

# FCC Report

## (NFC)

**Applicant:** Shenzhen xinli intelligent robot co.,ltd

**Address of Applicant:** F4/A, Building 5, HanHaiDa High Tech Industrial Park, TianLiao, Gongming Town, GuangMing, Shenzhen, China

### Equipment Under Test (EUT)

**Product Name:** two-wheel self-balancing electric scooter

**Trade Name:** ES1352B, ES1352

**Model No.:** ESWING

**FCC ID:** 2AHTH-ES1352

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.225: 2012

**Date of sample receipt:** April 11, 2016

**Date of Test:** April 11-14, 2016

**Date of report issued:** April 15, 2016

**Test Result :** PASS \*

\* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



**Robinson Lo**  
**Laboratory Manager**

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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## 2 Version

Version No.	Date	Description
00	April 15, 2016	Original

**Prepared By:**

*Zedward.Pan*

**Date:**

April 15, 2016

**Project Engineer**

**Check By:**

*hank.yan*

**Date:**

April 15, 2016

**Reviewer**

### 3 Contents

	Page
1 COVER PAGE .....	1
2 VERSION .....	2
3 CONTENTS .....	3
4 TEST SUMMARY .....	4
4.1 MEASUREMENT UNCERTAINTY .....	4
5 GENERAL INFORMATION .....	5
5.1 CLIENT INFORMATION .....	5
5.2 GENERAL DESCRIPTION OF E.U.T .....	5
5.3 TEST MODE .....	6
5.4 TEST FACILITY .....	6
5.5 TEST LOCATION .....	6
6 TEST INSTRUMENTS LIST .....	7
7 TEST RESULTS AND MEASUREMENT DATA .....	8
7.1 ANTENNA REQUIREMENT .....	8
7.2 CONDUCTED EMISSIONS .....	9
7.3 FIELD STRENGTH OF FUNDAMENTAL EMISSIONS AND MASK MEASUREMENT .....	12
7.4 RADIATED EMISSION .....	15
7.5 20dB EMISSION BANDWIDTH .....	18
7.6 FREQUENCY STABILITY MEASUREMENT .....	20
8 TEST SETUP PHOTO .....	22
9 EUT CONSTRUCTIONAL DETAILS .....	23

## 4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203	Pass
AC Power Line Conducted Emission	15.207	Pass
Field Strength of Fundamental Emissions and Mask Measurement	15.225	Pass
Radiated Emission	15.209	Pass
20dB Emission Bandwidth	15.225	Pass
Frequency Stability Measurement	15.225	Pass

*Pass: The EUT complies with the essential requirements in the standard.*

*Remark: Test according to ANSI C63.10 2013 and ANSI C63.4: 2014.*

### 4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(1)

*Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.*

## 5 General Information

### 5.1 Client Information

Applicant:	Shenzhen xinli intelligent robot co.,ltd
Address of Applicant:	F4/A, Building 5, HanHaiDa High Tech Industrial Park, TianLiao, Gongming Town, GuangMing, Shenzhen, China
Manufacturer/Factory:	Shenzhen xinli intelligent robot co.,ltd
Address of Manufacturer/Factory:	F4/A, Building 5, HanHaiDa High Tech Industrial Park, TianLiao, Gongming Town, GuangMing, Shenzhen, China

### 5.2 General Description of E.U.T.

Product Name:	two-wheel self-balancing electric scooter
Model No.:	ES1352B, ES1352
Operation Frequency:	13.56MHz
Channel Number:	1
Modulation:	ASK
Antenna type:	PCB antenna
Antenna gain:	0dBi
Adapter information :	Adapter Model: XVE-6300200 Input: AC 100-240VAC, 50/60Hz, 2.5A (max) Output: DC 63V, 2.0A

## 5.3 Test mode

Transmitter mode	Keep the EUT in continuously transmitting.
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## 5.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen 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 out files. Registration 600491, July 20, 2010.

- **Industry Canada (IC)**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. Has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-1.

## 5.5 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

## 6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 26 2016	Mar. 25 2017
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS533	Dec. 03 2015	Dec. 02 2016
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 30 2015	June 29 2016
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 30 2015	June 29 2016
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 26 2015	June 25 2016
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 26 2016	Mar. 25 2017
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	Mar. 27 2016	Mar. 26 2017
10	Coaxial Cable	GTS	N/A	GTS211	Mar. 27 2016	Mar. 26 2017
11	Coaxial cable	GTS	N/A	GTS210	Mar. 27 2016	Mar. 26 2017
12	Coaxial Cable	GTS	N/A	GTS212	Mar. 27 2016	Mar. 26 2017
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 30 2015	June 29 2016
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 30 2015	June 29 2016
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 26 2015	June 25 2016
16	Band filter	Amindeon	82346	GTS219	Mar. 27 2016	Mar. 26 2017
17	Power Meter	Anritsu	ML2495A	GTS540	June 30 2015	June 29 2016
18	Power Sensor	Anritsu	MA2411B	GTS541	June 30 2015	June 29 2016
19	Loop Antenna	ZHINAN	ZN30900A	GTS534	Feb. 21 2016	Feb. 20 2017

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.0(L)x3.0(W)x3.0(H)	GTS264	Sep. 06 2015	Sep. 05 2017
2	EMI Test Receiver	Rohde & Schwarz	ESCS30	GTS223	June 30 2015	June 29 2016
3	10dB Pulse Limita	Rohde & Schwarz	N/A	GTS224	June 30 2015	June 29 2016
4	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 30 2015	June 29 2016
5	LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	GTS226	June 30 2015	June 29 2016
6	Coaxial Cable	GTS	N/A	GTS227	June 30 2015	June 29 2016
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

## 7 Test results and Measurement Data

### 7.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203
<b>15.203 requirement:</b> 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
<b>E.U.T Antenna:</b>	
<i>The antenna is PCB antenna, the best case gain of the antenna is 0dBi</i>	

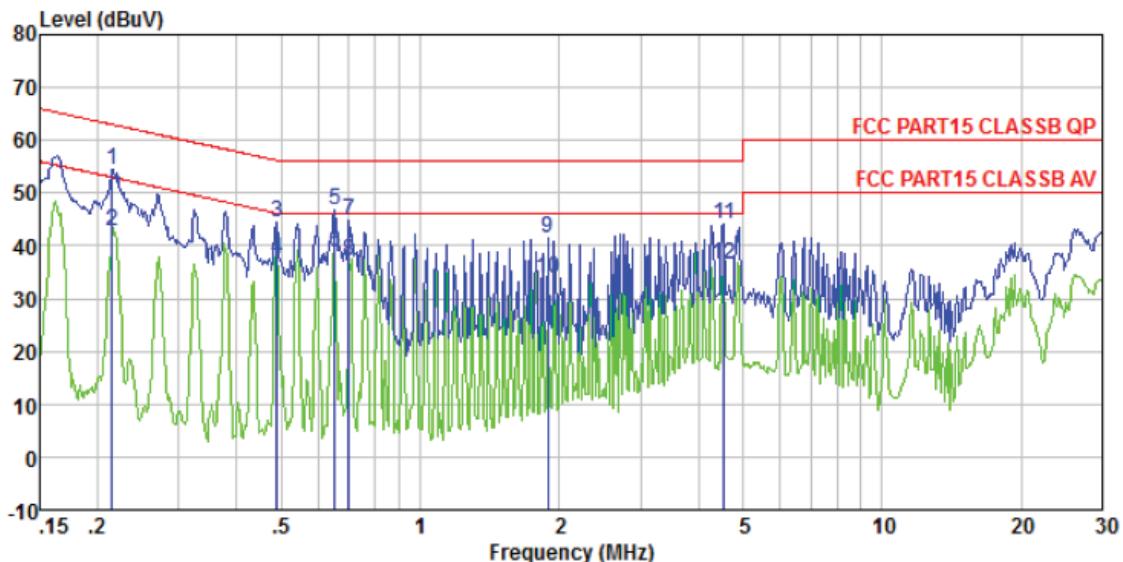


## 7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207																
Test Method:	ANSI C63.10:2013																
Test Frequency Range:	150KHz to 30MHz																
Class / Severity:	Class B																
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto																
Limit:	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>			Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)																
	Quasi-peak	Average															
0.15-0.5	66 to 56*	56 to 46*															
0.5-5	56	46															
5-30	60	50															
	<small>* Decreases with the logarithm of the frequency.</small>																
Test setup:	<p>Reference Plane</p> <p>LISN</p> <p>40cm</p> <p>80cm</p> <p>AUX Equipment</p> <p>E.U.T</p> <p>Test table/Insulation plane</p> <p>EMI Receiver</p> <p>Filter</p> <p>AC power</p> <p>Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>																
Test procedure:	<ol style="list-style-type: none"> <li>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</li> </ol>																
Test Instruments:	Refer to section 6.0 for details																
Test mode:	Refer to section 5.3 for details																
Test results:	Pass																

### Measurement data:

Line:



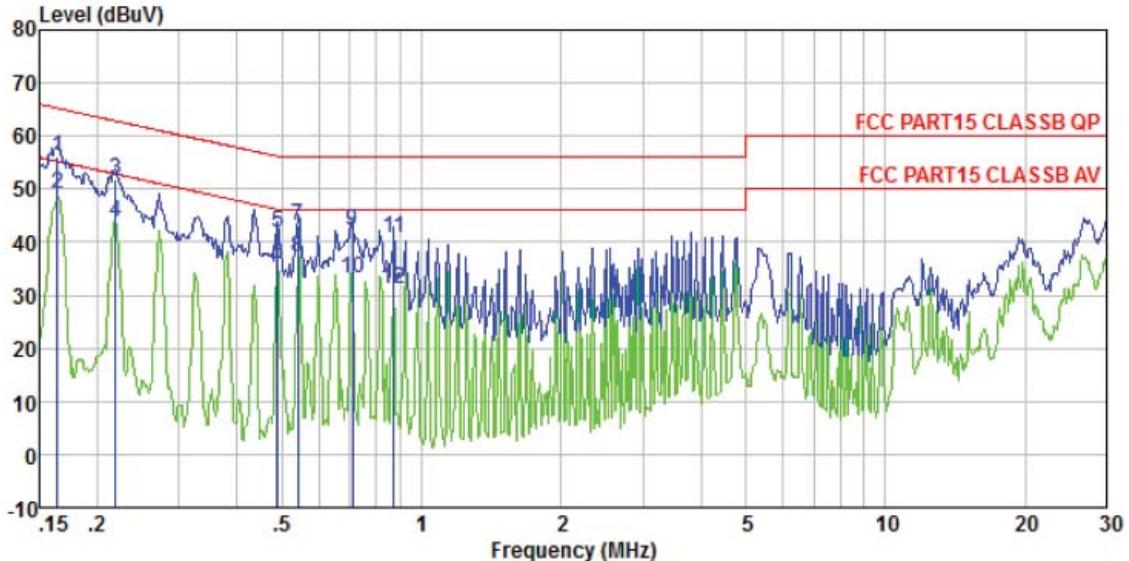
Condition : FCC PART15 CLASSB QP LISN-2013 LINE

Job No. : 0619

Test mode : RFID communication mode

Test Engineer: Sky

	Read Freq	LISN Level	Cable Factor	Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV		dB	dB	dBuV	dBuV	dB
1	0.215	54.31	0.13	0.13	54.57	63.01	-8.44	QP
2	0.215	42.56	0.13	0.13	42.82	53.01	-10.19	Average
3	0.489	44.18	0.12	0.11	44.41	56.19	-11.78	QP
4	0.489	37.41	0.12	0.11	37.64	46.19	-8.55	Average
5	0.654	46.37	0.13	0.13	46.63	56.00	-9.37	QP
6	0.654	38.63	0.13	0.13	38.89	46.00	-7.11	Average
7	0.701	44.66	0.14	0.13	44.93	56.00	-11.07	QP
8	0.701	36.93	0.14	0.13	37.20	46.00	-8.80	Average
9	1.888	41.29	0.12	0.14	41.55	56.00	-14.45	QP
10	1.888	33.55	0.12	0.14	33.81	46.00	-12.19	Average
11	4.549	43.86	0.21	0.15	44.22	56.00	-11.78	QP
12	4.549	36.22	0.21	0.15	36.58	46.00	-9.42	Average

**Neutral:**


Condition : FCC PART15 CLASSB QP LISN-2013 NEUTRAL

Job No. : 0619

Test mode : RFID communication mode

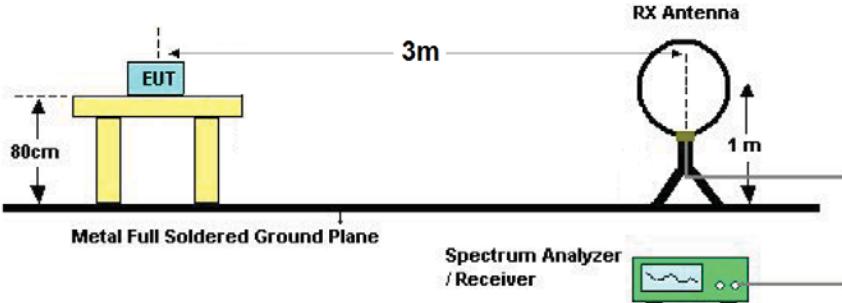
Test Engineer: Sky

	Read Freq	LISN Level	Cable Factor	Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV		dB	dBuV	dBuV		
1	0.164	55.76	0.07	0.12	55.95	65.25	-9.30	QP
2	0.164	48.95	0.07	0.12	49.14	55.25	-6.11	Average
3	0.219	51.44	0.06	0.13	51.63	62.88	-11.25	QP
4	0.219	43.63	0.06	0.13	43.82	52.88	-9.06	Average
5	0.489	41.64	0.06	0.11	41.81	56.19	-14.38	QP
6	0.489	35.82	0.06	0.11	35.99	46.19	-10.20	Average
7	0.541	42.95	0.07	0.11	43.13	56.00	-12.87	QP
8	0.541	37.13	0.07	0.11	37.31	46.00	-8.69	Average
9	0.708	41.79	0.07	0.13	41.99	56.00	-14.01	QP
10	0.708	32.98	0.07	0.13	33.18	46.00	-12.82	Average
11	0.871	40.63	0.07	0.13	40.83	56.00	-15.17	QP
12	0.871	30.83	0.07	0.13	31.03	46.00	-14.97	Average

**Notes:**

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss

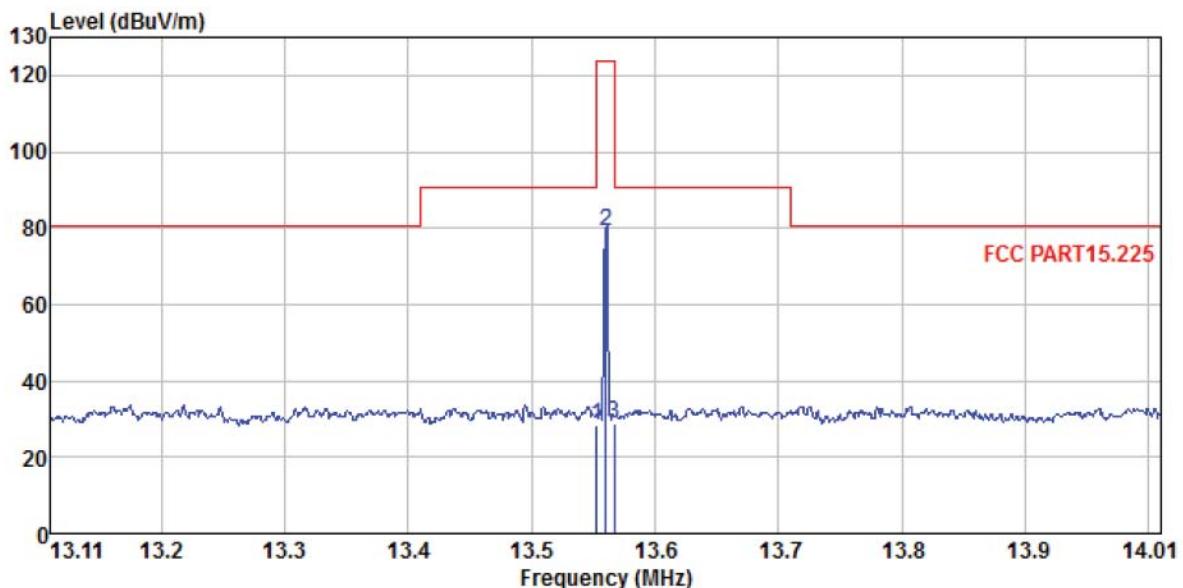
## 7.3 Field Strength of Fundamental Emissions and Mask Measurement

Test Requirement:	FCC Part15 C Section 15.225 and 15.209		
Test Method:	ANSI C63.10:2013		
Test site:	Measurement Distance: 3m		
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=Auto		
Limit:	Frequency (MHz)	Field Strength (microvolts/meter) at 30m	Field Strength (dBuV/m) at 3m
	13.553~13.567	15848	124 (QP)
Mark limit:	Frequency (MHz)	Field Strength (microvolts/meter) at 30m	Field Strength (dBuV/m) at 3m
	1.705~13.110	30	69.5
	13.110~13.410	106	80.5
	13.410~13.553	334	90.5
	13.553~13.567	15848	124.0
	13.567~13.710	334	90.5
	13.710~14.010	106	80.5
	14.010~30.000	30	69.5
Test setup:			
Test Procedure:	<ol style="list-style-type: none"> <li>Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.</li> <li>Power on the EUT, the turntable was rotated by 360 degrees to determine the position of the highest radiation.</li> <li>The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.</li> <li>For Fundamental emissions, use the receiver to measure QP reading.</li> <li>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</li> </ol>		

	a 0.1 second interval during which the field strength is at its maximum value.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Remark : All mode have been tested , only worse case is reported

Measurement data:



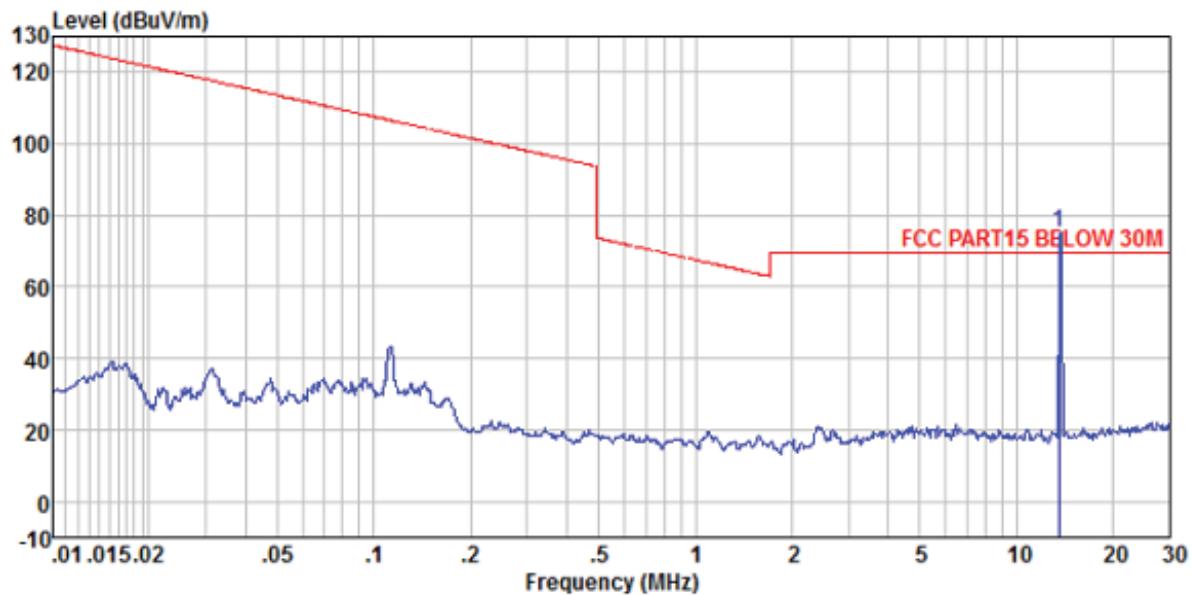
Condition : FCC PART15.225 ZN309000A(<30M)-2013

Job No. : 0619

Test mode : Transmitting mode

Test Engineer: He

	Read	Antenna	Cable	Preamp	Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	13.553	5.11	22.86	0.51	0.00	28.48	69.5	QP
2	13.560	56.00	22.86	0.51	0.00	79.37	124.00	-44.63 QP
3	13.567	5.31	22.86	0.51	0.00	28.68	69.5	QP



Condition : FCC PART15 BELOW 30M ZN309000A(<30M)-2013

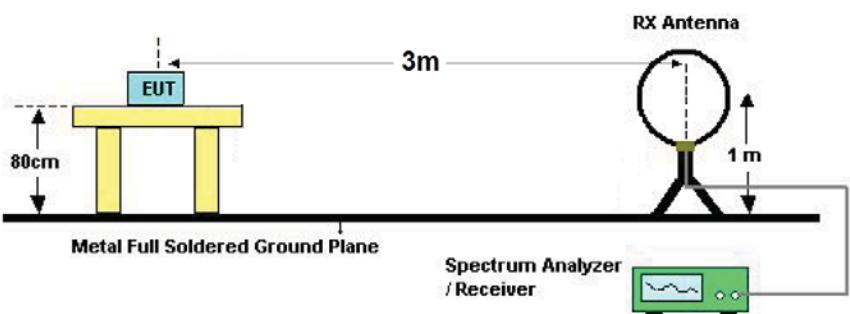
Job No. : 0619

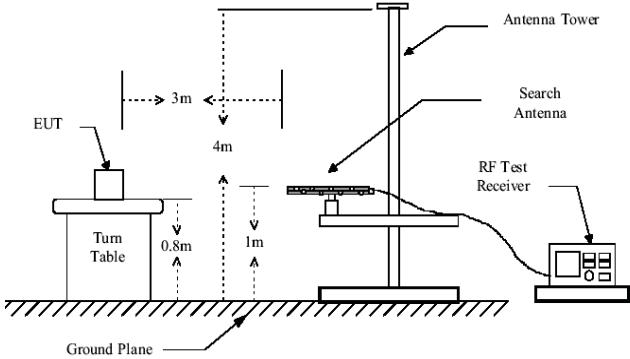
Test mode : Transmitting mode

Test Engineer: He

	Read	Antenna	Cable	Preamp	Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dB <sub>uV</sub>	dB/m	dB	dB	dB <sub>uV/m</sub>	dB <sub>uV/m</sub>	dB	
1 *	13.560	51.93	22.86	0.51	0.00	75.30	124	QP

## 7.4 Radiated Emission

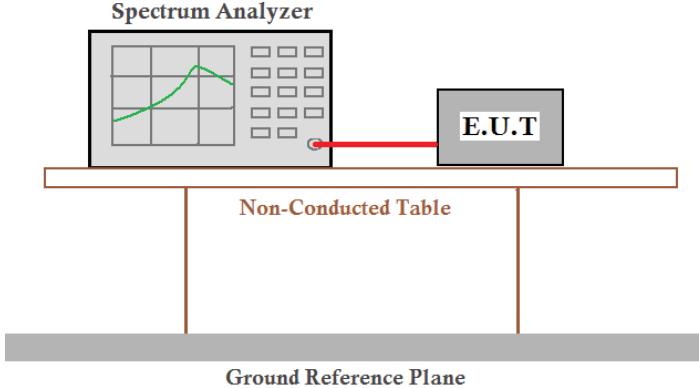
Test Requirement:	FCC Part15 C Section 15.209		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	9KHz to 1000MHz		
Test site:	Measurement Distance: 3m		
Receiver setup:	Frequency (MHz)	RBW(KHz)	Detector
	0.009~0.15	0.2	QP
	0.15~30	9	QP
	30~1000	120	QP
Limit:	The Field strength of any emissions which appear outside of 13.553~13.567MHz band shall not exceed the general radiated emissions limits		
	Frequency (MHz)	Field strength (microvolt/meter)	Measurement distance (meters)
	0.009~0.490	2400/F(KHz)	300
	0.490~1.705	24000/F(KHz)	30
	1.705~30	30	30
	30~88	100	3
	88~216	150	3
	216~960	200	3
	960~1000	500	3
Test setup:	<p>Below 30MHz</p>  <p>Above 30MHz</p>		

	
Test Procedure:	<ol style="list-style-type: none"> <li>1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.</li> <li>2. Power on the EUT, the turntable was rotated by 360 degrees to determine the position of the highest radiation.</li> <li>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.</li> <li>4. For each suspected emissions, the antenna tower was scan (from 1M to 4M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.</li> <li>5. Set the test-receiver system to Peak or CISPR quasi-peak detect function with specified bandwidth under maximum hold mode.</li> <li>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.</li> <li>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.</li> </ol>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement data:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
46.18	34.75	15.48	0.73	30.02	20.94	40.00	-19.06	Vertical
109.80	33.00	14.25	1.28	29.63	18.90	43.50	-24.60	Vertical
150.01	43.43	10.26	1.57	29.41	25.85	43.50	-17.65	Vertical
284.98	38.41	14.75	2.29	29.90	25.55	46.00	-20.45	Vertical
462.35	34.63	17.65	3.14	29.37	26.05	46.00	-19.95	Vertical
543.27	32.48	19.46	3.50	29.30	26.14	46.00	-19.86	Vertical
50.76	36.06	15.21	0.78	29.99	22.06	40.00	-17.94	Horizontal
108.27	38.93	14.39	1.26	29.64	24.94	43.50	-18.56	Horizontal
144.34	44.13	10.22	1.53	29.44	26.44	43.50	-17.06	Horizontal
225.31	42.97	13.41	1.99	29.44	28.93	46.00	-17.07	Horizontal
352.94	38.96	16.33	2.64	29.72	28.21	46.00	-17.79	Horizontal
651.94	34.86	20.65	3.92	29.25	30.18	46.00	-15.82	Horizontal

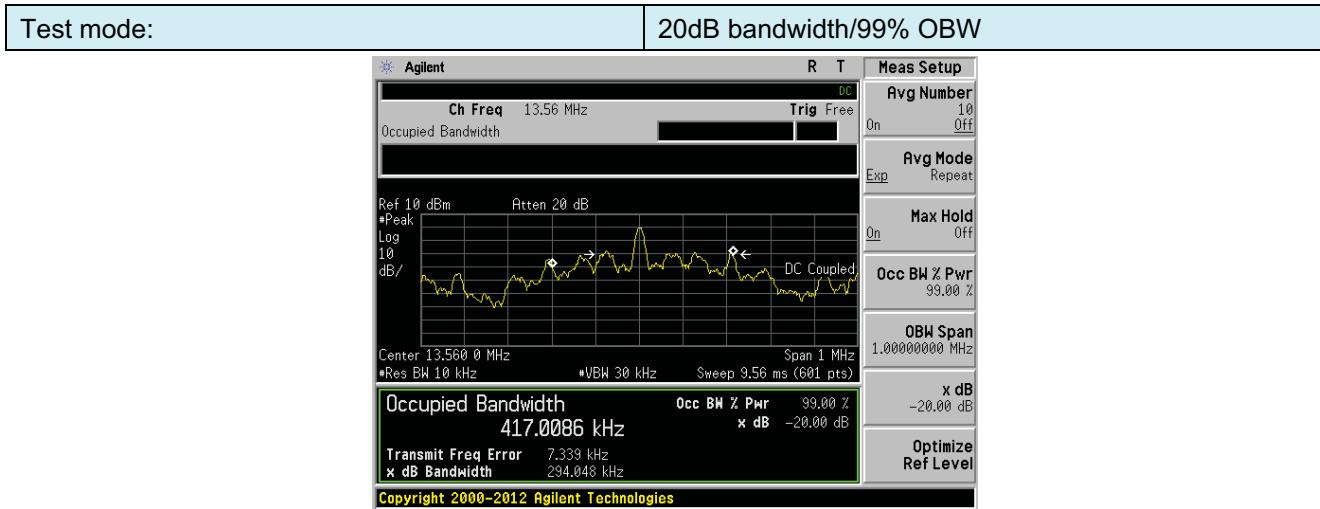
## 7.5 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.225 and 15.215
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

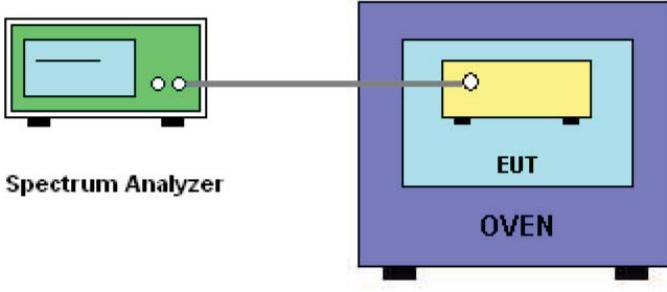
### Measurement Data

Frequency (MHz)	20dB Bandwidth (KHz)	99% OBW (KHz)
13.56MHz	294.048	417.0086

Test plot as follows:



## 7.6 Frequency Stability Measurement

Test Requirement:	FCC Part15 C Section 15.225
Test Method:	ANSI C63.10: 2013
Receiver setup:	RBW=1KHz, VBW=1KHz, Sweep time=Auto
Limit:	<p>The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency</p> <p>over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage,</p> <p>for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.</p> <p>For battery operated equipment, the equipment tests shall be performed using a new battery.</p>
Test setup:	 <p>The diagram illustrates the test setup. A green 'Spectrum Analyzer' is connected to the 'antenna port' of a yellow 'EUT' (Equipment Under Test) box. The 'EUT' box is placed inside a purple 'OVEN' (oven) which is used to maintain a constant temperature during the test.</p>
Test Procedure:	<ol style="list-style-type: none"> <li>1. The transmitter output (antenna port) was connected to the spectrum analyzer.</li> <li>2. EUT have transmitted absence of modulation signal and fixed channelize</li> <li>3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.</li> <li>4. Set RBW=1KHz, VBW=1KHz with peak detector and maxhold settings.</li> <li>5. fc is declaring of channel frequency. Then the frequency error formula is <math>(fc-f)/fc \times 10^6</math> ppm and the limit is less than <math>\pm 100</math> ppm.</li> <li>6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value</li> <li>7. Extreme temperature rule is <math>-20^{\circ}\text{C} \sim 50^{\circ}\text{C}</math></li> </ol>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

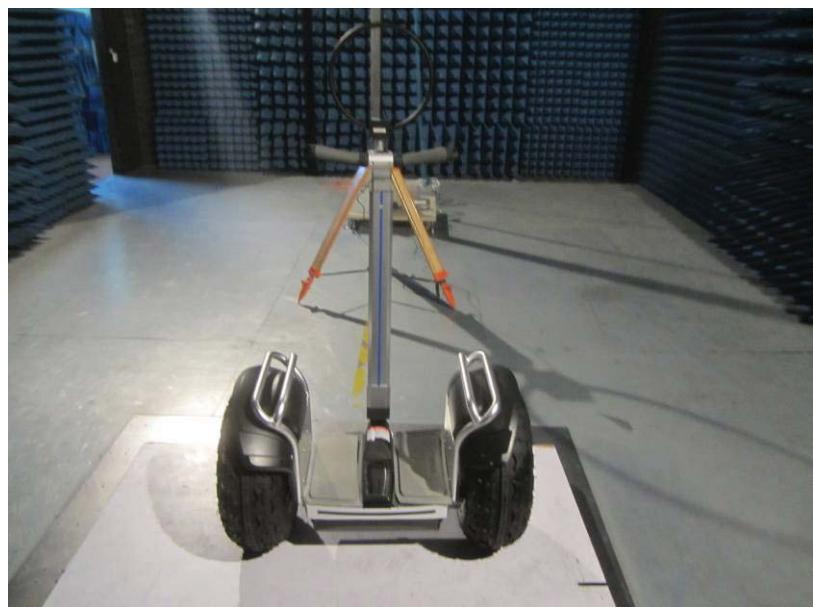
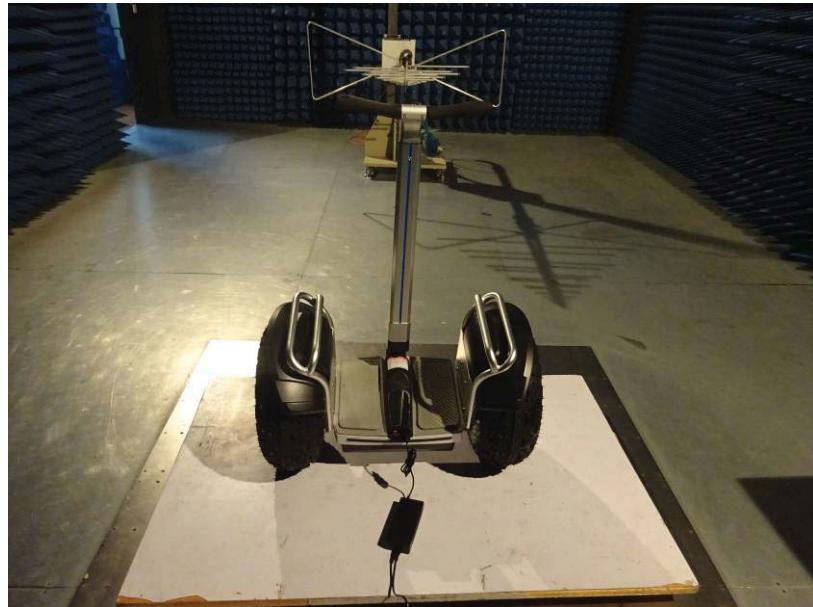
Measurement data:

Reference Frequency: 13.56MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit	Result
		Hz	%		
63.00	-20	54	0.00040%	+/- 0.01%	Pass
	-10	51	0.00038%		
	0	61	0.00045%		
	10	53	0.00039%		
	20	55	0.00041%		
	30	60	0.00044%		
	40	64	0.00047%		
	50	68	0.00050%		

Reference Frequency: 13.56MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit	Result
		Hz	ppm		
20	53.55	45	0.00033%	+/- 0.01%	Pass
	63.00	54	0.00040%		
	72.45	75	0.00055%		

## 8 Test Setup Photo

Radiated Emission



Conducted Emission



## 9 EUT Constructional Details

Reference to the test report No. GTS16000619E01

----- End -----