



RF TEST REPORT

Report No.: SET2015-05327

Product Name: EFTPOS

FCC ID: VWZT1000I

Model No. : SPECTRA T1000

Applicant: SPECTRA Technologies Holdings Co., Ltd.

Applicant Address: Unit 1301-09, 19-20, Tower II, Grand Century Place, 193 Prince Edward Road West, Kowloon, Hong Kong

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

Product Name : EFTPOS

Brand Name : N/A

Trade Name.....: SPECTRA

Applicant : SPECTRA Technologies Holdings Co., Ltd.


Applicant Address : Unit 1301-09, 19-20, Tower II, Grand Century Place, 193
Prince Edward Road West, Kowloon, Hong Kong


Manufacturer : SPECTRA Technologies Holdings Co., Ltd.

Manufacturer Address..... : Unit 1301-09, 19-20, Tower II, Grand Century Place, 193
Prince Edward Road West, Kowloon, Hong Kong

Test Standards : 47 CFR Part 15 Subpart C: Radio Frequency Devices
ANSI C63.10:2009: American National Standard for
Testing Unlicensed Wireless Devices

Test Result : PASS

Tested by : 
2015.04.15
Haigang He, Test Engineer

Reviewed by..... : 
2015.04.15
Zhu Qi, Senior Engineer


Approved by..... : 
2015.04.15
Wu Li'an, Manager



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Change History		
Issue	Date	Reason for change
1.0	2015-04-15	First edition



1. GENERAL INFORMATION

1.1 EUT Description

EUT Type	EFTPOS
Hardware Version	REV 10
Software Version	T1000_SystemPack_v1_9R0_pre_release
Frequency band(MHz)	13.56MHz
Frequency Range	13.553MHz – 13.567MHz
Number of channels	1
Modulation Type	ASK
Antenna Type	FPC Antenna
Antenna Gain	1dBi
Extreme Testing Voltages	Vnom=7.4V Vmin=6.3V Vmax= 8.4V
Temperature operating range	-20~55°C

1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2012	Radio Frequency Devices
2	ANSI C63.10 2009	American National Standard for Testing Unlicensed Wireless Devices

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

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.225(a) (b) (c)	Field Strength of Fundamental Emissions	Compliant
2.1049	20dB Spectrum Bandwidth	Compliant
§15.225(e)	Frequency Stability	Compliant
15.207	AC Power Line Conducted Emissions	Compliant
15.225(d) 15.209	Radiated Emissions	Compliant

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2009.

1.3 Test Modes

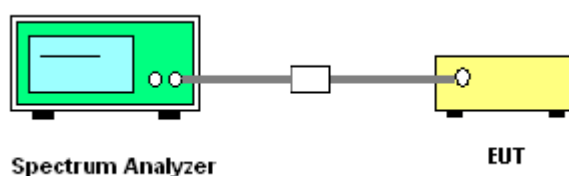
Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	
20dB Spectrum Bandwidth	Frequency Stability
AC Power Line Conducted Emissions	Field Strength of Fundamental Emissions
Radiated Emissions 9kHz~30MHz	Radiated Emissions 30MHz~1GHz
<p>NOTE:</p> <ol style="list-style-type: none"> 1. The EUT was programmed to be in continuously transmitting mode. 2. The ancillary equipment, NFC card, is used to make the EUT continuously transmit at 13.56MHz and is placed around 3cm gap to the EUT. 	

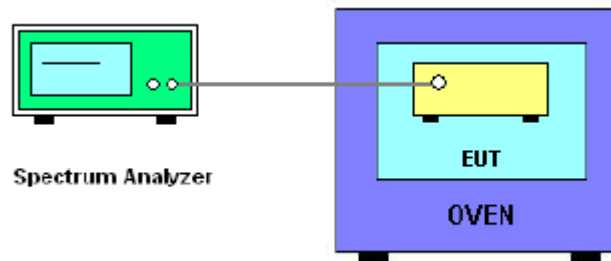
1.4 Description of the test setup

1.4.1 Conducted measurements

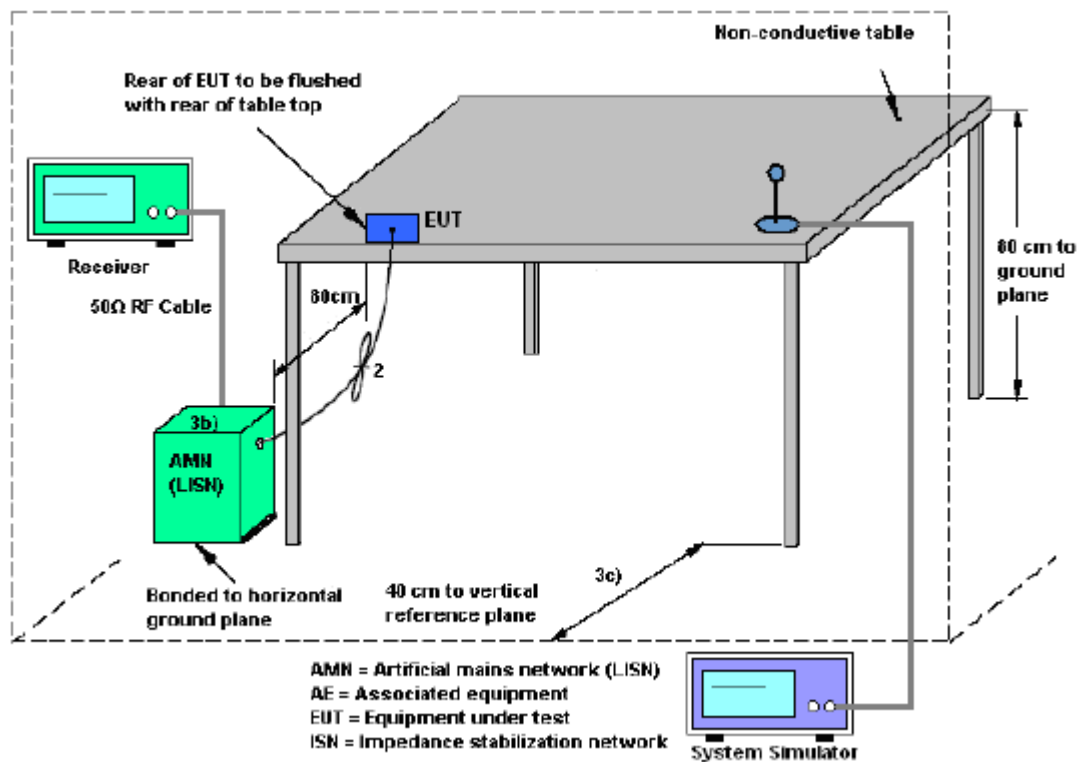
1.4.1.1 20dB Spectrum Bandwidth



1.4.1.2 Frequency Stability

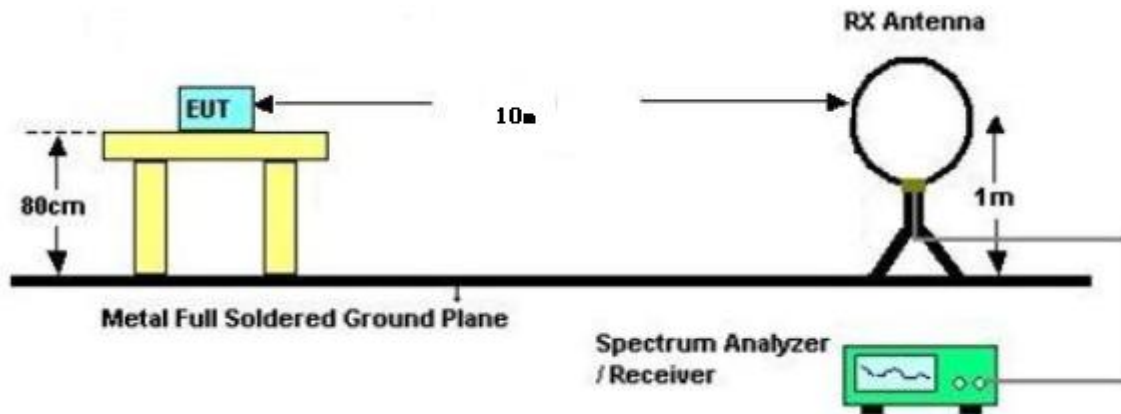


1.4.1.3 Conducted emissions

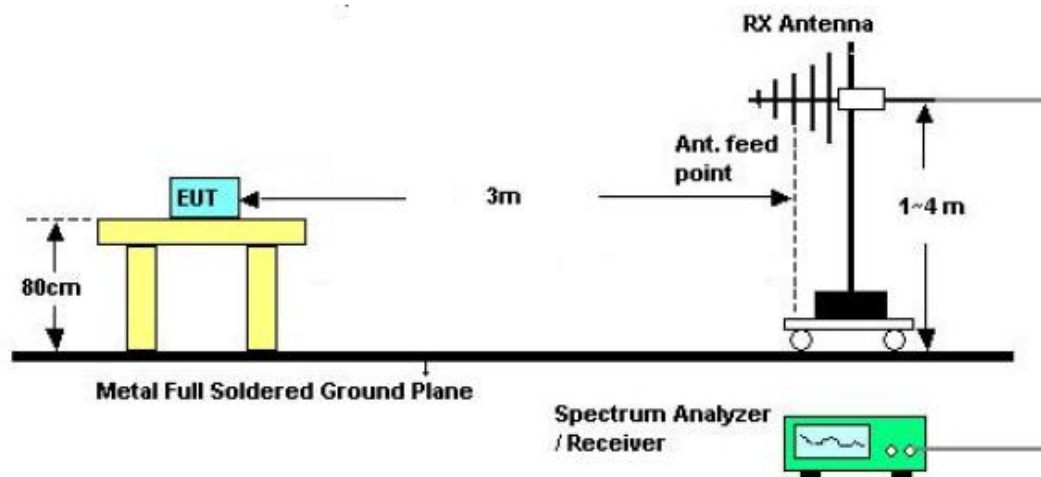


1.4.2 Radiated measurements

1.4.2.1 For radiated emissions below 30MHz



1.4.2.2 For radiated emissions above 30MHz



1.5 Facilities and Accreditations

1.5.1 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.

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.

1.5.2 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



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.

2.1.2 Antenna Information

Antenna Category:

Antenna General Information:

No.	EUT Model	Ant. Cat.	Gain(dBi)
1	SPECTRA T1000	FPC	1

2.1.3 Result: comply

The EUT has a permanently antenna. which complies with the Part 15.203. Please refer to the EUT internal photos.

2.2 20dB Spectrum Bandwidth

2.2.1 Limit

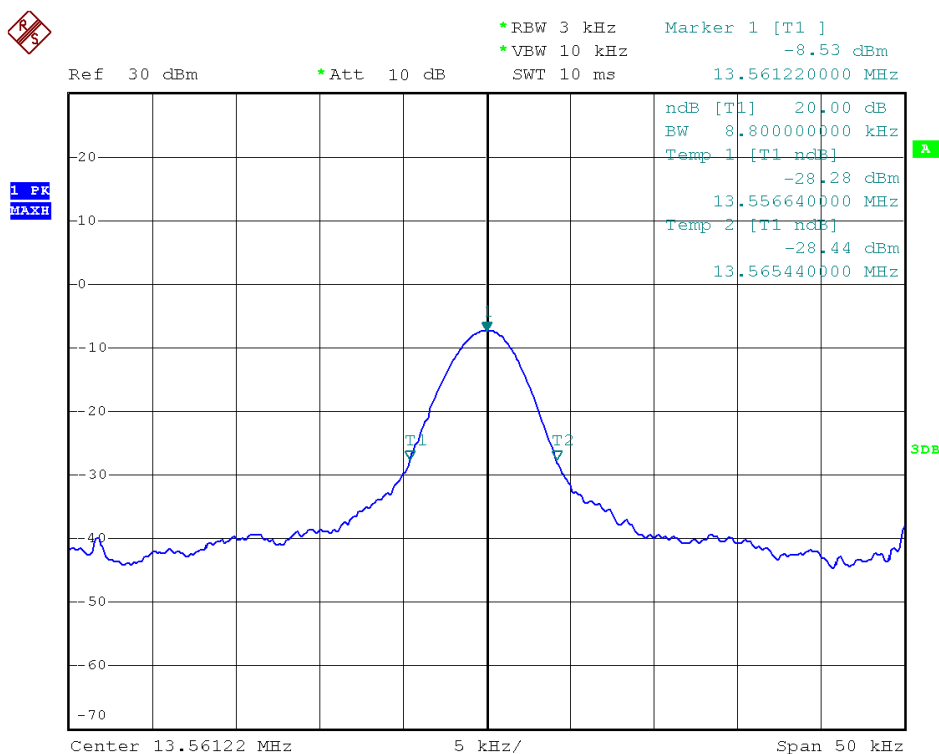
Intentional radiators must be designed to ensure that the 20dB bandwidth of the emissions in the specific band 13.553~13.567MHz

2.2.2 Test Procedures

1. The transmitter output(antenna port) was connected to the spectrum analyzer in peak max hold mode.
2. The resolution bandwidth of 1kHz and the video bandwidth of 3kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

2.2.3 Test result

Test conditions		20dB Spectrum Bandwidth	Test result
Tnom	Vnom	8.8kHz	PASS



2.3 Frequency Stability

2.3.1 Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

2.3.2 Test Procedures

1. The transmitter transmitter output(antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire emissions bandwidth.
4. Set RBW=1kHz, VBW=3kHz with peak detector and max hold settings.
5. The f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c * 10^6$ ppm and the limit is less than ± 100 ppm.
6. Extreme temperature rule is $-20^\circ\text{C} \sim 50^\circ\text{C}$.

2.3.3 Test result

Test Environment		Frequency Reading (MHz)	Frequency Error	Part 15.225 Limit	Result
Adapter Power Supply	Temperature ($^\circ\text{C}$)				
DC 9V	-20	13.56019	0.0014%	$\pm 0.01\%$	Pass
	-10	13.56024	0.0018%	$\pm 0.01\%$	Pass
	0	13.56027	0.0020%	$\pm 0.01\%$	Pass
	10	13.56026	0.0019%	$\pm 0.01\%$	Pass
	20	13.56028	0.0021%	$\pm 0.01\%$	Pass
	30	13.56029	0.0021%	$\pm 0.01\%$	Pass
	40	13.56028	0.0021%	$\pm 0.01\%$	Pass
	50	13.56028	0.0021%	$\pm 0.01\%$	Pass
Max. = DC 10.35V	20	13.56029	0.0021%	$\pm 0.01\%$	Pass
Min. = DC 7.65V	20	13.56027	0.0020%	$\pm 0.01\%$	Pass

2.4 Field Strength of the fundamental Emissions

2.4.1 Limit

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)			
Description	Compliance with the spectrum mask is tested using a spectrum analyzer with RBW set to a 9kHz for the band 13.553~13.567MHz			
Freq. of Emission (MHz)	Field Strength ($\mu\text{V/m}$) at 30m	Field Strength (dB $\mu\text{V/m}$) at 30m	Field Strength (dB $\mu\text{V/m}$) at 10m	Field Strength (dB $\mu\text{V/m}$) at 3m
1.705~13.110	30	29.5	48.58	69.5
13.110~13.410	106	40.5	59.58	80.5
13.410~13.553	334	50.5	69.58	90.5
13.553~13.567	15848	84.0	103.08	124.0
13.567~13.710	334	50.5	69.58	90.5
13.710~14.010	106	40.5	59.58	80.5
14.010~30.000	30	29.5	48.58	69.5

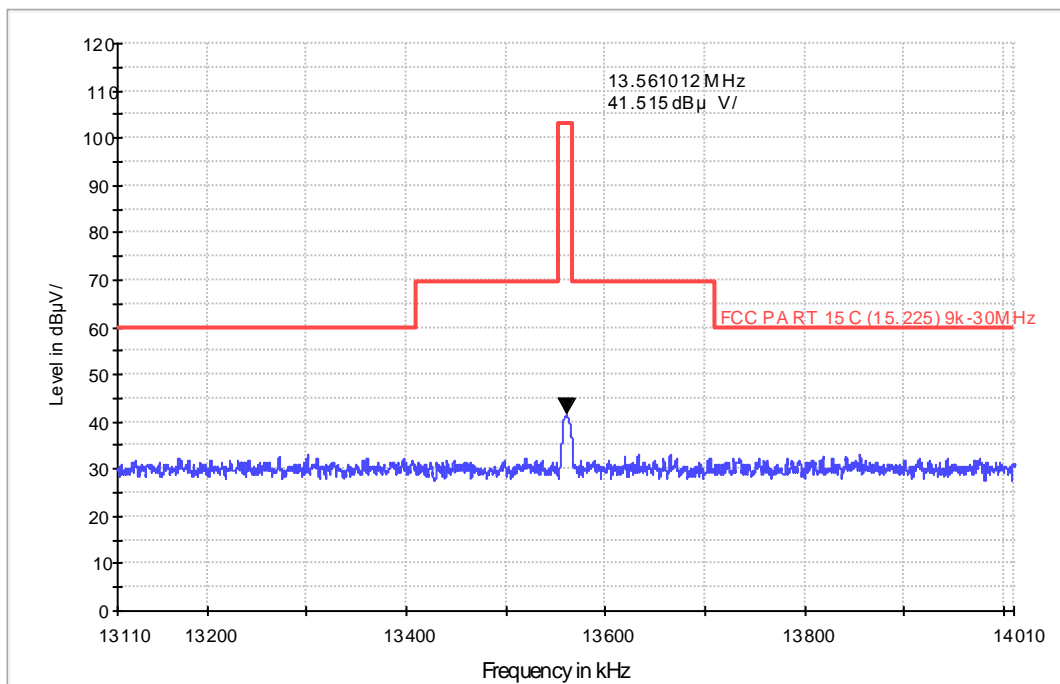
2.4.2 Test Procedures

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure QP reading.
5. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

6. Compliance with the spectrum mask is tested using a spectrum analyzer with RBW set to a 9kHz for the band 13.553~13.567MHz.

Note: Emission level (dB μ V/m) = 20 log Emission level (μ V/m).

2.4.3 Test Result



Note: All NFC's spurious emissions are below 20dB of limits

2.5 Conducted Emission

2.5.1 Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, 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)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

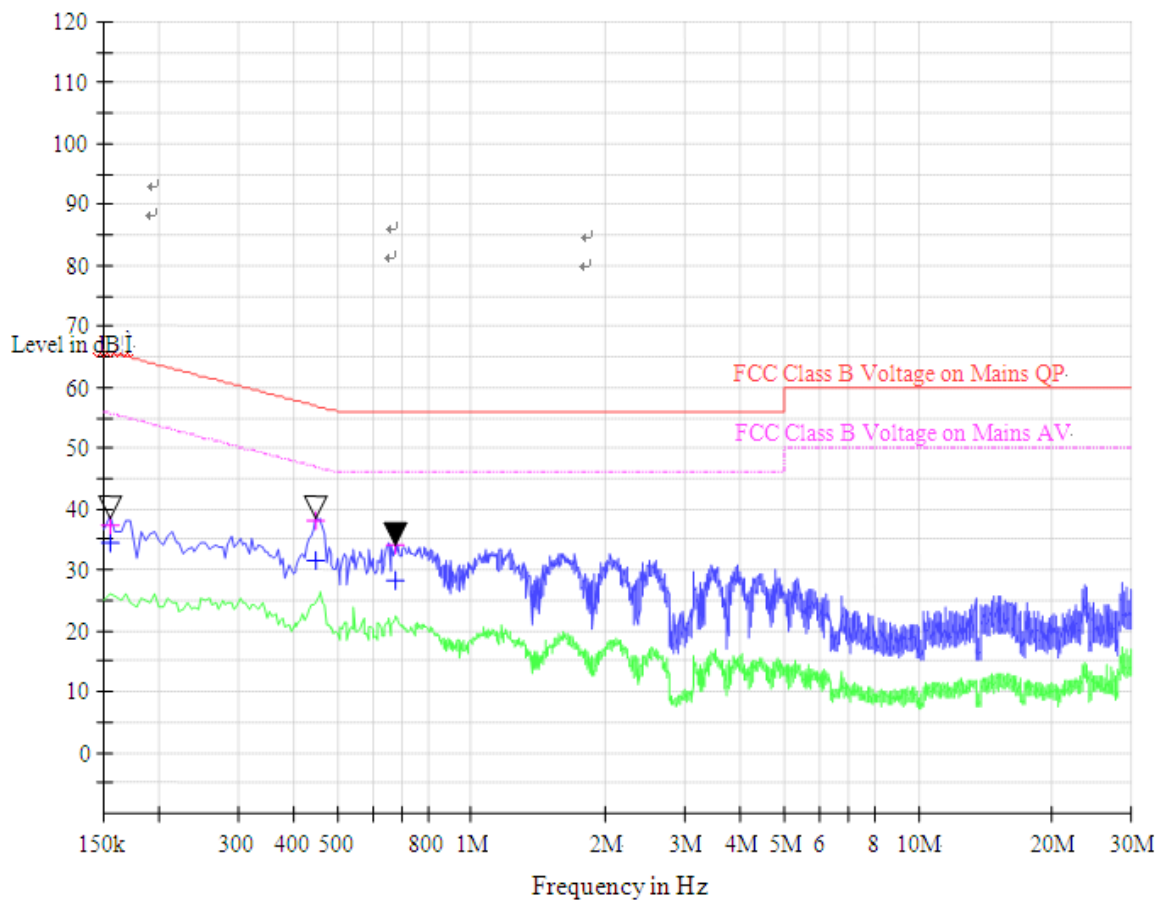
NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.5.2 Test Procedures

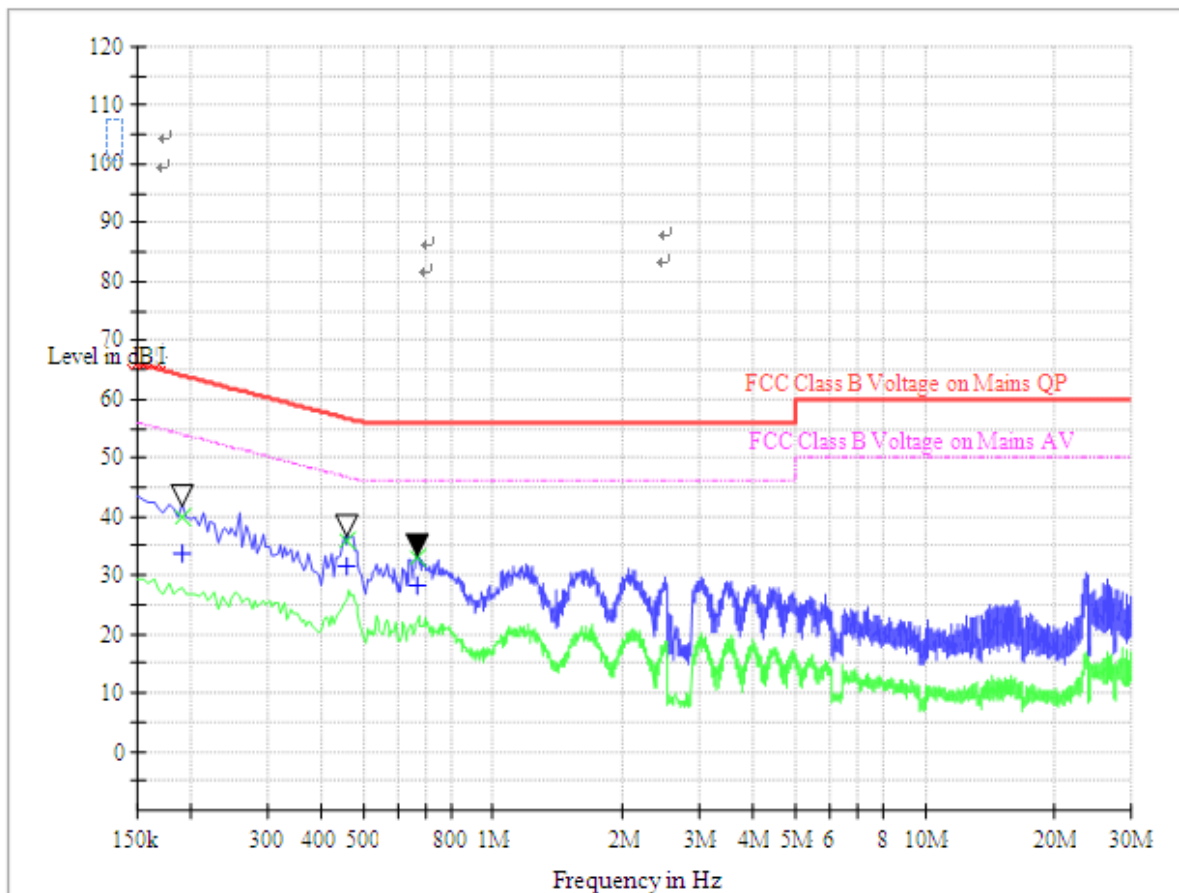
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

2.5.3 Test Result



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals					
L Test Data					
QP			AV		
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)
0.154500	65.8	29.56	0.154500	55.8	19.86
0.447000	56.9	20.22	0.447000	46.9	18.26
0.676500	56.0	24.01	0.676500	46.0	17.56



Conducted Disturbance at Mains Terminals					
N Test Data					
QP			AV		
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)
0.190500	64.0	38.62	0.190500	54.0	32.10
0.460500	56.7	34.13	0.460500	46.7	30.26
0.667500	56.0	32.33	0.667500	46.0	27.63

(Plot B: N Phase)

Test Result: PASS

2.6 Radiated Emission

2.6.1 Limit

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), 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 (MHz)	Field Strength ($\mu\text{V/m}$)	Field Strength ($\text{dB } \mu\text{V/m}$)	Measurement Distance (m)
0.009 - 0.490	$2400/F(\text{kHz})$	$20\log(2400/F(\text{kHz}))+80$	300
0.490 - 1.705	$24000/F(\text{kHz})$	$20\log(24000/F(\text{kHz}))+40$	30
1.705 - 30.0	30	$20\log(30)+40$	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

Note:

The radiated emission tests were performed in the 10-meter chamber test site, using the setup accordance with the ANSI C63.10:2009. The specification used was the FCC Part Subpart C limits.

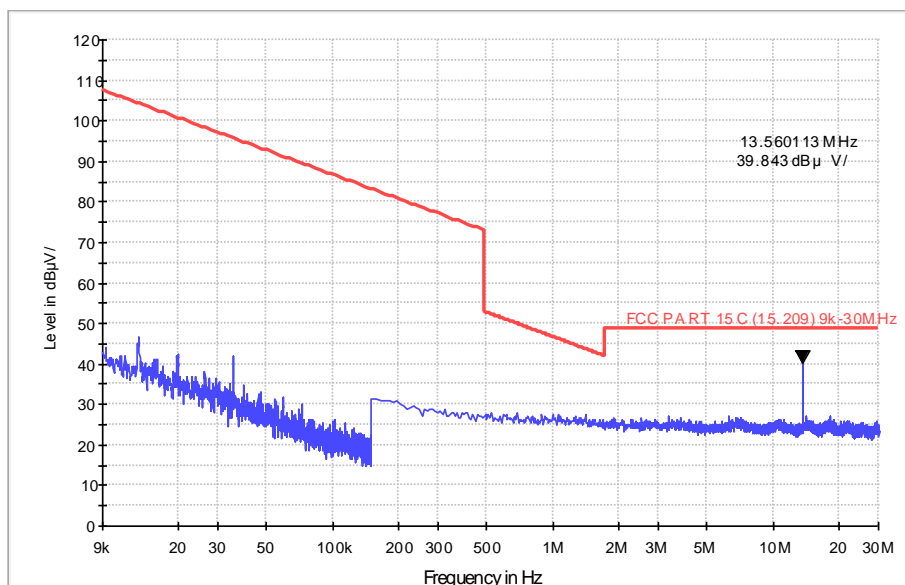
2.6.2 Test Description

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

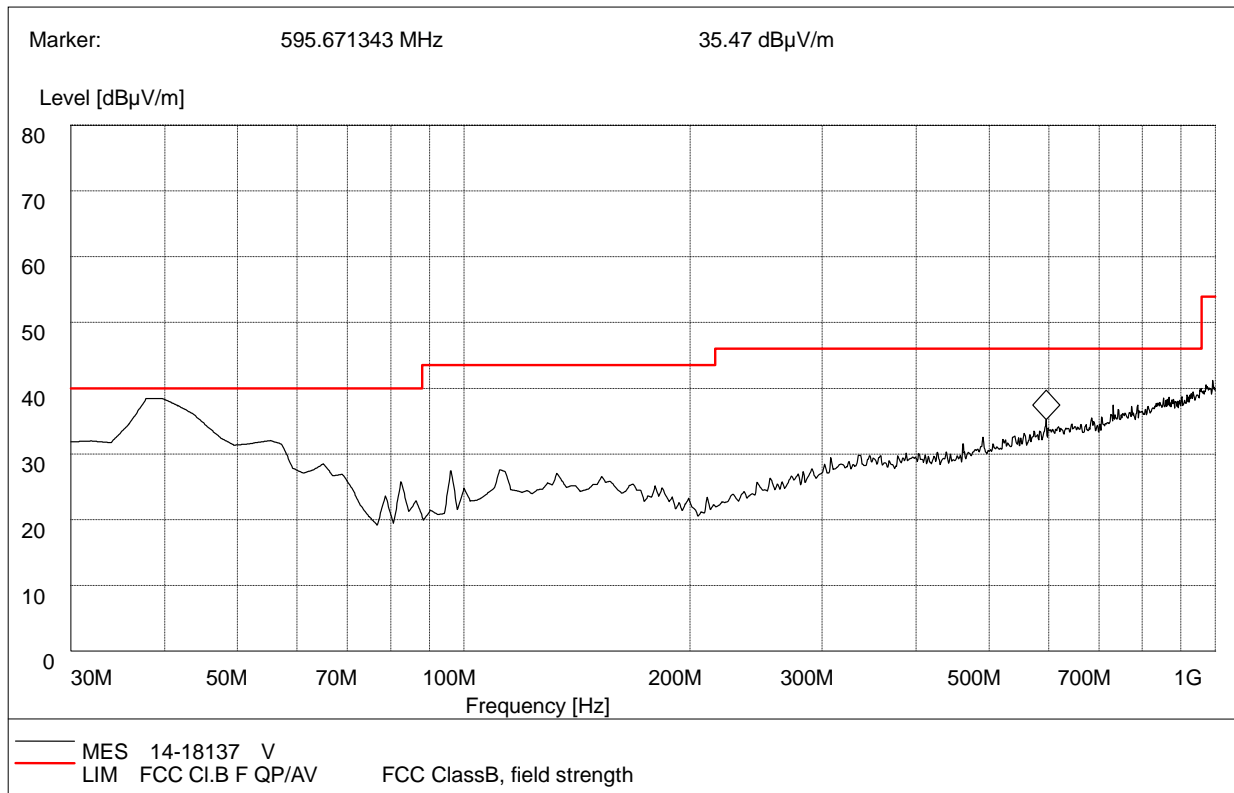
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. Antenna Requirements

2.6.3 Test Result

For 9 kHz to 30 MHz

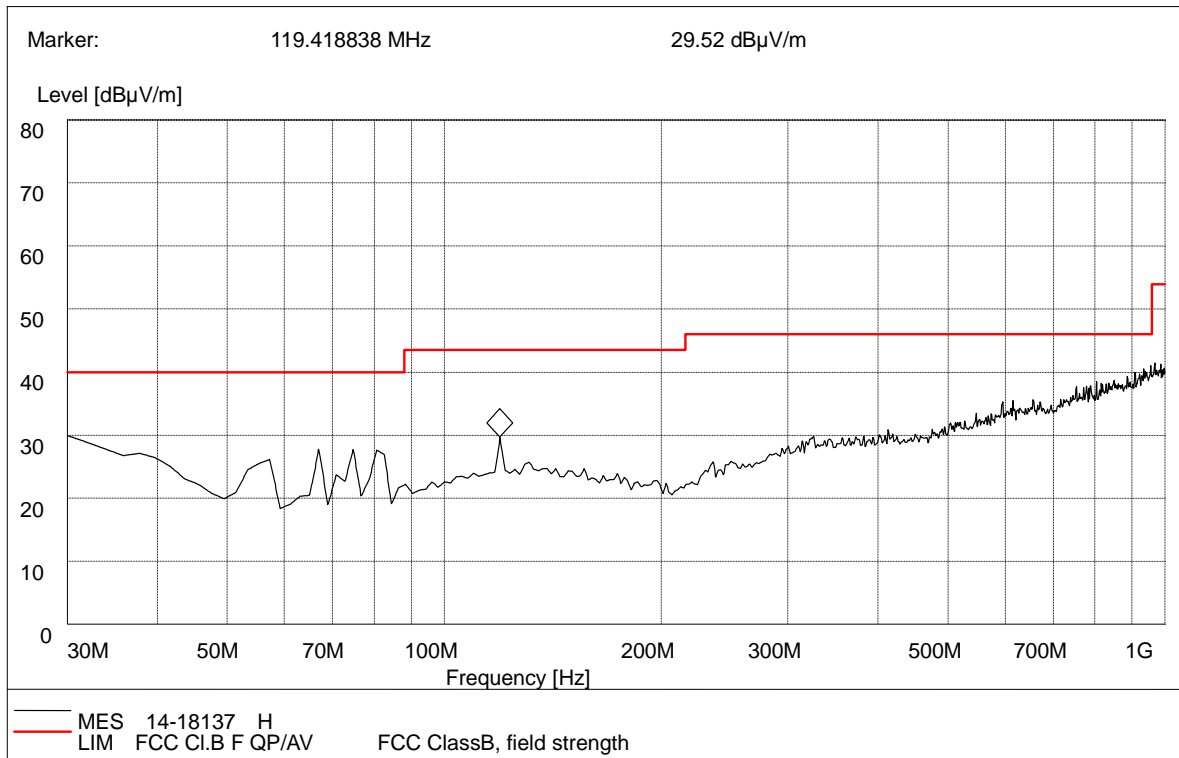


For 30MHz to 1000 MHz



(Plot A: 30MHz to 1GHz, Antenna Vertical)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
37.5900	37.50	120.000	100.0	40.00	Vertical	Pass
58.2769	31.04	120.000	100.0	40.00	Vertical	Pass
96.0922	28.49	120.000	100.0	43.50	Vertical	Pass
113.6203	27.14	120.000	100.0	43.50	Vertical	Pass
595.6713	34.82	120.000	100.0	46.00	Vertical	Pass
915.4689	37.59	120.000	100.0	46.00	Vertical	Pass



(Plot B: 30MHz to 1GHz, Antenna Horizontal)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30.2000	29.47	120.000	100.0	40.00	Horizontal	Pass
57.3694	27.12	120.000	100.0	40.00	Horizontal	Pass
119.4188	28.76	120.000	100.0	43.50	Horizontal	Pass
315.2348	29.57	120.000	100.0	46.00	Horizontal	Pass
599.9678	33.19	120.000	100.0	46.00	Horizontal	Pass
915.4689	36.27	120.000	100.0	46.00	Horizontal	Pass



3. LIST OF MEASURING EQUIPMENT

Description	Manufacturer	Model	Serial No.	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESCI	100591	2014.06.11	2015.06.10	Radiation
Loop Antenna	R&S	HFH2-Z6	0837.1866.54	2014.06.11	2015.06.10	Radiation
Bilog Antenna	Schwarzbeck	VULB 9163	9163-274	2014.06.10	2015.06.09	Radiation
Amplifier	HP	8447D AMJPLIFIER	D095562	2014.06.11	2015.06.10	Radiation
Full-Anechoic Chamber	Albatross	SAC-10MAC 19.6*11.8*8.5 5m	P23228	2014.06.11	2015.06.10	Radiation
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2014.06.11	2015.06.10	Conducted
Temperature Chamber	YinHe Experimental Equip.	HL4003T	(n.a.)	2014.06.10	2015.06.09	Conducted
EMI Test Receiver	ROHDE&SC HWRZ	ESCS30	A0304260	2014.06.11	2015.06.10	Conducted
LISN	ROHDE&SC HWRZ	ESH2-Z5	A0304221	2014.06.11	2015.06.10	Conducted
DC Power Supply	Good Will Instrument Co., Ltd.	(n.a)	(n.a)	2014.06.10	2015.06.09	Conducted

**** END OF REPORT ****