APPLICATION CERTIFICATION FCC Part 15C
On Behalf of
Libre Home Inc

Operating Control
Model No.: PDU

FCC ID: 2AQXA-PDU

Prepared for	:	Libre Home Inc
Address	:	13 Crestview Ter. Montvale, New Jersey, United States 07645
Prepared by	:	Shenzhen Accurate Technology Co., Ltd.
Address	:	1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China Tel: (0755) 26503290 Fax: (0755) 26503396

Report No.	:	ATE20181657
Date of Test	:	Sep. 8-Sep. 13, 2018
Date of Report	:	Sep. 14, 2018

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Test Report Certification

Applicant	:	Libre Home Inc
EUT Description	:	Operating Control
Model No.	:	PDU
Trade Name	:	Libre Home

Measurement Procedure Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247
ANSI C63.10: 2013

The EUT was tested according to DTS test procedure of August 24, 2018 KDB558074 D01 DTS Meas Guidance v05 for compliance to FCC 47CFR 15.247 requirements

The device described above is tested by Shenzhen Accurate Technology Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C Section 15.247 limits. The measurement results are contained in this test report and Shenzhen Accurate Technology Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Shenzhen Accurate Technology Co., Ltd.

Date of Test :	Sep. 8-Sep. 13, 2018
Date of Report :	Sep. 14, 2018

Prepared by : _____
(Stan Yang, Engineer)

Approved & Authorized Signer : _____
(Sean Liu, Manager)

1. GENERAL INFORMATION

1.1.Description of Device (EUT)

EUT	:	Operating Control
Model Number	:	PDU
Radio Device	:	ZigBee
Modulation Type	:	OQPSK
Frequency Range	:	2405-2480MHz
Number of Channels	:	16
Channel Spacing	:	5MHz
Antenna Gain	:	2.8dBi
Antenna Type	:	PCB Antenna
Power Supply	:	AC 120V/60Hz
Max Loading Rate	:	300W
Applicant	:	Libre Home Inc
Address	:	13 Crestview Ter. Montvale, New Jersey, United States 07645

1.2.Carrier Frequency of Channels

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	17	2435	23	2465
12	2410	18	2440	24	2470
13	2415	19	2445	25	2475
14	2420	20	2450	26	2480
15	2425	21	2455		
16	2430	22	2460		

1.3.Special Accessory and Auxiliary Equipment

N/A

1.4.Description of Test Facility

EMC Lab	:	Recognition of accreditation by Federal Communications Commission (FCC) The Designation Number is CN1189 The Registration Number is 708358 Listed by Innovation, Science and Economic Development Canada (ISEDC) The Registration Number is 5077A-2 Accredited by China National Accreditation Service for Conformity Assessment (CNAS) The Registration Number is CNAS L3193 Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 4297.01
Name of Firm	:	Shenzhen Accurate Technology Co., Ltd.
Site Location	:	1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China

1.5.Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty (9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty (30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty (Above 1GHz)	=	4.06dB, k=2

2. MEASURING DEVICE AND TEST EQUIPMENT

Table 1: List of Test and Measurement Equipment

Kind of equipment	Manufacturer	Type	S/N	Calibrated dates	Cal. Interval
EMI Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan. 06, 2018	One Year
EMI Test Receiver	Rohde&Schwarz	ESR	101817	Jan. 06, 2018	One Year
Spectrum Analyzer	Rohde&Schwarz	FSV-40	101495	Jan. 06, 2018	One Year
Pre-Amplifier	Rohde&Schwarz	CBLU1183540-01	3791	Jan. 06, 2018	One Year
Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan. 06, 2018	One Year
Bilog Antenna	Schwarzbeck	VULB9163	9163-323	Jan. 06, 2018	One Year
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan. 06, 2018	One Year
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	Jan. 06, 2018	One Year
LISN	Schwarzbeck	NSLK8126	8126431	Jan. 06, 2018	One Year
Highpass Filter	Wainwright Instruments	WHKX3.6/18G-10SS	N/A	Jan. 06, 2018	One Year
Band Reject Filter	Wainwright Instruments	WRCG2400/2485-2375/2510-60/11SS	N/A	Jan. 06, 2018	One Year
Conducted Emission Measurement Software: ES-K1 V1.71					
Radiated Emission Measurement Software: EZ_EMC V1.1.4.2					

3. OPERATION OF EUT DURING TESTING

3.1.Operating Mode

The mode is used: **Transmitting mode**

Low Channel: 2405MHz
Middle Channel: 2450MHz
High Channel: 2480MHz

Its duty cycle setting is greater than 98%.

3.2.Configuration and peripherals

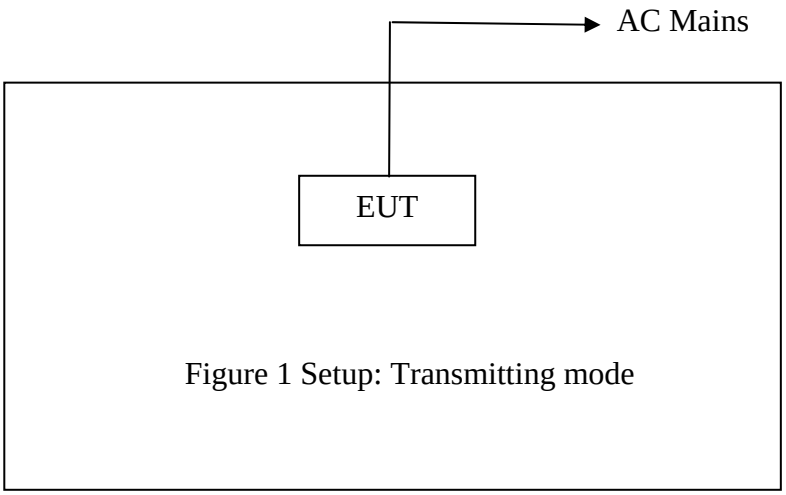


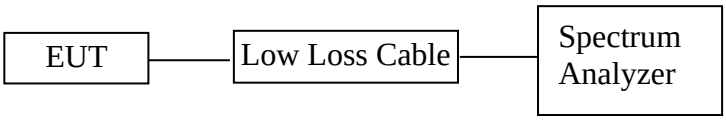
Figure 1 Setup: Transmitting mode

4. TEST PROCEDURES AND RESULTS

FCC Rules	Description of Test	Result
Section 15.247(a)(2)	6dB Bandwidth Test	Compliant
Section 15.247(b)(3)	Maximum Peak Output Power Test	Compliant
Section 15.247(e)	Power Spectral Density Test	Compliant
Section 15.247(d)	Band Edge Compliance Test	Compliant
Section 15.247(d) Section 15.209	Radiated Spurious Emission Test	Compliant
Section 15.207	AC Power Line Conducted Emission Test	Compliant
Section 15.203	Antenna Requirement	Compliant

5. 6DB BANDWIDTH TEST

5.1.Block Diagram of Test Setup



5.2.The Requirement For Section 15.247(a)(2)

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

5.3.EUT Configuration on Measurement

The equipment is installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

5.4.Operating Condition of EUT

5.4.1.Setup the EUT and simulator as shown as Section 5.1.

5.4.2.Turn on the power of all equipment.

5.4.3.Let the EUT work in TX modes measure it. The transmit frequency are 2405-2480MHz. We select 2405MHz, 2450MHz, and 2480MHz TX frequency to transmit.

5.5.Test Procedure

5.5.1.The transmitter output was connected to the spectrum analyzer through a low loss cable.

5.5.2.Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz.

5.5.3.The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

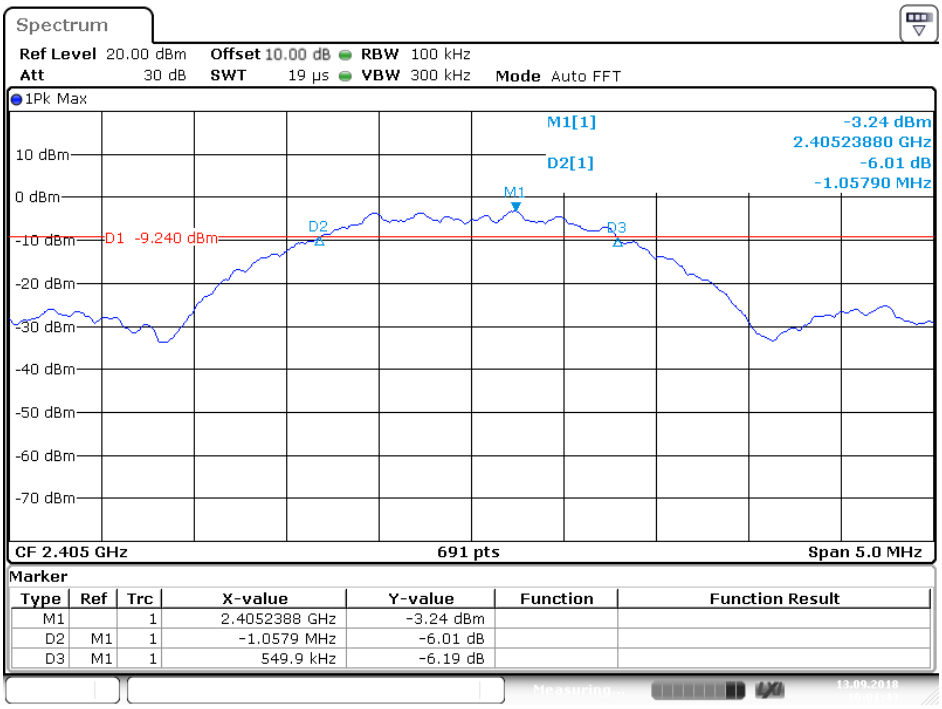
5.6.Test Result

Test Lab: Shielding room
Test Engineer: Star

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit(MHz)	Result
11	2405	1.608	0.5	PASS
20	2450	1.635	0.5	PASS
26	2480	1.643	0.5	PASS

The spectrum analyzer plots are attached as below.

channel 11



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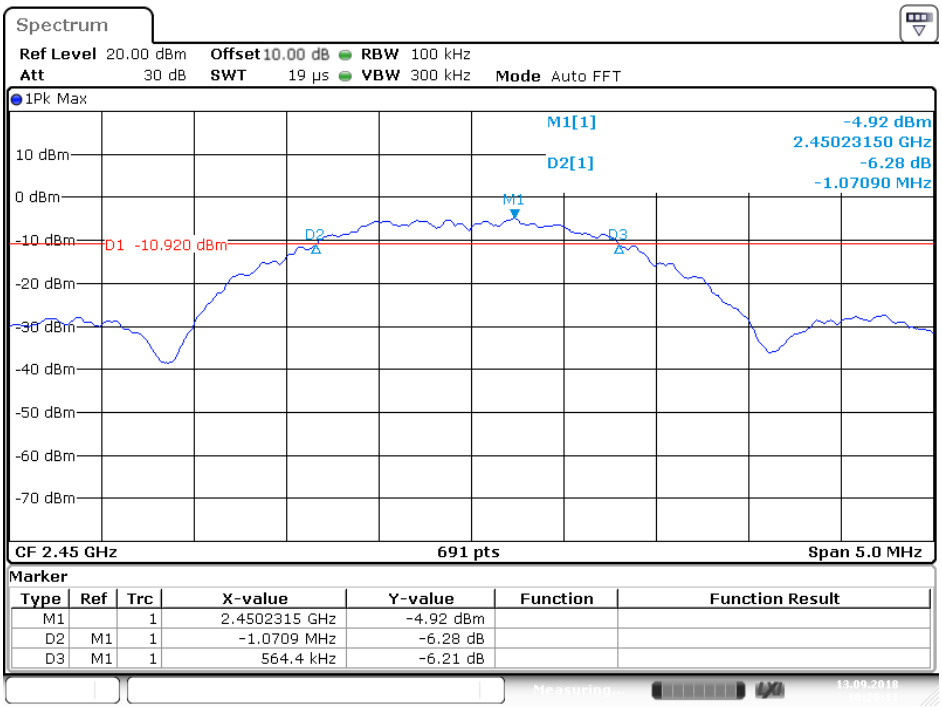
channel 20



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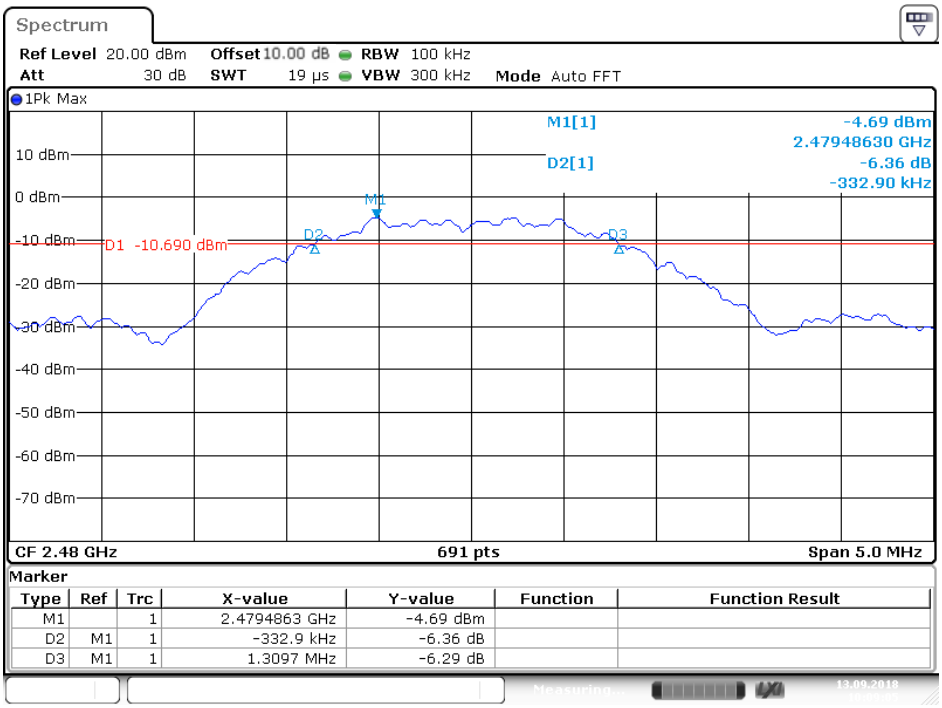
channel 26



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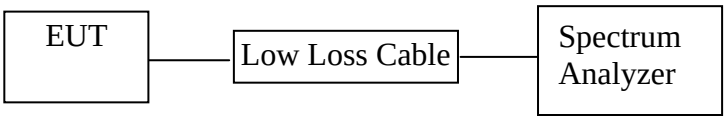
6. MAXIMUM PEAK OUTPUT POWER TEST

6.1.Block Diagram of Test Setup



6.2.The Requirement For Section 15.247(b)(3)

Section 15.247(b)(3): For systems using digital modulation in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands: 1 Watt.

6.3.EUT Configuration on Measurement

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

6.4.Operating Condition of EUT

6.4.1.Setup the EUT and simulator as shown as Section 6.1.

6.4.2.Turn on the power of all equipment.

6.4.3.Let the EUT work in TX modes measure it. The transmit frequency are 2405-2480MHz. We select 2405MHz, 2450MHz, and 2480MHz TX frequency to transmit.

6.5.Test Procedure

6.5.1.The transmitter output was connected to the spectrum analyzer through a low loss cable.

6.5.2.Set RBW of spectrum analyzer to 1 MHz and VBW to 3MHz.

6.5.3.Measurement the maximum peak output power.

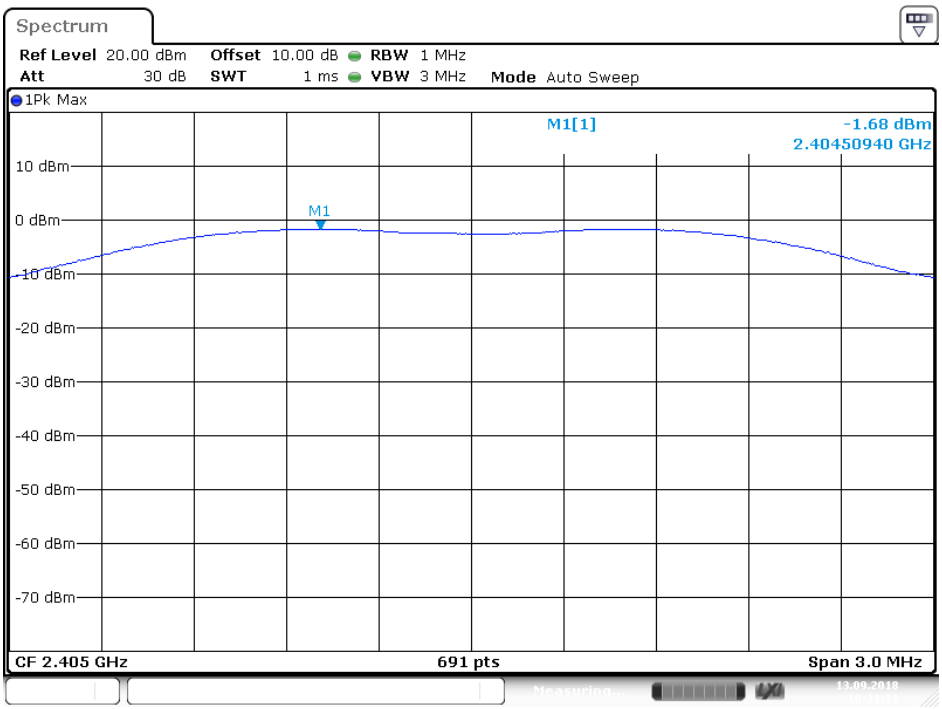
6.6.Test Result

Test Lab: Shielding room
Test Engineer: Star

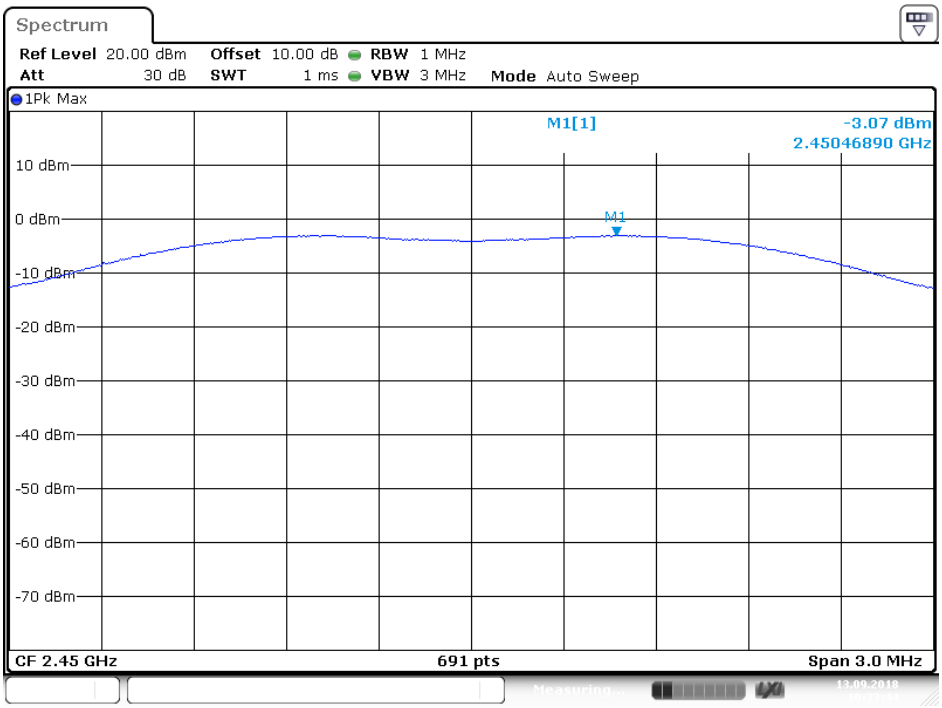
Channel	Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Result
11	2405	-1.68	30	PASS
20	2450	-3.07	30	PASS
26	2480	-2.73	30	PASS

The spectrum analyzer plots are attached as below.

channel 11



channel 20



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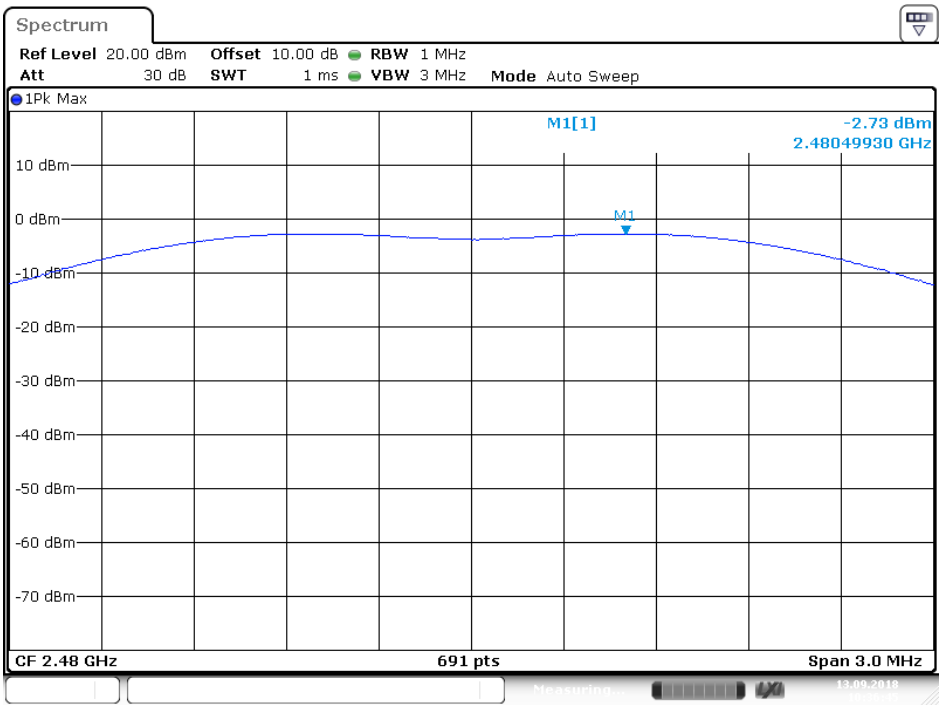
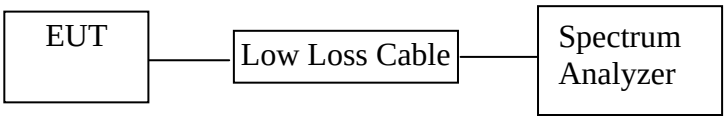
channel 26



Date: 13.SEP.2018 10:36:45

7. POWER SPECTRAL DENSITY TEST

7.1.Block Diagram of Test Setup



7.2.The Requirement For Section 15.247(e)

Section 15.247(e): 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.

7.3.EUT Configuration on Measurement

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

7.4.Operating Condition of EUT

7.4.1.Setup the EUT and simulator as shown as Section 7.1.

7.4.2.Turn on the power of all equipment.

7.4.3.Let the EUT work in TX modes measure it. The transmit frequency are 2405-2480MHz. We select 2405MHz, 2450MHz, and 2480MHz TX frequency to transmit.

7.5.Test Procedure

7.5.1.The transmitter output was connected to the spectrum analyzer through a low loss cable.

7.5.2.Measurement Procedure PKPSD:

7.5.3.This procedure must be used if maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit, and is optional if the maximum (average) conducted output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
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.
10. If measured value exceeds limit, reduce RBW (no less than 3kHz) and repeat.

7.5.4.Measurement the maximum power spectral density.

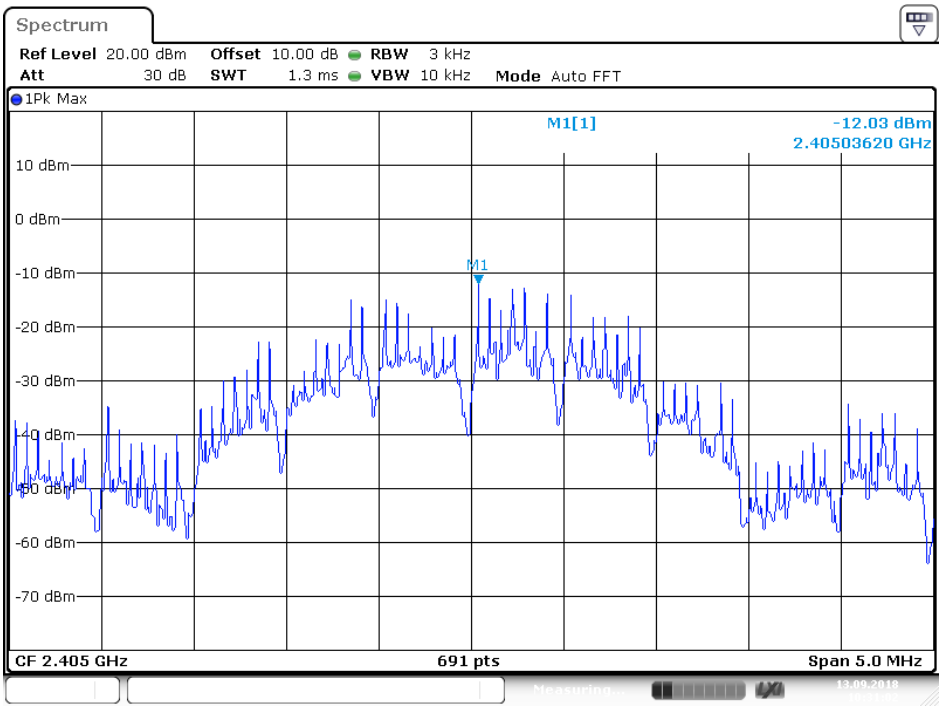
7.6.Test Result

Test Lab: Shielding room
Test Engineer: Star

Channel	Frequency (MHz)	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
11	2405	-12.03	8	PASS
20	2450	-14.78	8	PASS
26	2480	-13.67	8	PASS

The spectrum analyzer plots are attached as below.

channel 11



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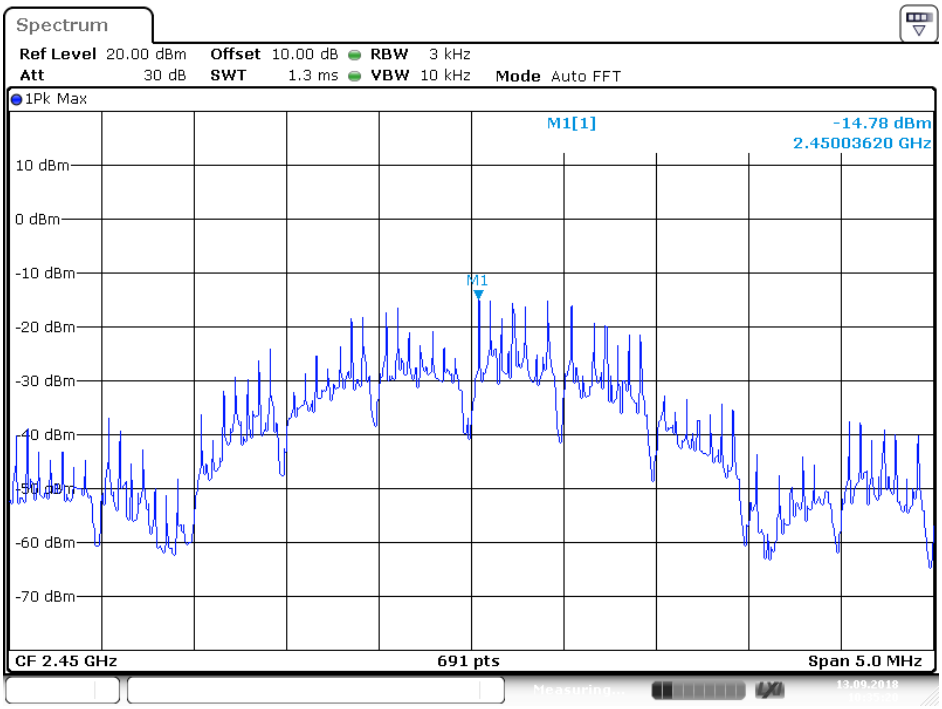
channel 20



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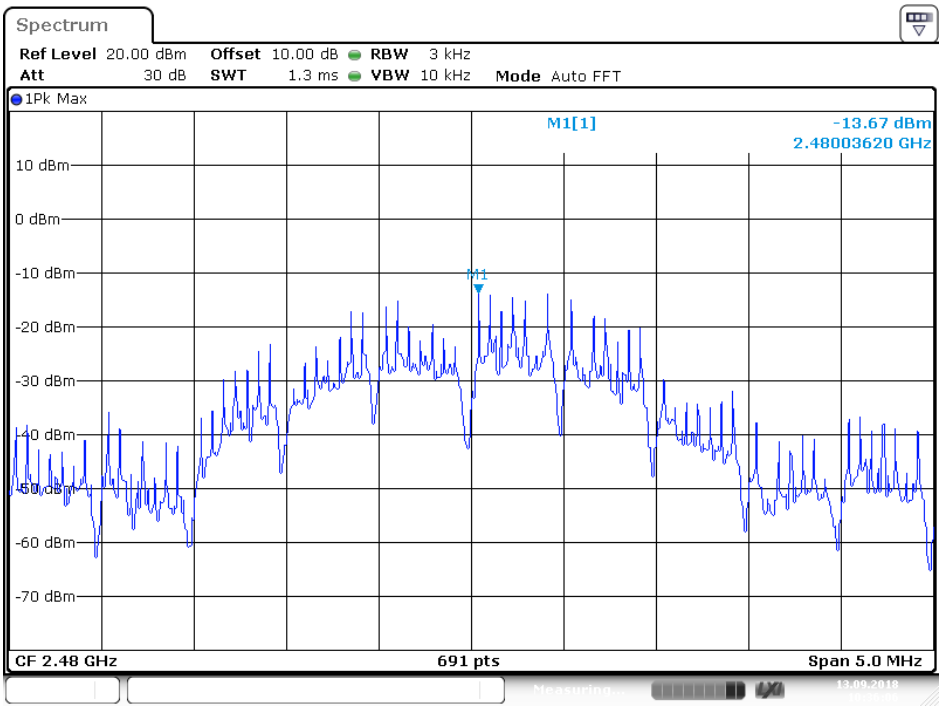
channel 26



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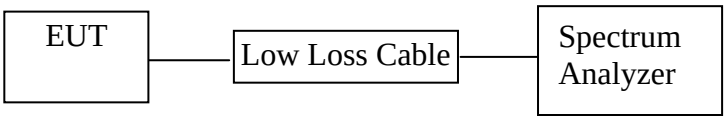
8. BAND EDGE COMPLIANCE TEST

8.1.Block Diagram of Test Setup



8.2.The Requirement For Section 15.247(d)

Section 15.247(d): 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

8.3.EUT Configuration on Measurement

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

8.4.Operating Condition of EUT

8.4.1.Setup the EUT and simulator as shown as Section 8.1.

8.4.2.Turn on the power of all equipment.

8.4.3.Let the EUT work in TX modes measure it. The transmit frequency are 2405-2480MHz. We select 2405MHz, 2480MHz TX frequency to transmit.

8.5.Test Procedure

Conducted Band Edge:

8.5.1.The transmitter output was connected to the spectrum analyzer via a low loss cable.

8.5.2.Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz.

Radiate Band Edge:

8.5.3.The EUT is placed on a turntable, which is 1.5m above the ground plane and worked at highest radiated power.

8.5.4.The turntable was rotated for 360 degrees to determine the position of maximum emission level.

8.5.5.EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.

8.5.6.Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

8.5.7.RBW=1MHz, VBW=1MHz

8.5.8.The band edges was measured and recorded.

8.6.Test Result

Pass.

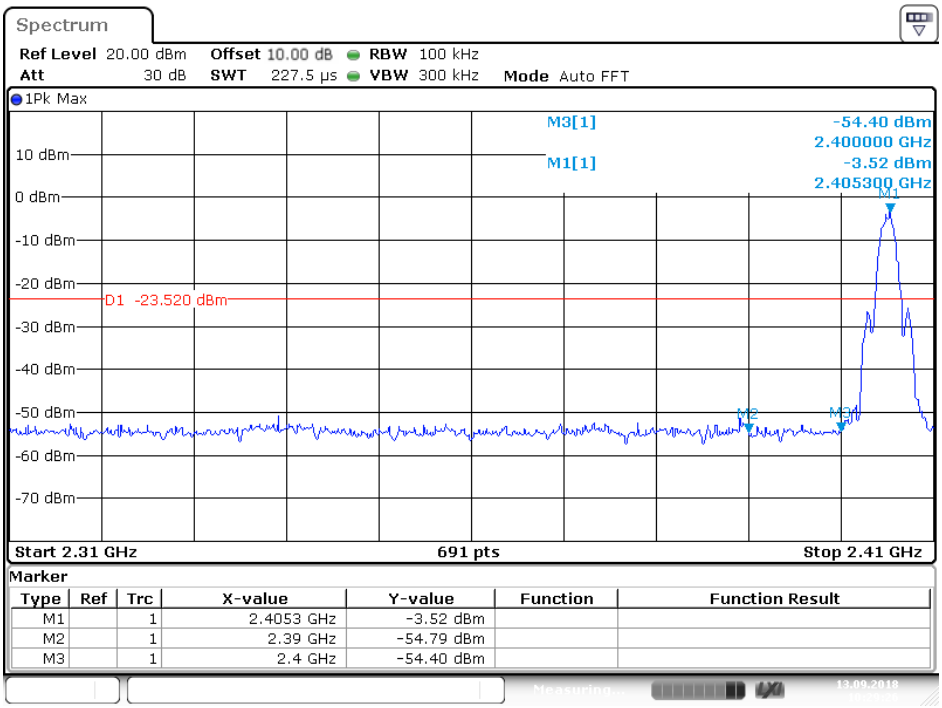
Test Lab: Shielding room
Test Engineer: Star

Conducted Band Edge Result

Channel	Frequency	Delta peak to band emission	Limit(dBc)
11	2.405GHz	50.88	＞20
26	2.480GHz	47.72	＞20

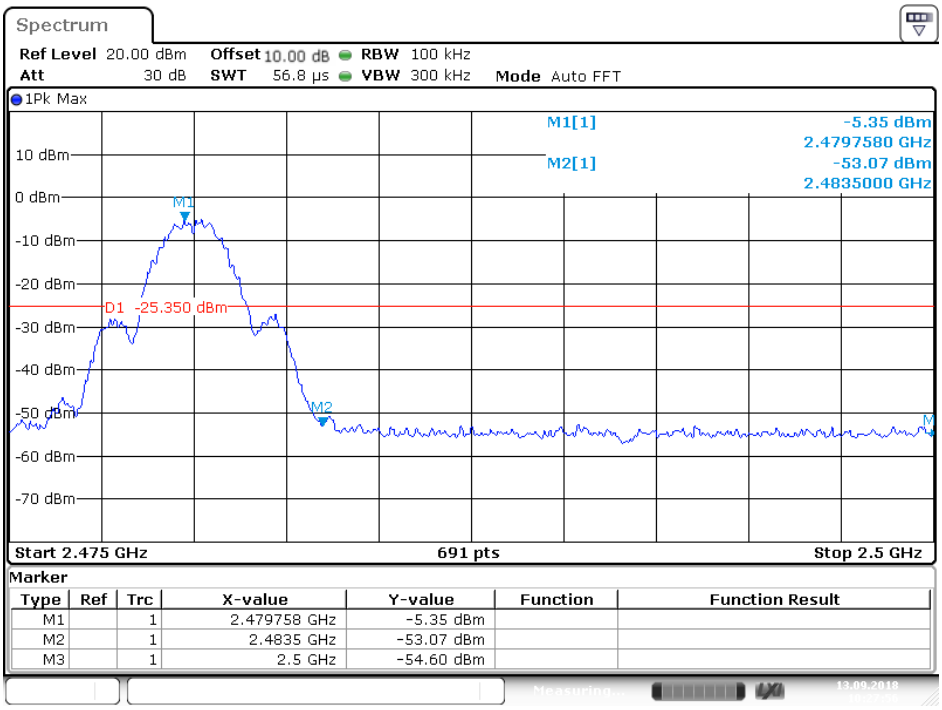
The spectrum analyzer plots are attached as below.

channel 11



Date: 13.SEP.2018 10:29:26

channel 26



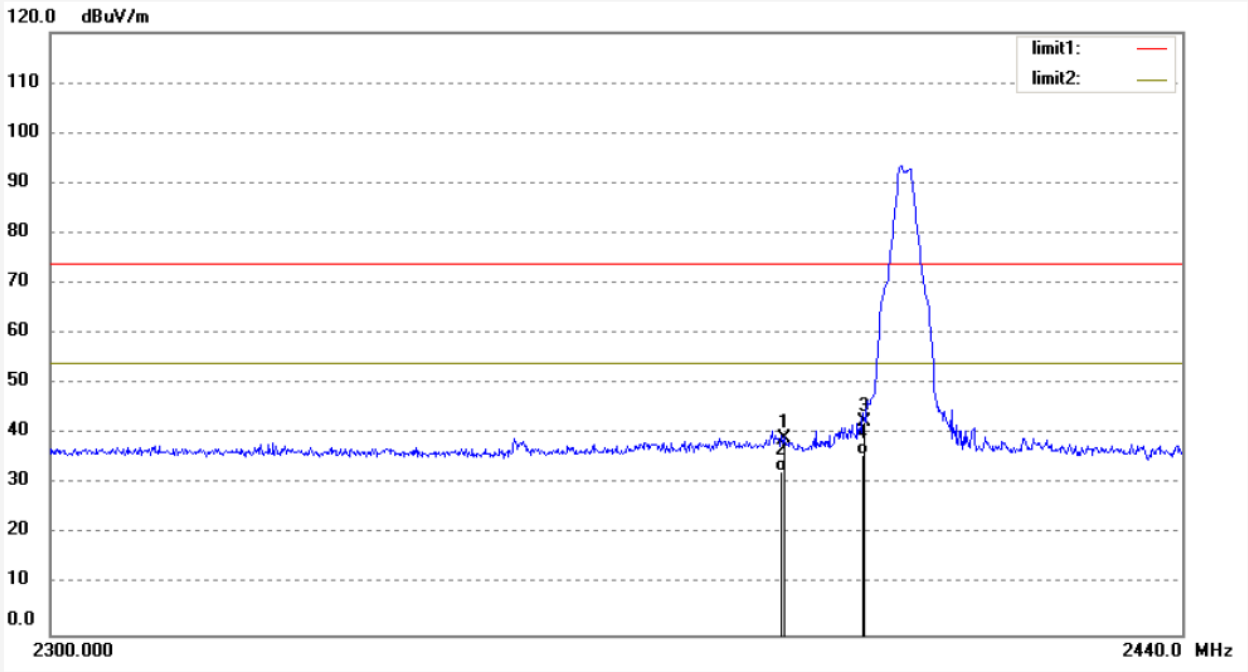
Date: 13.SEP.2018 10:27:56

Radiated Band Edge Result

ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2763	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:37:10
EUT: Operating Control	Engineer Signature: star
Mode: TX 2405MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657

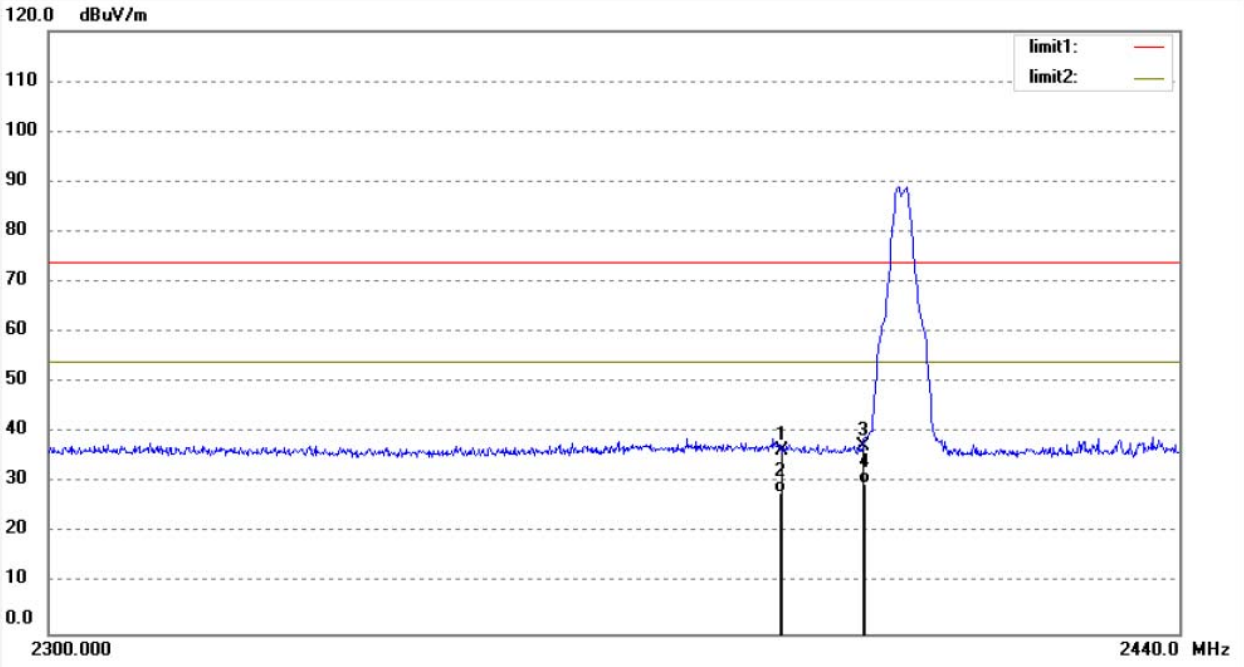


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	38.22	0.79	39.01	74.00	-34.99	peak	200	196	
2	2390.000	31.81	0.79	32.60	54.00	-21.40	AVG	200	188	
3	2400.000	41.48	0.88	42.36	74.00	-31.64	peak	200	121	
4	2400.000	34.90	0.88	35.78	54.00	-18.22	AVG	200	239	

ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2764	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:38:13
EUT: Operating Control	Engineer Signature: star
Mode: TX 2405MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	35.75	0.79	36.54	74.00	-37.46	peak	150	152	
2	2390.000	27.13	0.79	27.92	54.00	-26.08	AVG	150	107	
3	2400.000	36.60	0.88	37.48	74.00	-36.52	peak	150	269	
4	2400.000	28.92	0.88	29.80	54.00	-24.20	AVG	150	332	

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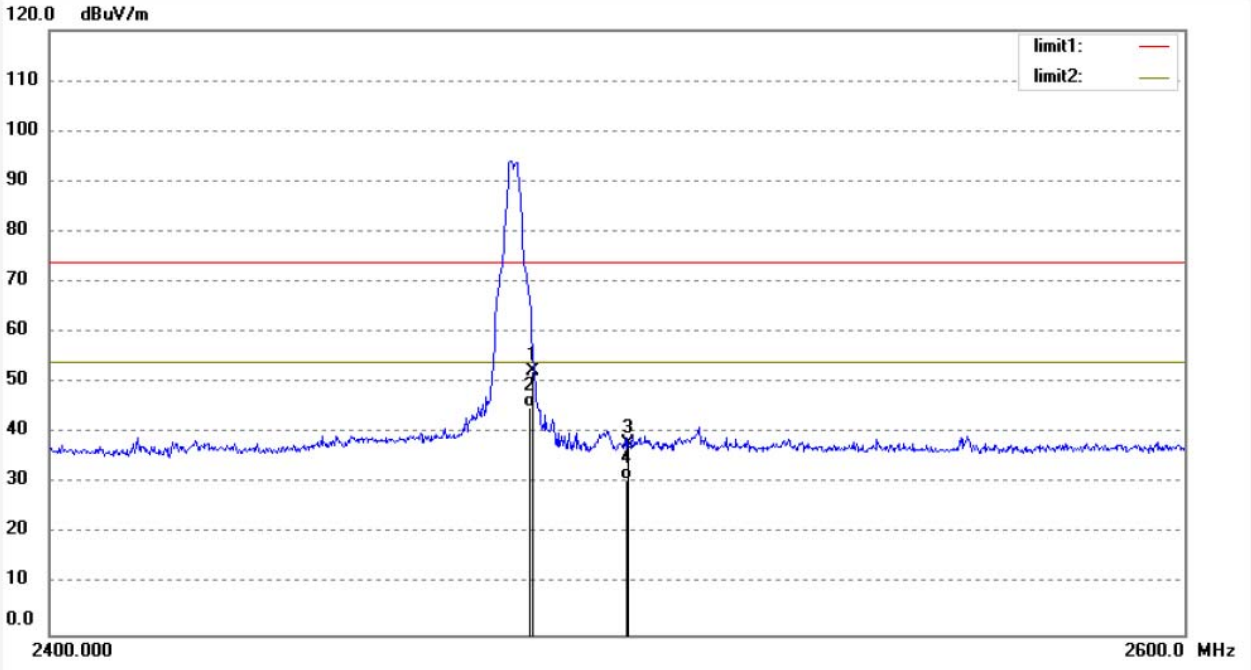
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2762	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:35:09
EUT: Operating Control	Engineer Signature: star
Mode: TX 2480MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	51.20	1.10	52.30	74.00	-21.70	peak	200	200	
2	2483.500	44.18	1.10	45.28	54.00	-8.72	AVG	200	75	
3	2500.000	36.86	1.10	37.96	74.00	-36.04	peak	200	100	
4	2500.000	29.53	1.10	30.63	54.00	-23.37	AVG	200	251	

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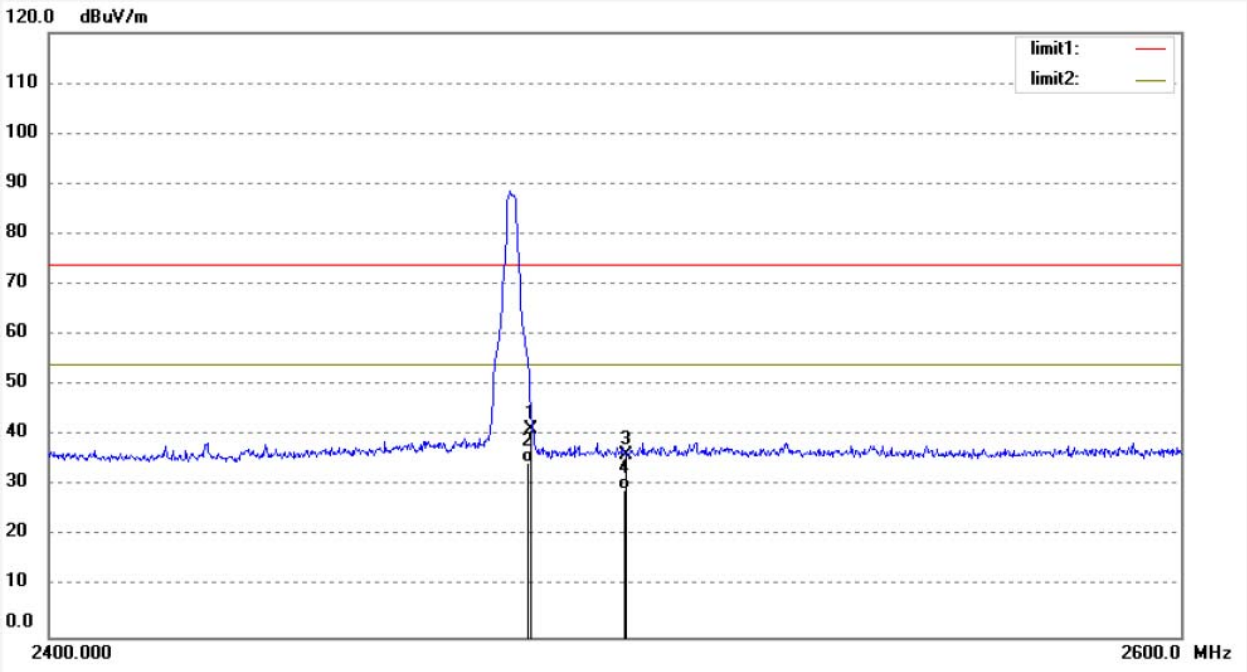
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2761	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:34:00
EUT: Operating Control	Engineer Signature: star
Mode: TX 2480MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	40.05	1.10	41.15	74.00	-32.85	peak	150	59	
2	2483.500	33.69	1.10	34.79	54.00	-19.21	AVG	150	200	
3	2500.000	35.17	1.10	36.27	74.00	-37.73	peak	150	133	
4	2500.000	28.14	1.10	29.24	54.00	-24.76	AVG	150	117	

Note:

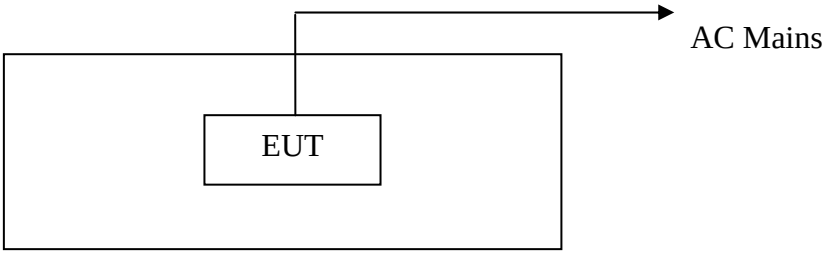
1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. The field strength is calculated by adding the antenna factor, high pass filter loss(if used) and cable loss, and subtracting the amplifier gain(if any)from the measured reading. The basic equation calculation is as follows:

   Result = Reading + Corrected Factor

9. RADIATED SPURIOUS EMISSION TEST

9.1.Block Diagram of Test Setup

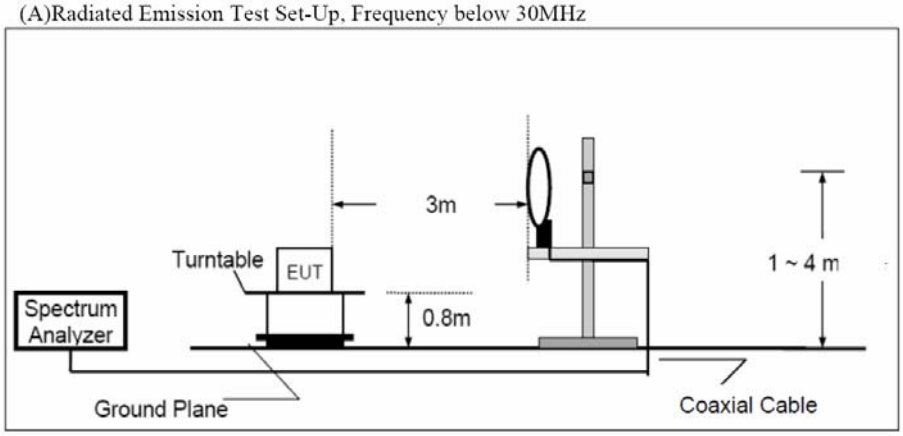
9.1.1.Block diagram of connection between the EUT and peripherals



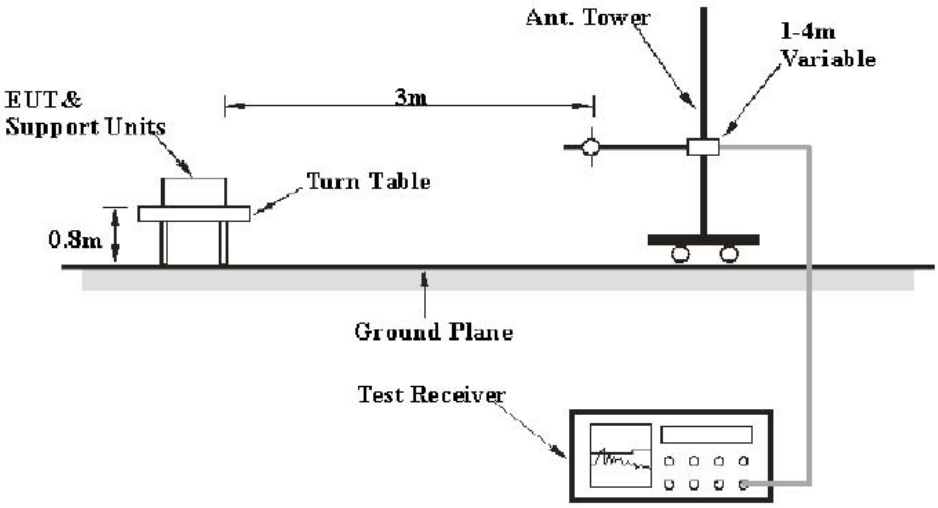
Setup: Transmitting mode

9.1.2.Semi-Anechoic Chamber Test Setup Diagram

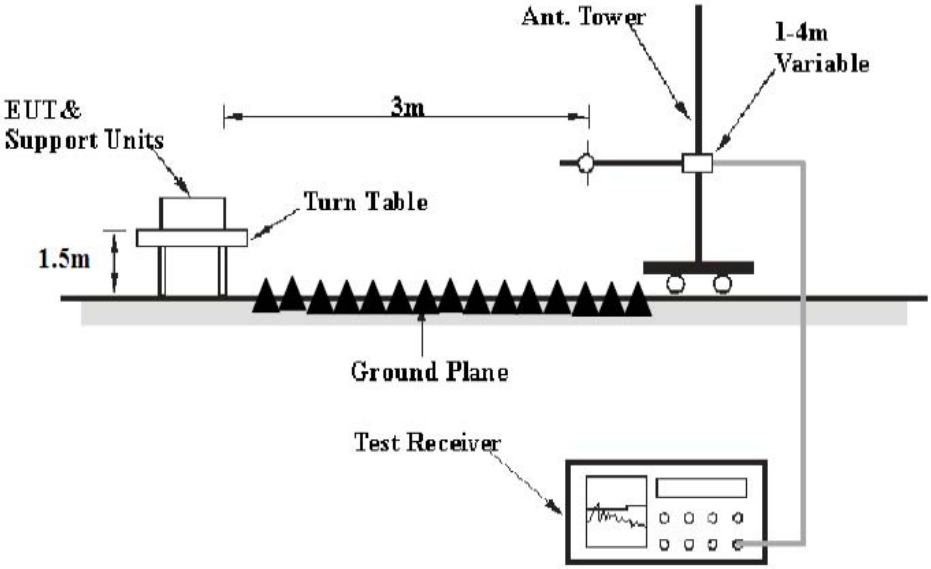
(A)Radiated Emission Test Set-Up, Frequency below 30MHz



(B)Radiated Emission Test Set-Up, Frequency 30MHz-1GHz



(C) Radiated Emission Test Set-Up, Frequency above 1GHz



9.2.The Limit For Section 15.247(d)

Section 15.247(d): 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

9.3. Restricted bands of operation

9.3.1.FCC Part 15.205 Restricted bands of operation

(a) Except as shown in paragraph (d) of this section, Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510
[2]Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emission appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, Compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

9.4.Configuration of EUT on Measurement

The equipment are installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

9.5. Operating Condition of EUT

9.5.1.Setup the EUT and simulator as shown as Section 9.1.

9.5.2.Turn on the power of all equipment.

9.5.3.Let the EUT work in TX modes measure it. The transmit frequency are 2405-2480MHz. We select 2405MHz, 2450MHz, and 2480MHz TX frequency to transmit.

9.6.Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground(Below 1GHz). The EUT and its simulators are placed on a turntable, which is 1.5 meter high above ground(Above 1GHz). The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bi-log antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the EUT location must be manipulated according to ANSI C63.10:2013 on radiated emission measurement. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

The bandwidth of test receiver is set at 9 kHz in below 30MHz. and set at 120 kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The final measurement in band 9-90 kHz, 110-490 kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.
The field strength is calculated by adding the antenna factor, and cable loss, and subtracting the amplifier gain from the measured reading.

9.7.Data Sample

Frequency (MHz)	Reading (dBμv)	Factor (dB/m)	Result (dBμv/m)	Limit (dBμv/m)	Margin (dB)	Remark
X.XX	43.85	-22.22	21.63	43.5	-21.87	QP

Frequency(MHz) = Emission frequency in MHz
Reading(dBμv) = Uncorrected Analyzer/Receiver reading
Factor (dB/m) = Antenna factor + Cable Loss – Amplifier gain
Result(dBμv/m) = Reading(dBμv) + Factor(dB/m)
Limit (dBμv/m) = Limit stated in standard
Margin (dB) = Result(dBμv/m) - Limit (dBμv/m)
QP = Quasi-peak Reading

Calculation Formula:
Margin(dB) = Result (dBμV/m)–Limit(dBμV/m)
Result(dBμV/m)= Reading(dBμV)+ Factor(dB/m)

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.

9.8.The Field Strength of Radiation Emission Measurement Results

Pass.

Test Lab: 3m Anechoic chamber
Test Engineer: Star

The frequency range from 9kHz to 26.5GHz is checked.

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.

2. The radiation emissions from 9kHz-30MHz and 18-26.5GHz are not reported, because the test values lower than the limits of 20dB.

The spectrum analyzer plots are attached as below.

Below 1GHz

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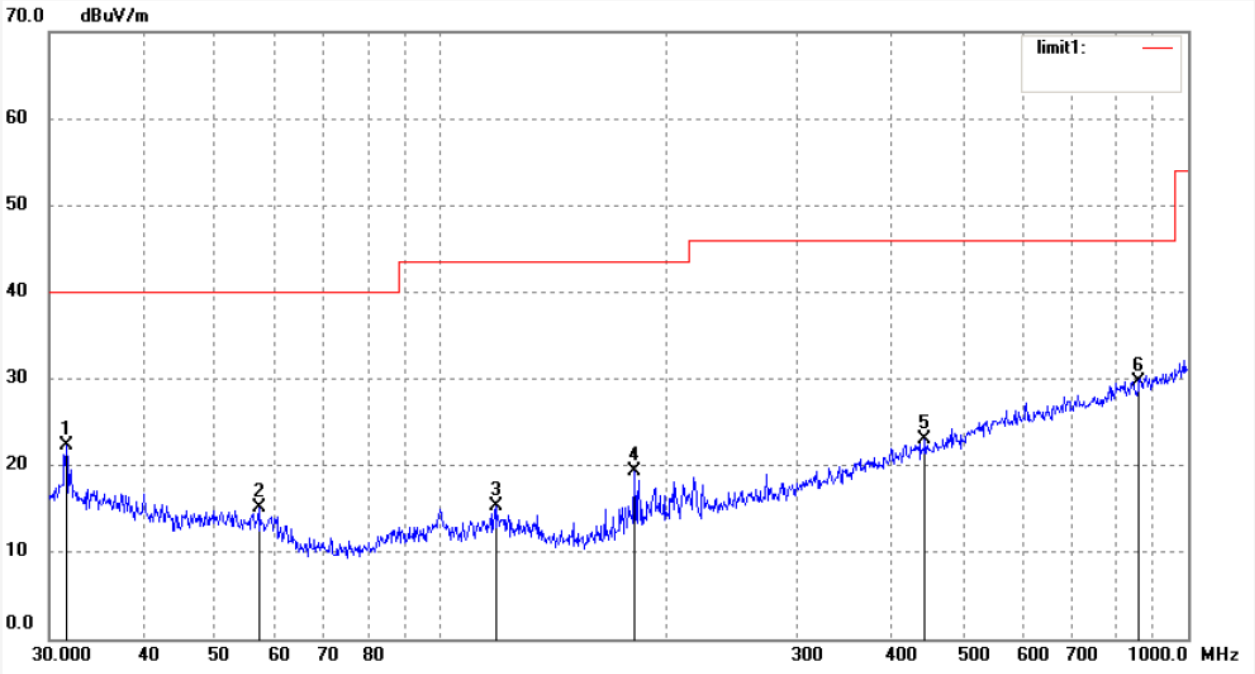
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2749	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:03:53
EUT: Operating Control	Engineer Signature: star
Mode: TX 2405MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	31.6202	32.43	-10.09	22.34	40.00	-17.66	peak	200	145	
2	57.1914	28.51	-13.37	15.14	40.00	-24.86	peak	200	210	
3	118.6013	28.38	-13.05	15.33	43.50	-28.17	peak	200	233	
4	181.9201	32.32	-13.02	19.30	43.50	-24.20	peak	200	29	
5	444.8514	28.41	-5.43	22.98	46.00	-23.02	peak	200	172	
6	860.0352	27.98	1.72	29.70	46.00	-16.30	peak	200	166	

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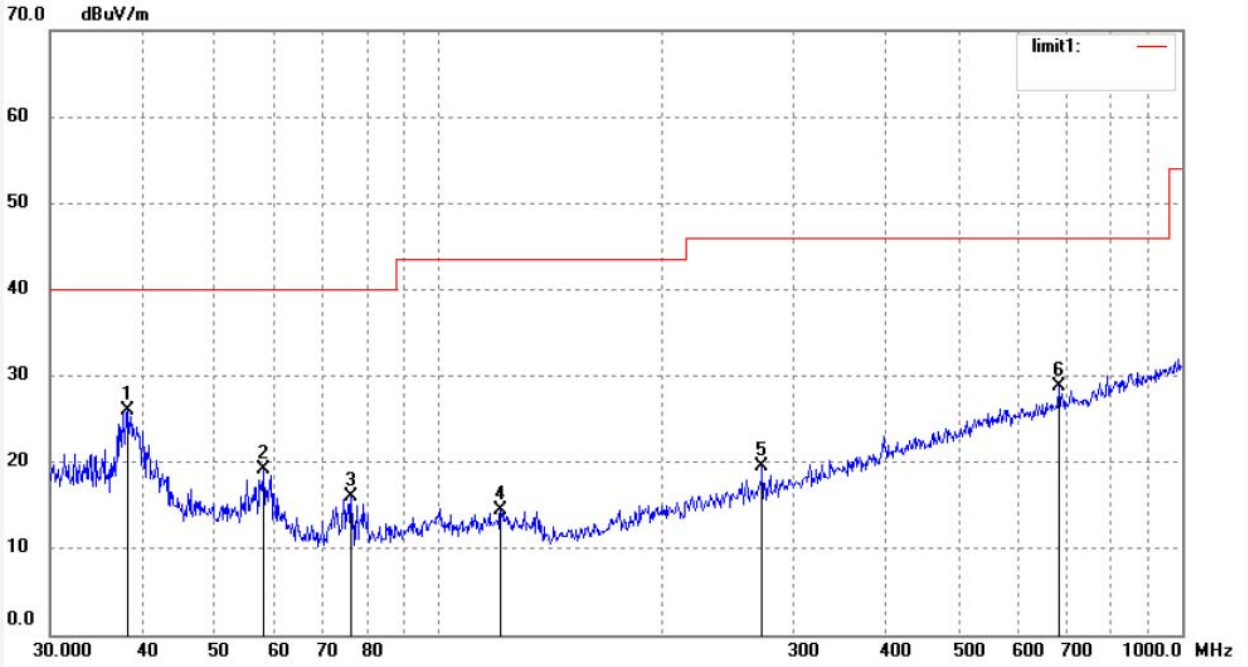
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2750	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:04:56
EUT: Operating Control	Engineer Signature: star
Mode: TX 2405MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	38.2120	37.04	-11.13	25.91	40.00	-14.09	peak	100	268	
2	58.2030	32.72	-13.56	19.16	40.00	-20.84	peak	100	305	
3	76.2442	32.64	-16.66	15.98	40.00	-24.02	peak	100	82	
4	121.1231	27.64	-13.19	14.45	43.50	-29.05	peak	100	147	
5	272.2776	29.40	-9.84	19.56	46.00	-26.44	peak	100	111	
6	682.3484	30.05	-1.33	28.72	46.00	-17.28	peak	100	239	

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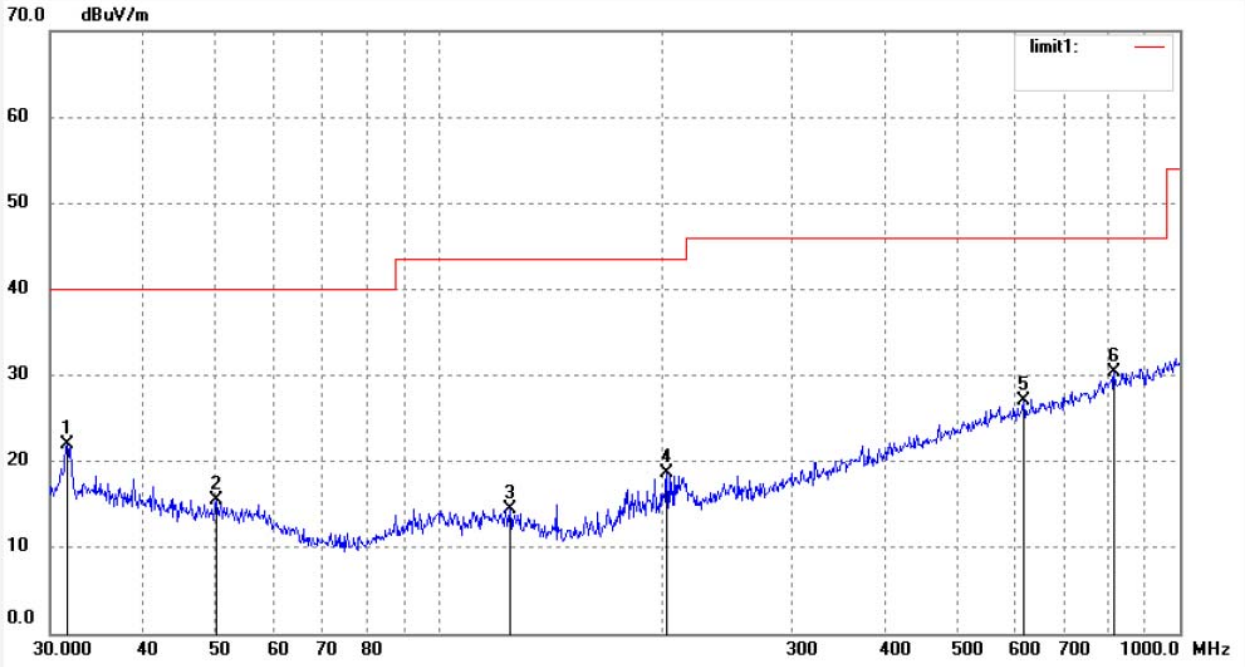
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2752	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:07:29
EUT: Operating Control	Engineer Signature: star
Mode: TX 2450MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	31.6202	31.97	-10.09	21.88	40.00	-18.12	peak	100	169	
2	50.2324	28.11	-12.60	15.51	40.00	-24.49	peak	100	222	
3	125.0066	28.15	-13.63	14.52	43.50	-28.98	peak	100	108	
4	203.5227	30.73	-12.16	18.57	43.50	-24.93	peak	100	139	
5	616.3718	29.24	-2.14	27.10	46.00	-18.90	peak	100	188	
6	815.9678	29.35	1.08	30.43	46.00	-15.57	peak	100	271	

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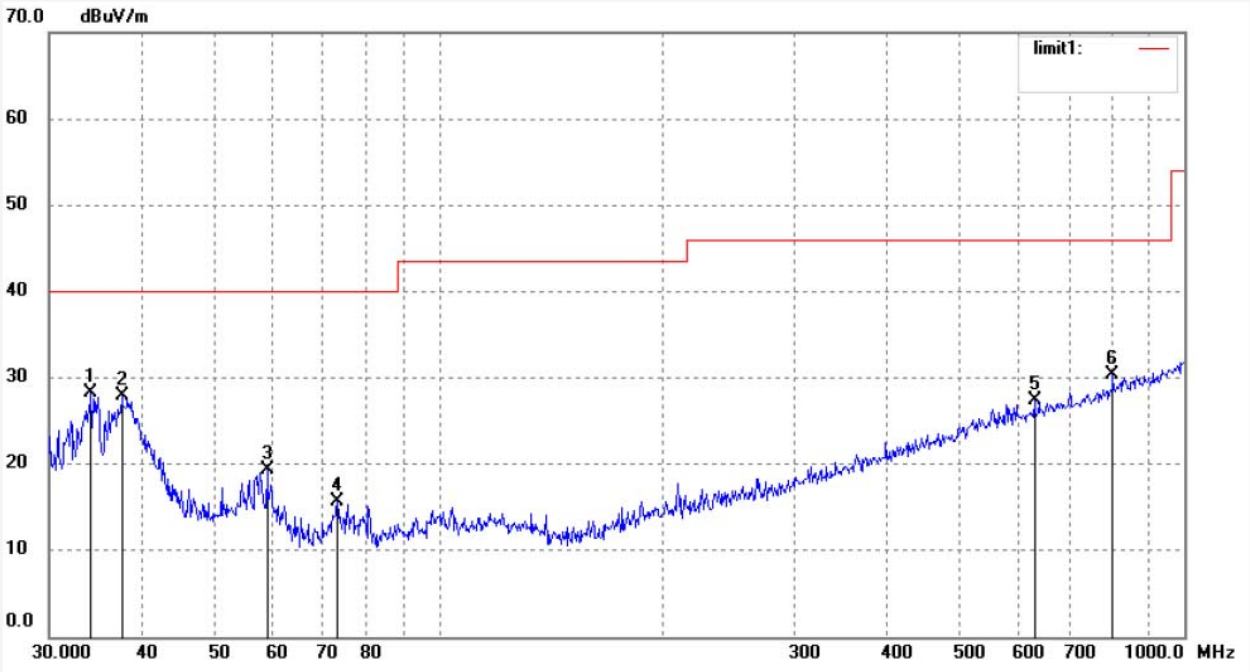
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2751	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:06:09
EUT: Operating Control	Engineer Signature: star
Mode: TX 2450MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	34.1561	38.38	-10.16	28.22	40.00	-11.78	peak	100	53	
2	37.5478	38.88	-10.98	27.90	40.00	-12.10	peak	100	103	
3	58.8185	33.09	-13.67	19.42	40.00	-20.58	peak	100	45	
4	73.1025	32.11	-16.48	15.63	40.00	-24.37	peak	100	100	
5	629.4772	29.38	-1.97	27.41	46.00	-18.59	peak	100	169	
6	801.7862	29.41	0.87	30.28	46.00	-15.72	peak	100	255	

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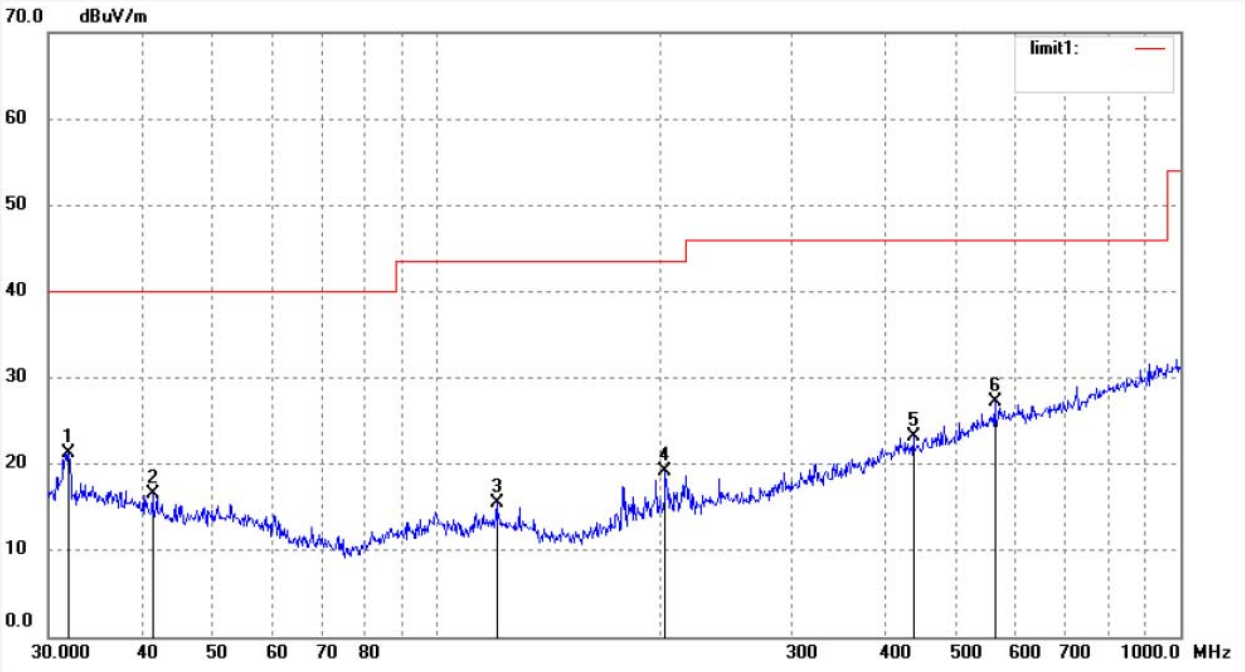
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2753	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:08:24
EUT: Operating Control	Engineer Signature: star
Mode: TX 2480MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	31.9545	31.46	-10.12	21.34	40.00	-18.66	peak	100	302	
2	41.4215	28.36	-11.85	16.51	40.00	-23.49	peak	100	279	
3	120.2766	28.53	-13.09	15.44	43.50	-28.06	peak	100	222	
4	202.8103	31.32	-12.17	19.15	43.50	-24.35	peak	100	51	
5	437.1198	28.66	-5.49	23.17	46.00	-22.83	peak	100	162	
6	562.6624	30.14	-2.87	27.27	46.00	-18.73	peak	100	199	

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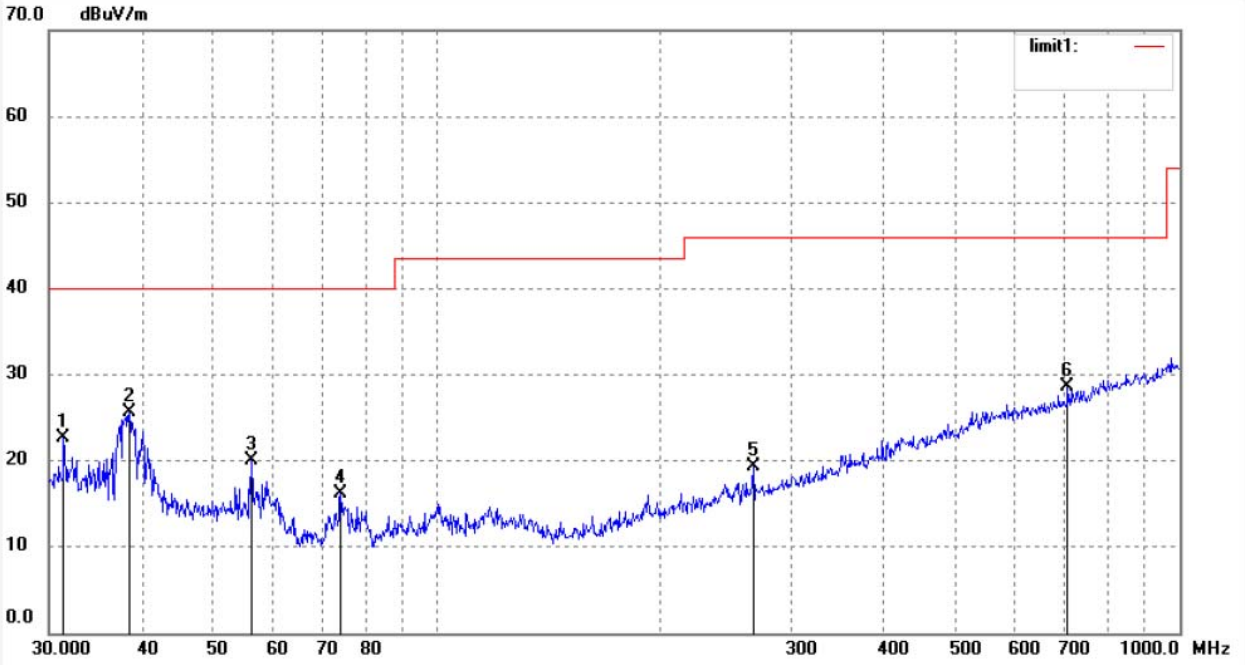
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2754	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:09:20
EUT: Operating Control	Engineer Signature: star
Mode: TX 2480MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	31.3992	31.95	-9.34	22.61	40.00	-17.39	peak	100	55	
2	38.4809	36.91	-11.20	25.71	40.00	-14.29	peak	100	139	
3	56.1974	33.16	-13.18	19.98	40.00	-20.02	peak	100	203	
4	74.1351	32.80	-16.59	16.21	40.00	-23.79	peak	100	217	
5	266.6089	29.51	-10.11	19.40	46.00	-26.60	peak	100	178	
6	706.6999	29.56	-0.92	28.64	46.00	-17.36	peak	100	269	

Above 1GHz

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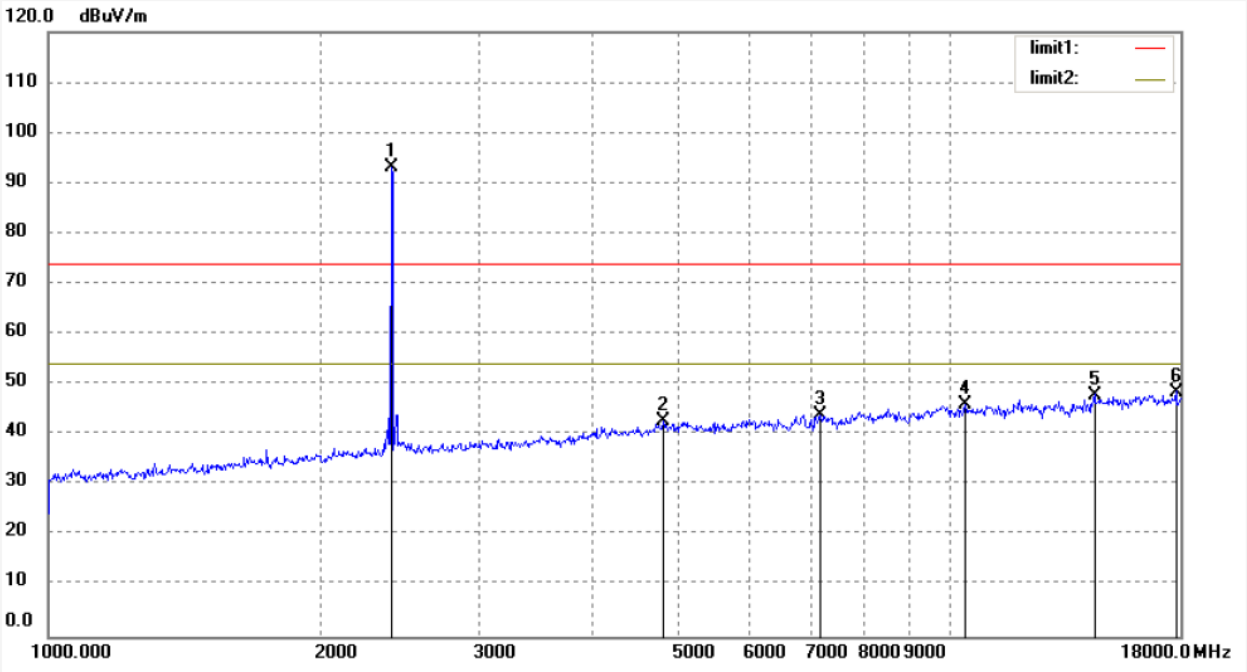
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2755	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:23:40
EUT: Operating Control	Engineer Signature: star
Mode: TX 2405MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2405.753	92.33	0.88	93.21			peak	200	117	
2	4804.110	35.45	7.40	42.85	74.00	-31.15	peak	200	162	
3	7179.527	32.91	11.01	43.92	74.00	-30.08	peak	200	203	
4	10393.713	29.48	16.59	46.07	74.00	-27.93	peak	200	288	
5	14450.131	-12.27	60.27	48.00	74.00	-26.00	peak	200	114	
6	17793.091	-16.30	64.90	48.60	74.00	-25.40	peak	200	236	

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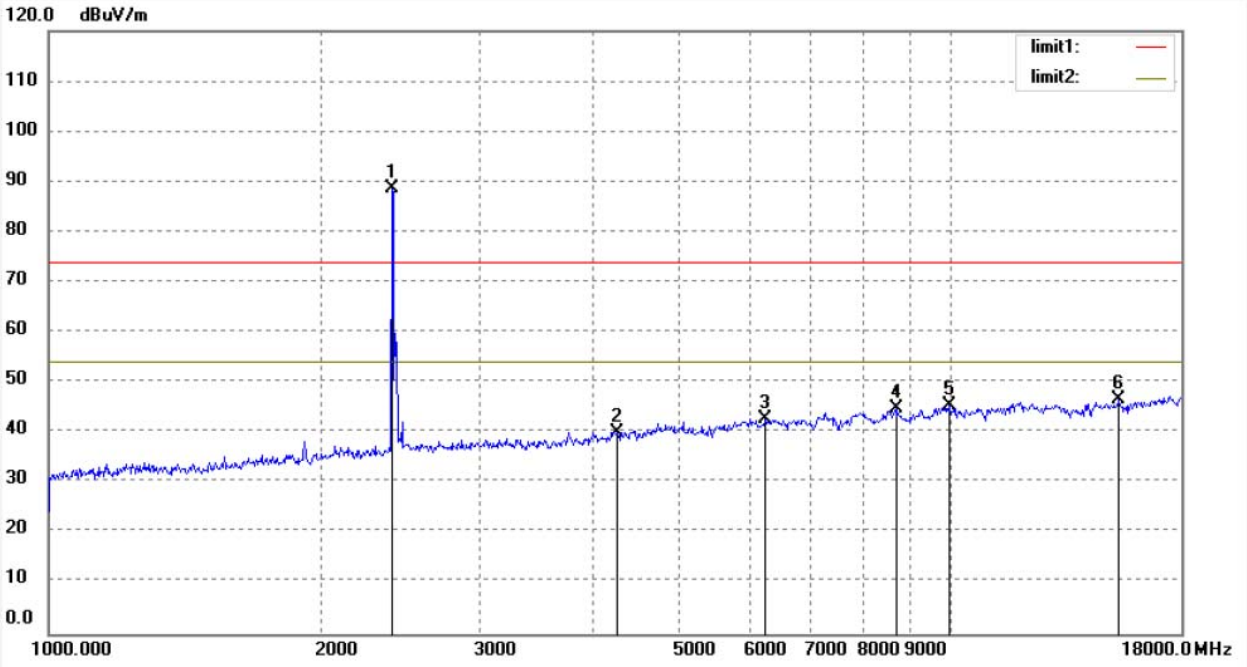
Fax:+86-0755-26503396

Job No.: STAR2016 #2756	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:25:22
EUT: Operating Control	Engineer Signature: star
Mode: TX 2405MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2405.053	87.67	0.88	88.55			peak	150	114	
2	4267.237	35.18	4.97	40.15	74.00	-33.85	peak	150	291	
3	6231.427	31.47	11.19	42.66	74.00	-31.34	peak	150	322	
4	8688.481	30.12	14.59	44.71	74.00	-29.29	peak	150	78	
5	9952.717	27.19	18.16	45.35	74.00	-28.65	peak	150	330	
6	15354.388	-11.75	58.53	46.78	74.00	-27.22	peak	150	174	

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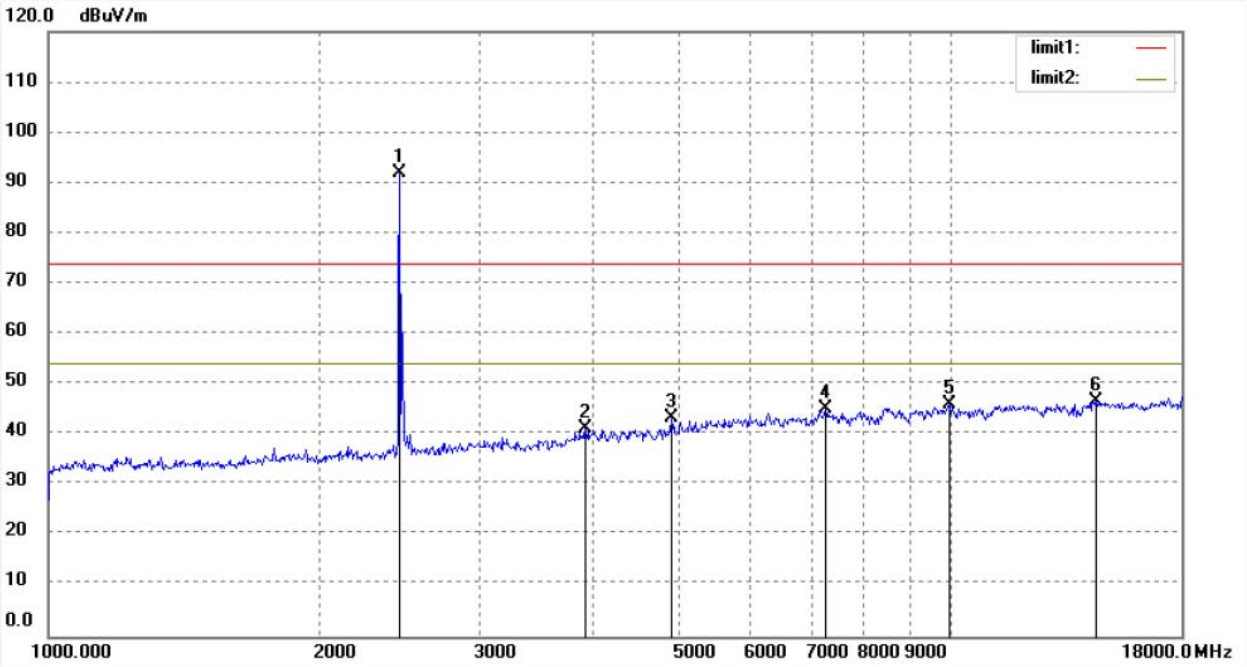
Fax:+86-0755-26503396

Job No.: STAR2016 #2758	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:28:38
EUT: Operating Control	Engineer Signature: star
Mode: TX 2450MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2450.022	90.96	1.09	92.05			peak	200	200	
2	3935.493	36.95	4.30	41.25	74.00	-32.75	peak	200	190	
3	4902.300	35.09	8.29	43.38	74.00	-30.62	peak	200	271	
4	7263.015	34.09	11.11	45.20	74.00	-28.80	peak	200	360	
5	9952.717	27.81	18.16	45.97	74.00	-28.03	peak	200	314	
6	14450.131	-13.58	60.27	46.69	74.00	-27.31	peak	200	51	

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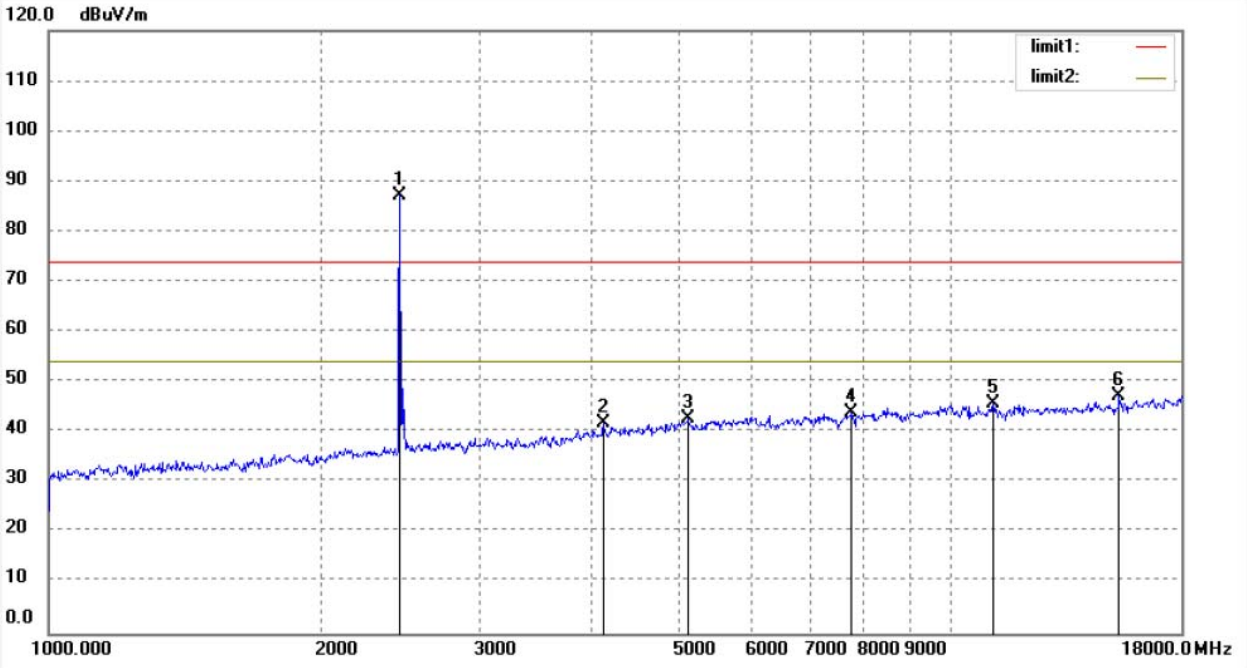
Fax:+86-0755-26503396

Job No.: STAR2016 #2757	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:27:22
EUT: Operating Control	Engineer Signature: star
Mode: TX 2450MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2450.022	85.95	1.09	87.04			peak	150	199	
2	4121.768	36.75	5.02	41.77	74.00	-32.23	peak	150	211	
3	5119.517	33.98	8.75	42.73	74.00	-31.27	peak	150	174	
4	7762.260	30.42	13.61	44.03	74.00	-29.97	peak	150	252	
5	11140.310	28.04	17.80	45.84	74.00	-28.16	peak	150	338	
6	15354.388	-11.26	58.53	47.27	74.00	-26.73	peak	150	200	

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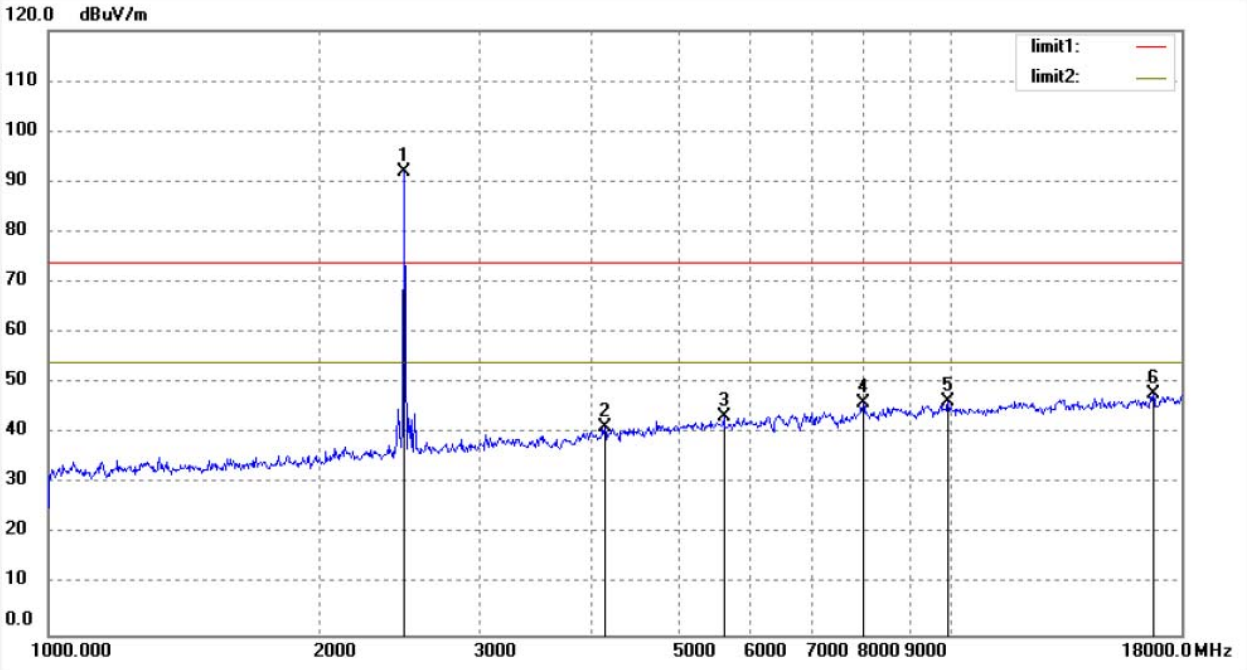
Fax:+86-0755-26503396

Job No.: STAR2016 #2759	Polarization: Horizontal
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:30:27
EUT: Operating Control	Engineer Signature: star
Mode: TX 2480MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

Note: Report No.: ATE20181657



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.010	90.80	1.10	91.90			peak	200	190	
2	4133.699	36.12	5.03	41.15	74.00	-32.85	peak	200	56	
3	5599.412	33.18	10.20	43.38	74.00	-30.62	peak	200	125	
4	7989.892	30.62	15.51	46.13	74.00	-27.87	peak	200	211	
5	9923.991	28.34	18.11	46.45	74.00	-27.55	peak	200	305	
6	16745.214	-12.30	60.09	47.79	74.00	-26.21	peak	200	348	

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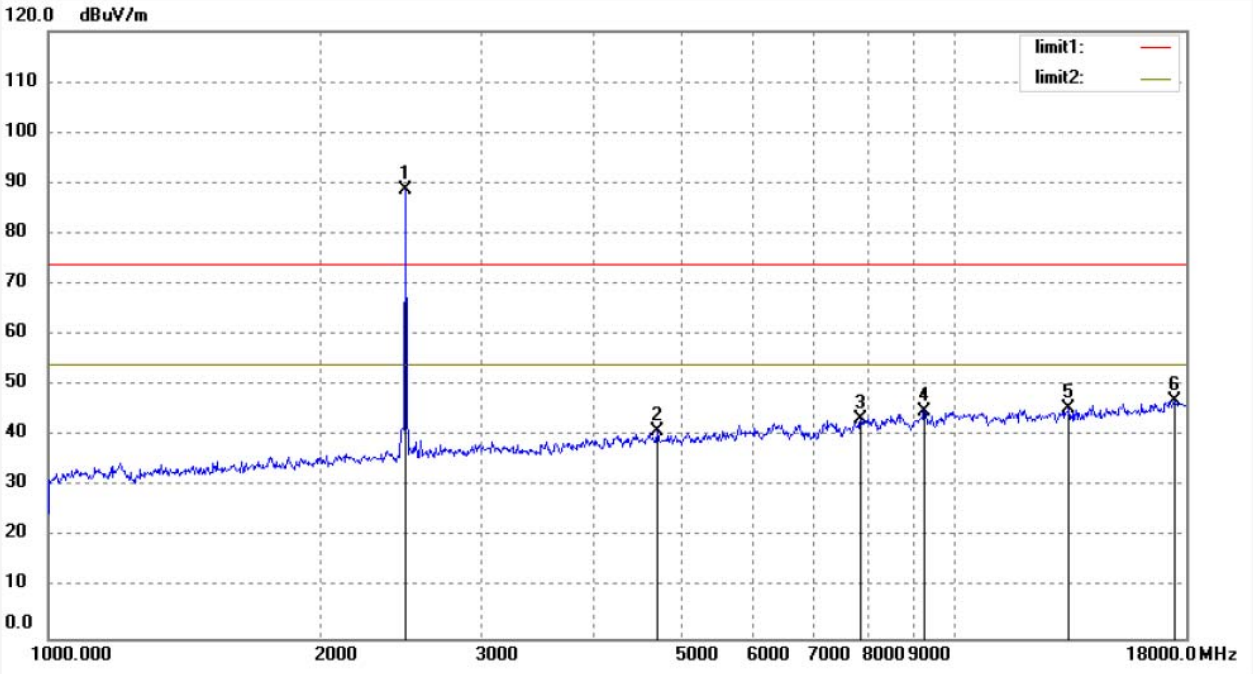
Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: STAR2016 #2760	Polarization: Vertical
Standard: FCC PART 15C 3M Radiated	Power Source: AC 120V/60Hz
Test item: Radiation Test	Date: 2018/09/08
Temp.(C)/Hum.(%) 23 C / 48 %	Time: 10:31:31
EUT: Operating Control	Engineer Signature: star
Mode: TX 2480MHz	Distance: 3m
Model: PDU	
Manufacturer: Libre Home Inc	

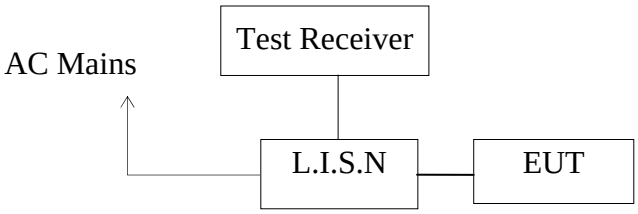
Note: Report No.: ATE20181657



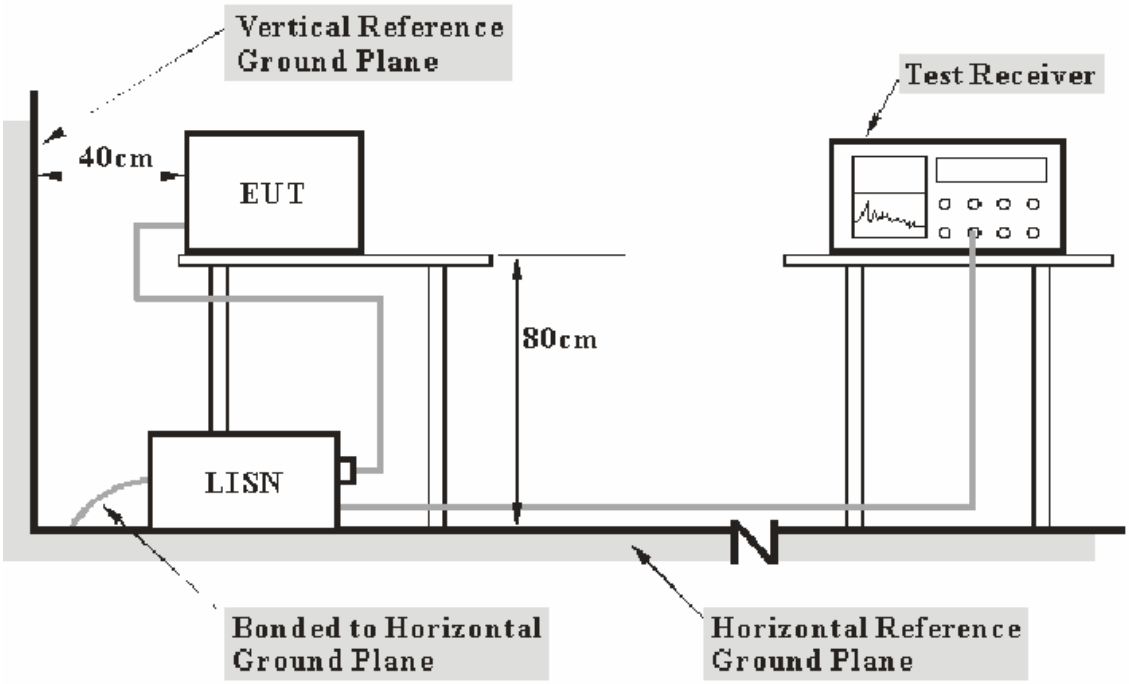
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.010	87.49	1.10	88.59			peak	150	220	
2	4694.300	34.04	6.83	40.87	74.00	-33.13	peak	150	117	
3	7875.254	28.97	14.49	43.46	74.00	-30.54	peak	150	101	
4	9258.909	29.11	15.70	44.81	74.00	-29.19	peak	150	196	
5	13365.322	-11.39	56.73	45.34	74.00	-28.66	peak	150	331	
6	17487.180	-16.10	63.14	47.04	74.00	-26.96	peak	150	308	

10. AC POWER LINE CONDUCTED EMISSION TEST

10.1. Block Diagram of Test Setup



10.2. Test System 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.

10.3.Power Line Conducted Emission Measurement Limits

Frequency (MHz)	Limit dB(μV)	
	Quasi-peak Level	Average Level
0.15 - 0.50	66.0 – 56.0 *	56.0 – 46.0 *
0.50 - 5.00	56.0	46.0
5.00 - 30.00	60.0	50.0
NOTE1: The lower limit shall apply at the transition frequencies. NOTE2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.		

10.4.Configuration of EUT on Measurement

The equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

10.5.Operating Condition of EUT

10.5.1.Setup the EUT and simulator as shown as Section 10.1.

10.5.2.Turn on the power of all equipment.

10.5.3.Let the EUT work in test mode and measure it.

10.6.Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Measurement.
The bandwidth of test receiver (R & S ESCS30) is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

10.7.Data Sample

Frequency (MHz)	Transducer value (dB)	QuasiPeak Level (dBμV)	Average Level (dBμV)	QuasiPeak Limit (dBμV)	Average Limit (dBμV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XX	10.5	51.1	34.2	56.0	46.0	4.9	11.8	Pass

Frequency(MHz) = Emission frequency in MHz
Transducer value(dB) = Insertion loss of LISN + Cable Loss
Level(dBμV) = Quasi-peak Reading/Average Reading + Transducer value
Limit (dBμV) = Limit stated in standard

Calculation Formula:
Margin = Limit (dBμV) - Level (dBμV)

10.8.Power Line Conducted Emission Measurement Results

PASS.

The frequency range from 150kHz to 30MHz is checked.

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

Emissions attenuated more than 20 dB below the permissible value are not reported.

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

The spectral diagrams are attached as below.

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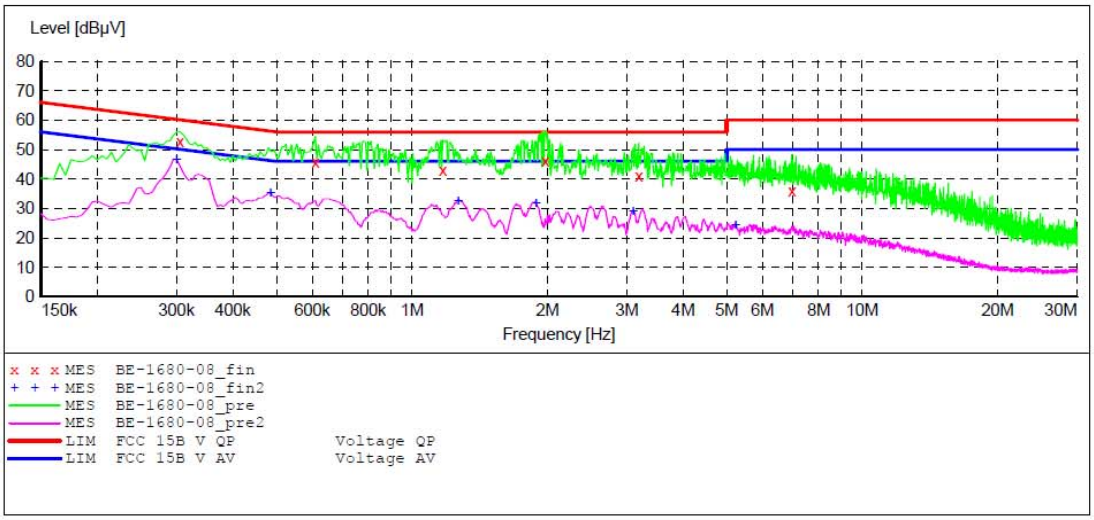
CONDUCTED EMISSION STANDARD FCC PART 15 C

```
EUT:                    Operating Control   M/N:PDU
Manufacturer:           Libre Home Inc
Operating Condition:    Wireless communication
Test Site:              1#Shielding Room
Operator:               star
Test Specification:     N  120V/60Hz
Comment:                Report NO.:ATE20181657
Start of Test:          9/12/2018 / 11:00:02AM
```

SCAN TABLE: "V 9K-30MHz fin"

Short Description: _SUB_STD_VTERM2 1.70

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
9.0 kHz	150.0 kHz	100.0 Hz	QuasiPeak Average	1.0 s	200 Hz	NSLK8126 2008
150.0 kHz	30.0 MHz	5.0 kHz	QuasiPeak Average	1.0 s	9 kHz	NSLK8126 2008



MEASUREMENT RESULT: "BE-1680-08_fin"

9/12/2018 11:03AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.305000	52.70	10.6	60	7.4	QP	N	GND
0.610000	45.60	10.7	56	10.4	QP	N	GND
1.170000	43.10	10.9	56	12.9	QP	N	GND
1.975000	46.20	11.0	56	9.8	QP	N	GND
3.190000	41.00	11.1	56	15.0	QP	N	GND
6.980000	35.80	11.2	60	24.2	QP	N	GND

MEASUREMENT RESULT: "BE-1680-08_fin2"

9/12/2018 11:03AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.300000	46.30	10.6	50	3.9	AV	N	GND
0.485000	35.00	10.7	46	11.3	AV	N	GND
1.265000	32.60	10.9	46	13.4	AV	N	GND
1.885000	31.70	11.0	46	14.3	AV	N	GND
3.100000	28.90	11.1	46	17.1	AV	N	GND
5.230000	24.20	11.2	50	25.8	AV	N	GND

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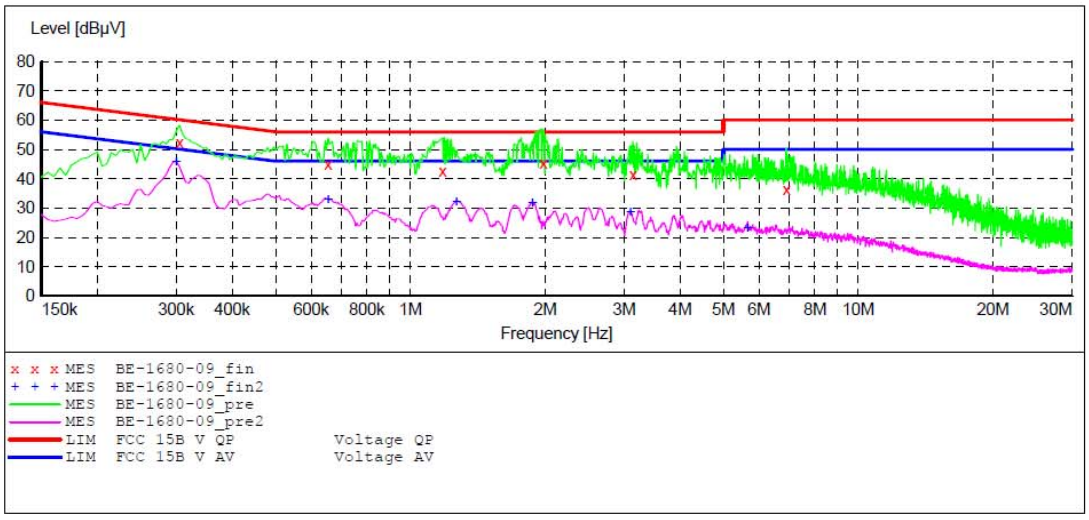
CONDUCTED EMISSION STANDARD FCC PART 15 C

```
EUT:                    Operating Control   M/N:PDU
Manufacturer:           Libre Home Inc
Operating Condition:    Wireless communication
Test Site:              1#Shielding Room
Operator:               star
Test Specification:     L  120V/60Hz
Comment:                Report NO.:ATE20181657
Start of Test:          9/12/2018 / 11:04:17AM
```

SCAN TABLE: "V 9K-30MHz fin"

Short Description: _SUB_STD_VTERM2 1.70

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
9.0 kHz	150.0 kHz	100.0 Hz	QuasiPeak Average	1.0 s	200 Hz	NSLK8126 2008
150.0 kHz	30.0 MHz	5.0 kHz	QuasiPeak Average	1.0 s	9 kHz	NSLK8126 2008



MEASUREMENT RESULT: "BE-1680-09_fin"

9/12/2018 11:07AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.305000	52.30	10.6	60	7.8	QP	L1	GND
0.655000	44.80	10.8	56	11.2	QP	L1	GND
1.180000	42.40	10.9	56	13.6	QP	L1	GND
1.980000	45.40	11.0	56	10.6	QP	L1	GND
3.140000	41.50	11.1	56	14.5	QP	L1	GND
6.910000	36.40	11.2	60	23.6	QP	L1	GND

MEASUREMENT RESULT: "BE-1680-09_fin2"

9/12/2018 11:07AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.300000	45.80	10.6	50	4.4	AV	L1	GND
0.655000	33.00	10.8	46	13.0	AV	L1	GND
1.265000	32.20	10.9	46	13.8	AV	L1	GND
1.870000	31.60	11.0	46	14.4	AV	L1	GND
3.100000	28.60	11.1	46	17.4	AV	L1	GND
5.660000	23.20	11.2	50	26.8	AV	L1	GND

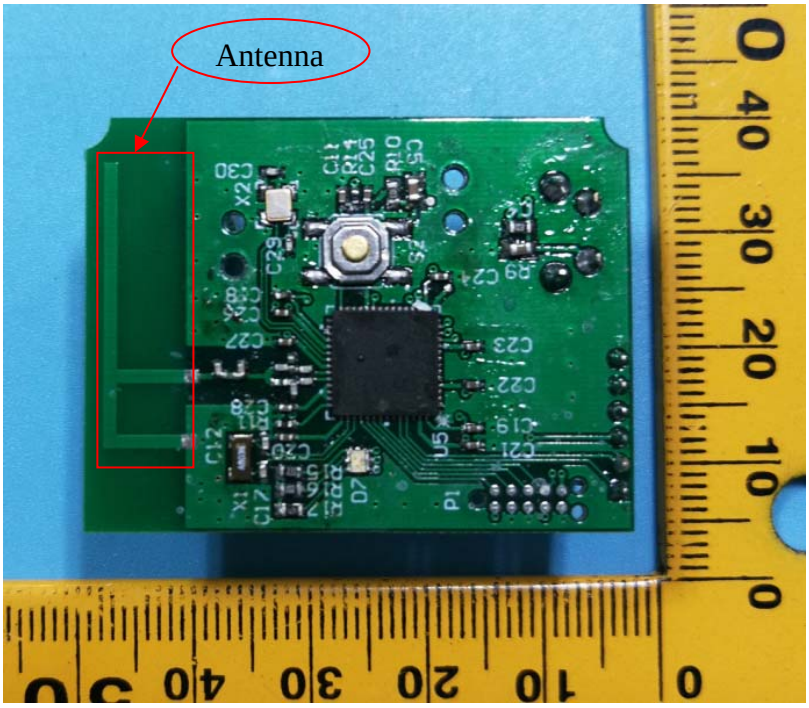
11. ANTENNA REQUIREMENT

11.1. The Requirement

According to Section 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.

11.2. Antenna Construction

Device is equipped with permanent attached antenna, which isn't displaced by other antenna. The Antenna gain of EUT is 2.8dBi. Therefore, the equipment complies with the antenna requirement of Section 15.203.



******* End of Test Report *******