



TEST REPORT

Test Report No. : UL-RPT-RP11060364JD03A V2.0

Manufacturer : Paxton Access Ltd
Model No. : 477-500
FCC ID : USE477500
Technology : Zigbee (IEEE 802.15.4)
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. This 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: 10 March 2016

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Company Signatory:

Steven White
Service Lead, Radio Laboratory,
UL VS LTD



This laboratory is accredited by UKAS.
The tests reported herein have been
performed in accordance with its terms
of accreditation.

UL VS LTD

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

This page has been left intentionally blank.

Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	6
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
3. Equipment Under Test (EUT)	7
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	8
3.5. Support Equipment	9
4. Operation and Monitoring of the EUT during Testing	10
4.1. Operating Modes	10
4.2. Configuration and Peripherals	10
5. Measurements, Examinations and Derived Results.....	11
5.1. General Comments	11
5.2. Test Results	12
5.2.1. Transmitter AC Conducted Spurious Emissions	12
5.2.2. Transmitter Minimum 6 dB Bandwidth	19
5.2.3. Transmitter Duty Cycle	22
5.2.4. Transmitter Power Spectral Density	25
5.2.5. Transmitter Maximum Peak Output Power	28
5.2.6. Transmitter Radiated Emissions	31
5.2.7. Transmitter Band Edge Radiated Emissions	38
6. Measurement Uncertainty	42
7. Report Revision History	43

1. Customer Information

Company Name:	Paxton Access Ltd
Address:	Paxton House Home Farm Road Brighton East Sussex BN1 9HU United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	11 February 2016 to 03 March 2016

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.35(c)	Transmitter Duty Cycle	Note 1
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	✓
Key to Results		
✓ = Complied	✗ = Did not comply	

Note(s):

1. The measurement was performed to assist with the calculation of the level of average radiated emissions.

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 v03r04 January 7, 2016
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
Reference:	FCC KDB Publication Number 174176 Date: June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Net2Air Bridge
Model Name or Number:	477-500
Test Sample Serial Number:	G0C-5094-1-06 (<i>Radiated sample</i>)
Hardware Version:	z-ezb1
Software Version:	1.2
FCC ID:	USE477500

Brand Name:	Net2Air Bridge
Model Name or Number:	477-500
Test Sample Serial Number:	G0C-5094-1-04 (<i>Conducted sample</i>)
Hardware Version:	z-ezb1
Software Version:	1.2
FCC ID:	USE477500

Brand Name:	Net2Air Bridge
Model Name or Number:	477-500
Test Sample Serial Number:	G0C-5094-1-10 (<i>Normal operating mode sample</i>)
Hardware Version:	z-ezb1
Software Version:	1.2
FCC ID:	USE477500

3.2. Description of EUT

The Equipment Under Test was access control equipment containing an IEEE 802.15.4 transmitter. The EUT is powered from a PoE (Power over Ethernet) Injector.

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:	IEEE 802.15.4 (Digital Transmission System)				
Type of Unit:	Transceiver				
Modulation:	O-QPSK				
Data Rate:	250 kbit/s				
Power Supply Requirement(s):	Nominal	48 VDC from 120 VAC 60 Hz via PoE			
Maximum Conducted Output Power:	11.8 dBm				
Antenna Gain:	0.5 dBi				
Transmit Frequency Range:	2405 MHz to 2475 MHz				
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)		
	Bottom	11	2405		
	Middle	18	2440		
	Top	25	2475		

3.5. Support Equipment

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

Description:	PoE Injector
Brand Name:	TP-Link
Model Name or Number:	TL-POE150S
Serial Number:	2159342003517

Description:	Power supply
Brand Name:	TP-Link
Model Name or Number:	T480050-2D1
Serial Number:	Not marked or stated

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	Precision M6-600
Serial Number:	Not marked or stated

Description:	Nano test jig comprising five, stacked Paxton Nano boards
Brand Name:	Paxton
Model Name or Number:	654-943
Serial Numbers:	1019193, 951637, 951617, 951614 & 923548

Description:	Ethernet cable. Quantity 2. Length 3 metres.
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated

Description:	Ethernet cable. Quantity 1. Length 10 metres.
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated

Description:	U.FL Female to SMA Female RF cable. Length 10 cm.
Brand Name:	Not marked or stated
Model Name or 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):

- Test Mode: Continuously transmitting at maximum power with 100 % duty cycle on the bottom, middle and top channels.
- Normal mode: Transmitting with a modulated carrier and worst-case duty cycle.

4.2. Configuration and Peripherals

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

- Continuous transmit tests: Controlled using a Paxton Net2Air Bridge test application on the laptop PC following operating instructions contained in the '*Net2Air Bridge test software for compliance testing 04 Feb 2016*' document. The application was used to enable continuous transmission to select the test channels as required.
- The EUT was powered from a PoE injector via Ethernet.
- Radiated emission tests: The test laptop and PoE injector were placed outside the anechoic chamber and connected to the EUT using a 10 metre Ethernet cable. The test laptop was connected to the PoE injector by a 3m Ethernet cable.
- All testing was performed with the EUT configured with a power setting of 10 dBm.
- Duty cycle measurements: The EUT and support equipment were controlled using a Paxton Net2Air Access Control version 127.0.0.1 application on the laptop PC following instructions contained in the '*Duty cycle test instructions_12 Feb 2016*' document. The customer supplied the EUT in its worst case (longest transmitter on time), normal mode of operation. The EUT was a conducted sample (Serial Number: G0C-5094-1-10), the support equipment was a Paxton Nano test jig. The EUT and support equipment were connected to each other via the through ports of an RF directional coupler. One side of the coupler was connected to the EUT via RF cables. An antenna was fitted to the opposite side of the directional coupler through port. This enabled communication from the EUT to the Paxton Nano test jig via a radio link. The EUT was connected to the laptop by an Ethernet cable and the support equipment communicated to the laptop PC over the air interface. The coupled port on the RF coupler was connected to the spectrum analyser.
- The customer supplied an RF test cable in order to perform conducted measurements. The insertion loss of the RF cable was included in any measurement results.
- Sample with Serial Number G0C-5094-1-06 was used for AC conducted emissions and transmitter radiated emissions tests.
- Sample with Serial Number G0C-5094-1-04 was used for 6 dB bandwidth, power spectral density and conducted output power tests.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Andrew Edwards	Test Dates:	23 February 2016 & 03 March 2016
Test Sample Serial Number:	G0C-5094-1-06		

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

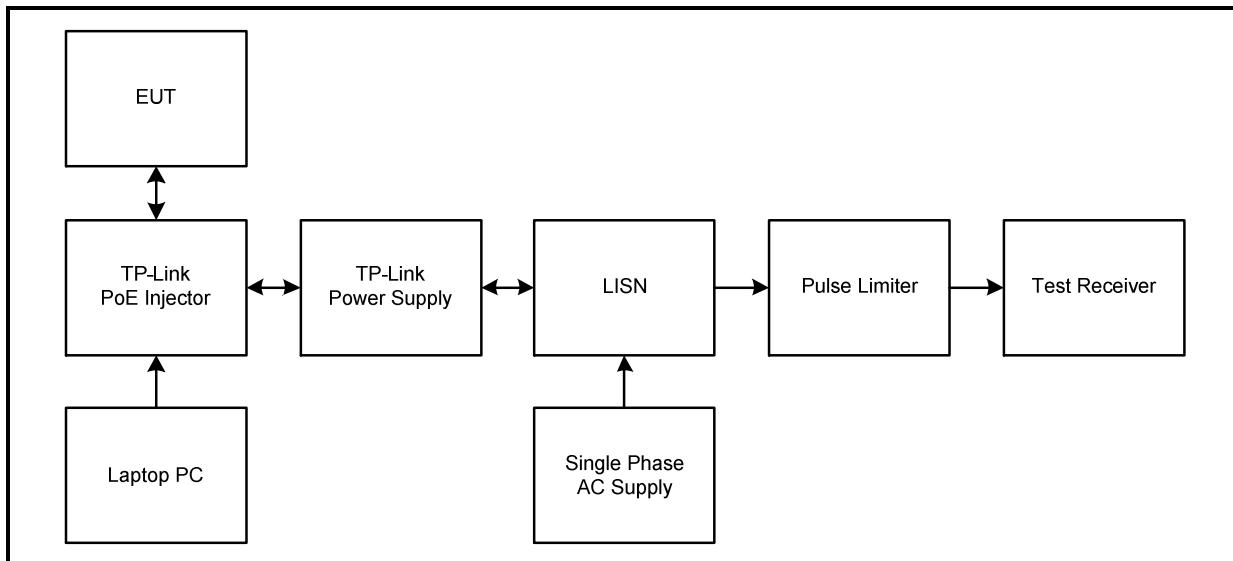
Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	29 to 31

Note(s):

1. The EUT was connected to the TP-link PoE injector via Ethernet. The TP-Link power supply was connected to a 120 VAC 60 Hz single phase supply via the LISN.
2. In accordance with FCC KDB 174176 Q4, tests were repeated with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the TP-Link power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.

Test setup:



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

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.150	Live	49.6	66.0	16.4	Complied
0.258	Live	46.4	61.5	15.1	Complied
0.321	Live	41.9	59.7	17.8	Complied
0.573	Live	43.4	56.0	12.6	Complied
0.578	Live	44.3	56.0	11.7	Complied
14.672	Live	33.0	60.0	27.0	Complied

Results: Live / Average / 120 VAC 60 Hz

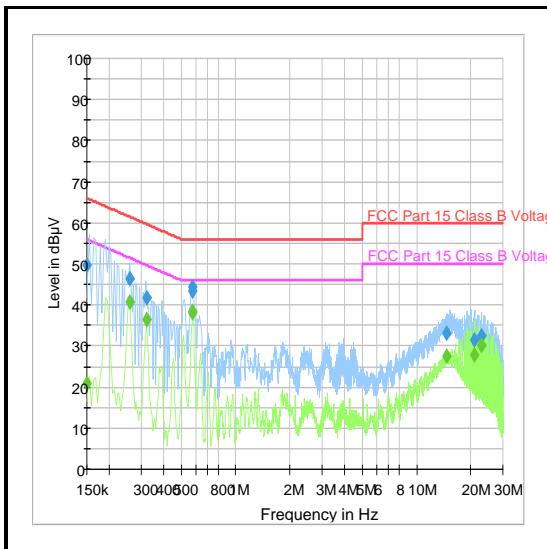
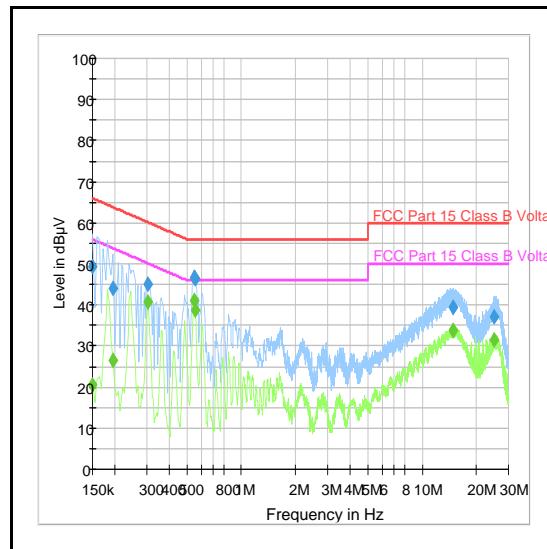
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.258	Live	40.8	51.5	10.7	Complied
0.321	Live	36.3	49.7	13.4	Complied
0.573	Live	38.1	46.0	7.9	Complied
0.578	Live	38.3	46.0	7.7	Complied
20.949	Live	27.9	50.0	22.1	Complied
22.817	Live	30.1	50.0	19.9	Complied

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

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.150	Neutral	49.3	66.0	16.7	Complied
0.195	Neutral	43.9	63.8	19.9	Complied
0.303	Neutral	44.9	60.2	15.3	Complied
0.551	Neutral	46.9	56.0	9.1	Complied
0.555	Neutral	46.4	56.0	9.6	Complied
14.856	Neutral	39.5	60.0	20.5	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.303	Neutral	40.9	50.2	9.3	Complied
0.551	Neutral	40.9	46.0	5.1	Complied
0.555	Neutral	38.6	46.0	7.4	Complied
14.798	Neutral	33.7	50.0	16.3	Complied
14.856	Neutral	33.8	50.0	16.2	Complied
25.085	Neutral	31.3	50.0	18.7	Complied

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

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

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.164	Live	42.8	65.3	22.5	Complied
0.362	Live	38.4	58.7	20.3	Complied
0.569	Live	38.9	56.0	17.1	Complied
15.617	Live	40.0	60.0	20.0	Complied
20.954	Live	44.9	60.0	15.1	Complied
21.750	Live	37.9	60.0	22.1	Complied

Results: Live / Average / 240 VAC 60 Hz

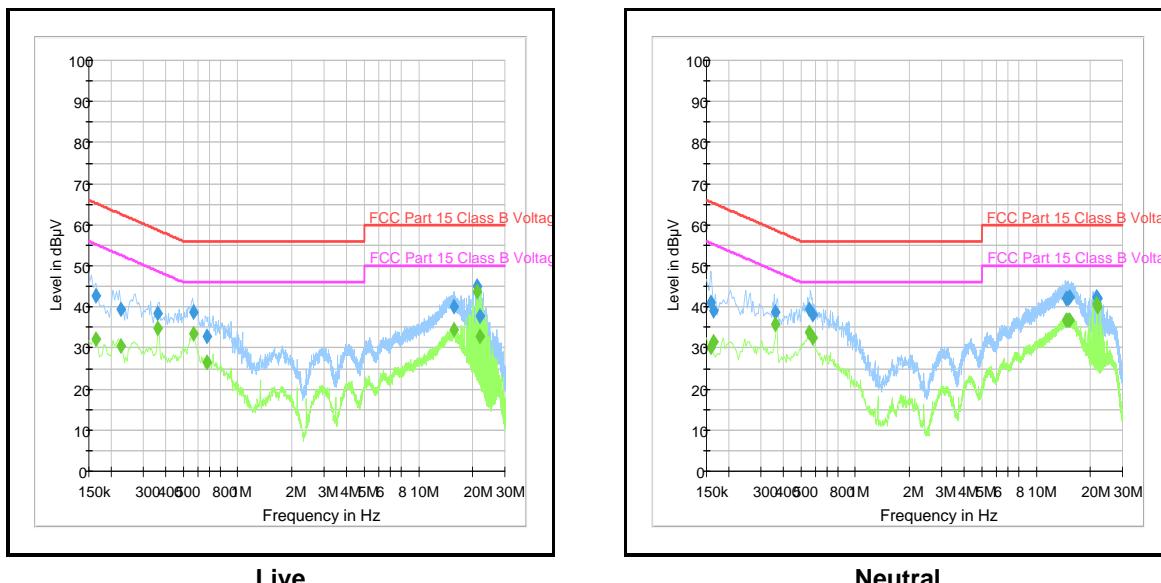
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.362	Live	34.9	48.7	13.8	Complied
0.569	Live	33.3	46.0	12.7	Complied
0.672	Live	26.6	46.0	19.4	Complied
15.617	Live	34.4	50.0	15.6	Complied
20.954	Live	43.6	50.0	6.4	Complied
21.750	Live	32.9	50.0	17.1	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: Neutral / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.555	Neutral	39.4	56.0	16.6	Complied
0.582	Neutral	38.1	56.0	17.9	Complied
14.951	Neutral	42.2	60.0	17.8	Complied
15.342	Neutral	42.3	60.0	17.7	Complied
21.480	Neutral	42.4	60.0	17.6	Complied
21.746	Neutral	42.1	60.0	17.9	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.362	Neutral	35.6	48.7	13.1	Complied
0.555	Neutral	33.7	46.0	12.3	Complied
14.951	Neutral	36.8	50.0	13.2	Complied
15.342	Neutral	36.7	50.0	13.3	Complied
21.480	Neutral	40.7	50.0	9.3	Complied
21.746	Neutral	40.2	50.0	9.8	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Average / 240 VAC 60 Hz**

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)
M1623	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	11 Jan 2017	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	14 Jul 2016	12
A1829	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100671	26 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
S0539	Variable AC Power Supply	Kikusui	PCR 1000L	13010170	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	23 Apr 2016	12

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	24 February 2016
Test Sample Serial Number:	G0C-5094-1-04		

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

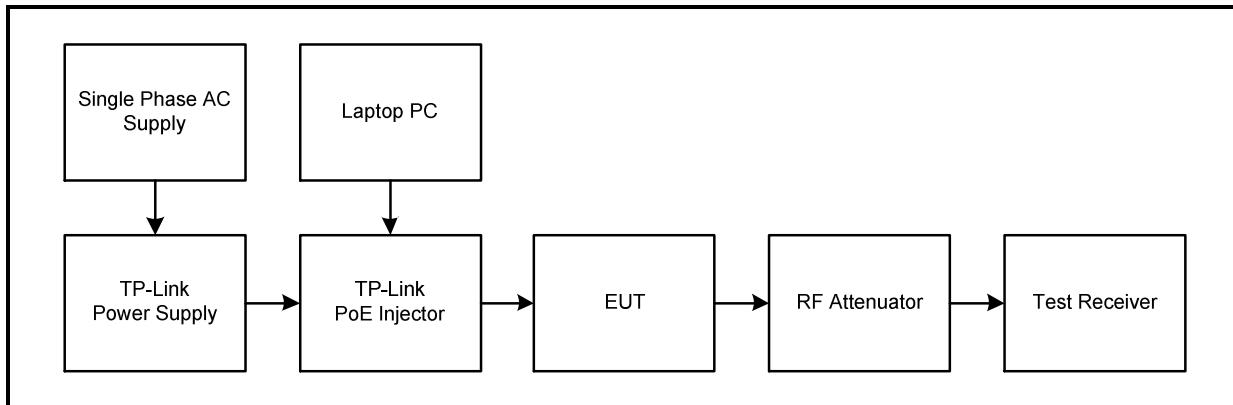
Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	30

Note(s):

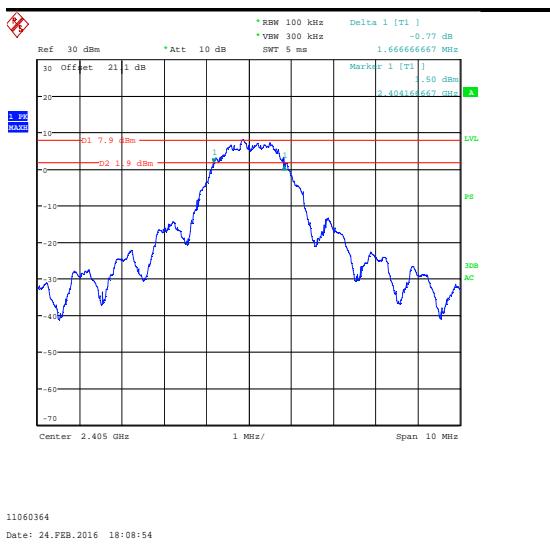
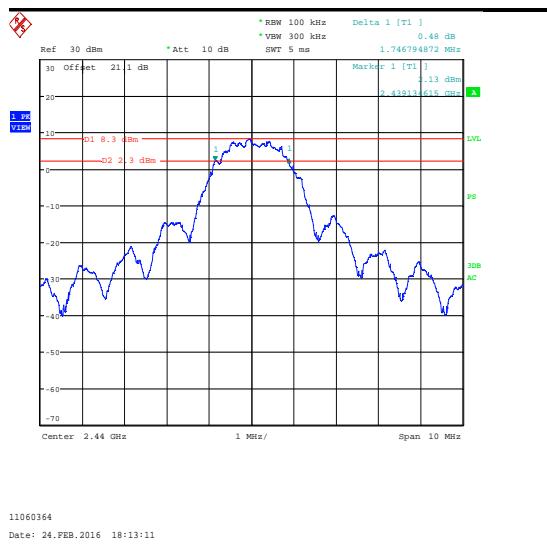
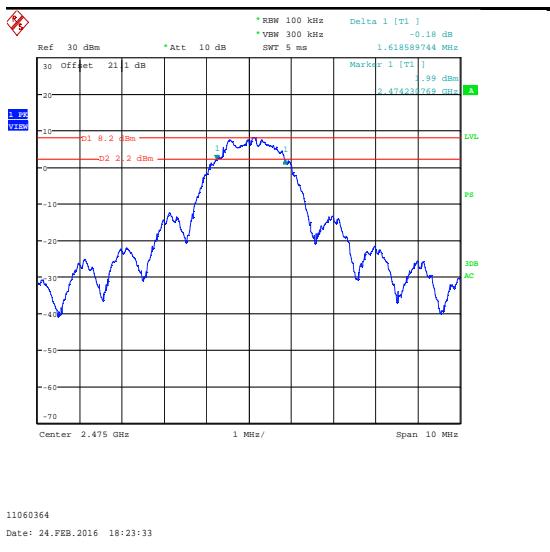
1. 6 dB DTS bandwidth tests were performed using a test receiver in accordance with FCC KDB 558074 Section 8.1 Option 1 measurement procedure. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. 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	1666.667	≥500	1166.667	Complied
Middle	1746.795	≥500	1246.795	Complied
Top	1618.590	≥500	1118.590	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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 May 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-

5.2.3. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	24 February 2016
Test Sample Serial Number:	G0C-5094-1-10		

FCC Reference:	Part 15.35(c)
Test Method Used:	ANSI C63.10 Section 7.5

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	30

Note(s):

1. In order to assist with the determination of the average level of spurious emissions field strength, conducted measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. Five pulses of 3.952 ms and six pulses of 0.298 ms duration occurred within a 100 ms period, therefore the total transmitter on time is 21.548 ms. The transmitter on time was measured using a test receiver in the time domain and duty cycle calculated as follows:

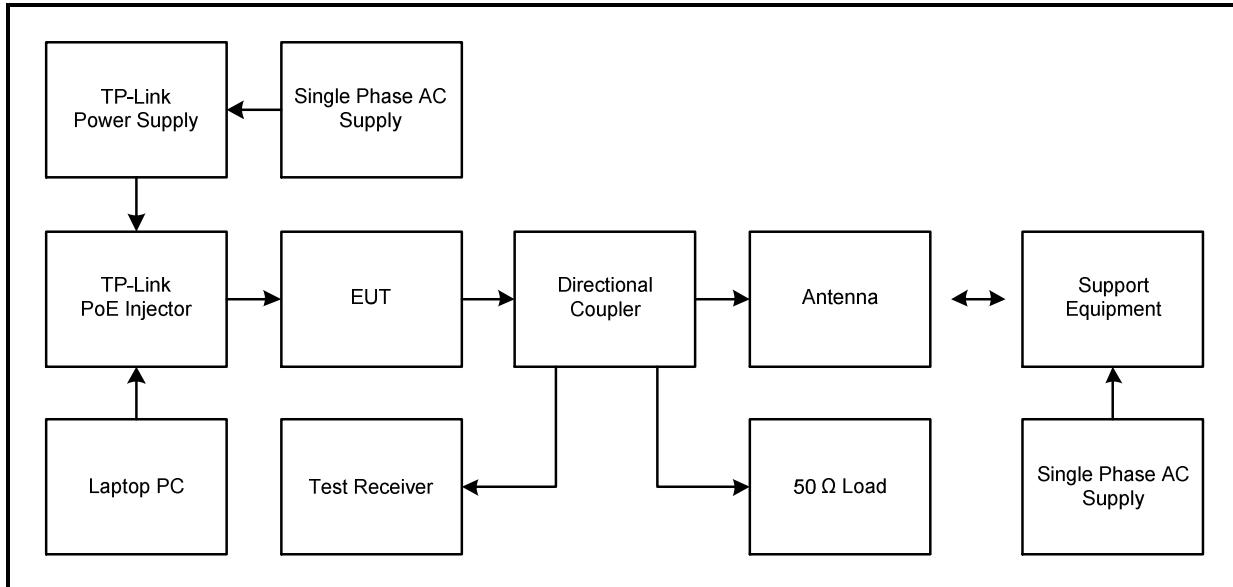
$$\delta (\text{dB}) = 20 \log \left[\sum (nt_1 + mt_2) / T \right]$$

$$\delta (\text{dB}) = 20 \log \left[\sum (19.760 + 1.788 \text{ ms}) / 100 \text{ ms} \right]$$

$$\delta (\text{dB}) = 20 \log \left[\sum (21.548 \text{ ms}) / 100 \text{ ms} \right] = 13.4 \text{ dB}$$

$$20 \log[0.215] = 13.4 \text{ dB}$$

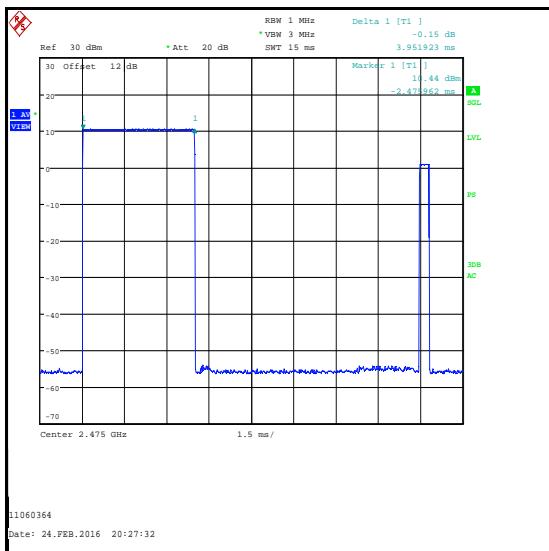
Test setup:



Transmitter Duty Cycle (continued)**Results:**

Total Pulse Duration (ms)	Duty Cycle (dB)
21.548	13.4

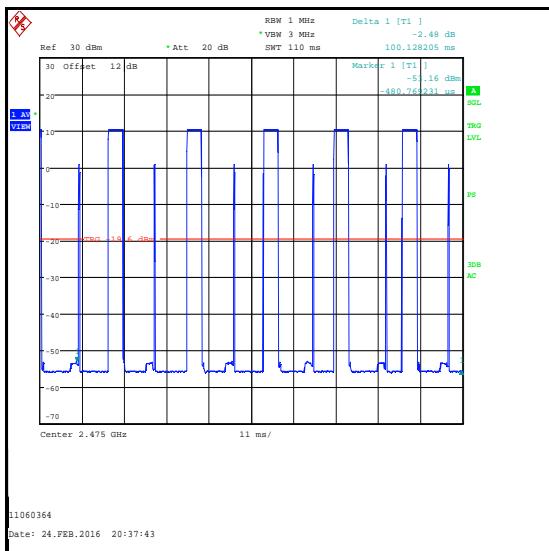
Sub pulse	Duration (ms)	Number of pulses in 100 ms	Total on time (ms)
1	3.952	5	19.760
2	0.298	6	1.788



Sub pulse 1



Sub pulse 2



100 ms period

Transmitter Duty Cycle (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	23 Apr 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 May 2016	12
A2032	Directional coupler	Narda	4242B	03547	Calibrated before use	-

5.2.4. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	02 March 2016
Test Sample Serial Number:	G0C-5094-1-04		

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

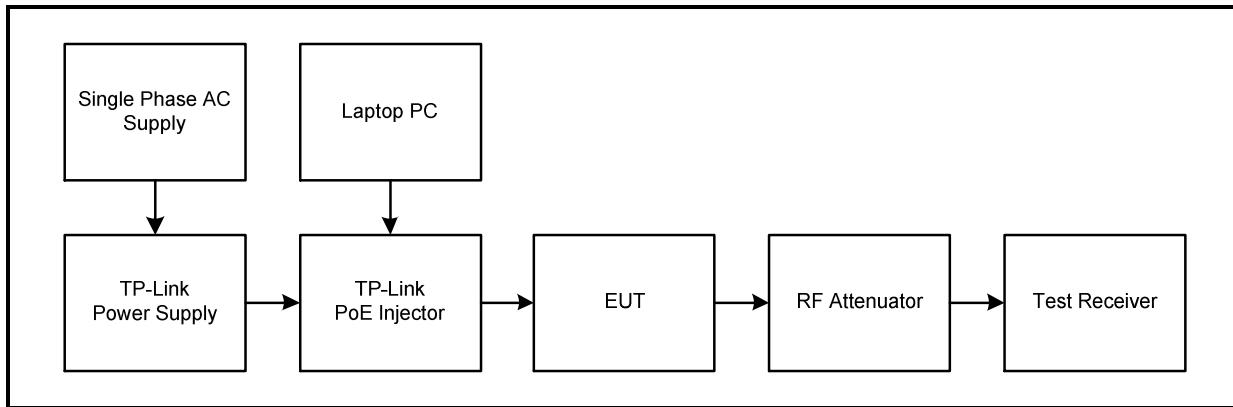
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	33

Note(s):

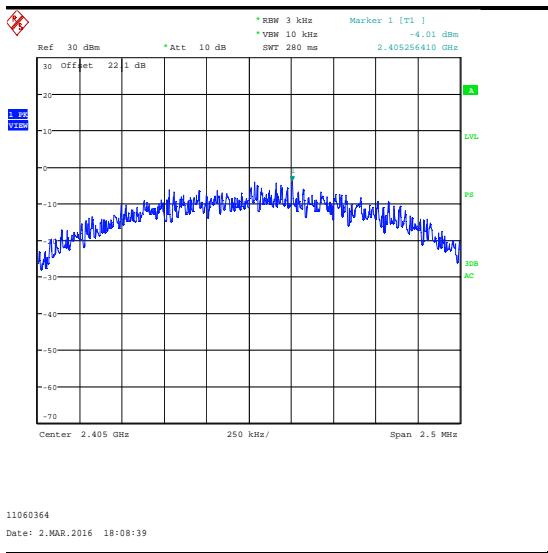
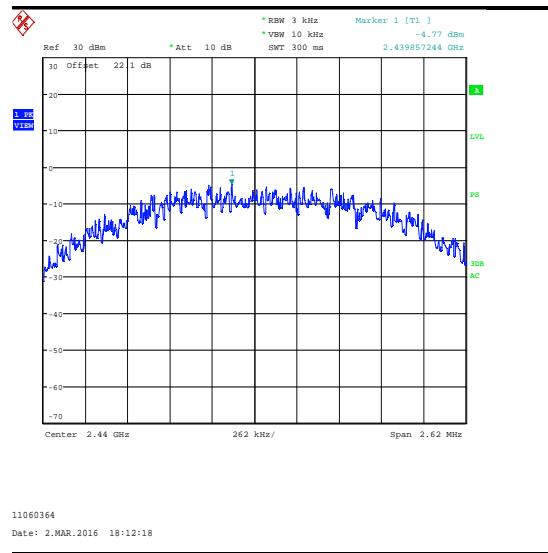
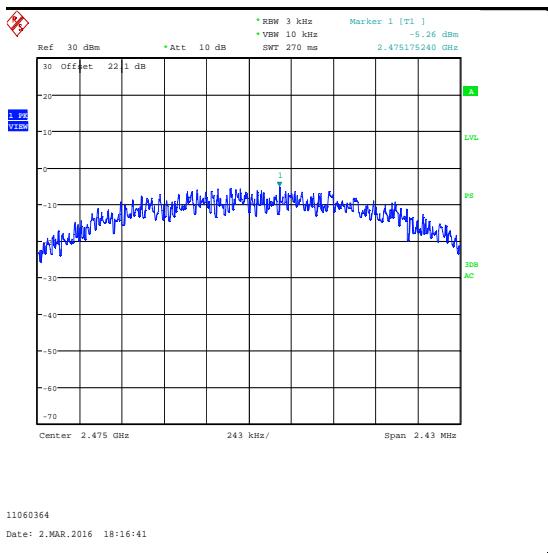
1. Transmitter Power Spectral Density tests in all bands were performed using a test receiver in accordance with FCC KDB 558074 Section 10.2.
2. The test receiver resolution bandwidth was set to 3 kHz and video bandwidth of 10 kHz. A peak detector was used, sweep time was set to auto and trace mode was 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 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.

Test setup:



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

Channel	Output Power (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-4.0	8.0	12.0	Complied
Middle	-4.8	8.0	12.8	Complied
Top	-5.3	8.0	13.3	Complied

**Bottom Channel****Middle 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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 May 2016	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-

5.2.5. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	24 February 2016
Test Sample Serial Number:	G0C-5094-1-04		

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

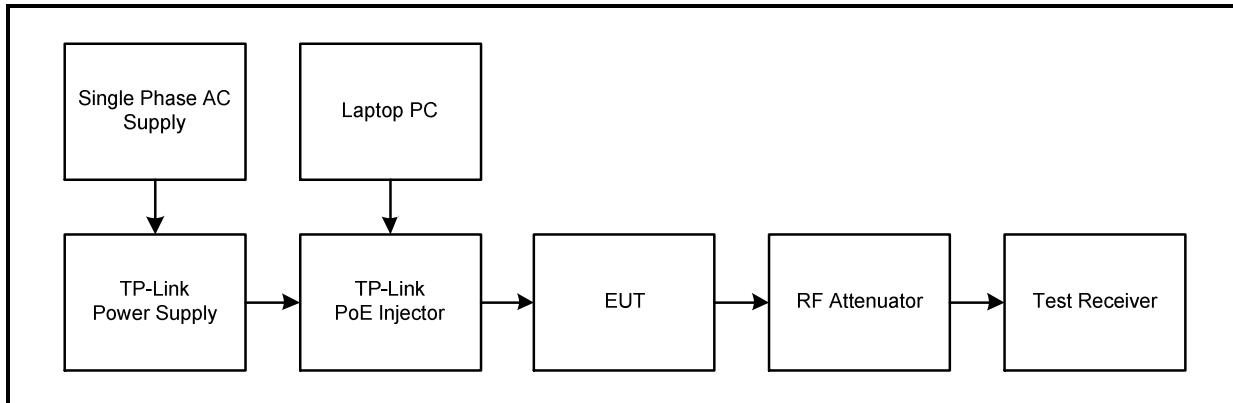
Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	30

Note(s):

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1.1.
2. The test receiver resolution bandwidth was set to 3 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 10 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 cables. An RF level offset was entered on the test receiver to compensate for the loss of the attenuator and RF cable.
4. The declared antenna gain was added to the conducted power to obtain the EIRP.

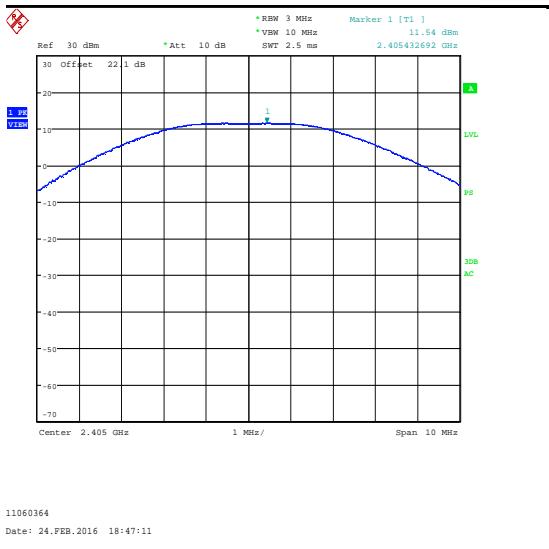
Test setup:



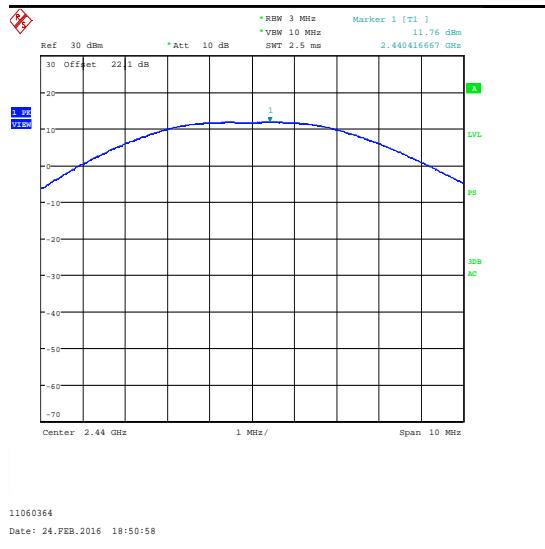
Transmitter Maximum Peak Output Power (continued)**Results:**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	11.5	30.0	18.5	Complied
Middle	11.8	30.0	18.2	Complied
Top	11.7	30.0	18.3	Complied

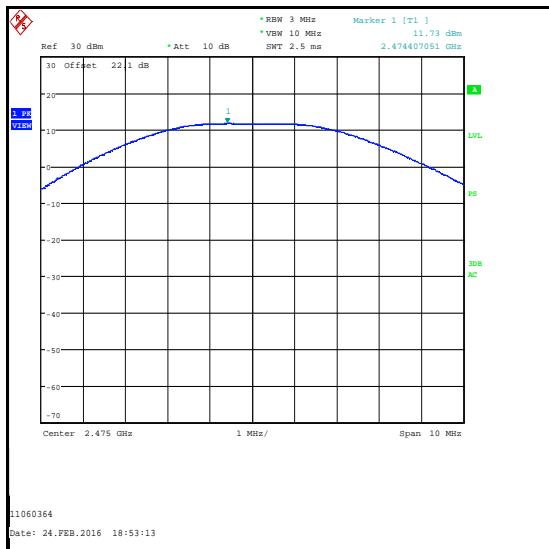
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	11.5	0.5	12.0	36.0	24.0	Complied
Middle	11.8	0.5	12.3	36.0	23.7	Complied
Top	11.7	0.5	12.2	36.0	23.8	Complied

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)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	23 Apr 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 May 2016	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	11 February 2016
Test Sample Serial Number:	G0C-5094-1-06		

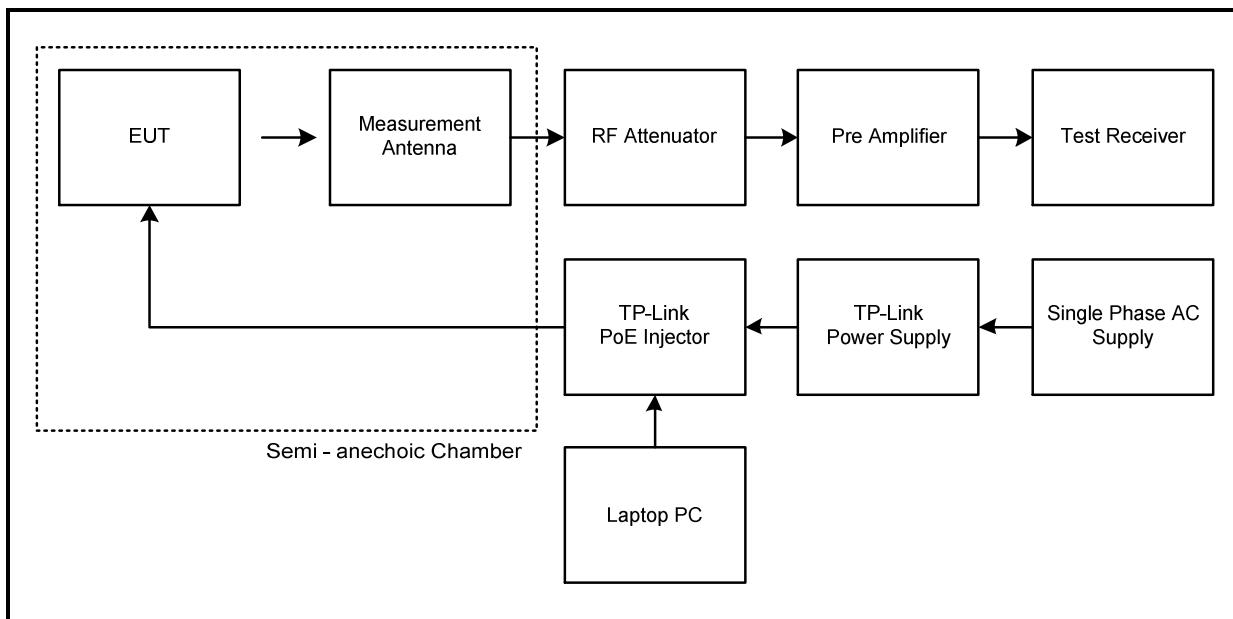
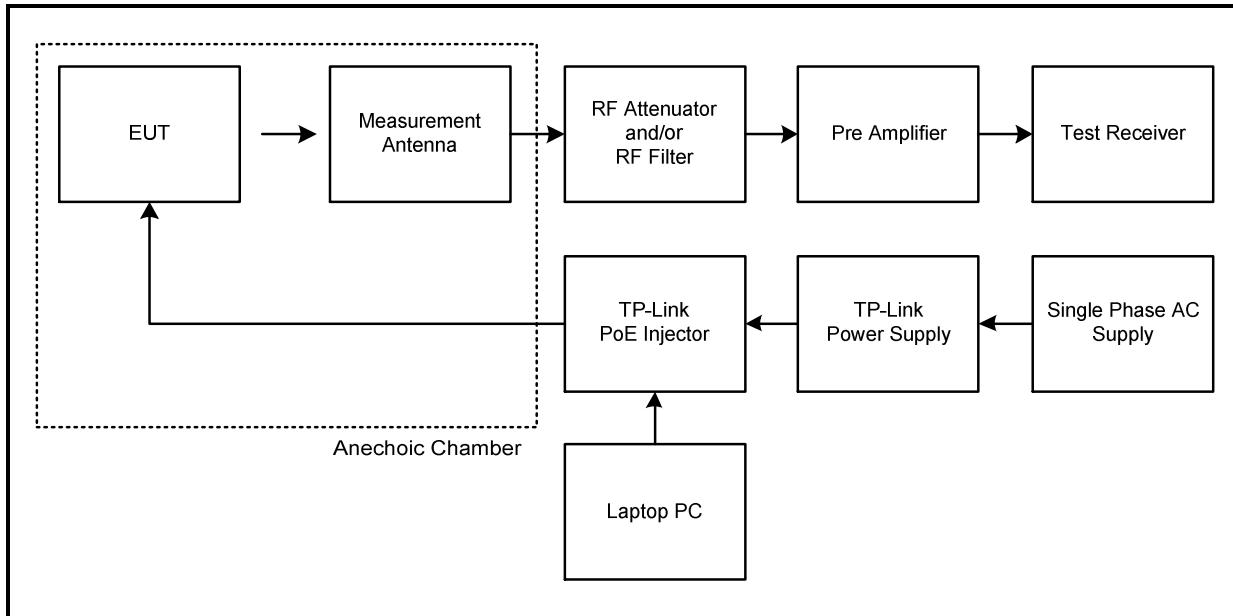
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

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

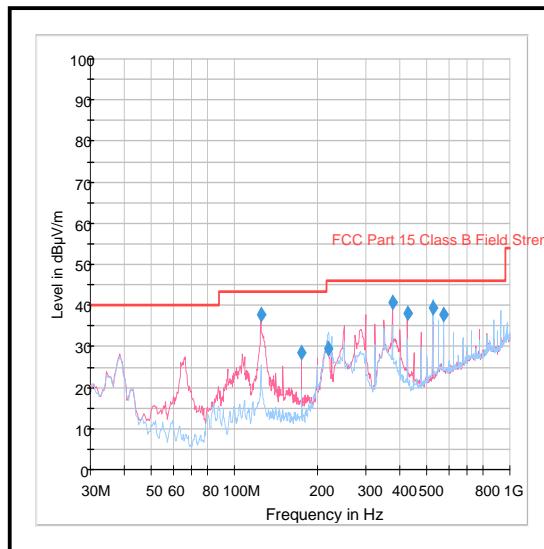
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. All other emissions were at least 20 dB below the appropriate limit or below the noise floor of the measurement system and therefore not recorded.
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. 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 wide enough to see the whole emission.

Transmitter Radiated Emissions (continued)**Test setup for radiated measurements: Semi-anechoic chamber****Test setup for radiated measurements: Anechoic chamber**

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
125.008	Vertical	37.7	43.5	5.8	Complied



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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1623	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	11 Jan 2017	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
G0543	Amplifier	Sonoma	310N	230801	Calibrated before use	3
A490	Antenna	Chase	CBL6111A	1590	30 Apr 2016	12
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12

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

Test Engineer:	Andrew Edwards	Test Date:	11 February 2016
Test Sample Serial Number:	G0C-5094-1-06		

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

Environmental Conditions:

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

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. 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 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.
5. Pre-scans were performed and markers placed on the highest measured levels the test receiver was set up as followed: a RBW set to 1 MHz, the VBW set to 3, with the sweep time set to auto couple. Peak and average measurements were performed with appropriate detectors during the pre-scan measurements.
6. *Duty cycle correction can be applied to a peak measurement in order to calculate the average emission level. Duty cycle was measured as 13.4 dB. Therefore 13.4 dB has been subtracted from the measured peak levels in order to obtain the average emission levels stated in the result tables below.

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
4809.071	Vertical	59.3	74.0	14.7	Complied

Results: Average / Bottom Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4809.071	Vertical	59.3	13.4	45.9*	54.0	8.1	Complied

Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4881.077	Horizontal	55.0	74.0	19.0	Complied
7321.571	Horizontal	54.9	74.0	19.1	Complied

Results: Average / Middle Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4881.077	Horizontal	55.0	13.4	41.6*	54.0	12.4	Complied
7321.571	Horizontal	54.9	13.4	41.5*	54.0	12.5	Complied

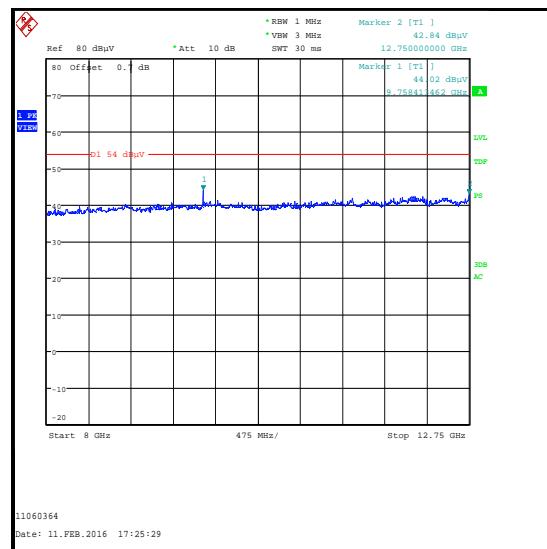
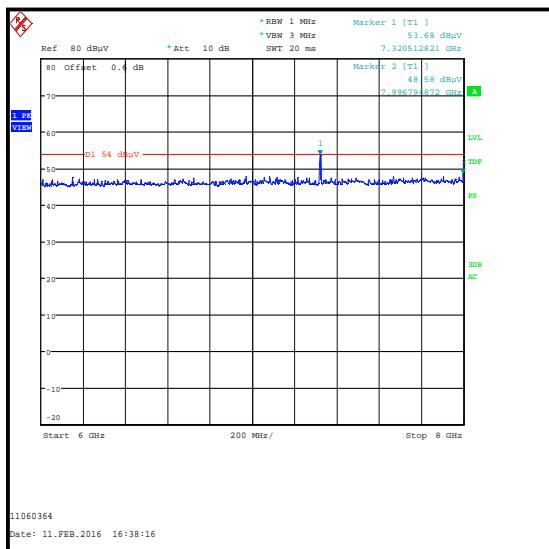
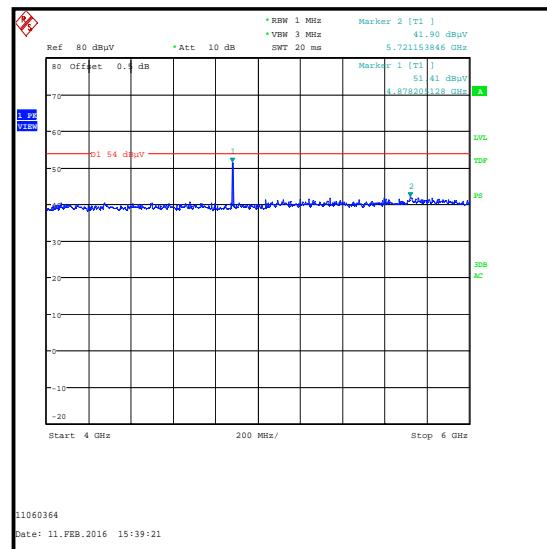
Results: Peak / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4949.055	Horizontal	56.1	74.0	17.9	Complied
7426.827	Vertical	54.7	74.0	19.3	Complied

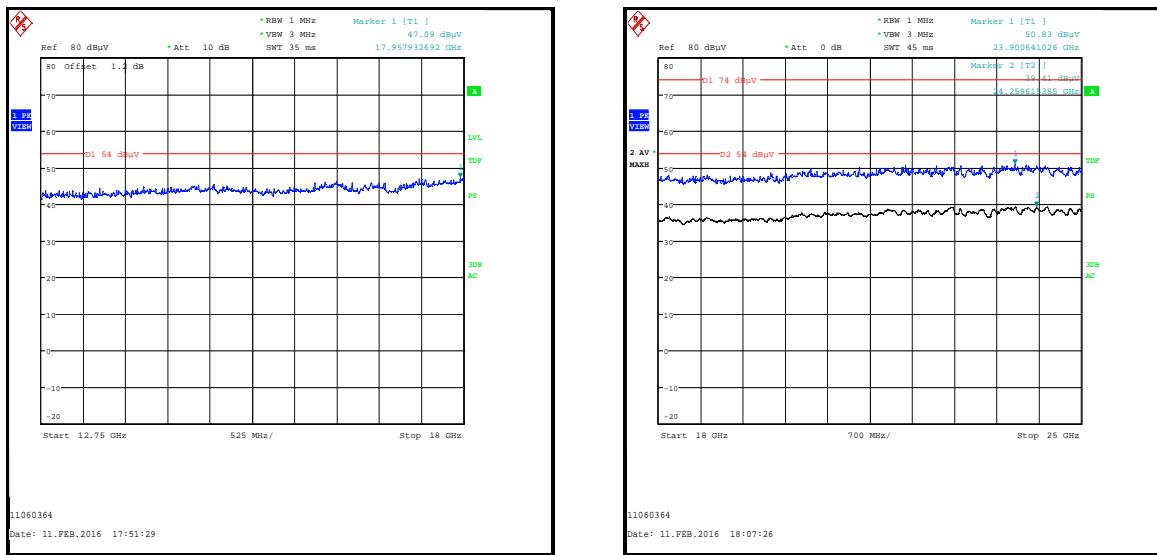
Results: Average / Top Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4949.055	Horizontal	56.1	13.4	42.7*	54.0	11.3	Complied
7426.827	Vertical	54.7	13.4	41.3*	54.0	12.7	Complied

Transmitter Radiated Emissions (continued)



Transmitter Radiated Emissions (continued)



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)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	EUS26	100554	21 May 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	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	05 May 2016	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	17 Apr 2016	12
A1980	High Pass Filter	AtlanTecRF	AFH-06000	09110900303	17 Apr 2016	12

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

Test Engineer:	Andrew Edwards	Test Dates:	11 February 2016
Test Sample Serial Number:	G0C-5094-1-06		

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 & 13.3.1

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	33

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 upper band edge average measurement exceeded the limit using the test method stated in ANSI C63.10 Section 6.10.5. Therefore the measurement was repeated using the integration method stated in FCC KDB 558074 Section 13.3.1 and the result was compliant.

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

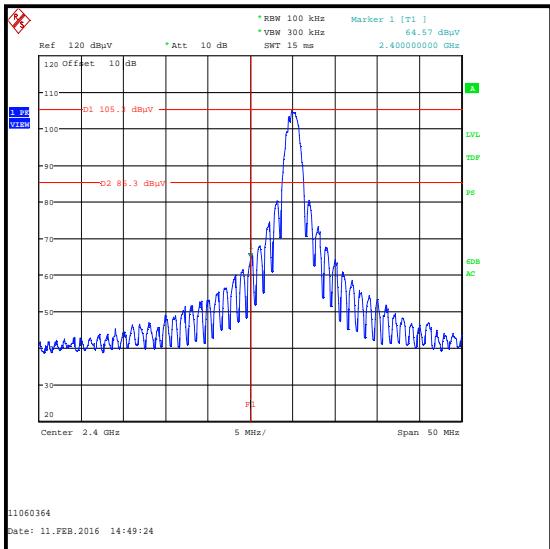
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2389.744	57.1	74.0	16.9	Complied
2400	64.6	85.3*	20.7	Complied
2483.5	60.1	74.0	13.9	Complied

Results: Average

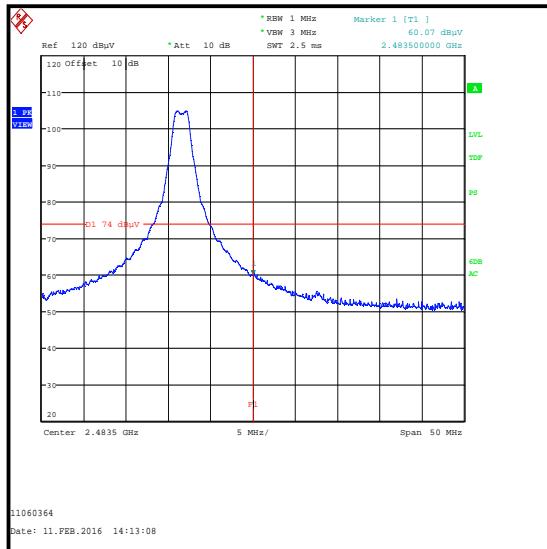
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2390.000	50.2	54.0	3.8	Complied
2483.5	51.0	54.0**	3.0	Complied

Transmitter Band Edge Radiated Emissions (continued)

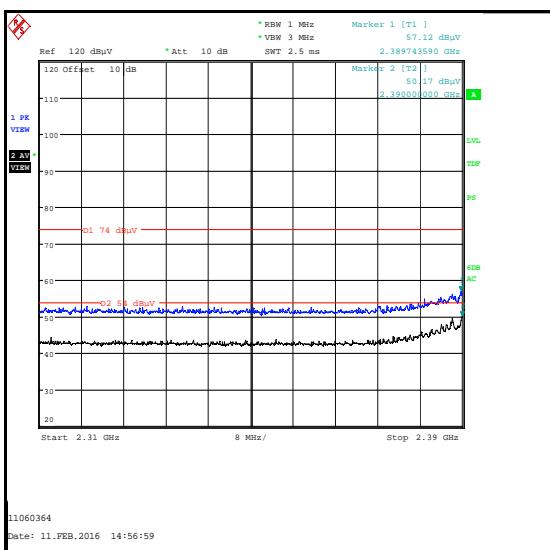
Results:



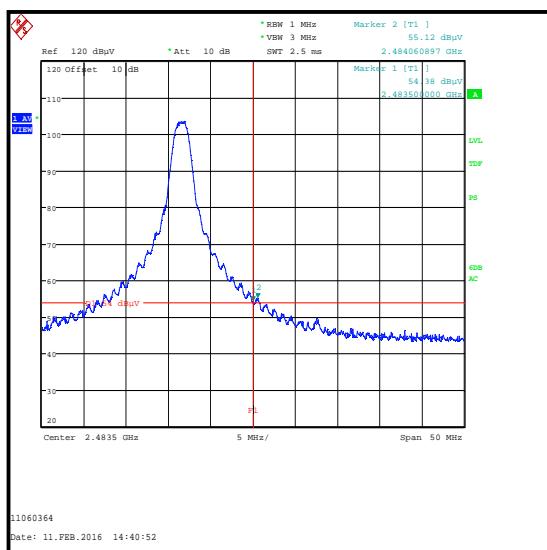
Lower Band Edge Peak Measurement



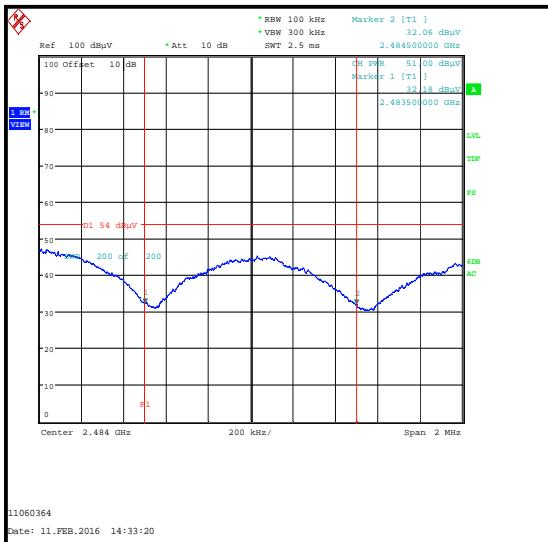
Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)**Results:****Upper Band Edge Average Measurement –**

**Channel power measurement over 1 MHz
bandwidth centred 0.5 MHz above the upper
band edge**

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	EUS26	100554	21 May 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 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 of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±1.14 %
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 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	12	-	Modified Note 2 at the request of the TCB

--- END OF REPORT ---