

# TEST REPORT

**Product Name** : Wireless Headphones  
**Brand Mark** : SOUNDPEATS  
**Model No.** : Engine4  
**Extension Model** : Q30 HD+,Q40 HS,Mini HS,Capsule 3SE,  
Free3 Crystal,Air4 Sport,Capsule4,Capsu  
le4 Pro,Opera07,Opera09  
**FCC ID** : 2AFTU-DD034  
**Report Number** : BLA-EMC-202302-A3602  
**Date of Sample Receipt** : 2023/2/23  
**Date of Test** : 2023/2/23 to 2023/3/2  
**Date of Issue** : 2023/3/5  
**Test Standard** : 47 CFR Part 15, Subpart C 15.247  
**Test Result** : Pass

Prepared for:

**Shenzhen Soundsoul Information Technology Co.,Ltd**  
**Room 1308-1309.Building B,Huihai Square,Chuangye Road, Longhua**  
**District,Shenzhen,Guangdong,China**

Prepared by:

**BlueAsia of Technical Services(Shenzhen) Co.,Ltd.**  
**Building C, No. 107, Shihuan Road, Shiyuan Sub-District, Baoan District,**  
**Shenzhen, Guangdong Province, China**  
**TEL: +86-755-23059481**

Compiled by: *charlie*  
Approved by: *Blue Zheng*

Review by: *Sueels*  
Date: 2023/3/5



**REPORT REVISE RECORD**

<b>Version No.</b>	<b>Date</b>	<b>Description</b>
00	2023/3/5	Original

BlueAsia

## TABLE OF CONTENTS

<b>1 TEST SUMMARY</b> .....	<b>6</b>
<b>2 GENERAL INFORMATION</b> .....	<b>7</b>
<b>3 GENERAL DESCRIPTION OF E.U.T.</b> .....	<b>7</b>
<b>4 TEST ENVIRONMENT</b> .....	<b>8</b>
<b>5 TEST MODE</b> .....	<b>8</b>
<b>6 MEASUREMENT UNCERTAINTY</b> .....	<b>8</b>
<b>7 DESCRIPTION OF SUPPORT UNIT</b> .....	<b>9</b>
<b>8 LABORATORY LOCATION</b> .....	<b>9</b>
<b>9 TEST INSTRUMENTS LIST</b> .....	<b>10</b>
<b>10 DWELL TIME</b> .....	<b>12</b>
10.1 LIMITS .....	12
10.2 BLOCK DIAGRAM OF TEST SETUP .....	12
10.3 TEST DATA .....	13
<b>11 HOPPING CHANNEL NUMBER</b> .....	<b>14</b>
11.1 LIMITS .....	14
11.2 BLOCK DIAGRAM OF TEST SETUP .....	14
11.3 TEST DATA .....	14
<b>12 CARRIER FREQUENCIES SEPARATION</b> .....	<b>15</b>
12.1 LIMITS .....	15
12.2 BLOCK DIAGRAM OF TEST SETUP .....	15
12.3 TEST DATA .....	15
<b>13 20DB BANDWIDTH</b> .....	<b>16</b>
13.1 BLOCK DIAGRAM OF TEST SETUP .....	16
13.2 TEST DATA .....	16
<b>14 CONDUCTED PEAK OUTPUT POWER</b> .....	<b>17</b>
14.1 LIMITS .....	17
14.2 BLOCK DIAGRAM OF TEST SETUP .....	17
14.3 TEST DATA .....	18
<b>15 CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ)</b> .....	<b>19</b>

15.1 LIMITS .....	19
15.2 BLOCK DIAGRAM OF TEST SETUP .....	19
15.3 PROCEDURE .....	19
15.4 TEST DATA .....	21
<b>16 RADIATED SPURIOUS EMISSIONS .....</b>	<b>23</b>
16.1 LIMITS .....	23
16.2 BLOCK DIAGRAM OF TEST SETUP .....	24
16.3 PROCEDURE .....	24
16.4 TEST DATA .....	26
<b>17 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS .....</b>	<b>34</b>
17.1 LIMITS .....	34
17.2 BLOCK DIAGRAM OF TEST SETUP .....	35
17.3 PROCEDURE .....	35
17.4 TEST DATA .....	37
<b>18 ANTENNA REQUIREMENT .....</b>	<b>41</b>
18.1 CONCLUSION .....	41
<b>19 CONDUCTED SPURIOUS EMISSIONS .....</b>	<b>42</b>
19.1 LIMITS .....	42
19.2 BLOCK DIAGRAM OF TEST SETUP .....	42
19.3 TEST DATA .....	43
<b>20 CONDUCTED BAND EDGES MEASUREMENT .....</b>	<b>44</b>
20.1 LIMITS .....	44
20.2 BLOCK DIAGRAM OF TEST SETUP .....	44
20.3 TEST DATA .....	45
<b>21 APPENDIX .....</b>	<b>46</b>
21.1 MAXIMUM CONDUCTED OUTPUT POWER .....	46
21.2 -20dB BANDWIDTH .....	51
21.3 OCCUPIED CHANNEL BANDWIDTH .....	56
21.4 BAND EDGE .....	61
21.5 BAND EDGE(HOPPING) .....	68
21.6 CONDUCTED RF SPURIOUS EMISSION .....	75
21.7 CARRIER FREQUENCIES SEPARATION .....	85
21.8 NUMBER OF HOPPING CHANNEL .....	87

21.9 DWELL TIME ..... 89

**APPENDIX A: PHOTOGRAPHS OF TEST SETUP ..... 97**

**APPENDIX B: PHOTOGRAPHS OF EUT ..... 99**

BlueAsia

## 1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass

## 2 GENERAL INFORMATION

<b>Applicant</b>	Shenzhen Soundsoul Information Technology Co.,Ltd
<b>Address</b>	Room 1308-1309, Building B,Huihai Square,Chuangye Road, Longhua District,Shenzhen,Guangdong,China
<b>Manufacturer</b>	Shenzhen Soundsoul Information Technology Co.,Ltd
<b>Address</b>	Room 1308-1309,Building B,Huihai Square,Chuangye Road, Longhua District,Shenzhen,Guangdong,China
<b>Factory</b>	N/A
<b>Address</b>	N/A
<b>Product Name</b>	Wireless Headphones
<b>Test Model No.</b>	Engine4
<b>Extension Model</b>	Q30 HD+,Q40 HS,Mini HS,Capsule 3SE,Free3 Crystal,Air4 Sport,Capsule4,Capsule4 Pro,Opera07,Opera09
<b>Remark</b>	All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are model name for commercial purpose.

## 3 GENERAL DESCRIPTION OF E.U.T.

<b>Hardware Version</b>	N/A
<b>Software Version</b>	N/A
<b>Operation Frequency:</b>	2402MHz-2480MHz
<b>Modulation Type:</b>	GFSK, pi/4DQPSK, 8DPSK
<b>Channel Spacing:</b>	1MHz
<b>Number of Channels:</b>	79
<b>Antenna Type:</b>	internal antenna
<b>Antenna Gain:</b>	2.5dBi(Provided by the customer)

#### 4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	25°C	3.6Vdc

#### 5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in continuously transmitting mode with modulation. (hopping and non hopping mode all have been tested, non hopping mode is worse case for RE )
Remark: Full battery is used during all test except ac conducted emission, DH1, DH3, DH5 all have been tested, during the test, GFSK, Pi/4QPSK, 8-DPSK modulation were all pre-scanned Only the 8-DPSK of the worst mode would be recorded in this report.	

#### 6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission(9kHz-30MHz)	±4.34dB
Radiated Emission(30Mz-1000MHz)	±4.24dB
Radiated Emission(1GHz-18GHz)	±4.68dB
AC Power Line Conducted Emission(150kHz-30MHz)	±3.45dB



## 7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
AC Adapter	UGREEN	CD112	N/A	N/A
PC	HASEE	K610D	N/A	N/A

## 8 LABORATORY LOCATION

All tests were performed at:  
BlueAsia of Technical Services(Shenzhen) Co., Ltd.  
Building C, No. 107, Shihuan Road, Shiyuan Sub-District, Baoan District, Shenzhen, Guangdong Province,  
China  
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673  
No tests were sub-contracted.

## 9 TEST INSTRUMENTS LIST

Test Equipment Of Radiated Spurious Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber 1	SKET	966	N/A	2020/11/10	2023/11/9
Chamber 2	SKET	966	N/A	2021/07/20	2024/07/19
Spectrum	R&S	FSP40	100817	2022/09/15	2023/09/14
Receiver	R&S	ESR7	101199	2022/09/15	2023/09/14
Receiver	R&S	ESPI7	101477	2022/07/16	2023/07/15
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2022/09/15	2023/09/14
Horn Antenna	Schwarzbeck	BBHA9120D	01892 P:00331	2022/09/13	2025/09/12
Amplifier	SKET	LNPA_30M01G-30	SK2021060801	2022/07/16	2023/07/15
Amplifier	SKET	PA-000318G-45	N/A	2022/09/13	2023/09/12
Amplifier	SKET	LNPA_18G40G-50	SK2022071301	2022/07/14	2023/07/13
Filter group	SKET	2.4G/5G Filter group r	N/A	2022/07/16	2023/07/15
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2022/9/14	2025/9/13
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

<b>Test Equipment Of Conducted Emissions at AC Power Line (150kHz-30MHz)</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>S/N</b>	<b>Cal.Date</b>	<b>Cal.Due</b>
Shield room	SKET	833	N/A	2020/11/25	2023/11/24
Receiver	R&S	ESPI3	101082	2022/09/14	2023/09/13
LISN	R&S	ENV216	3560.6550.15	2022/09/14	2023/09/13
LISN	AT	AT166-2	AKK1806000003	2022/09/14	2023/09/13
ISN	TESEQ	ISNT8-cat6	53580	2022/09/14	2023/09/13
Single-channel vehicle artificial power network	Schwarzbeck	NNBM 8124	01045	2022/08/17	2023/08/16
Single-channel vehicle artificial power network	Schwarzbeck	NNBM 8124	01075	2022/08/17	2023/08/16
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A

<b>Test Equipment Of RF Conducted Test</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>S/N</b>	<b>Cal.Date</b>	<b>Cal.Due</b>
Spectrum	R&S	FSP40	100817	2022/09/15	2023/09/14
Spectrum	Agilent	N9020A	MY49100060	2022/09/07	2023/09/06
Spectrum	KEYSIGHT	N9030A	MY52350152	2022/07/01	2023/06/30
Spectrum	KEYSIGHT	N9010A	MY54330814	2022/07/01	2023/06/30
Signal Generator	Agilent	N5182A	MY47420955	2022/09/07	2023/09/06
Signal Generator	Agilent	E8257D	MY44320250	2022/07/01	2023/06/30
Signal Generator	Agilent	N5181A	MY46240904	2022/08/02	2023/08/01
Signal Generator	R&S	CMW500	132429	2022/09/07	2023/09/06
BluetoothTester	Anritsu	MT8852B	06262047872	2022/09/07	2023/09/06
Power probe	DARE	RPR3006W	14100889SN042	2022/09/07	2023/09/06
DCPowersupply	zhaoxin	KXN-305D	20K305D1221363	2022/09/14	2023/09/13
DCPowersupply	zhaoxin	RXN-1505D	19R1505D050168	2022/09/14	2023/09/13
Audio Analyzer	Audioprecision	N/A	ATSI-41094	2022/7/1	2023/6/30
2.4GHz/5GHz RF Test software	MTS	MTS 8310	Version 2.0.0.0	N/A	N/A

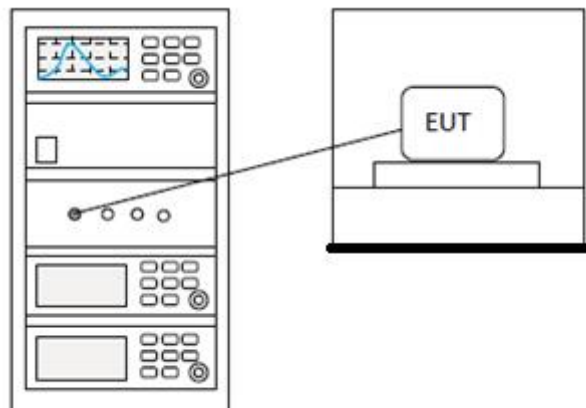
## 10 DWELL TIME

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.4
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Charlie
Temperature	25°C
Humidity	60%

### 10.1 LIMITS

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

### 10.2 BLOCK DIAGRAM OF TEST SETUP



### 10.3 TEST DATA

**Pass: Please Refer To Appendix: Appendix1 For Details**

BlueAsia

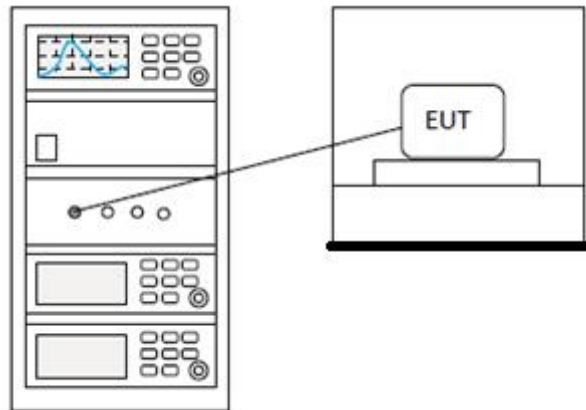
## 11 HOPPING CHANNEL NUMBER

<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.3
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 11.1 LIMITS

<b>Frequency range(MHz)</b>	<b>Number of hopping channels (minimum)</b>
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

### 11.2 BLOCK DIAGRAM OF TEST SETUP



### 11.3 TEST DATA

**Pass: Please Refer To Appendix: Appendix1 For Details**

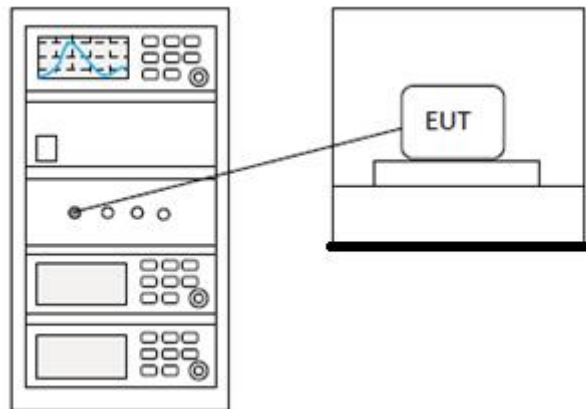
## 12 CARRIER FREQUENCIES SEPARATION

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Charlie
Temperature	25°C
Humidity	60%

### 12.1 LIMITS

<b>Limit:</b>	2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W
---------------	--

### 12.2 BLOCK DIAGRAM OF TEST SETUP



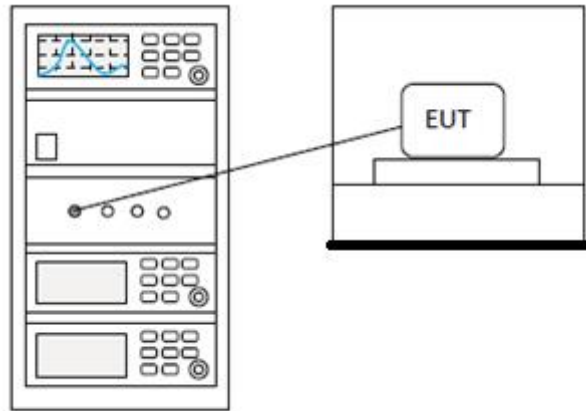
### 12.3 TEST DATA

<b>Pass: Please Refer To Appendix: Appendix1 For Details</b>
--

### 13 20DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.7
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Charlie
Temperature	25°C
Humidity	60%

#### 13.1 BLOCK DIAGRAM OF TEST SETUP



#### 13.2 TEST DATA

**Pass: Please Refer To Appendix: Appendix1 For Details**



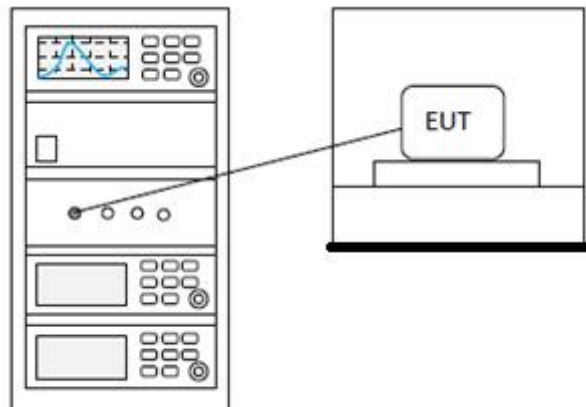
## 14 CONDUCTED PEAK OUTPUT POWER

<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.5
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 14.1 LIMITS

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for $\geq 50$ hopping channels
	0.25 for $25 \leq$ hopping channels $< 50$
	1 for digital modulation
2400-2483.5	1 for $\geq 75$ non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

### 14.2 BLOCK DIAGRAM OF TEST SETUP



### 14.3 TEST DATA

**Pass: Please Refer To Appendix: Appendix1 For Details**

BlueAsia

## 15 CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ)

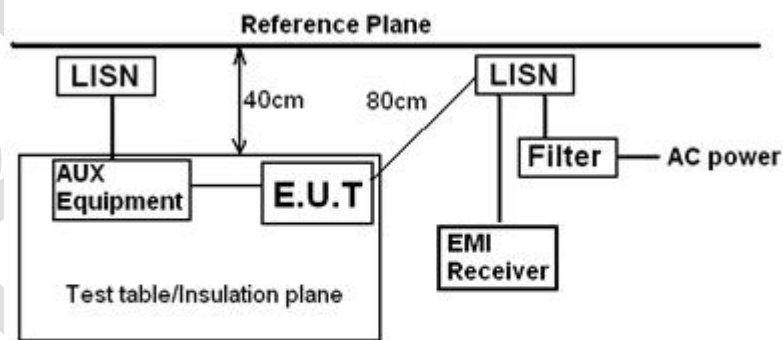
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Charlie
Temperature	25°C
Humidity	60%

### 15.1 LIMITS

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### 15.2 BLOCK DIAGRAM OF TEST SETUP



Remark:  
 E.U.T: Equipment Under Test  
 LISN: Line Impedance Stabilization Network  
 Test table height=0.8m

### 15.3 PROCEDURE

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50H + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
  - 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
  - 5) 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 on conducted measurement.
- Remark: LISN=Read Level+ Cable Loss+ LISN Factor

BlueAsia