



# TEST REPORT

**Test Report No. : UL-RPT-RP11287331JD06E V2.0**

**Manufacturer** : Raspberry Pi (Trading) Ltd

**Model No.** : v1.1

**FCC ID** : 2ABCB-RPI0W

**Test Standard(s)** : FCC Part 15.207(a)

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

**Date of Issue:** 21 December 2016

**Checked by:**

Ian Watch  
Senior Engineer, Radio Laboratory

**Company Signatory:**

Sarah Williams  
Senior Engineer, Radio Laboratory  
UL VS LTD



This laboratory is accredited by UKAS.  
The tests reported herein have been  
performed in accordance with its terms  
of accreditation.

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**1. Customer Information**




<b>Company Name:</b>	Raspberry Pi (Trading) Ltd
<b>Address:</b>	30 Station Road Cambridge CB1 2JH United Kingdom

## **2. Summary of Testing**

### **2.1. General Information**

<b>Specification Reference:</b>	47CFR15.207
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.207
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Date:</b>	26 October 2016

### **2.2. Summary of Test Results**

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 15.207(a)	Transmitter AC Conducted Emissions	
<b>Key to Results</b>  = Complied  = Did not comply		

### **2.3. Methods and Procedures**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
<b>Title:</b>	AC Power-Line Conducted Emissions Frequently Asked Questions

### **2.4. Deviations from the Test Specification**

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

<b>Brand Name:</b>	Raspberry Pi Zero W
<b>Model Name or Number:</b>	v1.1
<b>Test Sample Serial Number:</b>	UL Sample ID # 1 ( <i>Radiated sample</i> )
<b>Hardware Version:</b>	1.1
<b>Software Version:</b>	4.4
<b>FCC ID:</b>	2ABCB-RPI0W

#### **3.2. Description of EUT**

The Equipment Under Test was a single board computer. It contains a *Bluetooth* and 2.4 GHz WLAN module. It is powered from an AC/DC power supply.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

#### **3.4. Additional Information Related to Testing**

<b>Technology Tested:</b>	WLAN (IEEE 802.11b,g,n) / Digital Transmission System	
<b>Type of Unit:</b>	Transceiver	
<b>Data Rate:</b>	802.11b	11 Mbit/s
<b>Power Supply Requirement(s):</b>	Nominal	5 VDC via 120 /240 VAC 60 Hz adaptor
<b>Channel Spacing:</b>	20 MHz	
<b>Transmit Frequency Range:</b>	2412 MHz to 2462 MHz	
<b>Transmit Channels Tested:</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	6	2437

### **3.5. Support Equipment**

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	LCD monitor
<b>Brand Name:</b>	Asus
<b>Model Name or Number:</b>	PA348
<b>Serial Number:</b>	N/A

<b>Description:</b>	Power supply
<b>Brand Name:</b>	Stontronics
<b>Model Name or Number:</b>	DSA-13PFC-05
<b>Serial Number:</b>	4815HB

<b>Description:</b>	USB Hub
<b>Brand Name:</b>	Aprox
<b>Model Name or Number:</b>	appHM4B
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB Keyboard
<b>Brand Name:</b>	Microsoft
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	HDMI B to HDMI C cable (length 1.68 metres)
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

The EUT was tested in the following operating mode(s):

- Pre-scans were performed with the EUT transmitting on the centre channel of *Bluetooth* BR, *Bluetooth* LE and WLAN modes. The worst case mode was found to be 2.4 GHz WLAN 802.11b and final measurements were performed in this configuration.

### **4.2. Configuration and Peripherals**

The EUT was tested in the following configuration(s):

- The EUT was powered via an AC/DC power adaptor, which was in turn connected to a LISN. The LISN input was connected to a 120/240 60 Hz VAC single phase power supply.
- Controlled using a test script on the EUT. The script was used to enable a continuous transmission and to select the test channels as required. Test commands and instructions stated in the *rpi-zero-w\_Compliance testing guide.pdf* dated 16<sup>th</sup> August 2016 were used during testing.
- Transmitter AC conducted spurious emissions tests were performed with all EUT ports terminated.



## **5. Measurements, Examinations and Derived Results**

### **5.1. General Comments**

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

## **5.2. Test Results**

### **5.2.1. Transmitter AC Conducted Spurious Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	David Doyle	<b>Test Date:</b>	26 October 2016
<b>Test Sample Serial Number:</b>	UL Sample ID # 1		

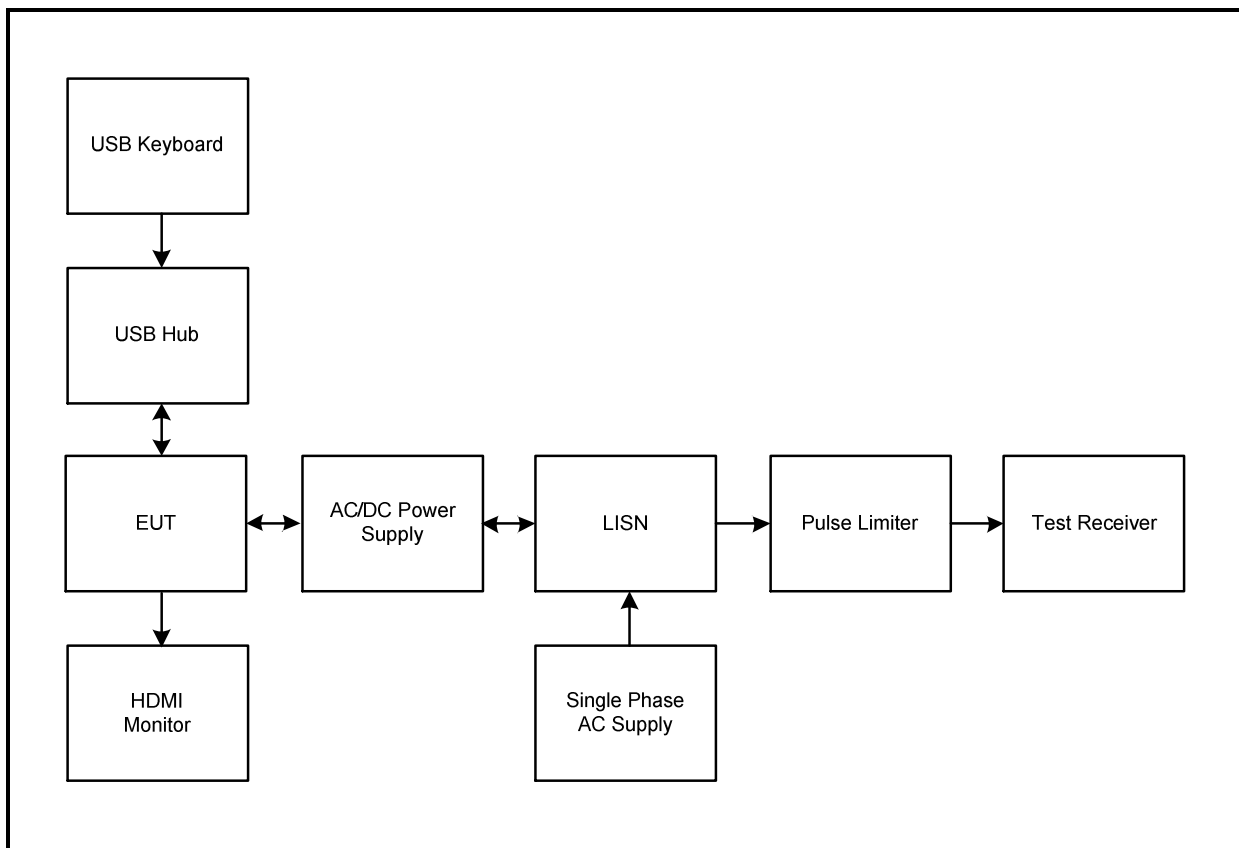
<b>FCC Reference:</b>	Part 15.207(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	48

#### **Note(s):**

1. The EUT was powered from the output of an AC/DC power supply via USB cable. The AC /DC power supply input was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were also performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the AC/DC power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
5. Prescans were performed with the EUT transmitting on the centre channel of *Bluetooth* BR, *Bluetooth* LE and WLAN modes. The worst case mode was found to be 2.4 GHz WLAN and final measurements were performed in this mode only. Prescan result plots for all other modes are archived on the UL VS LTD IT server and available for inspection if required.

**Transmitter AC Conducted Spurious Emissions (continued)****Test setup:**

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Live	47.8	66.0	18.2	Complied
0.330	Live	39.9	59.5	19.6	Complied
0.861	Live	37.6	56.0	18.4	Complied
1.460	Live	29.1	56.0	26.9	Complied
9.456	Live	32.3	60.0	27.7	Complied
9.717	Live	31.2	60.0	28.8	Complied

**Results: Live / Average / 120 VAC 60 Hz**

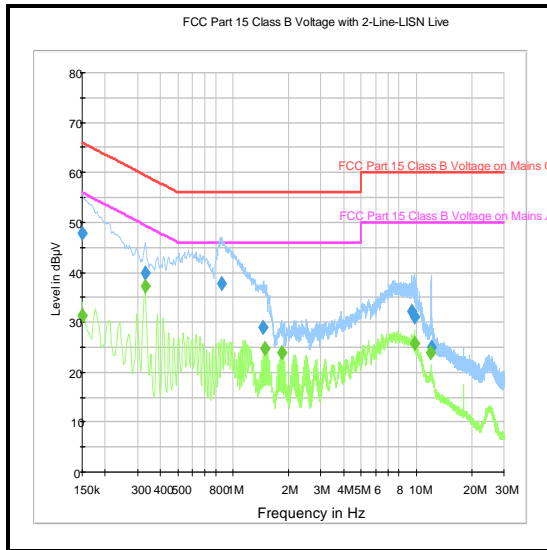
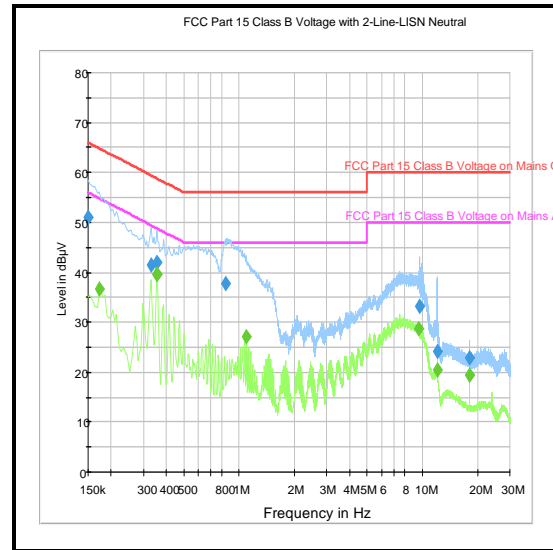
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Live	31.3	56.0	24.7	Complied
0.330	Live	37.3	49.5	12.2	Complied
1.487	Live	24.8	46.0	21.2	Complied
1.847	Live	23.9	46.0	22.1	Complied
9.717	Live	25.7	50.0	24.3	Complied
11.994	Live	23.9	50.0	26.1	Complied

**Results: Neutral / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Neutral	51.1	66.0	14.9	Complied
0.330	Neutral	41.5	59.5	18.0	Complied
0.357	Neutral	42.1	58.8	16.7	Complied
0.848	Neutral	37.8	56.0	18.2	Complied
9.636	Neutral	33.3	60.0	26.7	Complied
11.999	Neutral	24.2	60.0	35.8	Complied

**Results: Neutral / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.173	Neutral	36.7	54.8	18.1	Complied
0.357	Neutral	39.7	48.8	9.1	Complied
1.100	Neutral	27.2	46.0	18.8	Complied
9.506	Neutral	28.7	50.0	21.3	Complied
12.003	Neutral	20.5	50.0	29.5	Complied
18.092	Neutral	19.3	50.0	30.7	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 120 VAC 60 Hz****Live****Neutral**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Live	38.9	65.5	26.6	Complied
0.348	Live	35.3	59.0	23.7	Complied
1.001	Live	30.3	56.0	25.7	Complied
4.704	Live	36.5	56.0	19.5	Complied
7.719	Live	36.4	60.0	23.6	Complied
12.003	Live	28.1	60.0	31.9	Complied

**Results: Live / Average / 240 VAC 60 Hz**

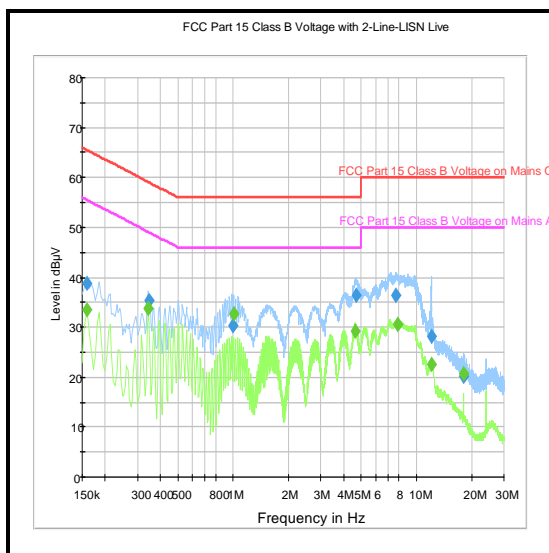
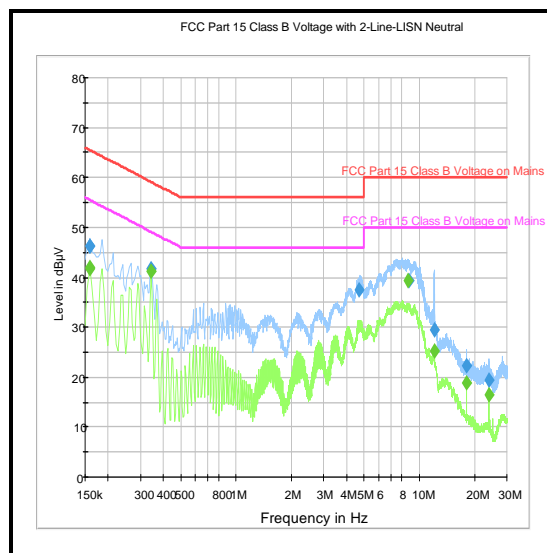
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Live	33.6	55.5	21.9	Complied
0.344	Live	33.6	49.1	15.5	Complied
1.005	Live	32.8	46.0	13.2	Complied
4.655	Live	29.4	46.0	16.6	Complied
7.868	Live	30.7	50.0	19.3	Complied
11.999	Live	22.5	50.0	27.5	Complied

**Results: Neutral / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Neutral	46.2	65.5	19.3	Complied
0.344	Neutral	41.7	59.1	17.4	Complied
4.709	Neutral	37.4	56.0	18.6	Complied
8.732	Neutral	39.5	60.0	20.5	Complied
12.003	Neutral	29.4	60.0	30.6	Complied
18.092	Neutral	22.4	60.0	37.6	Complied

**Results: Neutral / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Neutral	41.9	55.5	13.6	Complied
0.344	Neutral	41.2	49.1	7.9	Complied
8.705	Neutral	39.3	50.0	10.7	Complied
11.999	Neutral	25.3	50.0	24.7	Complied
18.092	Neutral	18.8	50.0	31.2	Complied
24.036	Neutral	16.6	50.0	33.4	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 240 VAC 60 Hz****Live****Neutral**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2014	Thermohygrometer	Testo	608-H1	45046246	10 Jun 2017	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	08 Feb 2017	12
A1829	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100671	05 May 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	11 Apr 2017	12
S0539	Variable AC Power Supply	Kikusui	PCR 1000L	13010170	Calibrated before use	N/A
M1818	Multimeter	Fluke	79 Series II	71811580	27 Apr 2017	12

## **6. Measurement Uncertainty**

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.



**7. Report Revision History**

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	1	-	Changed Model No. to v1.1
	6	-	Changed Model No. to v1.1 & Brand name to Raspberry Pi Zero W

--- END OF REPORT ---