



FCC PART 15.249

## TEST REPORT

For

**ABOVE ALL LIGHTING INC.**

1501 Industrial Way N.Toms River,NJ 08755

**FCC ID: 2AK5A-CR24GW**

<b>Report Type:</b> Original Report		<b>Product Type:</b> WiFi LED Controller	
<b>Test Engineer:</b>	Chris Wang <i>Chris. Wang</i>		
<b>Report Number:</b>	RKS170103005-00C		
<b>Report Date:</b>	2017-03-13		
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## GENERAL INFORMATION

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

Manufacturer	ABOVE ALL LIGHTING INC.
Tested Model	CR24GW
Product Type	WiFi LED Controller
Dimension	61.3 mm(L)×61.3 mm(W)×20 mm(H)
Power Supply	DC5.0V From Adapter

*Adapter information:*

*Model: MX520U*

*Input: 100-240 V 50-60Hz 0.35A*

*Output: 5.0V, 2.0A*

*\*All measurement and test data in this report was gathered from production sample serial number: 20170104001.  
(Assigned by BACL, Kunshan). The EUT was received on 2017-01-04.*

### Objective

This type approval report is prepared on behalf of ABOVE ALL LIGHTING INC. in accordance with Part 2-Subpart J, and Part 15-Subparts A, B 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, 15.209 and 15.249 rules.

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

FCC Part15.247 DTS submissions with FCC ID: 2AK5A-CR24GW.

### 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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Lab 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°C
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 December 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

### Justification

The system was configured in testing mode which was provided by manufacturer, 3 channels are provided for testing:

Low Channel: 2406MHz, Middle Channel: 2441MHz, High Channel: 2478 MHz

### EUT Exercise Software

No software was used during the test.

### Support Equipment List and Details

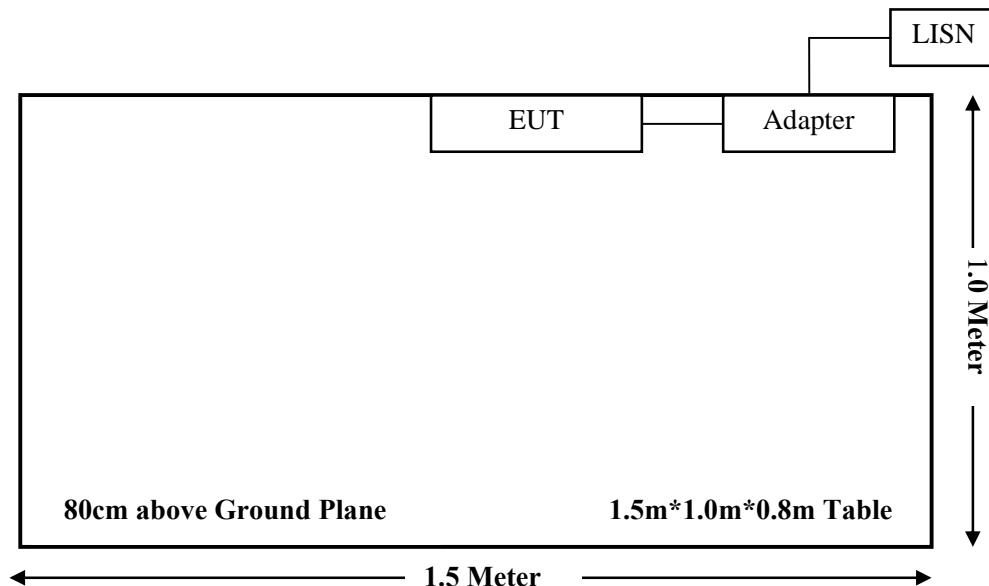
Manufacturer	Description	Model	Serial Number
ABOVE ALL	Adapter	MX520U	/

### External I/O Cable

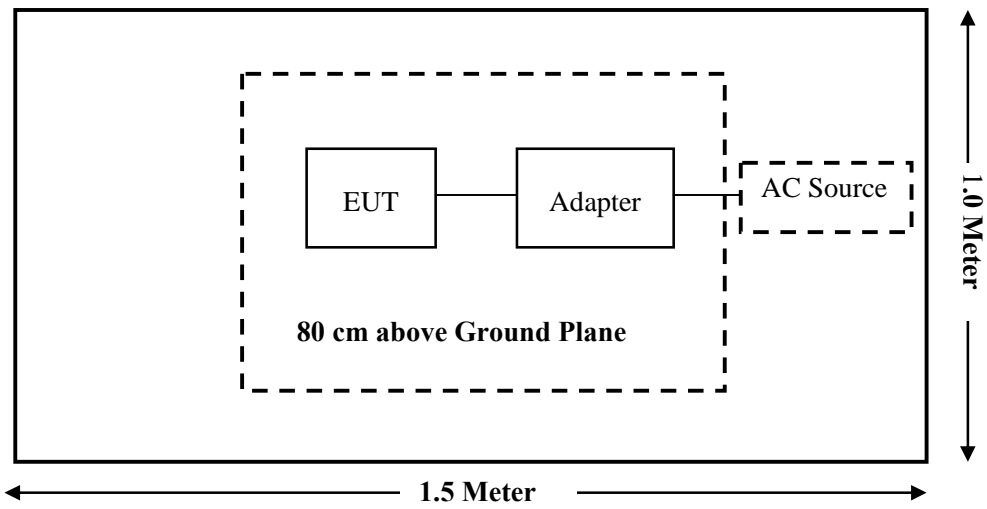
Cable Description	Length (m)	From Port	To
USB Cable	0.8	EUT	Adapter

### Block Diagram of Test Setup

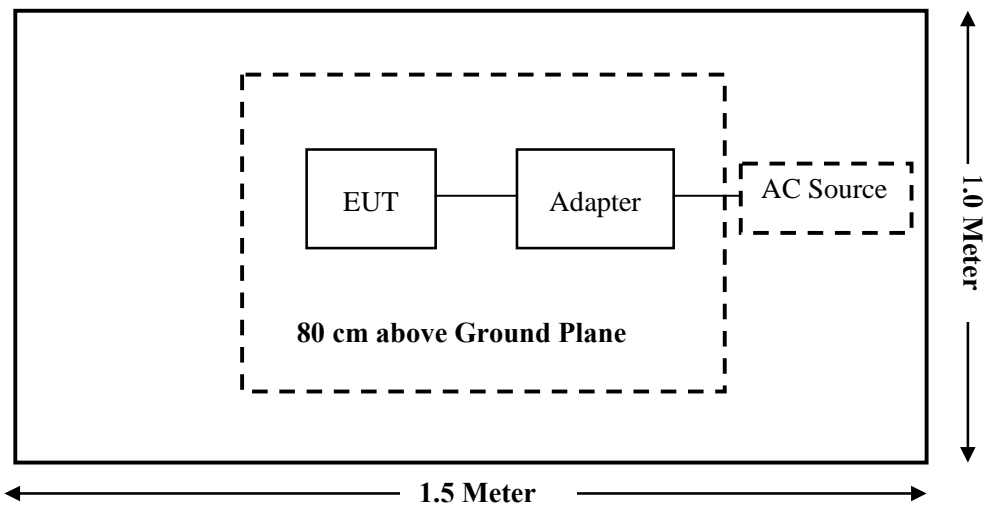
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions& Out of Band Emission	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
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-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Rohde & Schwarz	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
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
<b>RF Conducted Test</b>					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-20
ABOVE ALL	RF Cable	N/A	N/A	2017-02-18	2018-02-17
<b>Conducted Emission Test</b>					
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§15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

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

### **Antenna Connector Construction**

The EUT has a monopole antenna arrangement and antenna gain is 3dBi, which was permanently attached ,fulfill the requirement of this section, please refer to the EUT photos.

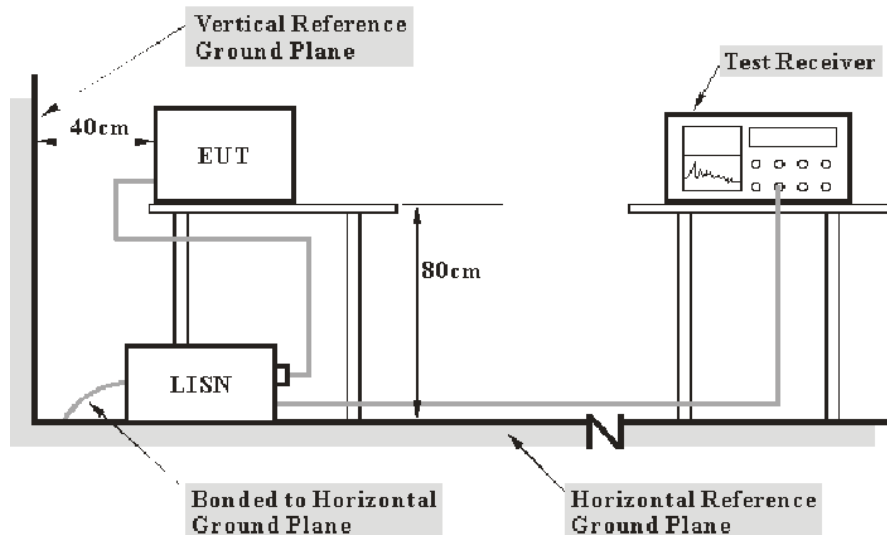
**Result:** Compliant.

## 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:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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:

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

### Test Results Summary

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

### Test Data

#### Environmental Conditions

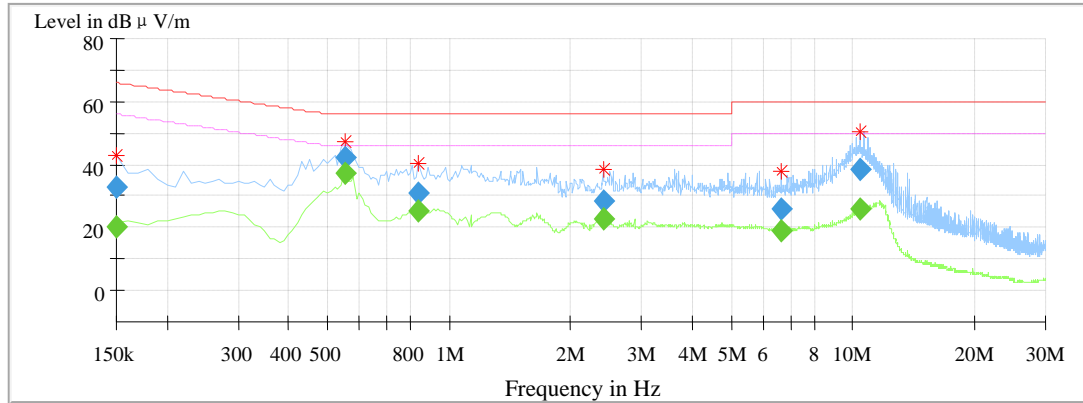
Temperature:	22 °C
Relative Humidity:	55 %
ATM Pressure:	101.1kPa

*The testing was performed by Chris Wang on 2017-02-20.*

*EUT operation mode: Transmitting*

## AC 120V/60 Hz, Line

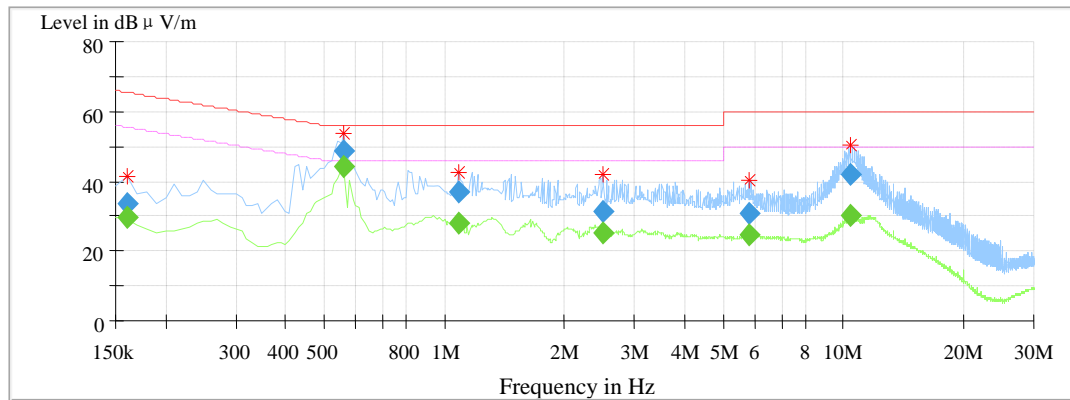
Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	---	20.13	9.000	L1	10.1	35.87	56.00	Compliance
0.150000	32.67	---	9.000	L1	10.1	33.33	66.00	Compliance
0.550000	---	37.19	9.000	L1	10.0	8.81	46.00	Compliance
0.550000	42.26	---	9.000	L1	10.0	13.74	56.00	Compliance
0.840000	---	24.94	9.000	L1	9.9	21.06	46.00	Compliance
0.840000	30.71	---	9.000	L1	9.9	25.29	56.00	Compliance
2.410000	---	22.58	9.000	L1	9.9	23.42	46.00	Compliance
2.410000	28.44	---	9.000	L1	9.9	27.56	56.00	Compliance
6.630000	---	19.02	9.000	L1	10.0	30.98	50.00	Compliance
6.630000	25.69	---	9.000	L1	10.0	34.31	60.00	Compliance
10.450000	---	25.83	9.000	L1	10.1	24.17	50.00	Compliance
10.450000	38.29	---	9.000	L1	10.1	21.71	60.00	Compliance

**AC 120V/60 Hz, Neutral**

Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.160000	---	29.51	9.000	N	10.1	25.95	55.46	Compliance
0.160000	33.44	---	9.000	N	10.1	32.02	65.46	Compliance
0.560000	---	43.96	9.000	N	10.1	2.04	46.00	Compliance
0.560000	48.45	---	9.000	N	10.1	7.55	56.00	Compliance
1.090000	---	28.02	9.000	N	9.9	17.98	46.00	Compliance
1.090000	36.71	---	9.000	N	9.9	19.29	56.00	Compliance
2.500000	---	25.23	9.000	N	9.9	20.77	46.00	Compliance
2.500000	31.57	---	9.000	N	9.9	24.43	56.00	Compliance
5.810000	---	24.62	9.000	N	9.9	25.38	50.00	Compliance
5.810000	30.54	---	9.000	N	9.9	29.46	60.00	Compliance
10.430000	---	30.38	9.000	N	10.0	19.62	50.00	Compliance
10.430000	41.88	---	9.000	N	10.0	18.12	60.00	Compliance

**Note:**

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

## FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS& OUT OF BAND EMISSION

### Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

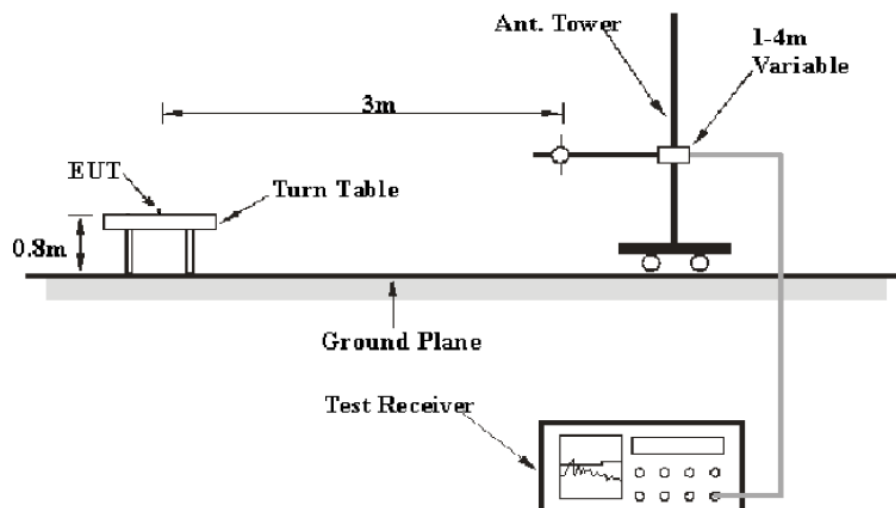
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

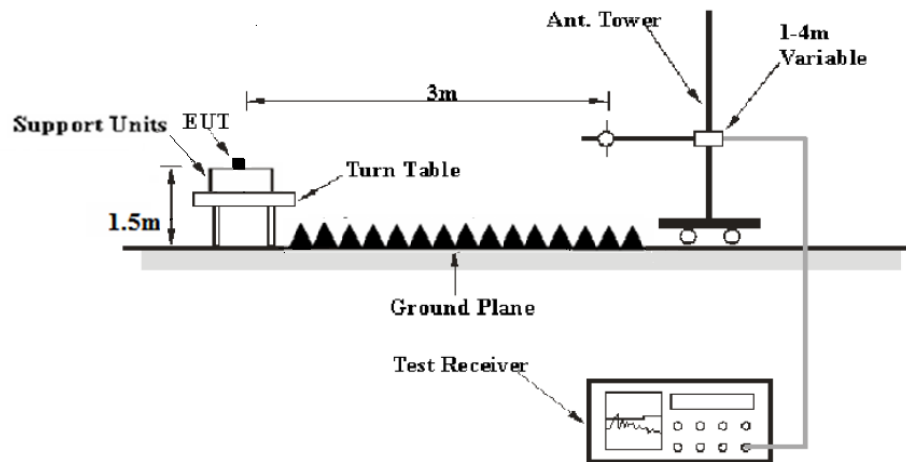
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission and out of band 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 15.209/15.205 and FCC 15.249 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

### Test Equipment 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	Detector
1GHz – 25GHz	1MHz	3 MHz	PK
	1MHz	10 Hz	Ave.

### Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode 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:

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

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 Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 &15.205 & 15.249.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	24.6°C
<b>Relative Humidity:</b>	52%
<b>ATM Pressure:</b>	101.2 kPa

*The testing was performed by Chris Wang on 2017-02-18.*

*Test Mode: Transmitting (Scan with X-Axis, Y-Axis and Z-Axis position, the worst case was recorded)*



**30MHz-25GHz:**

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/Q P/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/ m)	Margin (dB)
Low Channel (2406.00MHz)									
78.84	36.35	QP	23	216	V	-16.85	19.50	40.00	20.50
343.00	35.68	QP	56	208	V	-9.60	26.08	46.00	19.92
2406.00	99.51	PK	260	243	H	-6.18	93.33	114.00	20.67
2406.00	93.33	Ave	260	243	H	-6.18	87.15	94.00	6.85
2406.00	100.30	PK	250	118	V	-6.18	94.12	114.00	19.88
2406.00	94.12	Ave	250	118	V	-6.18	87.94	94.00	6.06
2390.00	56.58	PK	206	119	H	-6.22	50.36	74.00	23.64
2390.00	50.36	Ave	206	119	H	-6.22	44.14	54.00	9.86
2400.00	60.61	PK	33	150	V	-6.19	54.42	74.00	19.58
2400.00	52.42	Ave	33	150	V	-6.19	46.23	54.00	7.77
4812.00	58.63	PK	306	166	H	1.63	60.26	74.00	13.74
4812.00	49.23	Ave	306	166	H	1.63	50.86	54.00	3.14
7218.00	53.06	PK	152	214	H	7.56	60.62	74.00	13.38
7218.00	42.12	Ave	152	214	H	7.56	49.68	54.00	4.32

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/Q P/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Middle Channel (2441.00MHz)									
78.84	36.08	QP	228	205	V	-16.85	19.23	40.00	20.77
343.00	35.63	QP	125	144	V	-9.60	26.03	46.00	19.97
2441.00	99.46	PK	286	250	H	-6.10	93.36	114.00	20.64
2441.00	93.36	Ave	286	250	H	-6.10	87.26	94.00	6.74
2441.00	99.72	PK	201	266	V	-6.10	93.62	114.00	20.38
2441.00	93.62	Ave	201	266	V	-6.10	87.52	94.00	6.48
4882.00	57.63	PK	26	165	H	1.79	59.42	74.00	14.58
4882.00	48.20	Ave	26	165	H	1.79	49.99	54.00	4.01
6672.00	53.35	PK	123	188	V	6.40	59.75	74.00	14.25
6672.00	44.26	Ave	123	188	V	6.40	50.66	54.00	3.34
6950.00	52.83	PK	218	219	H	7.20	60.03	74.00	13.97
6950.00	43.16	Ave	218	219	H	7.20	50.36	54.00	3.64
7323.00	51.34	PK	45	254	H	7.67	59.01	74.00	14.99
7323.00	42.43	Ave	45	254	H	7.67	50.10	54.00	3.90

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/Q P/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/ m)	Margin (dB)
High Channel (2478.00MHz)									
78.84	35.88	QP	52	241	V	-16.85	19.03	40.00	20.97
343.00	35.02	QP	63	265	V	-9.60	25.42	46.00	20.58
2478.00	99.53	PK	245	243	H	-6.02	93.51	114.00	20.49
2478.00	93.51	Ave	245	243	H	-6.02	87.49	94.00	6.51
2478.00	98.84	PK	223	168	V	-6.02	92.82	114.00	21.18
2478.00	92.82	Ave	223	168	V	-6.02	86.80	94.00	7.20
2483.50	59.85	PK	19	219	V	-6.01	53.84	74.00	20.16
2483.50	53.84	Ave	19	219	V	-6.01	47.83	54.00	6.17
4956.00	57.08	PK	344	174	H	1.96	59.04	74.00	14.96
4956.00	47.16	Ave	344	174	H	1.96	49.12	54.00	4.88
6850.00	52.08	PK	166	254	V	6.91	58.99	74.00	15.01
6850.00	43.85	Ave	166	254	V	6.91	50.76	54.00	3.24
7434.00	52.18	PK	260	107	H	7.78	59.96	74.00	14.04
7434.00	43.05	Ave	260	107	H	7.78	50.83	54.00	3.17

Note:

Corrected Amplitude = Corrected Factor + Reading

Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor

Margin = Limit - Corr. Amplitude

## FCC §15.215(c) – 20 dB BANDWIDTH TESTING

### Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 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 on the test table without connection to measurement instrument. Turn on the EUT. 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 20 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:	22.2°C
Relative Humidity:	51 %
ATM Pressure:	101.2kPa

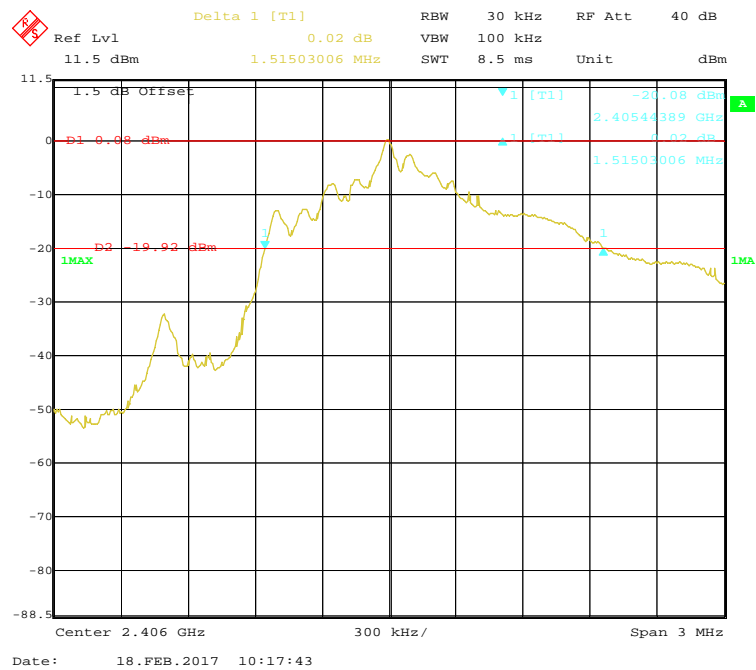
*The testing was performed by Chris Wang on 2017-02-18.*

**Test Result:** Compliant.

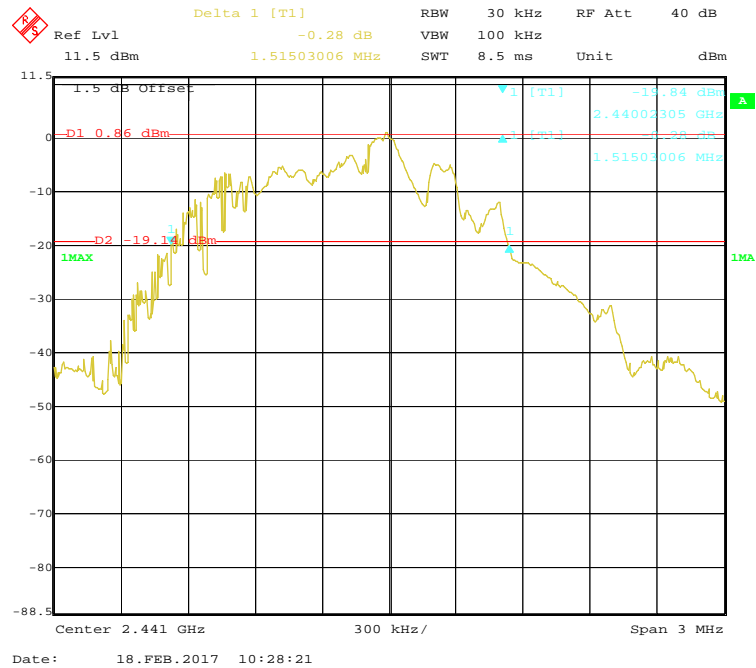
Please refer to following tables and plots

*Test Mode: Transmitting*

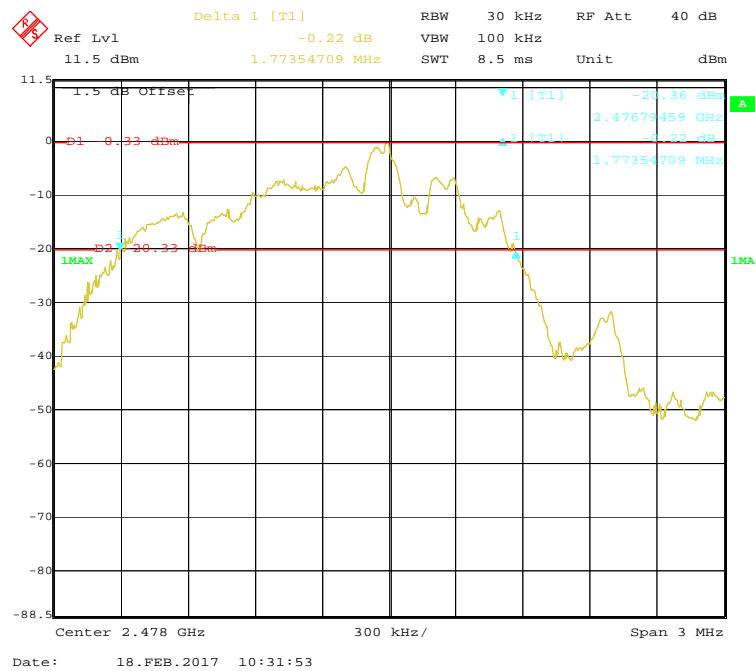
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2406.00	1.515
Middle	2441.00	1.515
High	2478.00	1.774

**Low Channel**

### Middle Channel



## High Channel



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