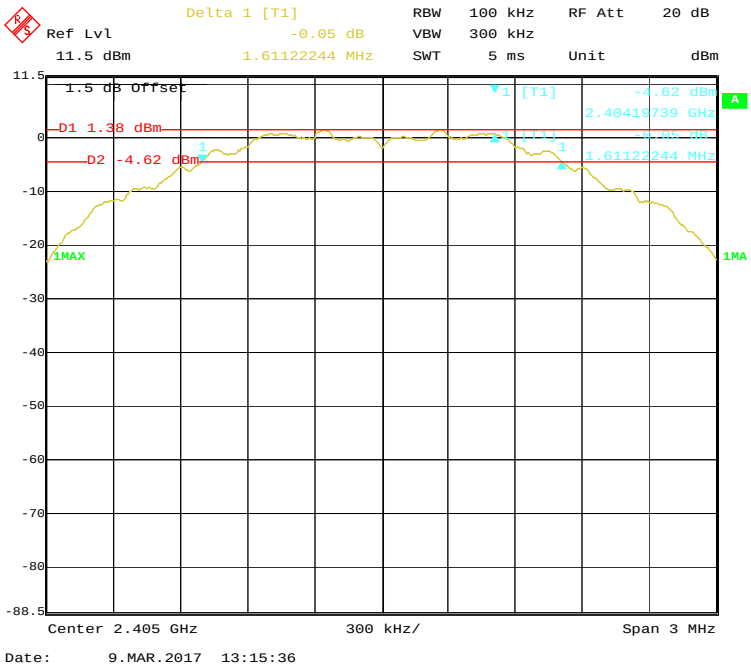
Test Result: Pass.

Please refer to the following tables and plots.

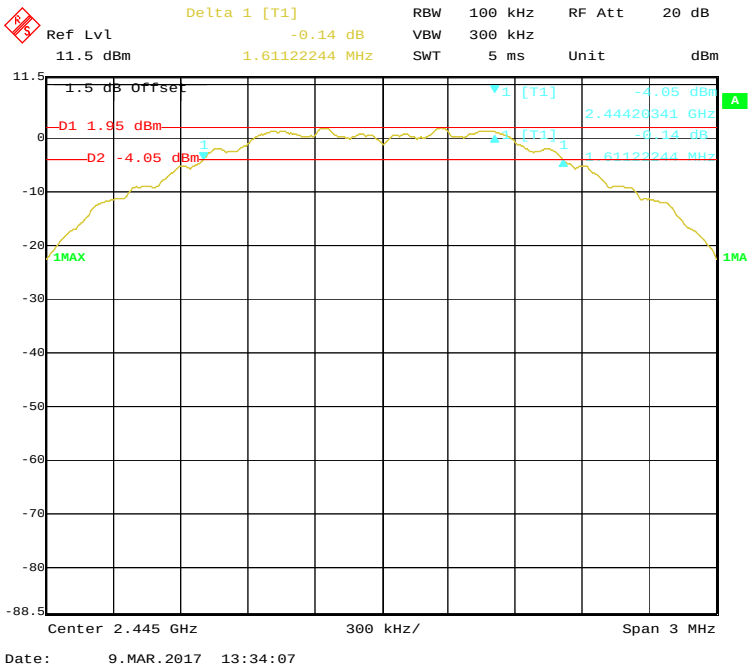
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
Zigbee mode			
Low	2405	1.611	≥0.5
Middle	2445	1.611	≥0.5
High	2480	1.617	≥0.5

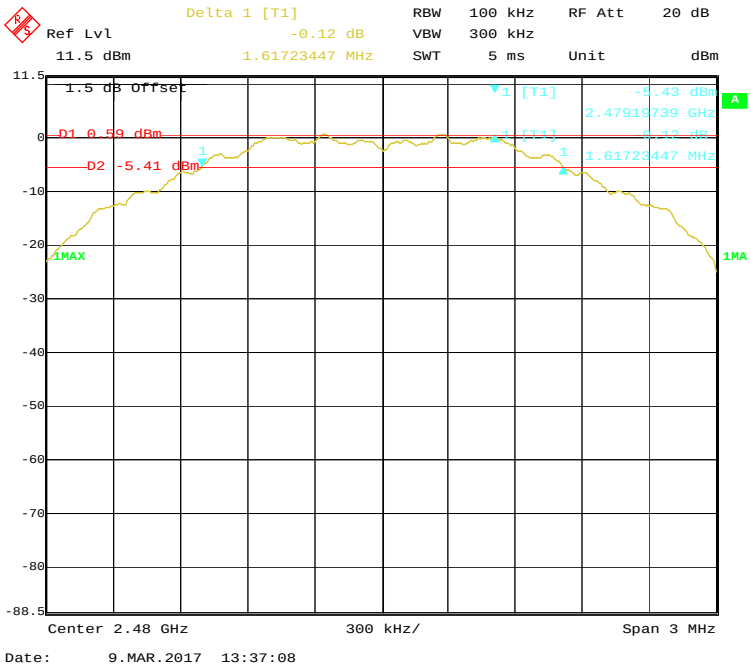
Low Channel



Middle Channel



High Channel



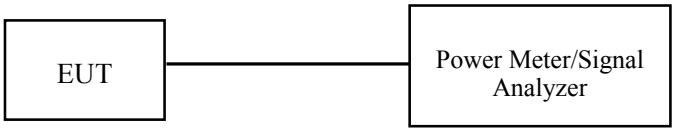
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	23.8℃
Relative Humidity:	54 %
ATM Pressure:	101.2 kPa

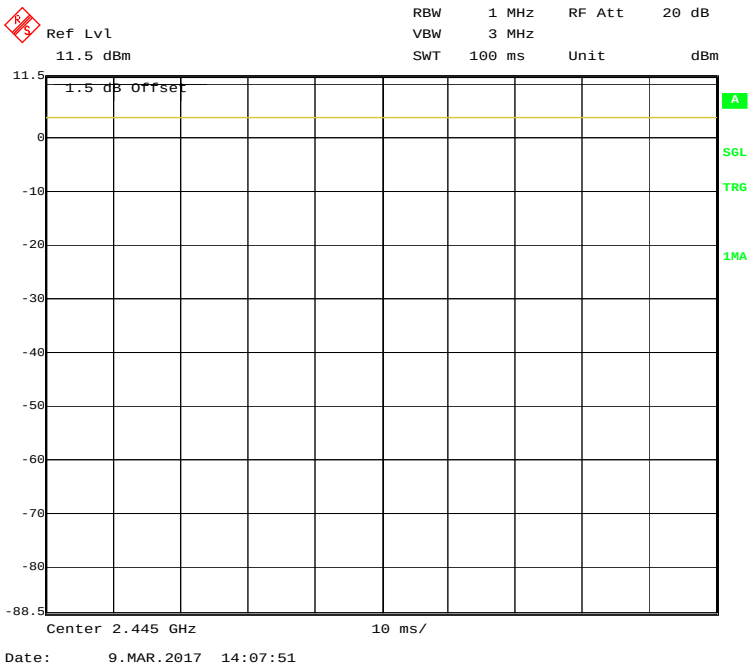
The testing was performed by Chris Wang on2017-03-09.

EUT operation mode: Transmitting

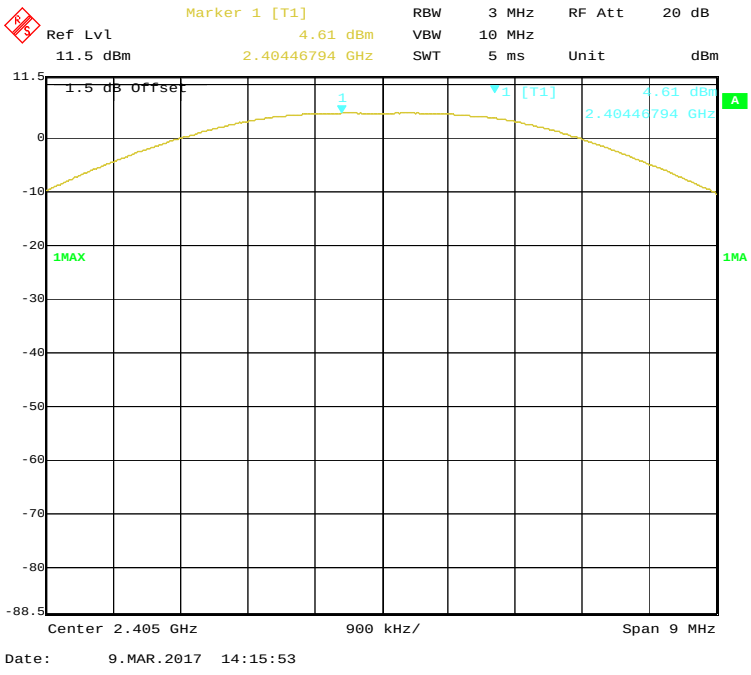
Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Conducted Average Output Power Reading (dBm)	Corrected Factor 10log(1/x) (dB)	Conducted Average Output Power (dBm)	Limit (dBm)	Result
Low	2405	4.61	3.14	0	3.14	30	Pass
Middle	2445	4.90	3.37	0	3.37	30	Pass
High	2480	3.56	2.22	0	2.22	30	Pass

Note: x is the duty cycle. x=1.0.
Conducted Average Output Power= Reading+ Corrected Factor
Peak Output Power was tested by Signal Analyzer, Average Output Power was tested by Power Meter.
The reading value is reading from the test software.

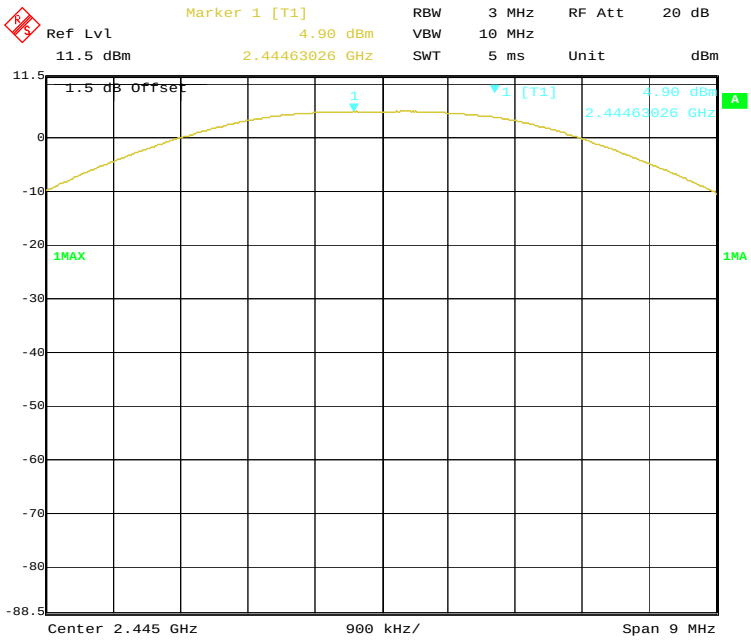
Middle Channel duty cycle



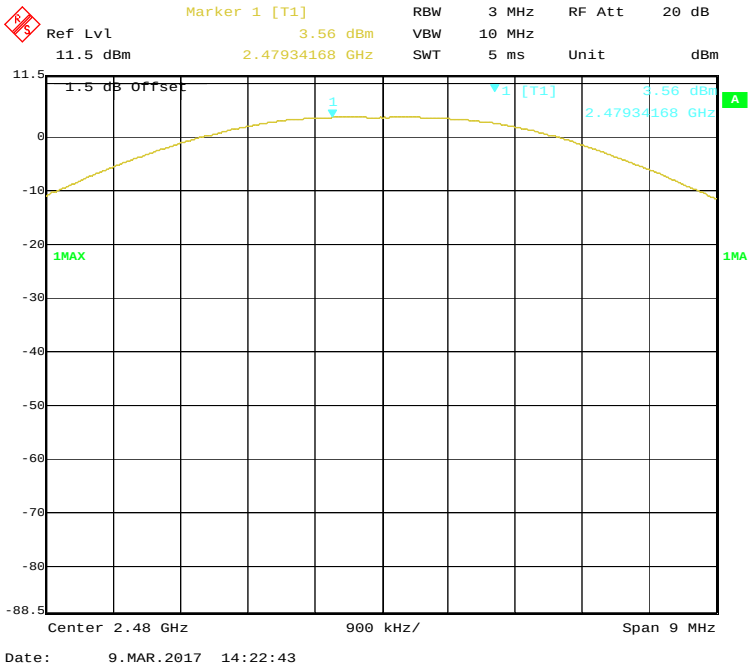
Low Channel power



Middle Channel power



High Channel power



FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

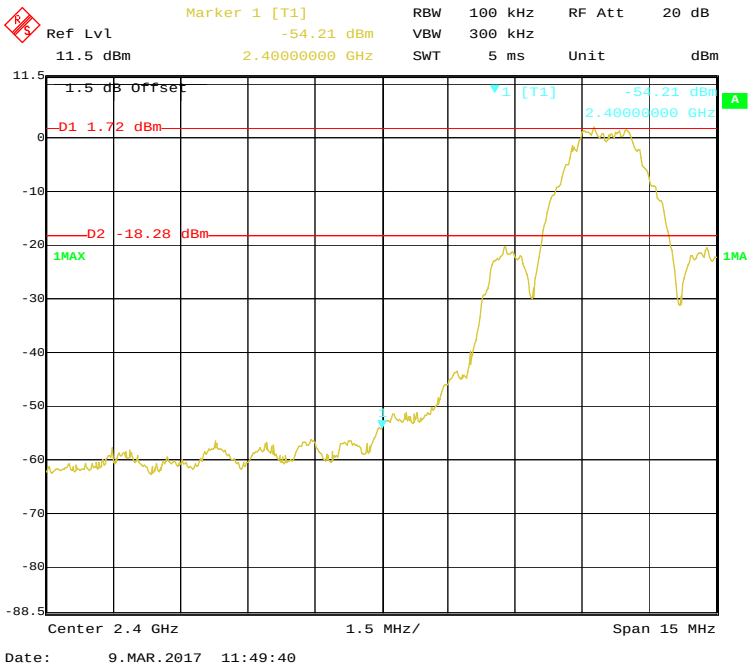
Temperature:	24.3 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-03-09.

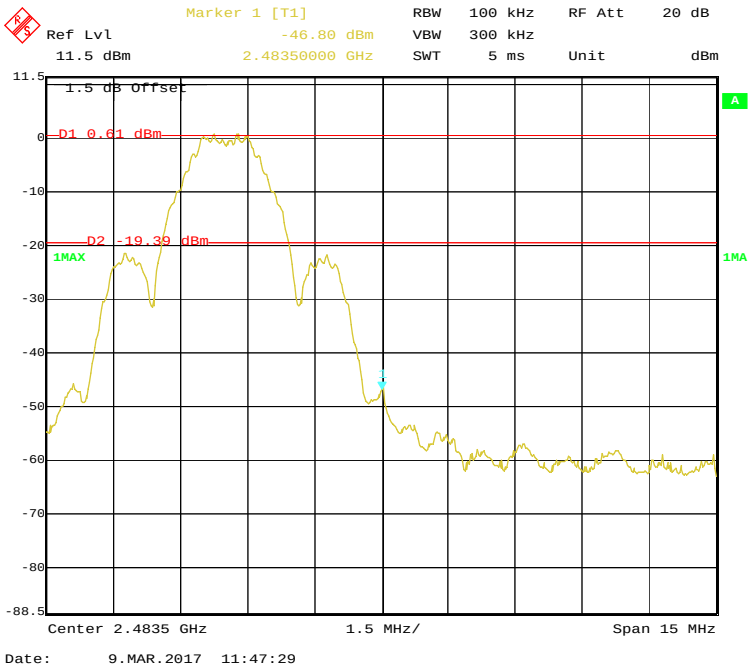
Test Result: *Compliance*

Please refer to the following table and plots.

Zigbee: Band Edge, Left Side



Zigbee:: Band Edge, Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

According to KDB558074 D01 DTS Meas Guidance v03r05.

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
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.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

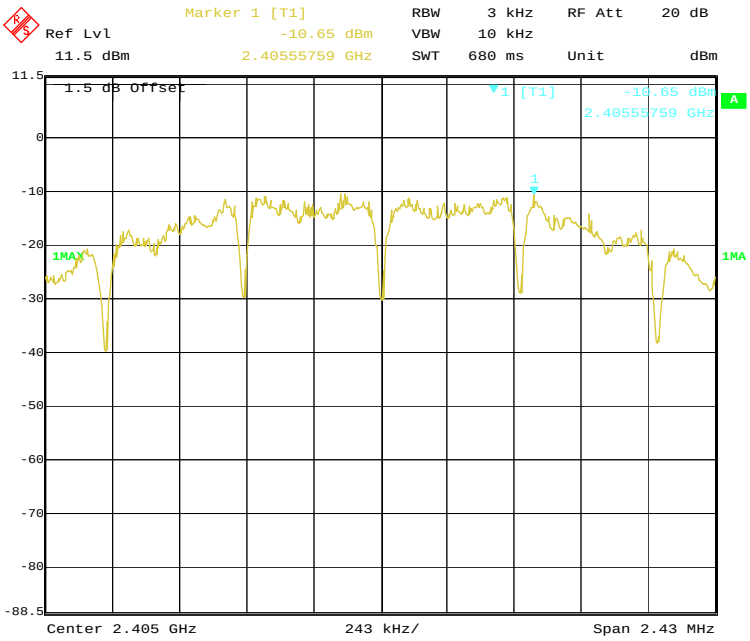
The testing was performed by Chris Wang on 2017-03-09.

EUT operation mode: Transmitting

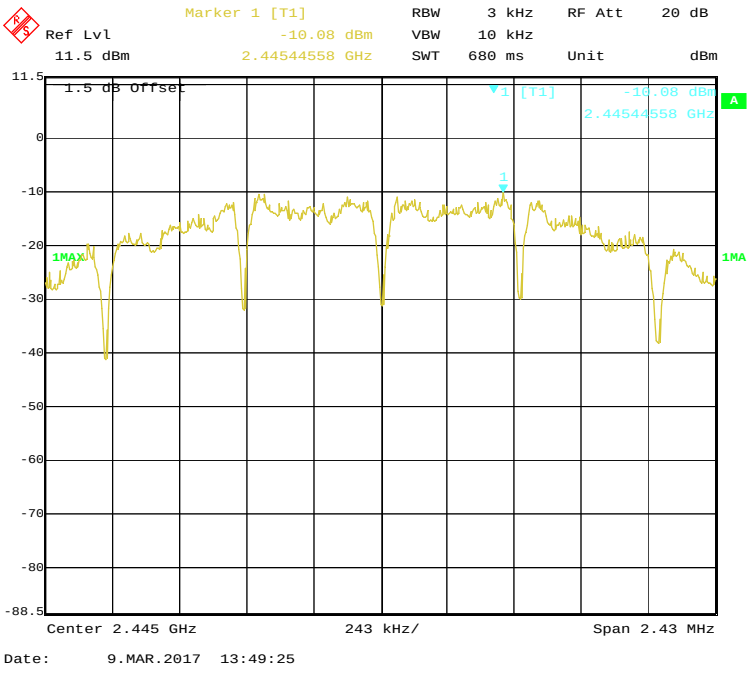
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2405	-10.65	≤8
Middle	2445	-10.08	≤8
High	2480	-10.61	≤8

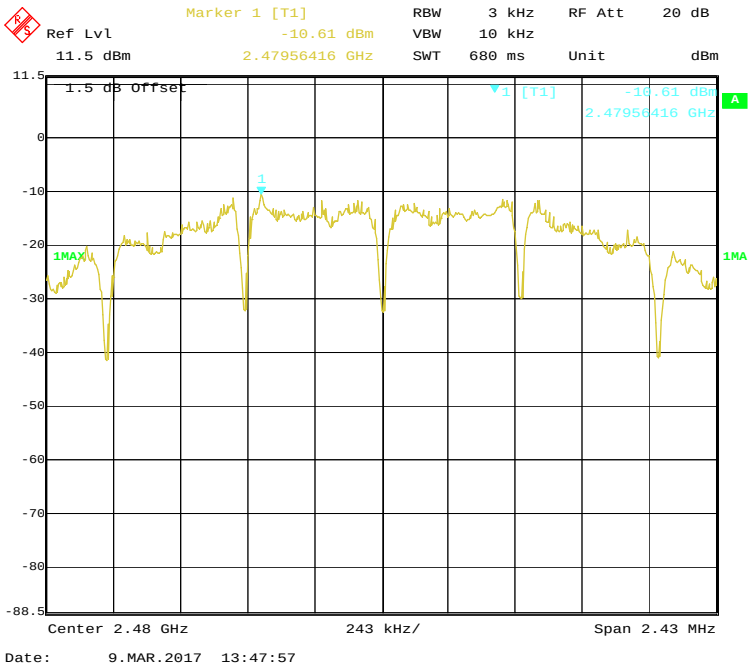
Power Spectral Density , Low Channel



Power Spectral Density , Middle Channel



Power Spectral Density , High Channel



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