


# FCC PART 15.247 TEST REPORT

For

**Light & Effects Technology Co., Ltd**

No2 Xinda Road, Hi-Tech West Zone, Chengdu, China

**FCC ID: 2AG6C-LES01**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Lettin Wireless Switch
<b>Report Number:</b> RSC180323001-0C	
<b>Report Date:</b> 2018-04-13 Sula Huang	
<b>Reviewed By:</b> Engineering Director 	
<b>Test Laboratory:</b> Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: 028-65525123 Fax: 028-65525125 www.baclcorp.com	

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Chengdu). This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA\* or any agency of the Federal Government. \* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “\*”.

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION .....</b>	<b>3</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	3
MECHANICAL DESCRIPTION OF EUT .....	3
OBJECTIVE .....	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
MEASUREMENT UNCERTAINTY .....	3
TEST METHODOLOGY .....	4
TEST FACILITY.....	4
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
DESCRIPTION OF TEST CONFIGURATION .....	5
EQUIPMENT MODIFICATIONS .....	5
EUT EXERCISE SOFTWARE.....	5
SUPPORT EQUIPMENT LIST AND DETAILS .....	7
EXTERNAL I/O CABLE .....	7
BLOCK DIAGRAM OF TEST SETUP .....	7
TEST EQUIPMENTS LIST.....	9
<b>SUMMARY OF TEST RESULTS .....</b>	<b>10</b>
<b>FCC §15.247 (i) &amp; §1.1310 &amp; §2.1093- RF EXPOSURE.....</b>	<b>11</b>
APPLICABLE STANDARD.....	11
<b>FCC §15.203 - ANTENNA REQUIREMENT .....</b>	<b>12</b>
APPLICABLE STANDARD.....	12
ANTENNA CONNECTOR CONSTRUCTION .....	12
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS.....</b>	<b>13</b>
APPLICABLE STANDARD.....	13
EUT SETUP.....	13
EMI TEST RECEIVER .....	14
TEST PROCEDURE .....	14
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	14
TEST DATA .....	15
<b>FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH .....</b>	<b>20</b>
APPLICABLE STANDARD.....	20
TEST PROCEDURE (RADIATED TEST).....	20
TEST DATA .....	20
<b>FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER .....</b>	<b>23</b>
APPLICABLE STANDARD.....	23
TEST PROCEDURE (RADIATED TEST).....	23
TEST DATA .....	23
<b>FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE .....</b>	<b>24</b>
APPLICABLE STANDARD.....	24
TEST PROCEDURE (RADIATED TEST).....	24
TEST DATA .....	24
<b>FCC §15.247(e) - POWER SPECTRAL DENSITY .....</b>	<b>26</b>
APPLICABLE STANDARD.....	26
TEST PROCEDURE (RADIATED TEST).....	26
TEST DATA .....	27

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The **Light & Effects Technology Co., Ltd**, model number: **LE-COW1150A** (FCC ID: **2AG6C-LES01**) or the "EUT" as referred to in this report was the **Lettin Wireless Switch**. The highest operating frequency is 2475MHz.

### Mechanical Description of EUT

The EUT was measured approximately: 147.2 mm(L) x 97.6 mm(W) x 18.3 mm(H).

Rated input voltage: DC 3V from battery

*\*All measurement and test data in this report were gathered from final production sample, serial number: 180323001/01 (assigned by BACL). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2018-03-21, and EUT complied with test requirement.*

### Objective

This report is prepared on behalf of **Light & Effects Technology Co., Ltd** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

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

### Related Submittal(s)/Grant(s)

None

### Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.71 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.57 dB
		V	4.81 dB
	200MHz-1GHz	H	5.69 dB
		V	6.07 dB
	1GHz-6GHz		5.49 dB
	6GHz-18GHz		5.57 dB
	18GHz-40GHz		5.48 dB
Conducted RF Power			±0.61dB
Power Spectrum Density			±0.61dB
Occupied Bandwidth			±5%
Conducted Emission			±1.5dB
Humidity			±5%
Temperature			±1°C

## **Test Methodology**

All measurements contained in this report were conducted with:

1. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
2. KDB558074 D01 DTS Meas Guidance v04.

## **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Chengdu) to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 910975, the FCC Designation No. : CN1186.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062C-1.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.

For Zigbee mode, 4 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	20	2450
15	2425	25	2475

EUT was tested with channel 11, 15, 20 and 25.

### Equipment Modifications

No modification was made to the EUT tested.

### EUT Exercise Software

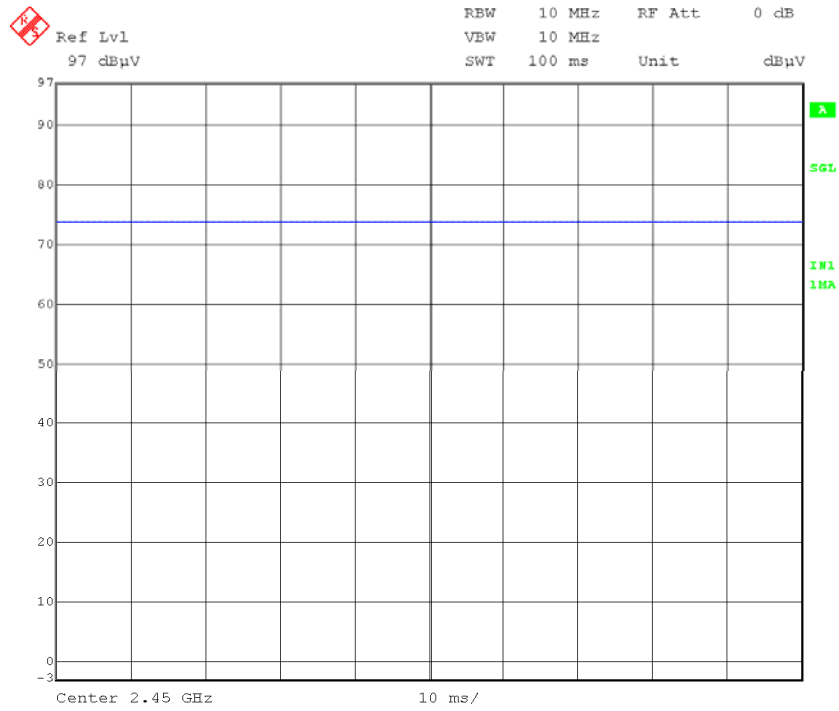
For Zigbee mode, the maximum power setting provided by the manufacturer is below:

Test Software Version	Lettin			
Test Frequency	2405 MHz	2425 MHz	2450 MHz	2475 MHz
Data Rate	Default	Default	Default	Default
Power Level	Default	Default	Default	Default

The software configured maximum duty cycle as below:

Test Mode	T <sub>on</sub> (ms)	T <sub>on+off</sub> (ms)	Duty Cycle (%)
Zigbee	100	100	100

### Duty Cycle



Date: 29.MAR.2018 14:48:42

### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
-	-	-	-

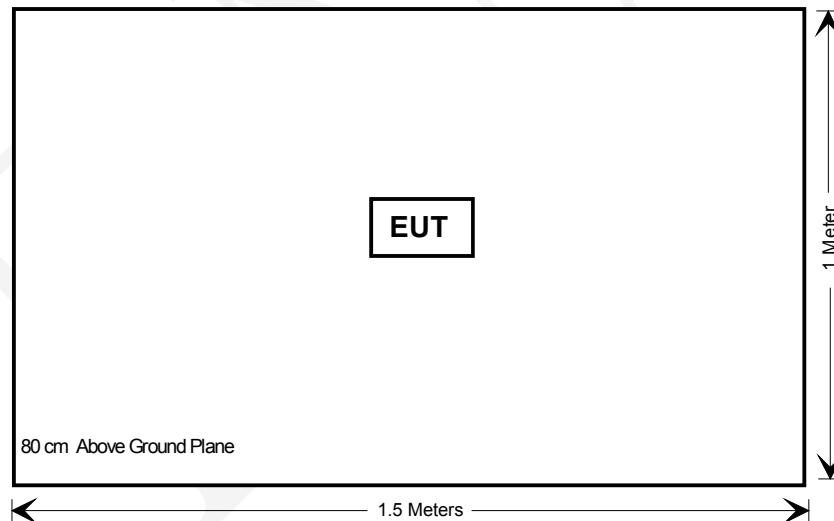
### External I/O Cable

Cable Description	Length (m)	From	To
-	-	-	-

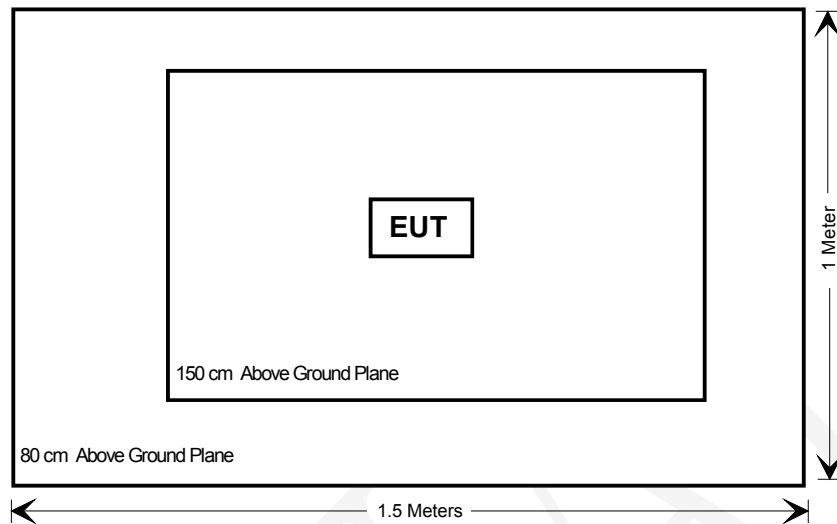
### Block Diagram of Test Setup

Radiated emissions test:

Below 1GHz



Above 1GHz





## Test Equipments List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emissions Test</b>					
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2017-05-20	2018-05-19
Sunol Sciences	Broadband Antenna	JB3	A121808	2017-05-18	2020-05-17
Sonoma	Pre-Amplifier	310N	186684	2017-08-18	2018-08-17
INMET	Attenuator	18N-6dB	64671	2017-11-10	2018-11-09
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2017-09-12	2018-09-11
ETS	Horn Antenna	3115	003-6076	2017-05-19	2020-05-18
A.H.Systems,inc	Horn Antenna	SAS-574	505	2017-12-02	2018-12-01
A.H.Systems,inc	Pre-Amplifier	PAM-0118P	467	2017-08-10	2018-08-10
EM Electronics Corporation	Pre-Amplifier	EM18G40	060725	2018-03-01	2019-02-28
Sinoscite.,Co Ltd	Reject Band Filter	BSF 2402-2480MN	0898-005	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	L-E005	N/A	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	T-E128	N/A	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	T-E129	N/A	2017-11-10	2018-11-09
N/A	RF Cable (above 1GHz)	T-E069	N/A	2017-11-10	2018-11-09
ORIDA RF LABS	RF Cable (18-40GHz)	KMS-160A- 72.0-KMS	1042	2017-11-10	2018-11-09
Micro-coax	RF Cable (18-40GHz)	UFA147A-1- 2362-100100	MFR 64639 2310	2017-11-10	2018-11-09
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## SUMMARY OF TEST RESULTS

---

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Not Applicable*
§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

\*Note: The device is battery operated equipment.

## **FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE**

---

### **Applicable Standard**

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

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

### **Measurement Result**

The max conducted power including tune-up tolerance is 3.5 dBm (2.24mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$   
 $= 2.24/5 \cdot (\sqrt{2.475}) = 0.7 < 7.5$

**So the stand-alone SAR evaluation is not necessary.**

## **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.

### **Antenna Connector Construction**

The EUT have one PCB antenna, which was permanently attached and the antenna gain is 3 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliant.

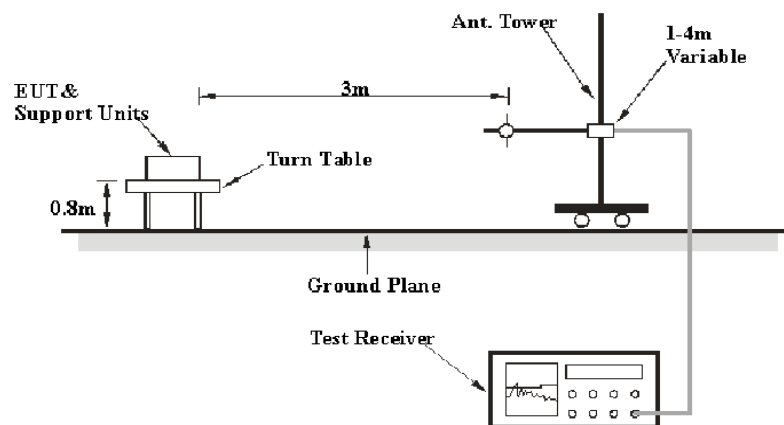
## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

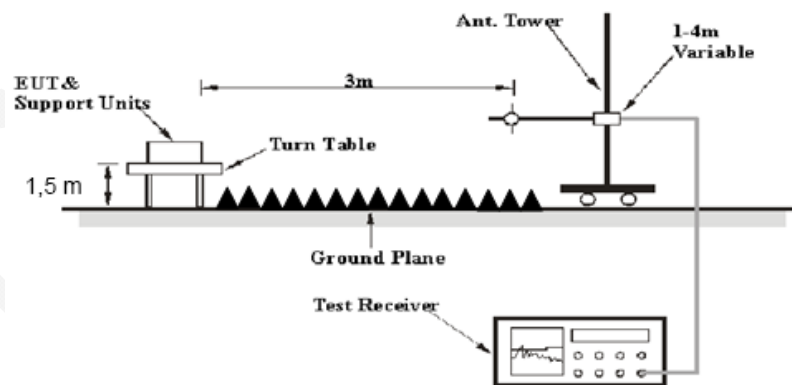
FCC §15.247 (d); §15.209; §15.205;

### EUT Setup

#### Below 1GHz:



#### Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber 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

The system was investigated from 30 MHz to 26 GHz.

During the radiated emission test, the EMI Test Receiver setup was 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	Measurement
Above 1 GHz	1MHz	3 MHz	Any	PK
	1MHz	10Hz	>98%	AV
	1MHz	1/T	<98%	AV

Note: T is Transmission Duration

## 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 Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Data

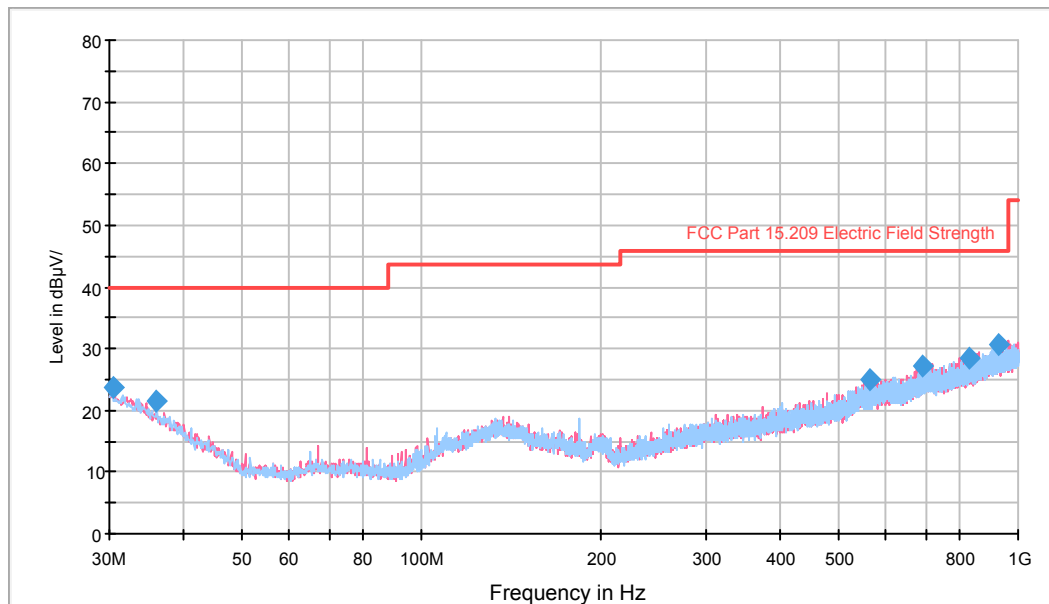
### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	95.5 kPa

\* The testing was performed by Johnny Ji on 2018-03-29.

Test Mode: Transmitting

### 30 MHz to 1 GHz: (Low Channel-worst case)



Frequency (MHz)	Max-hold Peak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBμV/m)
30.485000	23.7	100.0	V	7.0	-5.1	16.3	40.0
36.062500	21.6	100.0	H	182.0	-8.8	18.4	40.0
566.167500	24.8	100.0	H	189.0	-4.9	21.2	46.0
694.207500	27.3	100.0	V	126.0	-3.0	18.7	46.0
827.340000	28.4	100.0	H	17.0	-1.5	17.6	46.0
926.886250	30.7	100.0	V	346.0	0.6	15.3	46.0

**1GHz-26GHz:**

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	dB(1/m)	dB	dB	dBμV/m	dBμV/m	dB
<b>2405 MHz</b>									
2405	73.82	PK	H	28.72	3.00	0.00	101.15	N/A	N/A
2405	71.66	AV	H	28.72	3.00	0.00	99.54	N/A	N/A
2405	62.19	PK	V	28.72	3.00	0.00	93.91	N/A	N/A
2405	59.88	AV	V	28.72	3.00	0.00	91.60	N/A	N/A
2390	29.98	PK	H	28.67	3.00	0.00	61.65	74.00	12.35
2390	15.41	AV	H	28.67	3.00	0.00	47.08	54.00	6.92
4810	64.69	PK	H	33.87	6.03	44.73	59.86	74.00	14.14
4810	56.54	AV	H	33.87	6.03	44.73	51.71	54.00	*2.29
7215	62.59	PK	H	36.40	7.17	43.94	62.22	74.00	11.78
7215	52.02	AV	H	36.40	7.17	43.94	51.65	54.00	*2.35
<b>2425 MHz</b>									
2425	74.01	PK	H	28.78	3.00	0.00	100.68	N/A	N/A
2425	71.84	AV	H	28.78	3.00	0.00	98.57	N/A	N/A
2425	63.28	PK	V	28.78	3.00	0.00	95.06	N/A	N/A
2425	61.03	AV	V	28.78	3.00	0.00	92.81	N/A	N/A
4850	64.14	PK	H	33.98	6.06	44.72	59.46	74.00	14.54
4850	56.03	AV	H	33.98	6.06	44.72	51.35	54.00	*2.65
7275	62.00	PK	H	36.49	7.23	44.10	61.62	74.00	12.38
7275	51.43	AV	H	36.49	7.23	44.10	51.05	54.00	*2.95



Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	dB(1/m)	dB	dB	dBμV/m	dBμV/m	dB
<b>2450 MHz</b>									
2450	73.43	PK	H	28.85	3.00	0.00	100.98	N/A	N/A
2450	71.20	AV	H	28.85	3.00	0.00	98.62	N/A	N/A
2450	63.37	PK	V	28.85	3.00	0.00	95.22	N/A	N/A
2450	60.92	AV	V	28.85	3.00	0.00	92.77	N/A	N/A
4900	62.48	PK	H	34.12	6.10	44.71	57.99	74.00	16.01
4900	54.12	AV	H	34.12	6.10	44.71	49.63	54.00	*4.37
7350	61.44	PK	H	36.59	7.31	44.30	61.04	74.00	12.96
7350	51.90	AV	H	36.59	7.31	44.30	51.50	54.00	*2.50
<b>2475 MHz</b>									
2475	72.59	PK	H	28.93	2.99	0.00	101.36	N/A	N/A
2475	70.32	AV	H	28.93	2.99	0.00	98.79	N/A	N/A
2475	62.81	PK	V	28.93	2.99	0.00	94.73	N/A	N/A
2475	60.55	AV	V	28.93	2.99	0.00	92.47	N/A	N/A
2483.5	28.44	PK	H	28.95	2.99	0.00	60.38	74.00	13.62
2483.5	15.33	AV	H	28.95	2.99	0.00	47.27	54.00	6.73
4950	62.47	PK	H	34.26	6.14	44.71	58.16	74.00	15.84
4950	54.00	AV	H	34.26	6.14	44.71	49.69	54.00	*4.31
7425	62.57	PK	H	36.70	7.38	44.50	62.15	74.00	11.85
7425	52.18	AV	H	36.70	7.38	44.50	51.76	54.00	*2.24

*\*Within measurement uncertainty!*

Note:

Corrected Amplitude = Corrected Factor + Reading

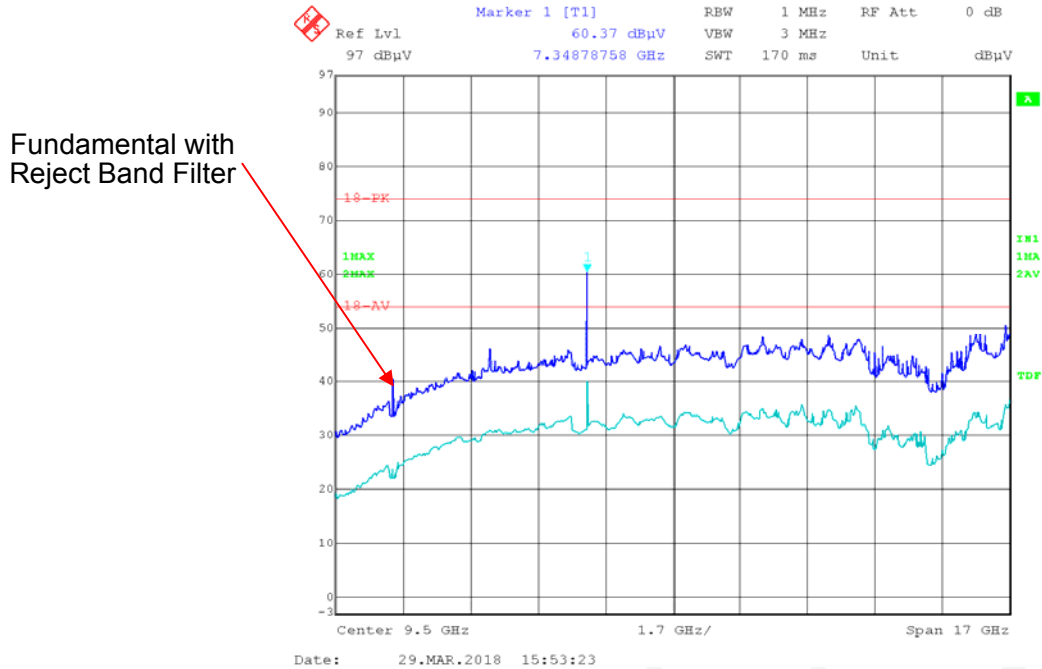
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor

Margin = Limit- Corr. Amplitude

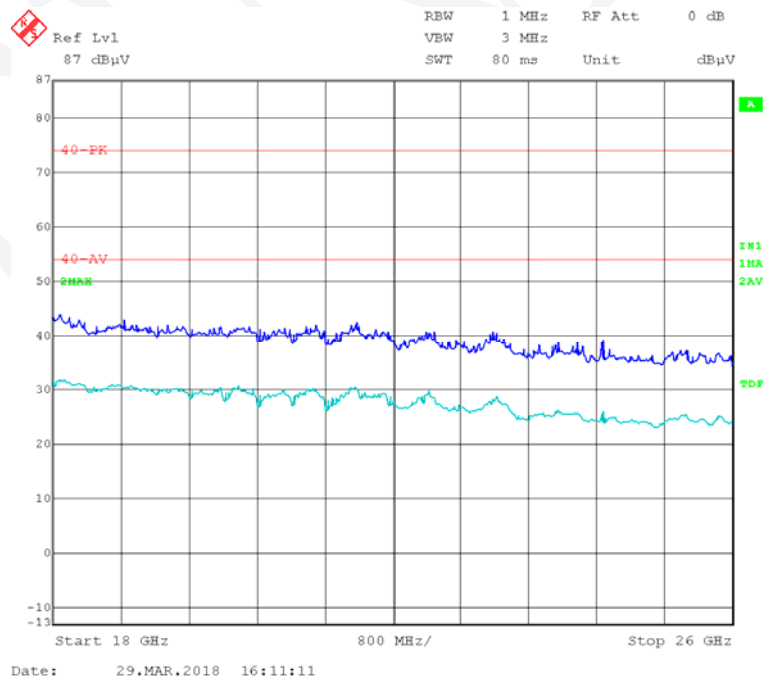
Spurious emissions more than 20 dB below the limit were not reported.

Please refer to the below pre-scan plot of worst case:

### High Channel\_Horizontal\_1GHz-18GHz

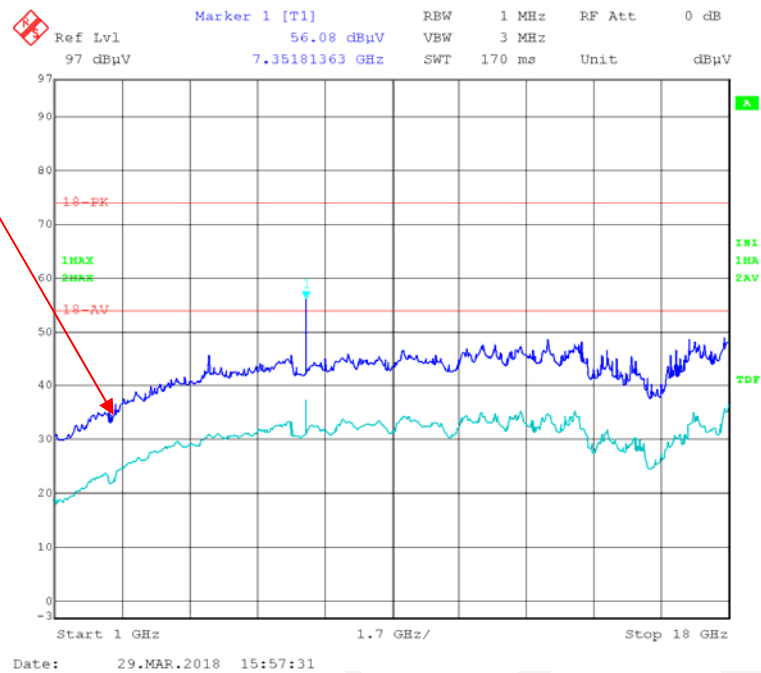


### High Channel\_Horizontal\_18GHz-26GHz

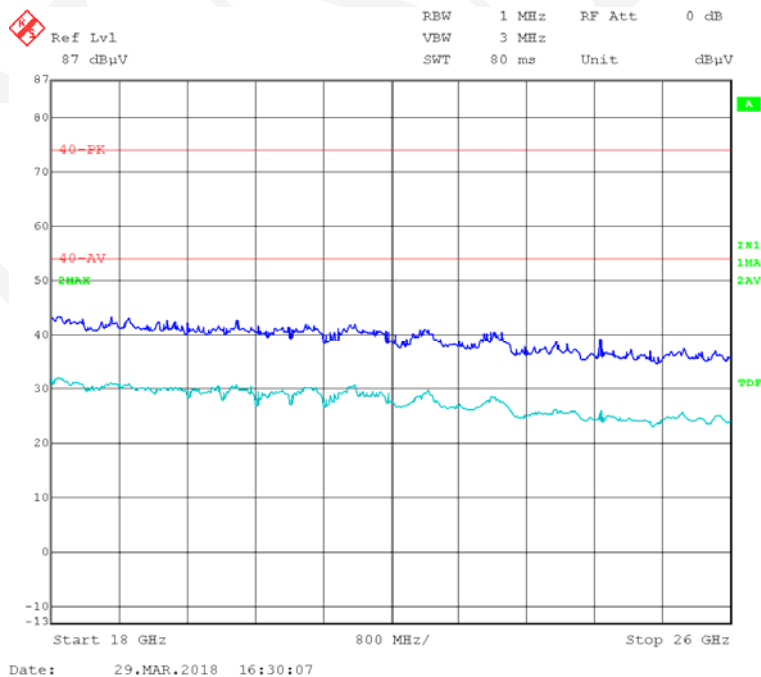


### High Channel\_Vertical\_1GHz-18GHz

Fundamental with  
Reject Band Filter



### High Channel\_Vertical\_18GHz-26GHz



## 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 (Radiated Test)

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times \text{RBW}$
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### Test Data

#### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	95.5 kPa

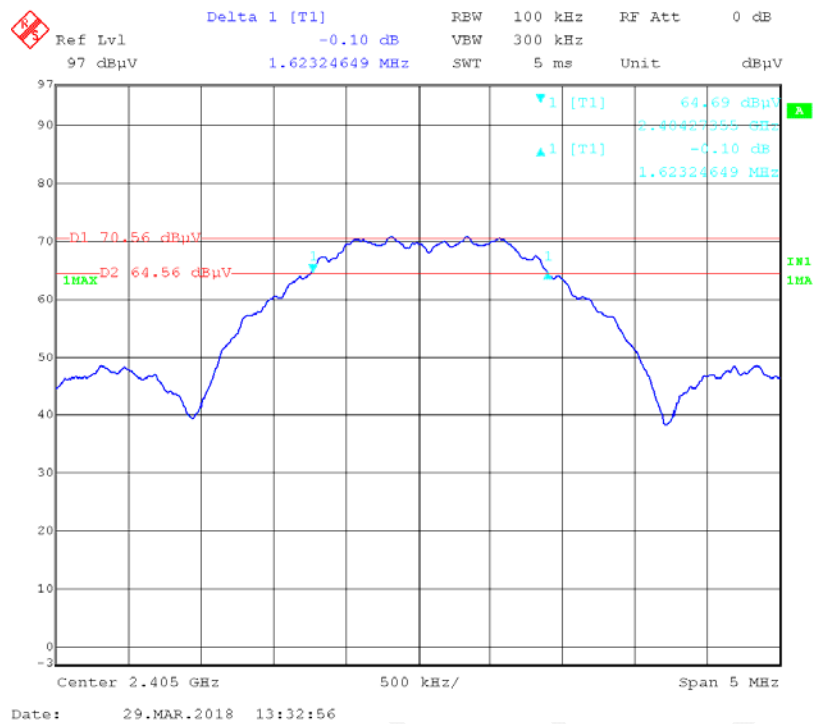
\* The testing was performed by Johnny Ji on 2018-03-29.

Test Mode: Transmitting

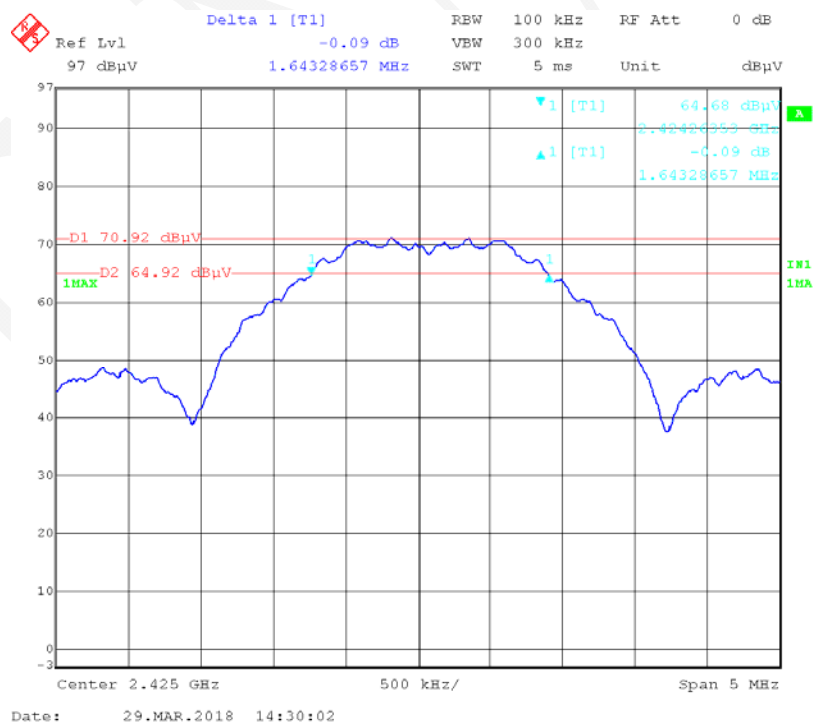
Test Result: Compliant. Please refer to the following table and plots.

Test Mode	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
Zigbee	2405	1.62	$\geq 0.5$
	2425	1.64	$\geq 0.5$
	2450	1.63	$\geq 0.5$
	2475	1.61	$\geq 0.5$

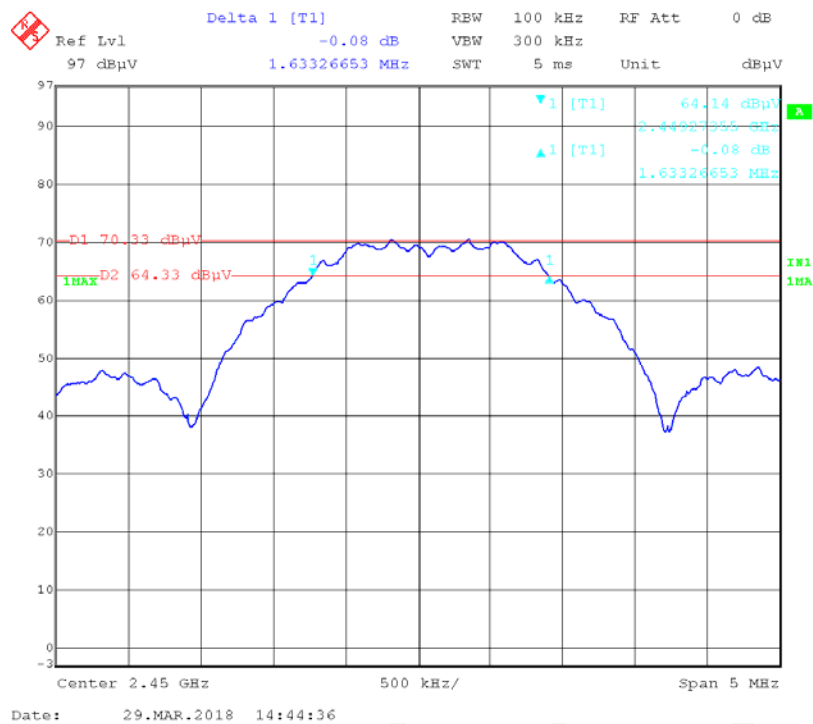
### 6dB Bandwidth - 2405 MHz



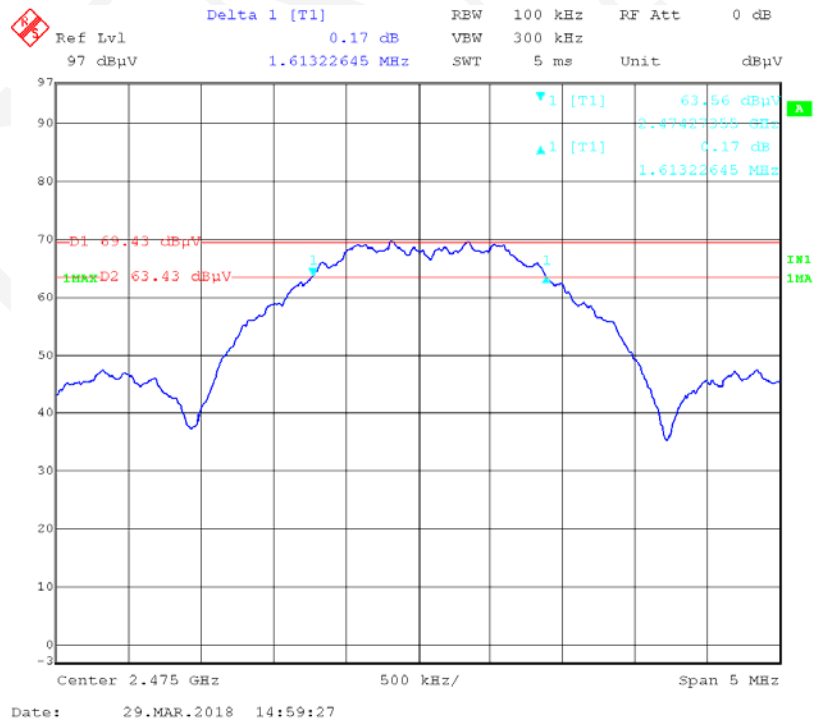
### 6dB Bandwidth - 2425 MHz



### 6dB Bandwidth - 2450 MHz



### 6dB Bandwidth - 2475 MHz



## 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 (Radiated Test)

According to ANSI C63.10-2013.

### Test Data

#### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	95.5 kPa

\* The testing was performed by Johnny Ji on 2018-03-29.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table.

Test Mode	Frequency (MHz)	Field Strength (dBμV/m)	EIRP (dBm)	Antenna Gain (dBi)	Conducted Output Power (dBm)	Limit (dBm)
Zigbee	2405	101.15	5.95	3	2.95	30
	2425	100.68	5.48	3	2.48	30
	2450	100.98	5.78	3	2.78	30
	2475	101.36	6.16	3	3.16	30

Note:  $EIRP[dBm] = E[dBμV/m] - 95.2$  when distance is 3 meter  
 $EIRP[dBm] = \text{Conducted Output Power}[dBm] + \text{Antenna Gain}$

Where: E is the field strength in dBμV/m  
EIRP is the equivalent isotropic radiated power in dBm

## **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 (Radiated Test)**

1. 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.
2. 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.
3. Repeat above procedures until all measured frequencies were complete.

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	52 %
<b>ATM Pressure:</b>	95.5 kPa

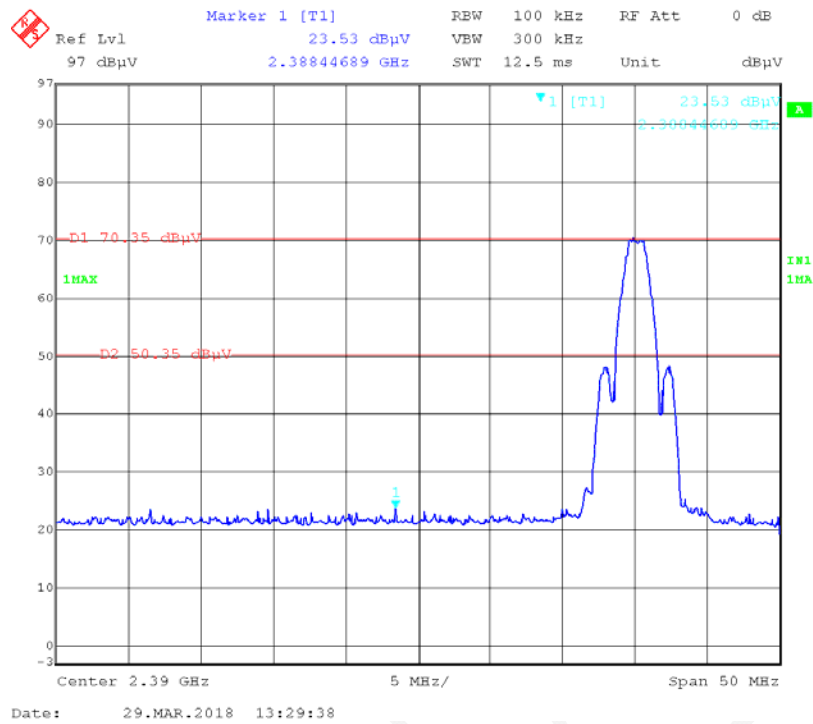
*\* The testing was performed by Johnny Ji on 2018-03-29.*

*Test Mode: Transmitting*

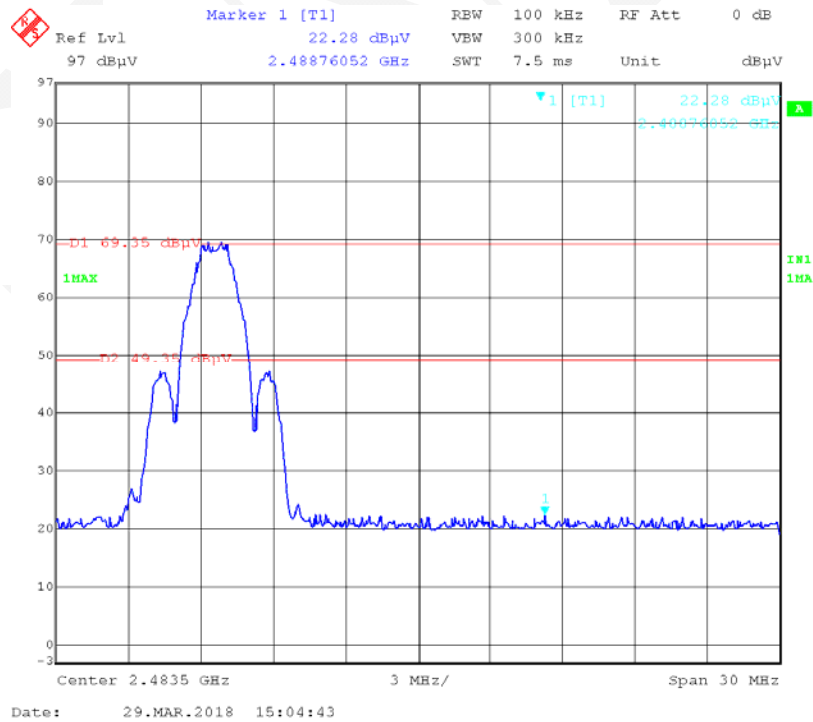
*Test Result: Compliant. Please refer to the following plots.*



### Band Edge, Left Side



### 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 (Radiated Test)**

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

## Test Data

### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	95.5 kPa

\* The testing was performed by Johnny Ji on 2018-03-29.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots.

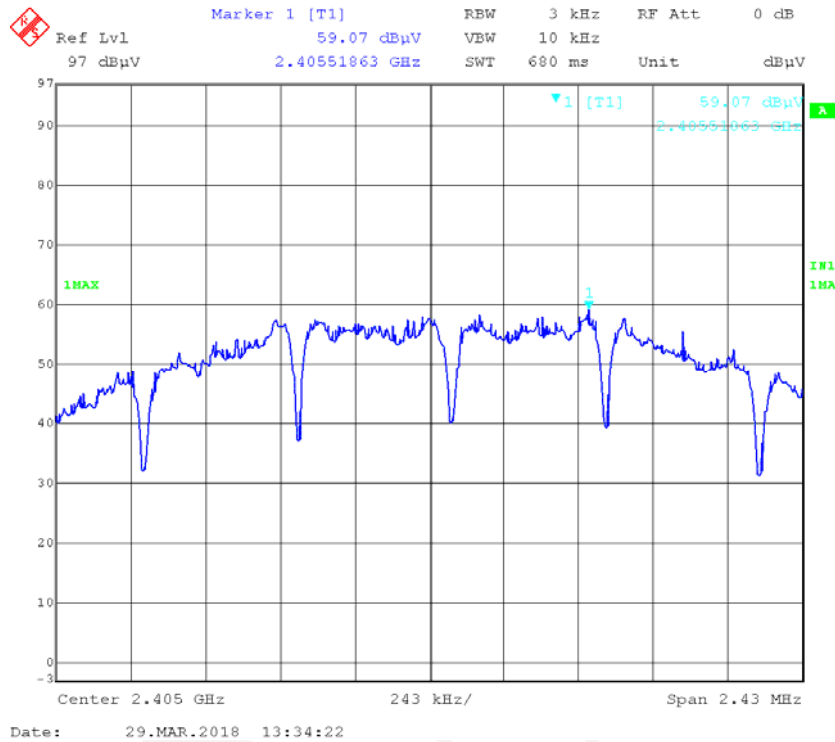
Frequency (MHz)	Reading (dBμV)	Polarity (H/V)	Factor (dB/m)	Cable Loss (dB)	Pre-Amp (dB)	Corrected Amplitude (dBμV/m)	Detector
2405	59.07	H	28.72	3.00	0.00	90.79	Peak
2425	58.70	H	28.78	3.00	0.00	90.48	Peak
2450	58.48	H	28.85	3.00	0.00	90.33	Peak
2475	59.81	H	28.93	3.00	0.00	91.74	Peak

Tset Mode	Frequency (MHz)	Field Strength (dBμV/m)	EIRP (dBm)	Antenna Gain (dBi)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Zigbee	2405	90.79	-4.41	3	-7.41	≤8
	2425	90.48	-4.72	3	-7.72	≤8
	2450	90.33	-4.87	3	-7.87	≤8
	2475	91.74	-3.46	3	-6.46	≤8

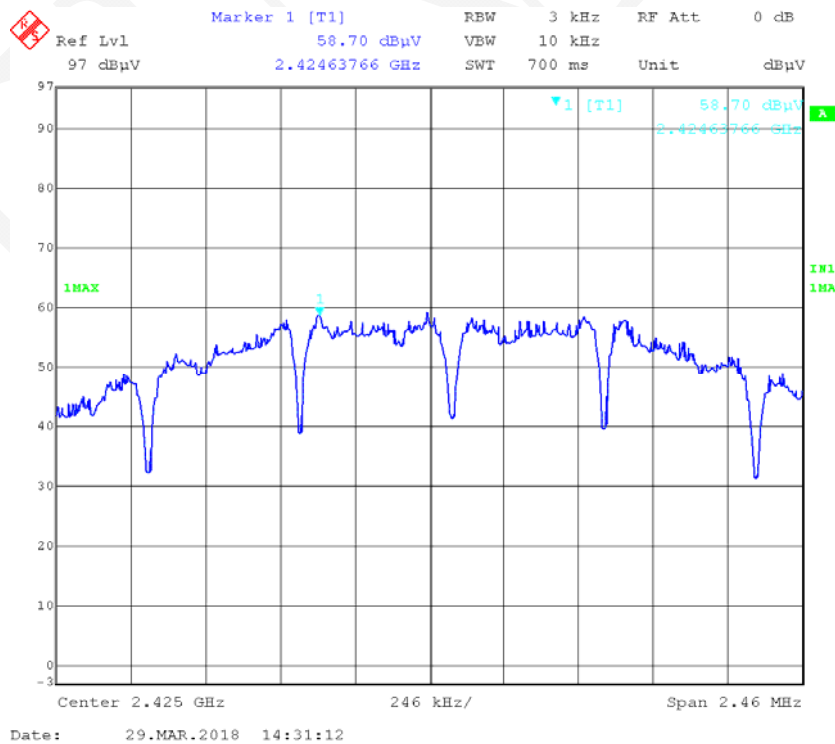
Note: EIRP[dBm] = E[dBμV/m]-95.2 when distance is 3 meter  
 EIRP[dBm] = Conducted Output Power[dBm] + Antenna Gain

Where: E is the field strength in dBμV/m  
 EIRP is the equivalent isotropic radiated power in dBm

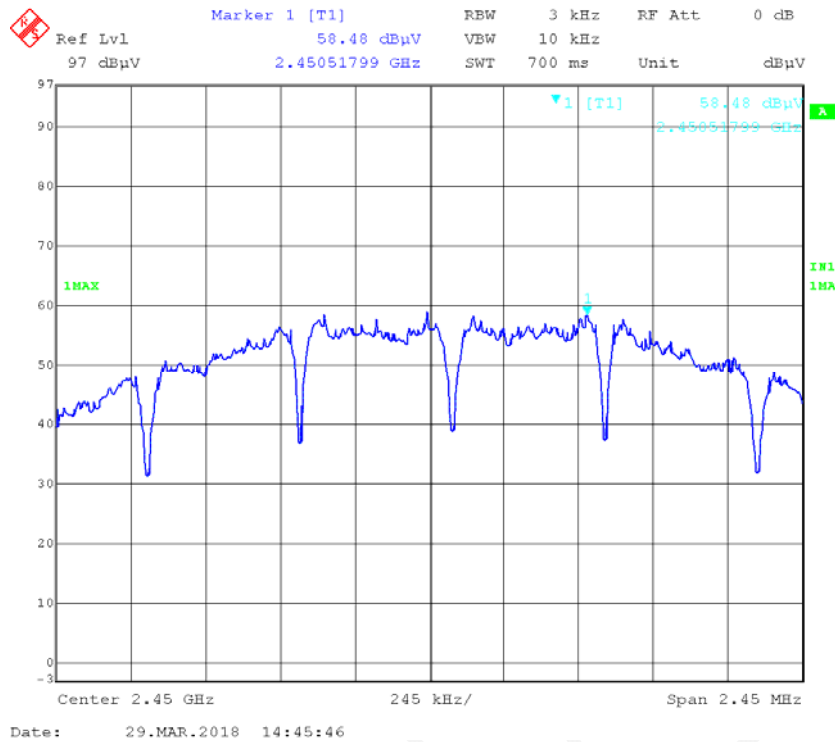
### Power Spectral Density, 2405 MHz



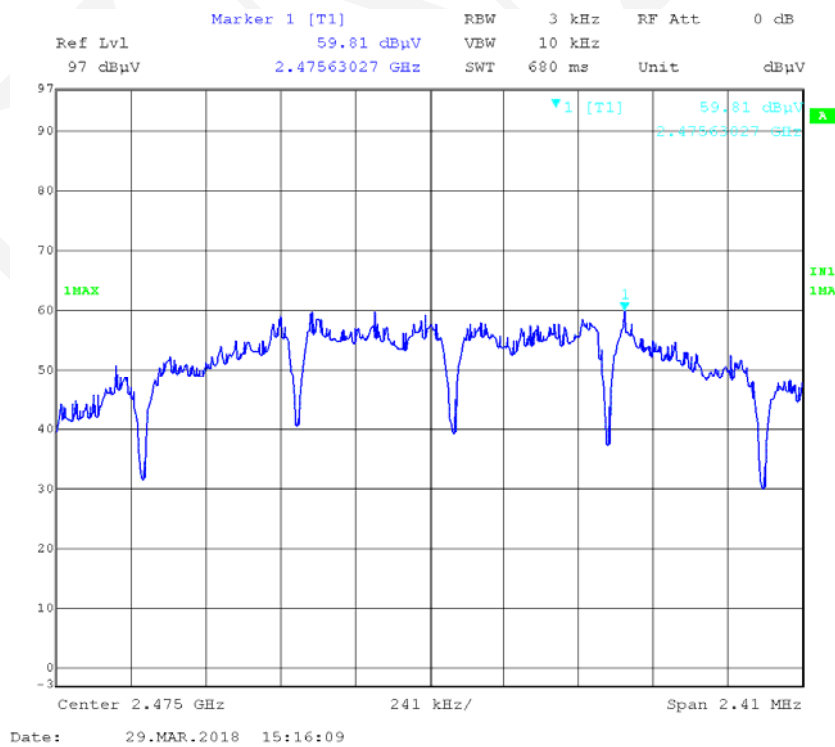
### Power Spectral Density, 2425 MHz



### Power Spectral Density, 2450 MHz



### Power Spectral Density, 2475 MHz



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