



# EMC TEST REPORT

**Report No.:** SET2016-16084

**Product Name:** Connected Handheld RFID Reader

**FCC ID:** P65ALR-H450B

**Model No. :** ALR-H450

**Applicant:** Alien Technology, LLC

**Address:** 845 Embedded Way, San Jose, CA 95138-1030, United States

**Received Date:** 2016-07-02

**Tested Date:** 2016-06-30—2016-06-30

**Issued by:** CCIC-SET

**Lab Location:** Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China

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### Test Report

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**Applicant**..... : Alien Technology, LLC

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**Manufacturer**..... : Alien Technology, LLC

**Manufacturer Address** ..... : 845 Embedded Way, San Jose, CA 95138-1030, United States

**Test Standards**..... : 47 CFR Part 15 Subpart B: Radio Frequency Devices

**Test Result** ..... : PASS

**Tested by** ..... : Ling Min Xie 2016.07.02  
Ling Min Xie Test Engineer

**Reviewed by**..... : Shuangwen Zhang 2016.07.02  
Shuangwen Zhang, Senior Engineer

**Approved by** ..... : Wu Lian 2016.07.02  
Wu Li'an, Manager



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Change History		
Issue	Date	Reason for change
1.0	2016.07.02	First edition



## 1. GENERAL INFORMATION

### 1.1 EUT Description

EUT Name ..... : Connected Handheld RFID Reader

FCC ID..... : P65ALR-H450B

Trade Name..... : ALIEN®

Brand Name..... : ALIEN

Hardware Version..... : C4050\_MB\_V5.0

Software Version ..... : V1.0.0\_10040006582\_20151221

Power Supply ..... : Battery1

Model No.: 935161(ICP10/51/59)

Capacitance: 3200 mAh

Rated Voltage: 3.7V

Charge Limit: 4.2V

Battery2

Model No.: 18650

Capacitance: 5000 mAh

Rated Voltage: 3.7V

Charge Limit: 4.2V

Ancillary Equipment..... : AC Adapter (Charger for Battery)

Model No.: HNC050200U

Rated Input: 100-240V, 50/60Hz ,0.35A

Rated Output: 5V=2.0A

Data cable(shield)

*Note 1:* The EUT is a Connected Handheld RFID Reader, it supports the following operating frequency band: GSM850/900/1800/1900, WCDMA850/1900, Wifi2.4G(b,g,n/20M,n/40M), GPS, Bluetooth 3.0+ EDR, Bluetooth4.0LE, RFID.

*Note 2:* The EUT is equipped with a T-Flash card slot; equipped with a USB port which can be connected to the ancillary equipments.

*Note 3:* The highest operation frequency or processor operate frequency is 1.3GHz.

*Note 4:* For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



## 1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart B:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart B 2014	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result
1	15.107	Conducted Emission	PASS
2	15.109	Radiated Emission	PASS

NOTE:

(1) The EUT has been tested according to 47 CFR Part 15 Subpart B, Class B. The test procedure is according to ANSI C63.4:2009.



### 1.3 Facilities and Accreditations

#### 1.3.1 Facilities

**CNAS-Lab Code: L1659**

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8\*6.8\*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.

**FCC-Registration No.: 406086**

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 406086, valid time is until October 28, 2017.

#### 1.3.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15°C - 35°C
Relative Humidity (%):	25% -75%
Atmospheric Pressure (kPa):	86kPa-106kPa

#### 1.3.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission:	Uc = 3.6 dB (k=2)
Uncertainty of Radiated Emission:	Uc = 4.5 dB (k=2)

## 2. TEST CONDITIONS SETTING

### 2.1 Test Peripherals

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

#### Support Equipment:

Description	Brand name	Model	Serial No.	FCCID /DOC
Notebook	ThinkPad	E430C	A131101550	N/A
Micro SD card	SanDisk	N/A	N/A	N/A
Mouse	Logitech	M100r	25011051	DOC
Printer	RICOH	SP200	JM175210006	N/A

#### Support Cable:

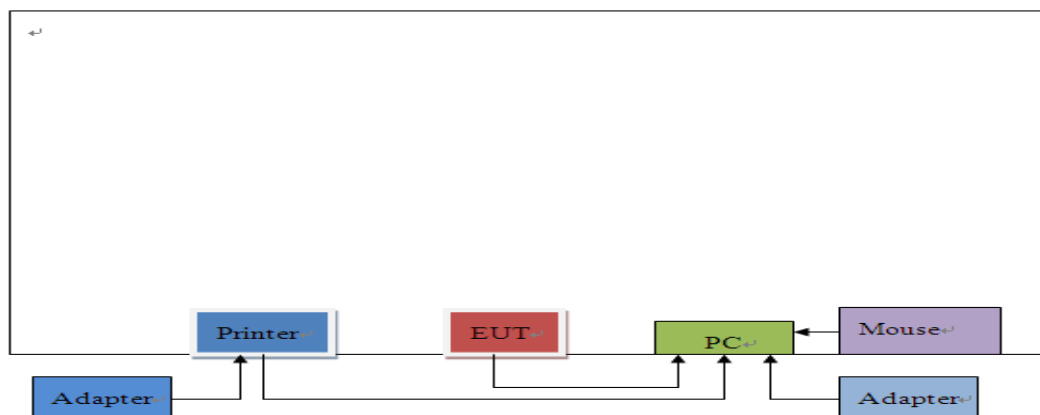
Description	Shield Type	Ferrite Core	Length
USB Cable	shielding	Yes	1.2m
RJ45 Cable	shielding	No	2m
Printer Power Cable	Un- shielding	No	1m
PC Power adapter Cable	Un- shielding	No	1.2m
Mouse Cable	Un- shielding	No	1m

### 2.2 Test Mode

The EUT configuration of the emission tests is TransFlash Card + EUT + PC+Printer+Mouse.

### 2.3 Connection Diagram of Test System

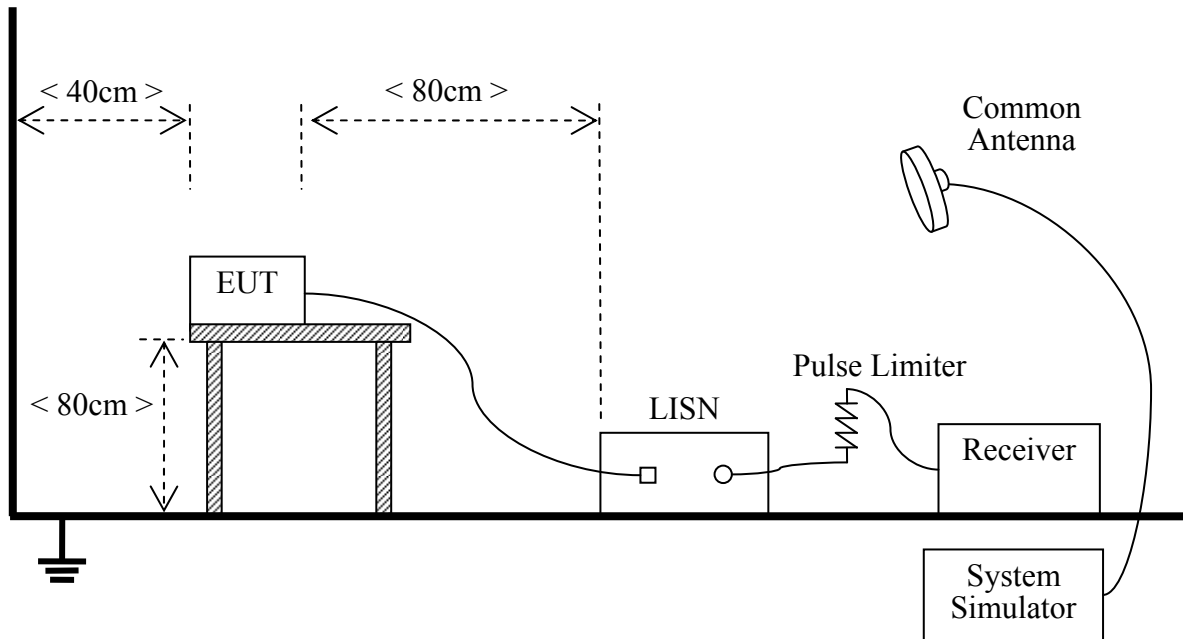
The EUT is installed in a typical configuration. Test software exercised the EUT.



## 2.4 Test Setup and Equipments List

### 2.4.1 Conducted Emission

#### A. Test Setup:



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides  $50\Omega/50\mu\text{H}$  of coupling impedance for the measuring instrument. The Common Antenna is used for the call between the EUT and the System Simulator (SS). A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

#### B. Equipments List:

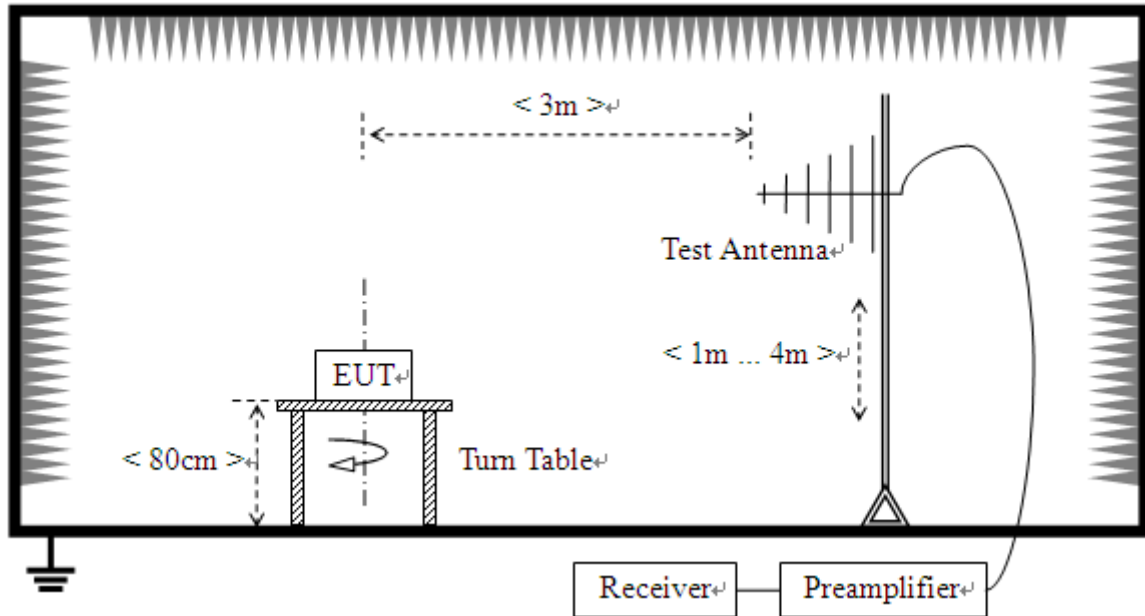
Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	ROHDE&SCHWARZ	ESCI	A130901475	2015.09.09	2016.09.08
LISN	ROHDE&SCHWARZ	ENV216	/	2016.04.28	2017.04.27
Cable	MATCHING PAD	W7	/	2016.06.05	2017.06.04

### 2.4.2 Radiated Emission

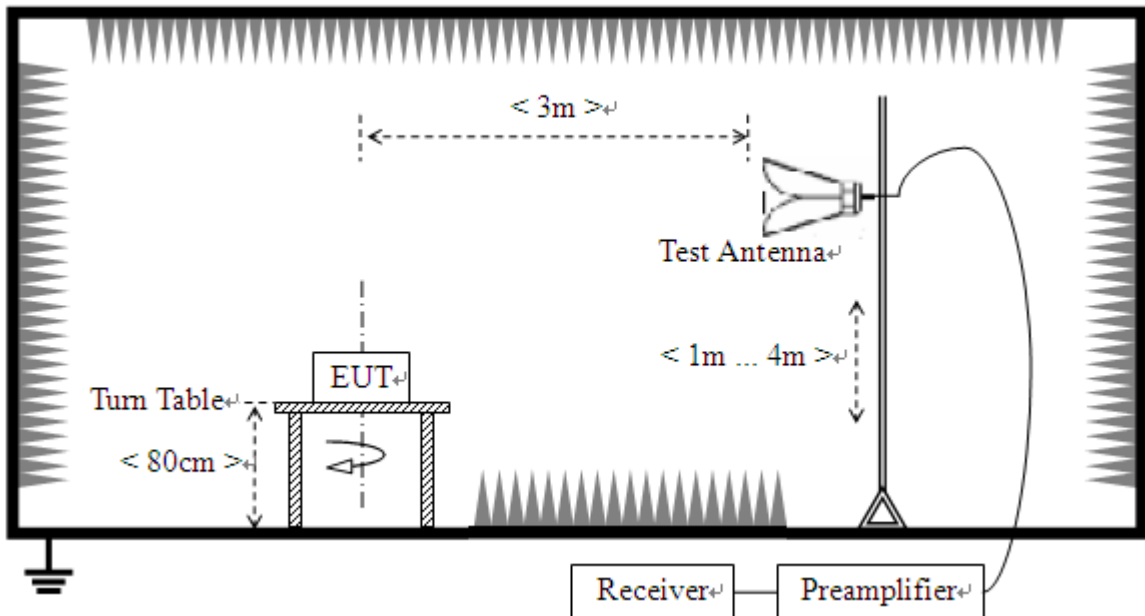
#### A. Test Setup:



- 1) For radiated emissions from 30MHz to 1GHz



- 2) For radiated emissions above 1GHz



## B. Test Procedure

The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a



variable-height antenna master tower.

For the test Antenna:

- 1) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

### C. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	ROHDE&SCHWARZ	ESIB7	A0501375	2016.06.09	2017.06.09
Test Receiver	ROHDE&SCHWARZ	ESIB26	A0304218	2016.06.09	2017.06.09
Semi-Anechoic Chamber	Albatross	9m*6m*6m	A0412372	2016.03.21	2017.03.21
Test Antenna - Bi-Log	HP	CBL6111A	A9704202	2016.06.09	2017.06.09
Test Antenna – Horn	ROHDE&SCHWARZ	HF906	A0304225	2016.06.09	2017.06.09
Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2016.03.21	2017.03.21
Amplifier 1G~18GHz	ROHDE&SCHWARZ	MITEQ AFS42-001018 00	A0509366	2016.06.09	2017.06.09
Amplifier 20M~3GHz	Compliance Direction System	PAP-0203H	A0509377	2016.06.09	2017.06.09
Cable	SUNHNER	SUCOFLEX 100	/	2016.06.09	2017.06.09
Cable	SUNHNER	SUCOFLEX 104	MY1758/4	2016.06.09	2017.06.09



### 3. 47 CFR PART 15B REQUIREMENTS

#### 3.1 Conducted Emission

##### 3.1.1 Requirement

According to FCC section 15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

**Note:**

- The limit subjects to the Class B digital device.
- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

##### 3.1.2 Test Description

See section 2.4.1 of this report.

##### 3.1.3 Test Result

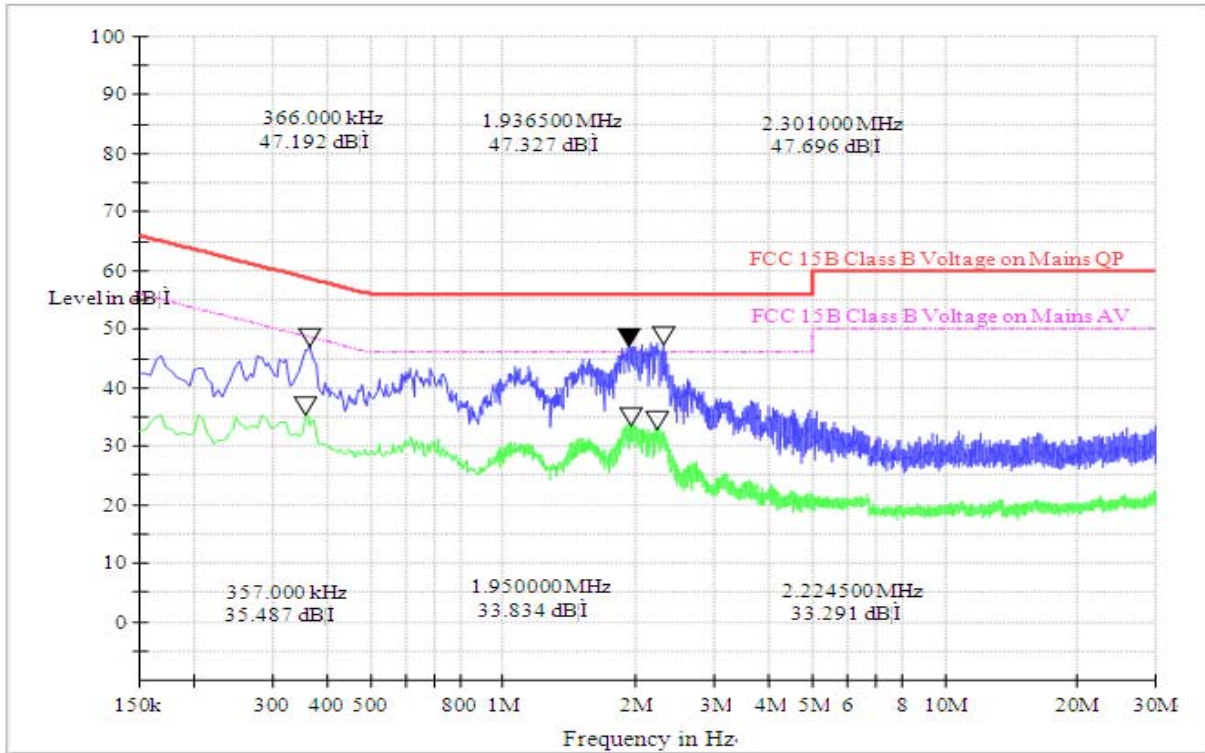
The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. All test modes are considered, refer to recorded points and plots below.

**Note:**

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a Nominal 120V AC,50/60Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

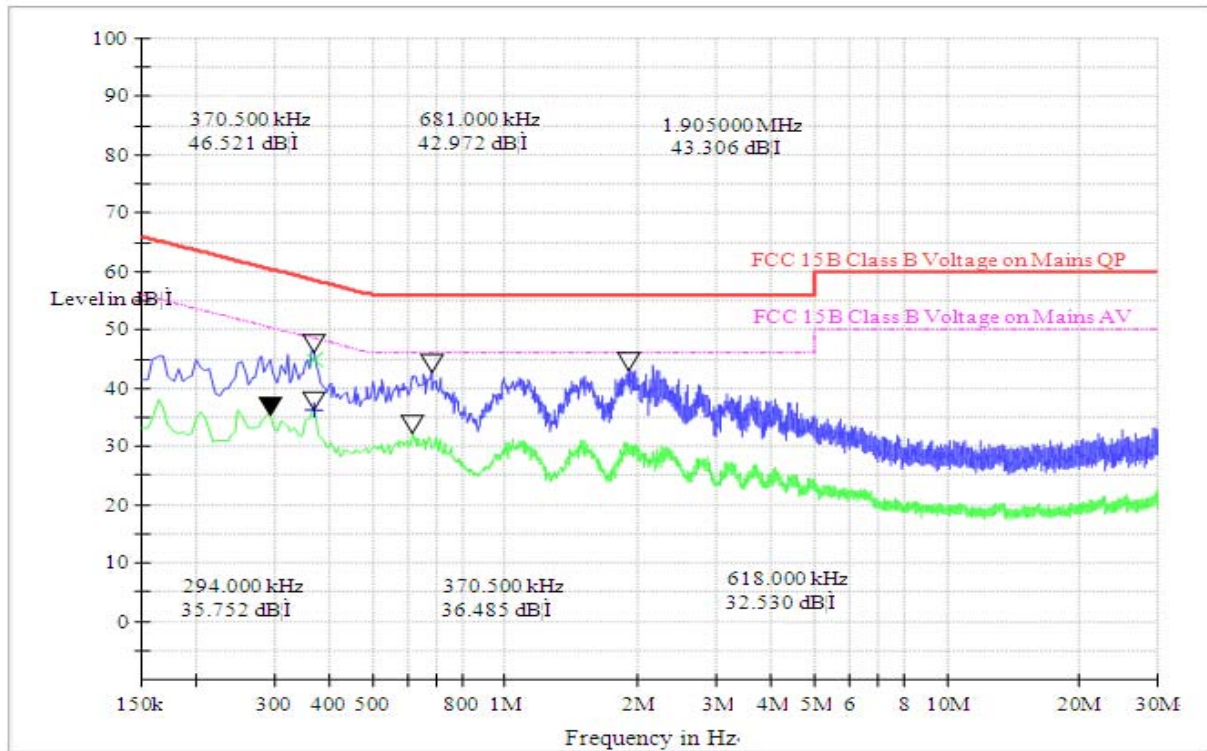
**Test voltage and frequency (120V AC,60Hz)**

**A. Test Plot and Suspicious Points:**



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals							
L Test Data							
QP				AV			
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)
0.3660	58.60	46.38	12.22	0.3660	48.60	34.05	14.55
1.9365	56.00	46.16	9.84	1.9500	46.00	32.36	13.64
2.3010	56.00	46.28	9.72	2.2245	46.00	32.19	13.81



(Plot B: N Phase)

Conducted Disturbance at Mains Terminals							
N Test Data							
QP				AV			
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Margin (dB)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Margin (dB)
0.3705	58.50	44.92	13.58	0.3705	48.50	36.26	12.24
0.6810	56.00	41.39	14.61	0.6810	46.00	29.04	16.96
1.9050	56.00	42.62	13.38	1.9050	46.00	28.34	17.66

**Test Result: PASS**

## 3.2 Radiated Emission

### 3.2.1 Requirement

According to FCC section 15.109, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength		Field Strength Limitation at 3m Measurement Dist	
	$\mu\text{V/m}$	Dist	( $\text{uV/m}$ )	( $\text{dBuV/m}$ )
0.009 - 0.490	2400/F(kHz)	300m	10000* 2400/F(kHz)	20log 2400/F(kHz) + 80
0.490 - 1.705	2400/F(kHz)	30m	100* 2400/F(kHz)	20log 2400/F(kHz) + 40
1.705 - 30.00	30	30m	100*30	20log 30 + 40
30.0 - 88.0	100	3m	100	20log 100
88.0 - 216.0	150	3m	150	20log 150
216.0 - 960.0	200	3m	200	20log 200
Above 960.0	500	3m	500	20log 500

- a) As shown in FCC section 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector. When average radiated emission measurements are specified in this part, including emission measurements below 1000MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.
- b) Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.
- c) For below 1G :QP detector RBW 120kHz ,VBW 300kHz.
- d) For Above 1G: PK detector RBW 1MHz,VBW 3MHz for PK value ;PK detector RBW 1MHz, VBW 10Hz for AV value.

#### Note:

- 1) The tighter limit shall apply at the boundary between two frequency range.
- 2) Limitation expressed in  $\text{dBuV/m}$  is calculated by  $20\log \text{Emission Level}(\text{uV/m})$ .
- 3) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of  $Ld1 = Ld2 * (d2/d1)^2$ .

Example:

F.S Limit at 30m distance is  $30\text{uV/m}$ , then F.S Limitation at 3m distance is adjusted as

$$Ld1 = L1 = 30\text{uV/m} * (10)^2 = 100 * 30\text{uV/m}.$$



### **3.2.2 Test Description**

See section 2.3.2 of this report.

### **3.2.3 Test Result**

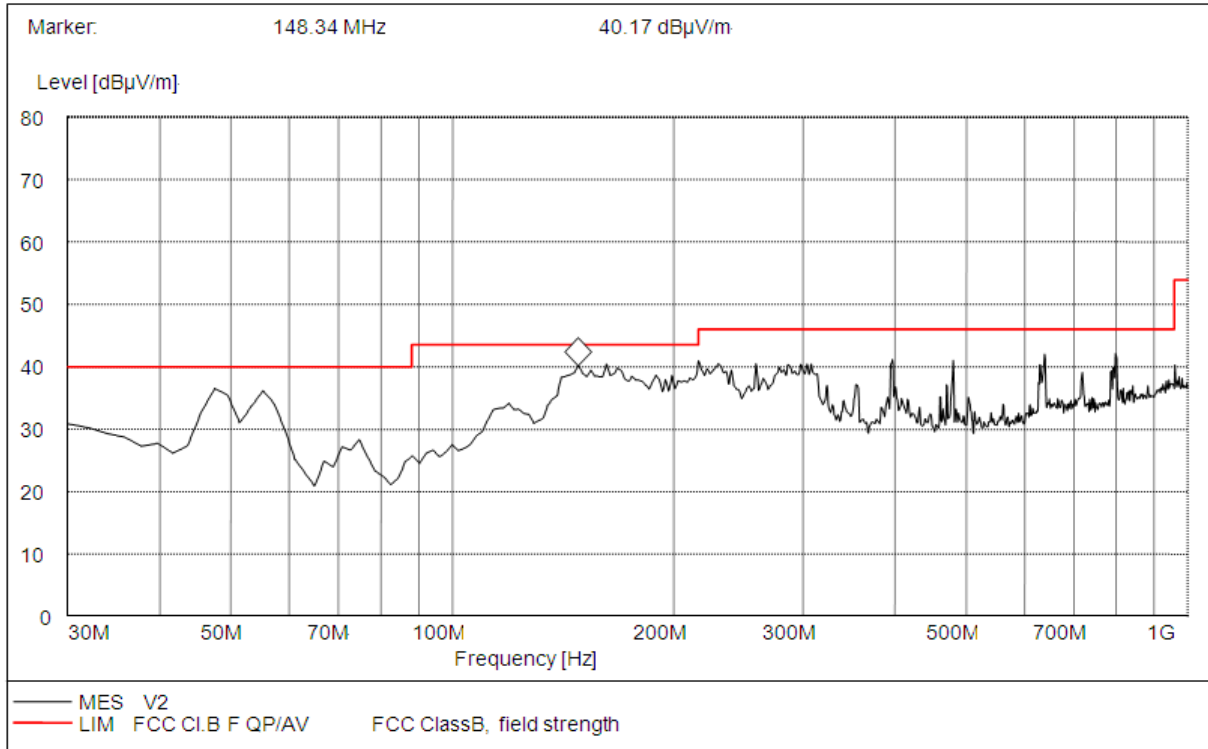
The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with AV and QP detectors. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests. All test modes are considered, refer to recorded points and plots below.

The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

Note: All radiated emission tests were performed in X, Y, Z axis direction, and only the worst axis test condition was recorded in this test report.

**B. Test Plots and Suspicious Points:**

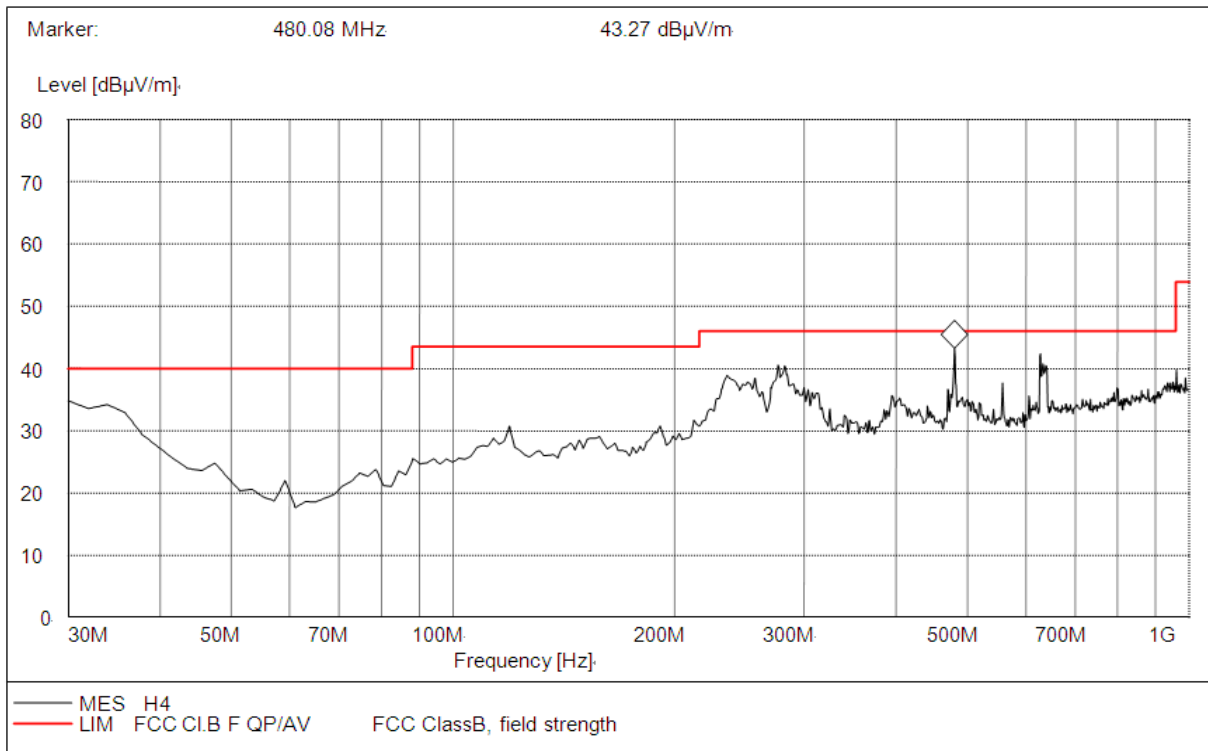
**Test result of radiated emission below 1GHz**



(Plot C: Test Antenna Vertical 30M - 1G)

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµV/m)	Margin (dB)	Antenna	Verdict
161.35000	39.58	120.000	276.0	43.50	3.92	Vertical	Pass
258.39000	38.59	120.000	186.0	46.00	7.41	Vertical	Pass
639.25000	41.69	120.000	258.0	46.00	4.31	Vertical	Pass

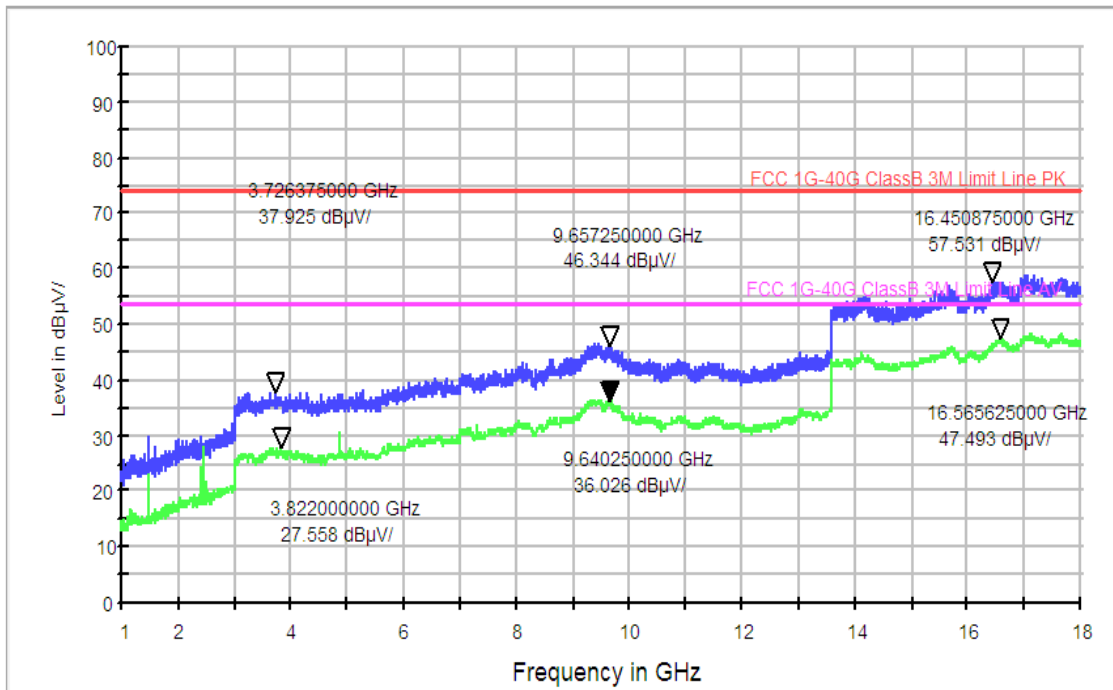




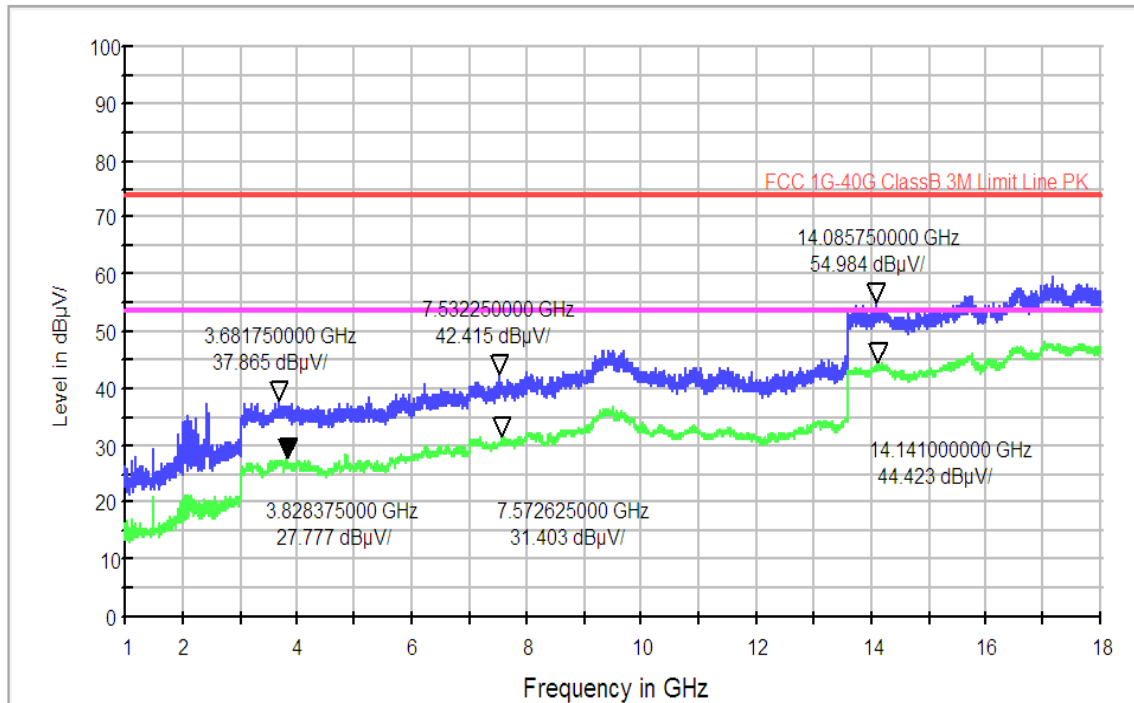
(Plot D: Test Antenna Horizontal 30M - 1G)

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµV/m)	Margin (dB)	Antenna	Verdict
31.11000	31.78	120.000	149.0	40.00	8.22	Horizontal	Pass
276.19000	39.58	120.000	264.0	46.00	6.42	Horizontal	Pass
480.26000	41.68	120.000	283.0	46.00	4.32	Horizontal	Pass

**Test result of radiated emission above 1GHz**



(Plot E: Test Antenna Horizontal 1G – 18G)



(Plot F: Test Antenna Vertical 1G – 18G)

**Test Result: PASS**