

## TEST REPORT



Applicant:	Particle Industries, Inc
Address:	126 Post St, 4th floor, San Francisco, CA 94108 USA

Manufacturer or Supplier:	Particle Industries, Inc
Address:	126 Post St, 4th floor, San Francisco, CA 94108 USA
Product:	E SERIES
Brand Name:	Particle Industries, Inc
Model Name:	E402
Date of tests:	Jun. 08, 2018 ~ Jun. 19, 2018

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

- ICES-003 Issue 6:2016
- ANSI C63.4:2014

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Issued by Alex Chen Engineer / Mobile Department	Approved by Sam Tung Manager / Mobile Department
	
Date: Jun. 20, 2018	Date: Jun. 20, 2018

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**BUREAU**  
**VERITAS**

Test Report No.: IV180608W006

## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
IV180608W006	Original release	Jun. 20, 2018



## 1 GENERAL INFORMATION

### 1.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	E SERIES	
<b>BRAND NAME</b>	Particle Industries,Inc	
<b>MODEL NAME</b>	E402	
<b>NOMINAL VOLTAGE</b>	DC 3.7V	
<b>MODULATION TYPE</b>	LTE	QPSK/16QAM
<b>OPERATING FREQUENCY</b>	LTE	1850.7MHz ~ 1909.3MHz (FOR LTE Band2) 1710.7MHz ~ 1754.3MHz (FOR LTE Band4) 824.7MHz ~ 848.3MHz (FOR LTE Band5) 2500MHz ~ 2570MHz (FOR LTE Band7) 699MHz ~ 716MHz (FOR LTE Band12) 777MHz ~ 787MHz (FOR LTE Band13)
<b>HW VERSION</b>	V007	
<b>SW VERSION</b>	V080	
<b>I/O PORTS</b>	Refer to user's manual	
<b>CABLE</b>	N/A	
<b>ACCESSORY DEVICES</b>	Refer to note as below	

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.



## 1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart B			
Standard Section	Test Item	Result	Remark
ICES-003 Issue 6: 2016, Class B	Radiated Emission Test (30MHz ~ 1GHz)	PASS	Meets Class B Limit Minimum passing margin is -11.04dB at 31.94MHz
	Radiated Emission Test (Above 1GHz)	PASS	Meets Class B Limit Minimum passing margin is -12.04dB at 3550MHz

## 1.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	30MHz ~ 1GHz	+/-3.26dB
	1GHz ~ 18GHz	+/-4.48dB



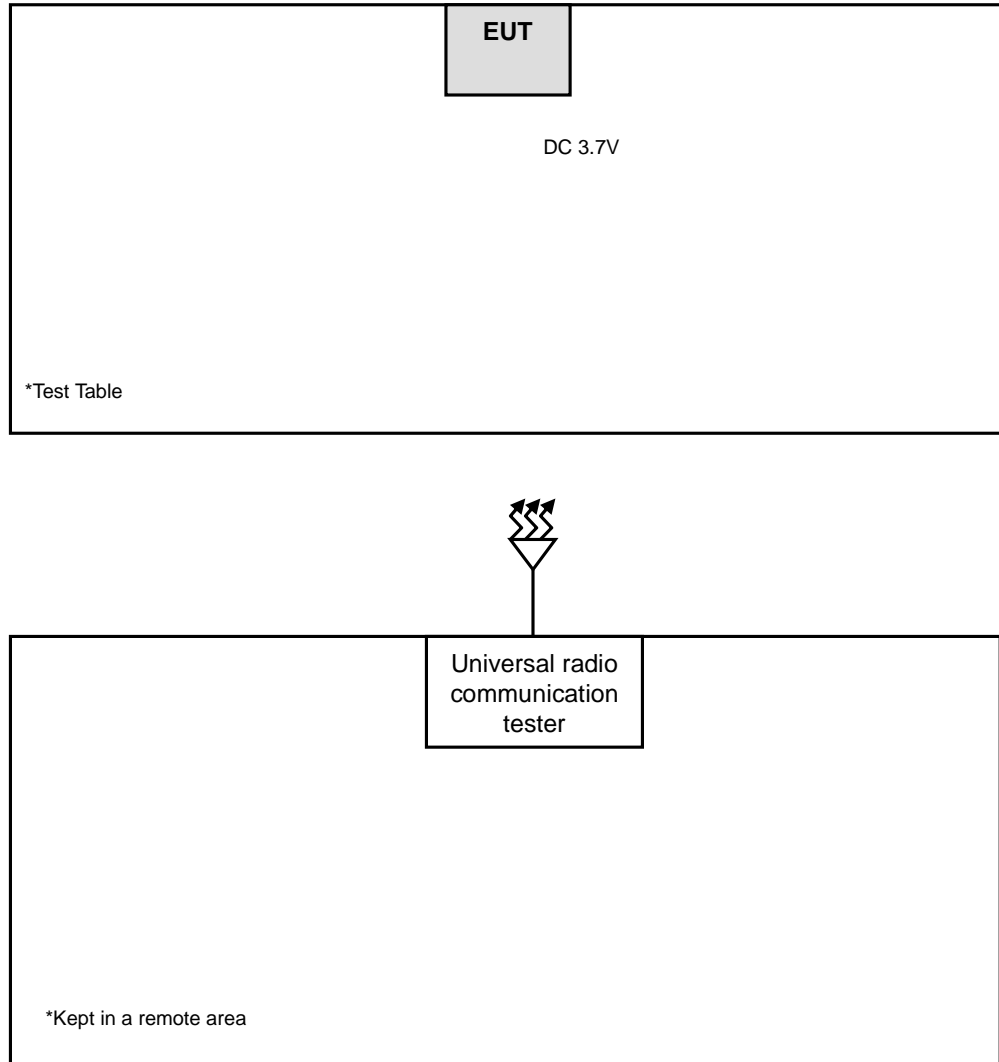
## 1.4 DESCRIPTION OF TEST MODES

Test Mode	Test Condition
<b>Radiated emission test</b>	
1	LTE B2 Idle
2	LTE B4 Idle
3	LTE B5 Idle
4	LTE B12 Idle
5	LTE B13 Idle

**NOTE:** For radiated emission test, test mode 1 was the worst case and only this mode was presented in this report.



## 1.5 CONFIGURATION OF SYSTEM UNDER TEST





## 2 EMISSION TEST

### 2.1 RADIATED EMISSION MEASUREMENT

#### 2.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

##### ICES-003 (Class A: section 5.4) (Class B: section 5.5)

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dBµV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	39	29.5	40	30
88-216	43.5	33.1		
216-230	46.4	35.6		
230-960			47	37
960-1000	49.5	43.5	Not defined	Not defined
1000-3000	Avg: 49.5	Avg: 43.5		
3000+	Peak: 69.5	Peak: 63.5	Not defined	Not defined

Radiated Emissions Limits at 3 meters (dBµV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	49.5	40	50.5	40.5
88-216	54	43.5		
216-230	56.9	46		
230-960			57.5	47.5
960-1000	60	54	Avg: 56 Peak: 76	Avg: 50 Peak: 70
1000-3000	Avg: 60	Avg: 54		
3000+	Peak: 80	Peak: 74	Avg: 60 Peak: 80	Avg: 54 Peak: 74





**Frequency Range (For unintentional radiators)**

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5 <sup>th</sup> harmonic of the highest frequency or 40GHz, whichever is lower

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
  3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
  4. QP detector shall be applied if not specified.



## 2.1.2 TEST INSTRUMENTS

### Frequency range below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	Apr. 21,18	Apr. 20,19
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Nov. 26,16	Nov. 25,18
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 16,18	Mar. 15,19
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jul. 27,17	Jul. 26,18

### Frequency range above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	Apr. 21,18	Apr. 20,19
Horn Antenna	ETS-LINDGREN	3117	00168728	Nov. 10,16	Nov. 09,18
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 16,18	Mar. 15,19
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jul. 24,17	Jul. 23,18

**NOTE:** 1. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in 3 Chamber.

3. The IC test Site Registration No. is 21771-1.



### **2.1.3 TEST PROCEDURE**

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters (below 1GHz) and 3 meters (above 1GHz) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna 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. The bore sight should be used during the test above 1GHz.
- d. 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.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test receiver/spectrum was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

**NOTE:**

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Average detection (AV) at frequency above 1GHz.
3. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
4. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
5. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
6. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier)
7. Margin value = Emission level – Limit value.

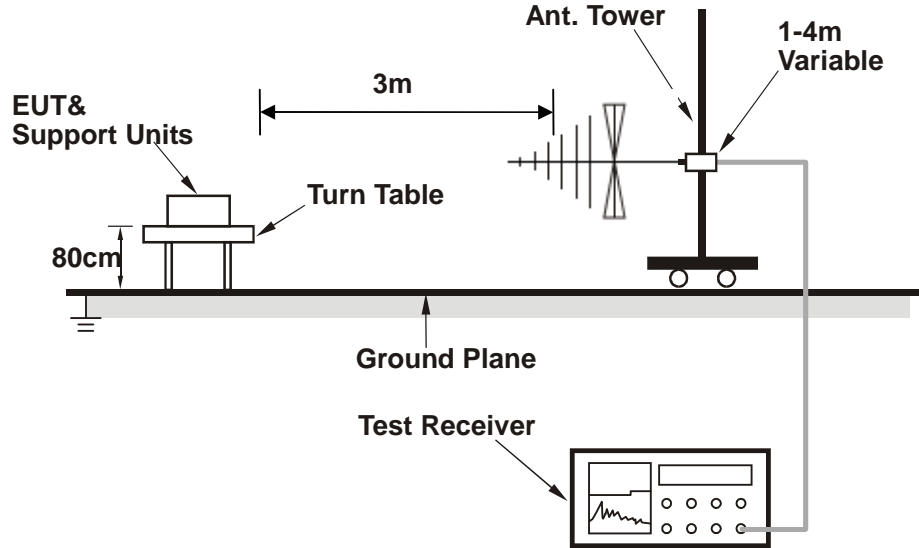
### **2.1.4 DEVIATION FROM TEST STANDARD**

No deviation.

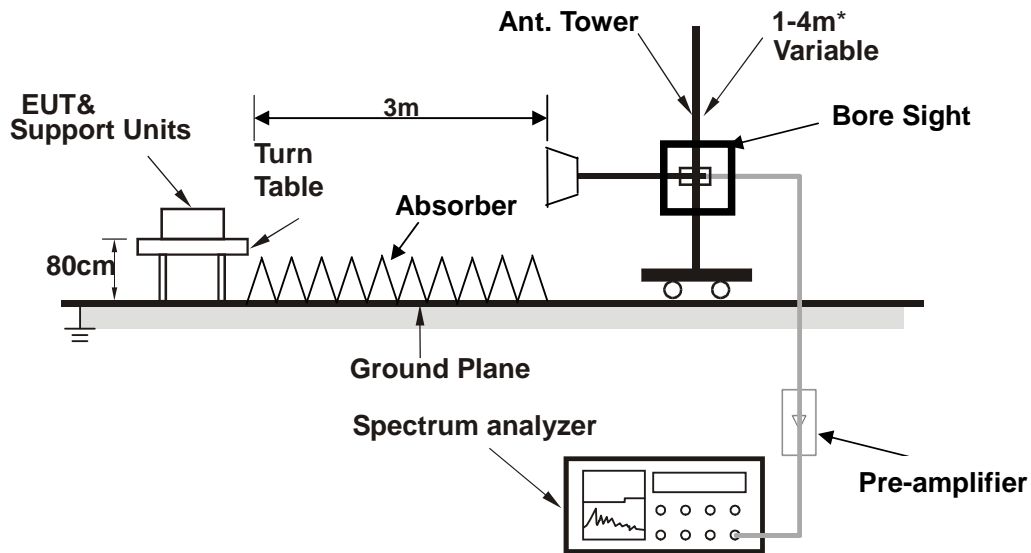


### 2.1.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



\* : depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

### 2.1.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.

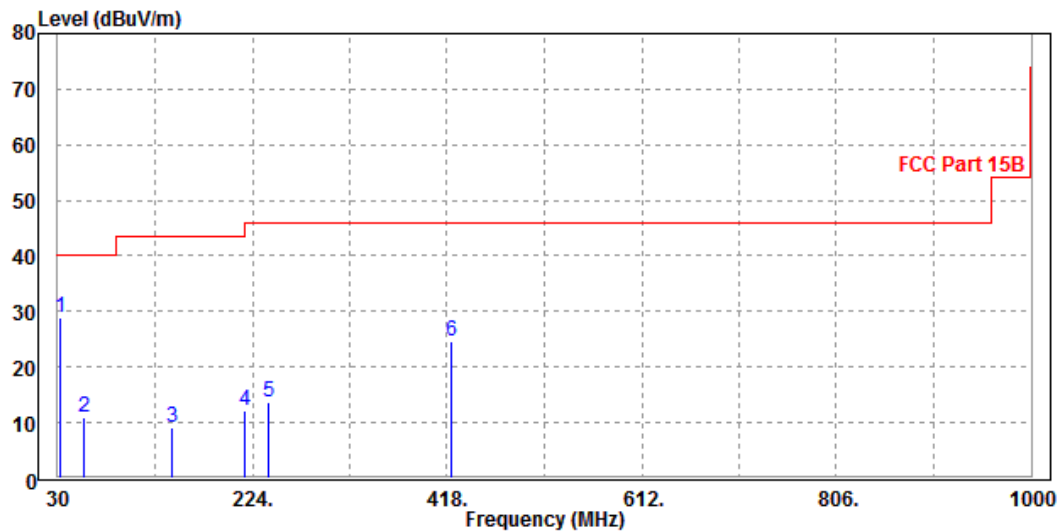


### 2.1.7 TEST RESULTS

<b>TEST VOLTAGE</b>	DC 3.7V Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	30-1000 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	24deg. C, 58 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Quasi-Peak , 120 kHz
<b>TESTED BY</b>	Vincent Chen		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
31.94	28.96	50.21	40	-11.04	15.91	0.5	37.66	100	320	QP
56.19	11	40.76	40	-29	6.8	0.77	37.33	100	170	QP
144.46	9.04	35.44	43.5	-34.46	9.2	1.27	36.87	100	50	QP
216.24	12.21	36	46	-33.79	11.28	1.51	36.58	100	140	QP
239.52	13.67	36.43	46	-32.33	12.26	1.61	36.63	100	60	QP
422.85	24.74	42.25	46	-21.26	17.31	2.05	36.87	100	160	QP

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.

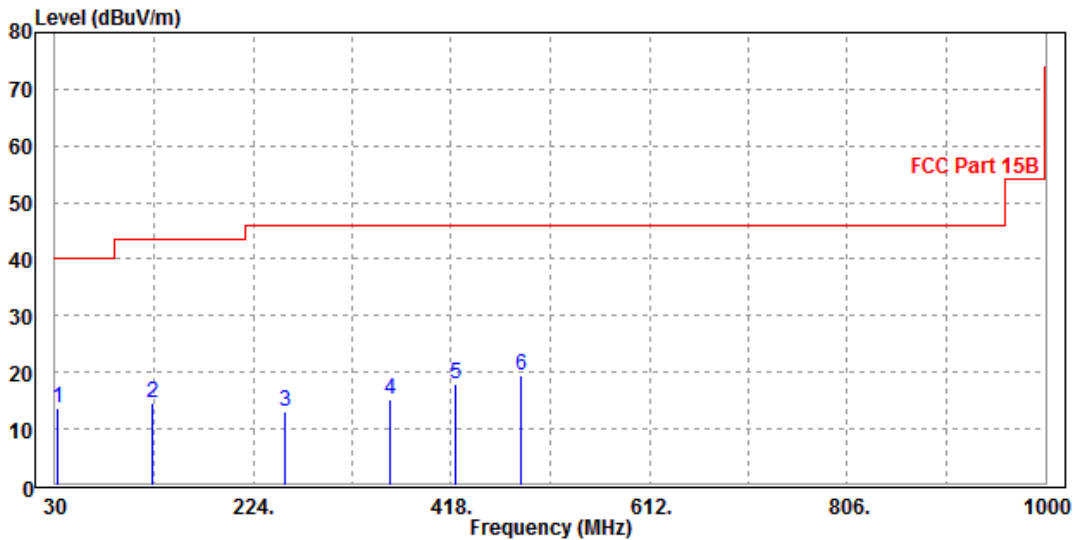




<b>TEST VOLTAGE</b>	DC 3.7V Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	30-1000 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	24deg. C, 58 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Quasi-Peak , 120 kHz
<b>TESTED BY</b>	Vincent Chen		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
31.94	13.77	35.02	40	-26.23	15.91	0.5	37.66	100	120	QP
125.06	14.71	42.06	43.5	-28.79	8.5	1.19	37.04	100	30	QP
256.01	13.08	35.25	46	-32.92	12.83	1.66	36.66	100	170	QP
358.83	15.11	34.29	46	-30.89	15.74	1.88	36.8	100	60	QP
422.85	18.07	35.58	46	-27.93	17.31	2.05	36.87	100	240	QP
486.87	19.48	36.41	46	-26.52	17.88	2.17	36.98	100	290	QP

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.

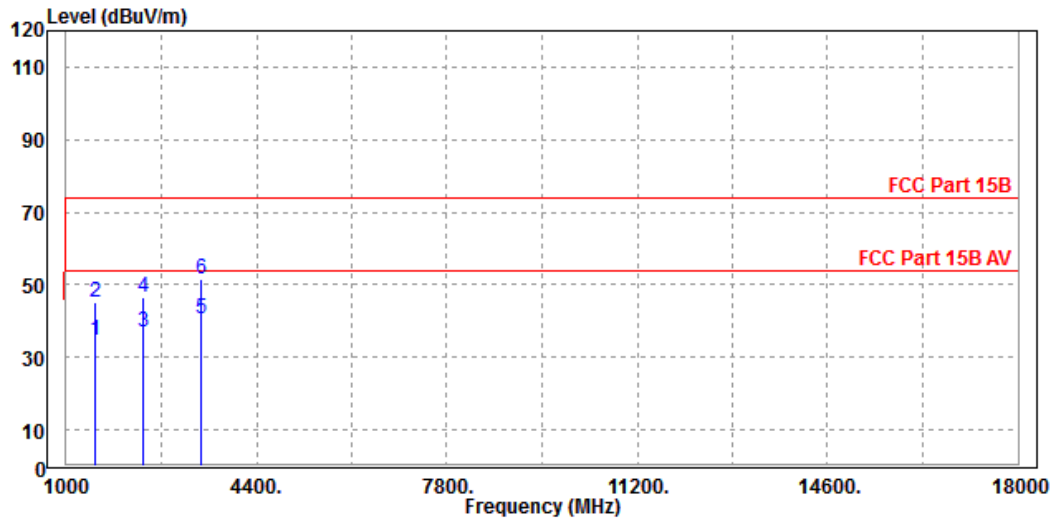




<b>TEST VOLTAGE</b>	DC 3.7V Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	1-18 GHz
<b>ENVIRONMENTAL CONDITIONS</b>	24deg. C, 58 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Peak/Average, 1 MHz
<b>TESTED BY</b>	Vincent Chen		

<b>ANTENNA POLARITY &amp; TEST DISTANCE: HORIZONTAL AT 3 M</b>										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1510	34.6	45.66	54	-19.4	28.76	6.34	46.16	100	64	Average
1510	44.95	56.01	74	-29.05	28.76	6.34	46.16	100	64	Peak
2377	37.13	42.64	54	-16.87	32.28	8.13	45.92	100	215	Average
2377	46.47	51.98	74	-27.53	32.28	8.13	45.92	100	215	Peak
3414	40.63	43.66	54	-13.37	32.98	9.82	45.83	100	136	Average
3414	51.46	54.49	74	-22.54	32.98	9.82	45.83	100	136	Peak

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 1GHz to 18GHz.
  4. Only emissions significantly above equipment noise floor are reported.

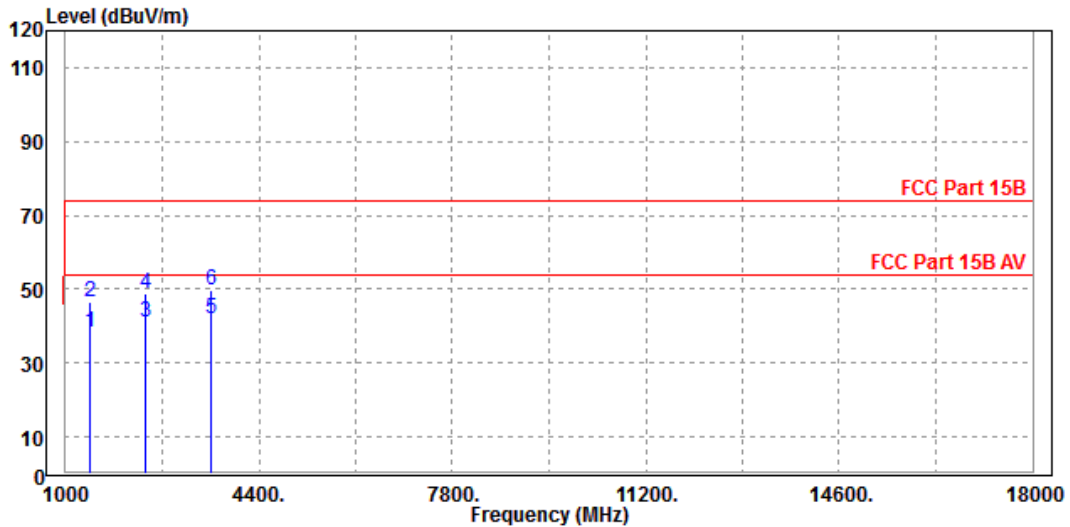




<b>TEST VOLTAGE</b>	DC 3.7V Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	1-18 GHz
<b>ENVIRONMENTAL CONDITIONS</b>	24deg. C, 58 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Peak/Average, 1 MHz
<b>TESTED BY</b>	Vincent Chen		

<b>ANTENNA POLARITY &amp; TEST DISTANCE: VERTICAL AT 3 M</b>										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1442	38.28	49.51	54	-15.72	28.76	6.18	46.17	100	96	Average
1442	46.64	57.87	74	-27.36	28.76	6.18	46.17	100	0	Peak
2394	41.19	46.66	54	-12.81	32.29	8.16	45.92	100	268	Average
2394	49.05	54.52	74	-24.95	32.29	8.16	45.92	100	0	Peak
<b>3550</b>	<b>41.96</b>	<b>44.68</b>	<b>54</b>	<b>-12.04</b>	<b>33.08</b>	<b>10.04</b>	<b>45.84</b>	<b>100</b>	<b>295</b>	<b>Average</b>
3550	49.68	52.4	74	-24.32	33.08	10.04	45.84	100	0	Peak

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 1GHz to 18GHz.
  4. Only emissions significantly above equipment noise floor are reported.







Test Report No.: IV180608W006

### 3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

---END---