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Job No.: SZEM171001099801
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TEST RESULT

Application No.: SZEM1710010998IT
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) : AS/NZS CISPR 32:2015
Date of Receipt: 2017-10-30
Date of Test: 2017-10-31 to 2017-11-03
Date of Issue: 2017-11-08

* This report is just a test result base on the test method and limit requirement shown in the form on the second page. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Leo Lai
Project Engineer



2 Test Summary

Emission Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at Mains Terminals (150kHz-30MHz)	AS/NZS CISPR 32:2015	AS/NZS CISPR 32:2015	Class B	Pass
Asymmetric Mode Conducted Emissions (150kHz-30MHz)	AS/NZS CISPR 32:2015	AS/NZS CISPR 32:2015	Class B	Pass
Radiated Emissions (30MHz-1GHz)	AS/NZS CISPR 32:2015	AS/NZS CISPR 32:2015	Class B	Pass
Radiated Emissions (above 1GHz)	AS/NZS CISPR 32:2015	AS/NZS CISPR 32:2015	Class B	Pass

Internal Source	Upper Frequency
Below 108MHz	1GHz
108MHz to 500MHz	2GHz
500MHz to 1GHz	5GHz
Above 1GHz	5 times the highest frequency or 6 GHz, whichever is less

All the tests were requested as per applicant's requirement.



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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:	Loss 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.



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

Asymmetric Mode Conducted Emissions (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
Capacitive Voltage Probe	Schwarzbeck	CVP9222B	SEM009-11	2017-07-26	2020-07-25
Current Sensor Probe	TESEQ	CSP9160A	SEM009-12	2016-12-21	2019-12-20

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



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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	AgilentTechnologies 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

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:	AS/NZS CISPR 32:2015
Test Method:	AS/NZS CISPR 32:2015
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

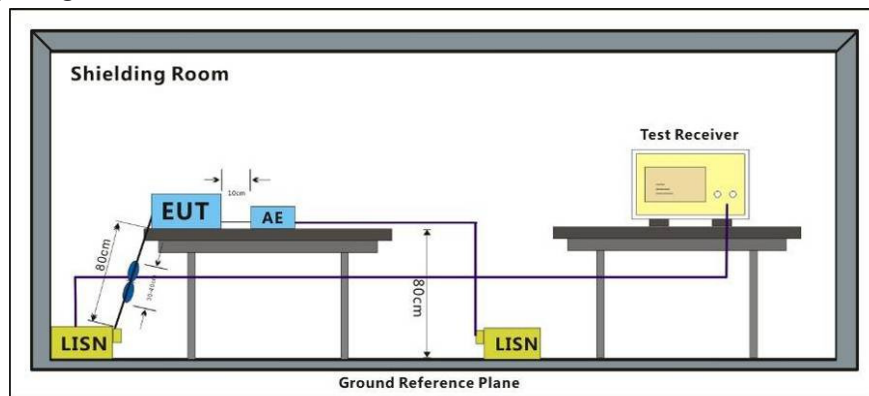
6.1.1 E.U.T. Operation

Operating Environment:

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

Test mode a: Data transfer&Video play&Network_Charging

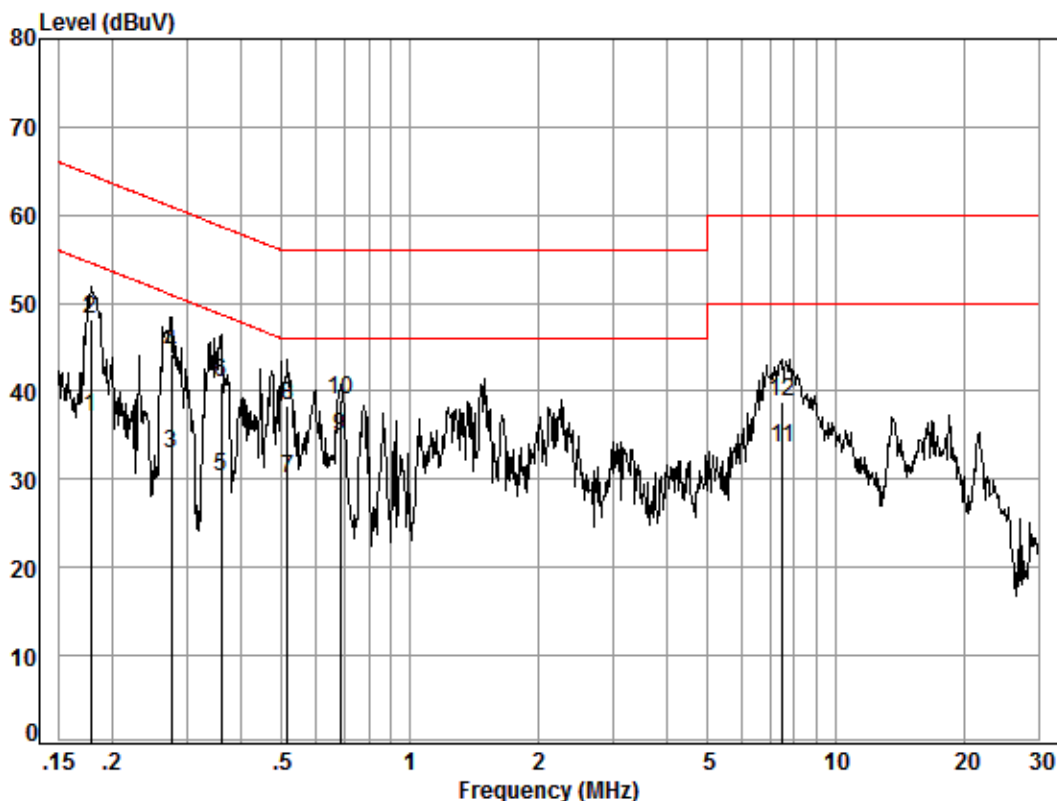
6.1.2 Test Setup Diagram



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

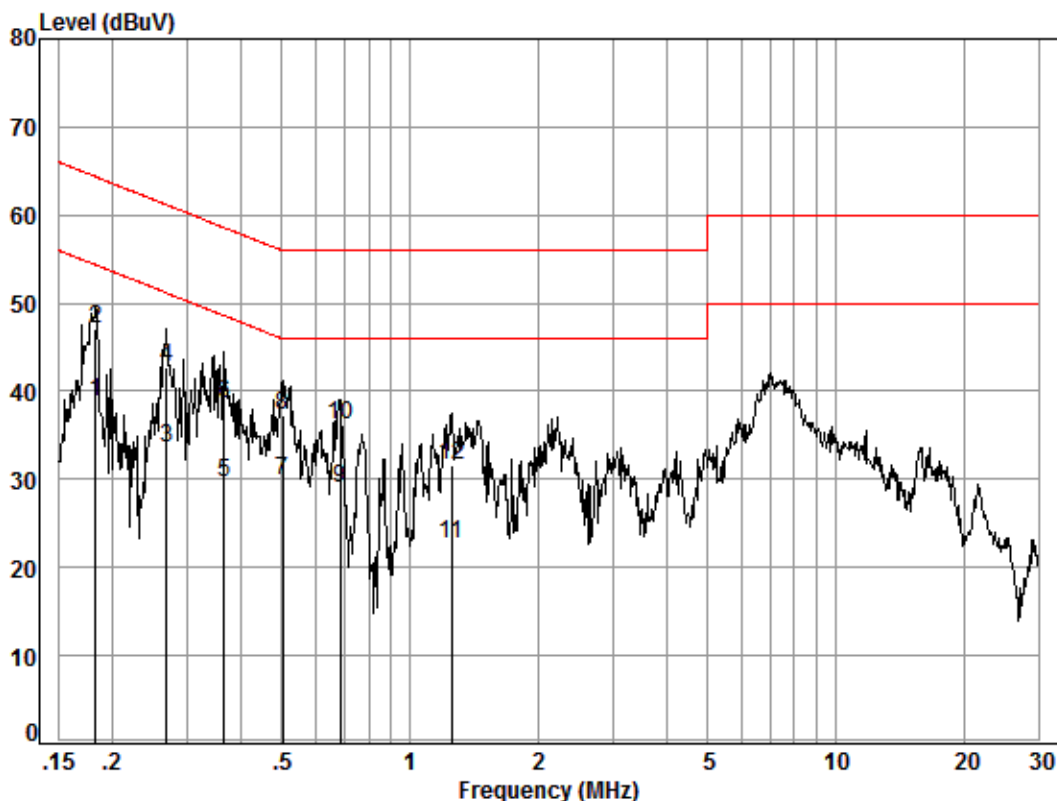
Condition: Line

Job No. : 10998IT

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	27.61	37.14	54.59	-17.45	Average
2	0.18	0.02	9.51	38.64	48.17	64.59	-16.42	QP
3	0.28	0.01	9.51	23.38	32.90	50.94	-18.04	Average
4	0.28	0.01	9.51	34.73	44.25	60.94	-16.69	QP
5	0.36	0.01	9.50	20.79	30.30	48.69	-18.39	Average
6	0.36	0.01	9.50	31.50	41.01	58.69	-17.68	QP
7	0.52	0.01	9.50	20.61	30.12	46.00	-15.88	Average
8	0.52	0.01	9.50	28.85	38.36	56.00	-17.64	QP
9	0.69	0.02	9.50	25.30	34.82	46.00	-11.18	Average
10	0.69	0.02	9.50	29.53	39.05	56.00	-16.95	QP
11	7.49	0.01	9.60	24.02	33.63	50.00	-16.37	Average
12	7.49	0.01	9.60	29.16	38.77	60.00	-21.23	QP

Mode:a; Line:Neutral Line



Site : Shielding Room

Condition: Neutral

Job No. : 10998IT

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	9.58	29.24	38.84	54.37	-15.53	Average
2	0.18	0.02	9.58	37.50	47.10	64.37	-17.27	QP
3	0.27	0.01	9.58	24.08	33.67	51.16	-17.49	Average
4	0.27	0.01	9.58	33.16	42.75	61.16	-18.41	QP
5	0.37	0.01	9.58	20.00	29.59	48.56	-18.97	Average
6	0.37	0.01	9.58	29.04	38.63	58.56	-19.93	QP
7	0.50	0.01	9.60	20.22	29.83	46.00	-16.17	Average
8	0.50	0.01	9.60	27.63	37.24	56.00	-18.76	QP
9	0.69	0.02	9.62	19.37	29.01	46.00	-16.99	Average
10	0.69	0.02	9.62	26.56	36.20	56.00	-19.80	QP
11	1.26	0.02	9.64	13.10	22.76	46.00	-23.24	Average
12	1.26	0.02	9.64	21.88	31.54	56.00	-24.46	QP

6.2 Asymmetric Mode Conducted Emissions (150kHz-30MHz)

Test Requirement: AS/NZS CISPR 32:2015

Test Method: AS/NZS CISPR 32:2015

Frequency Range: 150kHz to 30MHz

Limit:

0.15M-0.5MHz(Voltage) 84-74(dBμV) quasi-peak; 74-64(dBμV) average

0.5M-30MHz(Voltage) 74(dBμV) quasi-peak; 64(dBμV) average

0.15M-0.5MHz(Current) 40-30(dBμV) quasi-peak; 30-20(dBμV) average

0.5M-30MHz(Current) 30(dBμV) quasi-peak; 20(dBμV) average

Detector: 9kHz resolution bandwidth 0.15M to 30MHz

Remark: The voltage measured shall be corrected at each frequency of interest as follows:

if the current margin with respect to the current limit is ≤ 6 dB, the actual current margin shall be subtracted from the measured voltage;

if the current margin with respect to the current limit is > 6 dB, 6 dB shall be subtracted from the measured voltage.

6.2.1 E.U.T. Operation

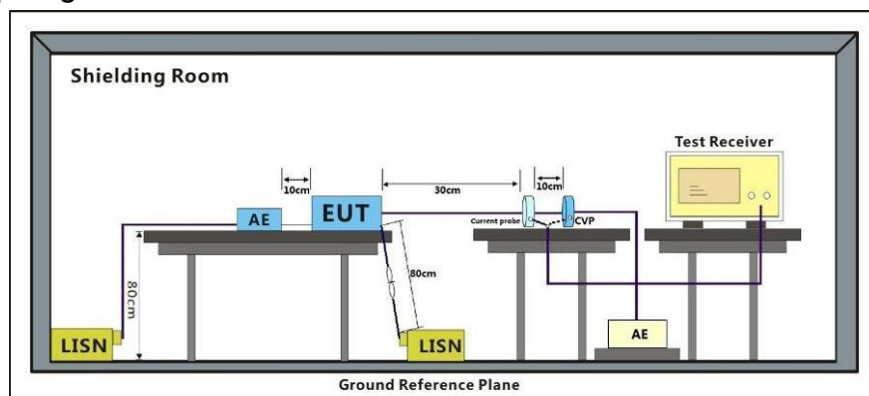
Operating Environment:

Temperature: 25 °C Humidity: 45 % 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

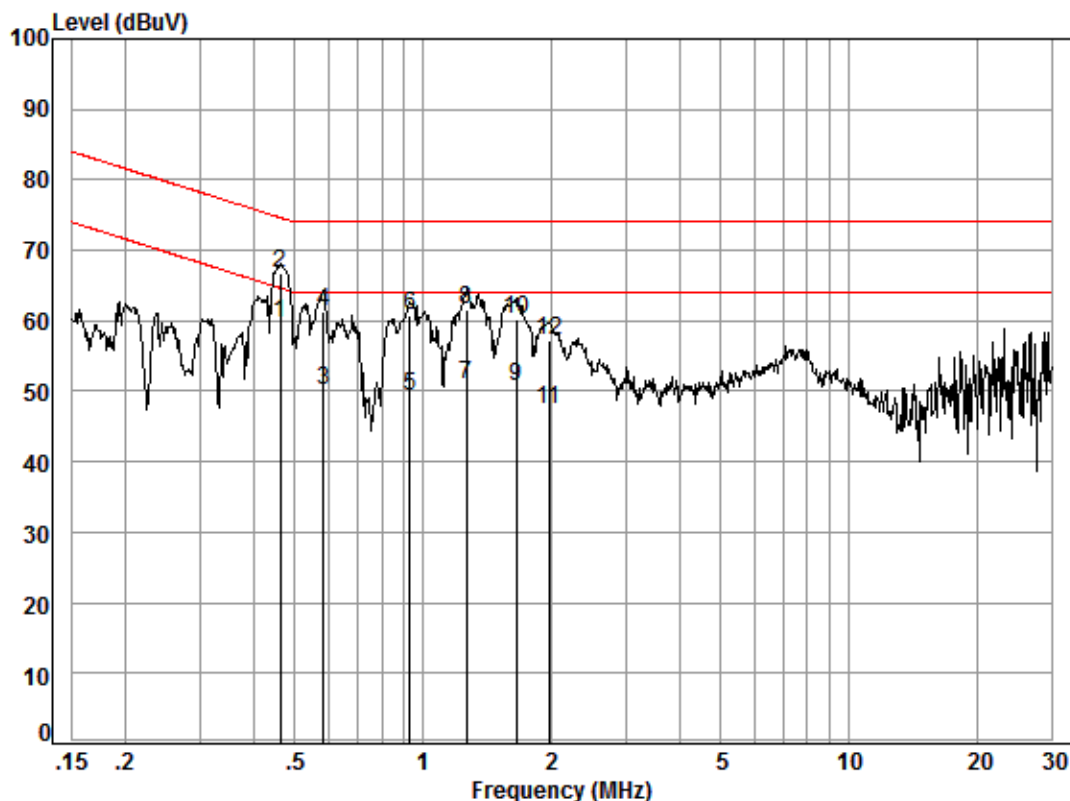
The worst case for final test: a: Data transfer&Video play&Network_Charging

6.2.2 Test Setup Diagram



6.2.3 Measurement Data

Mode:a



Site : Shielding Room

Condition:

Job No. : 10995IT

Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.46	0.01	9.64	50.06	59.71	64.63	-4.92	Average
2	0.46	0.01	9.64	57.01	66.66	74.63	-7.97	QP
3	0.59	0.01	9.58	40.57	50.16	64.00	-13.84	Average
4	0.59	0.01	9.58	51.65	61.24	74.00	-12.76	QP
5	0.93	0.02	9.49	39.79	49.30	64.00	-14.70	Average
6	0.93	0.02	9.49	51.12	60.63	74.00	-13.37	QP
7	1.27	0.02	9.45	41.59	51.06	64.00	-12.94	Average
8	1.27	0.02	9.45	52.10	61.57	74.00	-12.43	QP
9	1.65	0.02	9.41	41.20	50.63	64.00	-13.37	Average
10	1.65	0.02	9.41	50.81	60.24	74.00	-13.76	QP
11	1.98	0.02	9.38	37.89	47.29	64.00	-16.71	Average
12	1.98	0.02	9.38	47.87	57.27	74.00	-16.73	QP

6.3 Radiated Emissions (30MHz-1GHz)

Test Requirement:	AS/NZS CISPR 32:2015
Test Method:	AS/NZS CISPR 32:2015
Frequency Range:	30MHz to 1GHz
Measurement Distance:	3m
Limit:	
30MHz-230MHz	40 dB(μ V/m) quasi-peak
230MHz-1GHz	47 dB(μ V/m) quasi-peak
Detector:	Peak for pre-scan (120kHz resolution bandwidth) 30M to 1000MHz

6.3.1 E.U.T. Operation

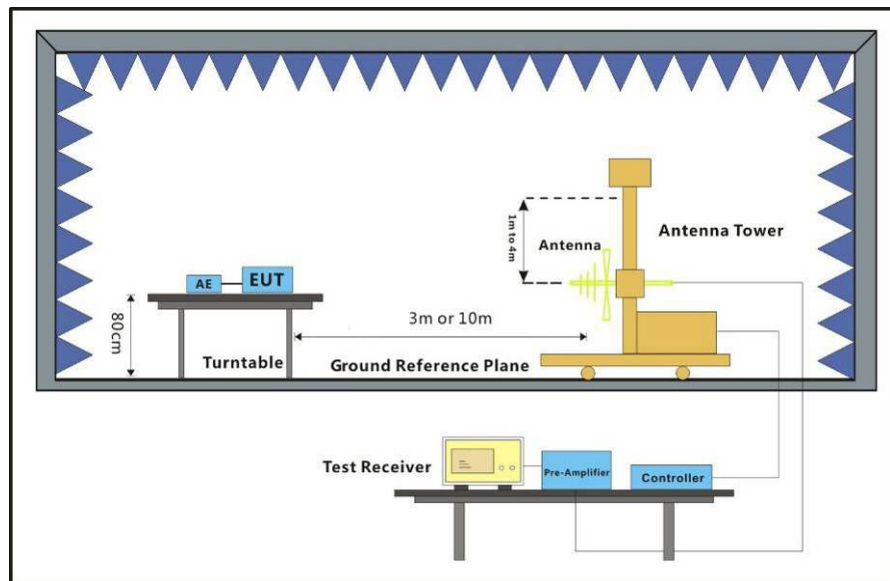
Operating Environment:

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

6.3.2 Test Setup Diagram

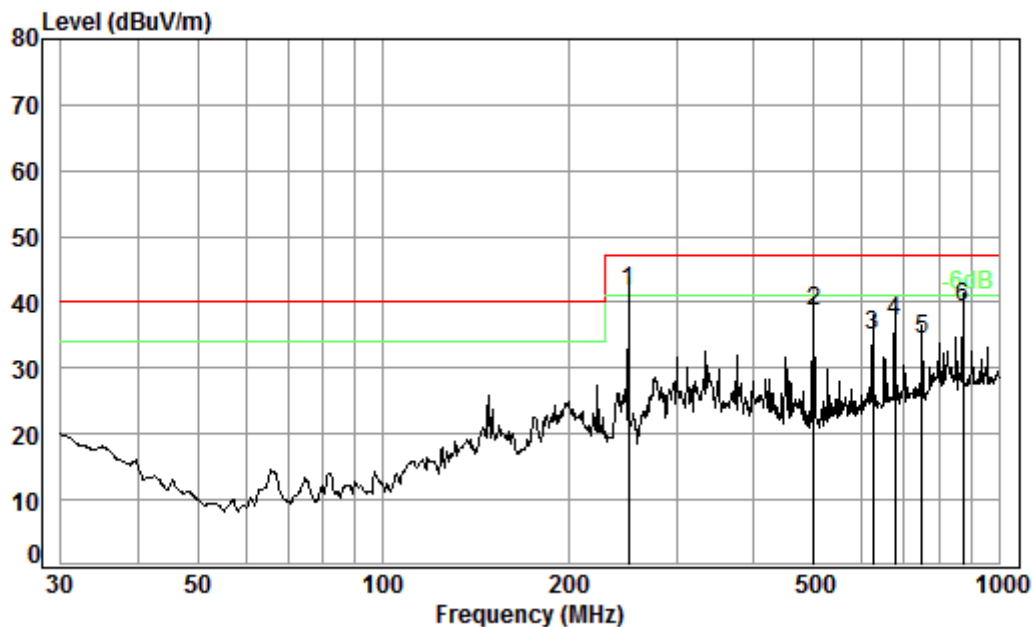


6.3.3 Measurement Data

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

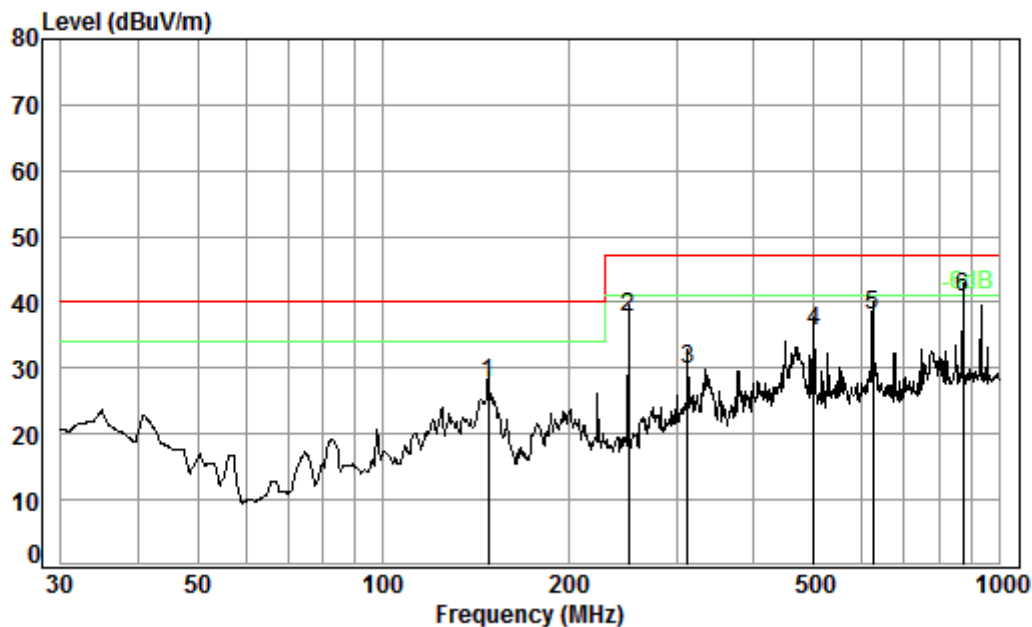
Job No. : 10998IT

Test Mode: a

		Cable	Ant	Preamp	Read		Limit	Over
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pp	250.30	1.68	12.31	26.54	54.29	41.74	47.00	-5.26
2	501.18	2.60	17.83	27.69	45.99	38.73	47.00	-8.27
3	625.08	2.75	20.50	27.51	39.16	34.90	47.00	-12.10
4	677.58	2.86	21.42	27.44	40.30	37.14	47.00	-9.86
5	750.11	3.06	21.70	27.35	37.04	34.45	47.00	-12.55
6	875.25	3.50	23.00	26.89	39.65	39.26	47.00	-7.74



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No. : 10998IT

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	148.44	1.32	8.86	26.91	44.36	27.63	40.00 -12.37
2	250.30	1.68	12.31	26.54	50.16	37.61	47.00 -9.39
3	312.18	1.94	14.34	26.50	40.08	29.86	47.00 -17.14
4	501.18	2.60	17.83	27.69	42.86	35.60	47.00 -11.40
5	625.08	2.75	20.50	27.51	42.27	38.01	47.00 -8.99
6 pp	875.25	3.50	23.00	26.89	41.17	40.78	47.00 -6.22

6.4 Radiated Emissions (above 1GHz)

Test Requirement:	AS/NZS CISPR 32:2015
Test Method:	AS/NZS CISPR 32:2015
Frequency Range:	Above 1GHz
Measurement Distance:	3m
Limit:	
1GHz-3GHz	70 dB(μ V/m) peak, 50 dB(μ V/m) average
3GHz-6GHz	74 dB(μ V/m) peak, 54dB(μ V/m) average
Detector:	Peak for pre-scan (1000kHz resolution bandwidth) 1000M to 6000MHz

6.4.1 E.U.T. Operation

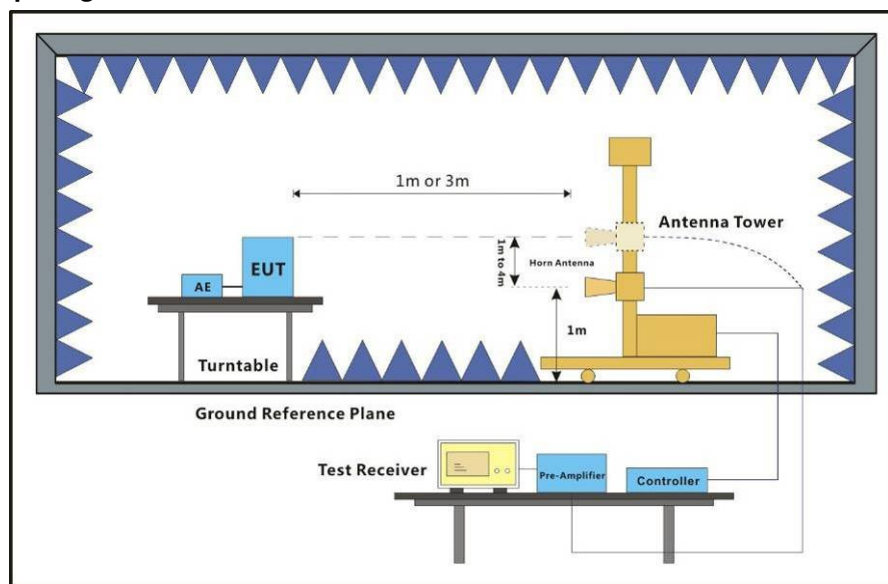
Operating Environment:

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

6.4.2 Test Setup Diagram

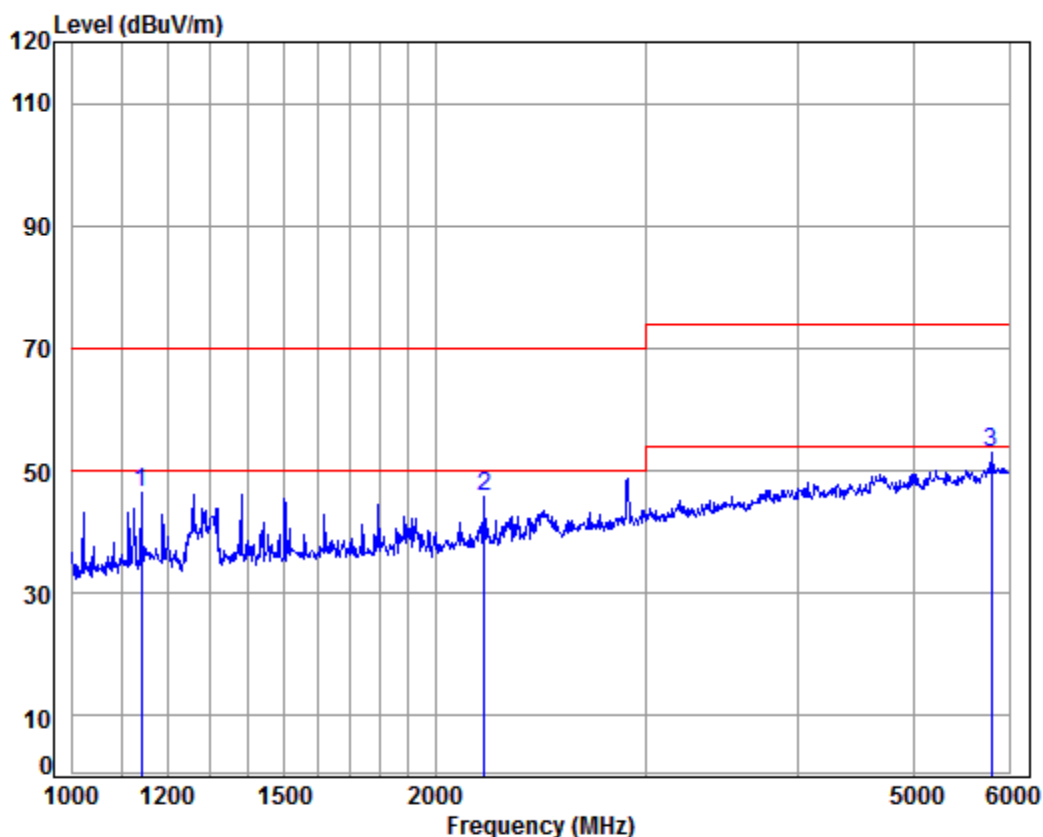


6.4.3 Measurement Data

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

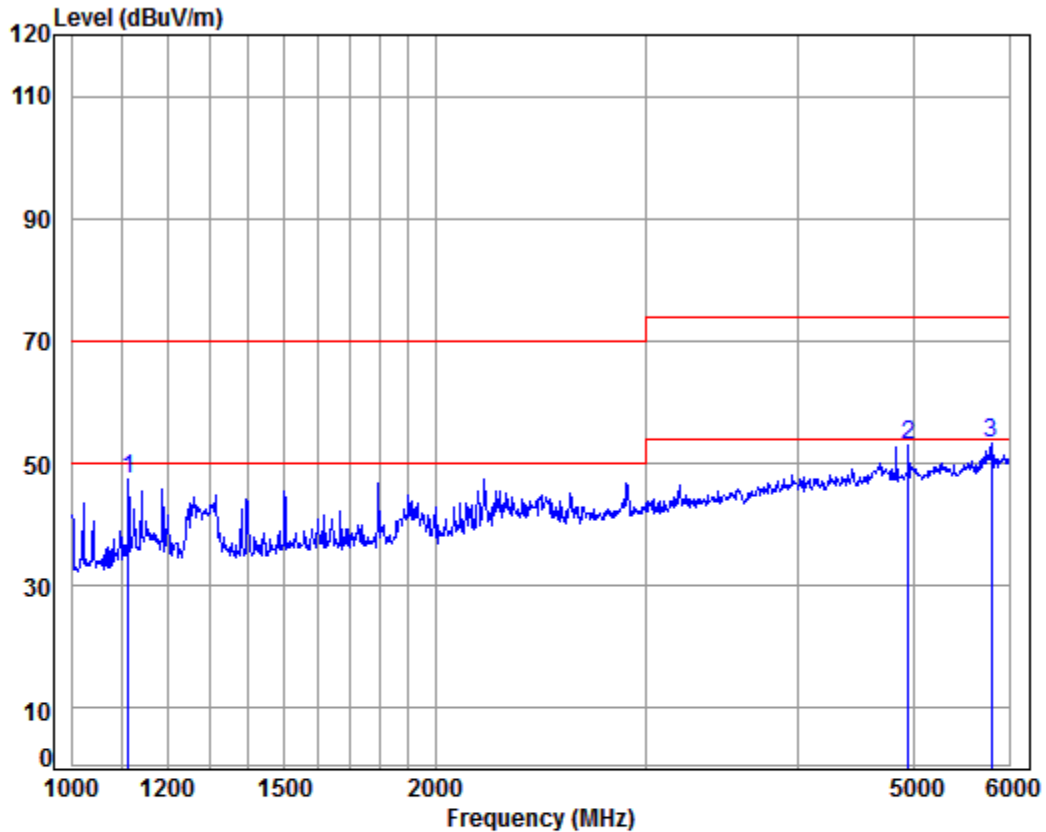


Condition: 3m Horizontal
Job No : 10995IT/10998IT
Mode : a

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Line	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1139.738	4.17	24.17	37.78	55.73	46.29	70.00	-23.71 Peak
2	2199.817	5.21	28.48	37.68	49.82	45.83	70.00	-24.17 Peak
3 pp	5799.177	9.90	34.58	37.79	46.35	53.04	74.00	-20.96 Peak



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No : 10995IT/10998IT

Mode : a

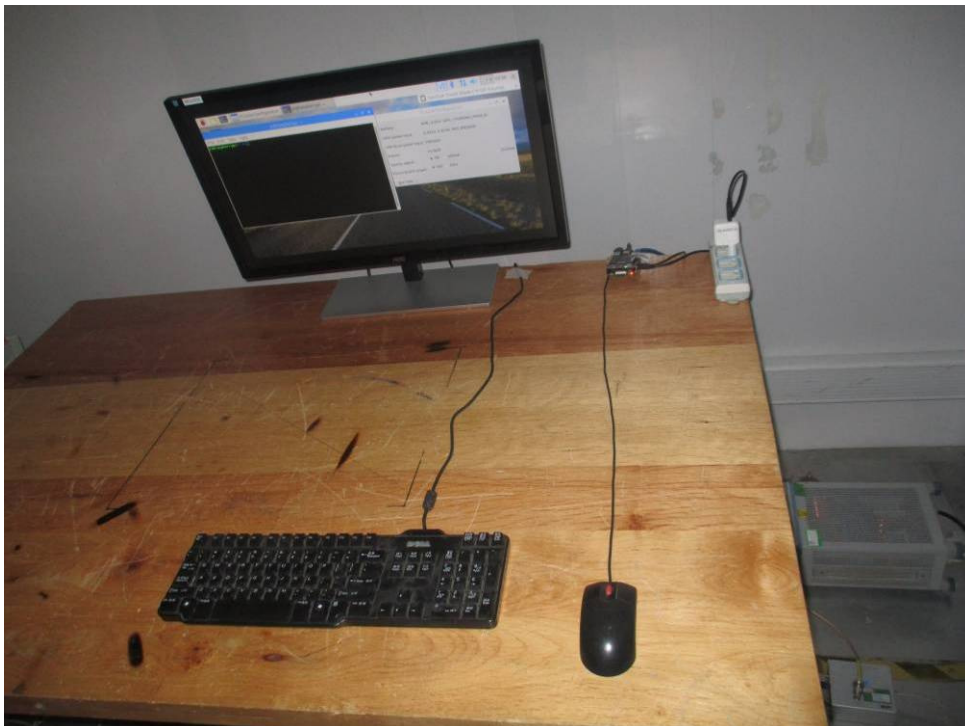
	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1113.497	4.06	24.04	37.78	57.09	47.41	70.00	-22.59	Peak
2	4944.370	8.03	34.40	37.29	47.84	52.98	74.00	-21.02	Peak
3 pp	5799.177	9.90	34.58	37.79	46.68	53.37	74.00	-20.63	Peak

7 Photographs

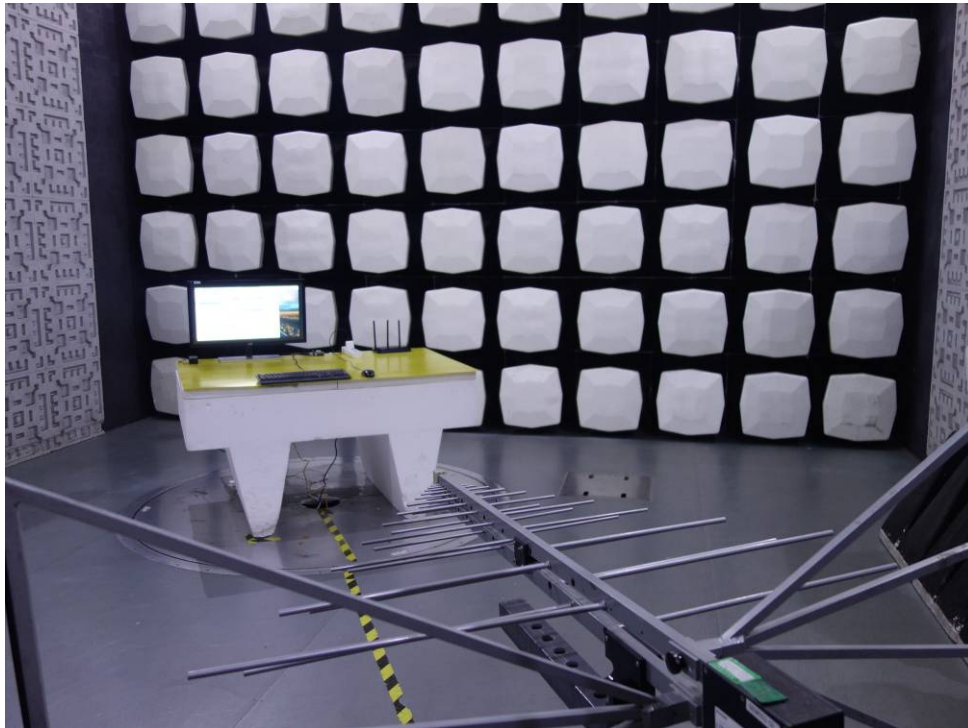
7.1 Conducted Emissions at Mains Terminals (150kHz-30MHz) Test Setup



7.2 Asymmetric Mode Conducted Emissions (150kHz-30MHz) Test Setup



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



7.4 EUT Constructional Details

