



# TEST REPORT

**Test Report No. :** UL-RPT-RP11265293JD07C

**Manufacturer** : Apple Inc.  
**Model No.** : A1785  
**FCC ID** : BCG-E3088A  
**Technology** : *Bluetooth* – Low Energy (using ePA)  
**Test Standard(s)** : FCC Parts 15.209(a) & 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 1.0

**Date of Issue:** 03 August 2016

**Checked by:**

Steven White  
Service Lead, Radio Laboratory

**Company Signatory:**

Sarah Williams  
Senior Engineer, Radio Laboratory  
UL VS LTD



This laboratory is accredited by UKAS.  
The tests reported herein have been  
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**1. Customer Information**








<b>Company Name:</b>	Apple
<b>Address:</b>	1 Infinite Loop Cupertino, CA 95014 U.S.A

## **2. Summary of Testing**

### **2.1. General Information**

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
<b>Specification Reference:</b>	47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	07 June 2016 to 22 July 2016

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

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	
Part 15.247(e)	Transmitter Power Spectral Density	
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	
<b>Key to Results</b>  = Complied  = Did not comply		

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

1. There are two vendors of the WiFi/Bluetooth radio modules, Vendor 1 and Vendor 2.
2. The WiFi/Bluetooth radio modules have the same mechanical outline (e.g. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances.

Baseline testing was performed on the two vendors to determine the worst case.

**2.3. Methods and Procedures**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
<b>Title:</b>	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §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)**

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1785
<b>Test Sample Serial Number:</b>	C39RP03EH95Y ( <i>Conducted sample #1 with RF port</i> )
<b>Hardware Version:</b>	REV 1.0
<b>Test Utility software:</b>	wl 1.359 RC65.0
<b>FCC ID:</b>	BCG-E3088A

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1785
<b>Test Sample Serial Number:</b>	C39RW01MHFML ( <i>Conducted sample #2 with RF port</i> )
<b>Hardware Version:</b>	REV 1.0
<b>Test Utility software:</b>	wl 1.359 RC65.0
<b>FCC ID:</b>	BCG-E3088A

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1785
<b>Test Sample Serial Number:</b>	C39RW001HFMH ( <i>Radiated Sample #1</i> )
<b>Hardware Version:</b>	REV 1.0
<b>Test Utility software:</b>	wl 1.359 RC65.0
<b>FCC ID:</b>	BCG-E3088A

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1785
<b>Test Sample Serial Number:</b>	C39RV00IHFML ( <i>Radiated Sample #2</i> )
<b>Hardware Version:</b>	REV 1.0
<b>Test Utility software:</b>	wl 1.359 RC65.0
<b>FCC ID:</b>	BCG-E3088A

**3.2. Description of EUT**

The Equipment Under Test was a mobile phone, with GSM/GPRS/EGPRS/UMTS/LTE/TD-SCDMA and CDMA Technologies. It also supports IEEE 802.11 a/b/g/n/ac, Bluetooth®, GPS and NFC.

The Rechargeable battery is not user accessible.

**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 Mbps		
Power Supply Requirement(s):	Nominal	3.8 VDC	
Maximum Conducted Output Power:	13.0 dBm		
Antenna Gain:	-2.2 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
Brand Name:	Apple
Model Name or Number:	Macbook Pro
Serial Number:	C02PD270G3QD

Description:	USB Diagnostic cable
Brand Name:	Apple
Model Name or Number:	Kong
Serial Number:	2074F5

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

### **4.1. Operating Modes**

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

- Transmitting 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 controlled with a test laptop and a third party test software application using commands supplied by the customer. Channels, packet lengths and other settings were then set using this software application as required.
- The EUT was powered by a bench DC power supply whilst being connected to the test laptop via a USB diagnostic cable for all conducted tests
- The procedure to set up and control the EUT was supplied by the customer in a document titled "AA1501J\_BTLE\_ePA\_iPA\_channels-V2.1.docx" dated 13/07/2016 which is stored on the company server.
- The EUT was placed in three orthogonal orientations X, Y and Z to determine the worst case orientation for radiated spurious emissions and the worst case was Z orientation (EUT positioned on its back).
- The EUT was configured to transmit continuously, with a duty cycle of greater than or equal to 98 %.
- The worst-case radiated emission among all accessories is determined by the manufacturer to be with the headset connected. The compliance lab performed final testing only with the headset.

## **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:	Sandeep Bharat	Test Date:	12 July 2016
Test Sample Serial Number:	C39RW01MHFML		

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

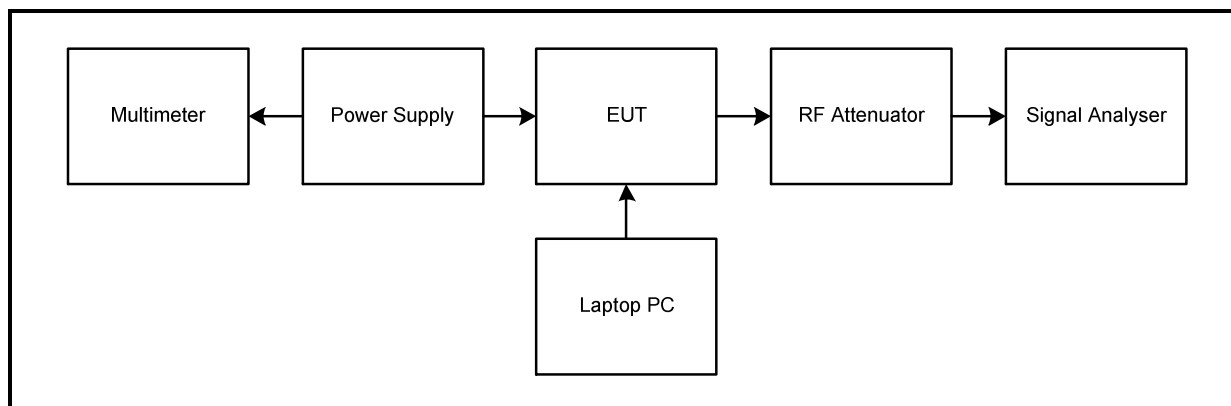
#### Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	46

#### Note(s):

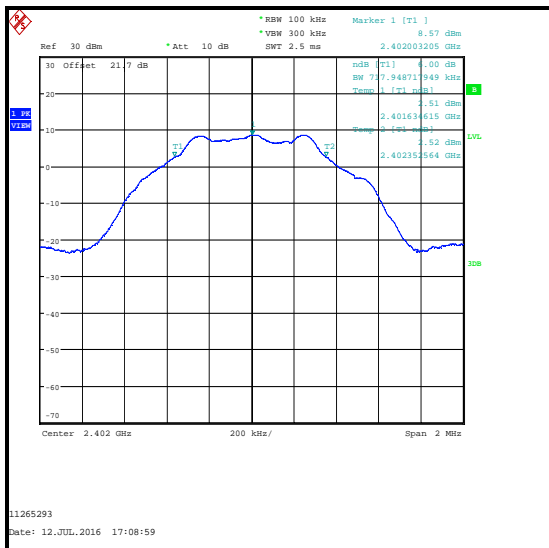
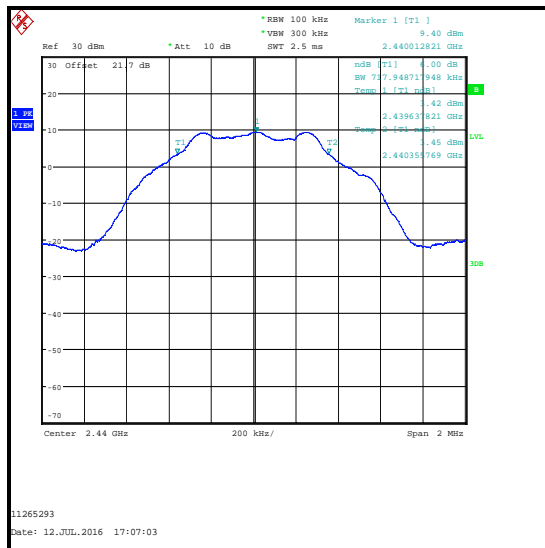
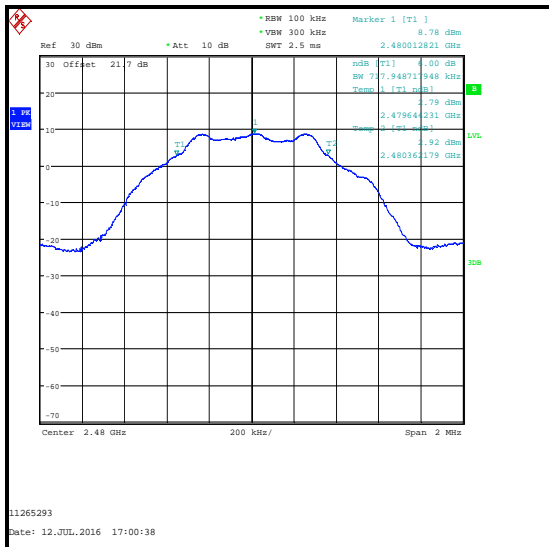
1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.1 Option 2 measurement procedure. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The spectrum 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	717.949	≥500	217.949	Complied
Middle	717.949	≥500	217.949	Complied
Top	717.949	≥500	217.949	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	02 Apr 2017	12
S021	Power Supply Unit	Thurlby Thandar	CPX200	061034	Calibrated before use	-
M1642	Multimeter	Fluke	52II	18890119	25 Apr 2017	12
A2724	Directional Coupler	AAMCS	AAMCS-UDC-0.5G-18G-10dB-SF	000641	Calibrated before use	-
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36
A2521	Attenuator	AtlanTecRF	AN18-20	832797#2	Calibrated before use	-
M1794	Spectrum Analyser	Rohde & Schwarz	FSU26	100027	09 Feb 2018	24

**5.2.2. Transmitter Power Spectral Density****Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	12 July 2016
Test Sample Serial Number:	C39RW01MHFML		

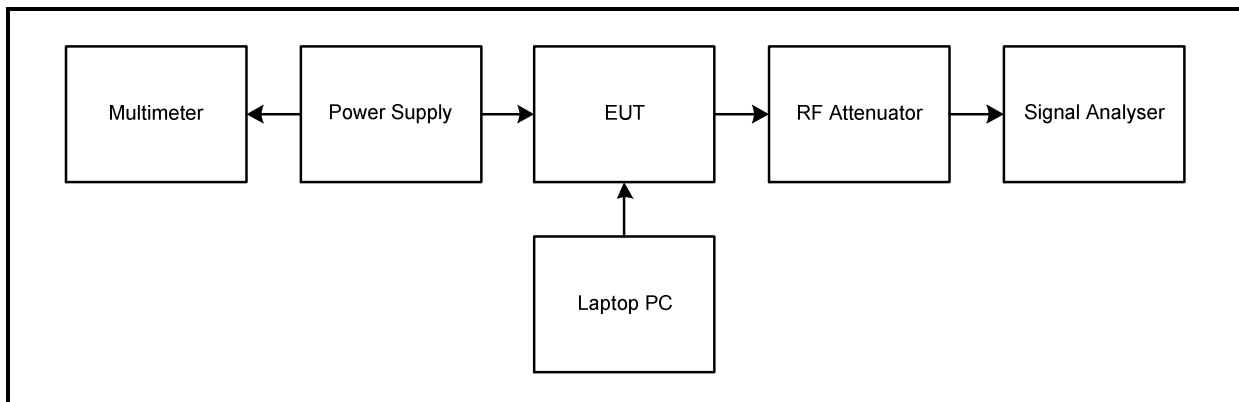
FCC Reference:	Part 15.247(e)
Test Method Used:	FCC KDB 558074 Section 10.2

**Environmental Conditions:**

Temperature (°C):	23
Relative Humidity (%):	46

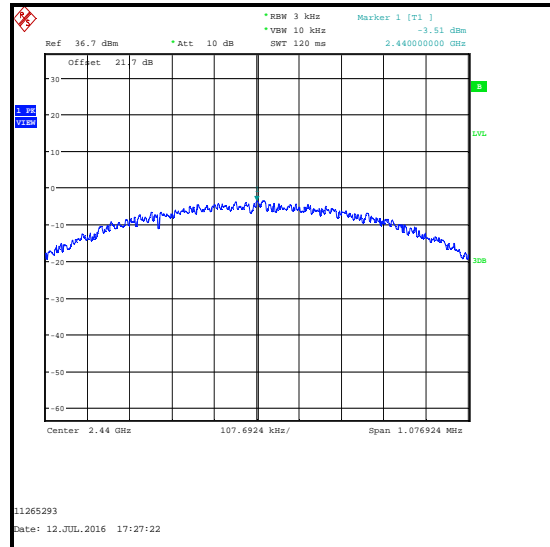
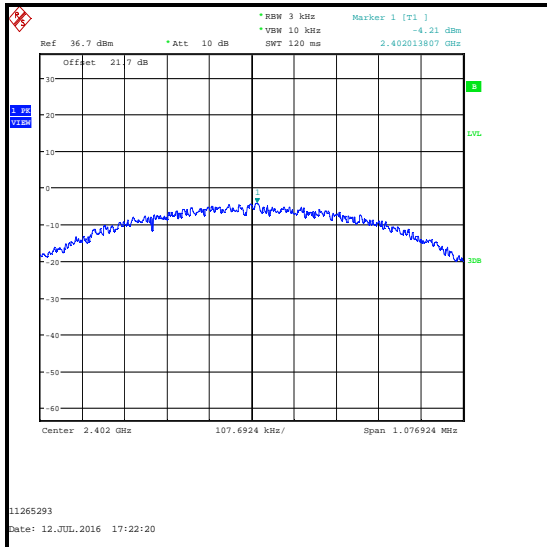
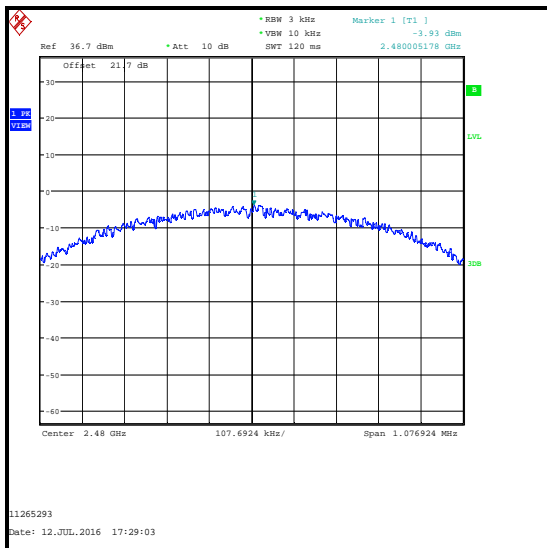
**Note(s):**

1. Transmitter Power Spectral Density tests in all bands were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 10.2 (Peak PSD)
2. The signal analyser resolution bandwidth was set to 3 kHz and video bandwidth of 10 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 1.5 times the measured DTS bandwidth. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

**Test setup:**

**Transmitter Power Spectral Density (continued)****Results:**

Channel	Output Power (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-4.2	8.0	12.2	Complied
Middle	-3.5	8.0	11.5	Complied
Top	-3.9	8.0	11.9	Complied

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



**Transmitter Power Spectral Density (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
S021	Power Supply Unit	Thurlby Thandar	CPX200	061034	Calibrated before use	-
M1642	Multimeter	Fluke	52II	18890119	25 Apr 2017	12
A2724	Directional Coupler	AAMCS	AAMCS-UDC-0.5G-18G-10dB-SF	000641	Calibrated before use	-
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36
A2521	Attenuator	AtlanTecRF	AN18-20	832797#2	Calibrated before use	-
M1794	Spectrum Analyser	Rohde & Schwarz	FSU26	100027	09 Feb 2018	24

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

<b>Test Engineer:</b>	Sandeep Bharat	<b>Test Date:</b>	12 July 2016
<b>Test Sample Serial Number:</b>	C39RW01MHFML		

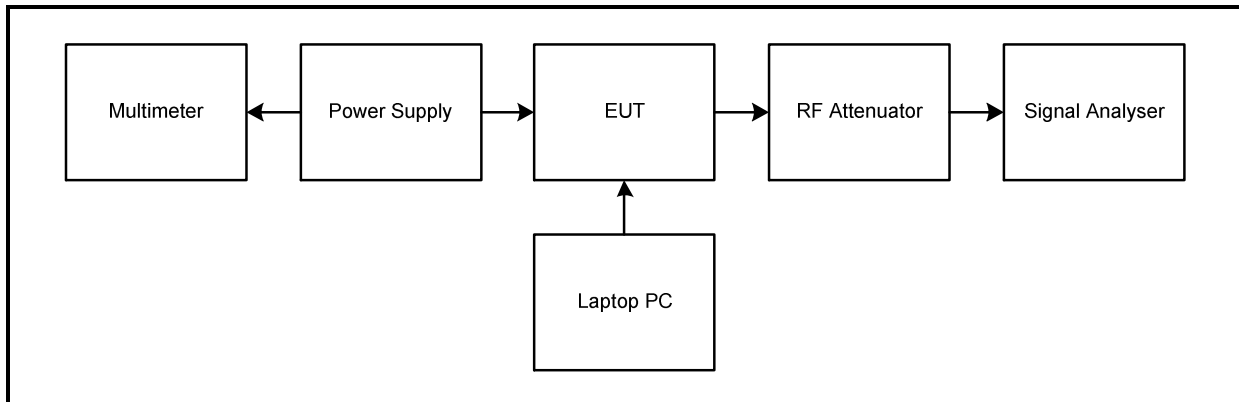
<b>FCC Reference:</b>	Part 15.247(b)(3)
<b>Test Method Used:</b>	FCC KDB 558074 Section 9.1.1

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	46

**Note(s):**

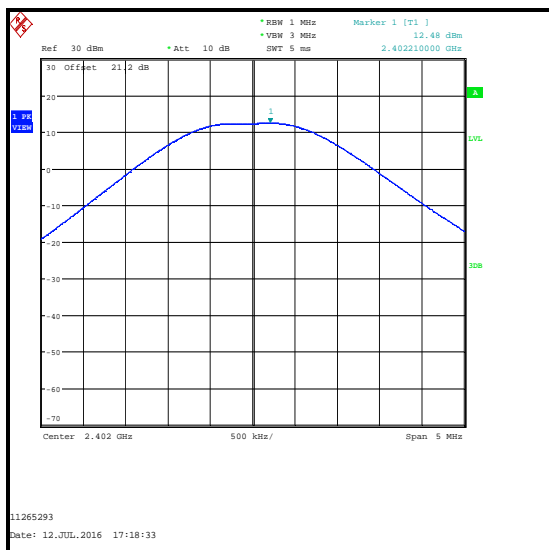
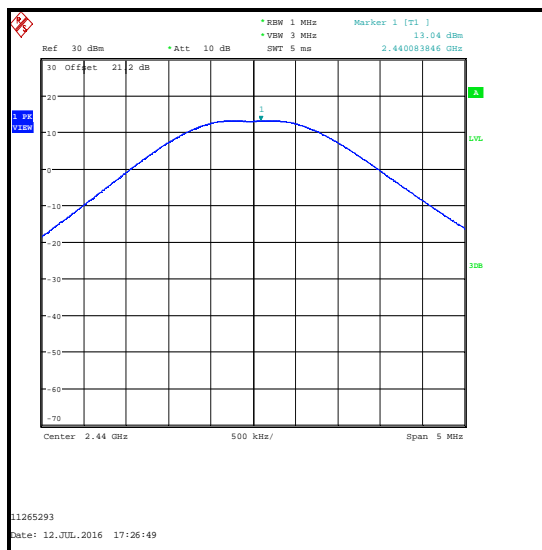
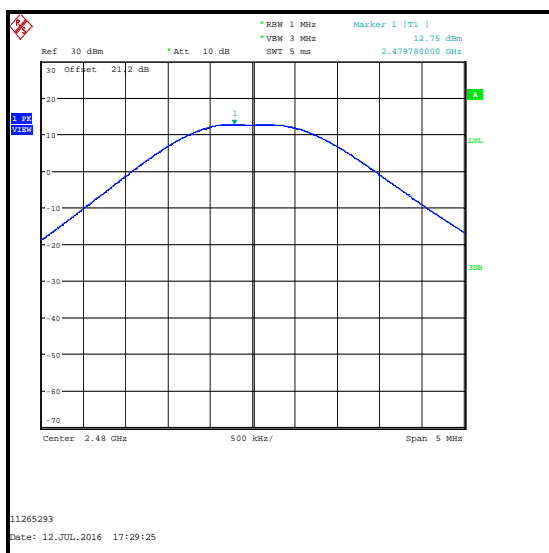
1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1.1 with the RBW > *DTS bandwidth* procedure.
2. The spectrum analyser resolution bandwidth was set to 1 MHz and video bandwidth to 3 MHz. A peak detector was used, sweep time was set to auto 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 spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser 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	12.5	30.0	17.5	Complied
Middle	13.0	30.0	17.0	Complied
Top	12.8	30.0	17.2	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	12.5	-2.2	10.3	36.0	25.7	Complied
Middle	13.0	-2.2	10.8	36.0	25.2	Complied
Top	12.8	-2.2	10.6	36.0	25.4	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)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
S021	Power Supply Unit	Thurlby Thandar	CPX200	061034	Calibrated before use	-
M1642	Multimeter	Fluke	52II	18890119	25 Apr 2017	12
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36
A2521	Attenuator	AtlanTecRF	AN18-20	832797#2	Calibrated before use	-
M1794	Spectrum Analyser	Rohde & Schwarz	FSU26	100027	09 Feb 2018	24

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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	25 July 2016
<b>Test Sample Serial Number:</b>	C39RW001HFMH		

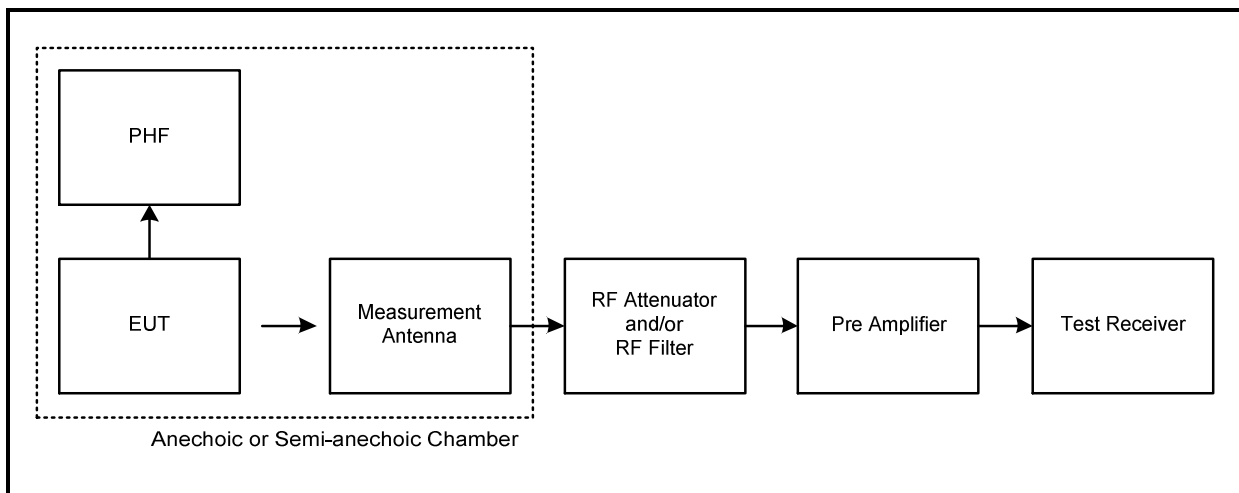
<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	43

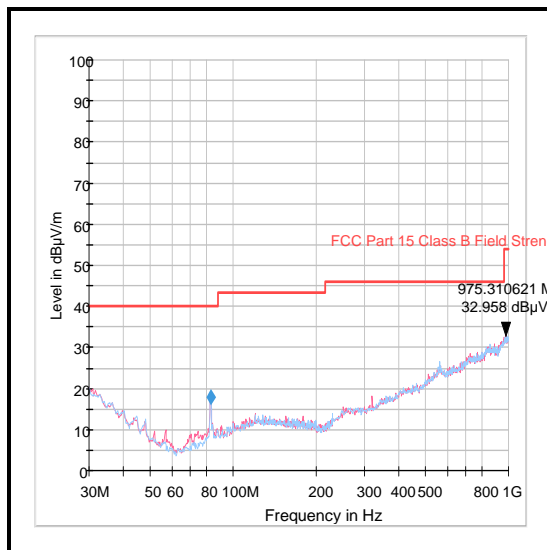
**Note(s):**

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.
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, using a CISPR quasi-peak detector and span big enough to see the whole emission.

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

**Transmitter Radiated Emissions (continued)****Results: Quasi-Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
975.311	Vertical	33.0	54.0	21.0	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	3m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	11 Apr 2017	12
A2959	Antenna	Schwarzbeck	VULB 9163	9163-967	22 Apr 2017	12
G0543	Pre Amplifier	Sonoma Instrument Co.	310N	230801	09 Dec 2016	6
A1834	Attenuator	Hewlett Packard	8491B	10444	30 Mar 2017	12

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

<b>Test Engineers:</b>	Jingang Li & Andrew Edwards	<b>Test Dates:</b>	18 to 25 July 2016
<b>Test Sample Serial Number:</b>	C39RW001HFMH		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24 to 26
<b>Relative Humidity (%):</b>	42 to 48

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss. All other emissions were 20dB from the relevant limit or below the noise floor of the measurement system
2. Pre scans above 1 GHz were performed on top, middle and bottom channels. Each channel of operation provided similar results during these pre scans and so for the purposes of this report, only middle channel pre-scan results have been shown.
3. All emissions were at least 20 dB below the specification limit or below the measurement system noise floor. Therefore the highest noise floor reading of the measuring receiver for top, middle and bottom channels has been recorded in the table below. All plots are available on the company server if require.
4. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
5. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.
6. Pre-scans 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.
7. 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)****Bottom Channel Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
3558.385	Horizontal	59.1	74.0	14.9	Complied

**Bottom Channel Results: Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
3584.769	Horizontal	49.4	54.0	4.6	Complied

**Middle Channel Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
3529.538	Horizontal	60.1	74.0	13.9	Complied

**Middle Channel Results: Average**

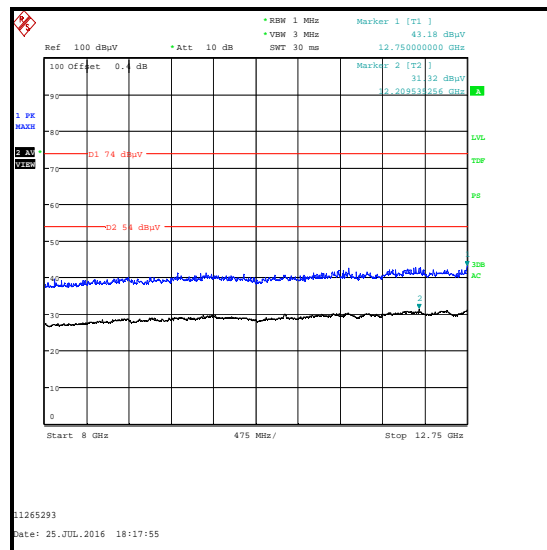
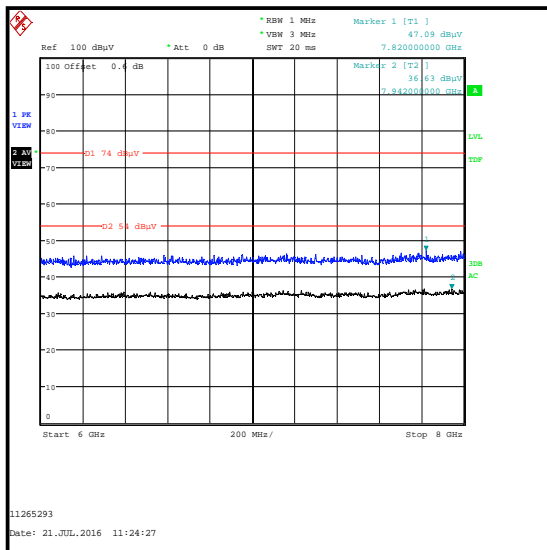
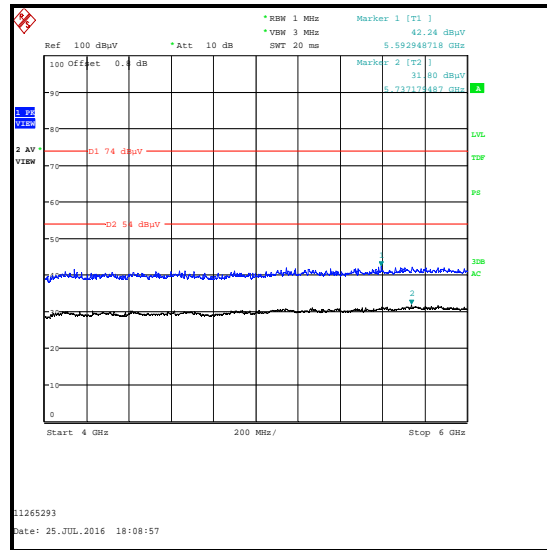
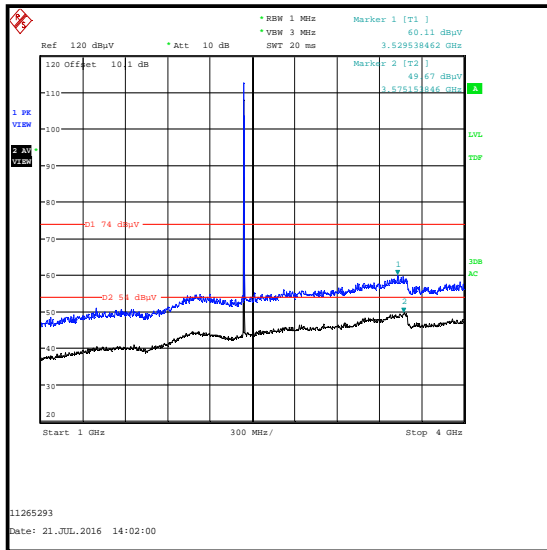
Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
3575.154	Horizontal	49.7	54.0	4.3	Complied

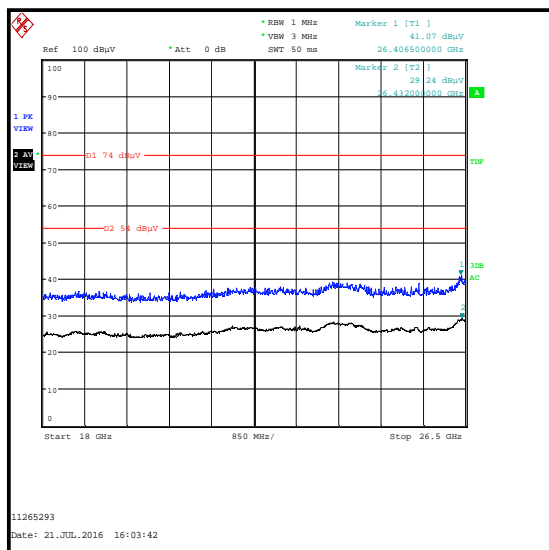
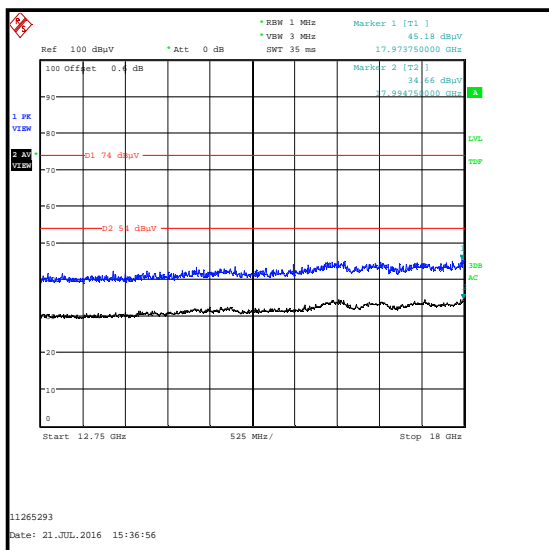
**Top Channel Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
3587.231	Horizontal	59.9	74.0	14.1	Complied

**Top Channel Results: Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
3536.692	Horizontal	49.7	54.0	4.3	Complied

**Transmitter Radiated Emissions (continued)**

**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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	12
A253	Antenna	Flann Microwave	12240-20	128	17 Dec 2016	12
A254	Antenna	Flann Microwave	14240-20	139	17 Dec 2016	12
A255	Antenna	Flann Microwave	16240-20	519	17 Dec 2016	12
A256	Antenna	Flann Microwave	18240-20	400	17 Dec 2016	12
A436	Antenna	Flann Microwave	20240-20	330	19 Dec 2016	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:**

<b>Test Engineer:</b>	Jingang Li	<b>Test Date:</b>	18 to 26 July
<b>Test Sample Serial Number:</b>	C39RW001HFMH		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.10.4, 6.10.5 & KDB 558074 Section 11 & 13

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	41

**Note(s):**

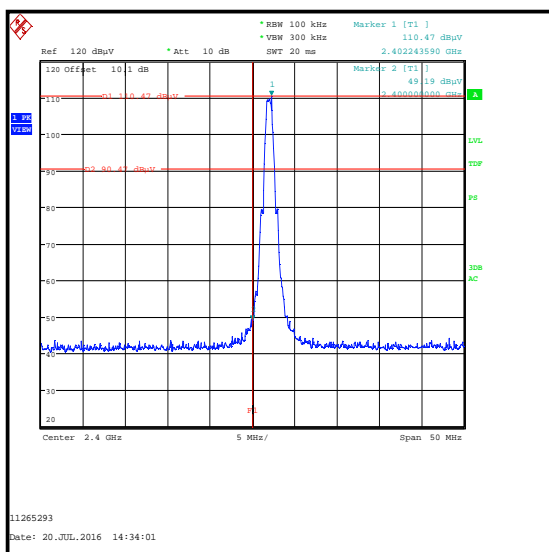
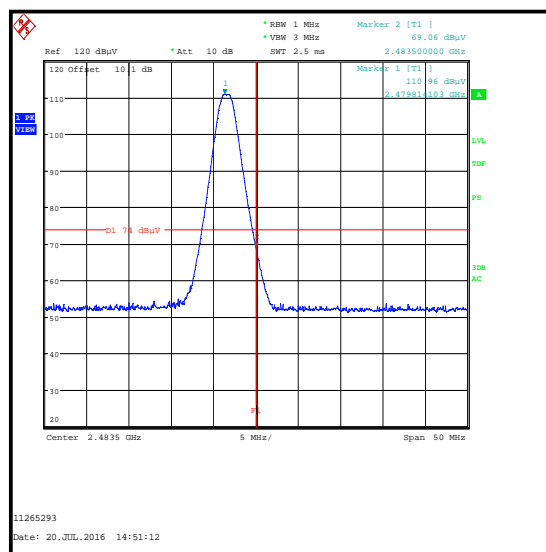
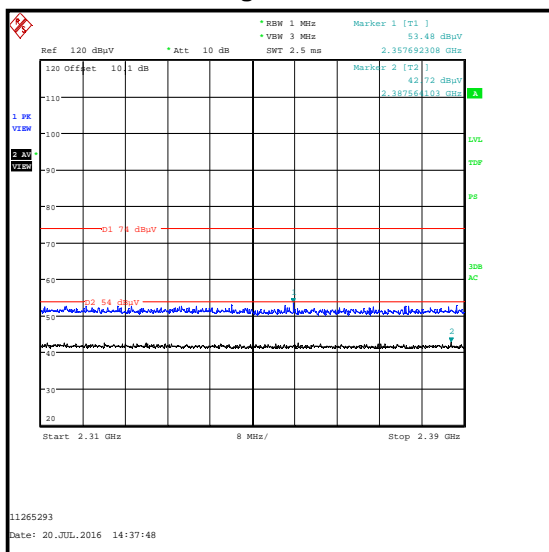
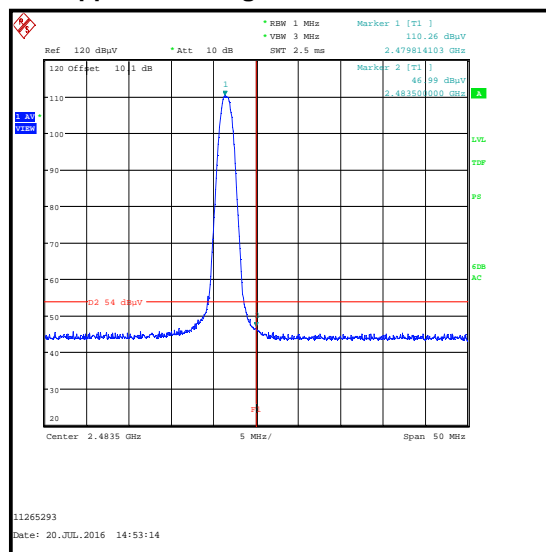
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with 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. 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. The test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. Peak and Average detectors were 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 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. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
6. -20 dBc limit.

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

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.0	Vertical	49.19	90.47*	41.28	Complied
2483.5	Vertical	69.06	74.0	4.94	Complied

**Results: Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Vertical	46.99	54.0	7.01	Complied

**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****2310 MHz to 2390 MHz Restricted Band Plot****Upper Band Edge Average Measurement**

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	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”.

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±3.92 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 26.5 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 ---