



TEST REPORT

Test Report No. : UL-RPT-RP10767845JD03A

Manufacturer : Polar Electro OY
Model No. : Loop 2, Model 1E
FCC ID : INW1E
Technology : *Bluetooth* – Low Energy
Test Standard(s) : FCC Parts 15.107, 15.109, 15.207, 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 2.0 supersedes all previous versions

Date of Issue: 03 June 2015

Checked by:

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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	8
4. Operation and Monitoring of the EUT during Testing	9
4.1. Operating Modes	9
4.2. Configuration and Peripherals	9
5. Measurements, Examinations and Derived Results.....	10
5.1. General Comments	10
5.2. Test Results	11
5.2.1. Receiver/Idle Mode Radiated Spurious Emissions	11
5.2.2. Receiver/Idle Mode AC Conducted Spurious Emissions	15
5.2.3. Transmitter AC Conducted Spurious Emissions	18
5.2.4. Transmitter Minimum 6 dB Bandwidth	21
5.2.5. Transmitter Maximum Peak Output Power	23
5.2.6. Transmitter Radiated Emissions	25
5.2.7. Transmitter Band Edge Radiated Emissions	31
6. Measurement Uncertainty	33
7. Report Revision History	34

1. Customer Information

Company Name:	Polar Electro OY
Address:	Professorintie 5 Kempele 90440 Finland

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:	19 May 2015 to 22 May 2015

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	
Part 15.107	Receiver/Idle Mode AC Conducted Emissions	
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 is not required if the maximum conducted power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured total output power.

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices
Reference:	KDB 558074 D01 v03r02 June 5, 2014
Title:	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)

Brand Name:	Polar
Model Name or Number:	Loop 2, Model 1E
Test Sample Serial Number:	C5151E0300049 (<i>Radiated sample</i>)
Hardware Version Number:	00753816.00
Software Version Number:	SW 0.9.3
FCC ID:	INW1E

Brand Name:	Polar
Model Name or Number:	Loop 2, Model 1E
Test Sample Serial Number:	C5151E0300016 (<i>Conducted sample with RF port #1</i>)
Hardware Version Number:	00753816.00
Software Version Number:	SW 0.9.3
FCC ID:	INW1E

Brand Name:	Polar
Model Name or Number:	Loop 2, Model 1E
Test Sample Serial Number:	C5151E0300149 (<i>Conducted sample with RF port #2</i>)
Hardware Version Number:	00753816.00
Software Version Number:	SW 0.9.3
FCC ID:	INW1E

3.2. Description of EUT

The equipment under test was an activity tracker incorporating a *Bluetooth* Low Energy transceiver.

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	3.7 VDC	
Maximum Conducted Output Power:	-1.7 dBm		
Antenna Gain:	0.5 dBi		
Transmit Frequency Range:	2400 MHz to 2483.5 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480

3.5. Support Equipment

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

Description:	Test Laptop
Brand Name:	Dell
Model Name or Number:	Latitude D610
Serial Number:	GN20Q1J

Description:	USB Link 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 continuously in *Bluetooth* LE test mode at maximum power on bottom, middle or top channel as required.
- Receive/Idle mode with the EUT active but not transmitting.

4.2. Configuration and Peripherals

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

- Transmit tests: The customer's test application running on a test laptop was used to place the EUT into *Bluetooth* LE test mode through a specific USB link cable connected to it. Different operating modes & channels were selected in the test application as required and the link then disconnected, leaving the EUT running in the chosen operating mode.
- Receive/Idle tests: The *Bluetooth* LE mode was active but not transmitting.
- The EUT radiated sample was powered via an integral rechargeable battery for all radiated tests. The battery was fully charged via USB before use, and the battery status was periodically monitored throughout testing using the specific USB link cable and customer's test software.
- The EUT conducted sample was powered via an external laboratory DC power supply for all conducted 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. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	Sandeep Bharat	Test Date:	19 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Part 15.109
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

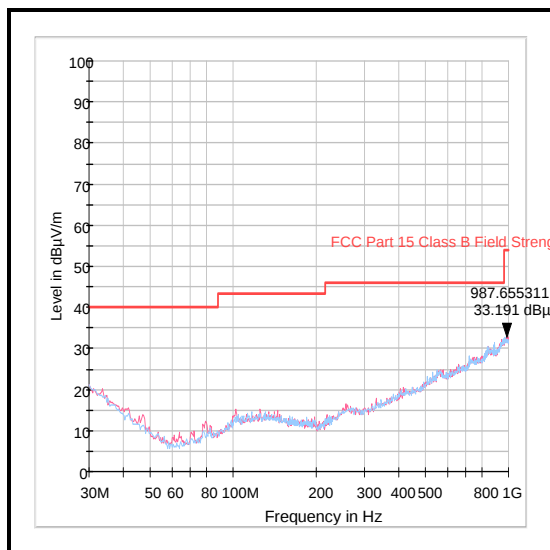
Temperature (°C):	24
Relative Humidity (%):	38

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
3. 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.

Results: Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
987.655	Horizontal	33.2	54.0	20.8	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1623	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	07 Jan 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	19 Mar 2016	12
G0543	Amplifier	Sonoma	310N	230801	05 Jun 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12

Receiver/Idle Mode Radiated Spurious Emissions (continued)**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	21 May 2015 to 22 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Part 15.109
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range:	1 GHz to 12.75 GHz

Environmental Conditions:

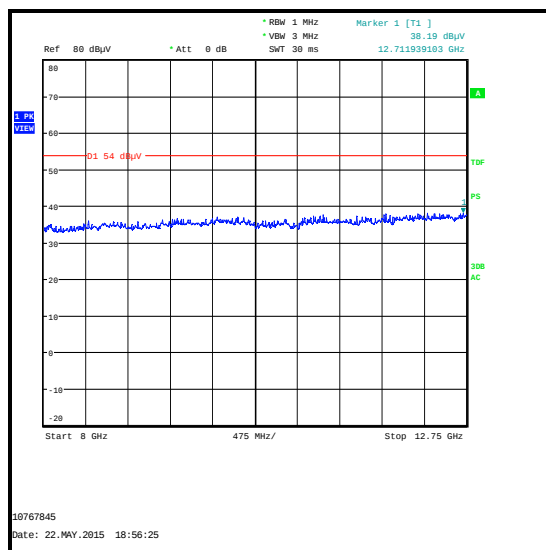
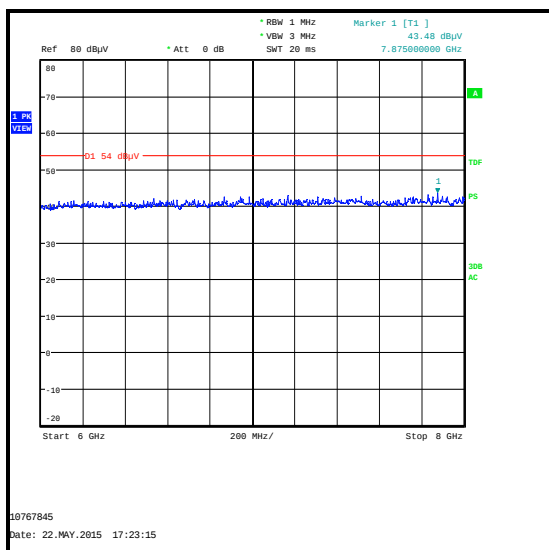
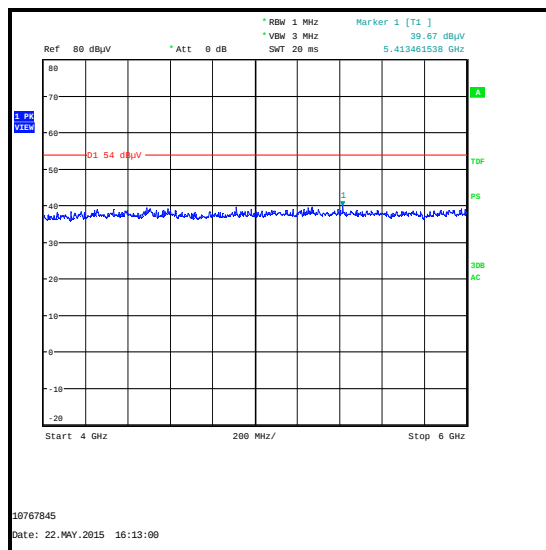
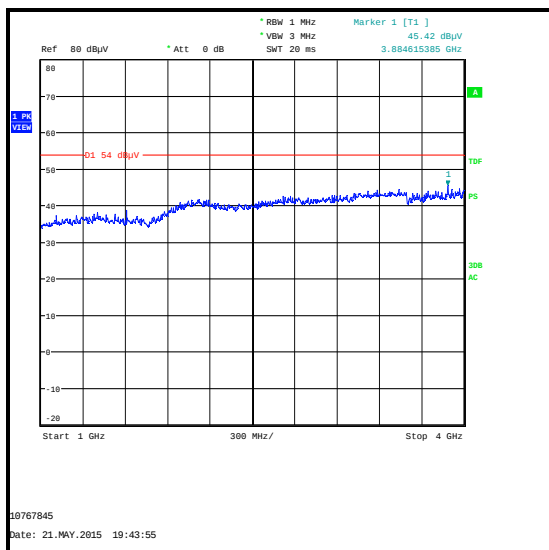
Temperature (°C):	24 to 25
Relative Humidity (%):	35 to 38

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
3. 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. 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 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.

Results:

Frequency (MHz)	Antenna Polarisation	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3884.615	Horizontal	45.4	54.0	8.6	Complied

Receiver/Idle Mode Radiated Spurious 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	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 Jun 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A254	Antenna	Flann Microwave	14240-20	139	20 Dec 2015	12
A255	Antenna	Flann Microwave	16240-20	519	20 Dec 2015	12

5.2.2. Receiver/Idle Mode AC Conducted Spurious Emissions**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	19 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Part 15.107
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	40

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Live	48.8	66.0	17.2	Complied
0.272	Live	51.1	61.1	10.0	Complied
0.542	Live	42.3	56.0	13.7	Complied
0.596	Live	39.3	56.0	16.7	Complied
1.032	Live	33.7	56.0	22.3	Complied
14.928	Live	32.7	60.0	27.3	Complied

Results: Live / Average

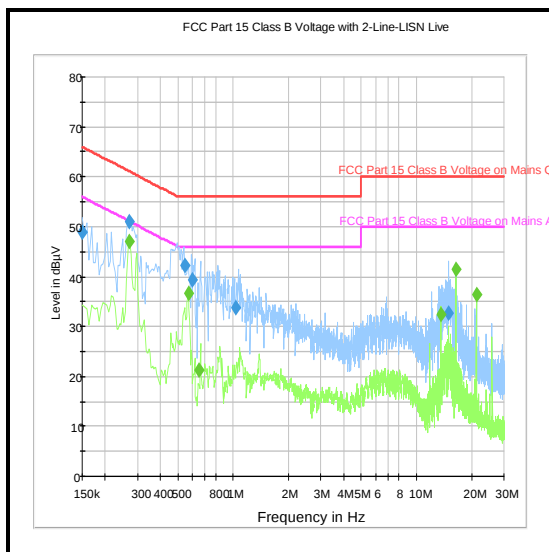
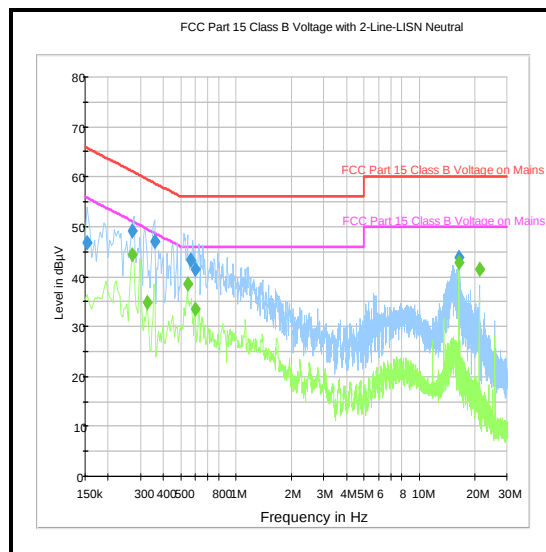
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.272	Live	47.2	51.1	3.9	Complied
0.569	Live	36.7	46.0	9.3	Complied
0.650	Live	21.2	46.0	24.8	Complied
13.560	Live	32.3	50.0	17.7	Complied
16.463	Live	41.4	50.0	8.6	Complied
21.170	Live	36.5	50.0	13.5	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)**Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.155	Neutral	46.9	65.8	18.9	Complied
0.272	Neutral	49.1	61.1	12.0	Complied
0.362	Neutral	47.0	58.7	11.7	Complied
0.564	Neutral	43.2	56.0	12.8	Complied
0.600	Neutral	41.4	56.0	14.6	Complied
16.463	Neutral	43.8	60.0	16.2	Complied

Results: Neutral / Average

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.272	Neutral	44.3	51.1	6.8	Complied
0.326	Neutral	34.7	49.6	14.9	Complied
0.546	Neutral	38.5	46.0	7.5	Complied
0.600	Neutral	33.4	46.0	12.6	Complied
16.463	Neutral	42.7	50.0	7.3	Complied
21.170	Neutral	41.6	50.0	8.4	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)**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)
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	07 Jan 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	14 Aug 2015	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	02 Mar 2016	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	14 Oct 2015	12

5.2.3. Transmitter AC Conducted Spurious Emissions**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	19 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Part 15.207
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	40

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.281	Live	48.4	60.8	12.4	Complied
0.303	Live	47.1	60.2	13.1	Complied
0.542	Live	40.8	56.0	15.2	Complied
0.654	Live	38.1	56.0	17.9	Complied
14.622	Live	34.1	60.0	25.9	Complied
14.982	Live	36.0	60.0	24.0	Complied

Results: Live / Average

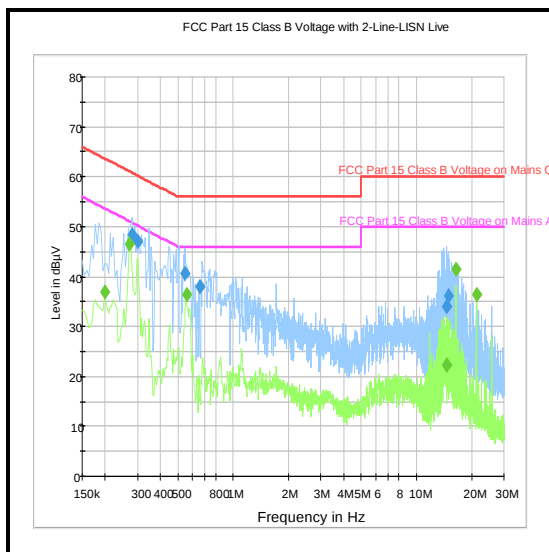
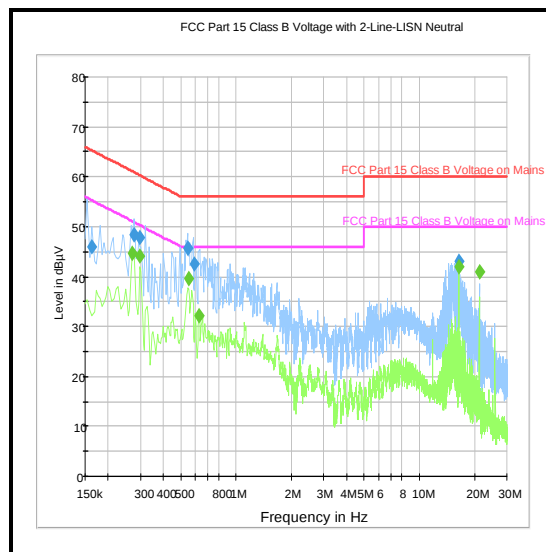
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.200	Live	36.8	53.6	16.8	Complied
0.272	Live	46.5	51.1	4.6	Complied
0.555	Live	36.4	46.0	9.6	Complied
14.510	Live	22.4	50.0	27.6	Complied
16.463	Live	41.5	50.0	8.5	Complied
21.170	Live	36.5	50.0	13.5	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.164	Neutral	45.9	65.3	19.4	Complied
0.276	Neutral	48.5	60.9	12.4	Complied
0.299	Neutral	47.8	60.3	12.5	Complied
0.546	Neutral	45.6	56.0	10.4	Complied
0.591	Neutral	42.5	56.0	13.5	Complied
16.463	Neutral	43.2	60.0	16.8	Complied

Results: Neutral / Average

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.272	Neutral	44.7	51.1	6.4	Complied
0.299	Neutral	44.2	50.3	6.1	Complied
0.551	Neutral	39.6	46.0	6.4	Complied
0.627	Neutral	32.3	46.0	13.7	Complied
16.463	Neutral	41.9	50.0	8.1	Complied
21.170	Neutral	40.9	50.0	9.1	Complied

Transmitter AC Conducted Spurious Emissions (continued)**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)
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	07 Jan 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	14 Aug 2015	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	02 Mar 2016	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	14 Oct 2015	12

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

Test Engineer:	Keith Tucker	Test Date:	20 May 2015
Test Sample Serial Number:	C5151E0300016		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	As detailed in FCC KDB 558074 Section 8.1 (Option 1)

Environmental Conditions:

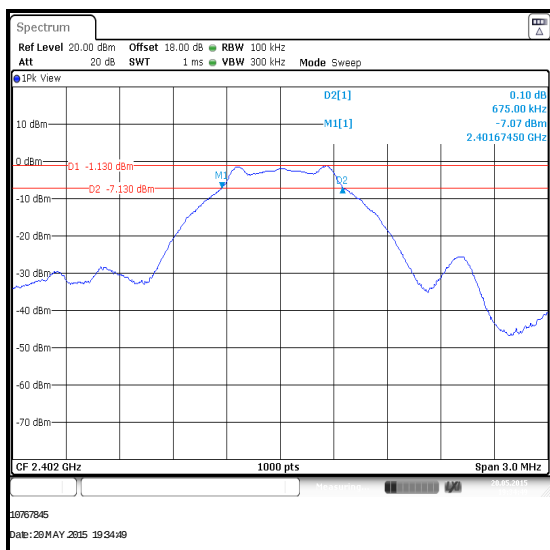
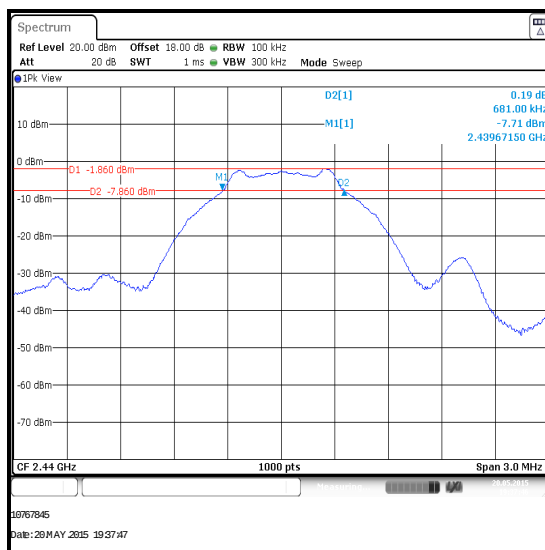
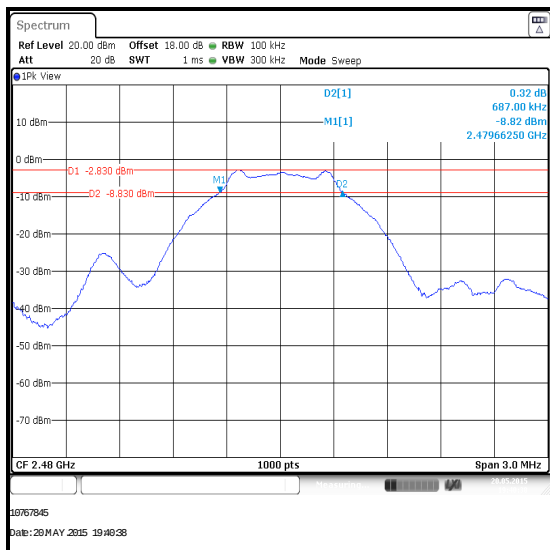
Temperature (°C):	23
Relative Humidity (%):	32

Note(s):

1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.1 (Option 1) measurement procedure.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results:

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	675.000	≥500	175.000	Complied
Middle	681.000	≥500	181.000	Complied
Top	687.000	≥500	187.000	Complied

Transmitter Minimum 6 dB Bandwidth (continued)**Results:****Bottom Channel****Middle Channel****Top Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1783	Thermohygrometer	JM Handelspunkt	30.5015.13	None Stated	23 Apr 2016	12
M1883	Signal Analyser	Rohde & Schwarz	FSV30	103084	02 Jun 2015	12
A1491	Attenuator	M/A COM	FSC 96341	2082-6173-10	Calibrated before use	-
G0615	Signal Generator	Rohde & Schwarz	SMBV100A	260473	22 May 2017	36
M1765	RF Power Sensor	Dare Instruments	RPR3006 W	13I00030SN O37	11 Dec 2015	12

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

Test Engineer:	Sandeep Bharat	Test Date:	21 May 2015
Test Sample Serial Number:	C5151E0300149		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	36

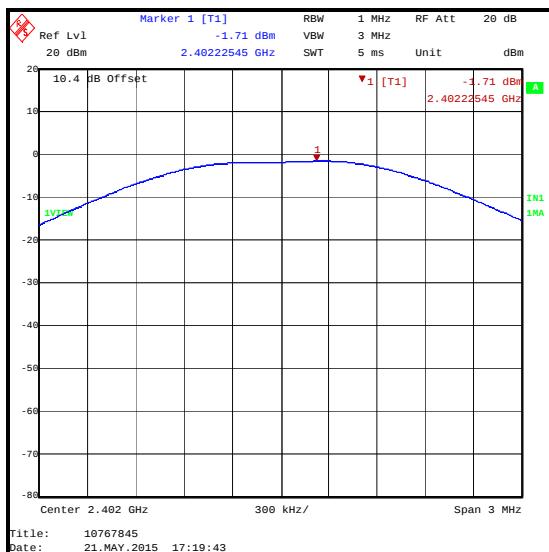
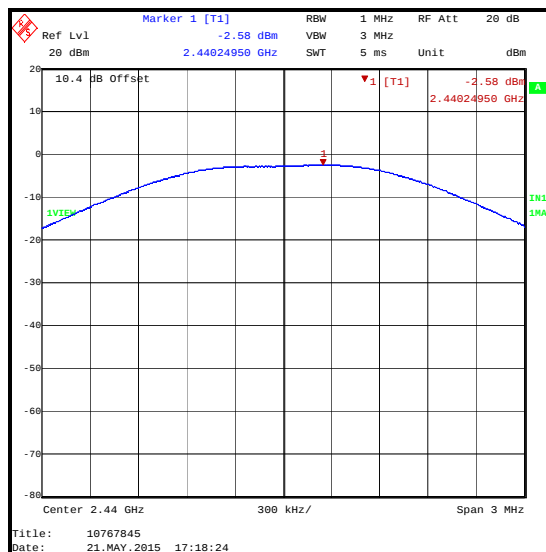
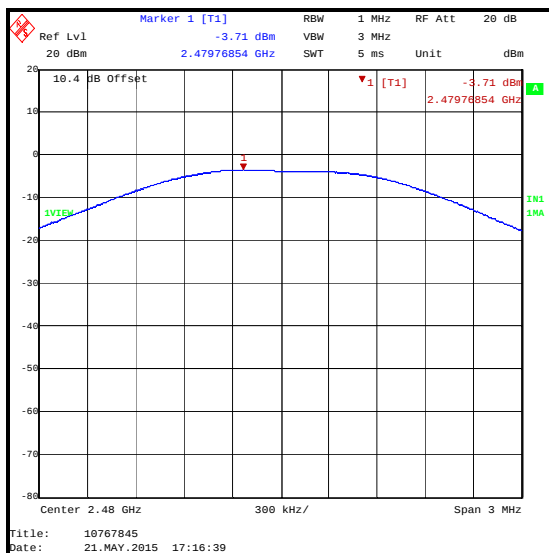
Note(s):

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1.1 RBW > *DTS bandwidth* procedure. A resolution bandwidth of 1 MHz was used and the video bandwidth was set to 3 MHz.
2. 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.
3. The declared antenna gain was added to the conducted power to obtain the EIRP.

Results:

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.7	30.0	31.7	Complied
Middle	-2.6	30.0	32.6	Complied
Top	-3.7	30.0	33.7	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.7	0.5	-1.2	36.0	37.2	Complied
Middle	-2.6	0.5	-2.1	36.0	38.1	Complied
Top	-3.7	0.5	-3.2	36.0	39.2	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	None stated	23 Apr 2016	12
A2518	Attenuator	Mini-Circuits	UNAT-10+	15542	Calibrated before use	N/A
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	06 Oct 2015	12
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	18 Jul 2016	36
S021	DC Power Supply	Thurlby Thandar	CPX200	061034	Calibrated before use	N/A
M1229	Digital Multimeter	Fluke	87640015	179	23 Apr 2016	12

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

Test Engineer:	Sandeep Bharat	Test Date:	19 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

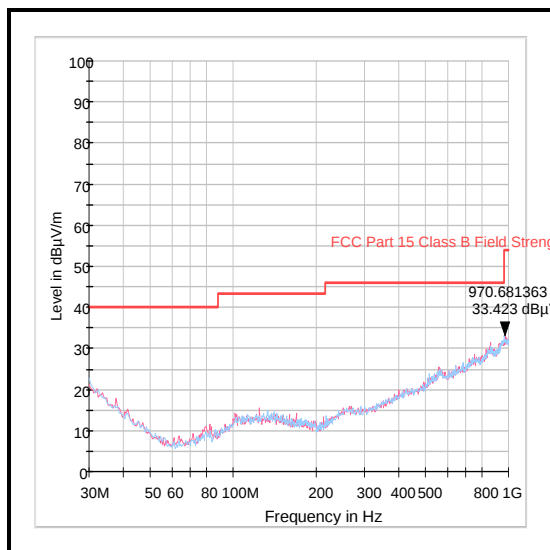
Temperature (°C):	24
Relative Humidity (%):	38

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 top channel only.
3. All emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
4. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
5. 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.

Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
970.681	Horizontal	33.4	54.0	20.6	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1623	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	07 Jan 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	19 Mar 2016	12
G0543	Amplifier	Sonoma	310N	230801	05 Jun 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12

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

Test Engineers:	Keith Tucker & Sandeep Bharat	Test Dates:	21 May 2015 to 22 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in FCC KDB 558074 Sections 11 & 12 referencing ANSI C63.10 Sections 6.3 and 6.6 and ANSI C63.4
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	24 to 25
Relative Humidity (%):	35 to 38

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other 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.
3. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.
4. *In accordance with ANSI C63.10 Section 6.6.4.3, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
5. ** -20 dBc limit applies in non-restricted band as the conducted output power measurements were performed using a peak detector.
6. The reference level for the emission in the non-restricted band was established by following KDB 558074 Section 11.2 procedure.
7. 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. 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 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.
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**

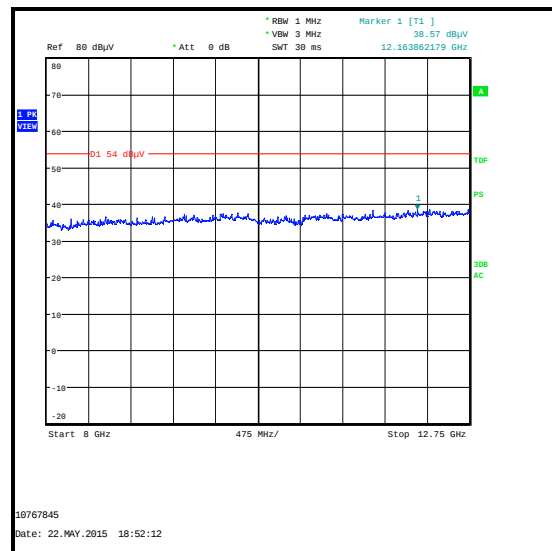
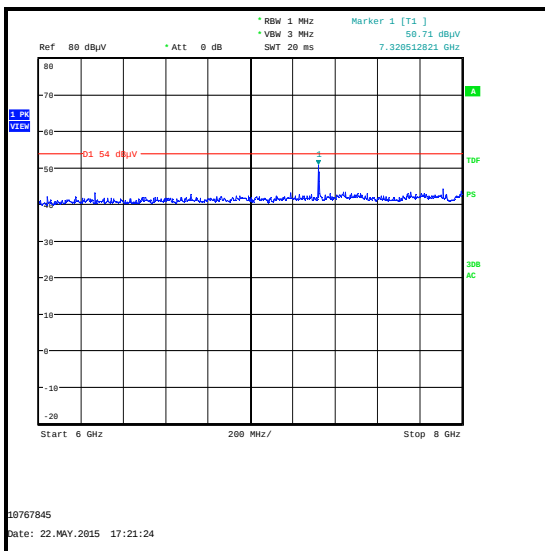
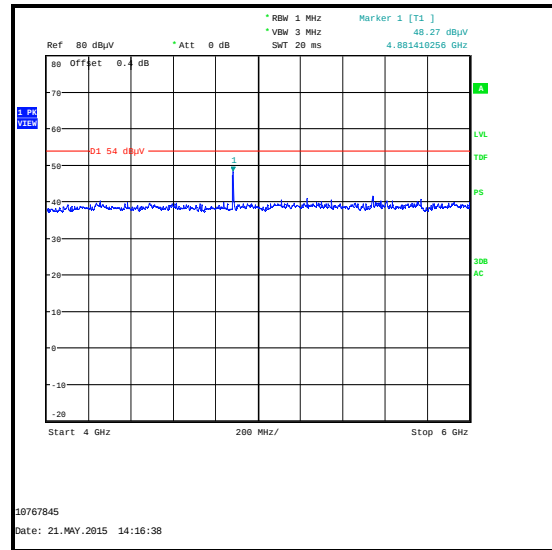
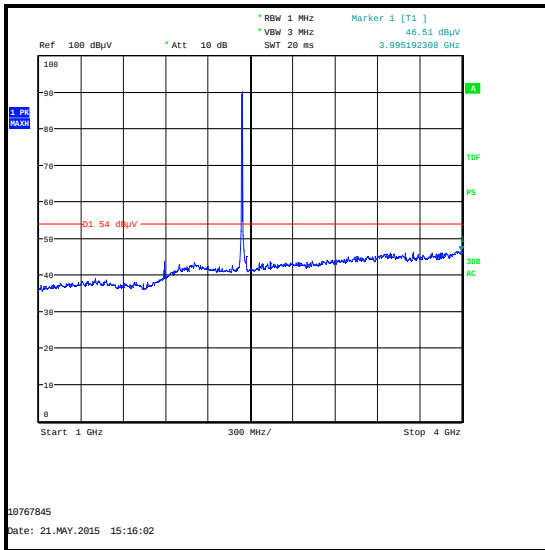
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4804.513	Horizontal	52.5	54.0*	1.5	Complied
7206.705	Horizontal	52.6	69.7**	17.1	Complied

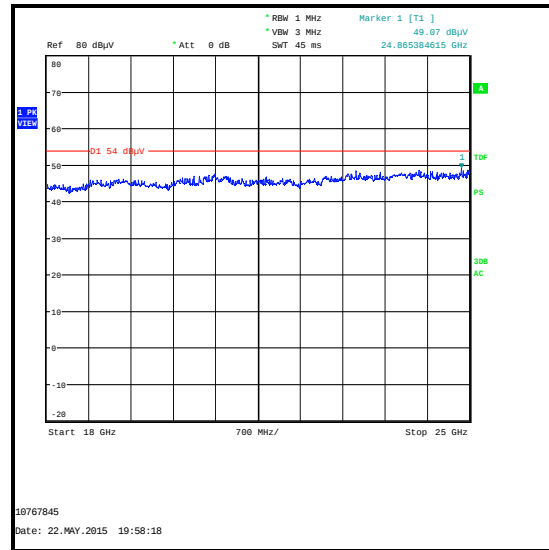
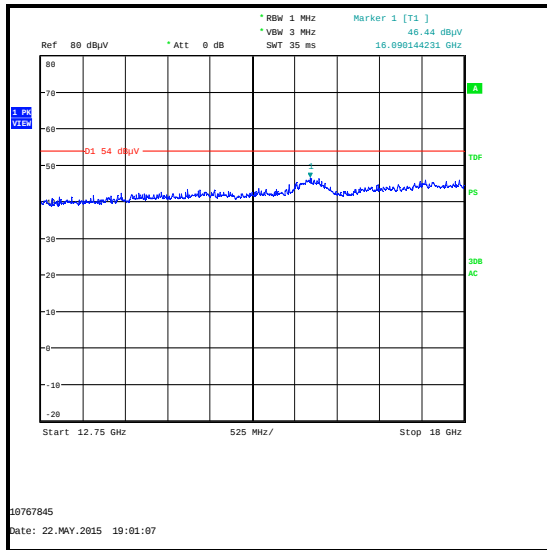
Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4880.401	Horizontal	51.9	54.0*	2.1	Complied
7320.801	Horizontal	51.0	54.0*	3.0	Complied

Results: Peak / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4959.567	Horizontal	53.8	54.0*	0.2	Complied
7439.327	Horizontal	50.9	54.0*	3.1	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.

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	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 Jun 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A254	Antenna	Flann Microwave	14240-20	139	20 Dec 2015	12
A255	Antenna	Flann Microwave	16240-20	519	20 Dec 2015	12
A256	Antenna	Flann Microwave	18240-20	400	20 Dec 2015	12
A436	Antenna	Flann Microwave	20240-20	330	21 Dec 2015	12

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

Test Engineer:	Keith Tucker	Test Date:	21 May 2015
Test Sample Serial Number:	C5151E0300049		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.2 & KDB 558074 Section 13

Environmental Conditions:

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

Note(s):

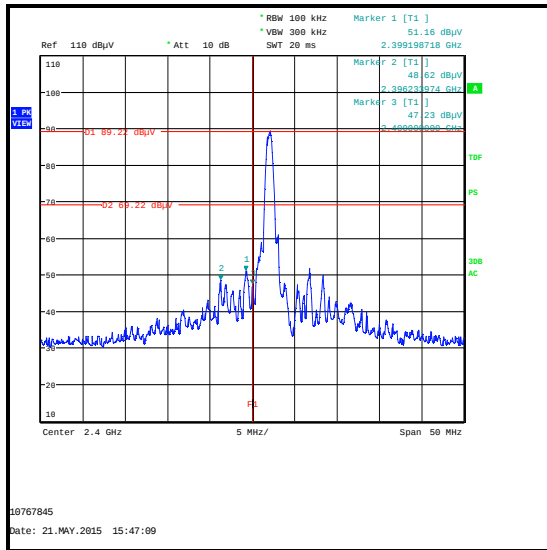
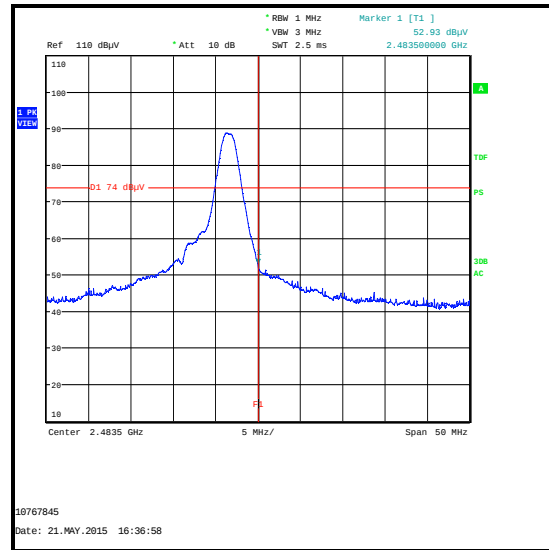
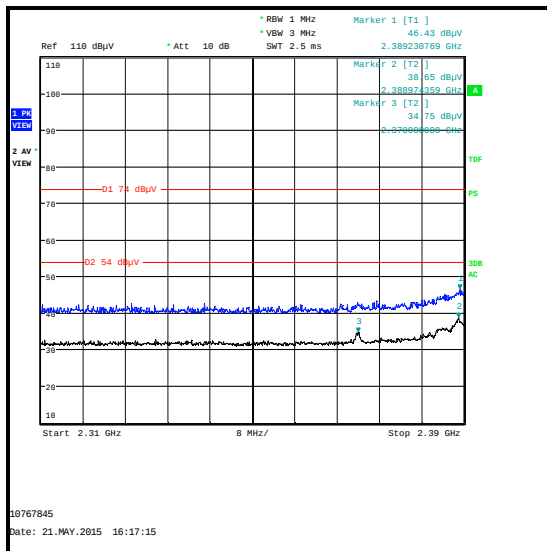
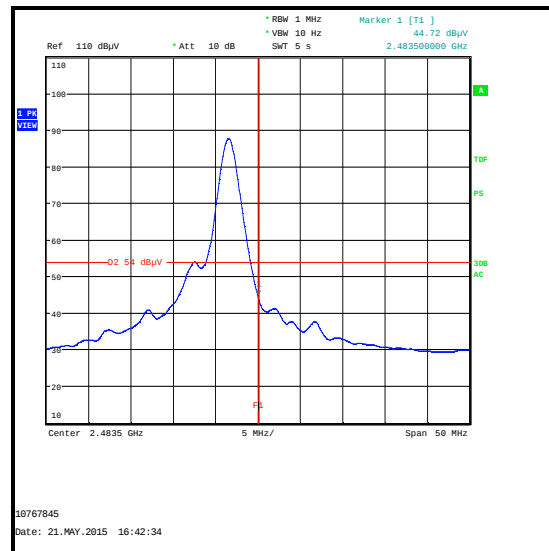
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. 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.
4. * -20 dBc limit.
5. The reference level was set to 110 dBµV in order to achieve sufficient headroom.

Results: Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.231	46.4	74.0	27.6	Complied
2396.234	48.6	74.0	25.4	Complied
2399.199	51.2	69.2	18.0	Complied
2400.000	47.2	69.2	22.0	Complied
2483.500	52.9	74.0	21.1	Complied

Results: Average

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2370.000	34.8	54.0	19.2	Complied
2483.500	44.7	54.0	9.3	Complied
2388.974	38.7	54.0	15.3	Complied

Transmitter Band Edge Radiated Emissions (continued)**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)
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
M1874	Signal Analyser	Rohde & Schwarz	ESU26	100553	13 Jun 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	23 Apr 2016	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%	±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
2.0	8	3.4	Amended Channel Numbers

--- END OF REPORT ---