




TEST REPORT

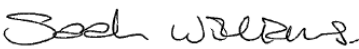
Test Report No. : UL-RPT-RP11327903JD02A V3.0

Manufacturer : Kontakt Micro-Location Sp. z o.o.
Model No. : Kontakt Smart Beacon 2
FCC ID : 2ADAO-SB2-V250
Technology : *Bluetooth* – Low Energy
Test Standard(s) : FCC Parts 15.209(a),15.35(c) & 15.247

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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 3.0 supersedes all previous versions.

Date of Issue: 06 October 2017

Checked by: 
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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:	Kontakt Micro-Location Sp z o.o.
Address:	Stoczniewców 3 30-709 Kraków Poland

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:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 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:	29 August 2017 to 08 September 2017

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.247(e)	Transmitter Power Spectral Density	Note 2
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. The measurement was performed to assist in the calculation of the level of emissions. The EUT cannot transmit continuously and sweep triggering/signal gating cannot be implemented.
2. In accordance with FCC KDB 558074 Section 10.1, PSD is 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 be equal to the measured 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 v04 April 5, 2017
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247

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:	Kontakt Smart Beacon 2
Model Name or Number:	Kontakt Smart Beacon 2
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)
Hardware Version:	v2.5
Software Version:	n/a
FCC ID:	2ADAO-SB2-V250

Brand Name:	Kontakt Smart Beacon 2
Model Name or Number:	Kontakt Smart Beacon 2
Test Sample Serial Number:	Not marked or stated (<i>Conducted sample with RF port</i>)
Hardware Version:	v2.5
Software Version:	n/a
FCC ID:	2ADAO-SB2-V250

3.2. Description of EUT

The Equipment Under Test was a *Bluetooth* LE beacon device. Power is supplied by two CR2477 coin batteries.

3.3. Modifications Incorporated in the EUT

The radiated spurious emissions testing was performed with the device housing removed to allow unique connection to the test cables. This can be considered worst case.

3.4. Additional Information Related to Testing

Technology Tested:	<i>Bluetooth</i> Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbps		
Power Supply Requirement(s):	Nominal	3.0 VDC	
Maximum Conducted Output Power:	2.8 dBm		
Antenna Gain:	3.1 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:	UL Asset No.00788

Description:	UART to USB converter
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	USB Type A to Mini USB cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
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 a modulated carrier, maximum data length available and Pseudorandom Bit Sequence 9 on bottom, middle or top channel as required.

4.2. Configuration and Peripherals

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

- The EUT was connected to the customer supplied UART to USB converter. The UART to USB converter was connected to the laptop PC by retractable USB cable.
- Controlled using the software application 'nRFgo Studio' on the test laptop PC. The application was used to enable continuous transmission and receive mode (all circuits active but not transmitting) and to select the test channels as required. The customer supplied Kontakt Beacon Certificate test kit operating manual V1.2.pdf containing instructions for test mode. These instructions were followed. The EUT was configured to send the maximum packet length of 37 bytes containing PRBS9.
- The laptop PC and USB cable were disconnected from the UART to USB converter during radiated tests and then removed from the test chamber.
- Powered by a pair of fully charged CR2477 batteries. The battery voltage was monitored throughout testing and the batteries replaced as required.

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 Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	David Doyle	Test Date:	08 September 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 1

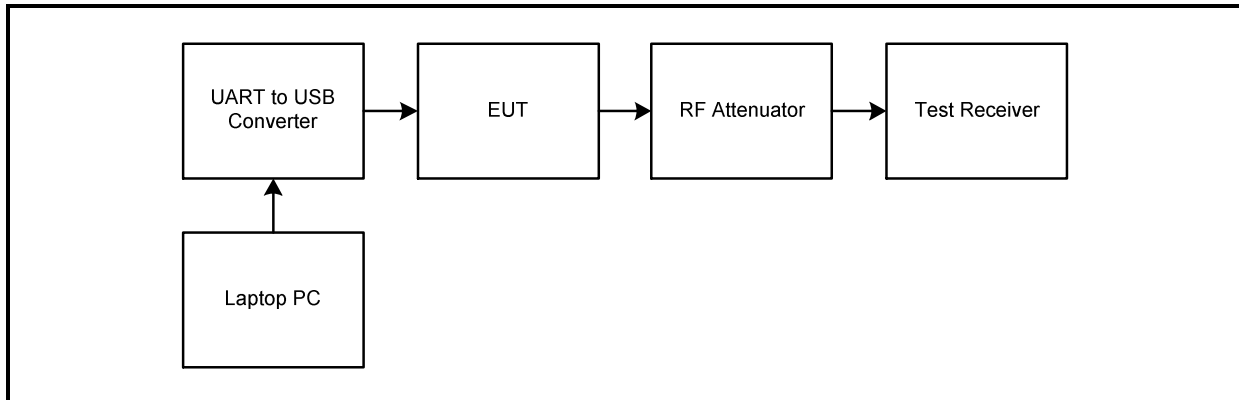
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	48

Note(s):

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

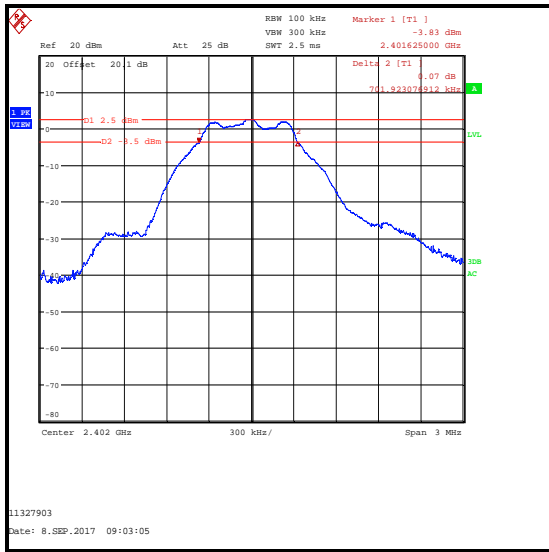
Test setup:



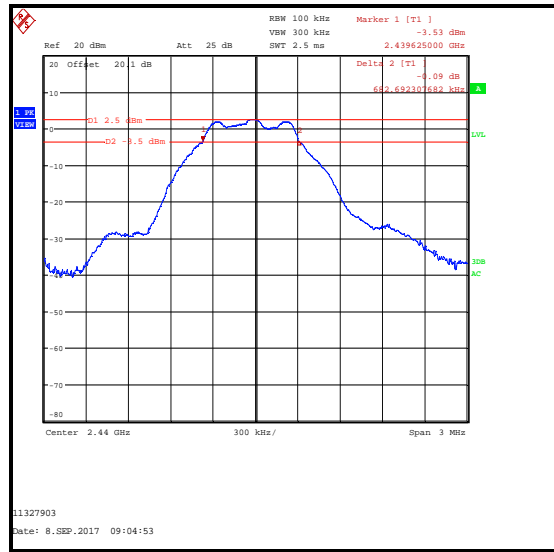
Transmitter Minimum 6 dB Bandwidth (continued)

Results:

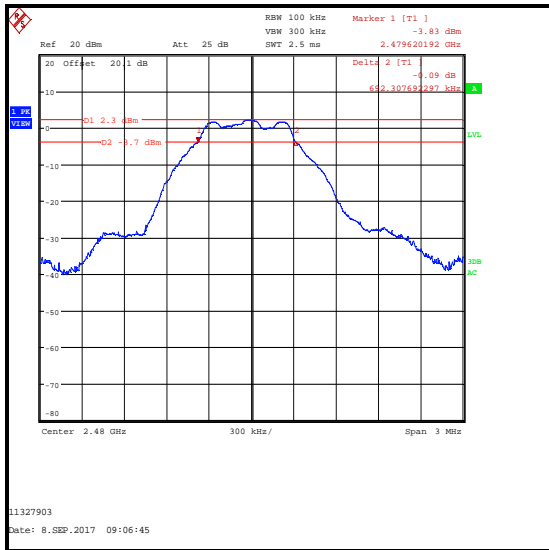
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	701.923	≥500	201.923	Complied
Middle	682.692	≥500	182.692	Complied
Top	692.308	≥500	192.308	Complied



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)
M2002	Thermohygrometer	Testo	608-H1	45041825	22 Feb 2018	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	04 Apr 2018	12
A2522	Attenuator	AtlanTecRF	AN18-20	832797#3	Calibrated before use	-
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	26 Oct 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
M1251	Digital Multimeter	Fluke	175	89170179	10 May 2018	12

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

Test Engineer:	Andrew Edwards	Test Date:	30 August 2017
Test Sample Serial Number:	Not marked or stated (<i>Conducted sample with RF port</i>)		

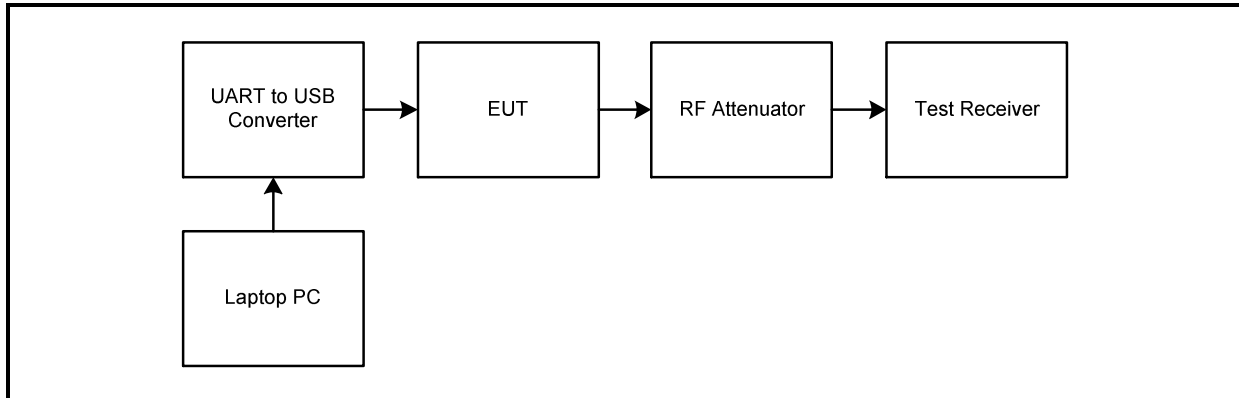
FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 9.1.1

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	43

Note(s):

1. Conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 Section 9.1.1 Measurement Procedure.
2. The test receiver 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 test receiver 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.

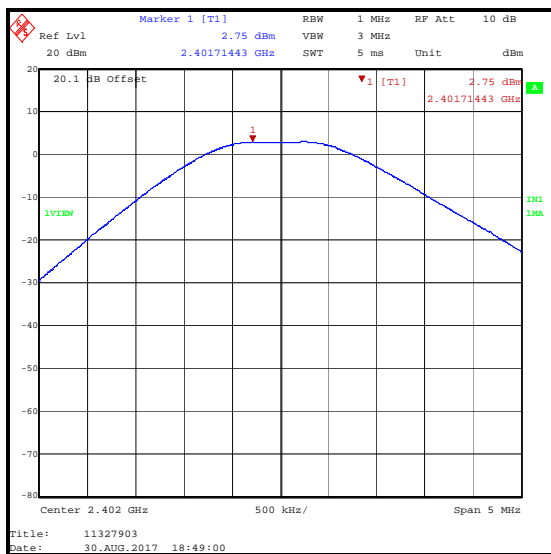
Test setup:

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

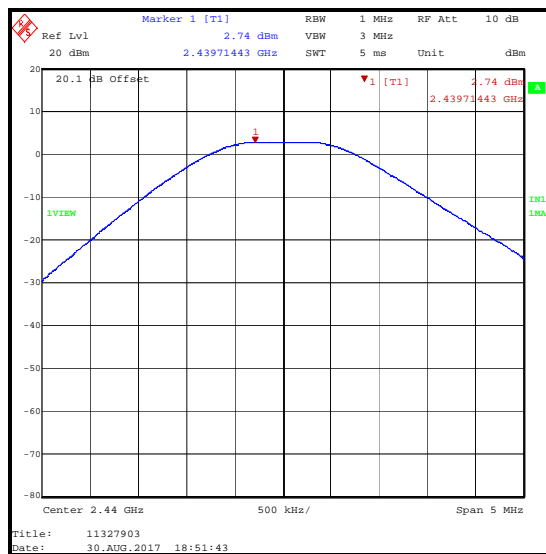
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.8	30.0	27.2	Complied
Middle	2.7	30.0	27.3	Complied
Top	2.5	30.0	27.5	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.8	3.1	5.9	36.0	30.1	Complied
Middle	2.7	3.1	5.8	36.0	30.2	Complied
Top	2.5	3.1	5.6	36.0	30.4	Complied

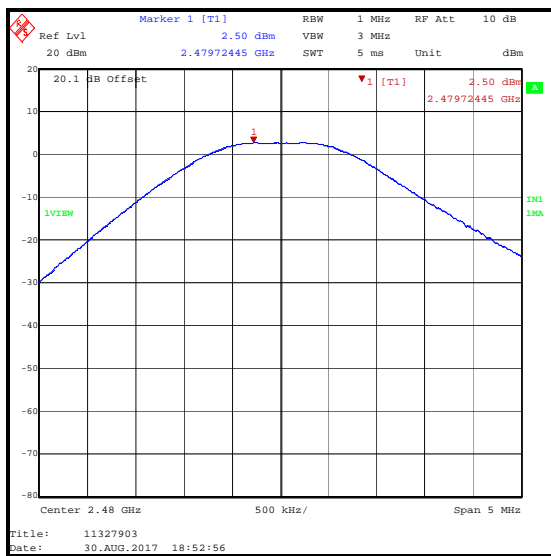
Transmitter Maximum Peak Output Power (continued)



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 Handlungspunkt	30.5015.13	Not stated	22 Feb 2018	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	13 Jul 2018	12
A2522	Attenuator	AtlanTecRF	AN18-20	832797#3	Calibrated before use	-
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	26 Oct 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
M1251	Digital Multimeter	Fluke	175	89170179	10 May 2018	12

5.2.3. Transmitter Duty Cycle**Test Summary:**

Test Engineers:	David Doyle	Test Date:	29 August 2017
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample</i>)		

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

Environmental Conditions:

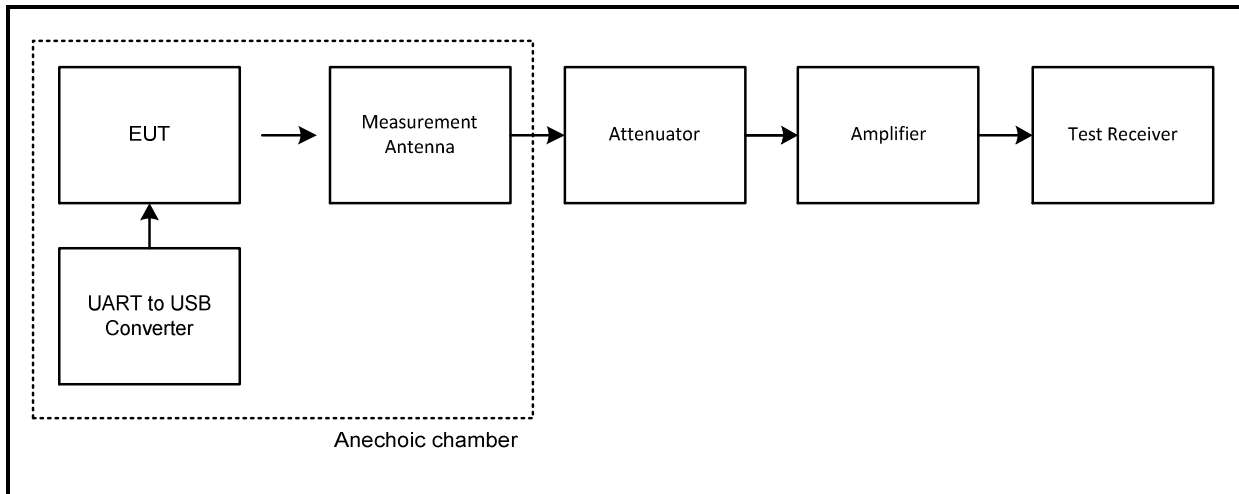
Temperature (°C):	23
Relative Humidity (%):	50

Note(s):

- In order to assist with the determination of the average level of 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 was measured using a test receiver in the time domain and calculated as shown below:

$$10 \log (1 / (\text{On Time} / [\text{Period or } 100 \text{ ms whichever is the lesser}])).$$

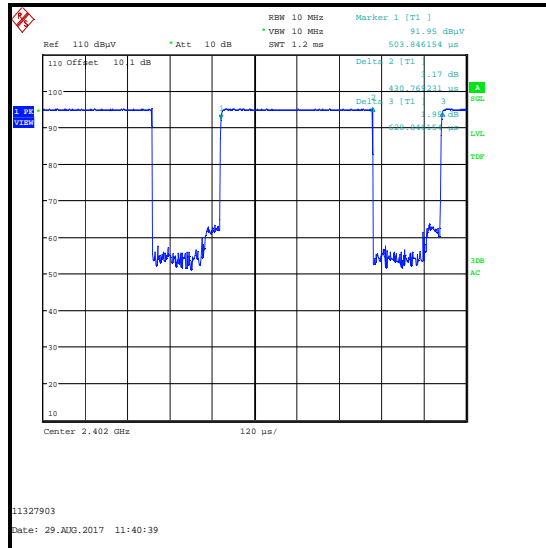
$$10 \log (1 / (430.769 / 628.846)) = 1.6 \text{ dB}$$

Test setup: Anechoic chamber

Transmitter Duty Cycle (continued)

Results:

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
430.770	628.846	1.6



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
A2863	Pre Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	12
M1251	Digital Multimeter	Fluke	175	89170179	10 May 2018	12

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

Test Engineer:	Alan Withers	Test Date:	30 August 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):	24
Relative Humidity (%):	49

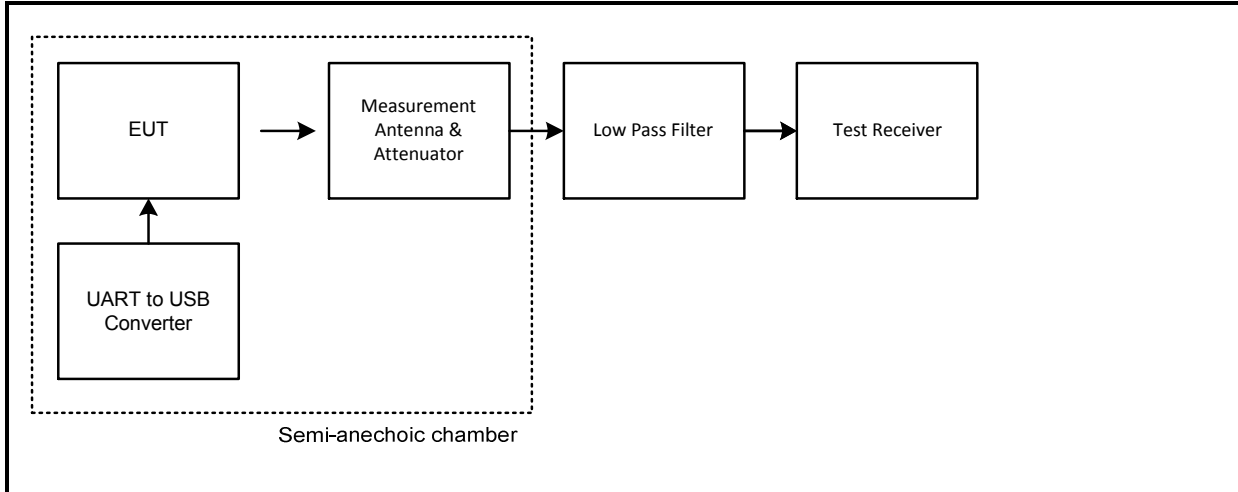
Note(s):

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. 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.
4. 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.

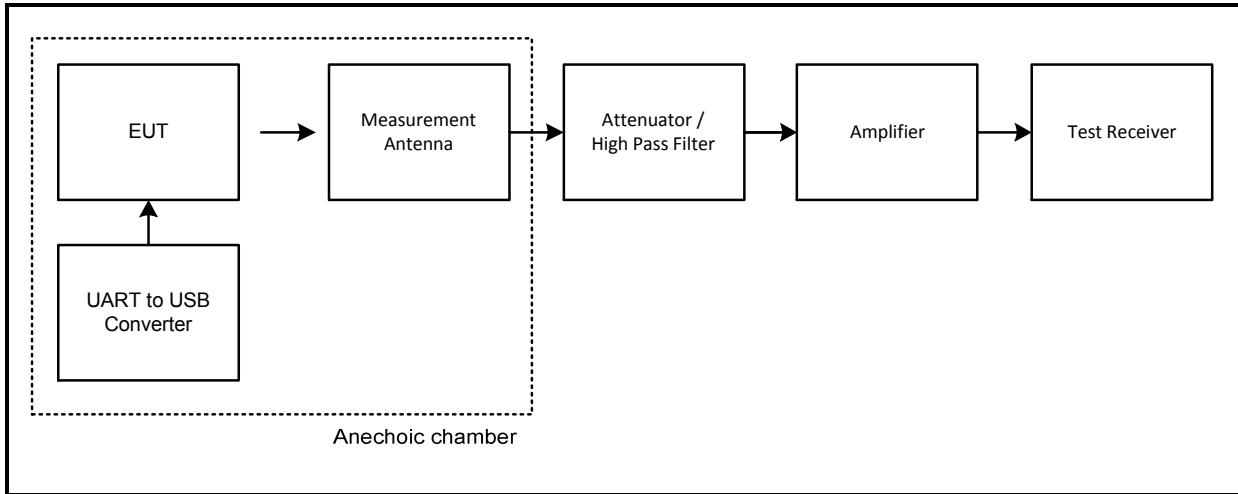
Transmitter Radiated Emissions (continued)

Test setup for radiated measurements:

Semi-anechoic chamber < 1 GHz:



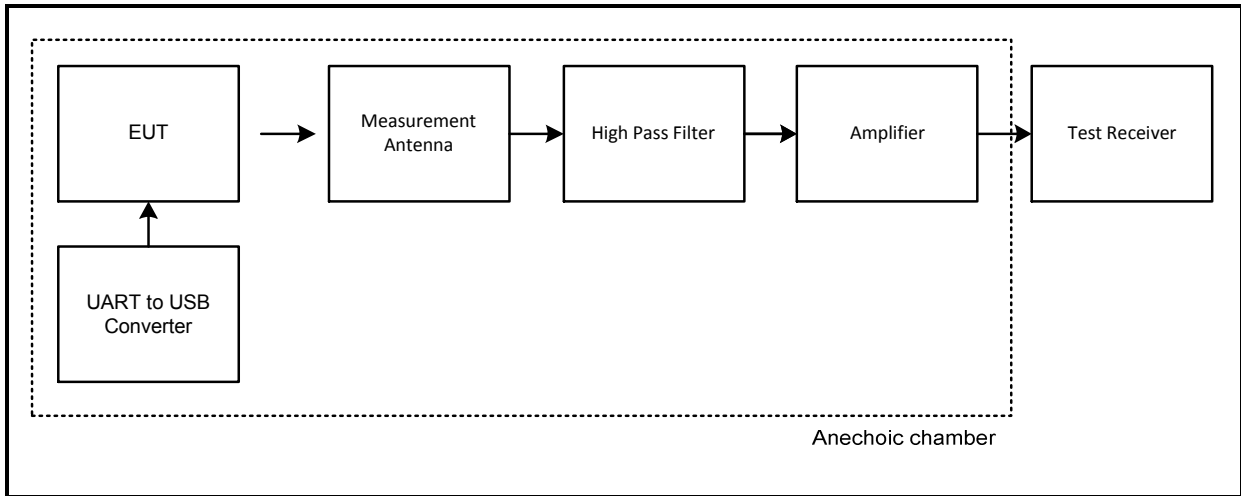
Anechoic chamber 1GHz to 8 GHz:



Transmitter Radiated Emissions (continued)

Test setup for radiated measurements:

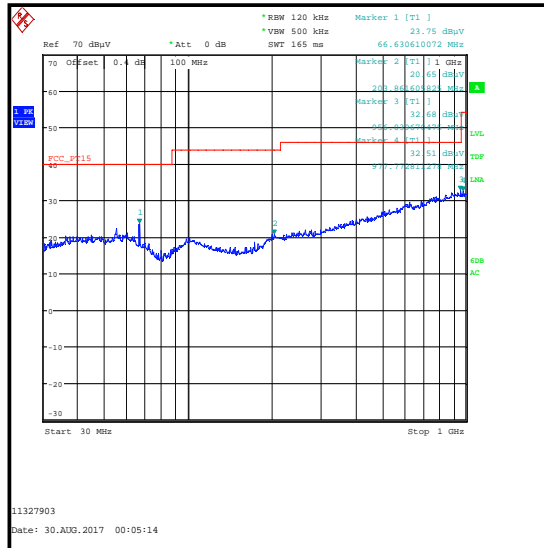
Anechoic chamber > 8 GHz:



Transmitter Radiated Emissions (continued)

Results: Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
956.040	Vertical	32.7	46.0	13.3	Complied



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-02000	JFB1004-002	27 Feb 2018	12
M1251	Digital Multimeter	Fluke	175	89170179	10 May 2018	12

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

Test Engineers:	David Doyle, Andrew Edwards & Alan Withers	Test Date:	29 August 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 & 12.2.5.2 referencing ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	24 to 25
Relative Humidity (%):	49 to 50

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 emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
3. All other emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor
4. The reference level for the emission in the non-restricted band was established by following KDB 558074 Section 11.2 procedure.
5. *-20 dBc limit applies in non-restricted band as the conducted output power measurements were performed using a peak detector.
6. **In accordance with ANSI C63.10 Section 6.6.4.3, Note 1, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
7. 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. Final measurements 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 m 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.
8. 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.

Transmitter Radiated Emissions (continued)**Results: Peak / Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2317.750	Vertical	58.3	74.0	15.7	Complied
2373.240	Vertical	60.9	74.0	13.1	Complied
4804.294	Horizontal	56.9	74.0	17.1	Complied
7205.970	Horizontal	57.9	74.6*	16.7	Complied
9607.925	Horizontal	58.9	74.6*	15.7	Complied
12008.680	Horizontal	56.0	74.0	18.0	Complied

Results: Average / Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Correction Factor (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2317.750	Vertical	41.3	1.6	42.9	54.0	11.1	Complied
2373.240	Vertical	42.6	1.6	44.2	54.0	9.8	Complied
4804.294	Horizontal	51.7	1.6	53.3	54.0	0.7	Complied
12008.680	Horizontal	48.6	1.6	50.2	54.0	3.8	Complied

Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2493.160	Vertical	55.7	74.0	18.3	Complied
4879.718	Vertical	53.4	54.0**	0.6	Complied
7319.229	Horizontal	56.2	74.0	17.8	Complied
12198.576	Horizontal	50.3	54.0**	3.7	Complied

Results: Average / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Correction Factor (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2493.160	Vertical	42.7	1.6	44.3	54.0	9.7	Complied
7319.229	Horizontal	48.6	1.6	50.2	54.0	3.8	Complied

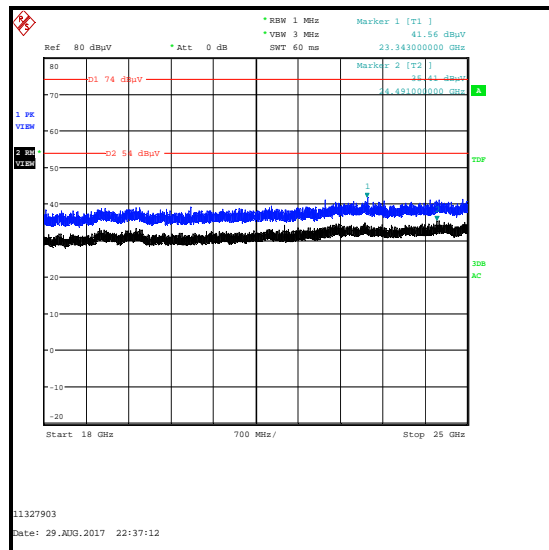
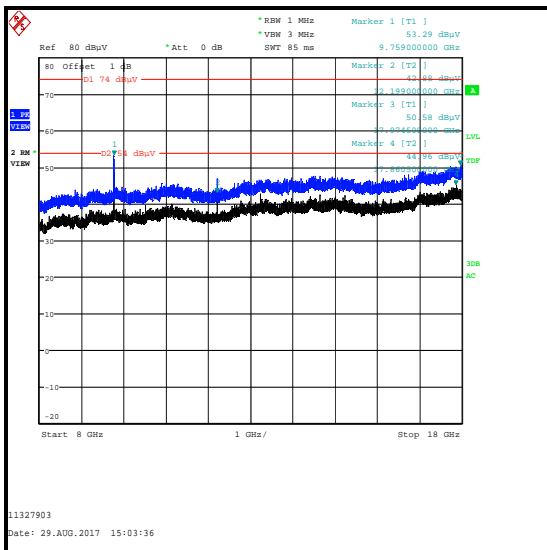
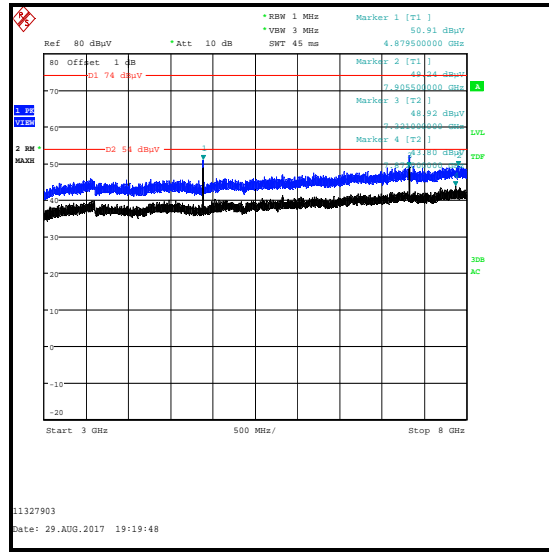
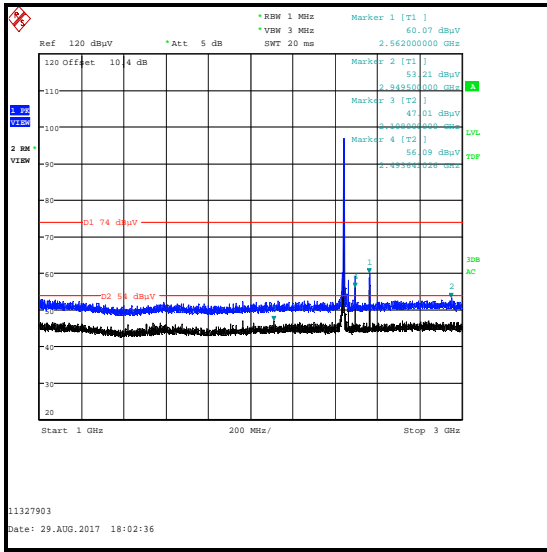
Transmitter Radiated Emissions (continued)**Results: Peak / Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2492.725	Vertical	61.8	74.0	12.2	Complied
2561.411	Vertical	61.3	76.5*	15.2	Complied
4959.862	Horizontal	54.7	74.0	19.3	Complied

Results: Average / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Correction Factor (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2492.725	Vertical	44.2	1.6	45.8	54.0	8.2	Complied
4959.862	Horizontal	45.5	1.6	47.1	54.0	6.9	Complied

Transmitter Radiated Emissions (continued)



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

Transmitter Radiated Emissions (continued)**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
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	BBHA 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
M1251	Digital Multimeter	Fluke	175	89170179	10 May 2018	12

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

Test Engineer:	David Doyle	Test Date:	29 August 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 Section 6.10.4, 6.10.5, KDB 558074 Section 11 & 12.2.5.2

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	50

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 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 peak conducted output power was measured using a peak detector in accordance with FCC KDB 558074 Section 9.1.1 an out-of-band limit line was placed 20 dB below the peak level (FCC KDB 558074 Section 11.1(a)). 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 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. Average measurements were performed using KDB 558074 Method 12.2.5.2 and the measure duty cycle was added to the measured level as a correction factor. 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. 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. Average measurements were performed using KDB 558074 Method 12.2.5.2 and the measure duty cycle was added to the measured level as a correction factor. Markers were placed on the highest point on each trace.
6. The reference level was set to 110 dBµV in order to achieve sufficient headroom.

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

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.000	52.1	74.6	22.5	Complied
2483.500	61.2	74.0	12.8	Complied

Results: Average

Frequency (MHz)	Level (dB μ V/m)	Correction Factor (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.500	50.6	1.6	52.2	54.0	1.8	Complied

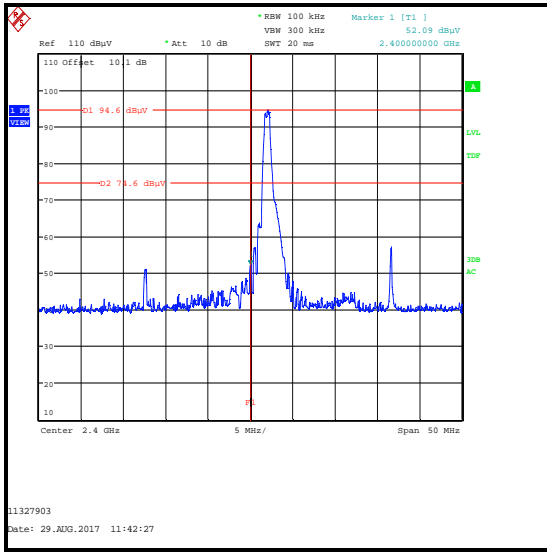
Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2332.436	55.9	74.0	18.1	Complied
2387.564	59.0	74.0	15.0	Complied

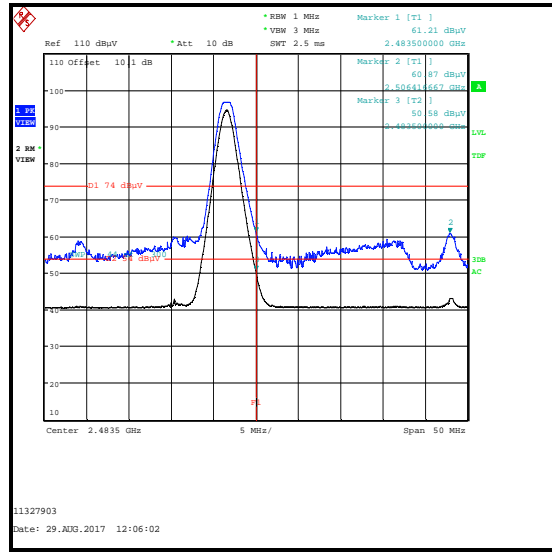
Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Level (dB μ V/m)	Correction Factor (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2332.436	40.6	1.6	42.2	54.0	11.8	Complied
2387.821	41.8	1.6	43.4	54.0	10.6	Complied

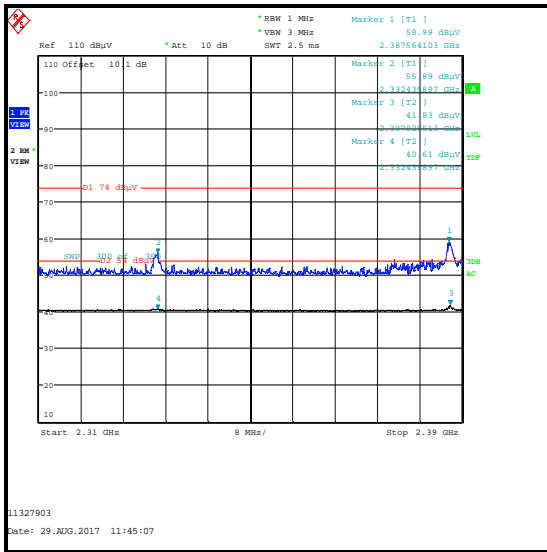
Transmitter Band Edge Radiated Emissions (continued)



Lower Band Edge Peak



Upper Band Edge Peak and Average



2310 MHz to 2390 MHz Restricted Band

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohyrometer	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	BBHA 9120 B 653	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	12
M1251	Digital Multimeter	Fluke	175	89170179	10 May 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 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
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±1.14 %
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
2.0	-	-	Section 3.1 updated
3.0	-	-	Section 3.3 updated

--- END OF REPORT ---