



EMC TEST REPORT

Report No.: SET2014-01570

Product Name: Smart Wireless Gateway

FCC ID: 2ABCTHA200

Model No. : Linxee - HA200+

Applicant: LINXEE (BEIJING) TECHNOLOGY LTD.

Address: 801,8F, Taipeng Mansion,No.10 Haidian North 2nd Street,
Haidian District,Beijing,China.

Received Date: 2013-12-23

Tested Date: 2013-12-24—2014-02-11

Issued by: CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.

Lab Location: Electronic Testing Building, Shahe Road, Xili, Nanshan District,
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Test Report

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Applicant Address..... : 801,8F, Taipeng Mansion,No.10 Haidian North 2nd
Street, Haidian District,Beijing,China.

Manufacturer..... : LONG BEN TECHNOLOGY LIMITED .

Manufacturer Address : NO.19,Jianshe Road, Shima Village, Tangxia Town,
Dongguan City, China.

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

Test Result : PASS

Tested by : Xiaolong Zhang 2014.03.01
Xiaolong Zhang, Test Engineer

Reviewed by..... : Shuangwen Zhang 2014.03.01
Shuangwen Zhang, Senior Engineer

Approved by : Wu Lian 2014.03.01
Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	2014.03.01	First edition



1. GENERAL INFORMATION

1.1 EUT Description

EUT Name : Smart Wireless Gateway
Serial No..... : (n.a, marked #1 by test site)
FCC ID : 2ABCTHA200
Hardware Version..... : /
Software Version : /
Ancillary Equipment 1 : AC Adapter (Charger for Battery)
Brand Name: /
Model No.: SP-01H0502000-U
Serial No.: (n.a. marked #1 by test site)
Rated Input: 100-240V, 0.5A, 50/60Hz
Rated Output: 5V=2.0A
Ancillary Equipment 2..... : PC1
Brand Name:ThinkPad
Model Name:E420
Serial No.:1141AH6
Ancillary Equipment 3..... : PC2
Brand Name:ThinkPad
Model Name:T430i
Serial No.: A130401289

*Note 1:*The EUT is a Smart wireless Gateway, it supports the following operating frequency band: 802.11b,802.11g,802.11n/20M and Zigbee.

*Note 2:*The EUT is equipped with 1 WLAN port,2 LAN port,1USB2.0 port which is used for charging other equipment,1micro USB.

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



2. TEST CONDITIONS SETTING

2.1 Test Mode

(1) The test mode

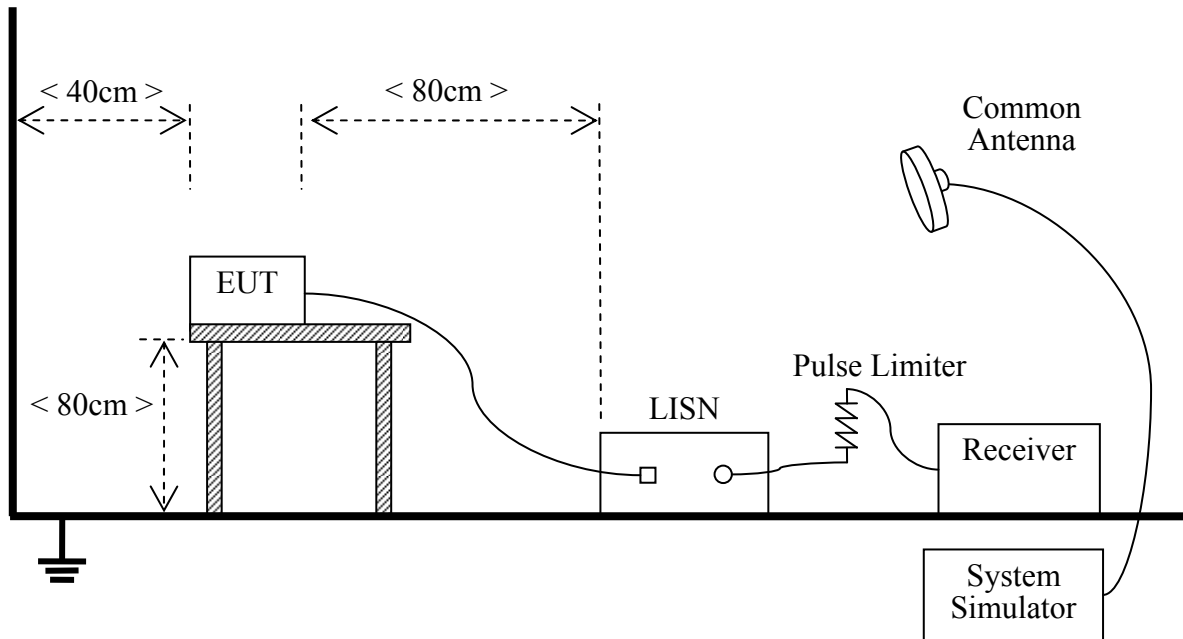
The EUT configuration of the emission tests is PC1+ EUT + PC2.

In this test mode, the PC1 was connected to EUT via a reticle, the same time, EUT was connected with PC2(which was outside the Anechoic Chamber) via reticle. During the measurement, a communication link was established between the PC1 and PC2 via EUT.

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 Ω /50 μ 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.

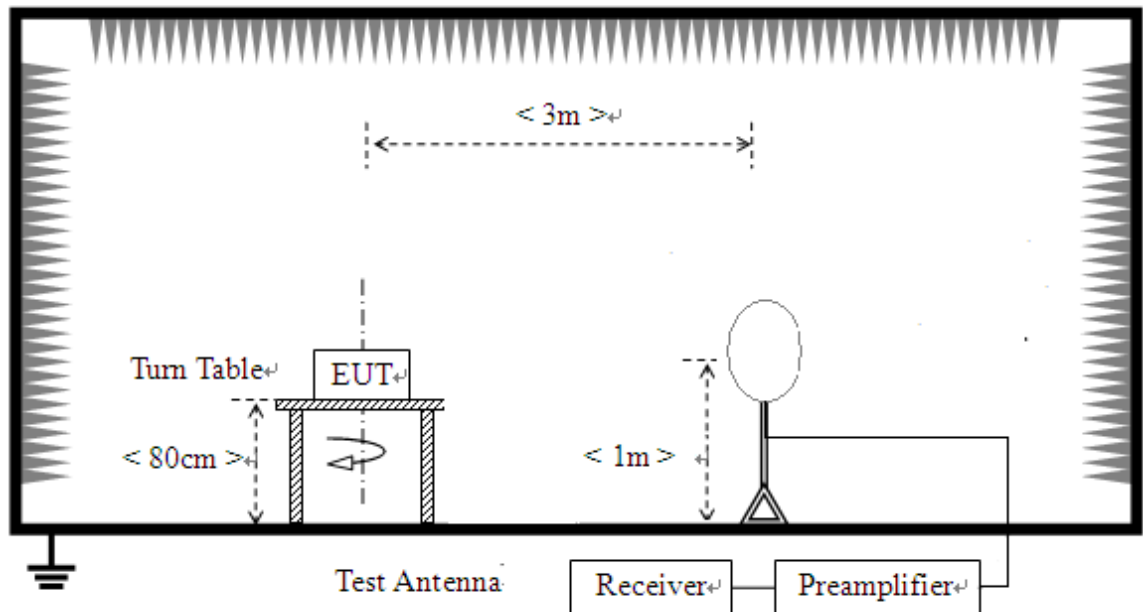
B. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Due. Date
Test Receiver	ROHDE&SCHWARZ	ESCI	A130901475	2014.09.09
LISN	Schaffner	NNB41	A0304245	2014.09.11

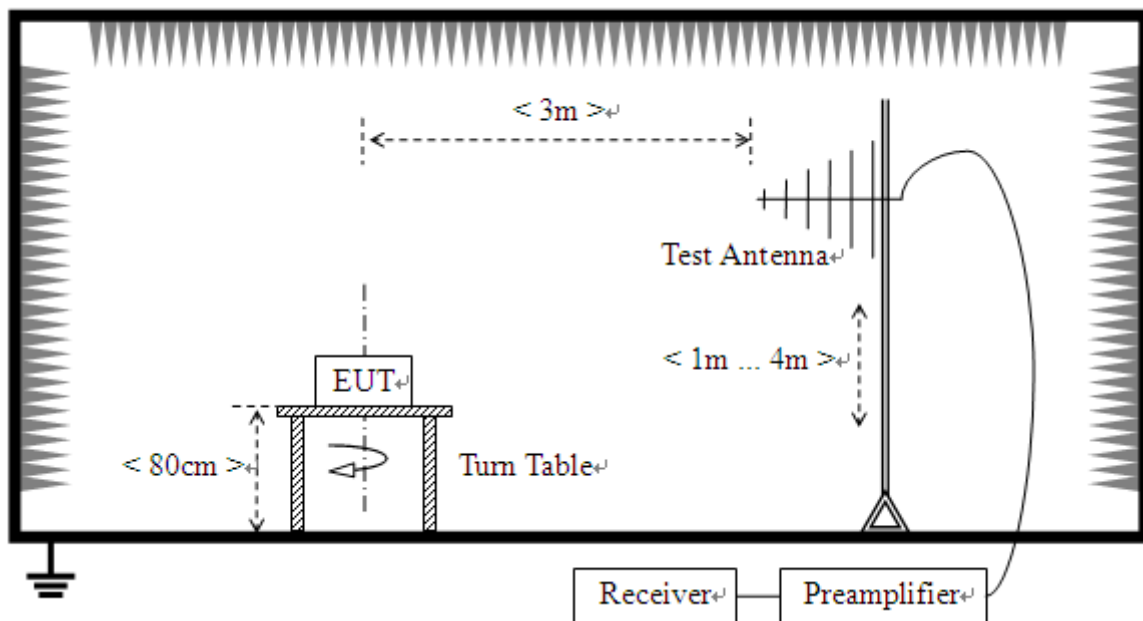
2.2.2 Radiated Emission

A. Test Setup:

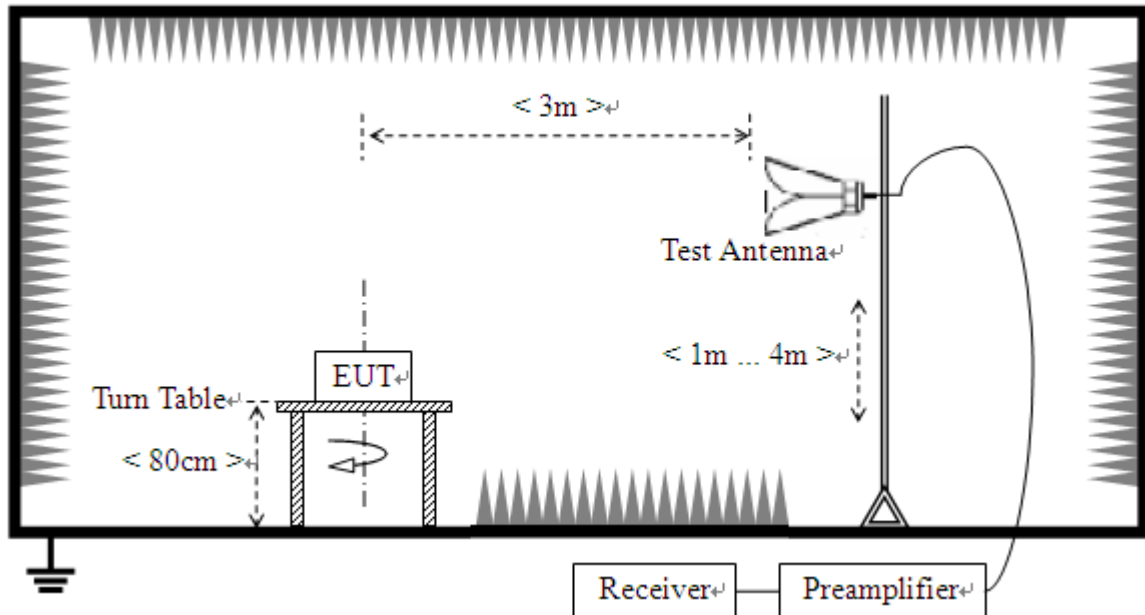
- 1) For radiated emissions from 9kHz to 30MHz



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 9 kHz 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.	Calibration Due. Date
Test Receiver	ROHDE&SCHWARZ	ESIB7	A0501375	2014.06.10
Test Receiver	ROHDE&SCHWARZ	ESIB26	A0304218	2014.06.10
Semi-Anechoic Chamber	Albatross	9m*6m*6m	A0412372	2015.01.04
Test Antenna - Bi-Log	HP	CBL6111A	A9704202	2014.06.10
Test Antenna - Horn	ROHDE&SCHWARZ	HF906	A0304225	2014.06.10
System Simulator	ROHDE&SCHWARZ	CMU200	A0304212	2014.06.10
Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2015.03.09
Ampifier 1G~18GHz	ROHDE&SCHWARZ	MITEQ AFS42-00101800	A0509366	2014.06.10
Amplifier 20M~3GHz	Compliance Direction System	PAP-0203H	A0509377	2014.06.10
loop antenna	HFH2-Z2	R&S	A0304220	2016.06.28
Anechoic Chamber	Albatross	SAC-5MAC 19.6x11.8x8.5m	A0304210	2015.03.09
EMI Test Receiver	R&S	ESCI	A0902601	2014.09.09

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 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

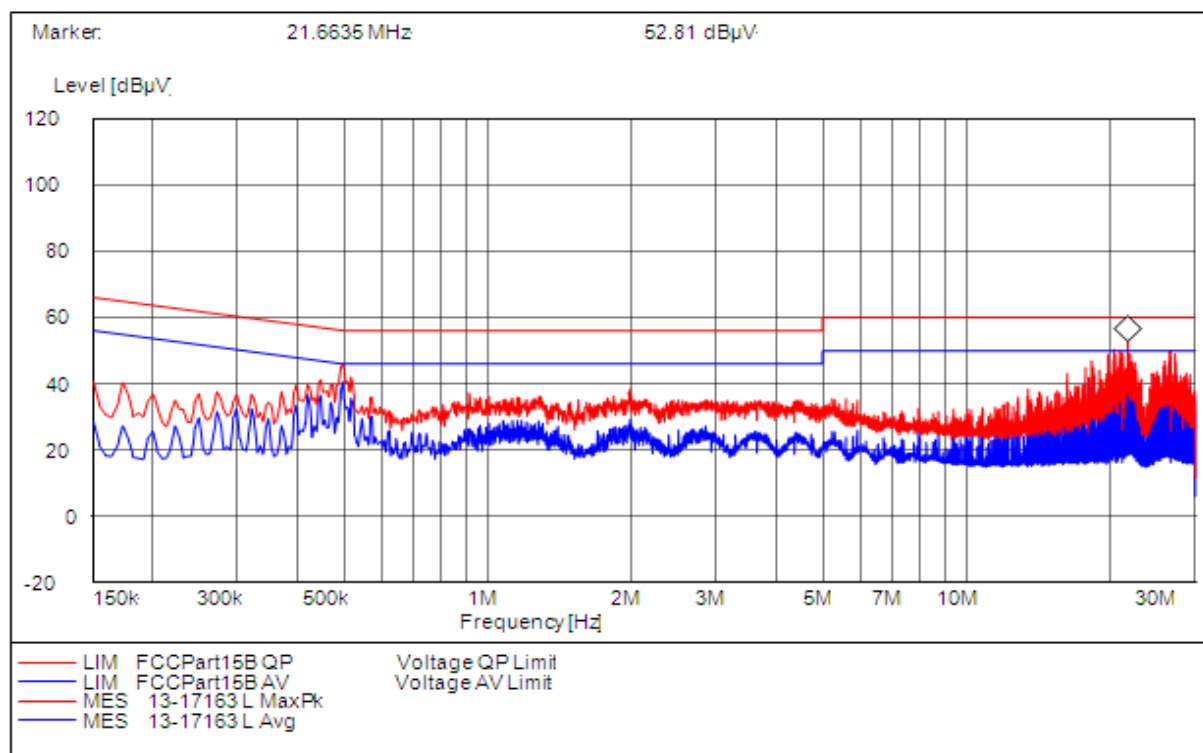
See section 2.2.1 of this report.

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.

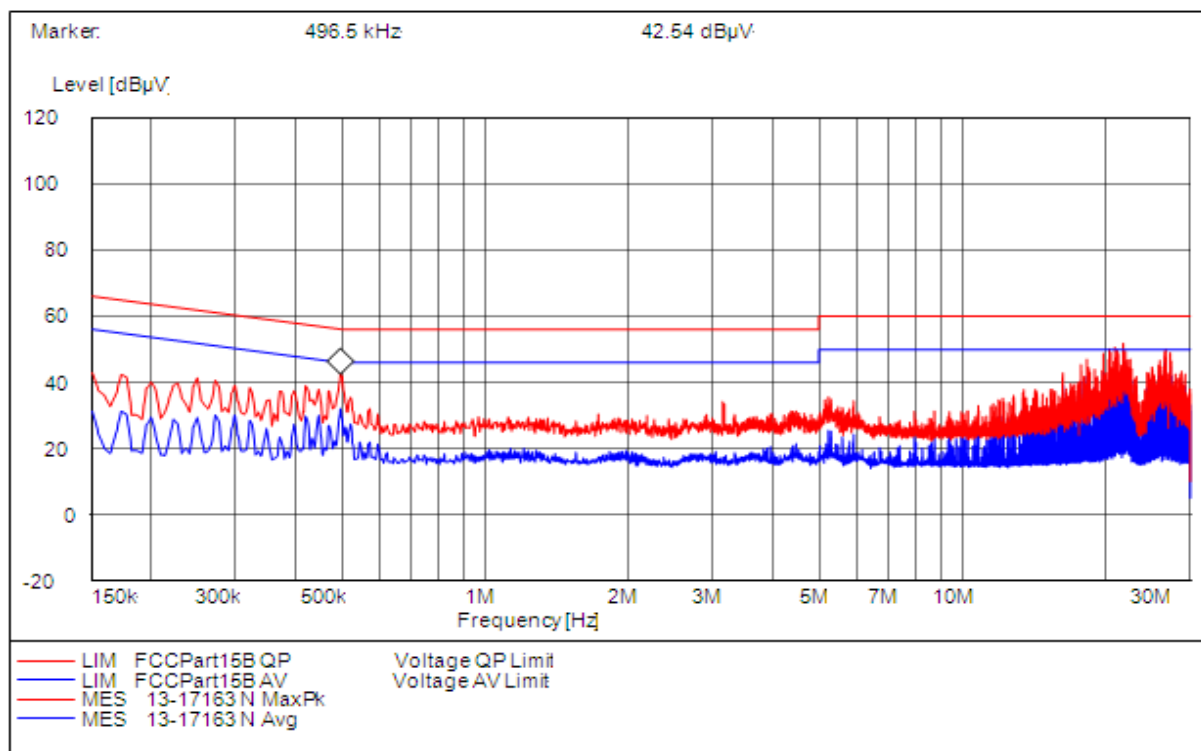
3.1.3.1 Test Mode

A. Test Plot and Suspicious Points:



Conducted Disturbance at Mains Terminals							
L Test Data							
QP				AV			
Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)	Frequency (MHz)	Limits (dBμV)	Measurement Value (dBμV)	Margin (dB)
0.4965	56.10	45.98	10.12	0.4965	46.10	40.52	5.58
0.5146	56	40.98	15.02	0.5146	46	36.76	19.24
21.6635	60	49.81	10.19	21.6635	50	46.33	3.67
L Test Curve							

(Plot A: L 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)
0.1500	66	43.60	22.40	0.1500	56	31.46	14.54
0.5000	56	41.93	14.07	0.5000	46	32.07	13.93
21.6635	60	49.77	10.23	5.9012	50	46.31	3.69

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

- 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.
- 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.
- For below 1G :QP detector RBW 120kHz ,VBW 300kHz.
- For Above 1G: PK detector RBW 1MHz,VBW 3MHz for PK value ;PK detector RBW 1MHz, VBW 10Hz for AV value.

Note:

- The tighter limit shall apply at the boundary between two frequency range.
- Limitation expressed in dBuV/m is calculated by $20\log \text{Emission Level}(\mu\text{V/m})$.
- 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 $30\mu\text{V/m}$, then F.S Limitation at 3m distance is adjusted as

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

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.

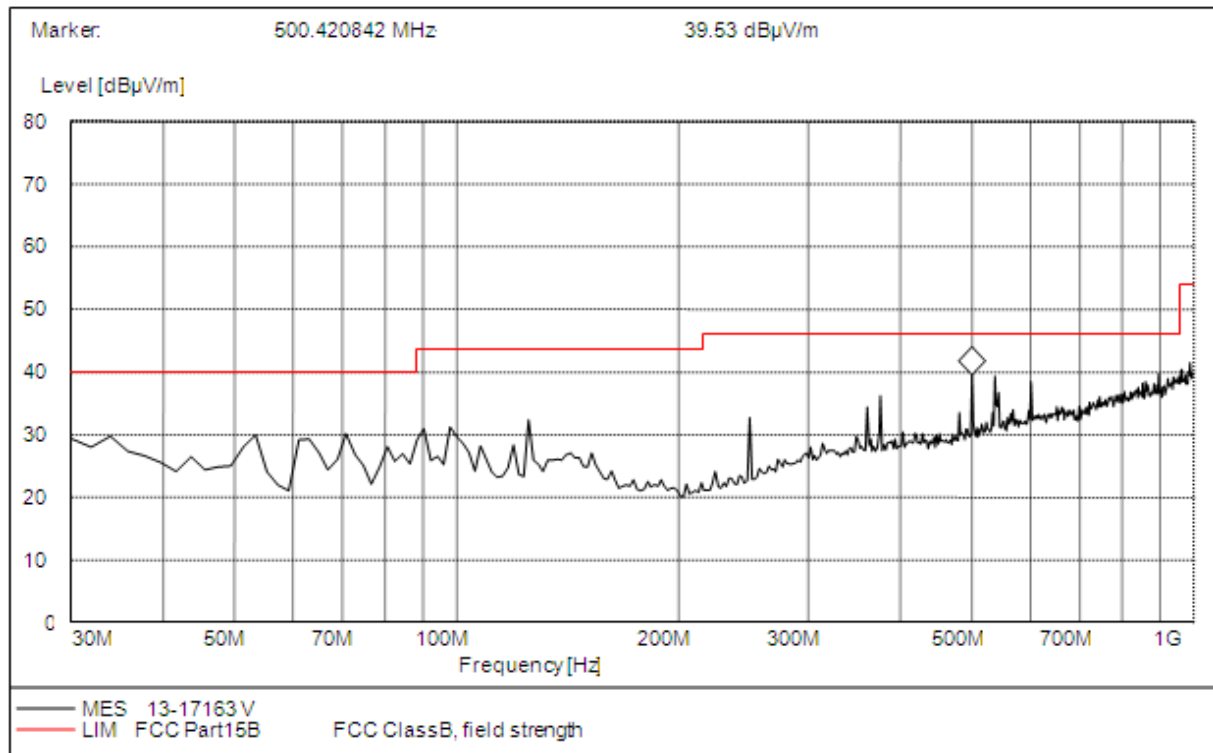
The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

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:

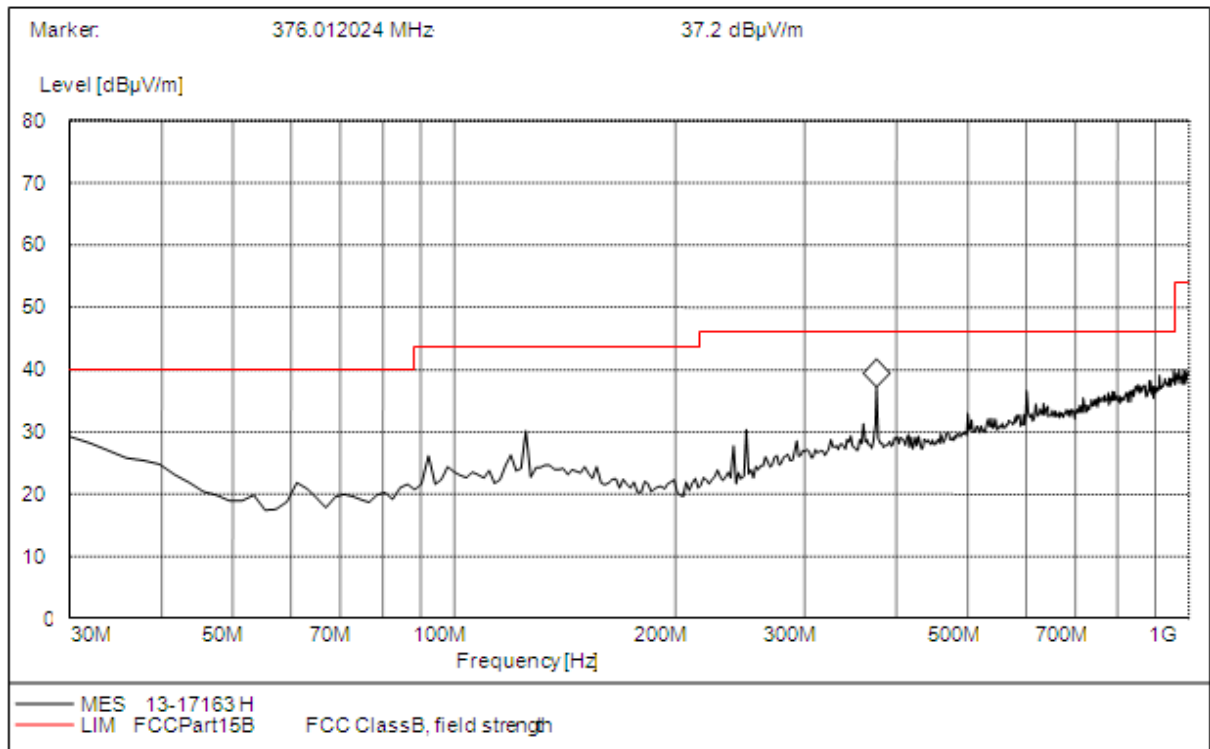


(Plot A: 9K – 30M)



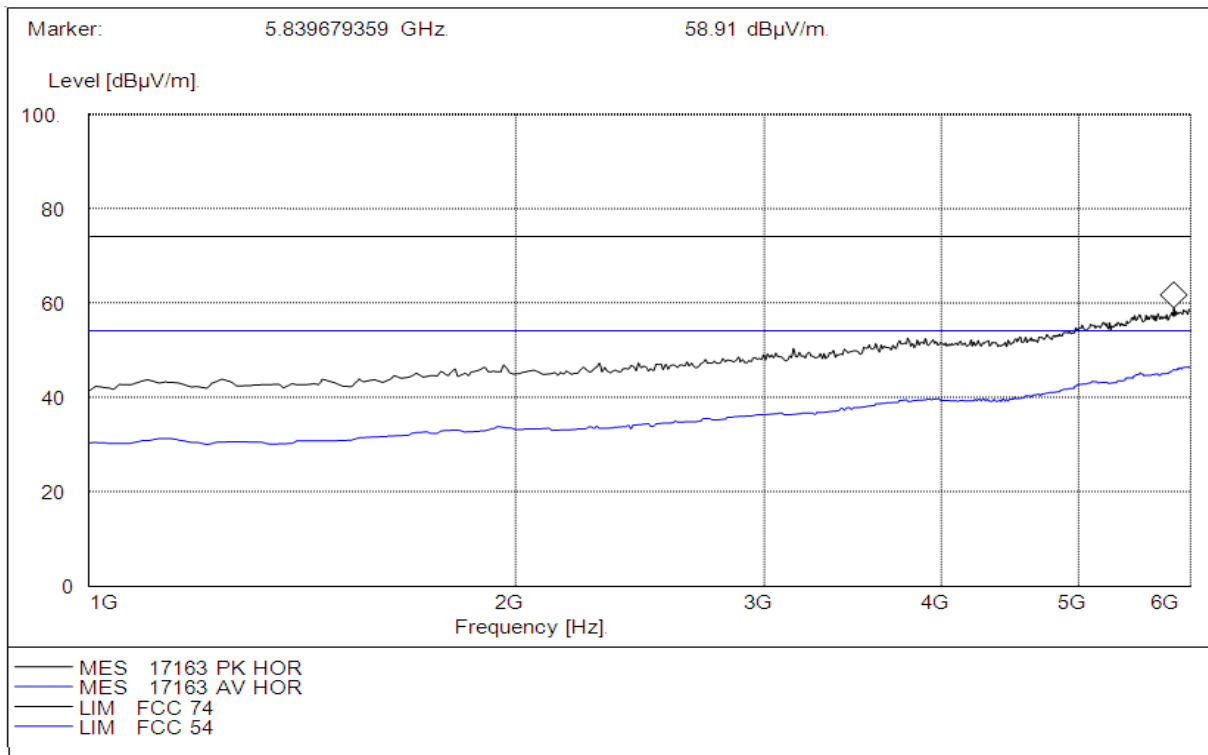
(PlotB: Test Antenna Vertical 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
33.940000	29.76	120.000	100.0	40.00	10.24	Vertical	Pass
131.080000	32.16	120.000	100.0	43.50	11.34	Vertical	Pass
500.420842	39.53	120.000	100.0	46.00	6.47	Vertical	Pass



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

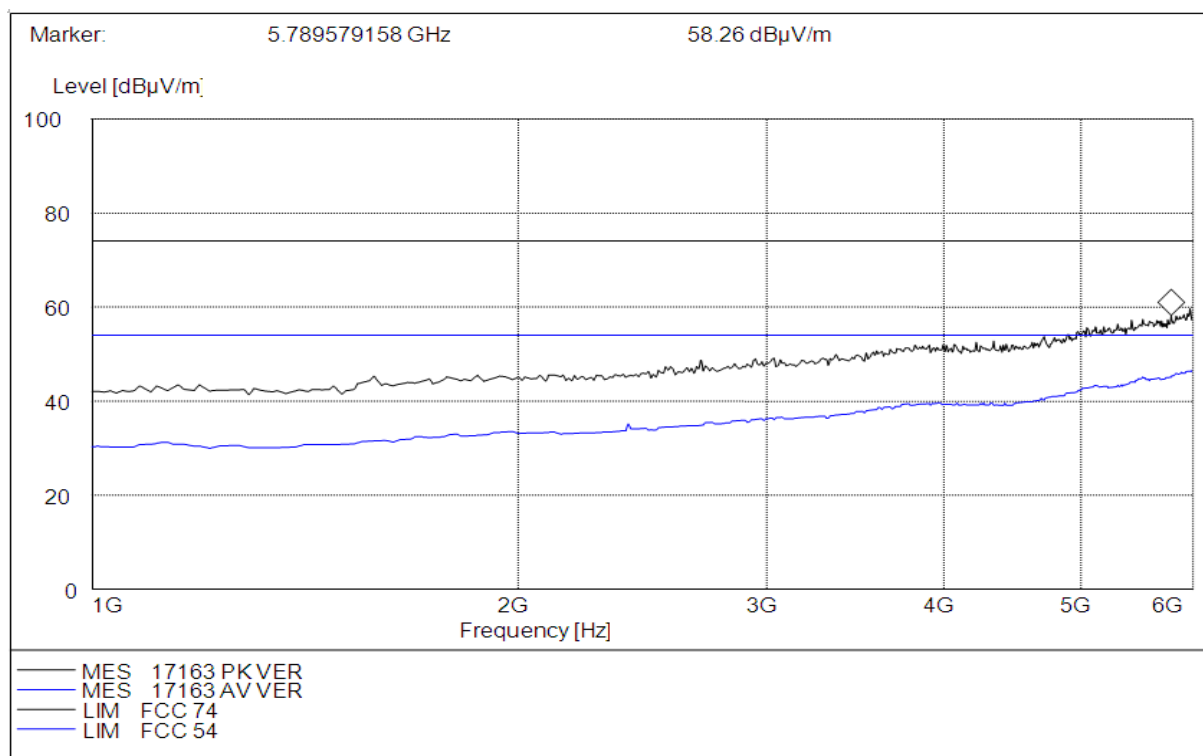
Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBμV/m)	Margin (dB)	Antenna	Verdict
30.000000	29.23	120.000	100.0	40.00	10.77	Horizontal	Pass
131.080000	39.56	120.000	100.0	43.50	13.94	Horizontal	Pass
376.012024	37.20	120.000	100.0	46.00	8.80	Horizontal	Pass



(Plot D: 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
1240.48090	30.60	1000.000	150.0	54.00	23.40	Horizontal	Pass
1961.92384	33.50	1000.000	150.0	54.00	20.50	Horizontal	Pass
2723.44680	35.50	1000.000	150.0	54.00	18.50	Horizontal	Pass
3144.28857	36.40	1000.000	150.0	54.00	17.60	Horizontal	Pass
4547.09418	39.80	1000.000	150.0	54.00	14.20	Horizontal	Pass
5839.67935	45.90	1000.000	100.0	54.00	8.10	Horizontal	Pass

Frequency (MHz)	PK (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
1240.48090	43.83	1000.000	150.0	74.00	30.17	Horizontal	Pass
1961.92384	46.88	1000.000	150.0	74.00	27.12	Horizontal	Pass
2723.44680	48.02	1000.000	150.0	74.00	25.98	Horizontal	Pass
3144.28857	50.36	1000.000	150.0	74.00	23.64	Horizontal	Pass
4547.09418	52.77	1000.000	150.0	74.00	21.23	Horizontal	Pass
5839.67935	58.91	1000.000	100.0	74.00	15.09	Horizontal	Pass



(Plot E: 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
1581.16232	31.60	1000.000	100.0	54.00	22.40	Vertical	Pass
2693.38677	34.90	1000.000	150.0	54.00	19.10	Vertical	Pass
2943.88770	36.10	1000.000	150.0	54.00	17.90	Vertical	Pass
3815.63120	39.20	1000.000	150.0	54.00	14.80	Vertical	Pass
4707.41483	40.30	1000.000	100.0	54.00	13.70	Vertical	Pass
5789.57915	45.10	1000.000	150.0	54.00	8.90	Vertical	Pass

Frequency (MHz)	PK (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Verdict
1581.16232	45.38	1000.000	100.0	74.00	28.62	Vertical	Pass
2693.38677	48.70	1000.000	150.0	74.00	25.30	Vertical	Pass
2943.88770	49.04	1000.000	150.0	74.00	24.96	Vertical	Pass
3815.63120	51.92	1000.000	100.0	74.00	22.08	Vertical	Pass
4707.41483	52.67	1000.000	150.0	74.00	21.33	Vertical	Pass
5789.57915	58.26	1000.000	100.0	74.00	15.74	Vertical	Pass

Test Result: PASS

4. PHOTOGRAPHS OF THE EUT



5. PHOTOGRAPHS OF THE TEST SET-UP



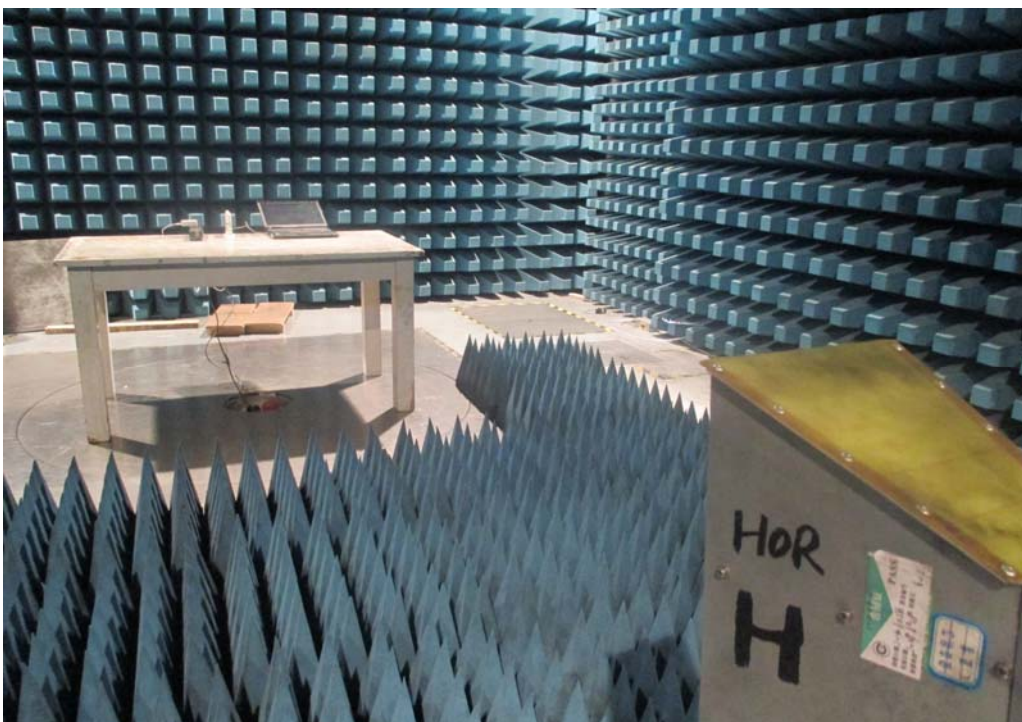
Conducted Emission



Radiated Emission of 9k-30M



Radiated Emission of 30M-1G



Radiated Emission of 1-6G

**** END OF REPORT ****