



TEST REPORT

Test Report No. : UL-RPT-RP11444781JD02C

Manufacturer : PASCE Ltd
Model No. : MRM
FCC ID : 2AD65MRM
Technology : *Bluetooth* – Low Energy
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 1.0.

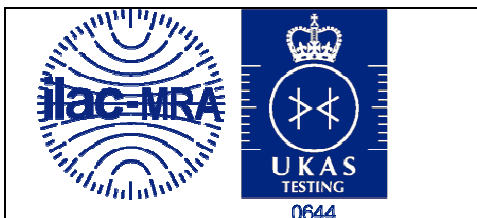
Date of Issue: 14 August 2017

Checked by:

Ian Watch
Senior Test Engineer, Radio Laboratory

Company Signatory:

Sarah Williams
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.

The *Bluetooth*[®] word mark and logos are owned by the *Bluetooth* SIG, Inc. and any use of such marks by UL VS LTD is under licence. Other trademarks and trade names are those of their respective owners.

UL VS LTD

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
3. Equipment Under Test (EUT)	7
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	8
3.5. Support Equipment	9
4. Operation and Monitoring of the EUT during Testing	10
4.1. Operating Modes	10
4.2. Configuration and Peripherals	10
5. Measurements, Examinations and Derived Results.....	11
5.1. General Comments	11
5.2. Test Results	12
5.2.1. Transmitter AC Conducted Spurious Emissions	12
5.2.2. Transmitter Minimum 6 dB Bandwidth	17
5.2.3. Transmitter Maximum Peak Output Power	20
5.2.4. Transmitter Radiated Emissions	23
5.2.5. Transmitter Band Edge Radiated Emissions	29
6. Measurement Uncertainty	32
7. Report Revision History	33

1. Customer Information








Company Name:	PASCE Ltd
Address:	Unit 4 City Business Park Easton Road Bristol BS5 0SP 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:	20 February 2017 to 16 March 2017

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	
Part 15.247(e)	Transmitter Power Spectral Density	Note 1
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	
Key to Results  = Complied  = Did not comply		

Note(s):

1. In accordance with FCC KDB 558074 Section 10.1, PSD measurements are not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to equal to the measured total output power.

2.3. Methods and Procedures

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 v03r05 April 8, 2016
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §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:	Minirig
Model Name or Number:	MRM
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)
Hardware Version:	V2F
Software Version:	6.0.52USB
FCC ID:	2AD65MRM

Brand Name:	Minirig
Model Name or Number:	MRM
Test Sample Serial Number:	Not marked or stated (<i>Conducted sample with RF port</i>)
Hardware Version:	V2F
Software Version:	6.0.52USB
FCC ID:	2AD65MRM

3.2. Description of EUT

The Equipment Under Test was a portable *Bluetooth* speaker.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Bluetooth Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbit/s		
Power Supply Requirement(s):	Nominal	5 VDC	
Maximum Conducted Output Power:	4.8 dBm		
Antenna Gain:	0.6 dBi		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	RF Channel	Channel Frequency (MHz)
	Bottom	0	2402
	Middle	19	2440
	Top	39	2480

3.5. Support Equipment

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

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	E5400
Serial Number:	01160

Description:	USB-SPI Converter. Length 2.48 metres
Brand Name:	CSR
Model Name or Number:	1224
Serial Number:	Not marked or stated

Description:	Level Shifter
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Charger/USB Cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Switching Power Supply
Brand Name:	Cromecast
Model Name or Number:	5005BBB0500100
Serial Number:	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):

- Transmitting at maximum power in *Bluetooth* LE mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

4.2. Configuration and Peripherals

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

- The EUT was powered from a fully charged 5 volt battery.
- Transmit tests: A laptop PC with CSR Bluetest application was used to place the EUT into *Bluetooth* LE test mode. Operating channels were selected in the test application. For radiated test, the laptop PC was disconnected from the EUT once in test mode and prior to testing.
- Radiated spurious emissions were performed with the EUT in the worst case orientation/position. Tests were performed with the EUT connected to its AC adaptor and USB cable. All other ports were terminated with suitable terminations.
- The EUT conducted sample was used for 6 dB bandwidth and maximum peak output power tests.
- The EUT radiated sample was used for AC conducted emissions and radiated spurious emissions 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:	David Doyle	Test Date:	16 March 2017
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)		

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

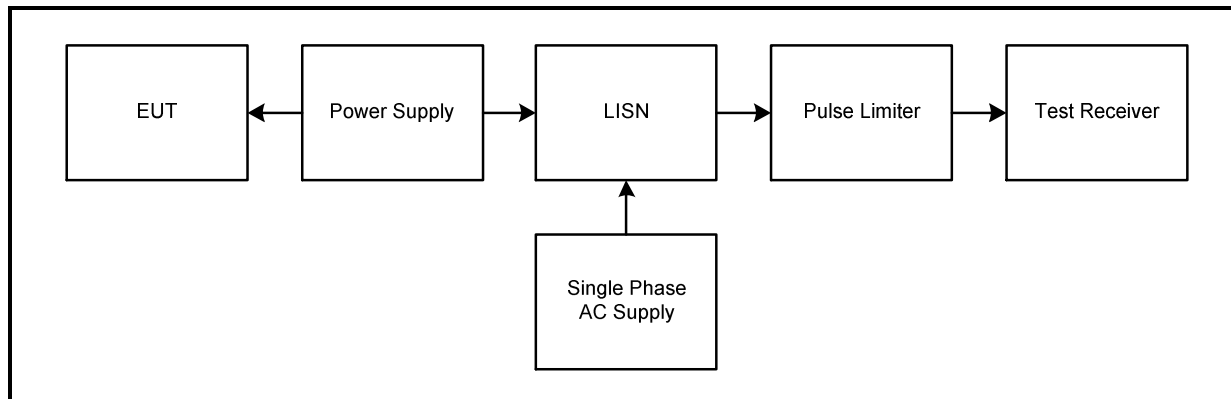
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	41

Note(s):

1. The EUT was connected to an AC charger via a USB cable. The AC charger was connected to a 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 AC 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:



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

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.452	Live	42.7	56.8	14.1	Complied
0.456	Live	43.4	56.8	13.4	Complied
0.906	Live	35.4	56.0	20.6	Complied
1.734	Live	30.4	56.0	25.6	Complied
2.148	Live	31.3	56.0	24.7	Complied
16.6426	Live	34.9	60.0	25.1	Complied

Results: Live / Average / 120 VAC 60 Hz

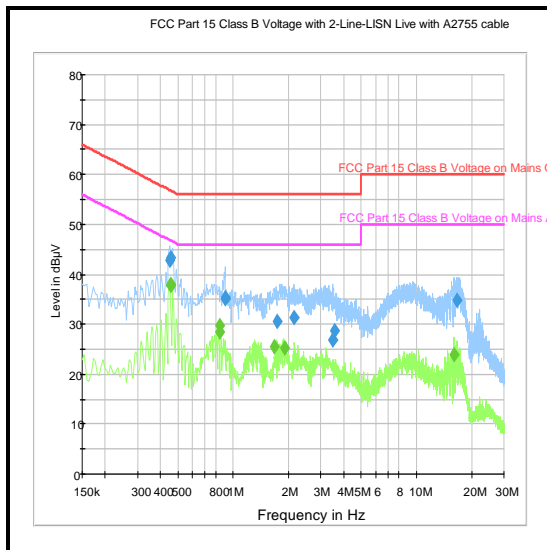
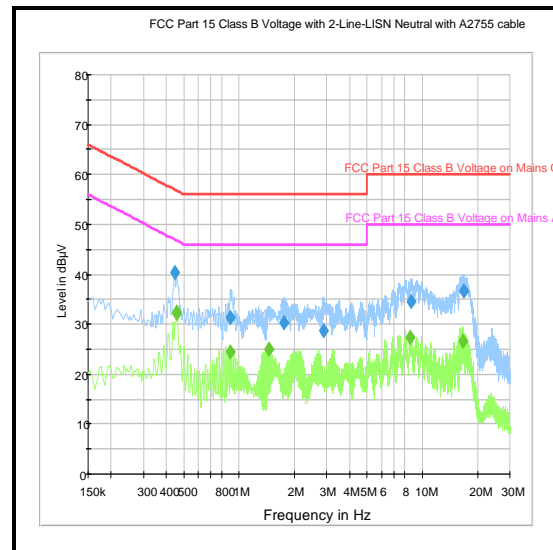
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.456	Live	38.0	46.8	8.8	Complied
0.843	Live	29.8	46.0	16.2	Complied
1.667	Live	25.4	46.0	20.6	Complied
1.910	Live	25.2	46.0	20.8	Complied
16.026	Live	24.0	50.0	26.0	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.447	Neutral	40.3	56.9	16.6	Complied
0.897	Neutral	31.3	56.0	24.7	Complied
1.761	Neutral	30.2	56.0	25.8	Complied
2.877	Neutral	28.7	56.0	27.3	Complied
8.678	Neutral	34.6	60.0	25.4	Complied
16.728	Neutral	36.6	60.0	23.4	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.456	Neutral	32.4	46.8	14.4	Complied
0.893	Neutral	24.4	46.0	21.6	Complied
1.455	Neutral	25.1	46.0	20.9	Complied
8.583	Neutral	27.3	50.0	22.7	Complied
16.602	Neutral	26.5	50.0	23.5	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
0.474	Live	47.7	56.4	8.7	Complied
0.848	Live	49.6	56.0	6.4	Complied
0.924	Live	52.1	56.0	3.9	Complied
1.356	Live	49.9	56.0	6.1	Complied
2.567	Live	46.1	56.0	9.9	Complied
2.958	Live	44.8	56.0	11.2	Complied

Results: Live / Average / 240 VAC 60 Hz

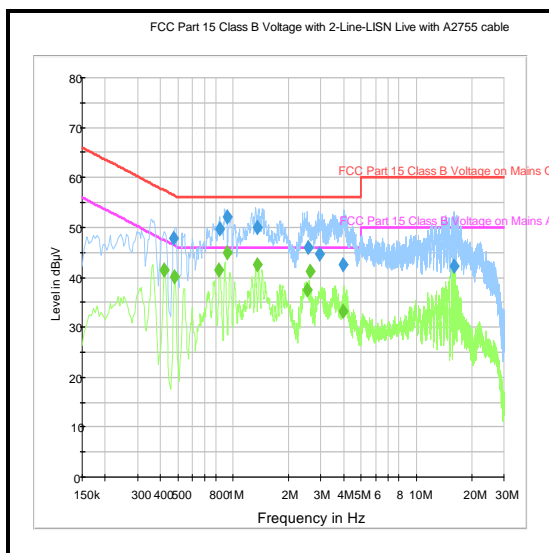
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.420	Live	41.5	47.4	5.9	Complied
0.479	Live	40.2	46.4	6.2	Complied
0.834	Live	41.6	46.0	4.4	Complied
0.924	Live	44.9	46.0	1.1	Complied
1.352	Live	42.4	46.0	3.6	Complied
2.621	Live	41.1	46.0	4.9	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.447	Neutral	45.6	56.9	11.3	Complied
0.888	Neutral	32.3	56.0	23.7	Complied
0.915	Neutral	33.1	56.0	22.9	Complied
1.280	Neutral	36.0	56.0	20.0	Complied
2.333	Neutral	35.3	56.0	20.7	Complied
15.626	Neutral	36.6	60.0	23.4	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.447	Neutral	40.6	46.9	6.3	Complied
0.884	Neutral	20.7	46.0	25.3	Complied
1.433	Neutral	27.8	46.0	18.2	Complied
2.126	Neutral	26.3	46.0	19.7	Complied
2.679	Neutral	27.2	46.0	18.8	Complied
3.998	Neutral	21.4	46.0	24.6	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)
M2013	Thermohygrometer	Testo	608-H1	45046419	10 Jun 2017	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	20 Jul 2017	12
A1829	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100671	05 May 2017	12
M1263	Test Receiver	Rohde & Schwarz	ESIB-7	100265	07 Nov 2017	12
M1818	Multimeter	Fluke	79 Series II	71811580	27 Apr 2017	12

5.2.2. Transmitter Minimum 6 dB Bandwidth**Test Summary:**

Test Engineer:	David Doyle	Test Date:	20 February 2017
Test Sample Serial Number:	Not marked or stated (<i>Conducted sample with RF port</i>)		

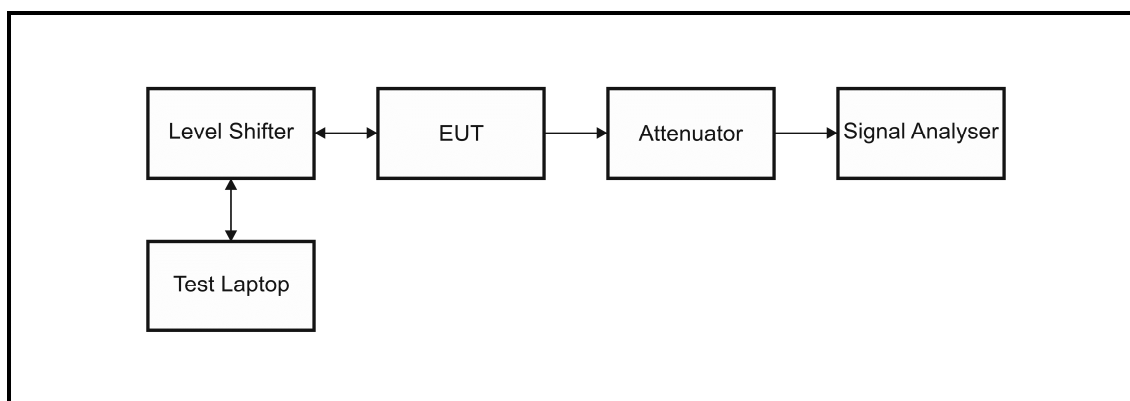
FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.1 Option 2

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	40

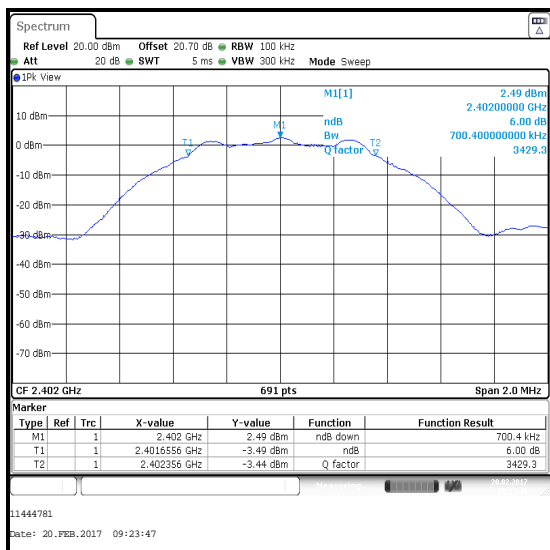
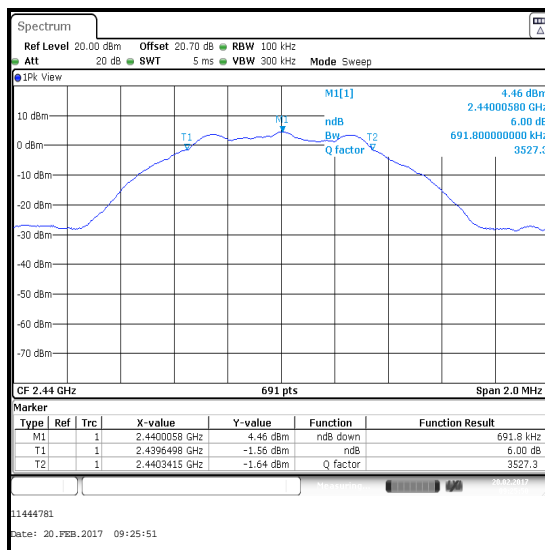
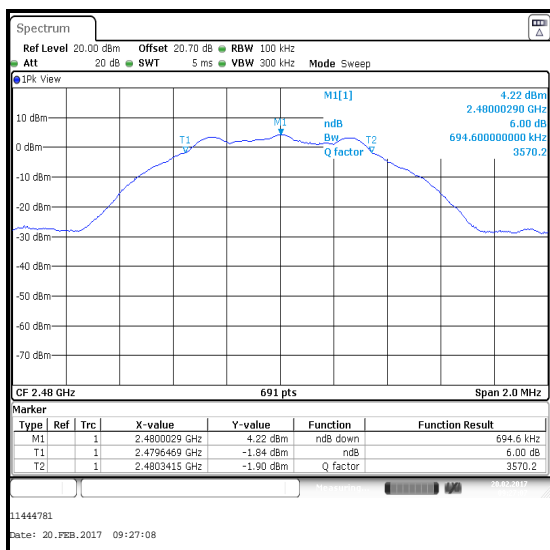
Note(s):

1. 6 dB DTS bandwidth tests were performed using a signal analyser in accordance with FCC KDB 558074 Section 8.1 Option 2 measurement procedure. 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 DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Test setup:

Transmitter Minimum 6 dB Bandwidth (continued)**Results:**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	700.400	≥500	200.400	Complied
Middle	691.800	≥500	191.800	Complied
Top	694.600	≥500	194.600	Complied

**Bottom Channel****Middle Channel****Top Channel**

Transmitter Minimum 6 dB Bandwidth (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	02 Apr 2017	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	22 Nov 2017	12
A2923	Attenuator	AtlanTecRF	AN18W5-20	832828#6	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	09 May 2017	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	11 Apr 2018	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	15 Apr 2018	24

5.2.3. Transmitter Maximum Peak Output Power**Test Summary:**

Test Engineer:	David Doyle	Test Date:	20 February 2017
Test Sample Serial Number:	Not marked or stated (<i>Conducted sample with RF port</i>)		

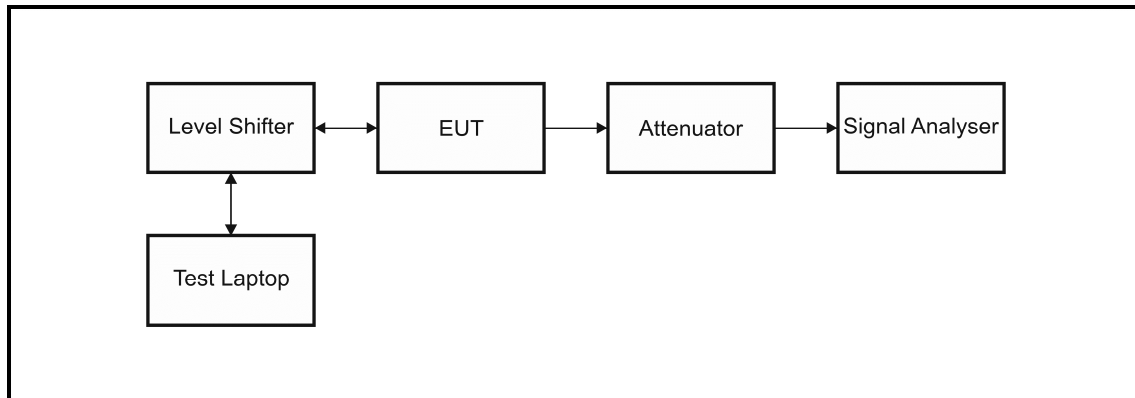
FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 9.1.1

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	40

Note(s):

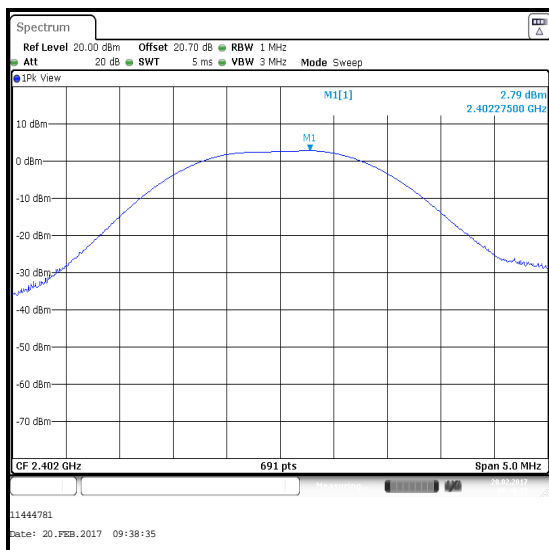
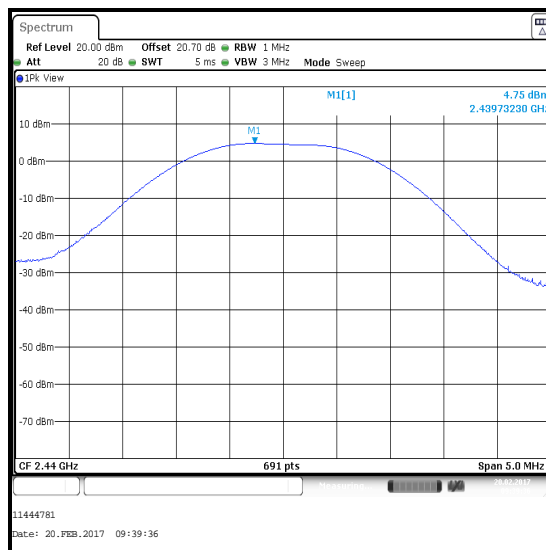
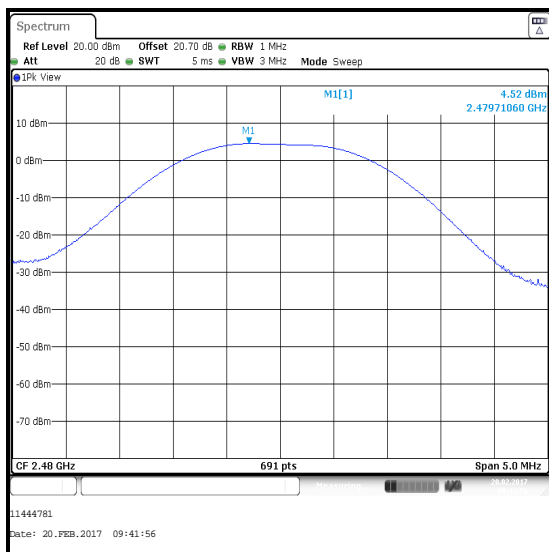
1. Conducted power tests were performed using a signal analyser in accordance with FCC KDB 558074 Section 9.1.1 with the RBW > *DTS bandwidth* procedure.
2. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 5 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
3. 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 test receiver to compensate for the loss of the attenuator and RF cable.
4. The conducted power was added to the declared antenna gain to obtain the EIRP.

Test setup:

Transmitter Maximum Peak Output Power (continued)**Results:**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.8	30.0	27.2	Complied
Middle	4.8	30.0	25.2	Complied
Top	4.5	30.0	25.5	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.8	0.6	3.4	36.0	32.6	Complied
Middle	4.8	0.6	5.4	36.0	30.6	Complied
Top	4.5	0.6	5.1	36.0	30.9	Complied

Transmitter Maximum Peak Output Power (continued)**Bottom Channel****Middle Channel****Top Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	02 Apr 2017	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	22 Nov 2017	12
A2923	Attenuator	AtlanTecRF	AN18W5-20	832828#6	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	09 May 2017	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	11 Apr 2018	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	15 Apr 2018	24

5.2.4. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	David Doyle	Test Date:	15 March 2017
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)		

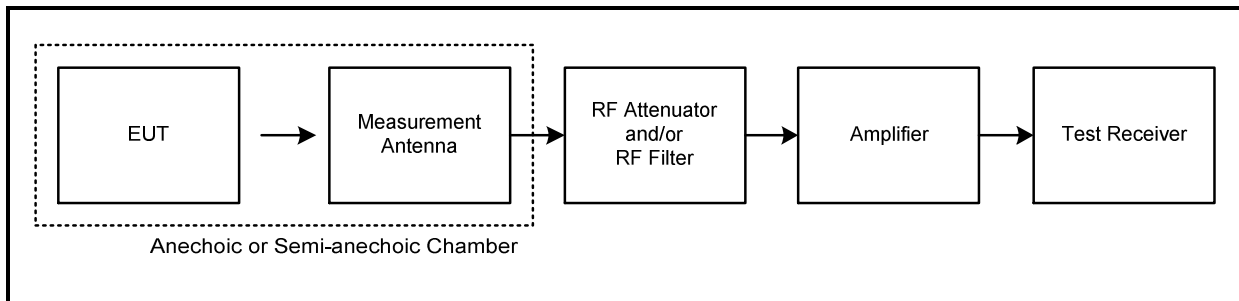
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	41

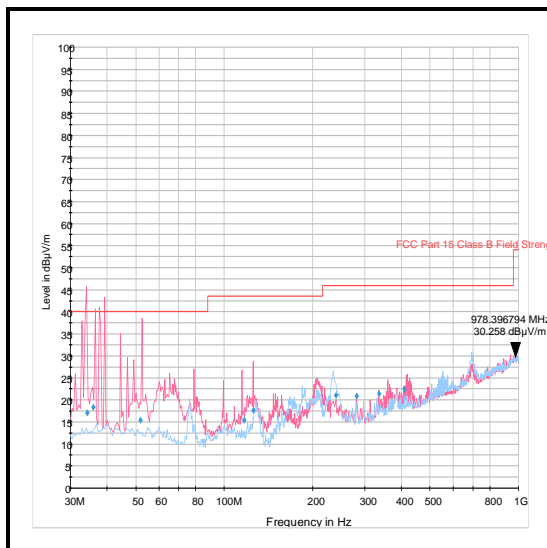
Note(s):

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 emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) 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 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

Transmitter Radiated Emissions (continued)**Test setup for radiated measurements:**

Transmitter Radiated Emissions (continued)**Results: Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
978.397	Vertical	30.3	54.0	23.7	Complied

**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
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	07 Dec 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	11 Apr 2017	12
A2959	Antenna	Schwarzbeck	VULB 9163	9163-967	08 Sep 2017	12
G0543	Amplifier	Sonoma	310N	230801	09 Jun 2017	6
A1834	Attenuator	Hewlett Packard	8491B	10444	30 Mar 2017	12

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	David Doyle	Test Date:	23 February 2017
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	44

Note(s):

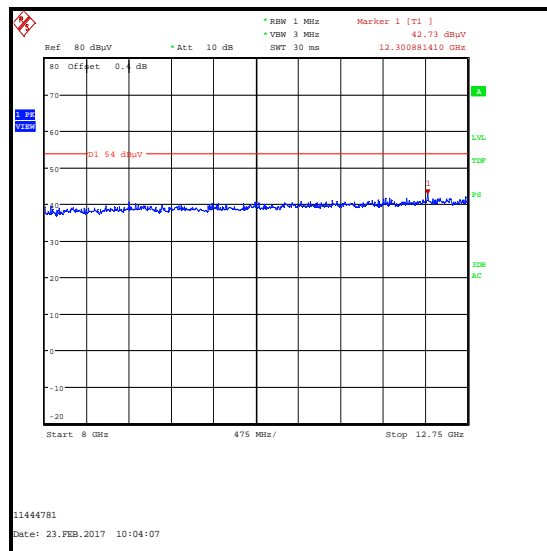
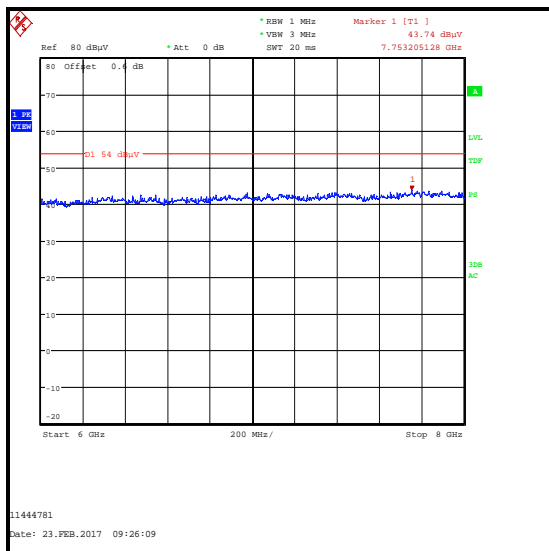
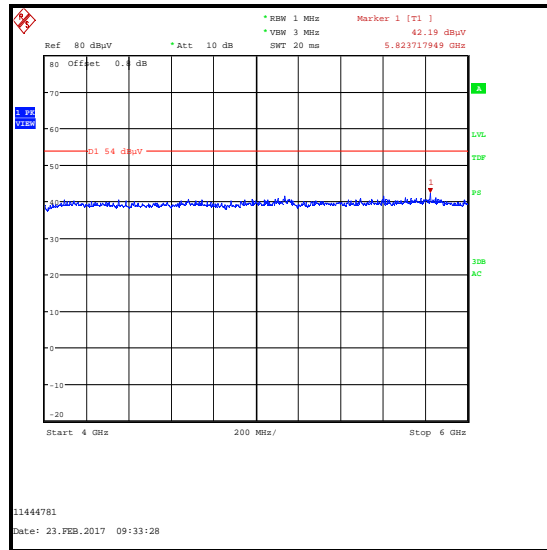
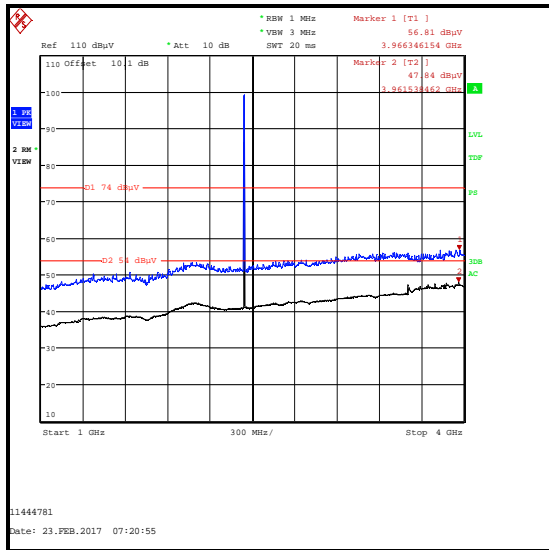
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest noise floor readings of the measuring receiver was recorded as shown in the tables below.
3. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.
4. Measurements above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) 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.

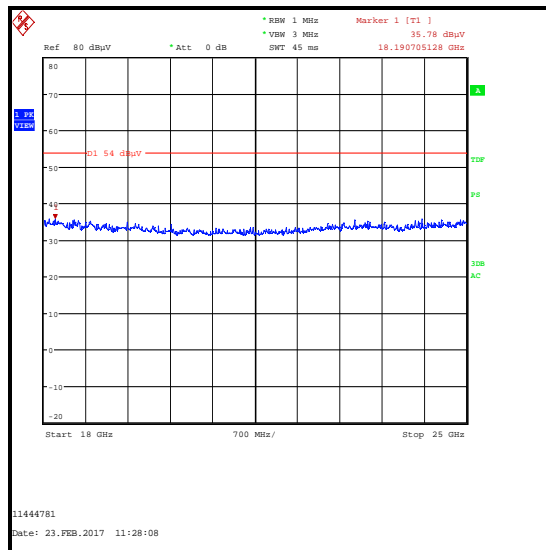
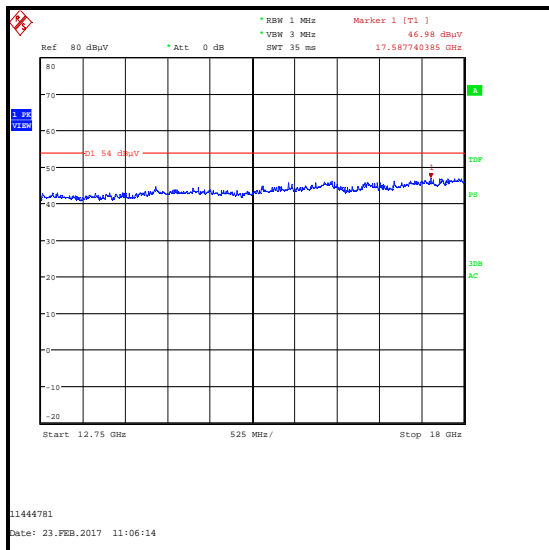
Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
3966.346	Horizontal	56.8	74.0	17.2	Complied

Results: Average / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
3961.538	Horizontal	47.8	54.0	6.2	Complied

Transmitter Radiated Emissions (continued)

Transmitter Radiated Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	16 Nov 2017	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	09 Nov 2017	12
A1818	Antenna	EMCO	3115	00075692	08 Nov 2017	12
A253	Antenna	Flann Microwave	12240-20	128	08 Nov 2017	12
A254	Antenna	Flann Microwave	14240-20	139	08 Nov 2017	12
A255	Antenna	Flann Microwave	16240-20	519	08 Nov 2017	12
A256	Antenna	Flann Microwave	18240-20	400	08 Nov 2017	12
A2896	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-023	09 Nov 2017	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	07 Apr 2017	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	26 Apr 2017	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	26 Apr 2017	12

5.2.5. Transmitter Band Edge Radiated Emissions**Test Summary:**

Test Engineer:	David Doyle	Test Date:	21 February 2017
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	KDB 558074 Sections 11 & 12

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	37

Note(s):

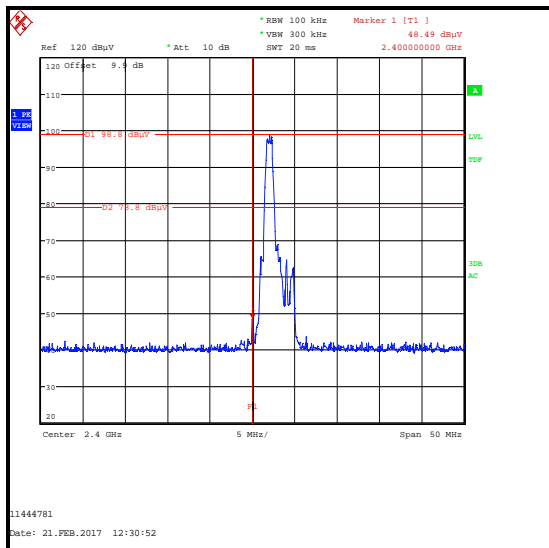
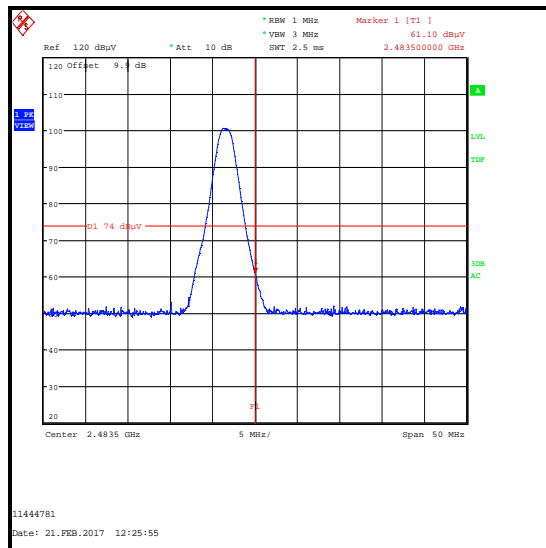
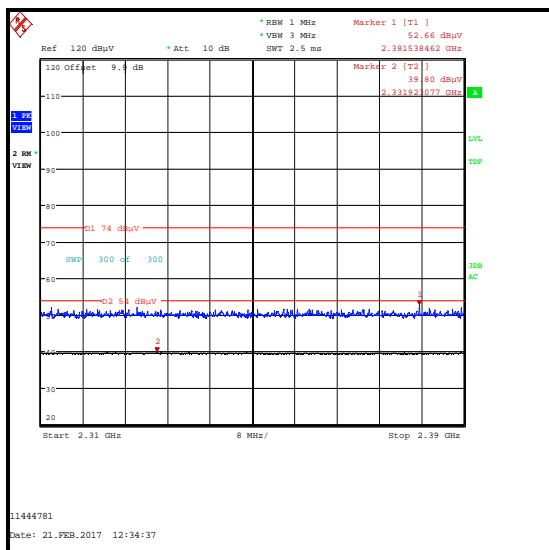
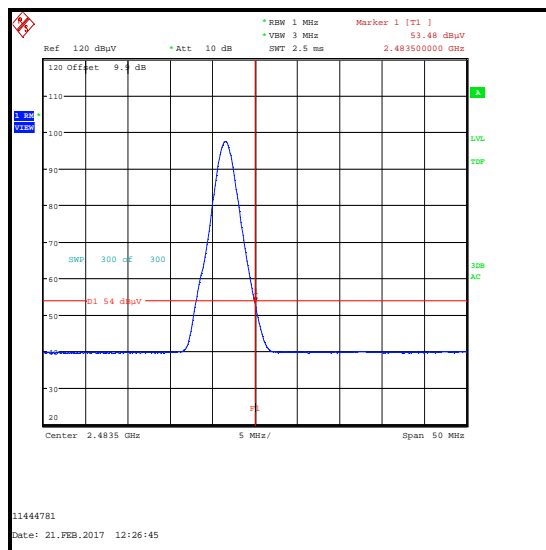
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge is adjacent to 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 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.
4. As the upper band edge is adjacent to 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 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 signal analyser 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.
5. There is a restricted band 10 MHz below the lower band edge from 2310 MHz to 2390 MHz. 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 peak and RMS detectors respectively. Markers were placed on the highest point on each trace.
6. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2381.538	52.7	74.0	21.3	Complied
2400.0	48.5	78.8*	30.3	Complied
2483.5	61.1	74.0	12.9	Complied

Results: Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2331.923	39.8	54.0	14.2	Complied
2483.5	53.5	54.0	0.5	Complied

Transmitter Band Edge Radiated Emissions (continued)**Lower Band Edge****Upper Band Edge****2310 MHz to 2390 MHz Restricted Band****Upper Band Edge****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelpunkt	30.5015	None stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	16 Nov 2017	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	09 Nov 2017	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1818	Antenna	EMCO	3115	0075692	08 Nov 2017	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	26 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 measured (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
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 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 Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version

--- END OF REPORT ---