FCC TEST REPORT

For

Shantou Chenghai Lihuang Plastic Toys Co.,Ltd

Remote Control Car

Model No.: LH-C013

Additional Model No.: Please Refer To Page 6

Prepared for	:	Shantou Chenghai Lihuang Plastic Toys Co.,Ltd
Address	:	No.1,1 Road, Huaihe Industrial Park,Lianxia,Chenghai,Shantou,China.
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China
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Date of receipt of test sample	:	May 13, 2020
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	May 13, 2020 ~ May 15, 2020
Date of Report	:	May 15, 2020

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FCC TEST REPORT
FCC CFR 47 PART 15 C(15.249)

Report Reference No.	**:**	**LCS200513007AEA**
Date of Issue.....	:	May 15, 2020
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**Shantou Chenghai Lihuang Plastic Toys Co.,Ltd**
Address.....	:	No.1,1 Road, Huaihe Industrial Park,Lianxia,Chenghai,Shantou,China.
Test Specification		
Standard.....	:	FCC CFR 47 PART 15 C(15.249)
Test Report Form No.....	**:**	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

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EUT Description.....	**:**	**Remote Control Car**
Trade Mark.....	:	Lead honor
Model/ Type reference.....	:	LH-C013
Ratings.....	:	DC 4.5V By 3*AA Battery
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Scent Hu	Jin Wang	Gavin Liang
Scent Hu / Administrators	Jin Wang / Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCS200513007AEA**	May 15, 2020 Date of issue

Type / Model.....	: LH-C013
EUT.....	: Remote Control Car
Applicant.....	**: Shantou Chenghai Lihuang Plastic Toys Co.,Ltd**
Address.....	: No.1,1 Road, Huaihe Industrial Park,Lianxia,Chenghai,Shantou,China.
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shantou Chenghai Lihuang Plastic Toys Co.,Ltd**
Address.....	: No.1,1 Road, Huaihe Industrial Park,Lianxia,Chenghai,Shantou,China.
Telephone.....	: /
Fax.....	: /
Factory.....	**: Shantou Chenghai Lihuang Plastic Toys Co.,Ltd**
Address.....	: No.1,1 Road, Huaihe Industrial Park,Lianxia,Chenghai,Shantou,China.
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	May 15, 2020	Initial Issue	Gavin Liang

TABLE OF CONTENTS

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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Remote Control Car
Test Model	:	LH-C013
Additional Model No.	:	LH-C006，LH-C023A，LH-C023B，LH-C028，LH-C029，LH-C030，LH-C031，LH-C032，LH-C033，LH-C034，LH-C035，RQ2047，RQ2048，RQ2049，RQ2050，RQ2051，RQ2067，RQ2068，RQ2071，RQ2072. Z107，Z108，Z109，Z120，666-191NA，666-641XNA，666-644CA，666-645CA，666-646CA，666-647SA，666-647CA，666-715CA，666-718CA，666-724CA，666-726CA， 666-764CA，666-801SA，666-803A
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	:	DC 4.5V By 3*AA Battery
Hardware Version	:	2500
Software Version	:	2500
2.4G Function		
Frequency Range	:	2410MHz ~ 2473MHz (2410MHz, 2442MHz, 2473MHz)
Channel Number	:	3 Channel
Modulation Type	:	GFSK
Antenna Description	:	Internal Antennal, 0dBi(Max)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
--	--	--

1.4. Description of Test Facility

FCC Registration Number is 254912.

Industry Canada Registration Number is 9642A.

EMSD Registration Number is ARCB0108.

UL Registration Number is 100571-492.

TUV SUD Registration Number is SCN1081.

TUV RH Registration Number is UA 50296516-001.

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier: CN0071.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be 2.4GHz mode(Low Channel).

All test modes were tested, only the result of the worst case was recorded in the report.

Channel List & Frequency

Channel	Frequency(MHz)
1	2410
2	2442
3	2473

Mode of Operations	Transmitting Frequency (MHz)
GFSK	2410
	2442
	2473
For Radiated Emission	
Test Mode	TX Mode

2. 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.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

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3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (N/A) provided by application.

3.3. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C		
FCC Rules	Description of Test	Result
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.215(c)	20 dB Bandwidth Measurement	Compliant
§15.205, §15.249(d)	Emissions at Restricted Band	Compliant
§15.207(a)	AC Line Conducted Emissions	N/A
§15.203	Antenna Requirements	Compliant

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5. TEST RESULT

5.1. Radiated Emission Measurement

5.1.1. Standard Applicable

1. According to §15.249 (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.

Frequencies(MHz)	Field Strength(microvolts/meter)	Measurement Distance(meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

2. According to §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		Field strength of harmonics	
	millivolts/meter	dBuV/m	microvolts/meter	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth

5.1.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 3MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 3MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/Average
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/Average
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

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5.1.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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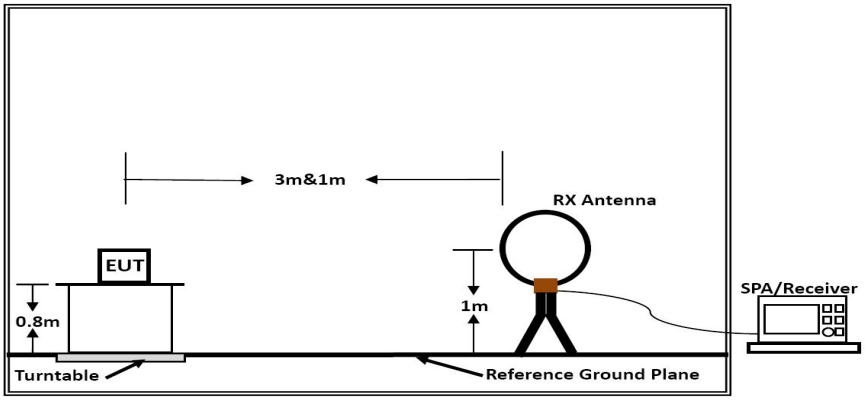
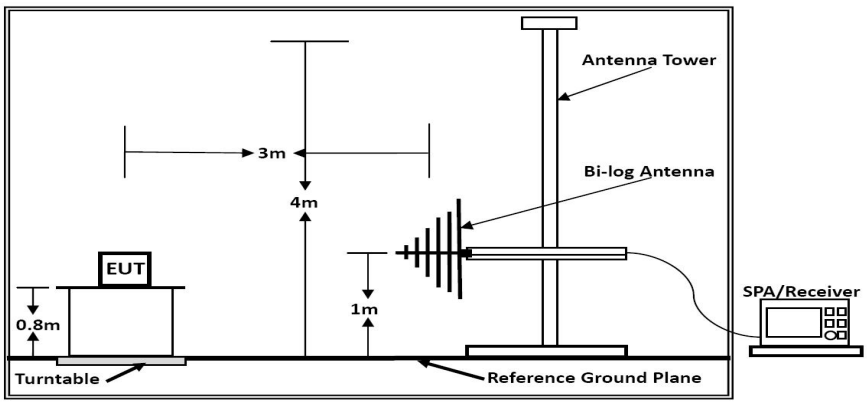
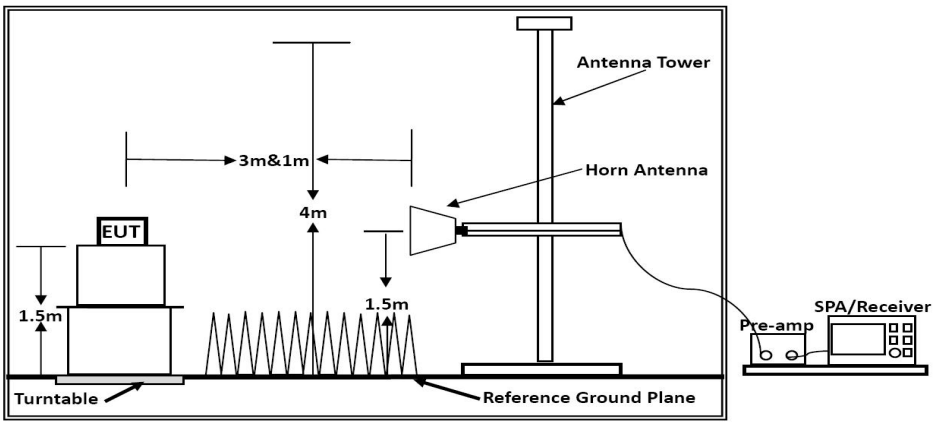
5.1.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.1.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	23.6℃	Humidity	54.2%
Test Engineer	ALisa Huang	Configurations	Low Channel

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dB)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.1.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	23.6℃	Humidity	54.2%
Test Engineer	ALisa Huang	Configurations	Low Channel

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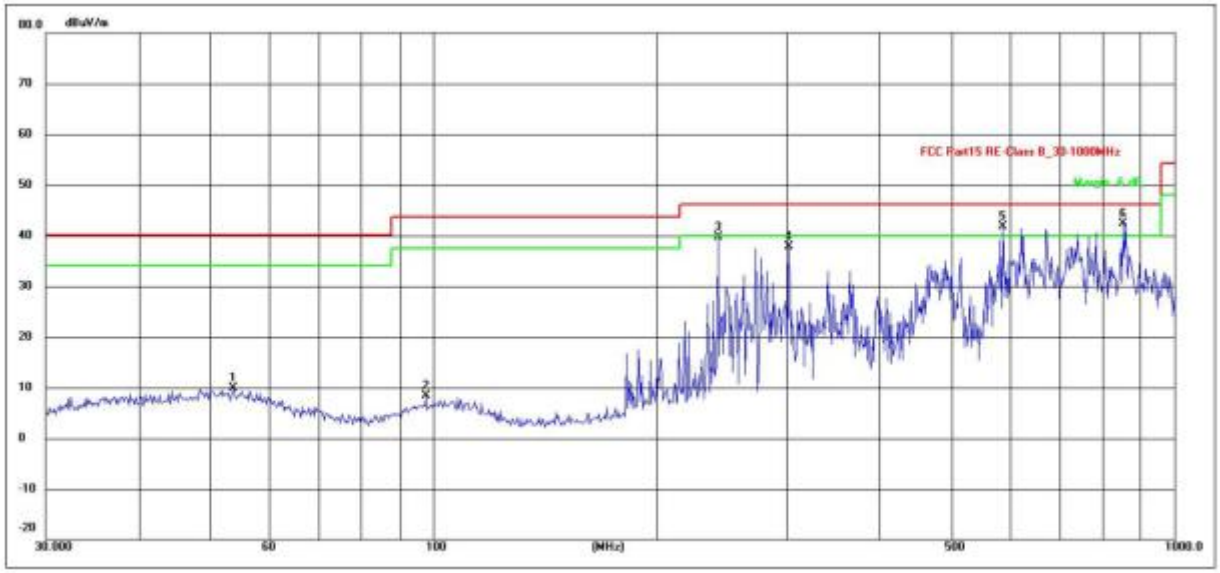
Low Channel

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	53.6931	26.86	-16.98	9.88	40.00	-30.12	QP
2	97.7980	27.11	-18.71	8.40	43.50	-35.10	QP
3	242.5252	56.77	-16.96	39.81	46.00	-6.19	QP
4	302.4811	53.41	-15.60	37.81	46.00	-8.19	QP
5 !	586.8436	51.33	-9.56	41.77	46.00	-4.23	QP
6 *	854.0247	48.84	-6.39	42.45	46.00	-3.55	QP

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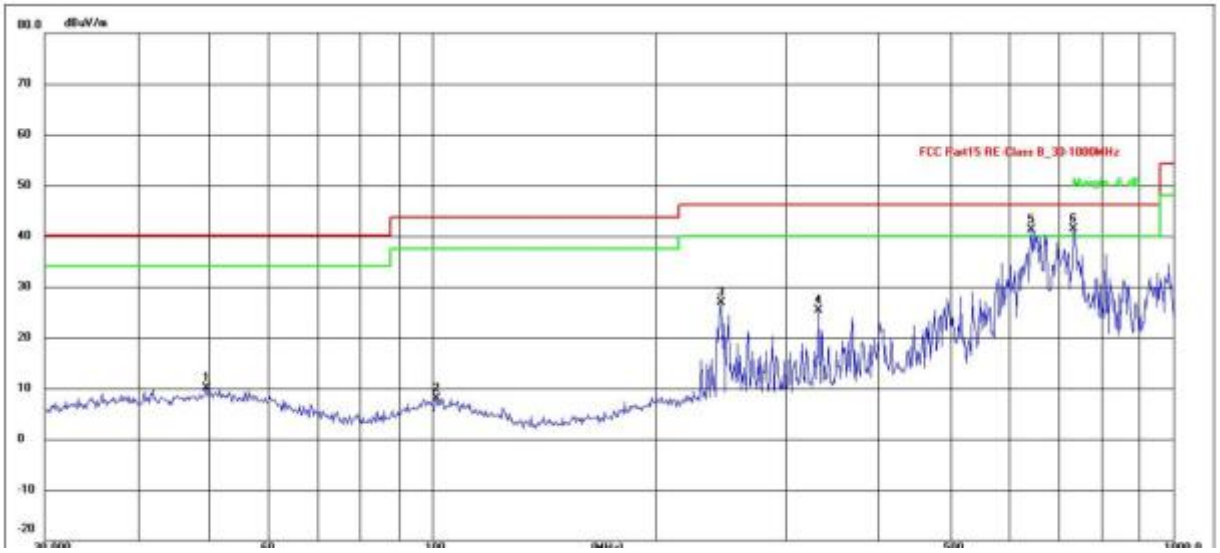
Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	49.5328	26.49	-16.40	10.09	40.00	-29.91	QP
2	101.2885	26.36	-18.36	8.00	43.50	-35.50	QP
3	245.0900	43.79	-16.88	26.91	46.00	-19.09	QP
4	332.5187	40.24	-14.79	25.45	46.00	-20.55	QP
5 !	642.8612	50.13	-8.83	41.30	46.00	-4.70	QP
6 *	734.4913	49.22	-7.87	41.35	46.00	-4.65	QP

Note:

1). Pre-scan all modes and recorded the worst case results in this report (Low Channel). Emission level (dBuV/m) = 20 log Emission level (uV/m).

2). Corrected Reading: Antenna Factor + Cable Loss + Read Level = Level.

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5.1.8. Results of Radiated Emissions (Above 1GHz)

Field Strength Of Fundamental						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2410	H	89.56	83.14	114	94	Pass
2410	V	89.43	82.94	114	94	Pass

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4807.27	52.92	33.06	35.04	3.94	54.88	74.00	-19.12	Peak	Horizontal
4807.18	38.99	33.06	35.04	3.94	40.95	54.00	-13.05	Average	Horizontal
4807.32	52.61	33.16	35.06	3.96	54.67	74.00	-19.33	Peak	Vertical
4807.25	40.46	33.16	35.06	3.96	42.52	54.00	-11.48	Average	Vertical

Field Strength Of Fundamental						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2442	H	88.16	82.46	114	94	Pass
2442	V	87.94	82.32	114	94	Pass

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4882.05	49.22	33.16	35.15	3.96	51.19	74.00	-22.81	Peak	Horizontal
4882.14	39.27	33.16	35.15	3.96	41.24	54.00	-12.76	Average	Horizontal
4882.03	51.45	33.26	35.17	3.98	53.52	74.00	-20.48	Peak	Vertical
4882.17	42.39	33.26	35.17	3.98	44.46	54.00	-9.54	Average	Vertical

Field Strength Of Fundamental						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2473	H	87.72	82.53	114	94	Pass
2473	V	87.54	81.42	114	94	Pass

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4954.23	51.26	33.26	35.14	3.98	53.36	74.00	-20.64	Peak	Horizontal
4954.31	39.36	33.26	35.14	3.98	41.46	54.00	-12.54	Average	Horizontal
4954.27	49.14	33.36	35.16	4.00	51.34	74.00	-22.66	Peak	Vertical
4954.21	39.44	33.36	35.16	4.00	41.64	54.00	-12.36	Average	Vertical

Notes:

1. *Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30MHz.*
2. *Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.*
3. *No emission was be recorded above 18GHz means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*

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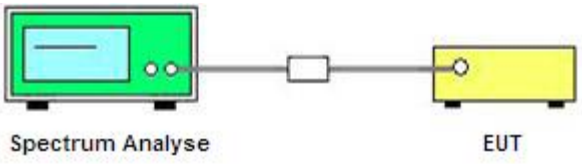
5.2. 99% Occupied Bandwidth and 20 dB Bandwidth Measurement

5.2.1. Standard Applicable

According to § 2.1049 and RSS-Gen section 6.7 "The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs."

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

5.2.2. Block Diagram of Test Setup



5.2.3. Test Procedure

Use the following spectrum analyzer settings:
Span = 3MHz
RBW = 100 KHz
VBW = 300 KHz
Sweep = auto
Detector function = peak
Trace = max hold
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

5.2.4. Test Result

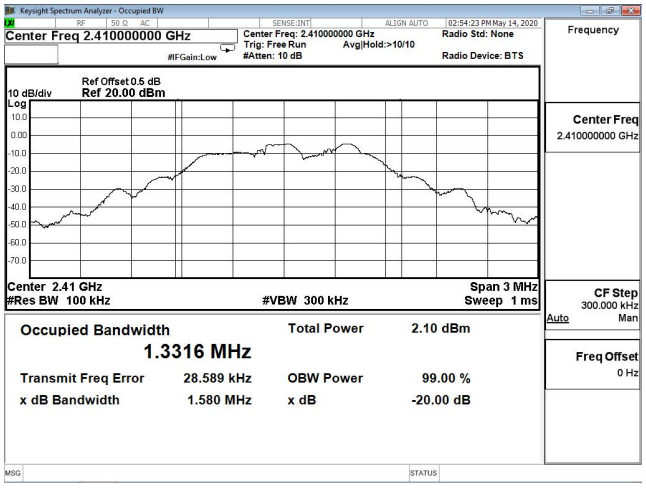
Temperature	24.5℃	Humidity	54.3%
Test Engineer	David Luo	Configurations	2.4G (GFSK)

Test Mode	Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Limits	Verdict
GFSK	Low	2410	1.580	Non-specified	PASS
	Middle	2442	1.613		
	High	2473	1.645		

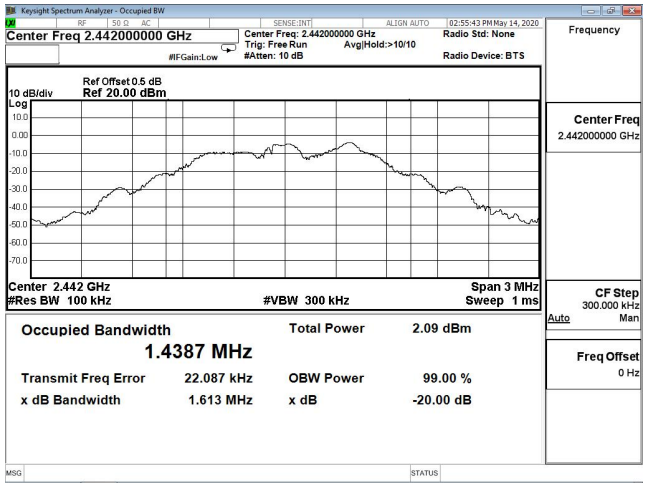
Remark:

1. *Test results including cable loss;*
2. *please refer to following plots;*

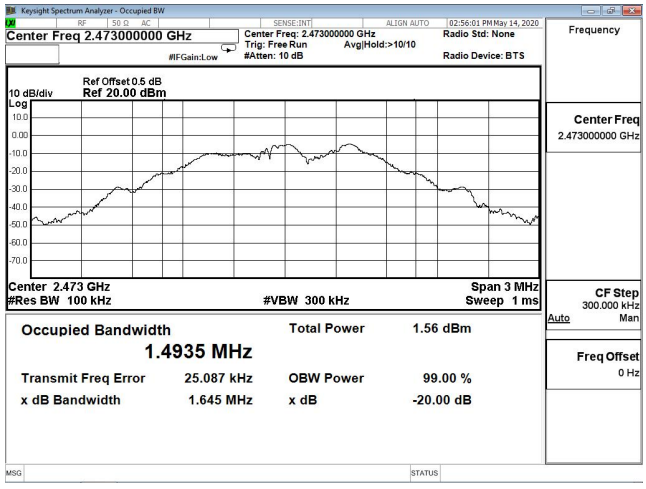
20dB Bandwidth and 99% Bandwidth



Low Channel- 2410MHz



Middle Channel- 2442MHz



High Channel- 2473MHz

5.3. AC Power line conducted emissions

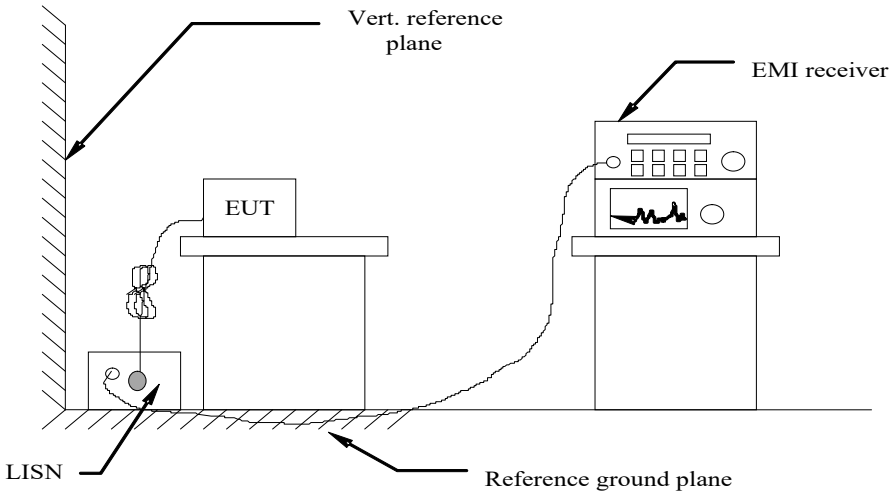
5.3.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

5.3.2 Block Diagram of Test Setup



5.3.3 Test Results

N/A

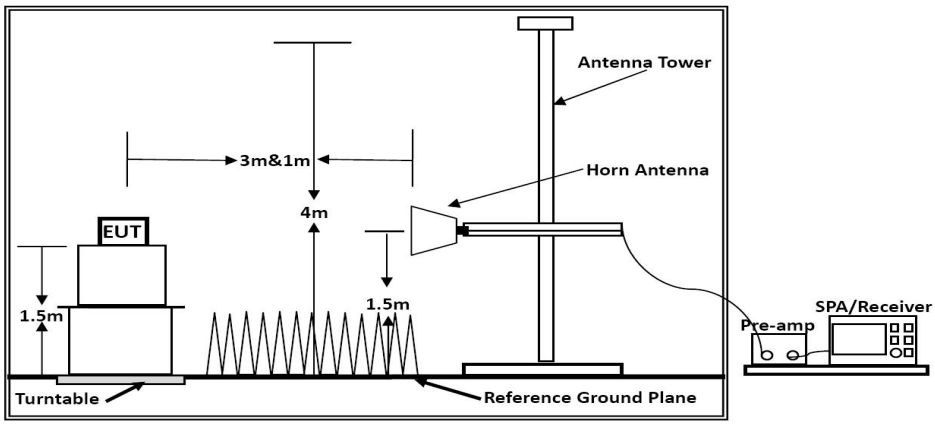
The EUT power supply by 3*AA Battery, so no need to be tested .

5.4. Results for Band edge Testing

5.4.1 Standard Applicable

According to FCC §15.249 (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.
According to RSS-210 B.10 (b): Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

5.4.2. Test Setup Layout



Above 1GHz

5.4.3. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

5.4.4. Test Procedures

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

5.4.5. Measuring Instruments and Setting

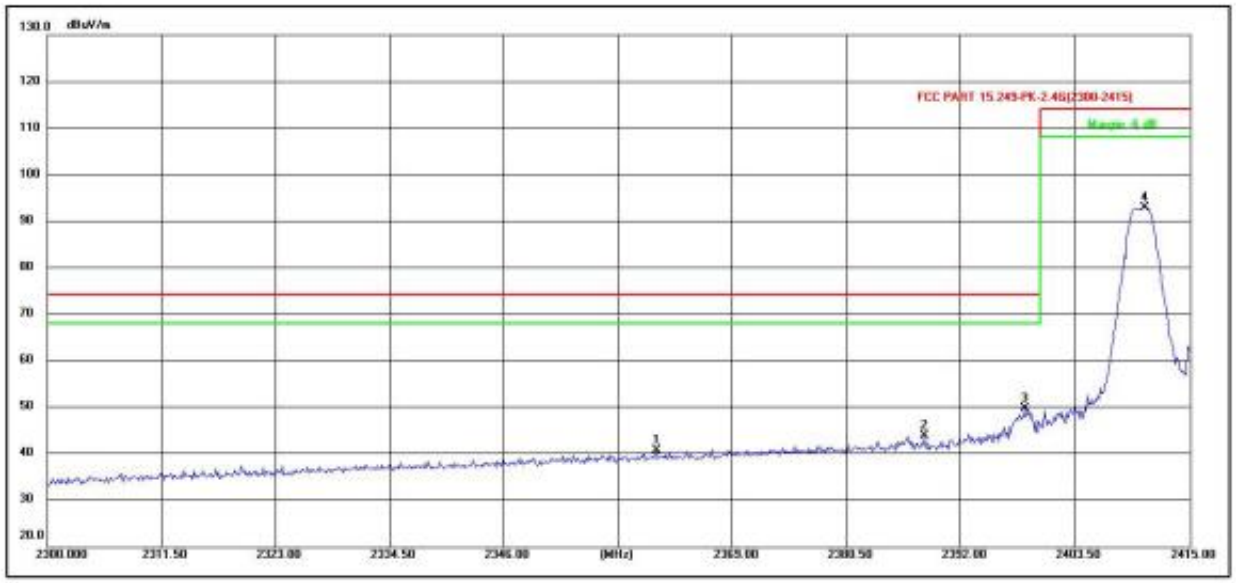
Temperature	24.6℃	Humidity	54.1%
Test Engineer	ALisa Huang		

PASS

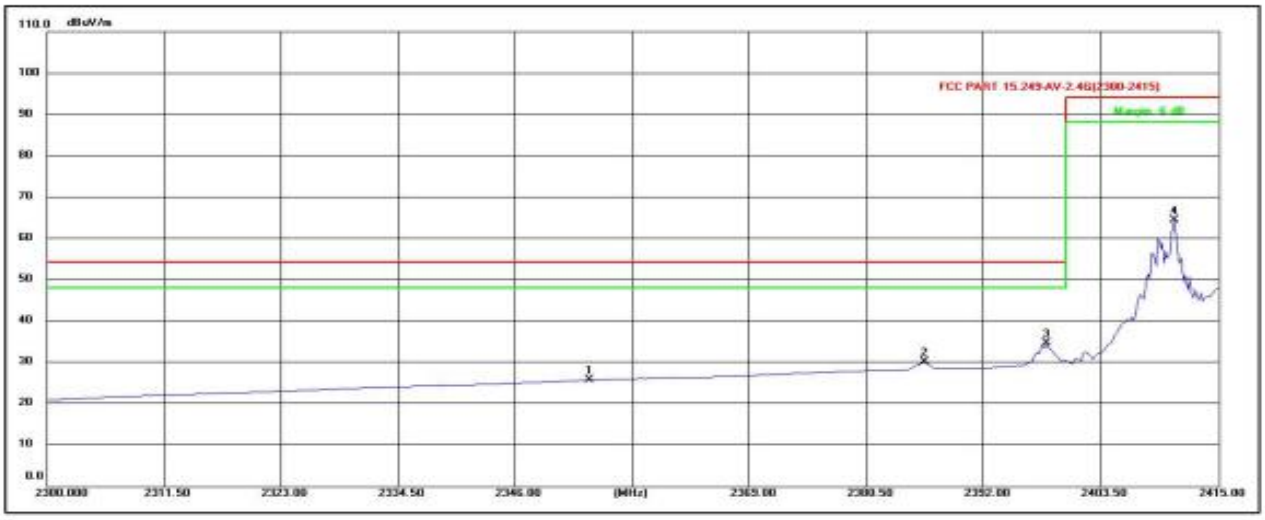
Remark:

1. *The other emission levels were very low against the limit.*
2. *The average measurement was not performed when the peak measured data under the limit of average detection.*
3. *Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;*
4. *Please refer to following test plots;*

Channel 1 / 2410MHz
Horizontal

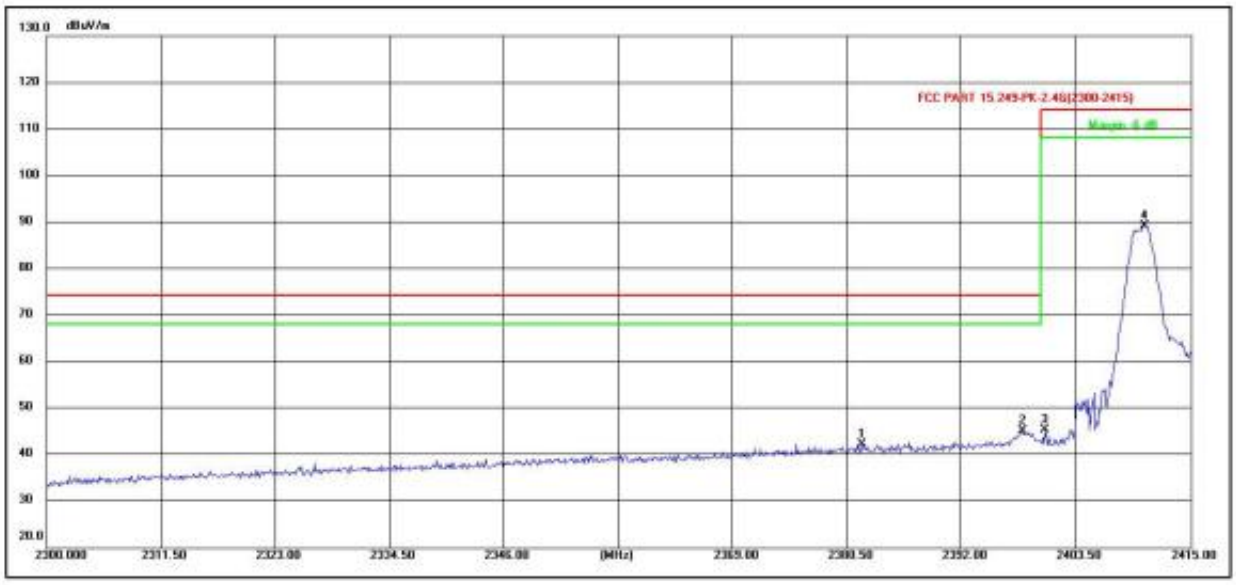


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2361.295	31.61	9.28	40.89	74.00	-33.11	PK
2	2388.320	34.39	9.68	44.07	74.00	-29.93	PK
3	2398.440	40.01	9.83	49.84	74.00	-24.16	PK
4 *	2410.515	83.00	10.01	93.01	114.00	-20.99	PK

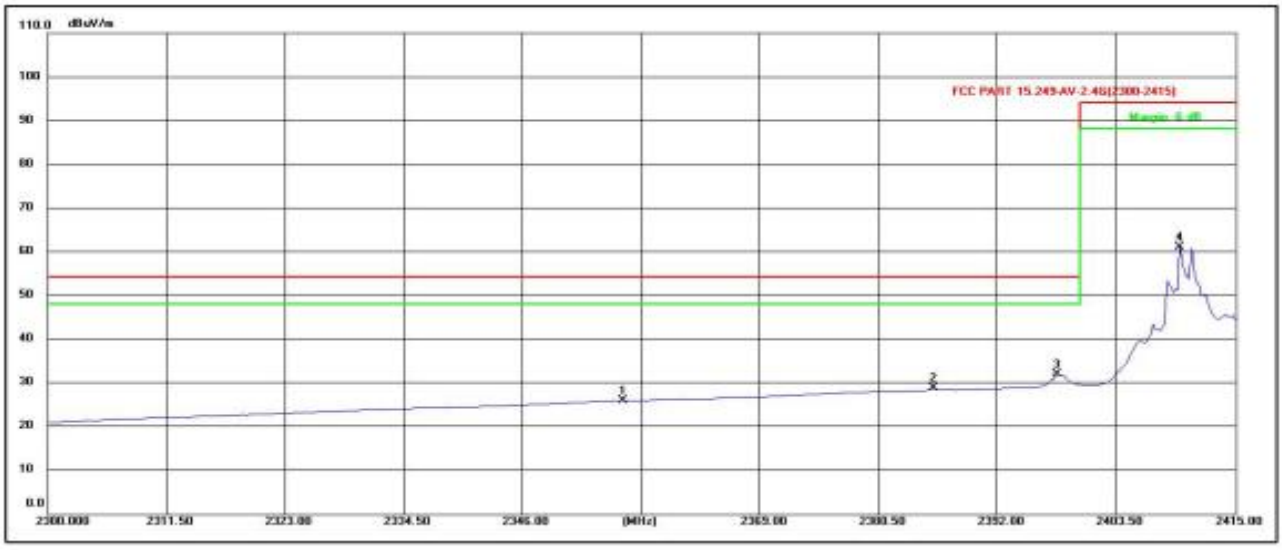


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2353.245	16.65	9.17	25.82	54.00	-28.18	AV
2	2386.135	20.62	9.65	30.27	54.00	-23.73	AV
3 *	2398.095	24.90	9.83	34.73	54.00	-19.27	AV
4	2410.630	54.50	10.02	64.52	94.00	-29.48	AV

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2381.995	32.89	9.52	42.41	74.00	-31.59	PK
2	2398.095	35.48	9.76	45.24	74.00	-28.76	PK
3	2400.395	35.58	9.79	45.37	74.00	-28.63	PK
4 *	2410.400	79.36	9.94	89.30	114.00	-24.70	PK



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2355.660	16.85	9.14	25.99	54.00	-28.01	AV
2	2385.790	19.28	9.58	28.86	54.00	-25.14	AV
3 *	2397.750	22.25	9.75	32.00	54.00	-22.00	AV
4	2409.595	51.13	9.93	61.06	94.00	-32.94	AV

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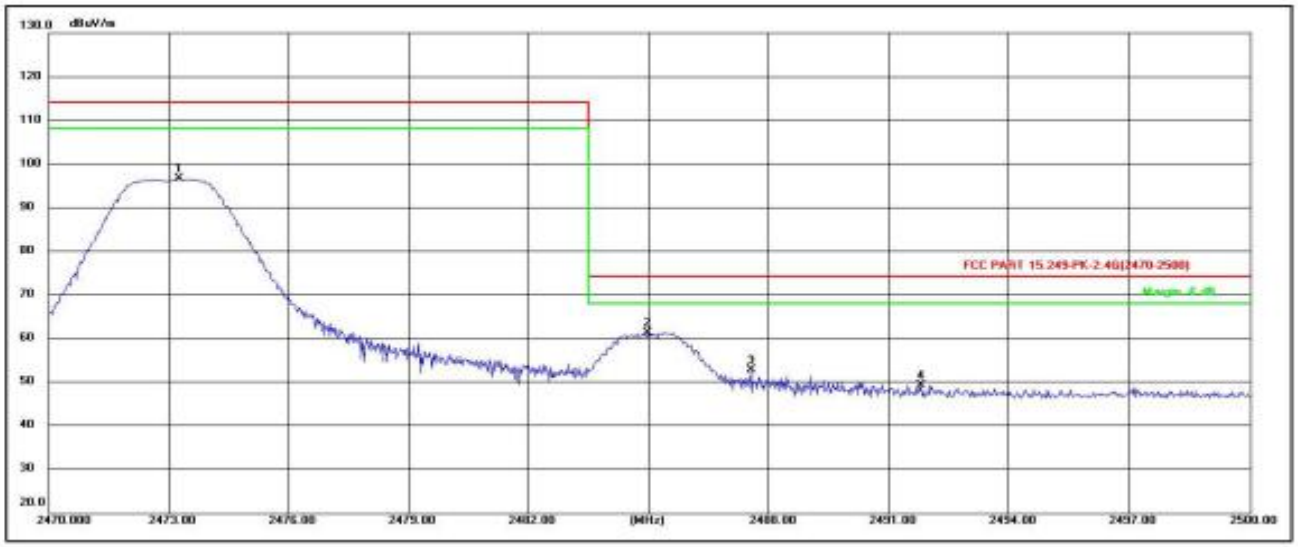
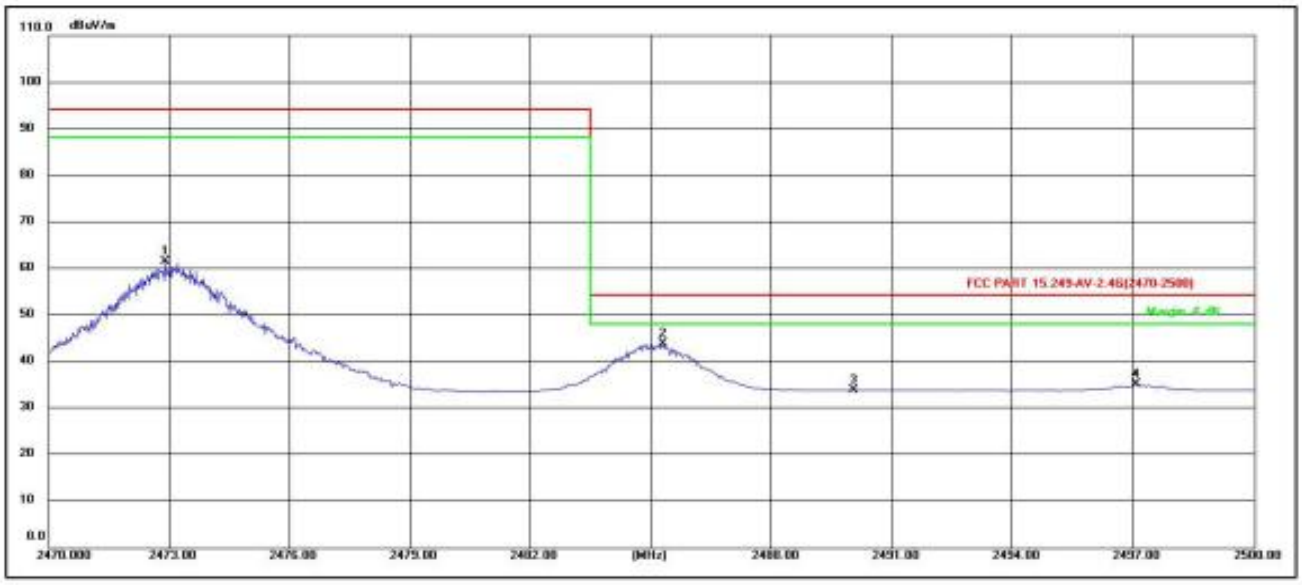
Channel 3 / 2473 MHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2473.270	85.63	10.97	96.60	114.00	-17.40	PK
2 *	2484.970	50.29	11.15	61.44	74.00	-12.56	PK
3	2487.550	41.76	11.19	52.95	74.00	-21.05	PK
4	2491.780	38.18	11.25	49.43	74.00	-24.57	PK



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2472.910	50.47	10.97	61.44	94.00	-32.56	AV
2 *	2485.300	32.81	11.15	43.96	54.00	-10.04	AV
3	2490.040	22.80	11.22	34.02	54.00	-19.98	AV
4	2497.060	23.81	11.34	35.15	54.00	-18.85	AV

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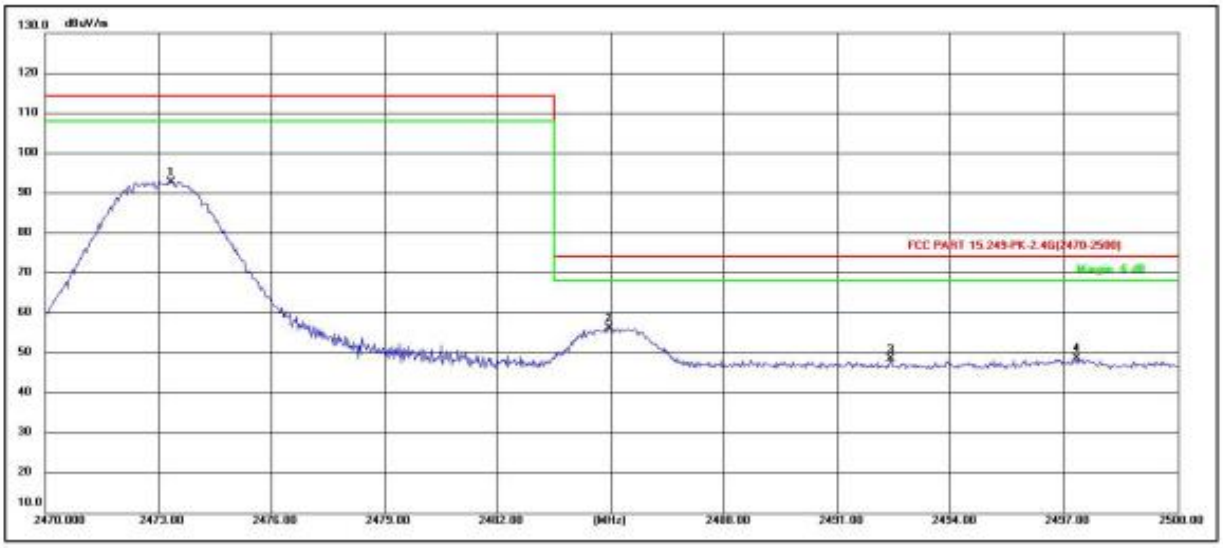
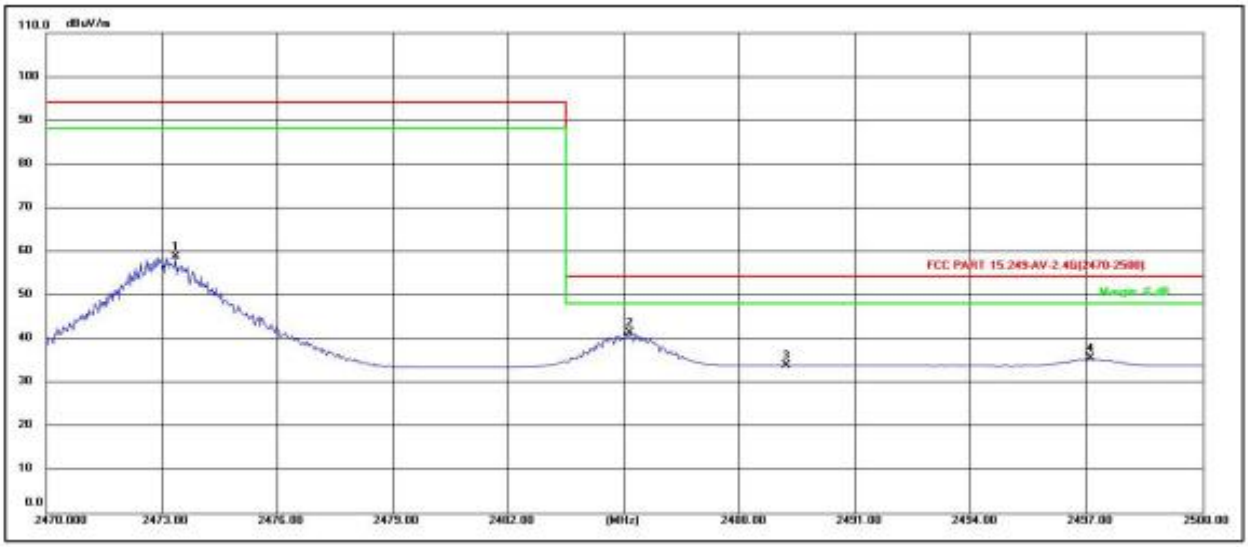
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2473.330	81.89	10.89	92.78	114.00	-21.22	PK
2 *	2484.940	45.27	11.06	56.33	74.00	-17.67	PK
3	2492.410	37.51	11.17	48.68	74.00	-25.32	PK
4	2497.330	37.56	11.25	48.81	74.00	-25.19	PK



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2473.360	47.93	10.89	58.82	94.00	-35.18	AV
2 *	2485.150	30.40	11.06	41.46	54.00	-12.54	AV
3	2489.200	22.86	11.12	33.98	54.00	-20.02	AV
4	2497.090	24.30	11.25	35.55	54.00	-18.45	AV

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5.5. Antenna Requirements

5.5.1 Standard Applicable

According to antenna requirement of §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 re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

5.5.2 Antenna Connected Construction

5.5.2.1. Standard Applicable

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.

5.5.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 0dBi, and the antenna is a internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.5.2.3. Results: Compliance.

6. LIST OF MEASURING EQUIPMENTS

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2019-11-14	2020-11-13
2	DC Power Supply	Agilent	E3642A	N/A	2019-11-14	2020-11-13
3	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2019-10-09	2020-10-08
4	EMI Test Software	AUDIX	E3	/	N/A	N/A
5	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2019-06-12	2020-06-11
6	Positioning Controller	MF	MF-7082	/	2019-06-12	2020-06-11
7	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2019-07-25	2020-07-24
8	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2019-07-25	2020-07-24
9	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2019-07-01	2020-06-30
10	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2019-09-19	2020-09-18
11	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-025	2019-09-19	2020-09-18
12	EMI Test Receiver	R&S	ESR 7	101181	2019-06-12	2020-06-11
13	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2019-11-14	2020-11-13
14	AMPLIFIER	QuieTek	QTK	CHM/0809065	2019-11-14	2020-11-13
15	RF Cable-R03m	Jye Bao	RG142	CB021	2019-06-12	2020-06-11
16	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2019-06-12	2020-06-11
17	EMI Test Receiver	R&S	ESPI	101840	2019-06-11	2020-06-10
18	Artificial Mains	R&S	ENV216	101288	2019-06-12	2020-06-11
19	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2019-06-11	2020-06-10
Note: All equipment is calibrated through CHINA CEPREI LABORATORY and GUANGZHOU LISAI CALIBRATION AND TEST CO., LTD.						

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7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------THE END OF REPORT----------

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