

# EMC TEST REPORT



Report No.: 15020668-FCC-E

Supersede Report No.: N/A

Applicant	Ringway Tech(Jiangsu) Co.,Ltd.	
Product Name	DIGITAL PIANO	
Main Model No.	PA-88H	
Test Standard	FCC Part 15 Subpart B Class B:2014, ANSI C63.4: 2014	
Test Date	July 02 to July 07, 2015	
Issue Date	July 10, 2015	
Test Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Equipment complied with the specification		<input checked="" type="checkbox"/>
Equipment did not comply with the specification		<input type="checkbox"/>
Deon Dai	Herve Idoko	
Deon Dai Test Engineer	Herve Idoko Checked By	
<p>This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only</p>		

Issued by:

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## Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

### Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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## 1. Report Revision History

Report No.	Report Version	Description	Issue Date
15020668-FCC-E	NONE	Original	July 10, 2015

## 2. Customer information

Applicant Name	Ringway Tech(Jiangsu) Co.,Ltd.
Applicant Add	No. 101 West Hanjiang Road, Changzhou,Jiangsu, China
Manufacturer	Ringway Tech(Jiangsu) Co.,Ltd.
Manufacturer Add	No. 101 West Hanjiang Road, Changzhou,Jiangsu, China

## 3. Test site information

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	986914
IC Test Site No.	4842B-1
Test Software	Labview of SIEMIC version 1.0

#### 4. Equipment under Test (EUT) Information

Description of EUT:	DIGITAL PIANO
Main Model:	PA-88H
Serial Model:	N/A
Date EUT received:	July 02, 2015
Test Date(s):	July 02 to July 07, 2015
Operating Frequency :	12 MHz
Port:	Power Port, USB to Host Port, MIDI OUT Port, PHONES Port, SUSTAIN Port, LINE OUT Port
Power:	12V 1A
Trade Name :	RINGWAY
FCC ID:	OCDPA-88H

## 5. Test Summary

The product was tested in accordance with the following specifications.  
 All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.107; ANSI C63.4: 2009	AC Power Line Conducted Emissions	Compliance
§15.109; ANSI C63.4: 2009	Radiated Emissions	Compliance

### Measurement Uncertainty

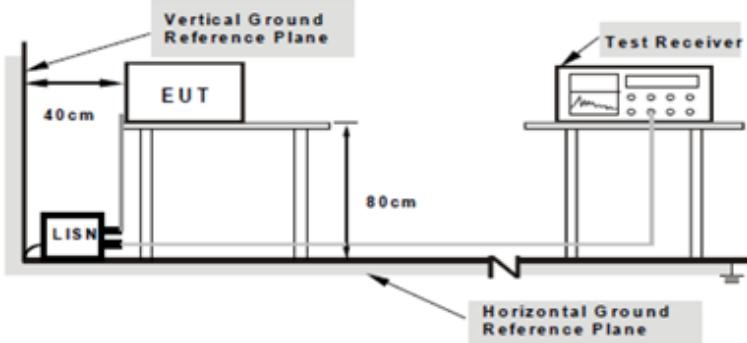
Emissions		
Test Item	Description	Uncertainty
Radiated Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	3.952dB

## 6. Measurements, Examination And Derived Results

### 6.1 AC Power Line Conducted Emissions

Temperature	24°C
Relative Humidity	50%
Atmospheric Pressure	1013mbar
Test date :	July 07, 2015
Tested By :	Deon Dai

#### Requirement(s):

Spec	Requirement	Applicable														
47CFR §15.107	<p>For Low-power radio-frequency devices 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 or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.</p> <table border="1"> <thead> <tr> <th rowspan="2">Frequency ranges (MHz)</th> <th colspan="2">Limit (dB<math>\mu</math>V)</th> </tr> <tr> <th>QP</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15 ~ 0.5</td> <td>66 ~ 56</td> <td>56 ~ 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 ranges (MHz)	Limit (dB $\mu$ V)		QP	Average	0.15 ~ 0.5	66 ~ 56	56 ~ 46	0.5 ~ 5	56	46	5 ~ 30	60	50	<input checked="" type="checkbox"/>
Frequency ranges (MHz)	Limit (dB $\mu$ V)															
	QP	Average														
0.15 ~ 0.5	66 ~ 56	56 ~ 46														
0.5 ~ 5	56	46														
5 ~ 30	60	50														
Test Setup	 <p><b>Note:</b> 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</p>															
Procedure	<ol style="list-style-type: none"> <li>1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.1m high, non-metallic table.</li> <li>2. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.</li> <li>3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.</li> <li>4. All other supporting equipment were powered separately from another main supply.</li> <li>5. The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.</li> <li>7. High peaks, relative to the limit line, were then selected. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz.</li> <li>8. Steps 6-7 were repeated for the LIVE line (for AC mains) or DC line (for DC power).</li> </ol>															
Remark																
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail														
Test Data	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> N/A														
Test Plot	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> N/A														

### Data sample

Frequency (MHz)	Quasi-Peak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Factors (dB)
xxx	56.21	66.00	-9.79	39.20	56.00	-16.80	12.22

Frequency (MHz) = Emission frequency in MHz

Quasi-Peak/Average (dB $\mu$ V/m)=Receiver Reading(dB $\mu$ V/m)+ Factor(dB)

Limit(dB $\mu$ V/m)=Limit stated in standard

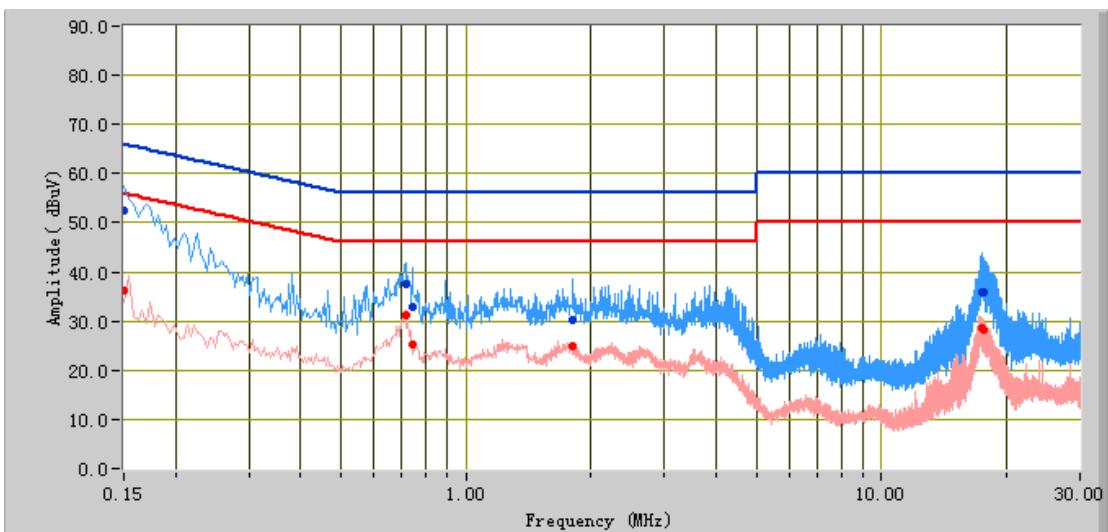
Factor (dB)= cable loss+ Insertion loss of LISN+ Insertion loss of transient limiter (The transient limiter included 10dB attenuation)

### Calculation Formula:

Margin (dB)=Quasi Peak / Average (dB $\mu$ V/m) – limit (dB $\mu$ V/m)

Test Mode:	Normal Working Mode
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<b>Peak Detector</b>		<b>Quasi Peak Limit</b>	
<b>Average Detector</b>		<b>Average Limit</b>	

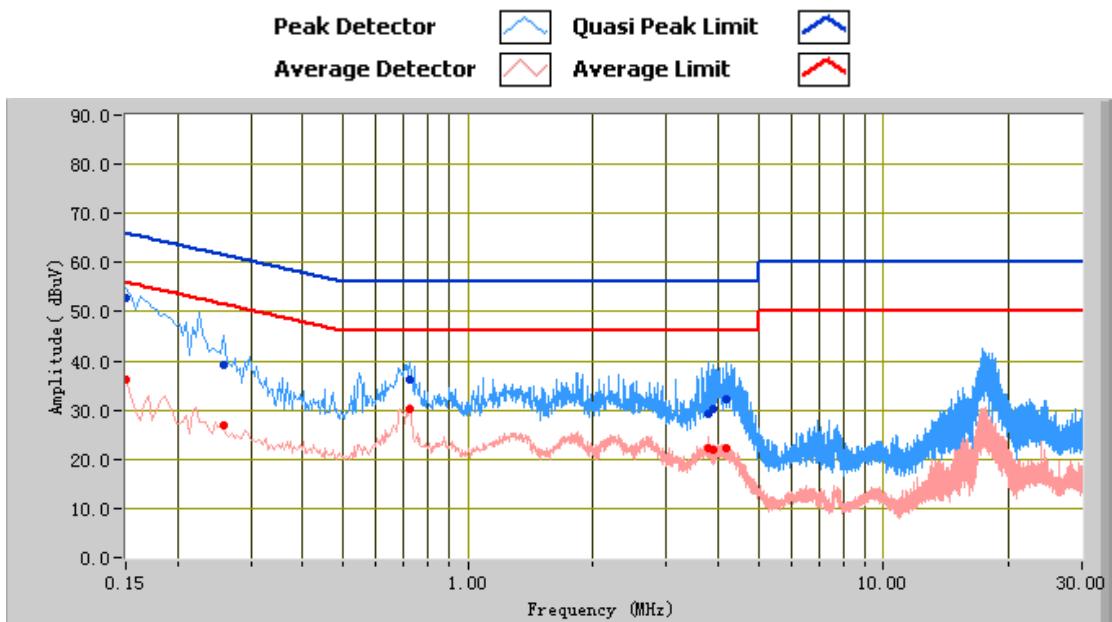


### Test Data

Phase Line Plot at 120Vac, 60Hz

Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Average (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Factors (dB)
0.15	52.59	66.00	-13.41	36.27	56.00	-19.73	12.22
0.71	37.36	56.00	-18.64	31.35	46.00	-14.65	10.91
0.74	32.92	56.00	-23.08	25.29	46.00	-20.71	10.89
17.38	35.97	60.00	-24.03	28.68	50.00	-21.32	11.47
17.58	35.87	60.00	-24.13	28.31	50.00	-21.69	11.48
1.81	30.38	56.00	-25.62	24.82	46.00	-21.18	10.84

Test Mode:	Normal Working Mode
------------	---------------------



### Test Data

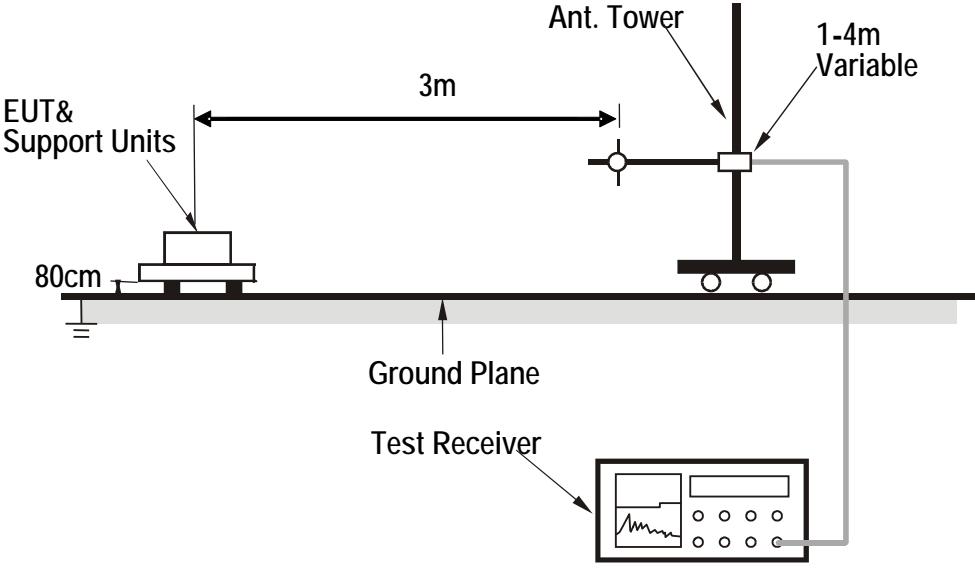
Phase Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Average (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Factors (dB)
0.15	52.79	66.00	-13.21	36.16	56.00	-19.84	12.21
3.79	29.31	56.00	-26.69	22.09	46.00	-23.91	10.94
0.72	36.13	56.00	-19.87	30.35	46.00	-15.65	10.90
0.26	39.14	61.50	-22.36	27.05	51.50	-24.45	11.44
4.20	32.22	56.00	-23.78	22.40	46.00	-23.60	10.94
3.89	30.33	56.00	-25.67	21.79	46.00	-24.21	10.94

## 6.2 Radiated Emissions

Temperature	24°C
Relative Humidity	50%
Atmospheric Pressure	1013mbar
Test date :	July 02, 2015
Tested By :	Deon Dai

### Requirement(s):

Spec	Requirement	Applicable										
47CFR §15.107(d)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges <table border="1" data-bbox="366 781 1171 945"> <tr> <th>Frequency range (MHz)</th> <th>Field Strength (<math>\mu</math>V/m)</th> </tr> <tr> <td>30 – 88</td> <td>100</td> </tr> <tr> <td>88 – 216</td> <td>150</td> </tr> <tr> <td>216 – 960</td> <td>200</td> </tr> <tr> <td>Above 960</td> <td>500</td> </tr> </table>	Frequency range (MHz)	Field Strength ( $\mu$ V/m)	30 – 88	100	88 – 216	150	216 – 960	200	Above 960	500	<input checked="" type="checkbox"/>
Frequency range (MHz)	Field Strength ( $\mu$ V/m)											
30 – 88	100											
88 – 216	150											
216 – 960	200											
Above 960	500											
Test Setup		 <p>The diagram illustrates the test setup for radiated emissions. A 'Ground Plane' is represented by a horizontal grey line. A 'Test Receiver' is shown as a box with a waveform and a series of buttons. A 'Test Antenna' is a vertical line with a horizontal segment at the top, labeled '1-4m Variable'. The 'EUT &amp; Support Units' are shown as a stack of rectangular blocks. A horizontal line connects the EUT to the antenna, with a distance of '3m' indicated. A '80cm' dimension is shown between the EUT and the ground plane. The entire setup is positioned above the ground plane.</p>										
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: <ol style="list-style-type: none"> <li>Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</li> <li>The EUT was then rotated to the direction that gave the maximum emission.</li> <li>Finally, the antenna height was adjusted to the height that gave the maximum emission.</li> </ol> 3. For emission frequencies measured below and above 1GHz, set the spectrum analyzer on a 100kHz and 1MHz resolution bandwidth respectively for each frequency measured. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.											
Remark	The EUT antenna was pre-tested under the following modes: X-Y axis; Y-Z axis; X-Z axis. We only recorded the worst case <b>X-Y axis</b> in this report.											
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail										

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Test Data	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> N/A
Test Plot	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> N/A

### Data sample

Frequency (MHz)	Quasi Peak (dB $\mu$ V/m)	Azimuth	Polarity (H/V)	Height (cm)	Factors (dB)	Limit (dB $\mu$ V/m)	Margin (dB)
XXX	32.23	181.00	H	350.00	-38.23	40.00	-7.77

Frequency (MHz) = Emission frequency in MHz

Quasi-Peak (dB $\mu$ V/m) = Receiver Reading(dB $\mu$ V/m) + Factor(dB)

Azimuth=Position of turn table

Polarity=Polarity of Receiver antenna

Height(cm)= Height of Receiver antenna

Factor (dB)=Antenna factor + cable loss- antenna gain

Limit (dB $\mu$ V/m)=Limit stated in standard

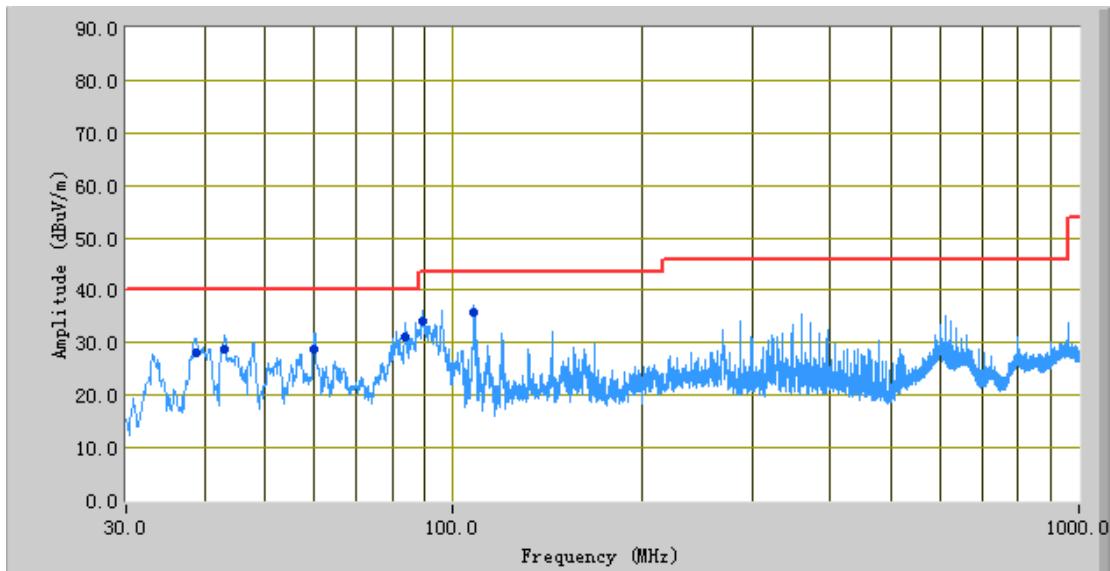
### Calculation Formula:

Margin (dB)=Quasi Peak (dB $\mu$ V/m) - limit (dB $\mu$ V/m)

Test Mode:	Normal Working Mode
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(Below 1GHz)

Peak Detector   
 Quasi Peak Limit 



### Test Data

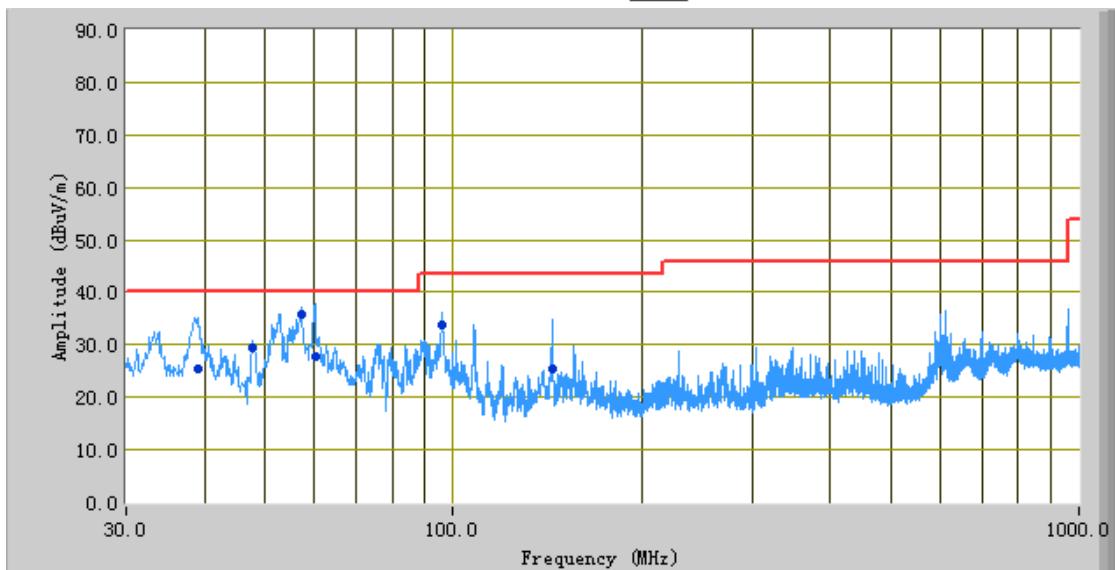
Horizontal Polarity Plot @3m

Frequency (MHz)	Quasi Peak (dB $\mu$ V/m)	Azimuth	Polarity (H/V)	Height (cm)	Factors (dB)	Limit (dB $\mu$ V/m)	Margin (dB)
83.88	30.96	34.00	H	342.00	-36.55	40.00	-9.04
107.85	35.87	212.00	H	268.00	-32.24	43.50	-7.63
89.36	34.01	182.00	H	196.00	-35.53	43.50	-9.49
59.92	28.78	237.00	H	258.00	-37.65	40.00	-11.22
43.13	28.92	218.00	H	299.00	-35.30	40.00	-11.08
38.80	28.11	238.00	H	397.00	-33.90	40.00	-11.89

Test Mode:	Normal Working Mode
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(Below 1GHz)

Peak Detector   
 Quasi Peak Limit 



### Test Data

#### Vertical Polarity Plot @3m

Frequency (MHz)	Quasi Peak (dB $\mu$ V/m)	Azimuth	Polarity (H/V)	Height (cm)	Factors (dB)	Limit (dB $\mu$ V/m)	Margin (dB)
60.03	27.70	217.00	V	99.00	-37.44	40.00	-12.30
57.22	35.96	262.00	V	152.00	-36.61	40.00	-4.04
38.84	25.52	233.00	V	124.00	-28.75	40.00	-14.48
96.04	33.74	252.00	V	110.00	-34.74	43.50	-9.76
144.00	25.49	147.00	V	112.00	-31.11	43.50	-18.01
47.99	29.36	256.00	V	108.00	-33.36	40.00	-10.64

Note: The highest frequency of the internal sources of the EUT is less than 108MHz, so the measurement shall only be made up to 1GHz.

## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted Emissions</b>					
R&S EMI Test Receiver	ESPI3	101216	11/04/2014	11/03/2015	<input checked="" type="checkbox"/>
V-LISN	ESH3-Z5	838979/005	09/27/2014	09/26/2015	<input checked="" type="checkbox"/>
Com-Power Transient Limiter	LIT-153	531021	10/09/2014	10/08/2015	<input checked="" type="checkbox"/>
SIEMIC Labview Conducted Emissions software	V1.0	N/A	N/A	N/A	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
Hp Spectrum Analyzer	8563E	3821A09023	10/09/2014	10/08/2015	<input checked="" type="checkbox"/>
R&S EMI Receiver	ESPI3	101216	11/04/2014	11/03/2015	<input checked="" type="checkbox"/>
Antenna (30MHz~6GHz)	JB6	A121411	06/04/2015	06/03/2016	<input checked="" type="checkbox"/>
INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/09/2014	10/08/2015	<input type="checkbox"/>
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/27/2014	10/26/2015	<input checked="" type="checkbox"/>
MITEQ Pre-Amplifier (0.1 ~ 18GHz)	LPA-6-30	1451709	06/25/2015	06/24/2016	<input type="checkbox"/>
SIEMIC Labview Radiated Emissions software	V1.0	N/A	N/A	N/A	<input checked="" type="checkbox"/>

## Annex B. EUT And Test Setup Photographs

### Annex B.i. Photograph EUT Internal Photo



Front View of EUT



Rear View of EUT

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Top View of EUT



Bottom View of EUT

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Left View of EUT



Right View of EUT

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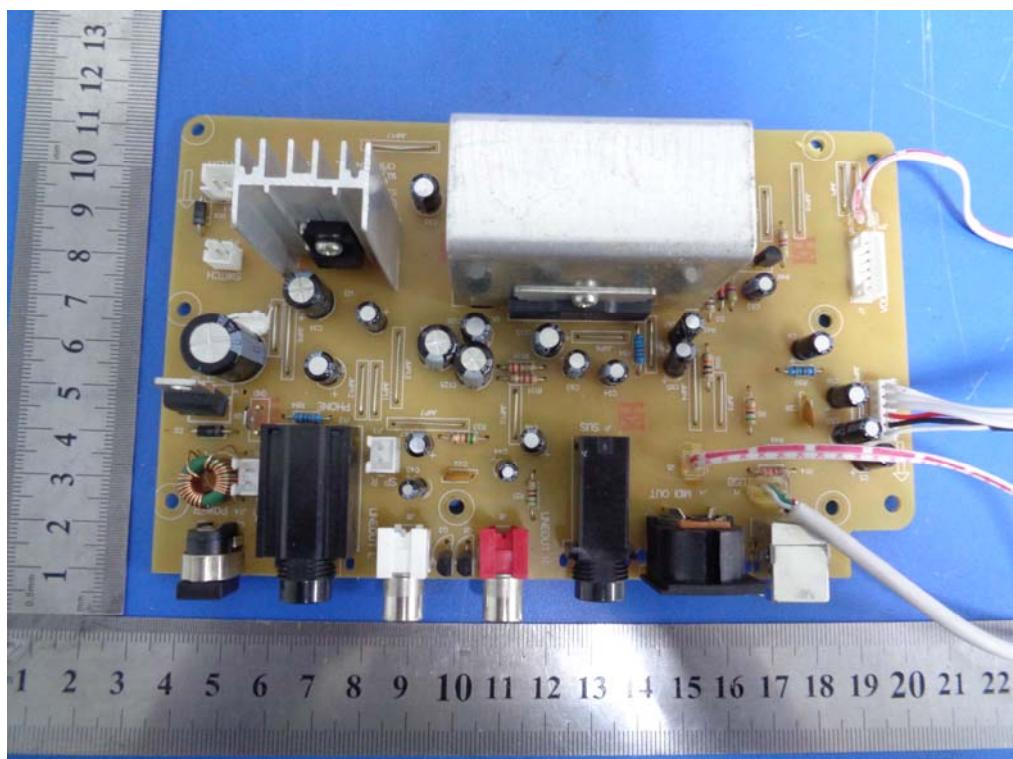


EUT – Port Front View

Annex B.ii. Photograph EUT Internal Photo

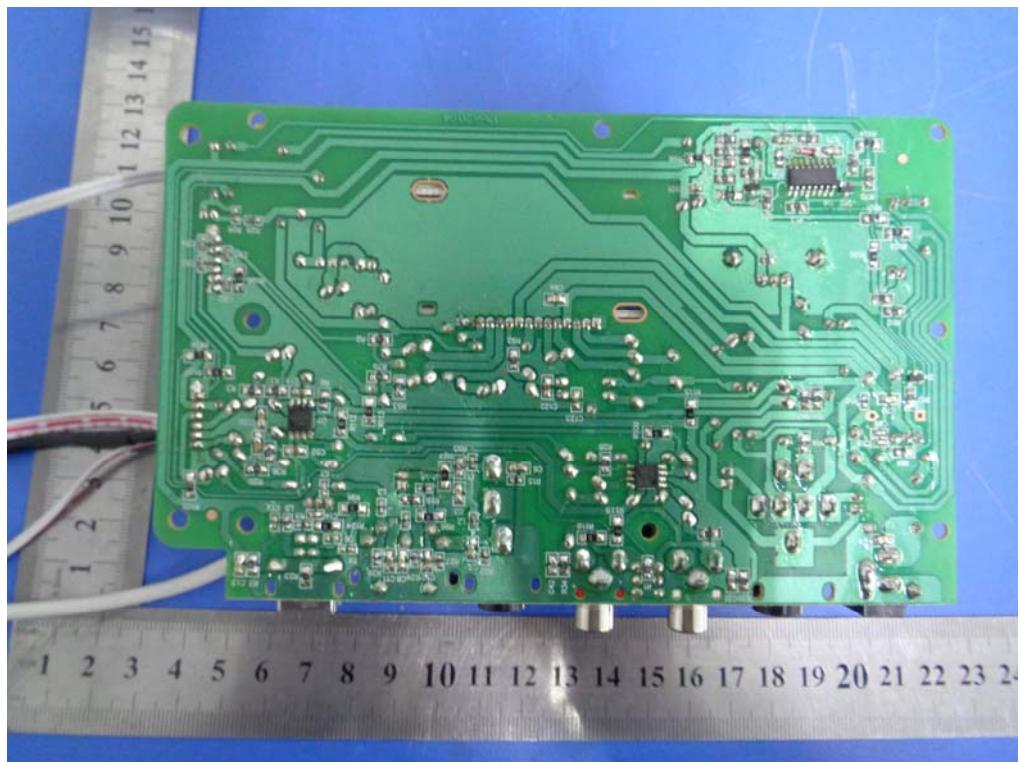


Uncover - Front View



EUT PCBA 1- Front View

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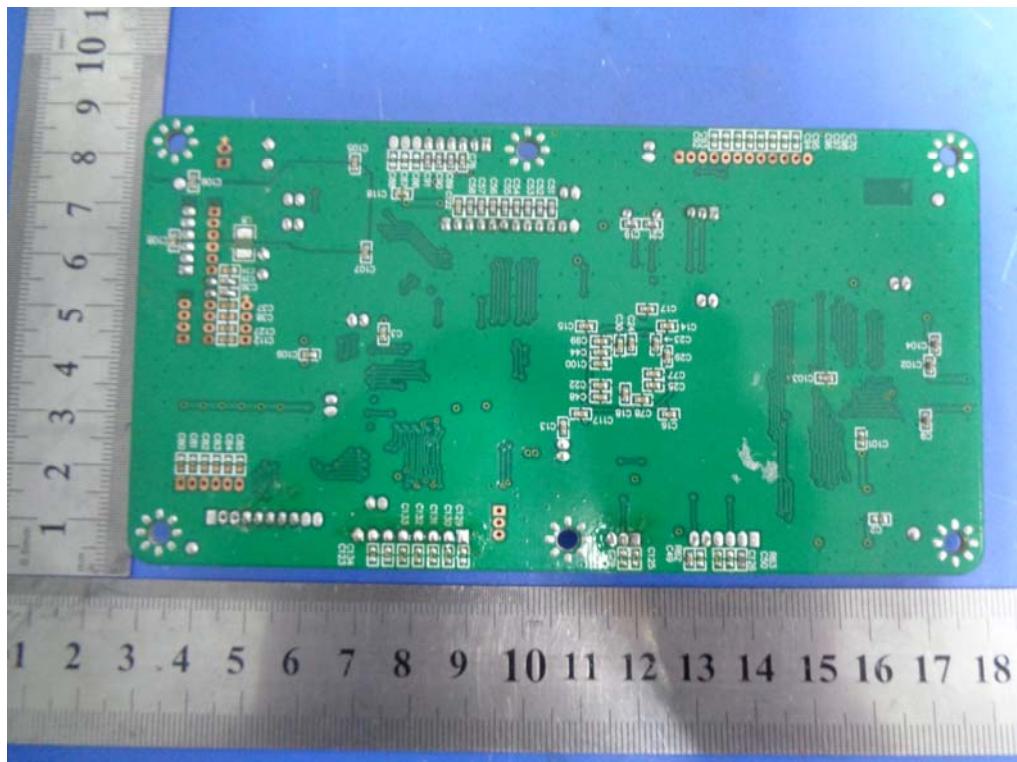


EUT PCBA 1- Rear View

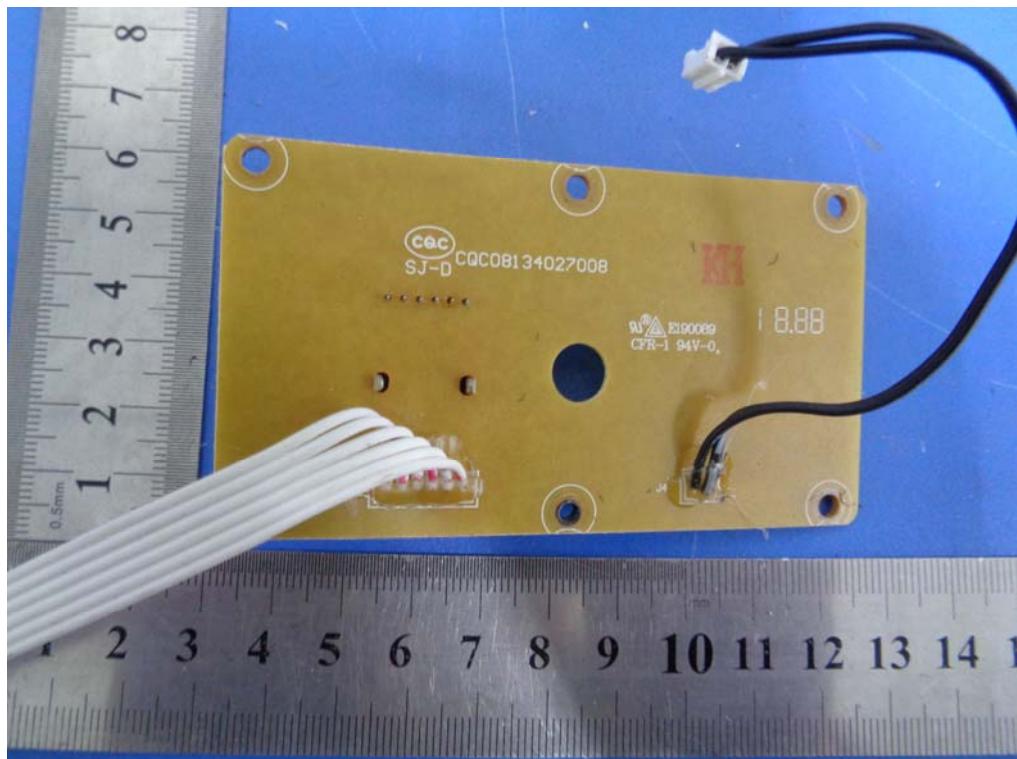


EUT PCBA 2- Front View

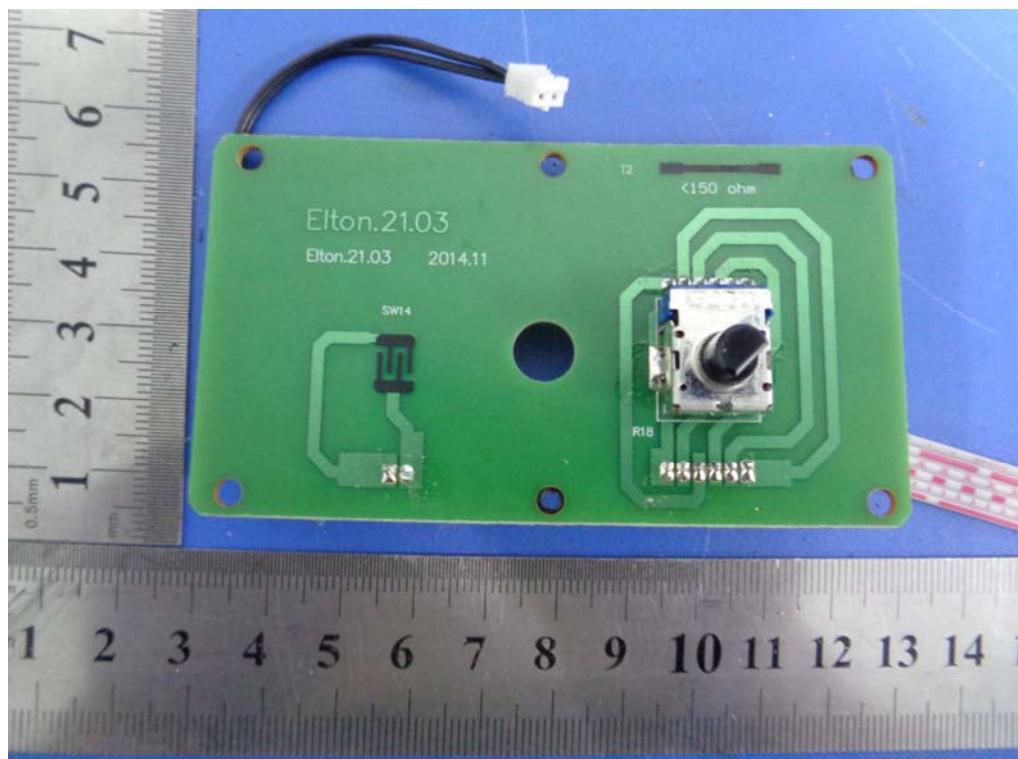
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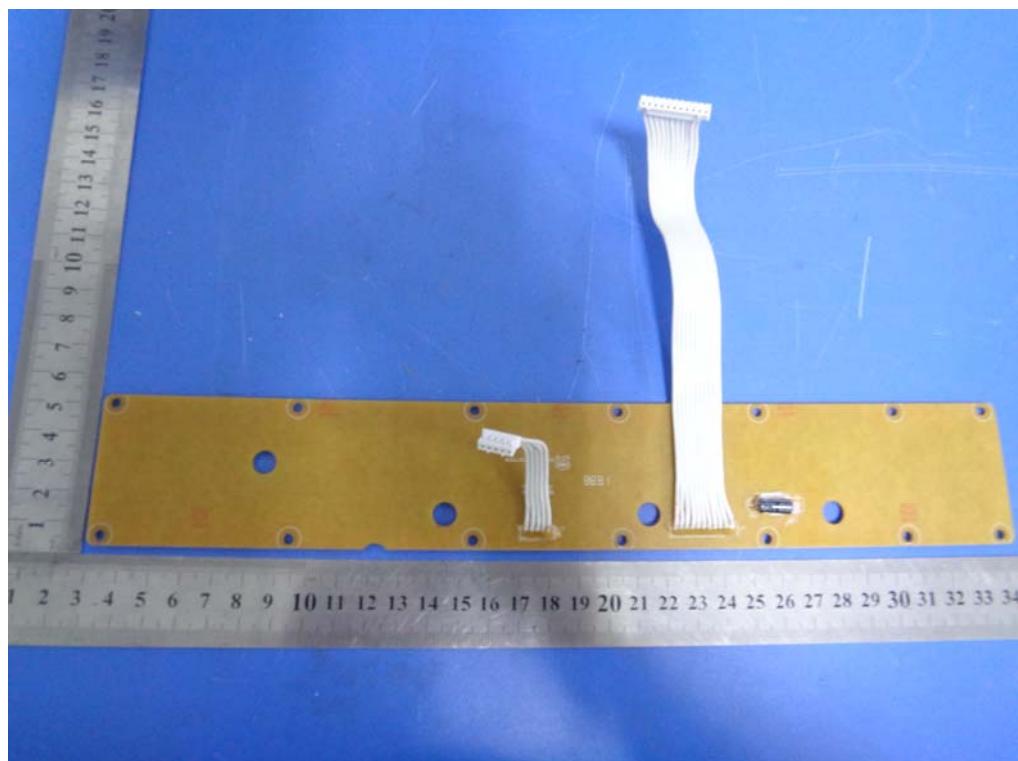
EUT PCBA 2- Rear View



EUT PCBA 3- Front View

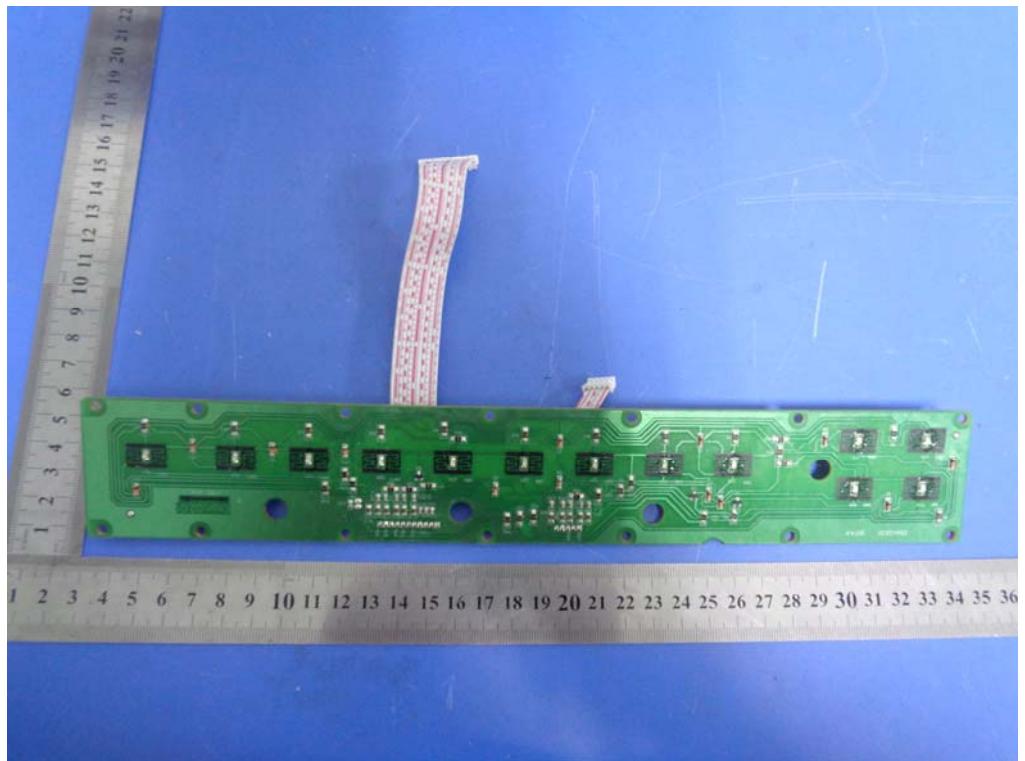


EUT PCBA 3- Rear View



EUT PCBA 4- Front View

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EUT PCBA 4- Rear View

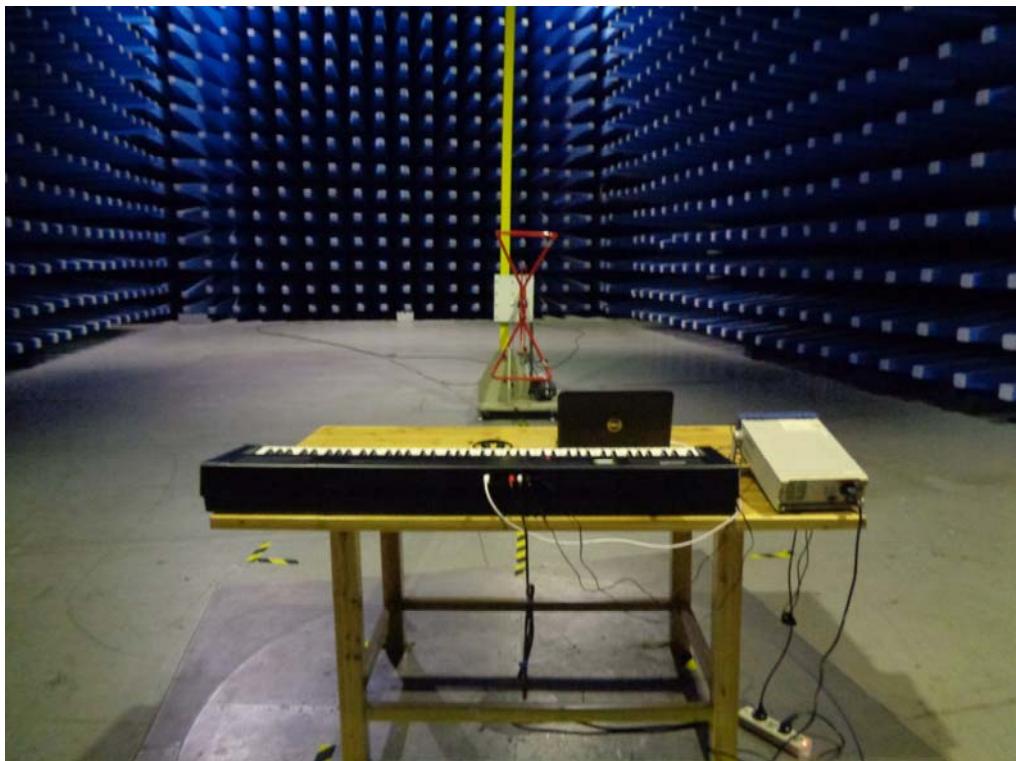
**Annex B.iii. Photograph Test Setup Photo**



Conducted Emissions Setup Front View



Conducted Emissions Setup Side View

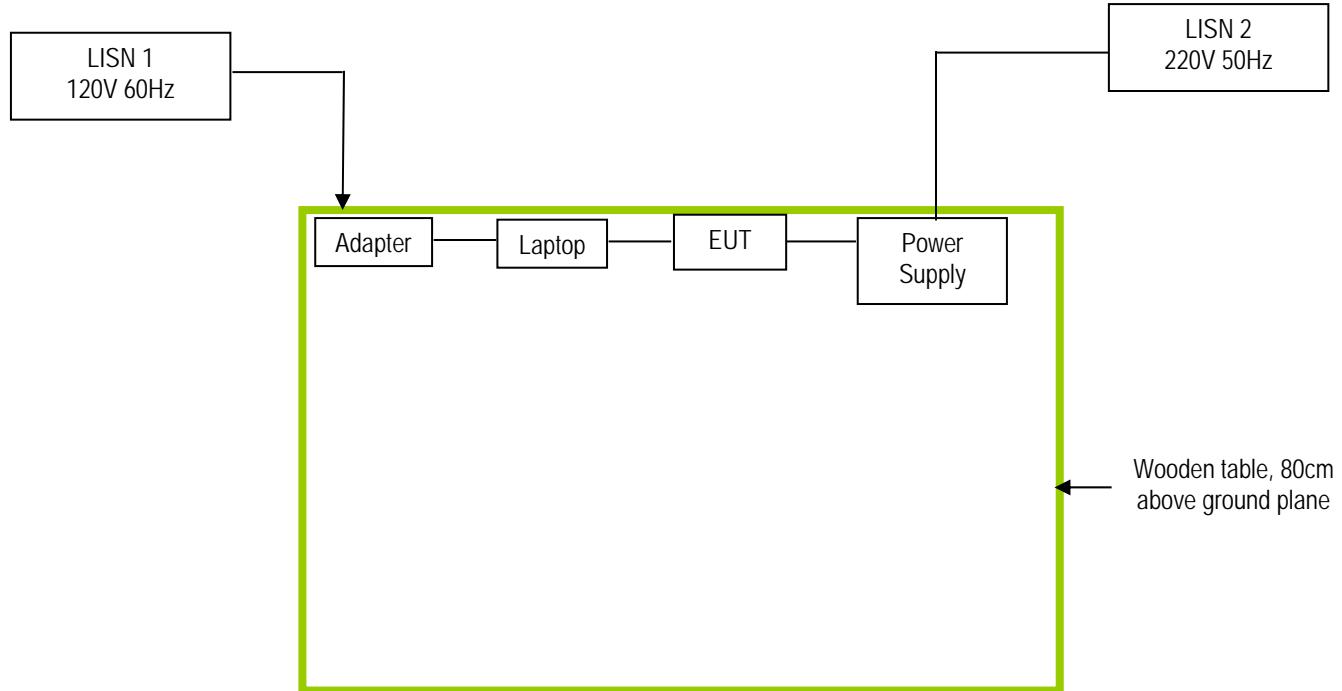


Radiated Emissions Setup Below 1GHz Front View

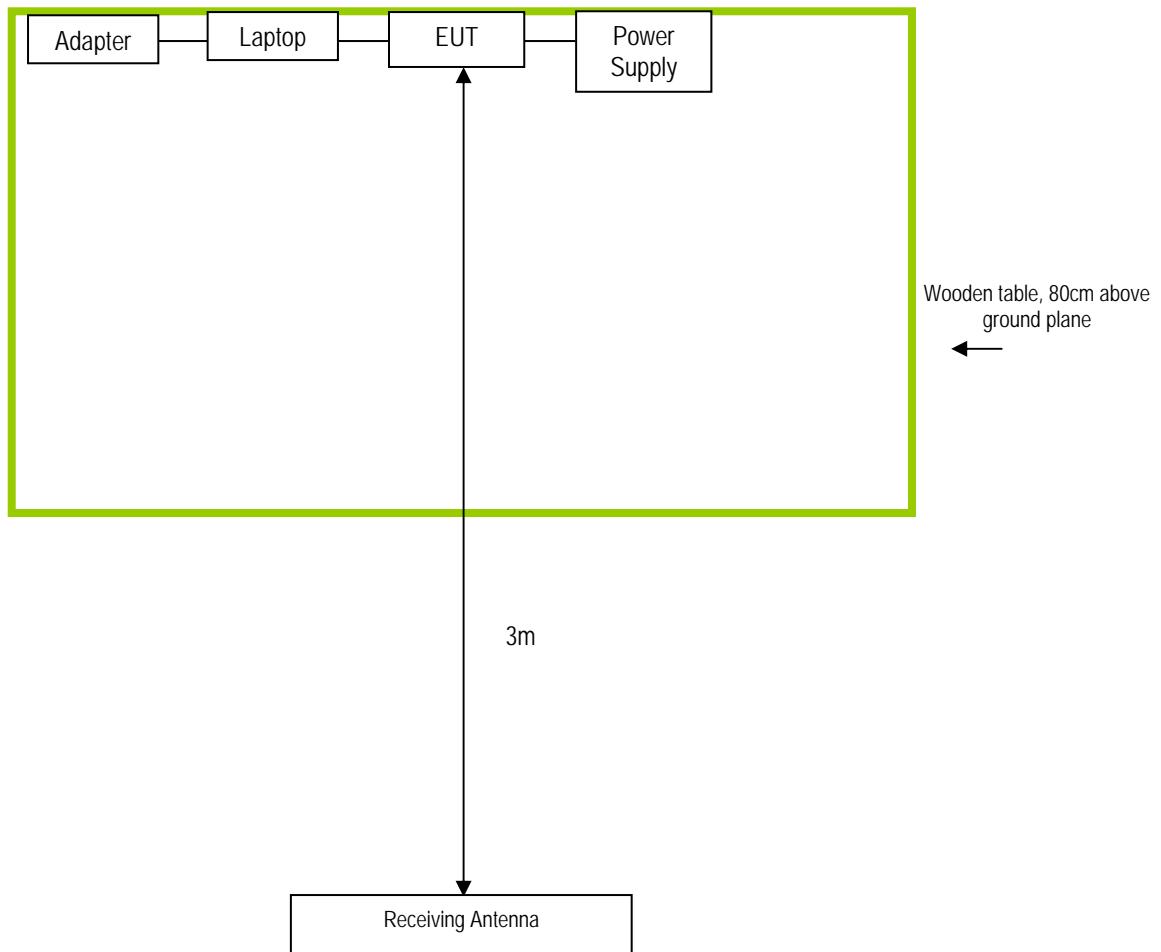
## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

### Annex C.i. TEST SET UP BLOCK

Block Configuration Diagram for Conducted Emissions



### Block Configuration Diagram for Radiated Emissions



### Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description	Model	Calibration Due Date
Gateway	Laptop	MS2288 & LXWHF02013951C3CA92200	N/A
BK PRECISION	DC Power Supply	1786B&169D12111	N/A

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## Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see Attachment

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## Annex E. DECLARATION OF SIMILARITY

N/A