

TEST REPORT

Test Report No. : UL-RPT-RP11913492-2016A V2.0

Manufacturer	:	Raspberry Pi (Trading) Ltd
Model No.	:	Raspberry Pi 3 Model B+
FCC ID	:	2ABCB-RPI3BP
Technology	:	WLAN
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247

- 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. The 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:

06 March 2018

Checked by:

WElzy

Sarah Williams Senior Test Engineer, Radio Laboratory

Company Signatory:

LMC

lan Watch Senior Test 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

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

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	09 January 2018 to 19 February 2018

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result	
Part 15.207	Transmitter AC Conducted Emissions	0	
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	0	
Part 15.35(c)	Transmitter Duty Cycle	Note 1	
Part 15.247(e)	Transmitter Power Spectral Density	0	
Part 15.247(b)(3)	Transmitter Maximum (Average) Output Power	0	
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	0	
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	0	
Key to Results			
Complied			

Note(s):

1. The measurement was performed to assist in the calculation of the level of maximum conducted output power, power spectral density and emissions. The EUT cannot transmit continuously and sweep triggering/signal gating cannot be implemented.

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Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	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)

Brand Name:	Raspberry Pi
Model Name or Number:	Raspberry Pi 3 Model B+
Test Sample Serial Number:	Not marked or stated (Conducted sample with RF port)
Hardware Version:	V1.0
Software Version:	4.4
FCC ID:	2ABCB-RPI3BP

Brand Name:	Raspberry Pi		
Model Name or Number:	Raspberry Pi 3 Model B+		
Test Sample Serial Number:	Not marked or stated (Radiated sample #1)		
Hardware Version:	V1.0		
Software Version:	4.4		
FCC ID:	2ABCB-RPI3BP		

Brand Name:	Raspberry Pi	
Model Name or Number:	Raspberry Pi 3 Model B+	
Test Sample Serial Number:	Not marked or stated (Radiated sample #2)	
Hardware Version:	V1.1	
Software Version:	4.4	
FCC ID:	2ABCB-RPI3BP	

3.2. Description of EUT

The Equipment Under Test was a single board computer. It contains a *Bluetooth* and 2.4 & 5 GHz WLAN module powered from an AC/DC power supply. The antenna is integral.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Ac	<u>ditional</u>	Information	Related to	<u>Testing</u>
				_

Technology Tested:	WLAN (IEEE 802.11b,g,n) / Digital Transmission System			
Type of Unit:	Transceiver			
Modulation Type:	DBPSK, DQPSK, BPSK,	QPSK,	16QAM & 64QAM	
Data Rates:	802.11b	1, 2, 5	5.5 & 11 Mbps	
	802.11g	6, 9, 1	2, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20	MCSC	to MCS7 (SISO)	
	802.11n HT40	MCSC	to MCS7 (SISO)	
Power Supply Requirement(s):	Nominal	5.0 VI	DC	
Maximum Conducted Output Power:	14.7 dBm			
Declared Antenna Gain:	3.5 dBi			
Channel Spacing:	20 MHz			
Transmit Frequency Range:	2412 MHz to 2462 MHz			
Transmit Channels Tested:	Channel Number		Channel Frequency (MHz)	
	1		2412	
	6		2437	
	11		2462	
Channel Spacing:	40 MHz			
Transmit Frequency Range:	2422 MHz to 2452 MHz			
Transmit Channels Tested:	Channel Number		Channel Frequency (MHz)	
	3		2422	
	9		2452	

3.5. Support Equipment

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

Description:	LCD Monitor
Brand Name:	Asus
Model Name or Number:	ProArt
Serial Number:	F4LMTF022693

Description:	USB Keyboard
Brand Name:	Dell
Model Name or Number:	КВ212-В
Serial Number:	CN-0C643N-71616-42B-09XA-A00

Support Equipment (continued)

Description:	USB Mouse	
Brand Name:	Dell	
Model Name or Number:	Not marked or stated	
Serial Number:	Not marked or stated	
Description:	Power Supply. 230 VAC Input / 5 VDC output	
Brand Name:	Strontronics Ltd	
Model Name or Number:	DSA-13PFC-05	
Serial Number:	Not marked or stated	
Description:	16 GB Micro SD card	
Brand Name:	SanDisk	
Model Name or Number:	HCI	
Serial Number:	Not marked or stated	
Description:	HDMI cable. Quantity 1. Length 1.9 metres	
Brand Name:	Not marked or stated	
Model Name or Number:	Not marked or stated	
Serial Number:	Not marked or stated	
Description:	LISB cable Quantity 4 Length 3.0 metres	
Brand Name:	Not marked or stated	
Model Name or Number:	Not marked or stated	
Sorial Number:		
Serial Nulliber.	Not marked of stated	
Description:	Ethernet cable. Quantity 1. Length 8.0 metres	
Brand Name:	Not marked or stated	
Model Name or Number:	Not marked or stated	
Serial Number:	Not marked or stated	
Description:	Ethernet cable. Quantity 1. Length 3.0 metres	
Brand Name:	Not marked or stated	

Not marked or stated

Not marked or stated

Model Name or Number:

Serial Number:

Support Equipment (continued)

Description:	Ethernet cable. Quantity 1. Length 1.0 metres
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	PHF
Brand Name:	Samsung
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	HDMI Hub
Brand Name:	SUMVISION
Model Name or Number:	Cyclone Micro
Serial Number:	SUM091104017 (UL Asset No. A1986)

Description:	USB Hub
Brand Name:	Belkein
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Laptop PC
Brand Name:	Lenovo
Model Name or Number:	L440
Serial Number:	R9-019EA1 14/04

Description:	Ethernet Hub
Brand Name:	Netgear
Model Name or Number:	DG834 V4
Serial Number:	1PL596BD001A4

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

• Continuously transmitting with a modulated carrier at maximum power on the relevant channels as required using the supported data rates/modulation types.

4.2. Configuration and Peripherals

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

- The customer's test application and supplied instructions were used to place the EUT into WLAN test mode. The supplied commands were entered into the console menu on the EUT. Test commands stated in the wlan_testing_3.sh file located on the /home/pi drive of the EUT were used to configure the EUT to enable a continuous transmission and to select the test channels, data rates and modulation schemes as required.
- The customer declared the following data rates to be used for all measurements as:
 - o 802.11b DBPSK / 1 Mbps / SISO
 - o 802.11g BPSK / 6 Mbps / SISO
 - o 802.11n HT20 BPSK / MCS0 / SISO
 - o 802.11n HT40 BPSK / MCS0 / SISO
- Testing was performed using the customer declared power settings:
 - o 802.11b 1 Mbps / power level 9
 - o 802.11g 6 Mbps / power level 12
 - o 802.11n HT20 MCS0 / power level 12
 - o 802.11n HT40 MCS0 / power level 12
- The EUT was powered via an AC/DC switch mode power supply.
- AC conducted emissions test was tested with the EUT transmitting on the middle channel using a data rate of 6 Mbps (802.11g), as this mode was found to transmit the highest power.
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 6 Mbps (802.11g). This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and as this mode emits the highest output power level, it was deemed to be the worst case.
- Radiated emissions tests pre-scans were initially checked in X,Y& Z orientations, while connected to its power supply. All active ports were terminated with suitable terminations. The worst case orientations were:
 - Below 1 GHz: Z Axis with the EUT back against the table.
 - Above 1 GHz & Radiated band edge: Y Axis with the EUT vertically positioned with the Power/HDMI/PHF cables from the bottom of the EUT.
- For radiated emissions the EUT was configured using a test laptop running putty to control the EUT. The test laptop was placed outside of the anechoic chamber. All other terminations apart from PHF were placed underneath the turntable.
- AC conducted tests were performed with all ports terminated, employing all available accessories.
- The conducted sample was used for minimum 6 dB bandwidth, duty cycle, maximum output power and power spectral density tests.

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:

Test Engineer:	Doug Freegard	Test Date:	23 January 2018
Test Sample Serial Number:	Not marked or stated (Radiated	l sample #1)	

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	46

Note(s):

- 1. The EUT was connected to a DC power supply which supplied the unit with 5.0 VDC. The DC power supply was connected to 120 VAC 60 Hz single phase supply via a LISN.
- 2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 5.0 V 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.

Test setup:



Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result	
0.164	Live	49.8	65.3	15.5	Complied	
0.299	Live	44.2	60.3	16.1	Complied	
0.852	Live	37.1	56.0	18.9	Complied	
1.392	Live	35.6	56.0	20.4	Complied	
5.730	Live	39.4	60.0	20.6	Complied	
25.058	Live	24.0	60.0	36.0	Complied	

Results: Live / Quasi Peak / 120 VAC 60 Hz

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.299	Live	43.5	50.3	6.8	Complied
0.596	Live	33.8	46.0	12.2	Complied
1.059	Live	31.7	46.0	14.3	Complied
1.392	Live	33.3	46.0	12.7	Complied
2.283	Live	32.9	46.0	13.1	Complied
5.658	Live	35.2	50.0	14.8	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.164	Neutral	52.1	65.3	13.2	Complied
0.335	Neutral	42.1	59.3	17.2	Complied
0.497	Neutral	36.8	56.1	19.3	Complied
0.852	Neutral	37.8	56.0	18.2	Complied
5.618	Neutral	41.3	60.0	18.7	Complied
7.130	Neutral	39.5	60.0	20.5	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Neutral	41.9	55.5	13.6	Complied
0.330	Neutral	42.0	49.5	7.5	Complied
0.663	Neutral	35.2	46.0	10.8	Complied
1.653	Neutral	31.8	46.0	14.2	Complied
2.283	Neutral	31.9	46.0	14.1	Complied
5.028	Neutral	34.5	50.0	15.5	Complied
6.878	Neutral	35.1	50.0	14.9	Complied

Results: 120 VAC 60 Hz FCC Part 15 Class B Voltage with 2-Line-LISN Live with A3019 cable FCC Part 15 Class B Voltage with 2-Line-LISN Neutral with A3019 cable CC Part 15 C C Part 15 C ss B V B V -evel in dBµV evel in dBµV 40 2 0 150k 300 400500 8001 M 2M 3M 4M5M 6 8 10M 20M 30M 150k 300 400500 8001 M 2M 3M 4M5M 6 8 10M 20M 30M Frequency in Hz Frequency in Hz

Live

Neutral

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

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.155	Live	45.6	65.8	20.2	Complied
0.893	Live	39.0	56.0	17.0	Complied
1.428	Live	39.3	56.0	16.7	Complied
1.982	Live	40.0	56.0	16.0	Complied
3.129	Live	40.5	56.0	15.5	Complied
4.862	Live	43.1	56.0	12.9	Complied

Results: Live / Quasi Peak / 240 VAC 60 Hz

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.308	Live	42.0	50.0	8.0	Complied
0.447	Live	34.2	46.9	12.7	Complied
0.920	Live	37.8	46.0	8.2	Complied
1.370	Live	38.6	46.0	7.4	Complied
1.982	Live	38.4	46.0	7.6	Complied
3.129	Live	37.1	46.0	9.0	Complied
4.830	Live	37.4	46.0	8.6	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.155	Neutral	47.3	65.8	18.5	Complied
0.177	Neutral	44.4	64.6	20.2	Complied
0.839	Neutral	38.3	56.0	17.7	Complied
1.338	Neutral	37.9	56.0	18.1	Complied
4.862	Neutral	44.6	56.0	11.4	Complied
7.292	Neutral	42.7	60.0	17.3	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.168	Neutral	45.5	55.1	9.6	Complied
0.308	Neutral	45.1	50.0	4.9	Complied
0.726	Neutral	36.5	46.0	9.5	Complied
1.397	Neutral	36.9	46.0	9.1	Complied
1.982	Neutral	36.8	46.0	9.2	Complied
3.156	Neutral	36.4	46.0	9.6	Complied
4.803	Neutral	37.6	46.0	8.4	Complied
7.319	Neutral	36.7	50.0	13.3	Complied

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)
M2013	Thermohygrometer	Testo	608-H1	45046424	20 Jun 2018	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	09 Aug 2018	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	09 May 2018	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	13 Nov 2018	12
A2953	Power Supply	Tacima	SC 5467	Not stated	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	12 May 2018	12

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Stefan Ho	Test Dates:	09 January 2018 & 10 January 2018		
Test Sample Serial Number:	Not marked or stated (Conduct	t marked or stated (Conducted sample with RF port)			

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.1

Environmental Conditions:

Temperature (°C):	20 to 21
Relative Humidity (%):	43 to 46

Note(s):

- Tests were performed in accordance with KDB 558074 Section 8.1 Option 1 measurement procedure on bottom, middle and top channels. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 40 MHz for 20 MHz channel bandwidths and 80 MHz for 40 MHz channel bandwidths. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
- The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

Test setup:



Transmitter Minimum 6 dB Bandwidth (continued)

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	8683	≥500	8183	Complied
6	8220	≥500	7720	Complied
11	8162	≥500	7662	Complied







Channel 6



Channel 11

Transmitter Minimum 6 dB Bandwidth (continued)

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	16324	≥500	15824	Complied
6	16382	≥500	15882	Complied
11	15282	≥500	14782	Complied





Channel 1





Channel 6

Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / BPSK / MCS0

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Limit Margin (kHz) (kHz)	
1	17366	≥500	16866	Complied
6	17250	≥500	16750	Complied
11	15289	≥500	14789	Complied

Spectrum





Channel 6



Channel 11

Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 40 MHz / BPSK / MCS0

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Limit Margin (kHz) (kHz)	
3	36190	≥500	35690	Complied
9	36000	≥500	35500	Complied





Channel 3

Channel 9

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Туре No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
A2919	Attenuator	AtlanTecRF	AN18W5-20	832828#2	Calibrated before use	-
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24

5.2.3. Transmitter Duty Cycle

Test Summary:

Test Engineers:	Stefan Ho & Doug Freegard	Test Dates:	09 January 2018 & 10 January 2018	
Test Sample Serial Number:	Not marked or stated (Conducted sample with RF port)			

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6.0

Environmental Conditions:

Temperature (°C):	20 to 21
Relative Humidity (%):	43 to 46

Note(s):

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

10 log (1 / (On Time / [Period or 100 ms whichever is the lesser])).

2. For 802.11b, 802.11g and 802.11n HT20, the duty cycle was measured to be greater than 98%.

Test setup:



Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / BPSK / MCS0

Pulse Duration (ms)	Period Duty Cycle (ms) %		Duty Cycle Correction factor (dB)
0.941	0.967	97.3	0.1

Spectrum							
Ref Level 3	0.00 dBm	Offset	12.40 dB (BRBW 28 MHz			
Att	38 dE	s 😑 SWT	2 ms (BVBW 28 MHz			
SGL							
⊖1Av Clrw							
					D3[1]]	0.10 dB
20 dBm					M1[1	1	907.00 µs 4.36 dBm
							459.00 µs
10 dBm		MI				D03	
0 dBm	decleation of				Constraints of Lands	A	the second s
-10 dBm							
-20 asm		4				pi	
-30 dBm							
-40 dBm				-			
FO dow							
-JU UBIII							
-60 dBm							
CF 2.422 GF	łz			1001 p	its		200.0 µs/
Marker							
Type Ref	Trc	X-valu	e	Y-value	Function	1 Fu	unction Result
M1	1	4	59.0 µs	4.36 dBm			
D2 M1	1	9.	41.0 µs	0.38 dB		_	
03 111	<u> </u>	Ai	onio µs	0.10 08		1	
	Л				Read	Y III	
11913492							
Date: 9.JAN.	2018 1	0:17:45					

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
A2919	Attenuator	AtlanTecRF	AN18W5-20	832828#2	Calibrated before use	-
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24

5.2.4. Transmitter Power Spectral Density

Test Summary:

Test Engineers:	Stefan Ho & Doug Freegard	Test Date:	15 January 2018	
Test Sample Serial Number:	Not marked or stated (Conducted sample with RF port)			

FCC Reference:	Part 15.247(e)
Test Method Used:	FCC KDB 558074 Sections 10.3 &10.5

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	42

Note(s):

- 1. Final measurements were performed on the bottom, middle and top channels.
- 2. For 802.11b, 802.11g and 802.11n HT20, the EUT was transmitting at ≥ 98% duty cycle and testing was performed in accordance with KDB 558074 Section 10.3 Method AVGPSD-1. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. An RMS detector was used and sweep time set manually to perform trace averaging over 300 traces. The span was set greater than 1.5 times the 99% occupied emission bandwidth (plots for the occupied bandwidth are archived on the company server and available for inspection upon request). The highest peak of the measured signal was recorded.
- 3. For 802.11n HT40, the EUT was transmitting at <98% duty cycle and testing was performed in accordance with KDB 558074 Section 10.5 Method AVGPSD-2. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. An RMS detector was used and sweep time set manually to perform trace averaging over 300 traces. The span was set greater than 1.5 times the 99% occupied emission bandwidth (plots for the occupied bandwidth are archived on the company server and available for inspection upon request). The highest peak of the measured signal was recorded. The calculated duty cycle in section 5.2.3 was added to the measured average power spectral density in order to compute the average power spectral density during the actual transmission time.</p>
- The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

VERSION 2.0

ISSUE DATE: 06 MARCH 2018

Transmitter Power Spectral Density (continued)

Test setup:



Transmitter Power Spectral Density (continued)

Results:	802.11b/	20 MHz /	/ DBPSK /	1 Mbps

Channel	PSD (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
1	-5.3	8.0	13.3	Complied
6	-5.6	8.0	13.6	Complied
11	-5.7	8.0	13.7	Complied





Channel 6



Transmitter Power Spectral Density (continued)

Results:	802.11g/	′ 20 MHz /	BPSK /	6 Mb	os
					_

Channel	PSD (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
1	-3.6	8.0	11.6	Complied
6	-3.7	8.0	11.7	Complied
11	-3.0	8.0	11.0	Complied









Transmitter Power Spectral Density (continued)

Results:	802.11n/	20 MH	lz / BPS	K / MCS0

Channel	PSD (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
1	-4.3	8.0	12.3	Complied
6	-4.3	8.0	12.3	Complied
11	-3.7	8.0	11.7	Complied





Channel 1



Channel 11

Transmitter Power Spectral Density (continued)

Channel	PSD (dBm/100 kHz)	Duty Cycle Correction (dB)	Corrected PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
3	-7.1	0.1	-7.0	8.0	15.0	Complied
9	-7.0	0.1	-6.9	8.0	14.9	Complied







Channel 3

Channel 9

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Туре No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
A2919	Attenuator	AtlanTecRF	AN18W5-20	832828#2	Calibrated before use	-
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24

5.2.5. Transmitter Maximum (Average) Output Power

Test Summary:

Test Engineer:	Doug Freegard	Test Dates:	25 January 2018 & 19 February 2018	
Test Sample Serial Number:	Not marked or stated (Conducted sample with RF port)			

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Sections 9.2.2.2 & 9.2.2.4

Environmental Conditions:

Temperature (°C):	20 to 25
Relative Humidity (%):	36 to 43

Note(s):

- 1. Final measurements were performed on the bottom, middle and top channels. The power has been integrated over the 99% emission bandwidth. Plots for the occupied bandwidth are archived on the company server and available for inspection upon request.
- 2. For 802.11b, 802.11g and 802.11n HT20 the EUT was transmitting at ≥ 98% duty cycle and testing was performed in accordance with KDB 558074 Section 9.2.2.2 Method AVGSA-1. The signal analyser's integration function was used to integrate across the 99% occupied bandwidth. The signal analyser resolution bandwidth was set to 200 kHz and video bandwidth 1 MHz. An RMS detector was used and sweep time set manually to perform trace averaging over 300 traces. The span was set greater than 1.5 times the 99% occupied emission bandwidth.
- 3. For 802.11n HT40, the EUT was transmitting at <98% duty cycle and testing was performed in accordance with KDB 558074 Section 9.2.2.4 Method AVGSA-2. The signal analyser's integration function was used to integrate across the 99% occupied bandwidth. The signal analyser resolution bandwidth was set to 500 kHz and video bandwidth 2 MHz. An RMS detector was used and sweep time set manually to perform trace averaging over 300 traces. The span was set greater than 1.5 times the 99% occupied emission bandwidth. The calculated duty cycle in section 5.2.3 was added to the measured power in order to compute the average power during the actual transmission time.</p>
- The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.
- 5. Plots for 40 MHz channel bandwidth have an incorrect job number.

VERSION 2.0

ISSUE DATE: 06 MARCH 2018

Transmitter Maximum (Average) Output Power (continued)

Test setup:



Results: 802.11b / 20 MHz / DBPSK / 1 Mbps

Conducted Peak Limit Comparison

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	11.5	30.0	18.5	Complied
6	11.5	30.0	18.5	Complied
11	12.4	30.0	17.6	Complied

De Facto EIRP Limit Comparison

Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	11.5	3.5	15.0	36.0	21.0	Complied
6	11.5	3.5	15.0	36.0	21.0	Complied
11	12.4	3.5	15.9	36.0	20.1	Complied

Results: 802.11b / 20 MHz / DBPSK / 1 Mbps



Channel 1





Channel 6

Results: 802.11g / 20 MHz / BPSK / 6 Mbps

Conducted Peak Limit Comparison

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	14.6	30.0	15.4	Complied
6	14.7	30.0	15.3	Complied
11	14.7	30.0	15.3	Complied

De Facto EIRP Limit Comparison

Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	14.6	3.5	18.1	36.0	17.9	Complied
6	14.7	3.5	18.2	36.0	17.8	Complied
11	14.7	3.5	18.2	36.0	17.8	Complied

Results: 802.11g / 20 MHz / BPSK / 6 Mbps



Channel 1





Channel 6

Results: 802.11n / 20 MHz / BPSK / MCS0

Conducted Peak Limit Comparison

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	14.2	30.0	15.8	Complied
6	14.2	30.0	15.8	Complied
11	13.5	30.0	16.5	Complied

De Facto EIRP Limit Comparison

Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	14.2	3.5	17.7	36.0	18.3	Complied
6	14.2	3.5	17.7	36.0	18.3	Complied
11	13.5	3.5	17.0	36.0	19.0	Complied

Results: 802.11n / 20 MHz / BPSK / MCS0



Channel 1





Channel 6

VERSION 2.0

Transmitter Maximum (Average) Output Power (continued)

Results: 802.11n / 40 MHz / BPSK / MCS0

Conducted Peak Limit Comparison

Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
3	13.9	0.1	14.0	30.0	16.0	Complied
9	13.6	0.1	13.7	30.0	16.3	Complied

De Facto EIRP Limit Comparison

Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
3	14.0	3.5	17.5	36.0	18.5	Complied
9	13.7	3.5	17.2	36.0	18.8	Complied





Channel 9

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Туре No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	22 Feb 2018	12
A2946	Attenuator	AtlanTecRF	AN18W5-20	832828#2	Calibrated before use	-
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	06 Mar 2018	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	04 Apr 2018	12
G0615	Signal Generator	Rohde & Schwarz	SMBV100A	260473	08 May 2020	36

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	16 January 2018
Test Sample Serial Number:	Not marked or stated (Radiated sample #1)		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	40

Note(s):

- 1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- 2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
- 3. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the measurement system noise floor and therefore not recorded.
- 4. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
- 5. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
- 6. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold, with the span big enough to see the whole emission.

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Transmitter Radiated Emissions (continued)

Test setup for radiated measurements:



Transmitter Radiated Emissions (continued)

Test setup for radiated measurements (continued):



Results: Peak / Middle Channel / 802.11g / 6 Mbps

Frequency	Antenna	Level	Limit	Margin	Result
(MHz)	Polarity	(dBµV/m)	(dBµV/m)	(dB)	
246.064	Vertical	29.9	46.0	16.1	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Feb 2018	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	25 Apr 2018	12
A2147	Attenuator	AtlanTecRF	AN18-06	09020206-06	25 Apr 2018	12
A2131	Low Pass Filter	AtlanTecRF	AFL-0200	JFB 1004-002	27 Feb 2018	12

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	15 January 2018
Test Sample Serial Number:	Not marked or stated (Radiated sample #1)		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 , 6.6 & FCC KDB 558074 Sections 11 & 12
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	46

Note(s):

- 1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- 2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
- 3. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
- 4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
- 5. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.

Results: Peak

Frequency	Antenna	Peak Level	Peak Limit	Margin	Result
(MHz)	Polarity	(dBμV/m)	(dBμV/m)	(dB)	
2495.000	Vertical	55.1	74.0	18.9	Complied

Results: Average

Frequency	Antenna	Average Level	Average Limit	Margin	Result
(MHz)	Polarity	(dBμV/m)	(dBμV/m)	(dB)	
2517.000	Vertical	48.0	54.0	6.0	Complied





700 MHz/

Stop 25 GHz

Start 18 GHz

Date: 15.JAN.2018 20:12:29

11913492

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Feb 2018	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Feb 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2891	Pre Amplifier	Schwarzbeck	BBV 9718	9718-306	11 Apr 2018	12
A2893	Pre Amplifier	Schwarzbeck	BBV 9721	9721-021	11 Apr 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	9120 B 653	11 Apr 2018	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	11 Apr 2018	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	06 Mar 2018	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	18 May 2018	12

5.2.7. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	15 January 2018 to 19 February 2018	
Test Sample Serial Numbers:	Not marked or stated (Radiated samples #1 & #2)			

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & FCC KDB 558074 Sections 11 & 12

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	34 to 44

Note(s):

- 1. The customer declared the following data rates to be used for all measurements as:
 - o 802.11b DBPSK / 1 Mbps
 - o 802.11g BPSK / 6 Mbps
 - o 802.11n HT20 BPSK / MCS0
 - o 802.11n HT40 BPSK / MCS0

Final measurements were performed with the above configurations.

- 2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- The maximum conducted (average) output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(b), the lower band edge measurement should be performed with a peak detector and the -30 dBc limit applied.
- 4. As the lower band edge falls within a non-restricted band, only peak measurements are required. In accordance with FCC KDB 558074 Section 11.1, the test method in Section 11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. As the maximum conducted (average) output power was measured using an RMS detector in accordance with FCC KDB 558074 Section 9.2.2.4 an out-of-band limit line was placed 30 dB (FCC KDB 558074 Section 11.1(b)) below the peak level. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
- 5. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. An RMS detector was used, sweep time was set to auto and trace mode was trace averaging over 300 sweeps. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.

Note(s):

- 6. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
- For 802.11n HT40 the EUT was transmitting at <98% duty cycle, in accordance with KDB 558074 Section 12.2.5.2, the calculated duty cycle in section 5.2.3 was added to the measured result for average measurements.
- *For 802.11n HT40 modes, the integration method was used in accordance with FCC KDB 558074 Section 13.3.2, in order to meet the average limit. As the EUT had a duty cycle < 98% the duty cycle correction factor has been added to the band edge result.
- The lower and upper band measurements were performed using a reference level of 130 dBμV/m in order to achieve the correct headroom as specified in FCC KDB 558074 Section 5.2.

Results: 802.11b / 20 MHz / DBPSK / 1 Mbps

Results: Lower Band Edge

Frequency (MHz)	Level (dBμV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2398.878	53.0	69.7	16.7	Complied
2400	52.2	69.7	17.5	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	55.2	74.0	18.8	Complied
2488.660	56.2	74.0	17.8	Complied

Results: Upper Band Edge / Average

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2483.5	43.3	54.0	10.7	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2387.051	53.4	74.0	20.6	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2339.103	41.6	54.0	12.4	Complied

VERSION 2.0

Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11b / 20 MHz / DBPSK / 1 Mbps



Lower Band Edge



2310 MHz to 2390 MHz Restricted Band



Upper Band Edge

Results: 802.11g / 20 MHz / BPSK / 6 Mbps

Results: Lower Band Edge

Frequency (MHz)	Level (dBμV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.760	64.8	68.9	4.1	Complied
2400	62.5	68.9	6.4	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	66.6	74.0	7.4	Complied
2483.949	66.7	74.0	7.3	Complied

Results: Upper Band Edge / Average

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2483.5	49.2	54.0	4.8	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2389.744	70.9	74.0	3.1	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2390.000	51.8	54.0	2.2	Complied

VERSION 2.0

Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11g / 20 MHz / BPSK / 6 Mbps



Lower Band Edge



2310 MHz to 2390 MHz Restricted Band



Upper Band Edge

Results: 802.11n HT20 / BPSK / MCS0

Results: Lower Band Edge

Frequency (MHz)	Level (dBμV/m)	-30 dBc Limit (dBμV/m)	Margin (dB)	Result
2399.760	64.5	68.6	4.1	Complied
2400	63.7	68.6	4.9	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	64.8	74.0	9.2	Complied
2483.612	67.0	74.0	7.0	Complied

Results: Upper Band Edge / Average

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2483.5	48.5	54.0	5.5	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2389.872	68.1	74.0	5.9	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2390.000	49.2	54.0	4.8	Complied

VERSION 2.0

Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11n HT20 / BPSK / MCS0



Lower Band Edge



2310 MHz to 2390 MHz Restricted Band



Upper Band Edge

Results: 802.11n HT40 / BPSK / MCS0

Results: Lower Band Edge

Frequency (MHz)	Level (dBμV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2396.827	64.4	65.2	0.8	Complied
2400	62.7	65.2	2.5	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	64.4	74.0	9.6	Complied
2483.676	67.5	74.0	6.5	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dBµV/m)	Duty Cycle Correction (dB)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	52.1	0.1	52.2	54.0	1.8	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency	Level	Limit	Margin	Result
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	
2389.487	69.2	74.0	4.8	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Level (dBµV/m)	Duty Cycle Correction (dB)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.615	*52.3	0.1	52.4	54.0	1.6	Complied

Results: 802.11n HT40 / BPSK / MCS0





2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band / Average – Integration performed 0.5 MHz away from 2389.615 MHz

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Туре No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Feb 2018	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	9120 B 653	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	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%	±2.40 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±1.14 %
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Conducted Maximum Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±4.65 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±2.94 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	Revision Details			
Number	Page No(s)	Clause	Details	
1.0	-	-	Initial Version	
2.0	44	-	Test setup diagram added	

--- END OF REPORT ---