RF TEST REPORT

Report No.:	SET2013-05820
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
	Tel: 86 755 26627338 **Fax:** 86 755 26627238

Test Report

Product Name ..... :	Toughshield
Brand Name ..... :	ToughShield
Trade Name ..... :	ToughShield
Applicant ..... :	Toughshield devices ltd
Applicant Address ..... :	2nd Floor, Belgravia House, 34-44 Circular Road, Douglas, Isle of Man. IM1 1AE
Manufacturer ..... :	Toughshield devices ltd
Manufacturer Address ..... :	2nd Floor, Belgravia House, 34-44 Circular Road, Douglas, Isle of Man. IM1 1AE
Test Standards ..... :	47 CFR Part 15 Subpart C：Radio Frequency Devices
Test Result ..... :	PASS
Tested by ..... :	2013-10-18 Lu Lei，Test Engineer
Reviewed by..... :	2013-10-18 Shuangwen Zhang, Senior Egineer
Product……..:	2013-10-18 Wu Li'an，Manager

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Change History		
Issue	Date	Reason for change
1.0	Oct 18, 2013	First edition

1. GENERAL INFORMATION

1.1 EUT Description

EUT Type ..... :	Toughshield	
Serial No..... :	(n.a, marked #1 by test site)	
FCC ID ..... :	OHV-R500PLUS	
Hardware Version..... :	S103M001P000	
Software Version ..... :	R500+_VER_2.0_01010_20130820	
Frequency Range..... :	13.553MHz~13.567MHz	
Frequency ..... :	13.56MHz	
Channel Number ..... :	1	
Modulation Type ..... :	ASK	
Antenna Type	PIFA Antenna	
Antenna Gain ..... :	0	
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

Note 1: The EUT is Toughshield, it supports 13.56MHz NFC which was tested in this report.

Note 2: 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 C (Wi-Fi, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2012	Radio Frequency Devices

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

No.	Section	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.207	Conducted Emission	PASS
3	15.209 15.225(a)(b)(c)(d)	Radiated Emission	PASS
4	15.225(e)	Frequency Tolerance	PASS
5	15.215(c)	20dB Bandwidth	PASS

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in 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, Renewal date Nov. 19, 2011, valid time is until Nov. 18, 2014.

IC-Registration No.: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on July. 15, 2013, valid time is until July. 15, 2016.

1.3.2 Test Environment Conditions

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

Temperature (°C):	15℃- 35℃
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:	±1.8dB
Uncertainty of Radiated Emission:	±3.1dB

2. 47 CFR PART 15C REQUIREMENTS

2.1 Antenna requirement

2.1.1 Applicable Standard

According to FCC 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2 Antenna Information

Antenna Category: External antenna
An External antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna General Information:

No.	EUT Model	Ant. Cat.	Ant. Type	Gain(dBi)
1	R500+	External	PIFA	0

2.1.3 Result: comply

2.2 Conducted Emission

2.2.1 Test Requirement

According to FCC section 15.207, 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 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

a) The limit subjects to the Class B digital device.

b) The lower limit shall apply at the band edges.

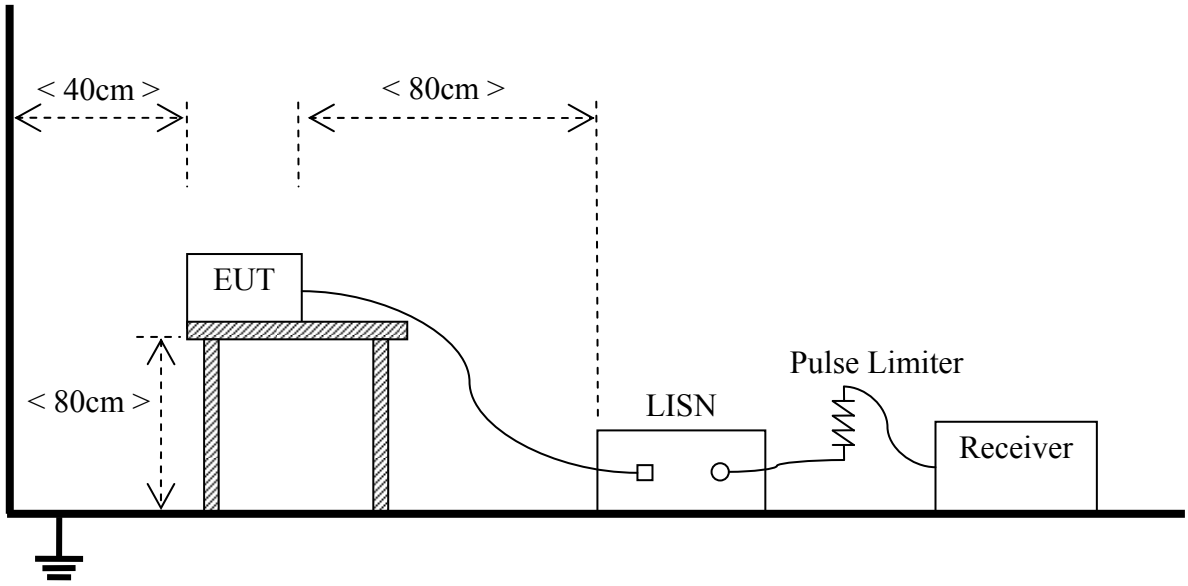
c) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.2.2 Test Equipment

Description	Manufacturer	Model	Serial No.	Cal. Date
Receiver	ROHDE&SCHWARZ	ESIB7	A0501375	Jun.10, 2013
Receiver	ROHDE&SCHWARZ	ESIB26	A0304218	Jun.10, 2013
LISN	Schwarzbeck	NSLK 8127	A0304233	Jun.10, 2013
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	A0304224	(n.a.)

The Cal. Interval was one year.

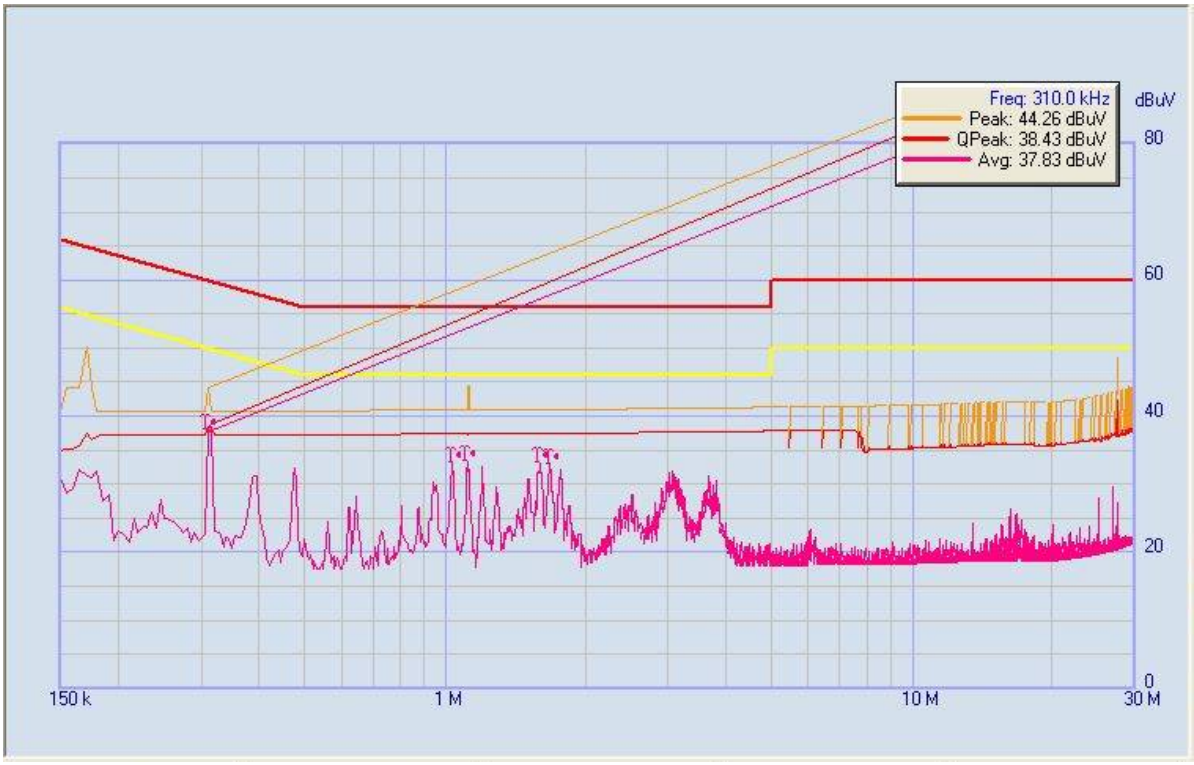
2.2.3 Test Result



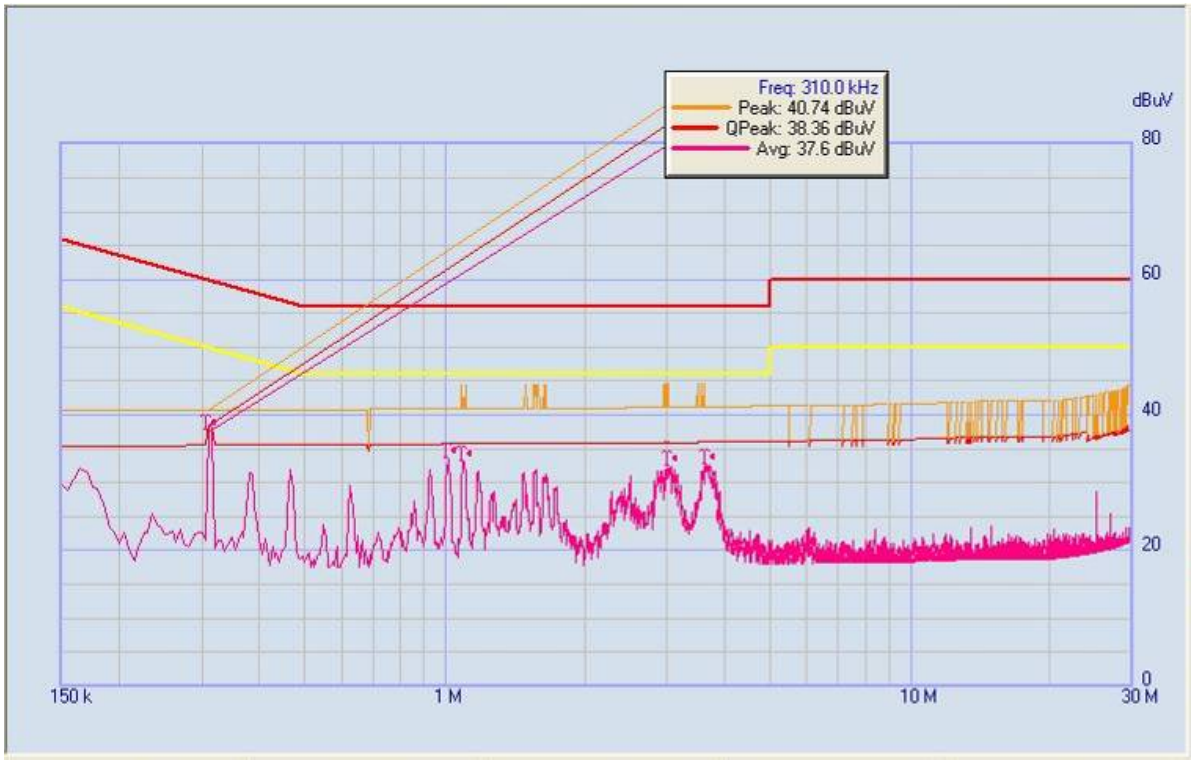
The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides 50Ω/50μH of coupling impedance for the measuring instrument. The RF Card is used for the call between with the EUT, and the EUT was measured by transmitter mode continuously. A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

2.2.3.1 Test Result

The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; Tests for both L phase and N phase lines of the power mains connected to the EUT are performed.



(Plot A: L Phase)



(Plot B: N Phase)

Result: PASS

2.3 Radiated Emission

2.3.1 Test Requirement

A. Radiated Emission <30MHz (9KHz-30MHz, H-field)

According to FCC section 15.225, for <30MHz, Radiated emissions were measured according to ANSIC63.4. The EUT was set to transmit at the highest output power. The EUT was set 30 meter away from the measuring antenna. The loop antenna was positioned 1 meter above the ground from the center of the loop. The measuring bandwidth was set to 10KHz. (Note: During testing the receive antenna was rotated about its axis to maximize the emission from the EUT)

There was no detected Restricted bands and Radiated suprious emission below 30MHz. The 30m limit was converted to 3m Limit using square factor(x) as it was found by measurements as follows;
3 m Limit(dBuV/m) = 20log(X)+40log(30/3)= 20log(15848)+40log(30/3) = 124dBuV
Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency range (MHz)	Field Strength@30m		Field Strength@3m
	μV/m	dBμV/m	dBμV/m
Below 13.110	30	29.5	69.5
13.110 ~ 13.410	106	40.5	80.5
13.410 ~ 13.553	334	50.5	90.5
13.553 ~13.567	15.848	84	124
13.567 ~ 13.710	334	50.5	90.5
13.710 ~14.010	106	40.5	80.5
Above 14.010	30	29.5	69.5

NOTE:
a) Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
b) In the emission tables above, the tighter limit applies at the band edges.

B. Radiated Emission >30MHz (30MHz-1GHz, E-field)

According to FCC section 15.205, the field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength	
	μV/m	dBμV/m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

NOTE:
a) Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].

b) In the emission tables above, the tighter limit applies at the band edges.

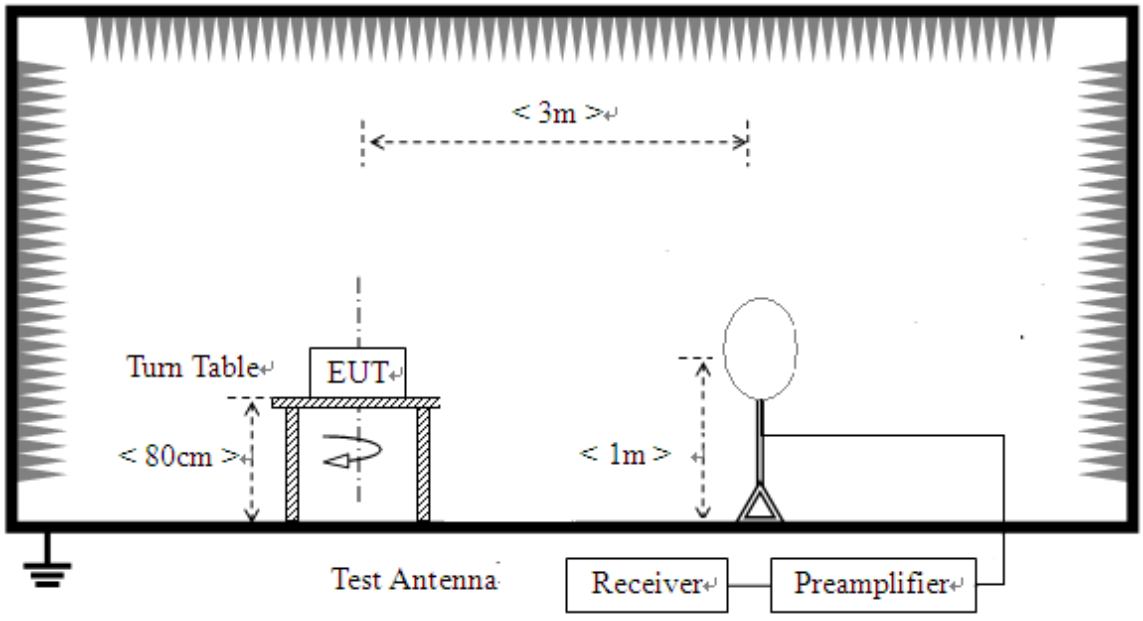
2.3.2 Test Equipment

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	ROHDE&SCHWARZ	FSP40	1164.4391.40	2013.06.10
Receiver	ROHDE&SCHWARZ	ESIB7	A0501375	2013.06.10
Receiver	ROHDE&SCHWARZ	ESIB26	A0304218	2013.06.10
Semi-Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2013.03.09
Test Antenna - Bi-Log	HP	CBL6111A	A9704202	2013.06.10
Test Antenna - Horn	ROHDE&SCHWARZ	HF906	A0304225	2013.06.10
Test Antenna -Loop	Schwarzbeck	FMZB 1519	1519-022	2013.06.10

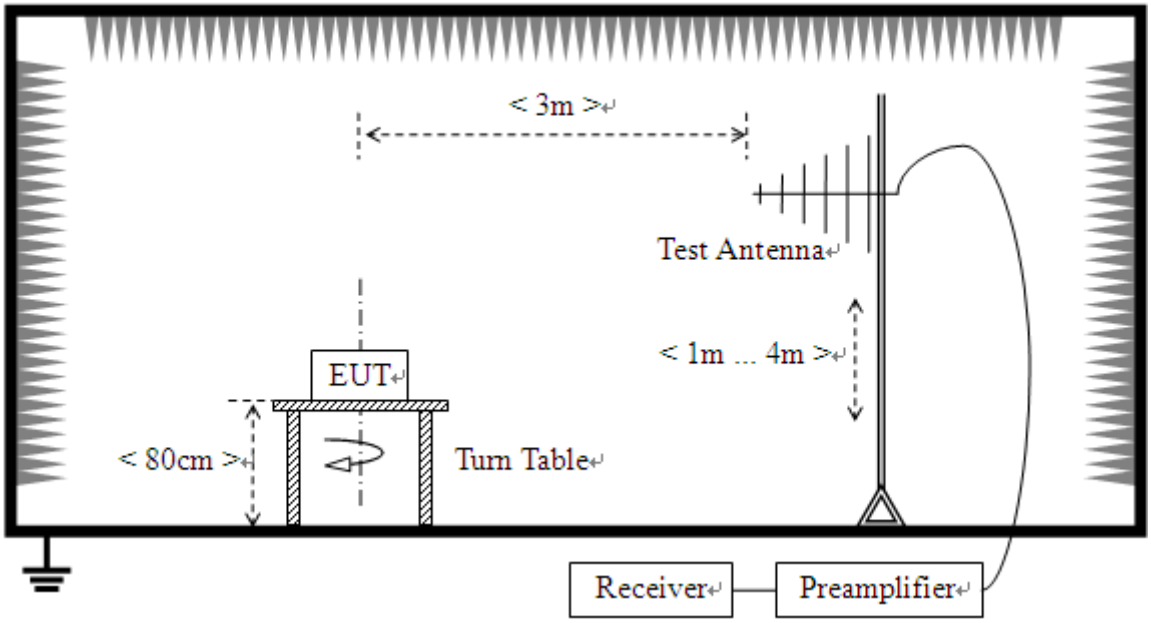
The Cal. Interval was one year.

2.3.3 Test Setup

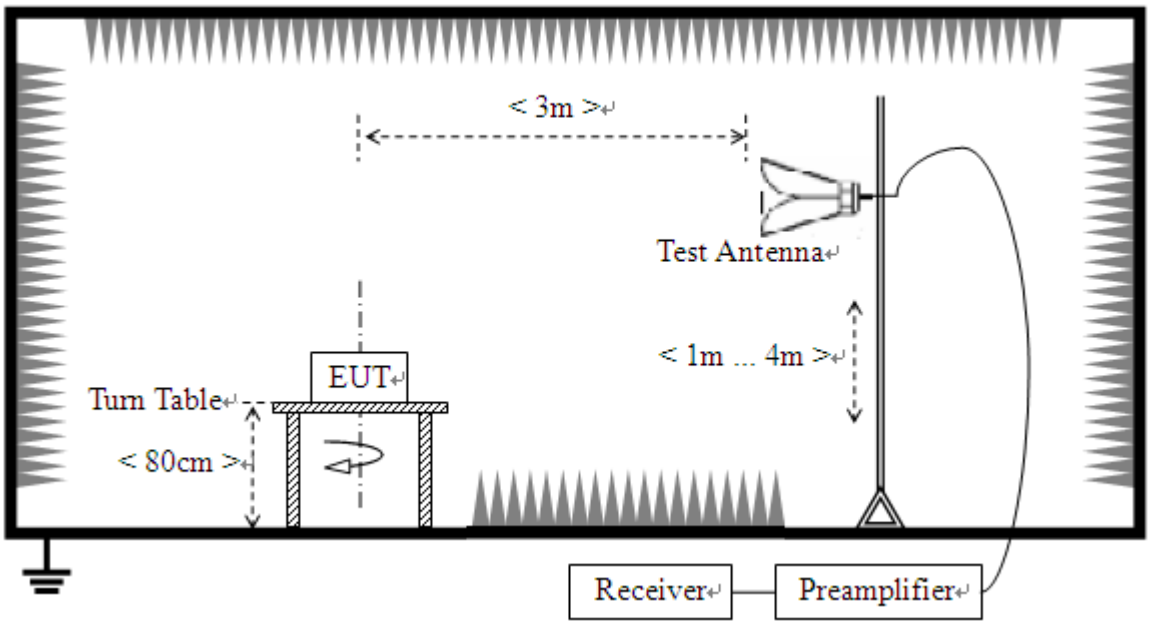
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



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:

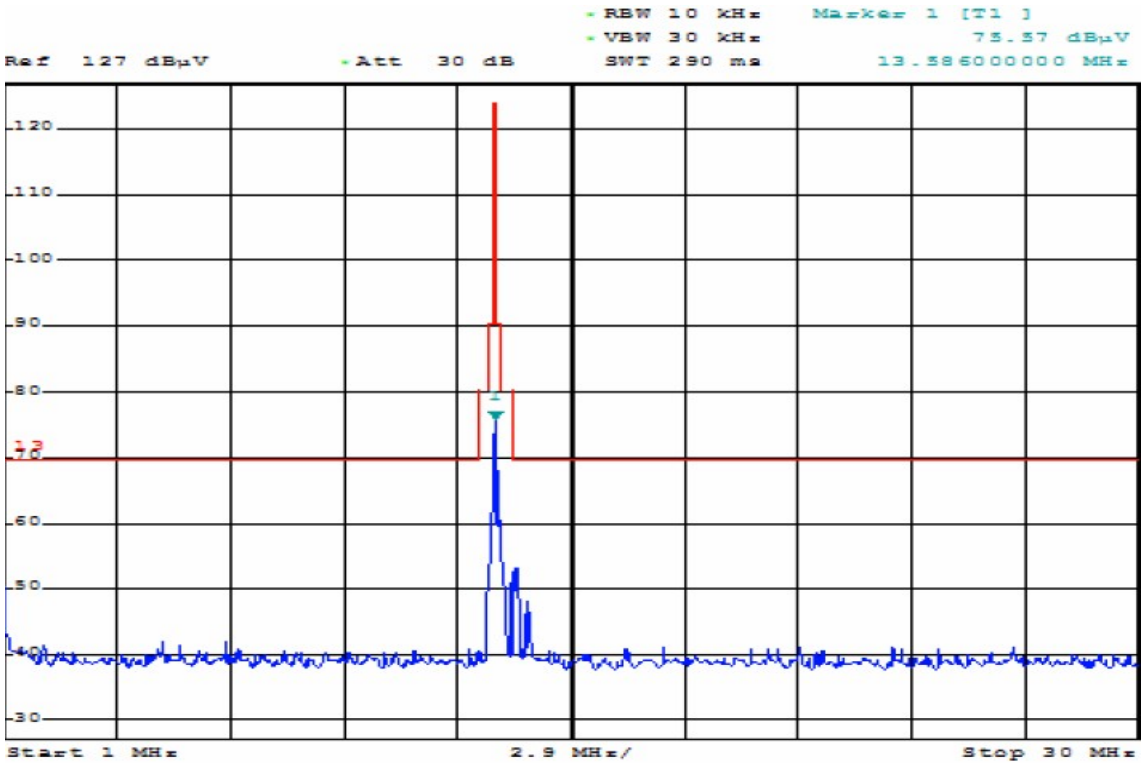
1) In the frequency range of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its 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.

2.3.4 Test Result

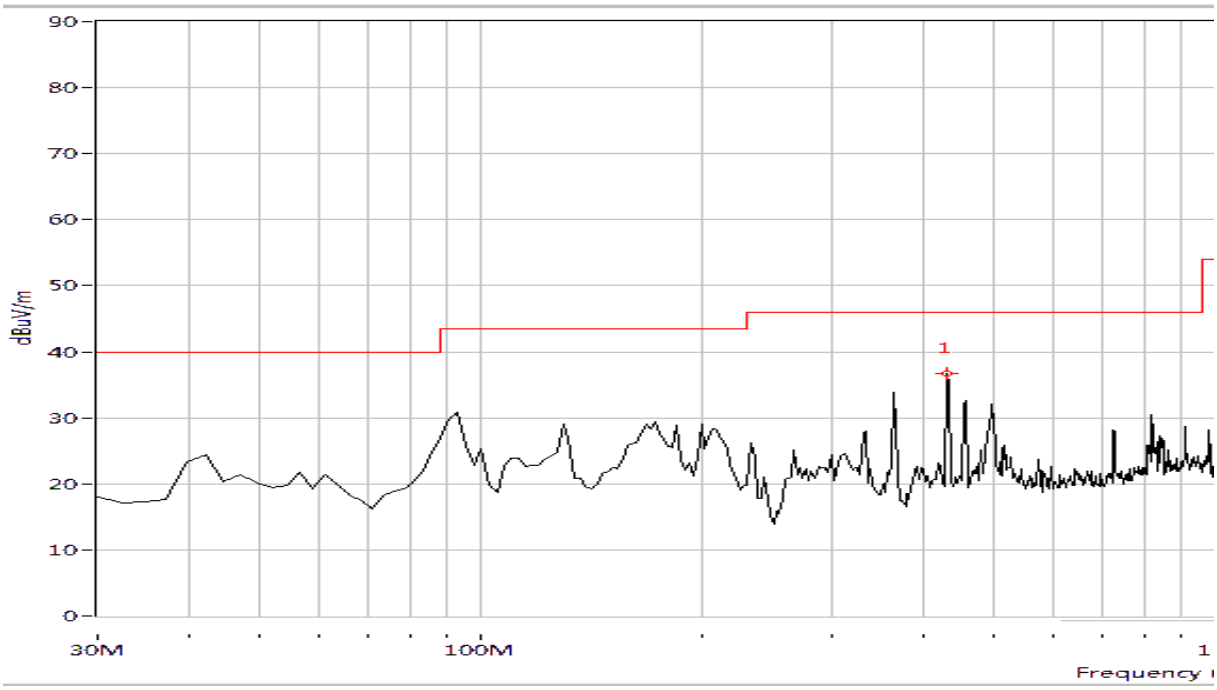
2.3.4.1 Radiated Emission <30MHz (9KHz-30MHz, H-field)

A. Test Plots



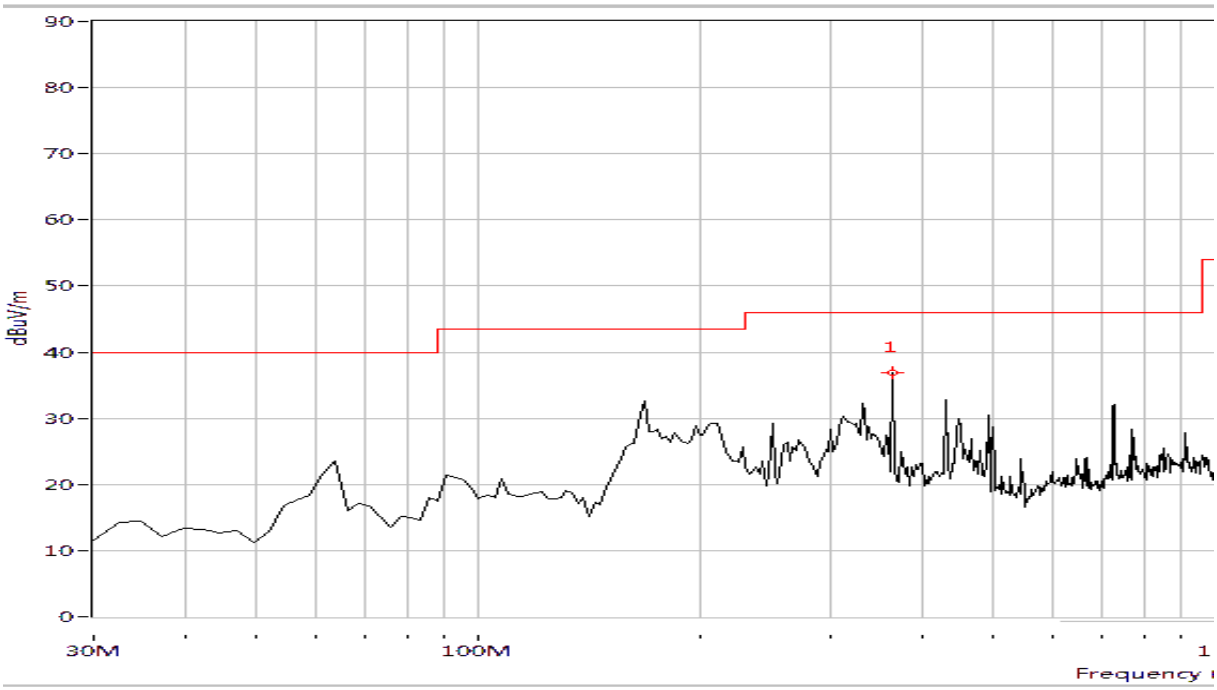
2.3.4.2 Radiated Emission >30MHz (30MHz-1GHz, E-field)

A. Test Plots:



(Plot A: Test Antenna Vertical)

NO.	Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
1	431.546	36.78	N.A	N.A	N.A	46.0	N.A	Vertical	PASS



(Plot B: Test Antenna Horizontal)

NO.	Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
1	363.815	36.98	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS

Result: PASS

2.4 Frequency Tolerance

2.4.1 Test Requirement

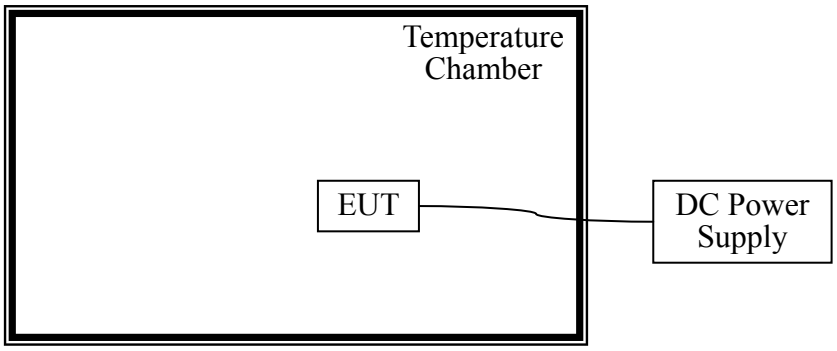
According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

2.4.2 Test Equipment

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	ROHDE&SCHWARZ	FSP40	1164.4391.40	2013.06.10
DC Power Supply	Good Will	GPS-3030DD	EF920938	2013.06.10
Temperature Chamber	YinHe Experimental Equip.	HL4003T	(n.a.)	2013.06.10

The Cal. Interval was one year.

2.4.3 Test Setup



The EUT, which is powered by the DC Power Supply directly, is located in the Temperature Chamber. The EUT was measured by transmitter mode continuously.

2.4.4 Test Result

Operating Frequency: 13,560,000 Hz

Deference Voltage: 3.7V

Deviant Limit: ±0.01%

VOLTAGE (%)	Test Conditions		Frequency(Hz)	Deviation(%)	Verdict
	Power (VDC)	Temperature (°C)			
100	3.7	+20°C(Ref)	13,560,305	+0.002249	PASS
100		-20	13,559,685	-0.002323	
100		-10	13,559,677	-0.002382	
100		0	13,559,652	-0.002566	
100		+10	13,559,614	-0.002847	
100		+20	13,559,562	-0.003230	
100		+25	13,559,553	-0.003297	
100		+30	13,559,544	-0.003363	
100		+40	13,559,551	-0.003311	
100		+50	13,560,579	+0.004270	
Battery End Point	3.6	+20	13,559,571	-0.003164	
115	4.2	+20	13,559,592	-0.003009	

Result: PASS

2.5 20dB Bandwidth

2.5.1 Test Requirement

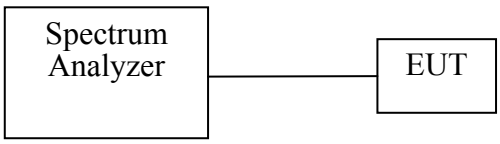
According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

2.5.2 Test Equipment

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.06.10
DC Power Supply	Good Will	GPS-3030DD	EF920938	2013.06.10

The Cal. Interval was one year.

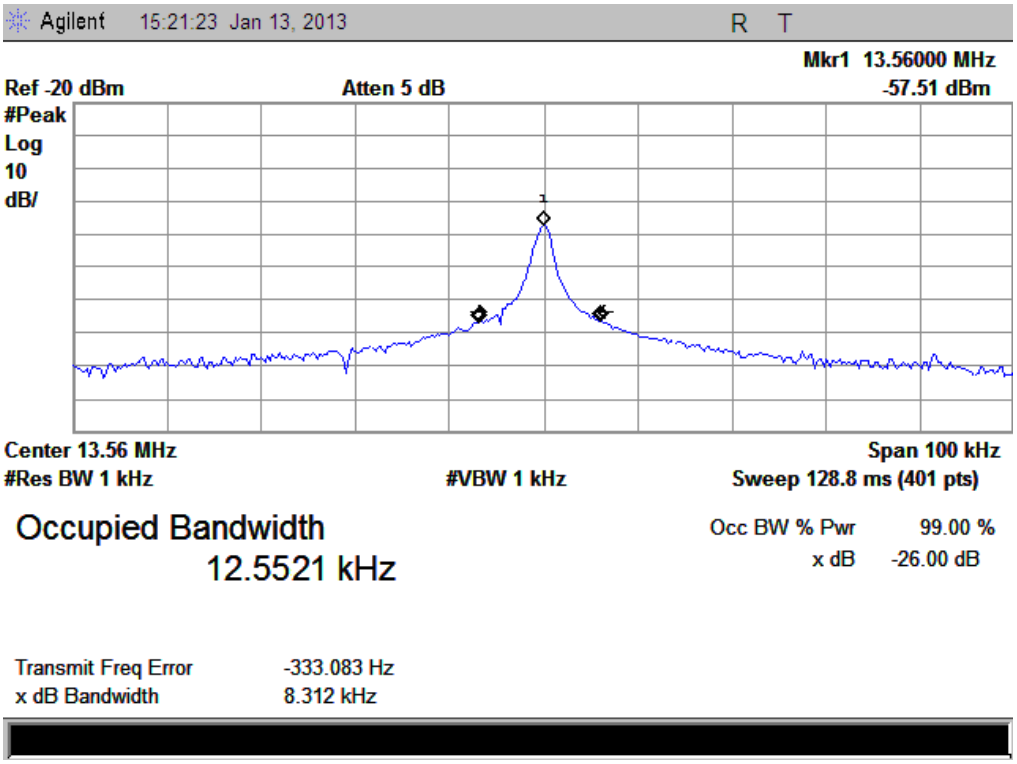
2.5.3 Test Setup



2.5.4 Test Result

Centre Frequency	Measurement		Limit		Verdict
	20dB Bandwidth (KHz)	Frequency Range (MHz)	20dB Bandwidth(KHz)	Frequency Range (MHz)	
13.56MHz	12.5521	13.55371~13.56626	14	13.553~13.567	Pass

Please refer to the following plot.



Result: PASS

** END OF REPORT **