



EMC TEST REPORT

Report No.: SET2013-05819

Product Name: Toughshield

FCC ID: OHV-R500PLUS

Model No. : R500+

Applicant: Toughshield devices Ltd

Address: 2nd Floor, Belgravia House, 34-44 Circular Road, Douglas, Isle of Man. IM1 1AE

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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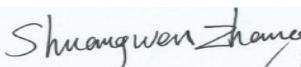
Manufacturer Address : 2nd Floor, Belgravia House, 34-44 Circular Road,
Douglas, Isle of Man. IM1 1AE

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

Test Result : PASS

Tested by :  2013-10-18

Lu Lei, Test Engineer

Reviewed by :  2013-10-18

Shuangwen Zhang, Senior Engineer

Approved by :  2013-10-18

Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	2013-10-18	First edition

1. GENERAL INFORMATION

1.1 EUT Description

EUT Type : R500+
Serial No. : (n.a, marked #1 by test site)v
FCC ID : OHV-R500PLUS
Hardware Version : S103M001P000
Software Version : R500+_VER_2.0_01010_20130820
Power Supply : Battery
Brand Name: ToughShield
Model No.: R500+
Serial No.: (n.a. marked #1 by test site)
Capacitance: 1500mAh
Rated Voltage: 3.7V
Charge Limit: 4.2V
Ancillary Equipment 1 : AC Adapter (Charger for Battery)
Brand Name: ToughShield
Model Name: SC13TS
Serial No.: (n.a. marked #1 by test site)
Rated Input: 100-240V, 0.15A, 50/60Hz
Rated Output: = 5V, 1000mA
Ancillary Equipment 2 : PC
Brand Name: ThinkPad
Model Name: E420
Serial No.: 1141AH6

Note 1: The EUT is a Toughshield, it supports the following operating mode and frequency band:
GSM850/PCS1900/WCDMA1900/WCDMA850,802.11b,802.11g ,802.11n20 and Bluetooth 3.0

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 supplied by the manufacturer e.g. the AC Adapter and the USB Cable.

Note 3: 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 2012	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: 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 and CISPR 22:2008. The test results are as following:



1.3 Facilities and Accreditations

1.3.1 Facilities

CNAS-Lab Code: L1659

CCIC-SET 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-SET 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, Renewal date Nov. 19, 2011, valid time is until Nov. 18, 2014.

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 (%):	30% -60%
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:	U _c = 3.6 dB (k=2)
Uncertainty of Radiated Emission:	U _c = 4.5 dB (k=2)

2. TEST CONDITIONS SETTING

2.1 Test Mode

(1) The first test mode (Idle)

The EUT configuration of the emission tests is EUT + Battery + Charger.

During the test, The EUT was synchronized to the BCCH, listening to the CCCH and able to respond to paging message. Periodic location updating was disabled.

(2) The first test mode (USB)

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

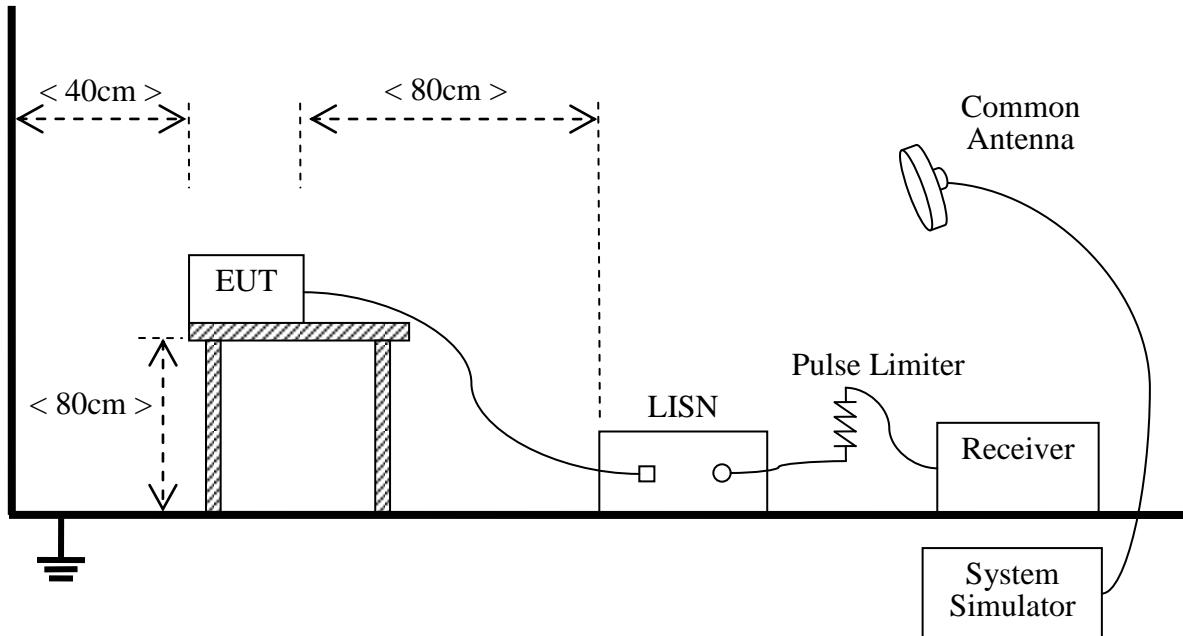
In this test mode, the EUT with a TransFlash Card embedded is connected with a PC via a USB cable supplied by applicant. During the measurement, a communication link was established between the EUT and a System Simulator (SS), the data is transmitting between the PC and the TransFlash Card of the EUT.

NOTE: All test modes are performed, only the worst cases are recorded in this report.

2.2 Test Setup and Equipments List

2.2.1 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:

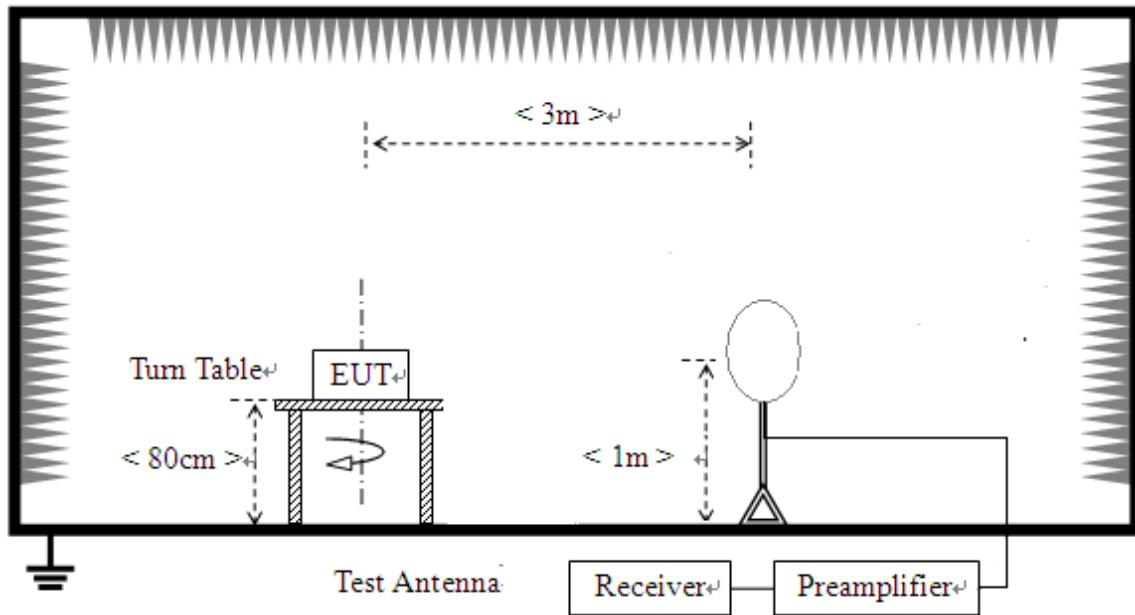
Description	Manufacturer	Model	Serial No.	Cal. Date
Test Receiver	ROHDE&SCHWARZ	ESCS30	A0304260	2013.06.10
System Simulator	ROHDE&SCHWARZ	CMU200	A0304212	2013.06.10
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2013.06.10

The Cal. Interval was one year.

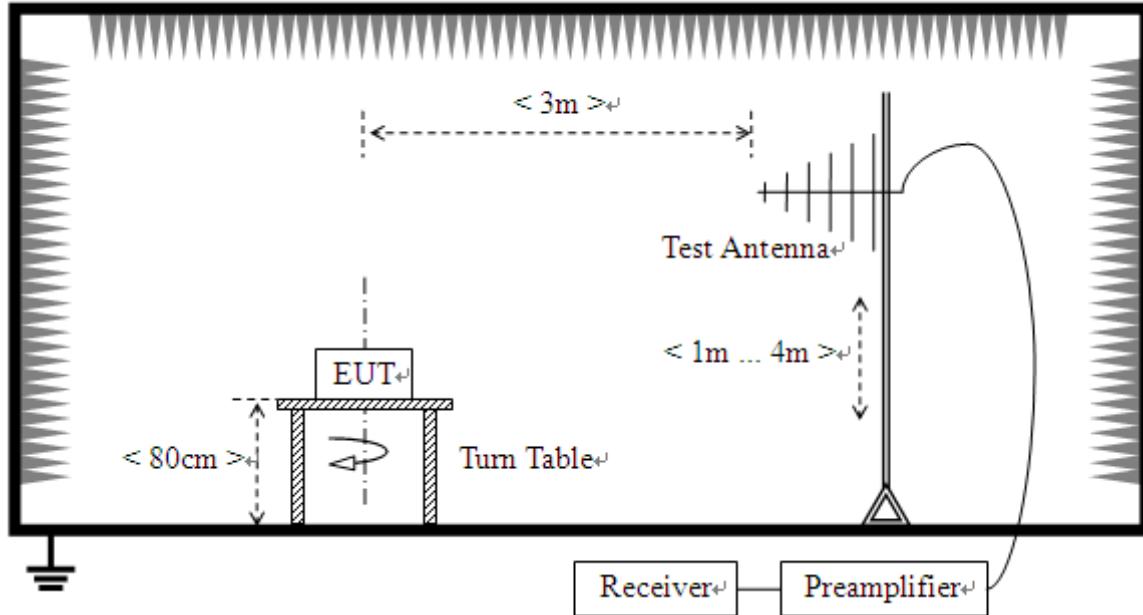
2.2.2 Radiated Emission

A. Test Setup:

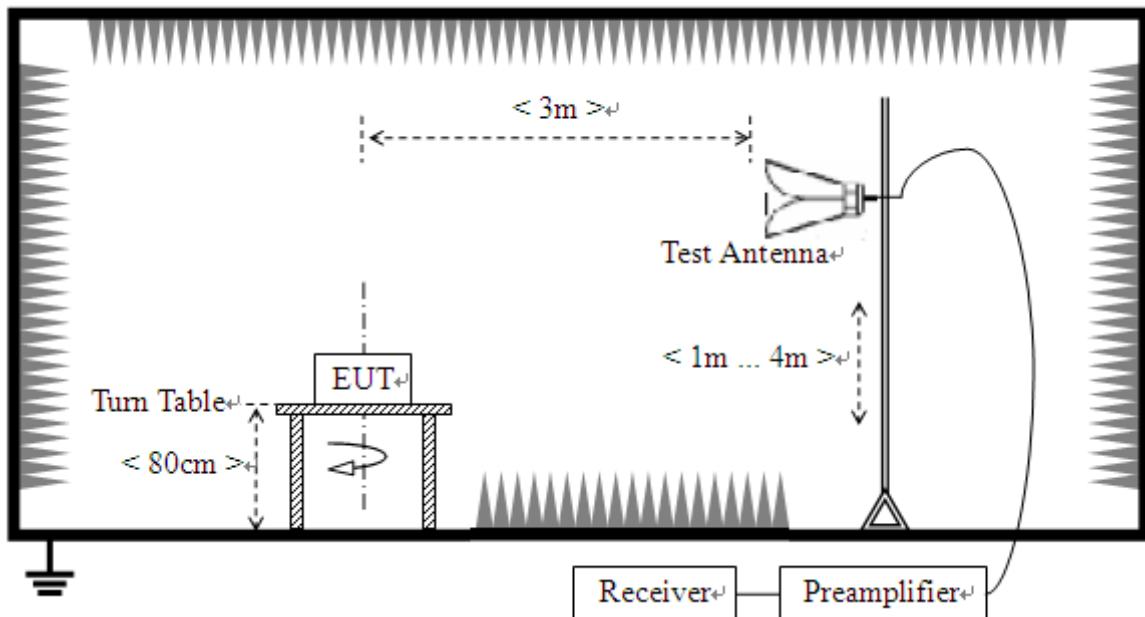
- 1) For radiated emissions from 9kHz to 30MHz



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



3) 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 of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) 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.	Cal. Date
Test Receiver	ROHDE&SCHWARZ	ESIB7	A0501375	2013.06.10
Test Receiver	ROHDE&SCHWARZ	ESIB26	A0304218	2013.06.10
Semi-Anechoic	Albatross	9m*6m*6m	A0412372	2013.01.04



Description	Manufacturer	Model	Serial No.	Cal. Date
Chamber				
Test Antenna - Bi-Log	HP	CBL6111A	A9704202	2013.06.10
Test Antenna - Horn	ROHDE&SCHWARZ	HF906	A0304225	2013.06.10
System Simulator	ROHDE&SCHWARZ	CMU200	A0304212	2013.06.10
Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4 m	A0304210	2013.03.09
Ampilier 1G~18GHz	ROHDE&SCHWARZ	MITEQ AFS42-0010 1800	25-S-42	2013.06.10
amplifier 20M~3GHz	Compliance Direction System	PAP-0203H	22018	2013.06.10

The Cal. Interval was one year.

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 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ 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

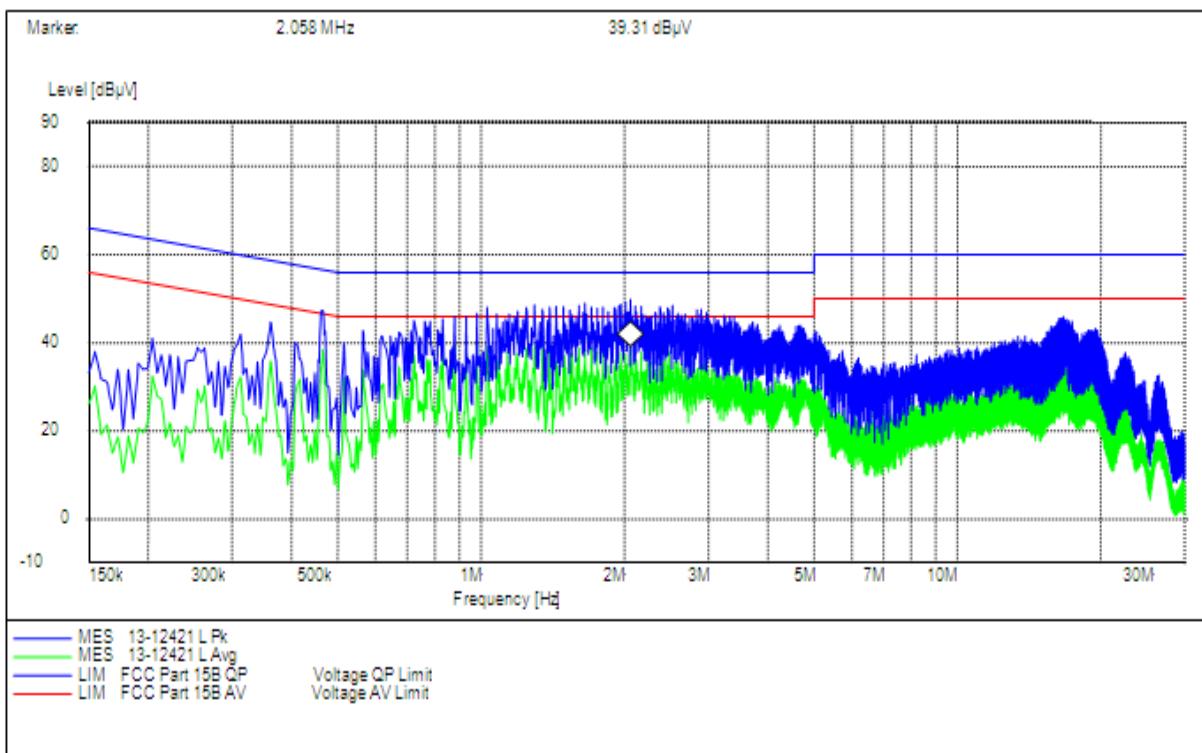
See section 2.2.1 of this report.

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.

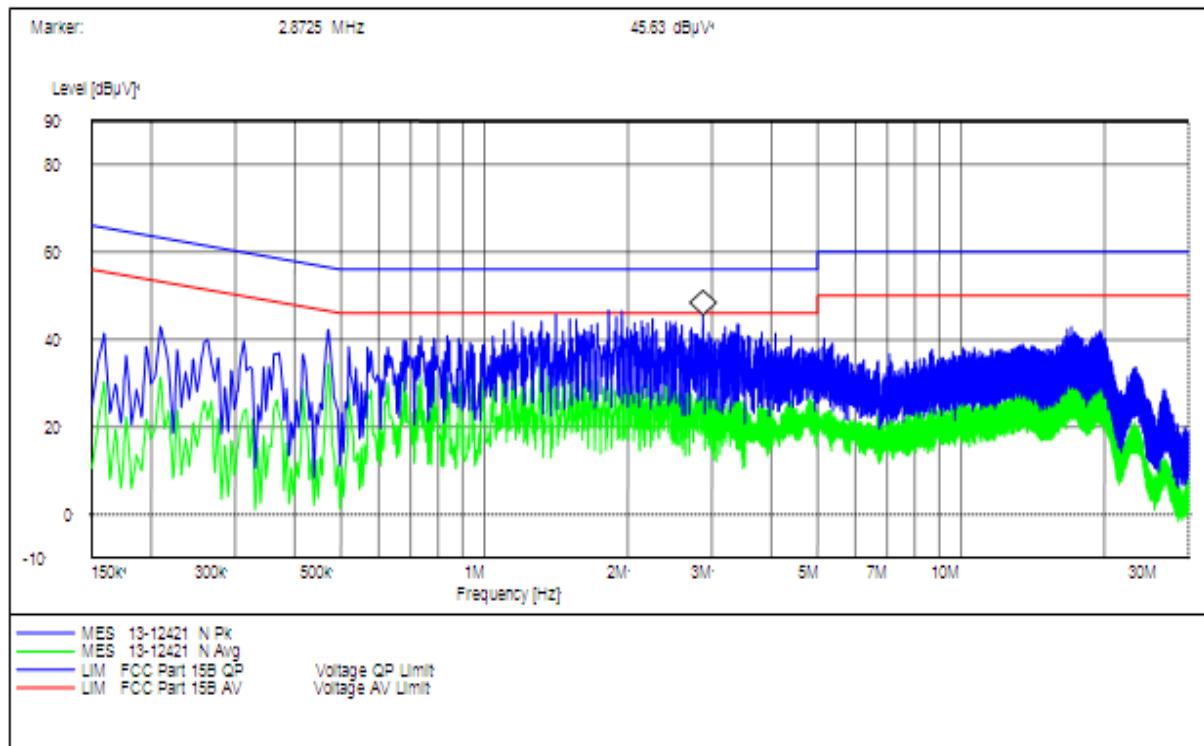
3.1.3.1 Test Mode

A. Test Plot and Suspicious Points:



Conducted Disturbance at Mains Terminals							
L Test Data							
QP				AV			
Frequency (MHz)	Limits (dB μ V)	Measurement Value (dB μ V)	Margin (dB)	Frequency (MHz)	Limits (dB μ V)	Measurement Value (dB μ V)	Margin (dB)
0.4650	56.60	45.60	11.00	0.4650	46.60	38.43	8.17
1.02750	56	46.60	9.40	1.0275	46	39.26	6.74
2.0580	56	47.56	8.44	2.0580	46	39.31	6.69
L Test Curve							

(Plot A: L Phase)



Conducted Disturbance at Mains Terminals							
N Test Data							
QP				AV			
Frequen cy (MHz)	Limits (dB μ V)	Measurem ent Value (dB μ V)	Margin (dB)	Frequen cy (MHz)	Limits (dB μ V)	Measurem ent Value (dB μ V)	Margin (dB)
1.8240	56	45.16	10.84	1.8240	46	30	16
1.9410	56	46.03	9.97	1.9410	46	24.33	21.67
2.8725	56	44.13	11.87	2.8725	46	29.23	16.77
N Test Curve							

(Plot B: N Phase)

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	
	μV/m	Dist	(uV/m)	(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

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.

Note:

- 1) The tighter limit shall apply at the boundary between two frequency range.
- 2) Limitation expressed in dBuV/m is calculated by 20log Emission Level(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 30uV/m, then F.S Limitation at 3m distance is adjusted as
 $Ld1 = L1 = 30uV/m * (10)^2 = 100 * 30uV/m$.

3.2.2 Test Description

See section 2.2.2 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

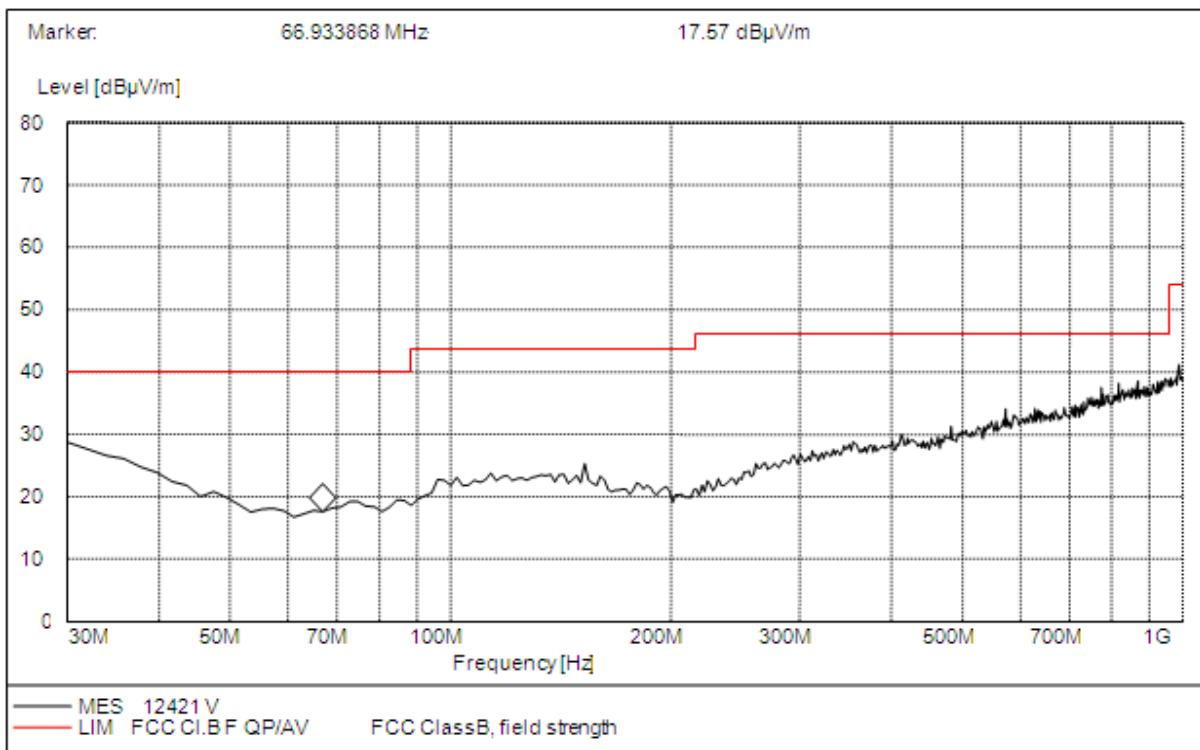
perform the tests. All test modes are considered, refer to recorded points and plots below.

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.

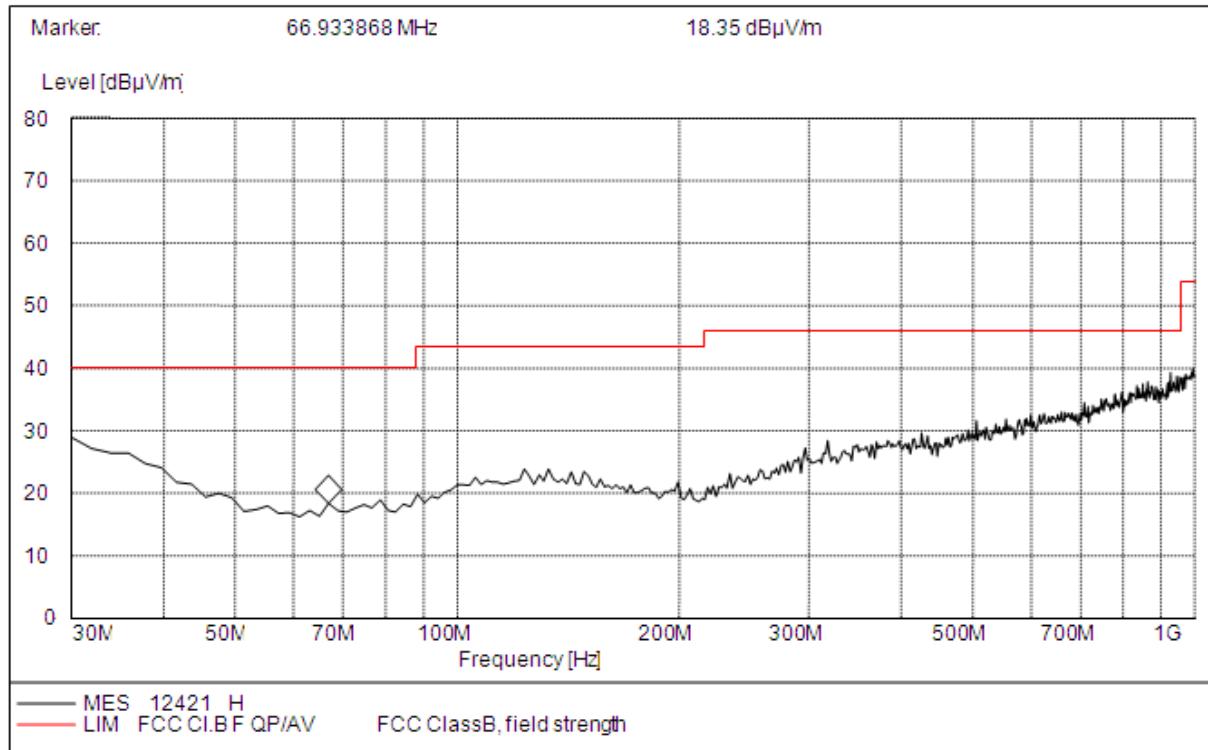
A. Test Plots and Suspicious Points:

NOTE: The emissions are too small to be measured and are at least 6 dB below the limit, So all the data of marked are pass.



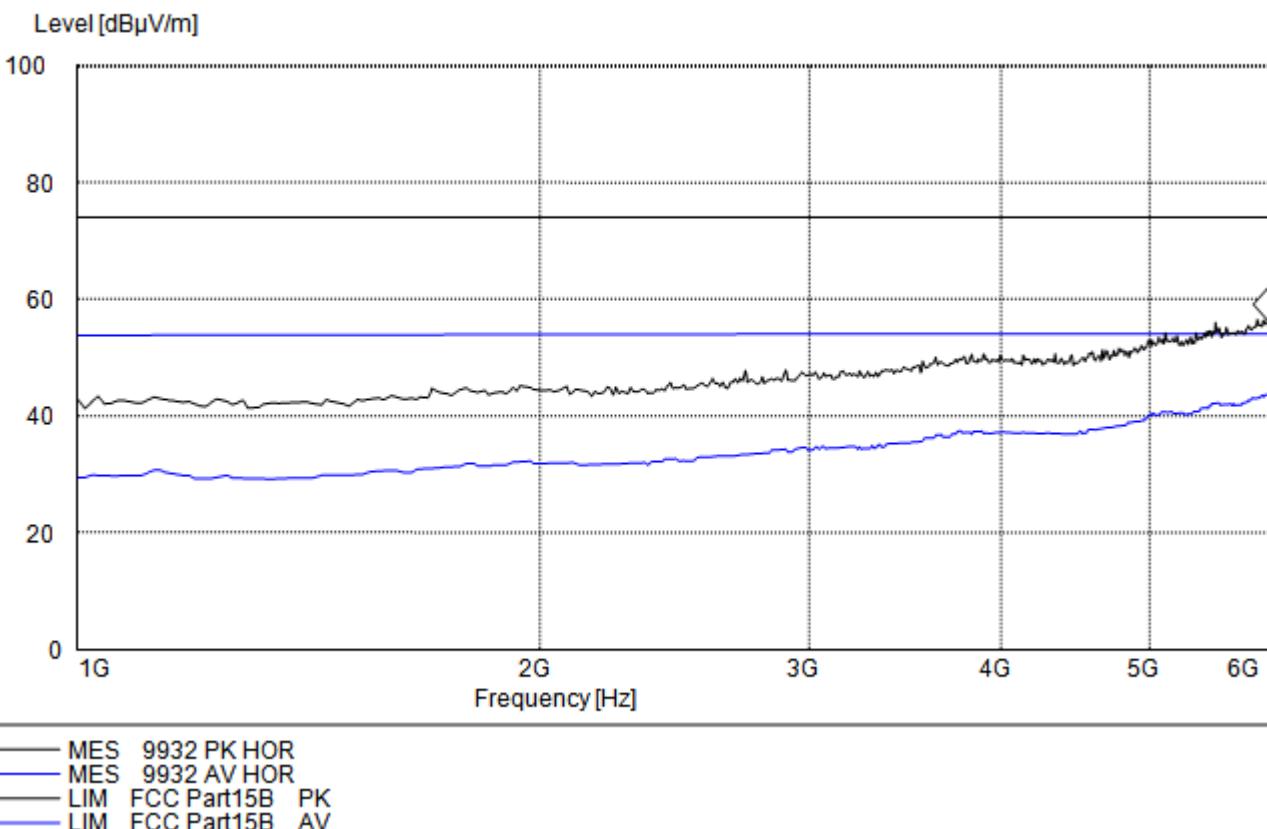
(Plot A: Test Antenna Vertical 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
66.933868	17.57	120.000	100.0	40.00	22.43	Vertical	Pass
158.352306	24.67	120.000	100.0	43.50	18.83	Vertical	Pass
506.041324	30.14	120.000	100.0	46.00	15.86	Vertical	Pass



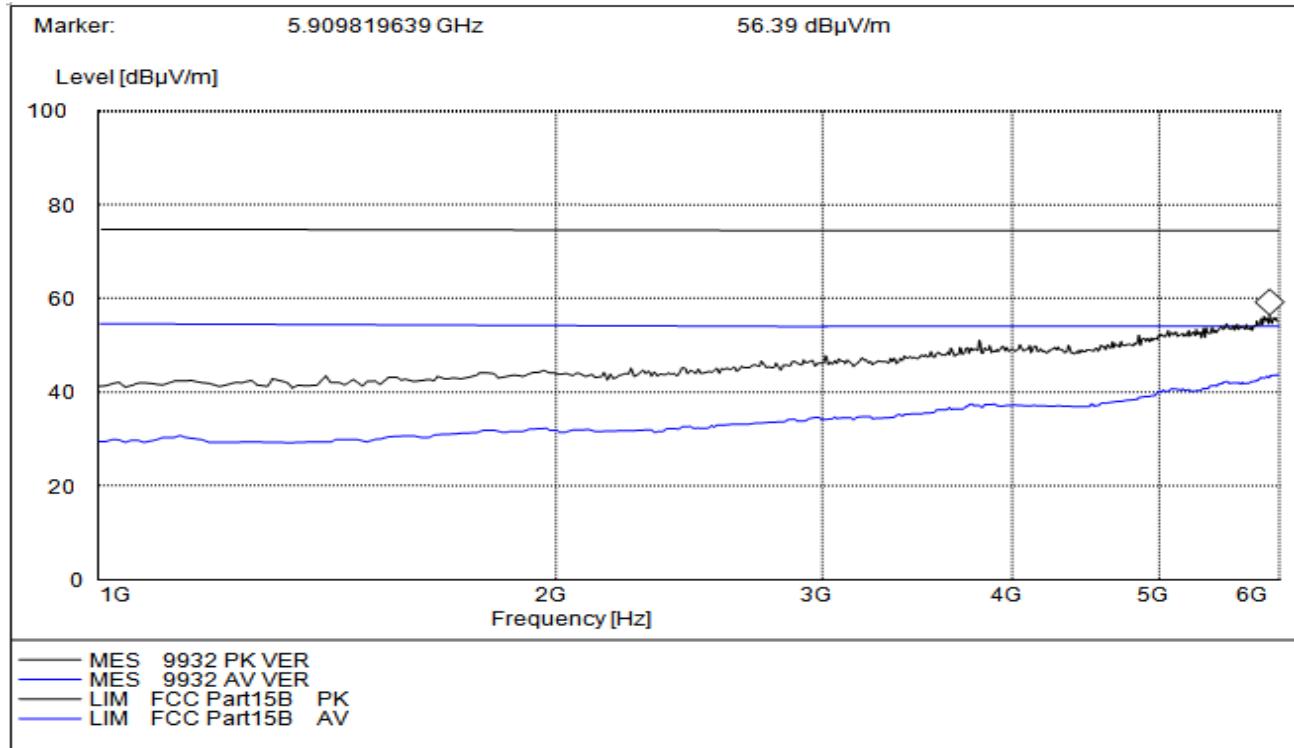
(Plot B: Test Antenna Horizontal 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
66.933868	18.35	120.000	100.0	40.00	21.65	Horizontal	Pass
158.352306	24.43	120.000	100.0	43.50	19.07	Horizontal	Pass
579.293425	32.81	120.000	100.0	46.00	13.19	Horizontal	Pass

Marker: 5.96993988 GHz 56.35 dB μ V/m


(Plot C: Test Antenna Horizontal 1G – 6G)

Frequency (MHz)	AV (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
1180.28136	28.35	1000.000	100.0	54	25.65	Horizontal	Pass
1758.35230	30.43	1000.000	150.0	54	23.57	Horizontal	Pass
3756.14551	38.15	1000.000	100.0	54	15.85	Horizontal	Pass
5979.29342	42.81	1000.000	100.0	54	11.19	Horizontal	Pass



(Plot D: Test Antenna Vertical 1G – 6G)

Frequency (MHz)	AV (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
1184.22425	29.14	1000.000	100.0	54	24386	Horizontal	Pass
1868.35345	31.43	1000.000	150.0	54	22.57	Horizontal	Pass
3868.14154	38.57	1000.000	100.0	54	15.43	Horizontal	Pass
5981.29342	43.24	1000.000	100.0	54	10.76	Horizontal	Pass

Test Result: PASS

** END OF REPORT **