FCC REPORT

Applicant: Neutron Holdings, Inc.

Address of Applicant: 85 2nd St, San Francisco, CA 94105 USA

Equipment Under Test (EUT)

Product Name: Central controller

Model No.: Lime-4.0-US

Trade mark: Lime

FCC ID: 2APB2LIME-V4-US

Applicable standards: FCC CFR Title 47 Part 15 Subpart B

Date of sample receipt: 08 May, 2021

Date of Test: 08 May, to 04 Jun., 2021

Date of report issued: 04 Jun., 2021

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*04 Jun., 2021*	*Original*

Tested by:  ***Date:*** *04 Jun., 2021*

Test Engineer

Reviewed by:  ***Date:*** *04 Jun., 2021*

Project Engineer

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4 Test Summary

Test Item	Section in CFR 47	Result
Conducted Emission	Part 15.107	N/A
Radiated Emission	Part 15.109	Pass

Remark:

1. Pass: The EUT complies with the essential requirements in the standard.

2. N/A: The EUT not applicable of the test item.

Test Method:	*ANSI C63.4:2014*

5 General Information

5.1 Client Information

Applicant:	Neutron Holdings, Inc.
Address:	85 2nd St, San Francisco, CA 94105 USA
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Factory:	MeiG Smart Technology Co., Ltd.
Address:	1/2/3F A, Building A, B, No.5 Lingxia Road, 4th Fenghuang Industrial Park, Fuyong Street, Baoan District, Shenzhen, Guangdong, China

5.2 General Description of E.U.T.

Product Name:	Central controller
Model No.:	Lime-4.0-US
Power supply:	Rechargeable Li-ion Battery DC3.7V, 1250mAh
External power supply:	DC 36V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

5.3 Test Mode and test samples plans

Operating mode	Detail description
Working mode	Keep the EUT in Wworking mode(Worst case)

The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

Test Samples Plans :

Samples Number	Used for Test Items
1#	Conducted Emission
2#	Radiated Emission
3#	EUT constructional details

Remark: *JianYan Testing Group Shenzhen Co., Ltd. is only responsible for the test project data of the above samples, and will keep the above samples for a month.*

5.4 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±3.20 dB (k=2)

5.5 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
LENOVO	Laptop	SL510	2847A65	DoC

5.6 Related Submittal(s) / Grant (s)

This is an original grant, no related submittals and grants.

5.7 Description of Cable Used

N/A

5.8 Additions to, deviations, or exclusions from the method

No

5.9 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.10 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

5.11 Test Instruments list

Radiated Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	966	01-19-2021	01-18-2024
Loop Antenna	SCHWARZBECK	FMZB1519B	00044	03-07-2020	03-06-2021
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-03-2021	03-02-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-03-2021	03-02-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-18-2020	06-17-2021
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-18-2020	11-17-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-03-2021	03-02-2022
Pre-amplifier	CD	PAP-1G18	11804	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-18-2020	11-17-2021
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-03-2021	03-02-2022
Cable	MICRO-COAX	MFR64639	K10742-5	03-03-2021	03-02-2022
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-03-2021	03-02-2022

6 Test results and Measurement Data

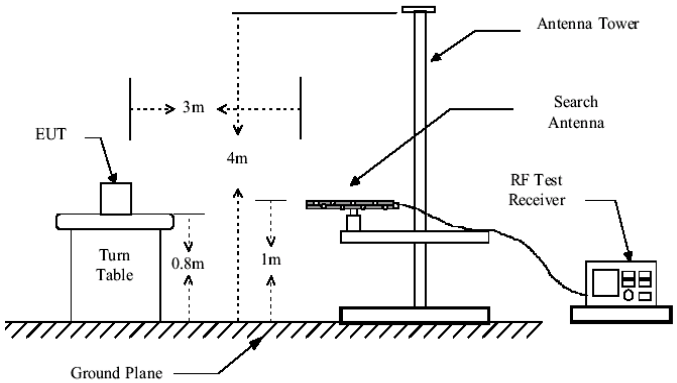
6.1 Radiated Emission

Test Requirement:	FCC Part 15 B Section 15.109				
Test Frequency Range:	30MHz to 6000MHz				
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

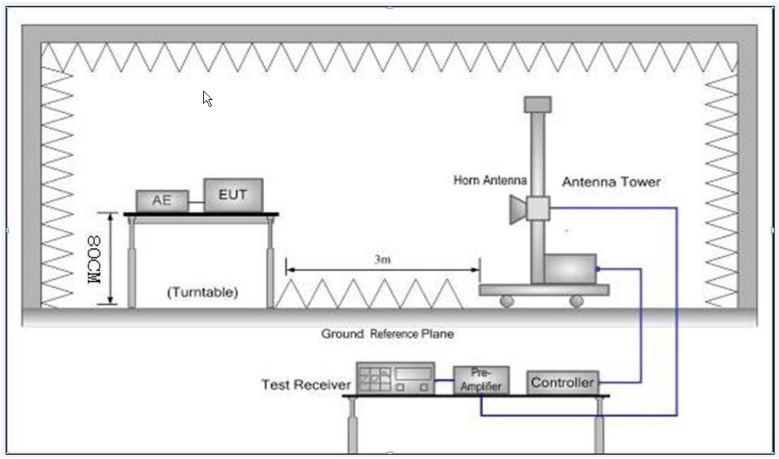
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test setup:

Below 1GHz



Above 1GHz



Test Procedure:

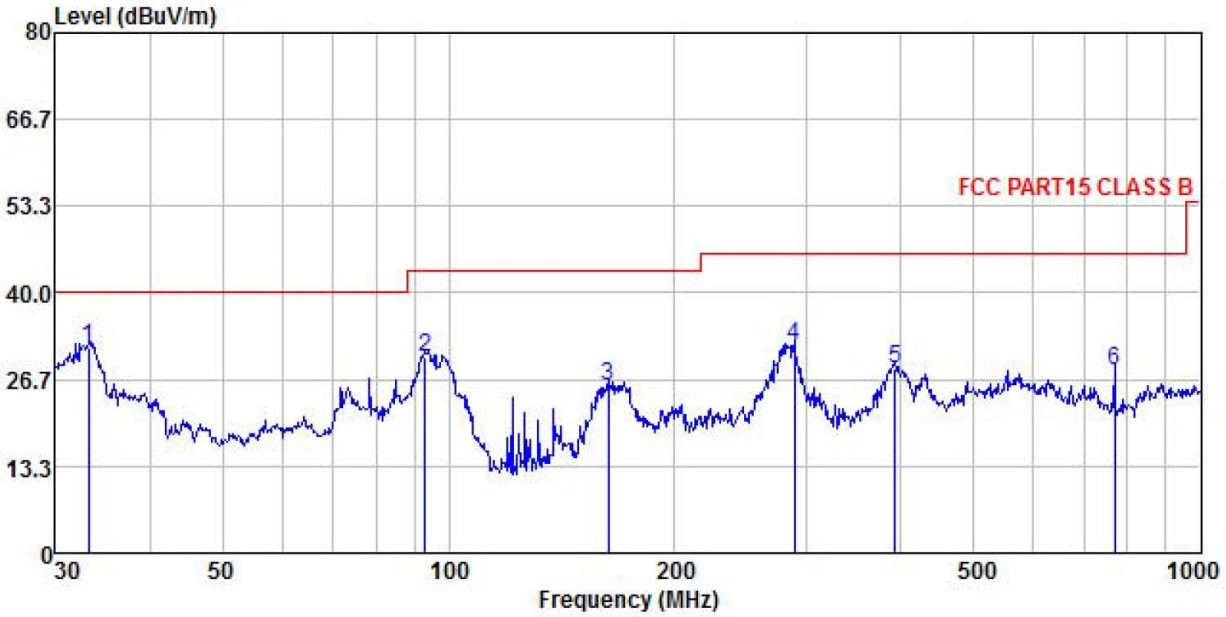
1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both

	horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 5.11 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	All of the observed value above 6GHz ware the niose floor , which were no recorded

Measurement Data:

Below 1GHz:

Product Name:	Central controller	**Product Model:**	Lime-4.0-US
Test By:	YT	**Test mode:**	Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	DC 36V	**Environment:**	Temp: 24℃ Huni: 57%

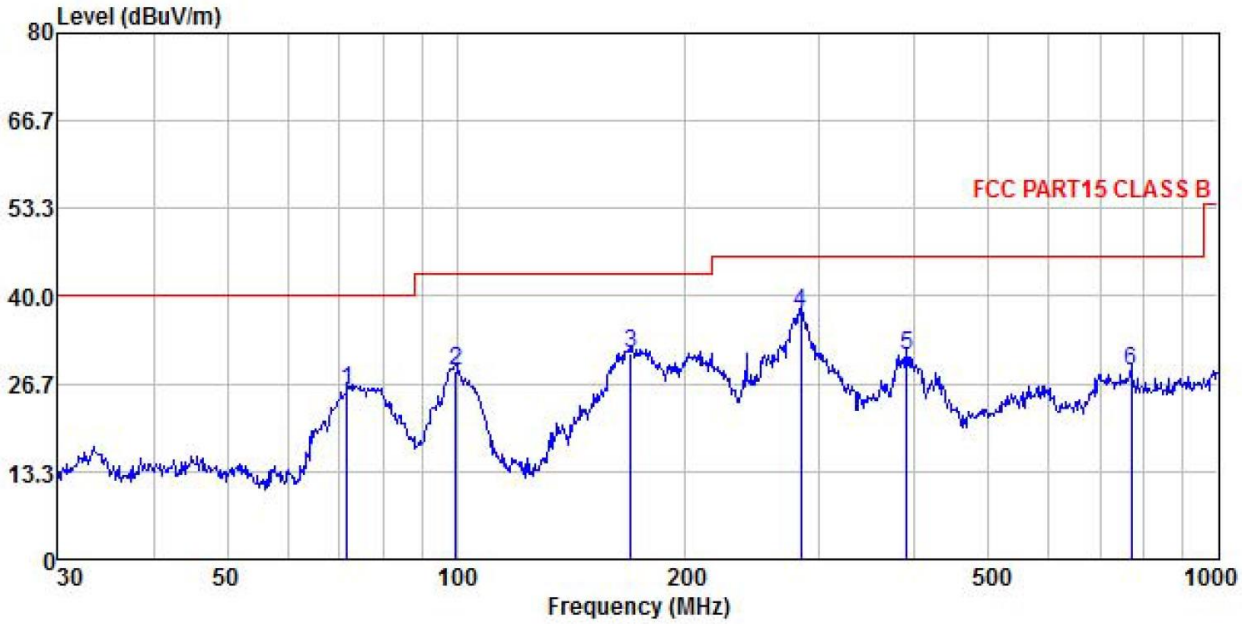


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	33.211	48.85	12.33	0.38	29.96	31.60	40.00	-8.40	QP
2	93.113	49.52	9.44	0.75	29.56	30.15	43.50	-13.35	QP
3	163.182	38.00	15.57	1.15	29.11	25.61	43.50	-17.89	QP
4	287.990	39.94	18.65	1.71	28.47	31.83	46.00	-14.17	QP
5	392.095	35.95	19.05	2.01	28.75	28.26	46.00	-17.74	QP
6	768.748	32.59	20.72	3.03	28.37	27.97	46.00	-18.03	QP

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The Aux Factor is a notch filter switch box loss, this item is not used.*

Product Name:	Central controller	Product Model:	Lime-4.0-US
Test By:	YT	Test mode:	Working mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC 36V	Environment:	Temp: 24℃ Huni: 57%



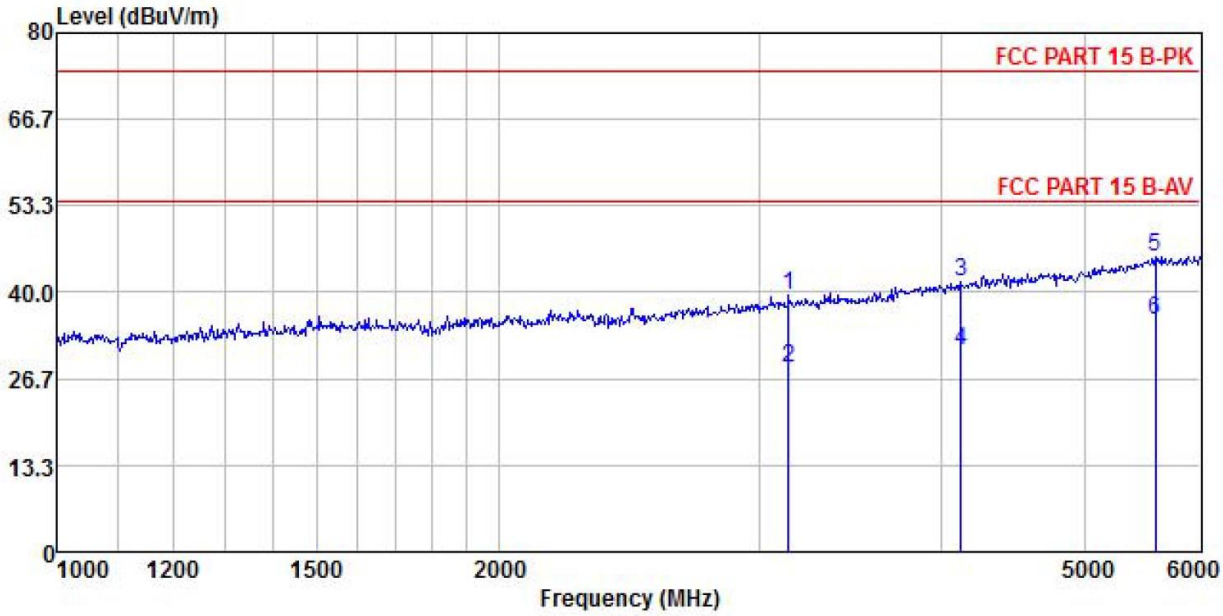
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	71.832	44.16	10.62	0.66	29.71	25.73	40.00	-14.27	QP
2	99.878	48.45	8.80	0.79	29.53	28.51	43.50	-14.99	QP
3	169.599	42.84	16.40	1.20	29.05	31.39	43.50	-12.11	QP
4	282.985	45.65	18.63	1.69	28.48	37.49	46.00	-8.51	QP
5	390.723	38.78	19.04	2.00	28.74	31.08	46.00	-14.92	QP
6	768.748	33.24	20.72	3.03	28.37	28.62	46.00	-17.38	QP

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The Aux Factor is a notch filter switch box loss, this item is not used.*

Above 1GHz:

Product Name:	Central controller	**Product Model:**	Lime-4.0-US
Test By:	YT	**Test mode:**	Working mode
Test Frequency:	1 GHz ~ 6 GHz	**Polarization:**	Vertical
Test Voltage:	DC 36V	**Environment:**	Temp: 24℃ Huni: 57%

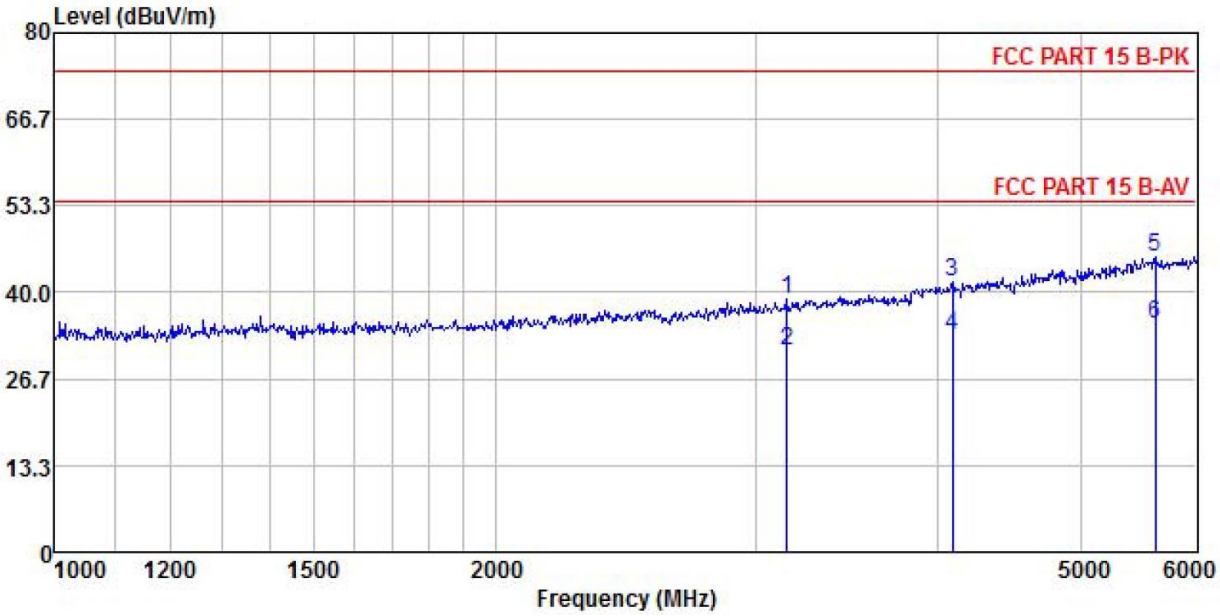


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	3146.029	43.64	28.50	8.75	41.43	39.46	74.00	-34.54	Peak
2	3146.029	32.56	28.50	8.75	41.43	28.38	54.00	-25.62	Average
3	4123.171	43.98	29.50	9.94	41.81	41.61	74.00	-32.39	Peak
4	4123.171	33.46	29.50	9.94	41.81	31.09	54.00	-22.91	Average
5	5585.559	44.13	32.33	10.88	41.80	45.54	74.00	-28.46	Peak
6	5585.559	34.20	32.33	10.88	41.80	35.61	54.00	-18.39	Average

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Central controller	Product Model:	Lime-4.0-US
Test By:	YT	Test mode:	Working mode
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Horizontal
Test Voltage:	DC 36V	Environment:	Temp: 24℃ Huni: 57%



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	3152.157	43.14	28.50	8.77	41.43	38.98	74.00	-35.02	Peak
2	3152.157	35.19	28.50	8.77	41.43	31.03	54.00	-22.97	Average
3	4091.203	44.05	29.44	9.90	41.81	41.58	74.00	-32.42	Peak
4	4091.203	35.91	29.44	9.90	41.81	33.44	54.00	-20.56	Average
5	5618.262	43.83	32.35	10.98	41.81	45.35	74.00	-28.65	Peak
6	5618.262	33.65	32.35	10.98	41.81	35.17	54.00	-18.83	Average

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

8 EUT Constructional Details

Reference to the test report No.: JYTSZB-R12-2100762

------End of report------