



**SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch**

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053
Fax: +86 (0) 755 2671 0594
Email: ee.shenzhen@sgs.com

Report No.: SZEM171001099701
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TEST REPORT

Application No.: SZEM1710010997IT
Applicant: RAAMaudio UK LTD t/a Pi Supply
Address of Applicant: Unit 4 Yew Green Business Court, Bells Yew Green, East Sussex, TN39BJ, United Kingdom
Manufacturer: RAAMaudio UK LTD t/a Pi Supply
Address of Manufacturer: Unit 4 Yew Green Business Court, Bells Yew Green, East Sussex, TN39BJ, United Kingdom
Factory: Embest Technology Co., Ltd
Address of Factory: Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave. No.1183, Nanshan District, Shenzhen, Guangdong, China
Equipment Under Test (EUT):
EUT Name: PiJuice HAT
Model No.: PiJuice HAT
Standard(s) : ICES-003:Issue 6, 2016
Date of Receipt: 2017-10-30
Date of Test: 2017-10-30 to 2017-11-03
Date of Issue: 2017-11-08

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.



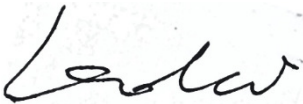

Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2017-11-08		Original

Authorized for issue by:				
				
		Leo Lai /Project Engineer		
				
		Eric Fu /Reviewer		



2 Test Summary

Emission Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at Mains Terminals (150kHz-30MHz)	ICES-003:Issue 6, 2016	ANSI C63.4	Class B	Pass
Radiated Emissions (30MHz-1GHz)	ICES-003:Issue 6, 2016	ANSI C63.4	Class B	Pass
Radiated Emissions (above 1GHz)	ICES-003:Issue 6, 2016	ANSI C63.4	Class B	Pass

Internal Source	Upper Frequency
Below 1.705MHz	30MHz
1.705MHz to 108MHz	1GHz
108MHz to 500MHz	2GHz
500MHz to 1GHz	5GHz
Above 1GHz	5th harmonic of the highest frequency or 40GHz, whichever is lower



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3.7 or DC 5V from USB port
Cable:	1m shielded USB cable
Internal source:	Less than 108MHz

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
U-disk	Sandisk	SDCZ60-016G	REF. No.SEA0100
TF Card	Kingston	SDC8GB	REF. No.SEA0400
Micro USB Cable	PHILIPS	SWR2101	REF. No.SEA0700
HDMI Cable	Apple	MC838FE/B	REF. No.SEA0900
AC/DC Adapter	SGS	DC 5V	REF. No.SEA0500
Monitor	AOC	280LM00004	KBWG9JA000563

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Conduction emission	3.0dB (150kHz to 30MHz)
2	Radiated emission	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-6GHz)
3	Temperature test	1 °C
4	Humidity test	3%



4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China.
518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 3816.01.

- **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



5 Equipment List

Conducted Emissions at Mains Terminals (150kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	ChangZhou ZhongYu	GB-88	SEM001-06	2017-05-10	2018-05-09
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2017-07-13	2018-07-12
LISN	Rohde & Schwarz	ENV216	SEM007-01	2017-09-27	2018-09-26
LISN	ETS-LINDGREN	3816/2	SEM007-02	2017-04-14	2018-04-13
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2017-04-14	2018-04-13

Radiated Emissions (30MHz-1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2017-07-13	2018-07-12
EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2017-09-27	2018-09-26
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2017-04-14	2018-04-13

Radiated Emissions (above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2017-05-02	2020-05-01
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2017-07-13	2018-07-12
EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-09	2017-06-05	2018-06-04
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-06	2015-06-14	2018-06-13
Low Noise Amplifier (100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2017-09-27	2018-09-26



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General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2017-09-29	2018-09-28
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2017-09-29	2018-09-28
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2017-09-29	2018-09-28
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2017-04-18	2018-04-17

6 Emission Test Results

6.1 Conducted Emissions at Mains Terminals (150kHz-30MHz)

Test Requirement:	ICES-003:Issue 6, 2016
Test Method:	ANSI C63.4
Frequency Range:	150kHz to 30MHz
Limit:	
0.15M-0.5MHz	66dB(μV)-56dB(μV) quasi-peak, 56dB(μV)-46dB(μV) average
0.5M-5MHz	56dB(μV) quasi-peak, 46dB(μV) average
5M-30MHz	60dB(μV) quasi-peak, 50dB(μV) average
Detector:	Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz

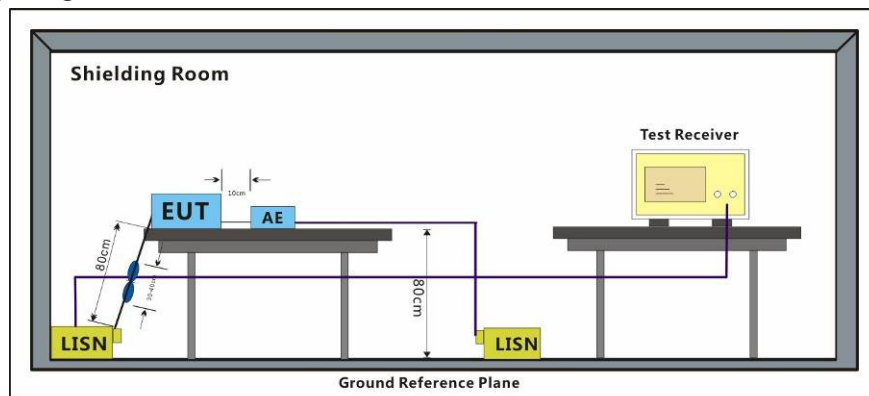
6.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 45 % RH Atmospheric Pressure: 1010 mbar

Test mode a:Data transfer&Video play&Network_Charging

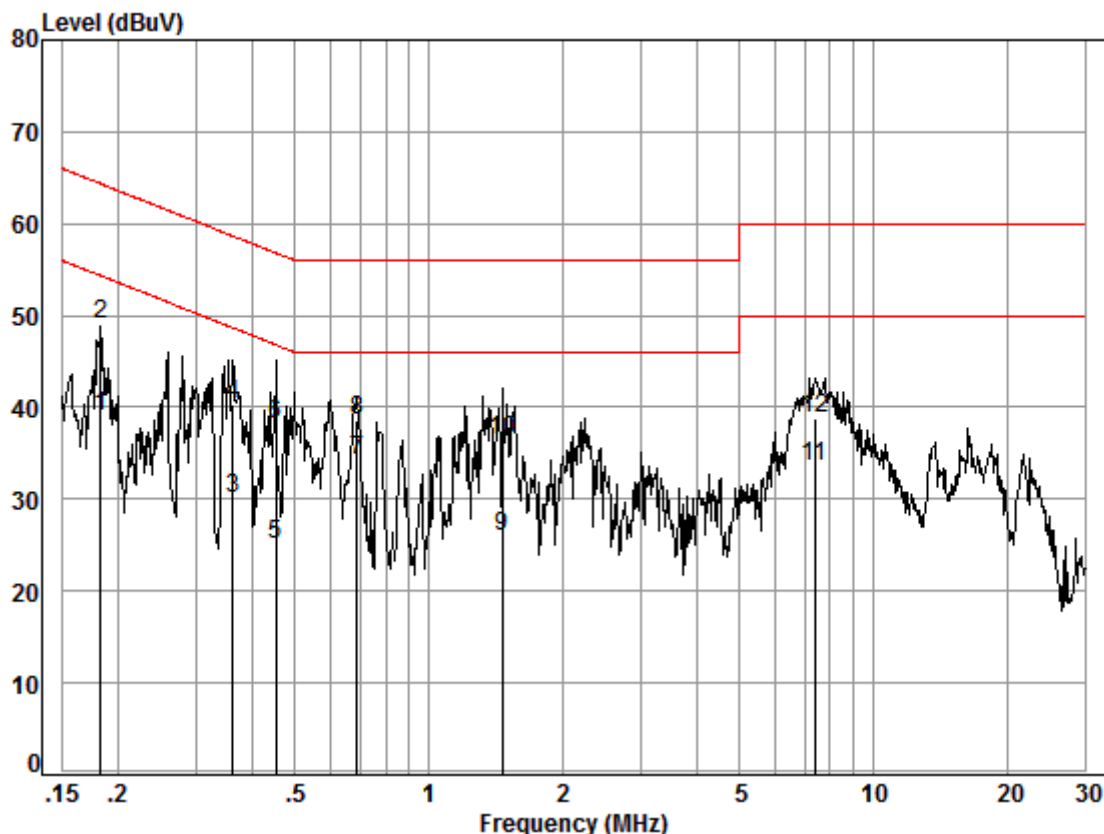
6.1.2 Test Setup Diagram



6.1.3 Measurement Data

An initial pre-scan was performed with peak detector. Quasi-Peak or Average measurement were performed at the frequencies with maximized peak emission were detected.

Mode:a; Line:Live Line



Site : Shielding Room

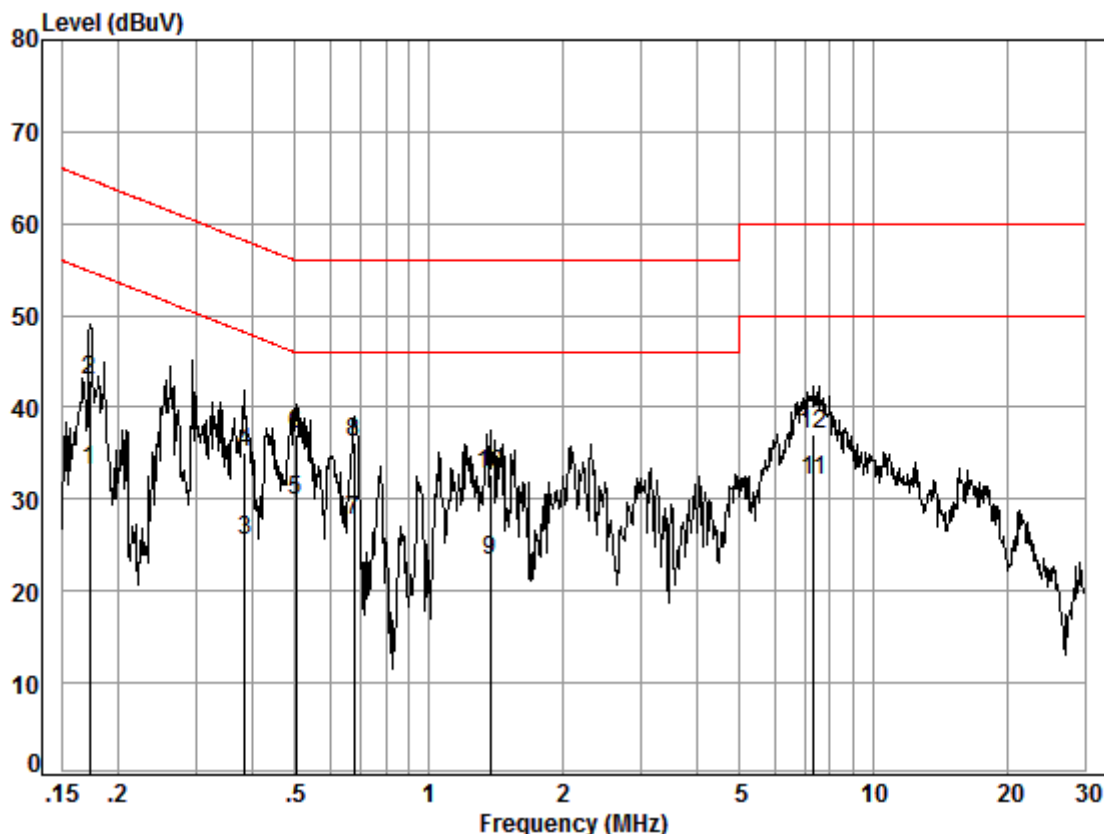
Condition: Line

Job No. : 10997IT

Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.18	0.02	9.51	29.59	39.12	54.37	-15.25	Average
2	0.18	0.02	9.51	39.41	48.94	64.37	-15.43	QP
3	0.36	0.01	9.50	20.52	30.03	48.65	-18.62	Average
4	0.36	0.01	9.50	30.75	40.26	58.65	-18.39	QP
5	0.45	0.01	9.49	15.66	25.16	46.80	-21.64	Average
6	0.45	0.01	9.49	28.67	38.17	56.80	-18.63	QP
7	0.69	0.02	9.49	24.79	34.30	46.00	-11.70	Average
8	0.69	0.02	9.49	29.11	38.62	56.00	-17.38	QP
9	1.46	0.02	9.51	16.44	25.97	46.00	-20.03	Average
10	1.46	0.02	9.51	26.89	36.42	56.00	-19.58	QP
11	7.41	0.01	9.60	23.93	33.54	50.00	-16.46	Average
12	7.41	0.01	9.60	29.19	38.80	60.00	-21.20	QP

Mode:a; Line:Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 10997IT
Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.17	0.02	9.59	23.56	33.17	54.81	-21.64	Average
2	0.17	0.02	9.59	33.34	42.95	64.81	-21.86	QP
3	0.39	0.01	9.59	15.81	25.41	48.17	-22.76	Average
4	0.39	0.01	9.59	25.48	35.08	58.17	-23.09	QP
5	0.50	0.01	9.60	20.30	29.91	46.00	-16.09	Average
6	0.50	0.01	9.60	27.41	37.02	56.00	-18.98	QP
7	0.68	0.02	9.62	18.06	27.70	46.00	-18.30	Average
8	0.68	0.02	9.62	26.65	36.29	56.00	-19.71	QP
9	1.37	0.02	9.63	13.69	23.34	46.00	-22.66	Average
10	1.37	0.02	9.63	23.10	32.75	56.00	-23.25	QP
11	7.37	0.01	9.73	22.26	32.00	50.00	-18.00	Average
12	7.37	0.01	9.73	27.22	36.96	60.00	-23.04	QP

6.2 Radiated Emissions (30MHz-1GHz)

Test Requirement:	ICES-003:Issue 6, 2016
Test Method:	ANSI C63.4
Frequency Range:	30MHz to 1GHz
Measurement Distance:	3m
Limit:	
30MHz -88MHz	40.0(dBμV/m) quasi-peak
88MHz-216MHz	43.5(dBμV/m) quasi-peak
216MHz-960MHz	46.0(dBμV/m) quasi-peak
960MHz-1000MHz	54.0(dBμV/m) quasi-peak
Detector:	Peak for pre-scan (120kHz resolution bandwidth) 30M to1000MHz

6.2.1 E.U.T. Operation

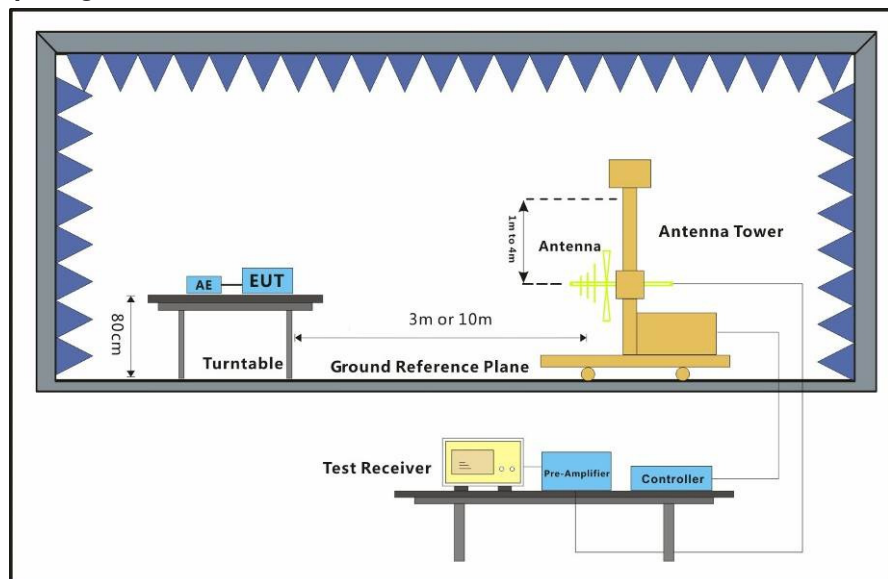
Operating Environment:

Temperature: 24 °C Humidity: 54 % RH Atmospheric Pressure: 1010 mbar

Pretest these mode to find the worst case:
a:Data transfer&Video play&Network_Charging
b: Data transfer&Video play&Network_Battery

The worst case for final test:
a:Data transfer&Video play&Network_Charging

6.2.2 Test Setup Diagram

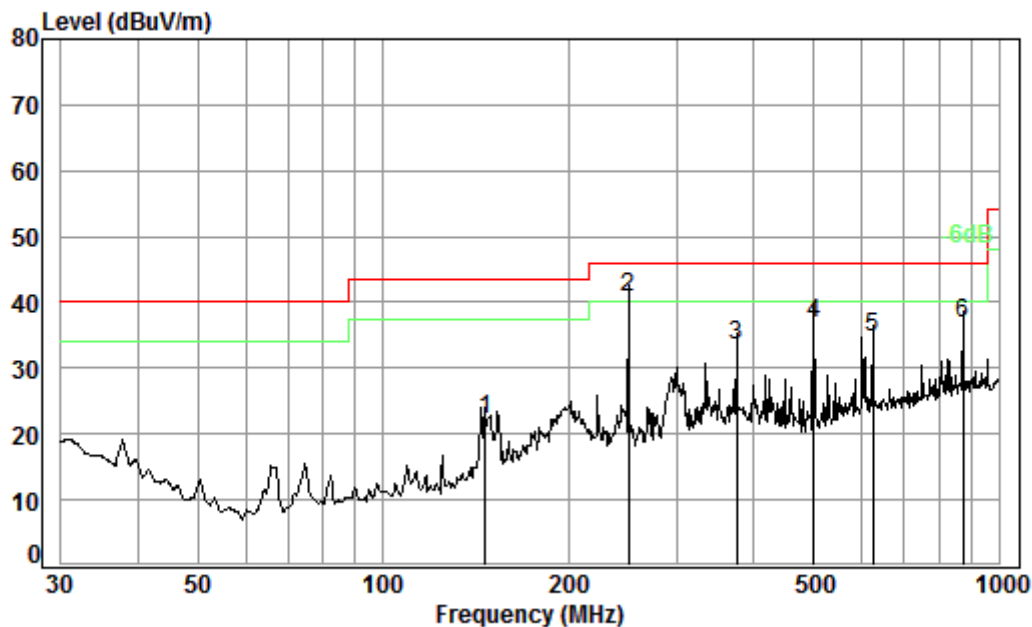


6.2.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities.



Mode:a; Polarization:Horizontal



Condition: 3m HORIZONTAL

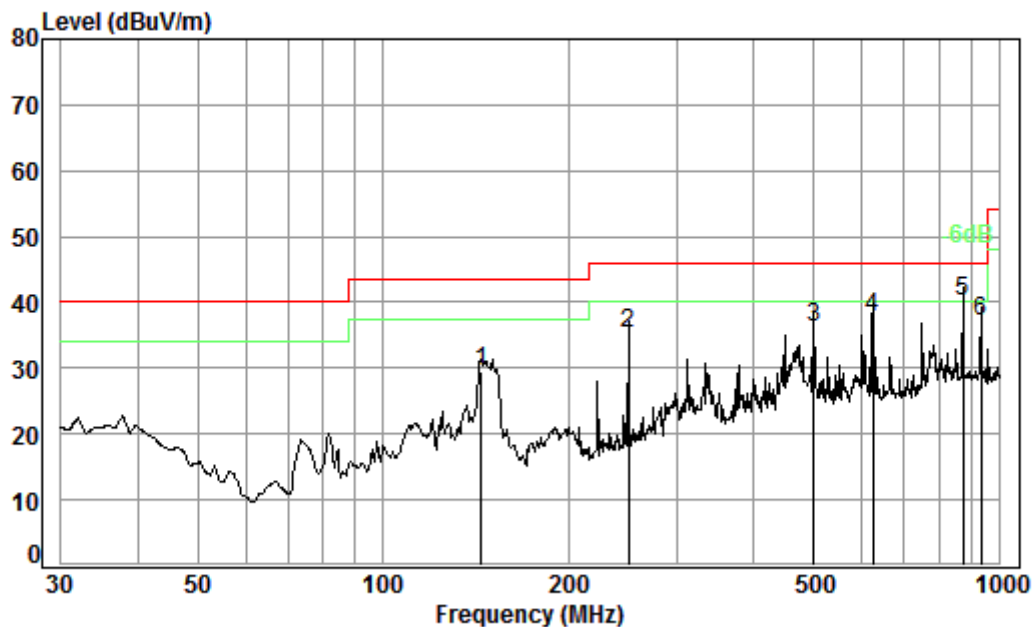
Job No. : 10997IT

Test Mode: a

	Freq	Cable	Ant	Preamp	Read	Limit	Over
	MHz	Loss	Factor	Factor	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dB
1	146.37	1.31	8.67	26.93	39.08	22.13	43.50 -21.37
2 pp	250.30	1.68	12.31	26.54	53.22	40.67	46.00 -5.33
3	375.94	2.14	16.01	26.97	42.22	33.40	46.00 -12.60
4	501.18	2.60	17.83	27.69	43.94	36.68	46.00 -9.32
5	625.08	2.75	20.50	27.51	38.80	34.54	46.00 -11.46
6	875.25	3.50	23.00	26.89	37.05	36.66	46.00 -9.34



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No. : 10997IT

Test Mode: a

	Freq	Cable	Ant	Preamp	Read	Limit	Over
	MHz	Loss	Factor	Factor	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m
1	144.33	1.31	8.49	26.94	46.57	29.43	43.50
2	250.30	1.68	12.31	26.54	47.73	35.18	46.00
3	501.18	2.60	17.83	27.69	43.46	36.20	46.00
4	625.08	2.75	20.50	27.51	42.10	37.84	46.00
5 pp	875.25	3.50	23.00	26.89	40.57	40.18	46.00
6	935.55	3.64	23.30	26.61	36.87	37.20	46.00

6.3 Radiated Emissions (above 1GHz)

Test Requirement: ICES-003:Issue 6, 2016
 Test Method: ANSI C63.4
 Frequency Range: Above 1GHz
 Measurement Distance: 3m
 Limit:
 Above 1GHz 74(dBμV/m) peak, 54(dBμV/m) average
 Detector: Peak for pre-scan (1000kHz resolution bandwidth) 1000M to18000MHz

6.3.1 E.U.T. Operation

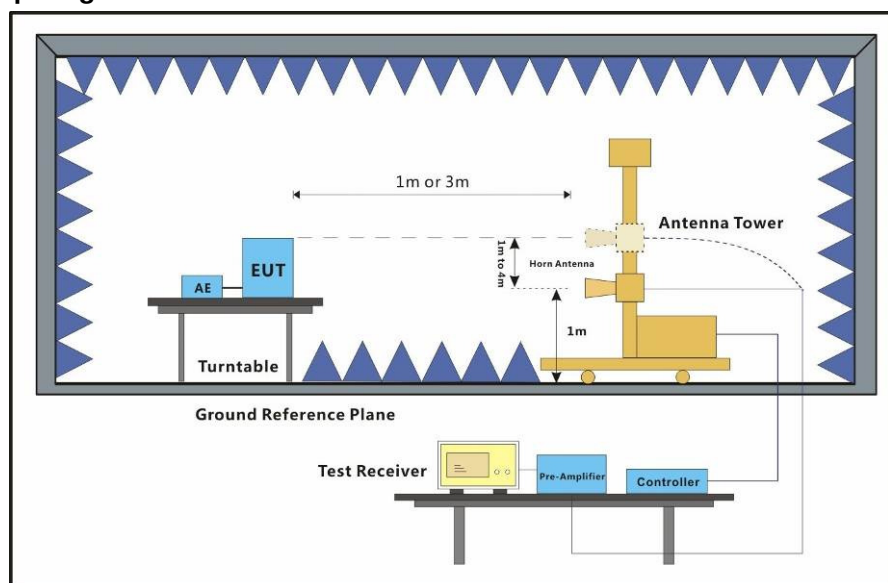
Operating Environment:

Temperature: 23 °C Humidity: 54 % RH Atmospheric Pressure: 1010 mbar

Pretest these mode to find the worst case:
 a:Data transfer&Video play&Network_Charging
 b: Data transfer&Video play&Network_Battery

The worst case for final test:
 a:Data transfer&Video play&Network_Charging

6.3.2 Test Setup Diagram

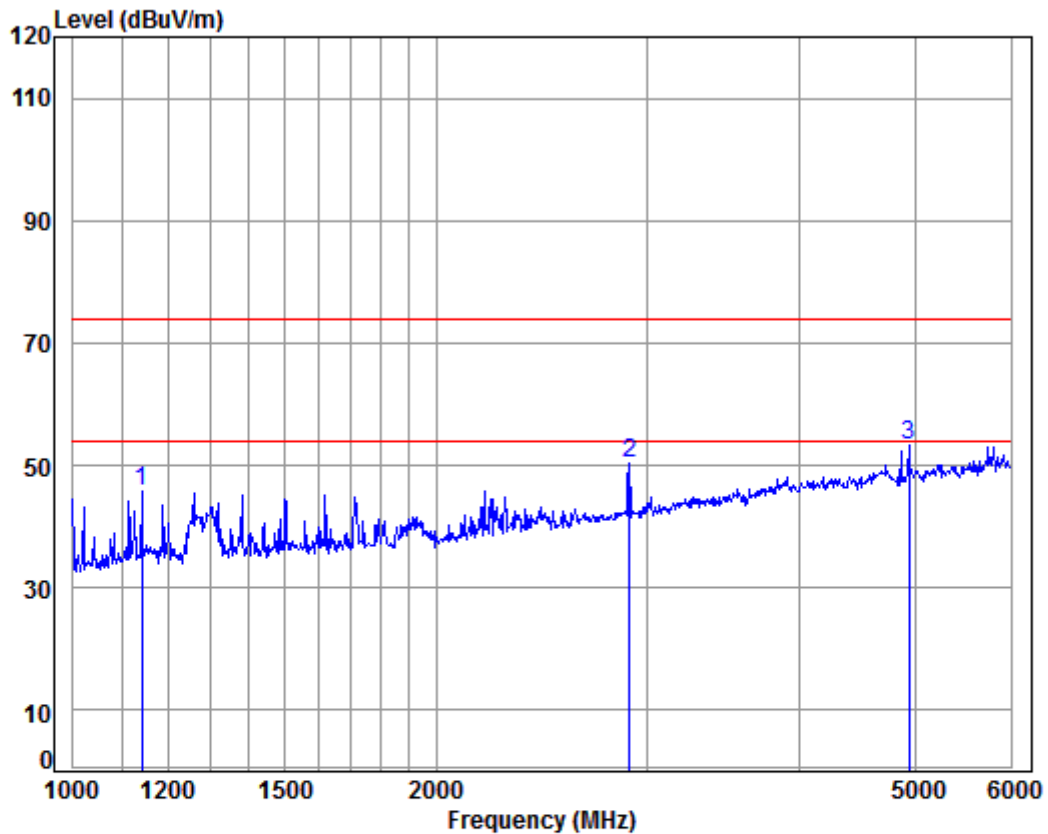


6.3.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities.



Mode:a; Polarization:Horizontal



Condition: 3m Horizontal

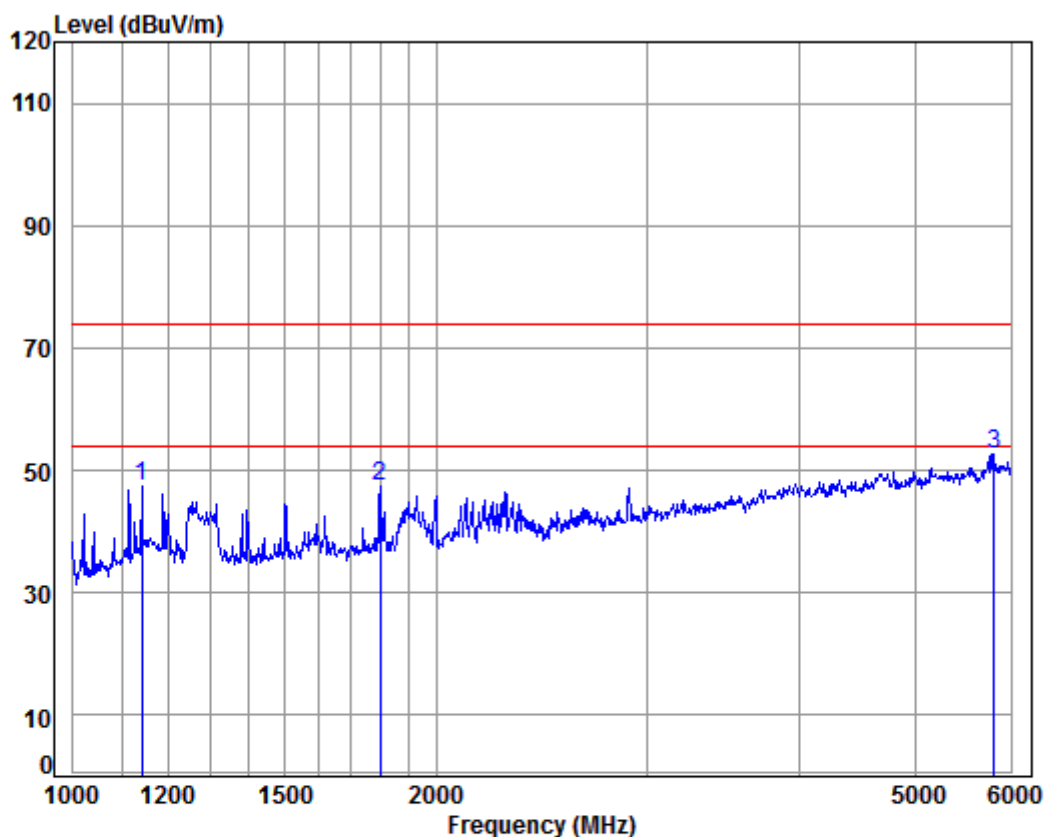
Job No : 10996IT/10997IT

Mode : a

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	Remark
1	1139.738	4.17	24.17	37.78	55.32	45.88	74.00	-28.12	Peak
2	2893.635	5.91	30.92	37.61	51.17	50.39	74.00	-23.61	Peak
3 pp	4935.518	8.02	34.39	37.29	48.06	53.18	74.00	-20.82	Peak



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No : 10996IT/10997IT

Mode : a

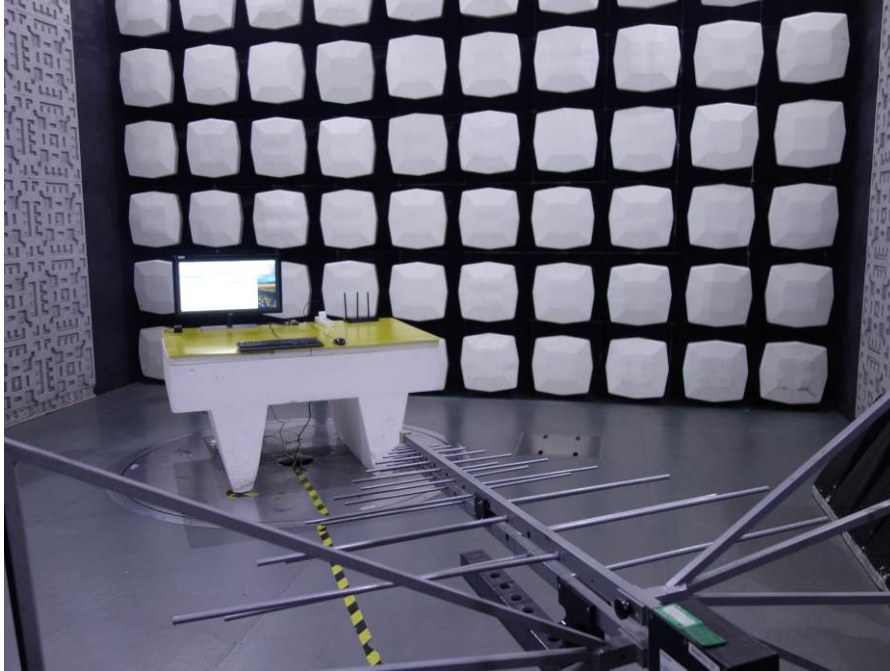
	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1139.738	4.17	24.17	37.78	56.71	47.27	74.00	-26.73	Peak
2	1799.839	5.11	27.07	37.72	52.87	47.33	74.00	-26.67	Peak
3 pp	5809.577	9.93	34.59	37.79	45.89	52.62	74.00	-21.38	Peak

7 Photographs

7.1 Conducted Emissions at Mains Terminals (150kHz-30MHz) Test Setup



7.2 Radiated Emissions (30MHz-1GHz) Test Setup



7.3 EUT Constructional Details

