



# TEST REPORT

**Test Report No. :** UL-RPT-RP10066997JD03A

**Manufacturer** : Ubisense Ltd  
**Model No.** : UBIMOD30  
**FCC ID** : SEAMOD30  
**Technology** : IEEE 802.15.4f  
**Test Standard(s)** : FCC Part 15.249

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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:** 05 November 2013

**Checked by:**

Ian Watch  
Senior Engineer, Radio Laboratory

**Issued by :**

pp

John Newell  
Group Quality Manager,  
WiSE Basingstoke,  
UL VS LTD



This laboratory is accredited by UKAS.  
The tests reported herein have been  
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of accreditation.

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## UL VS LTD

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

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**Table of Contents**

<b>1. Customer Information .....</b>	<b>4</b>
<b>2. Summary of Testing .....</b>	<b>5</b>
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
<b>3. Equipment Under Test (EUT) .....</b>	<b>6</b>
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	7
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>8</b>
4.1. Operating Modes	8
4.2. Configuration and Peripherals	8
<b>5. Measurements, Examinations and Derived Results .....</b>	<b>9</b>
5.1. General Comments	9
5.2. Test Results	10
5.2.1. Transmitter AC Conducted Spurious Emissions	10
5.2.2. Transmitter Fundamental Field Strength	13
5.2.3. Transmitter Duty Cycle	16
5.2.4. Transmitter 20 dB Bandwidth	18
5.2.5. Transmitter Radiated Emissions	20
5.2.6. Transmitter Band Edge Radiated Emissions	26
<b>6. Measurement Uncertainty .....</b>	<b>28</b>
<b>7. Report Revision History .....</b>	<b>29</b>

**1. Customer Information**








<b>Company Name:</b>	Ubisense Ltd
<b>Address:</b>	St Andrew's House St Andrew's Road Chesterton, Cambridge Cambridgeshire CB4 1DL United Kingdom

## **2. Summary of Testing**

### **2.1. General Information**

<b>Specification Reference:</b>	47CFR15.249
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.249
<b>Specification Reference:</b>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 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>	11 October 2013 to 31 October 2013

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

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.249(a)(e)	Transmitter Fundamental Field Strength	
Part 15.35(c)	Duty cycle	Note 1
Part 2.1049	Transmitter 20 dB Bandwidth	
Part 15.249(d)(e) & 15.209(a)	Transmitter Radiated Emissions	
Part 15.249(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	
<b>Key to Results</b>  = Complied  = Did not comply		

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

1. The measurements were performed to assist in the calculation of average fundamental field strength as the EUT was in test mode and not giving a true average result.

### **2.3. Methods and Procedures**

<b>Reference:</b>	ANSI C63.4 (2009)
<b>Title:</b>	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
<b>Reference:</b>	ANSI C63.10 (2009)
<b>Title:</b>	American National Standard for Testing Unlicensed Wireless Devices

### **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>	Ubisense
<b>Model Name or Number:</b>	UBIMOD30
<b>Test Sample Serial Number:</b>	0001 ( <i>Radiated sample #1</i> )
<b>Hardware Version Number:</b>	1.0
<b>Software Version Number:</b>	1.0
<b>FCC ID:</b>	SEAMOD30

<b>Brand Name:</b>	Ubisense
<b>Model Name or Number:</b>	UBIMOD30
<b>Test Sample Serial Number:</b>	0002 ( <i>Radiated sample #2 used for duty cycle test</i> )
<b>Hardware Version Number:</b>	1.0
<b>Software Version Number:</b>	1.0
<b>FCC ID:</b>	SEAMOD30

#### **3.2. Description of EUT**

The Equipment Under Test was a location-tracking tag module containing an IEEE 802.15.4f transceiver operating in the 2.4 GHz ISM band. The unit has an integral antenna and is normally powered by host equipment from a nominal 3 VDC supply.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

Tested Technology:	IEEE 802.15.4f 2.4GHz PHY		
Power Supply Requirement:	Nominal	3.0 VDC via 120 VAC 60 Hz	
Type of Unit:	Transceiver		
Modulation Type:	MSK		
Data Rate:	250 kbit/s		
Transmit Frequency Range:	2400 to 2483.5 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	LOW	2401.750
	Middle	MID	2442.000
	Top	HIGH	2481.750

**3.5. Support Equipment**

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

<b>Description:</b>	Switch-mode power supply
<b>Brand Name:</b>	Stontronics
<b>Model Name or Number:</b>	3A-061WP03
<b>Serial Number:</b>	T3915ST

<b>Brand Name:</b>	Ubisense
<b>Description:</b>	Power cable with multi pin connector and Light Emitting Diode
<b>Cable Length and Type:</b>	1.8 Metre / twin core
<b>Connected to Port:</b>	Multi pin connector on EUT and DC connector on Mains Power Supply Unit

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

### **4.1. Operating Modes**

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

- Transmitting at maximum power, with and without a modulated signal on the bottom, middle and top channels as required.

### **4.2. Configuration and Peripherals**

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

- The manufacturer pre-loaded test software/firmware prior to testing. This enabled the EUT to transmit with a 250 kbit/s modulated signal on the bottom, middle or top channels as required.
- The sample with serial number 0002 was used for duty cycle measurements. All other measurements were performed using the sample with serial number 0001.
- The EUT is normally powered by host equipment which can be battery or mains supplied. During all testing the EUT was powered by 3 VDC via a 120 VAC 60 Hz Stontronics power supply. The power supply was connected to the EUT multi-pin connector via a 1.8 metre two core cable.



## **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:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	16 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Part 15.207
<b>Test Method Used:</b>	ANSI C63.10 Section 6.2 referencing ANSI C63.4

**Environmental Conditions:**

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

**Note(s):**

1. The EUT was connected to the Stontronics power supply. The power supply was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. 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.
3. A pulse limiter was fitted between the LISN and the test receiver.

**Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.353	Live	33.3	58.9	25.6	Complied
0.605	Live	29.2	56.0	26.8	Complied
0.672	Live	27.5	56.0	28.5	Complied
0.974	Live	26.6	56.0	29.4	Complied
1.037	Live	27.4	56.0	28.6	Complied
1.401	Live	26.8	56.0	29.2	Complied

**Results: Live / Average**

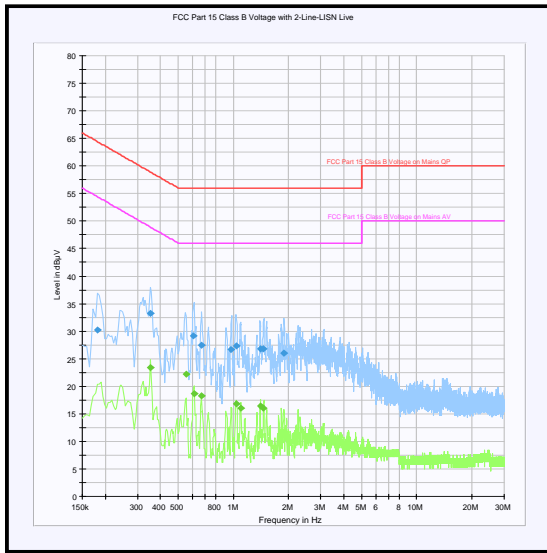
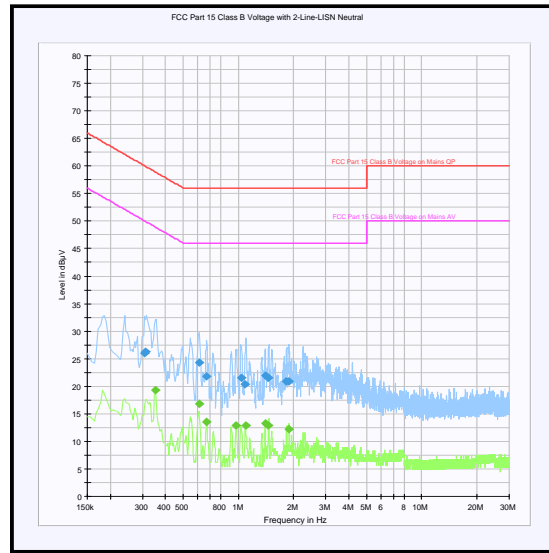
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.353	Live	23.3	48.9	25.6	Complied
0.551	Live	22.3	46.0	23.8	Complied
0.609	Live	18.6	46.0	27.4	Complied
0.672	Live	18.3	46.0	27.7	Complied
1.037	Live	16.9	46.0	29.1	Complied
1.401	Live	16.4	46.0	29.6	Complied

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

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.308	Neutral	26.1	60.0	33.9	Complied
0.312	Neutral	26.3	59.9	33.6	Complied
0.609	Neutral	24.3	56.0	31.7	Complied
0.668	Neutral	21.8	56.0	34.2	Complied
1.401	Neutral	21.9	56.0	34.1	Complied
1.460	Neutral	21.5	56.0	34.5	Complied

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.353	Neutral	19.2	48.9	29.7	Complied
0.609	Neutral	16.9	46.0	29.1	Complied
0.672	Neutral	13.6	46.0	32.4	Complied
1.095	Neutral	12.9	46.0	33.1	Complied
1.406	Neutral	13.2	46.0	32.8	Complied
1.460	Neutral	12.9	46.0	33.1	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)
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	30 Oct 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
M1379	Test Receiver	Rohde & Schwarz	ESIB 7	100330	15 Nov 2013	12
M1625	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	09 Jan 2014	12

**5.2.2. Transmitter Fundamental Field Strength****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	17 October 2013 & 25 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Part 15.249(a)(e)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.6

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	47 to 52

**Note(s):**

1. The final measured value in the tables below incorporates the calibrated antenna factor and cable loss.
2. The average level was obtained by subtracting the duty cycle correction (2.0 dB) from the previously measured peak level.

**Results: Bottom Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2401.750	Vertical	95.5	114.0	18.5	Complied

**Results: Bottom Channel / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2401.750	Vertical	93.5	94.0	0.5	Complied

**Results: Middle Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2442.000	Vertical	95.6	114.0	17.7	Complied

**Results: Middle Channel / Average**

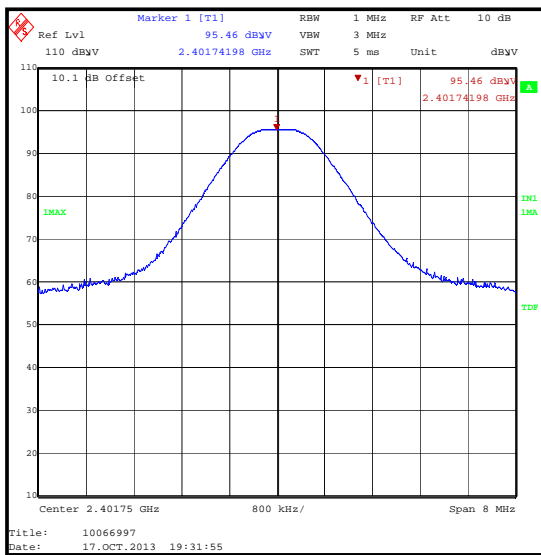
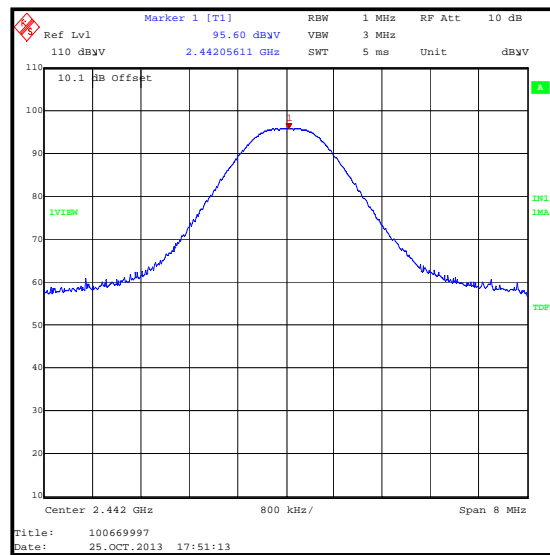
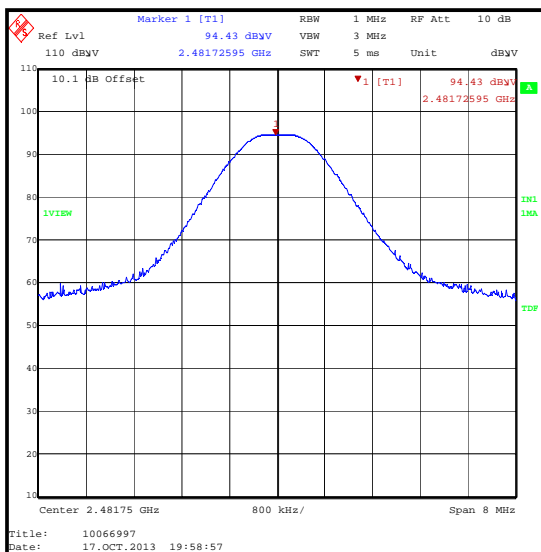
Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2442.000	Vertical	93.6	94.0	0.4	Complied

**Transmitter Fundamental Field Strength (continued)****Results: Top Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2481.750	Vertical	94.4	114.0	19.6	Complied

**Results: Top Channel / Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2481.750	Vertical	92.4	94.0	1.6	Complied

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

**Transmitter Fundamental Field Strength (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
A1396	Attenuator	Huber + Suhner	6810.17.B	757987	10 May 2014	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	10046K	01 Oct 2014	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	25 October 2013
<b>Test Sample Serial Number:</b>	0002		

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

**Environmental Conditions:**

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

**Note(s):**

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by  $20 \log(\text{On Time} / (\text{Period or } 100 \text{ ms whichever is the lesser}))$ :

$$\text{Duty cycle} = 20 \log ((77.217 \text{ ms}) / (97.464 \text{ ms}))$$

$$\text{Duty cycle} = 20 \log (0.79)$$

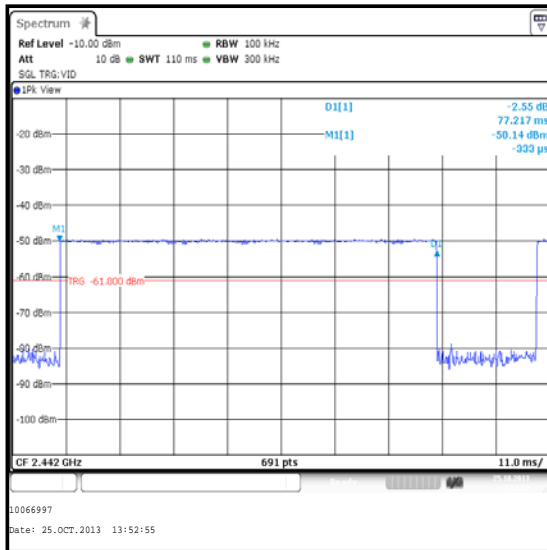
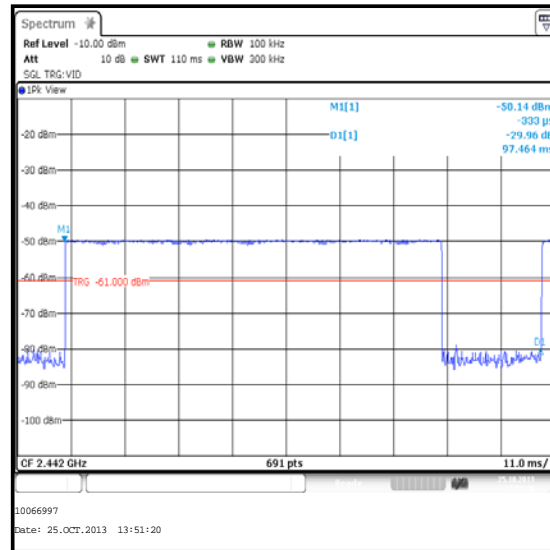
$$\text{Duty cycle} = 2.0 \text{ dB}$$

**Results:**

Pulse Duration (ms)	Duty Cycle (dB)
77.217	2.0

Period (ms)
97.464



**Transmitter Duty Cycle (continued)****Tx on****Tx on+off****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
L1028	Signal Analyser	Rohde & Schwarz	FSV 30	100854	02 May 2014	12
M1658	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

**5.2.4.Transmitter 20 dB Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	31 October 2013
<b>Test Sample Serial Number:</b>	0001		

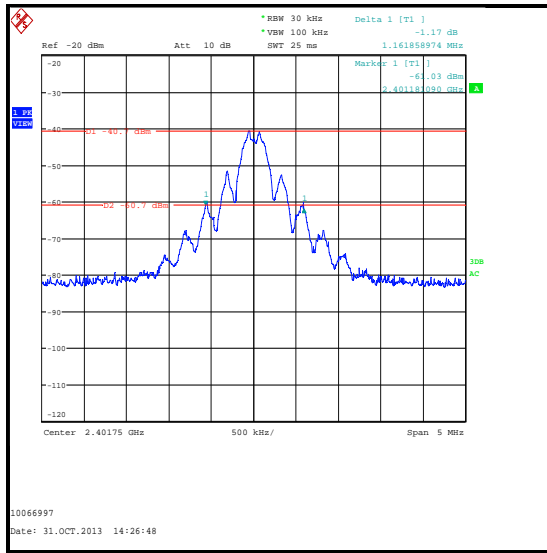
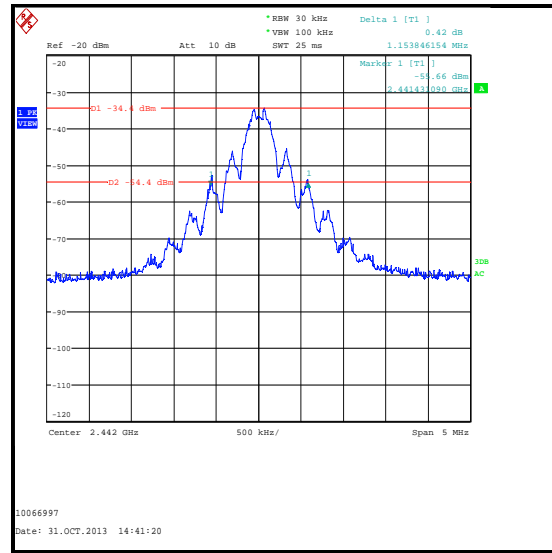
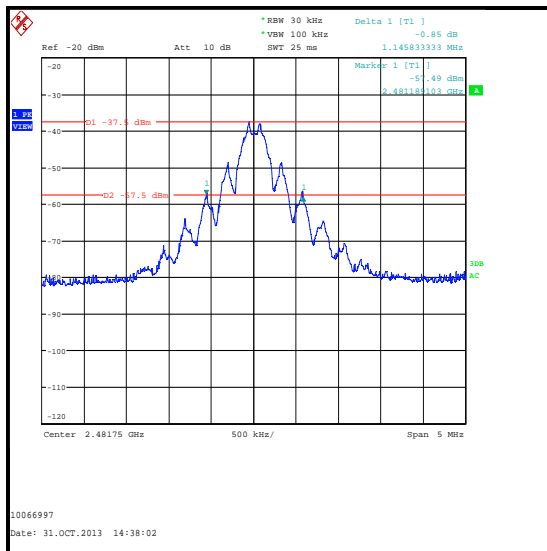
<b>FCC Reference:</b>	Part 2.1049
<b>Test Method Used:</b>	ANSI C63.10 Section 6.9.1

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	45

**Results:**

<b>Channel</b>	<b>20 dB Bandwidth (kHz)</b>
Bottom	1161.859
Middle	1153.846
Top	1145.833

**Transmitter 20 dB Bandwidth (continued)****Bottom Channel****Middle Channel****Top Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12
M1658	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	15 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Parts 15.249(d)(e) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
<b>Frequency Range</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

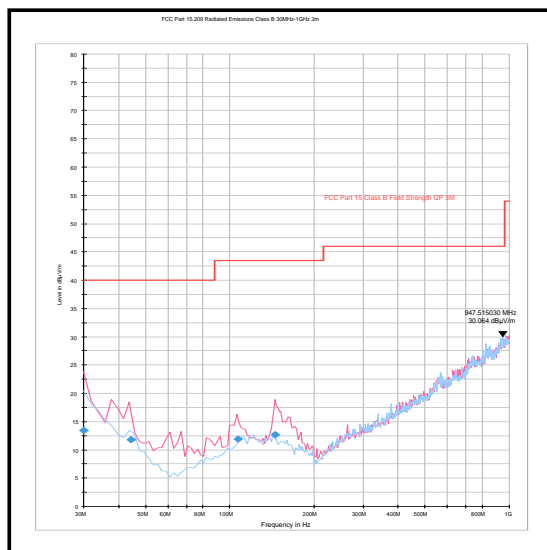
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	38

**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-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 as shown 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.

**Results: Quasi-Peak**

<b>Frequency (MHz)</b>	<b>Antenna Polarity</b>	<b>Level (dB<math>\mu</math>V/m)</b>	<b>Limit (dB<math>\mu</math>V/m)</b>	<b>Margin (dB)</b>	<b>Result</b>
947.515	Vertical	30.1	54.0	23.9	Complied

**Transmitter Radiated Emissions (continued)**

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)
A490	Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
G0543	Pre-Amplifier	Sonoma	310N	230801	08 Jan 2014	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
M1622	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	14 October 2013 & 15 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Parts 15.249(d)(e) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	22 to 23
<b>Relative Humidity (%):</b>	43 to 44

**Note(s):**

1. The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.
2. The emission shown on the 1 GHz to 4 GHz pre-scan plot is the EUT fundamental at 2481.75 MHz.
3. In accordance with ANSI C63.4 Section 8.3.2.2 NOTE 1, the peak level results complied with the average limit, therefore the average results were not required.
4. All other emissions shown on the pre-scan plot were investigated and found to be >20 dB below the applicable limit or below the measurement noise floor.
5. 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.

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

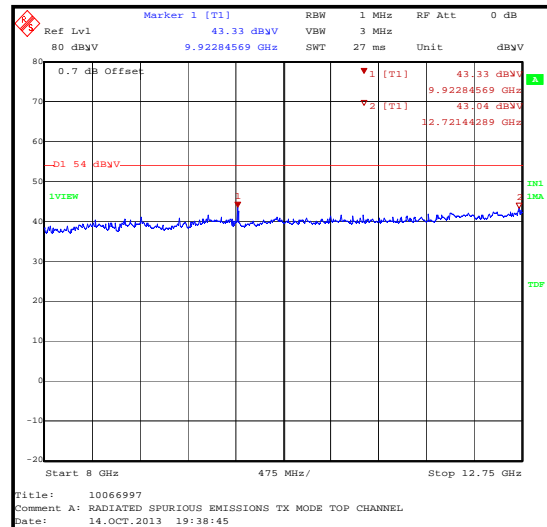
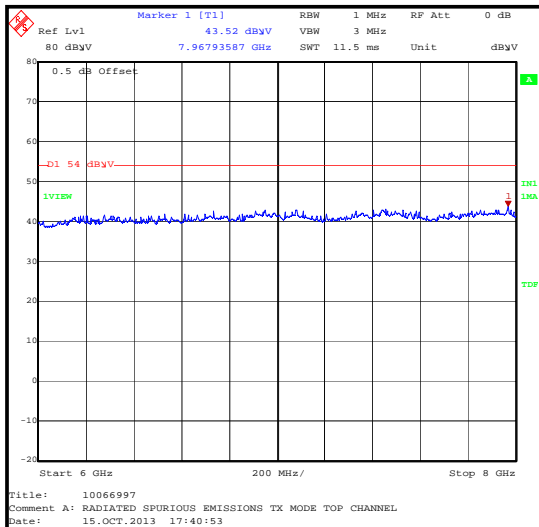
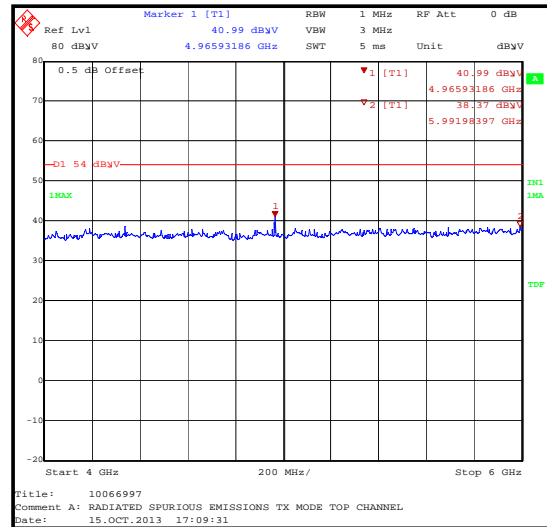
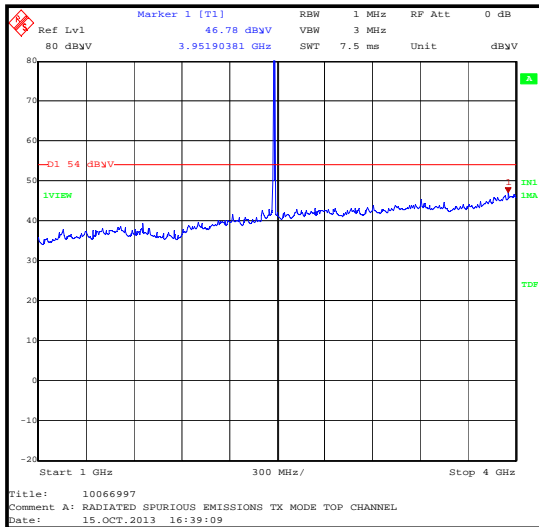
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4803.445	Vertical	40.6	54.0	13.4	Complied
7205.386	Vertical	49.0	54.0	5.0	Complied

**Results: Middle Channel**

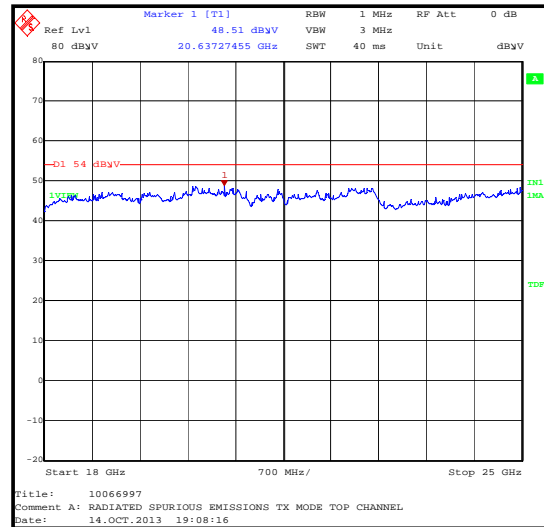
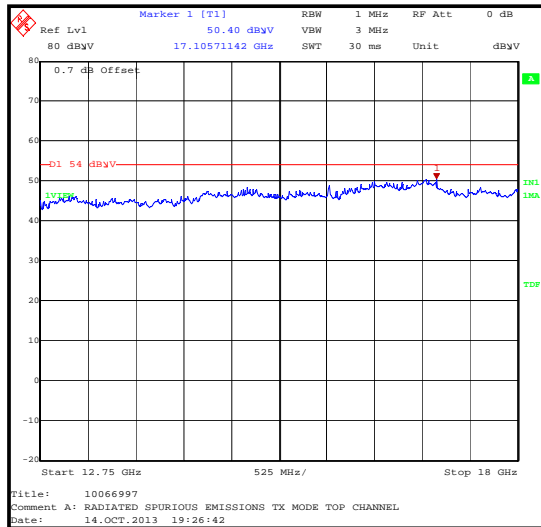
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4884.115	Horizontal	41.0	54.0	13.0	Complied
7326.072	Vertical	46.5	54.0	7.5	Complied

**Results: Top Channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4963.485	Horizontal	41.9	54.0	12.1	Complied
7444.633	Vertical	45.3	54.0	8.7	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)
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20240-20	330	04 Nov 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	19 Apr 2014	12
A2176	High Pass Filter	AtlanTecRF	AFH-07000	800980	10 May 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	10046K	01 Oct 2014	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	15 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Parts 15.249(d) & 15.209
<b>Test Method Used:</b>	ANSI C63.10 Section 6.9.2 and 6.9.3

**Environmental Conditions:**

<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	44

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. \*-20 dBc.
3. \*\* The upper band edge average measurement was performed using ANSI C63.10 Section 6.9.3 marker-delta method. An in-band field strength measurement was initially performed. A second measurement was performed using a reduced RBW of 500 kHz which is 1% of the 50 MHz span. The amplitude delta between the peak of the fundamental emission and the emission level at the upper band edge was noted. The delta was subtracted from the initial in-band field strength level to obtain the upper band edge level. Result plots can be found at the end of this section.

*Initial fundamental peak emission level using a RBW/VBW of 1 MHz/10 Hz = 90.2 dB $\mu$ V/m*

*Delta between fundamental and band edge using RBW/VBW of 500 kHz/10 Hz = 45.6 dB $\mu$ V/m*

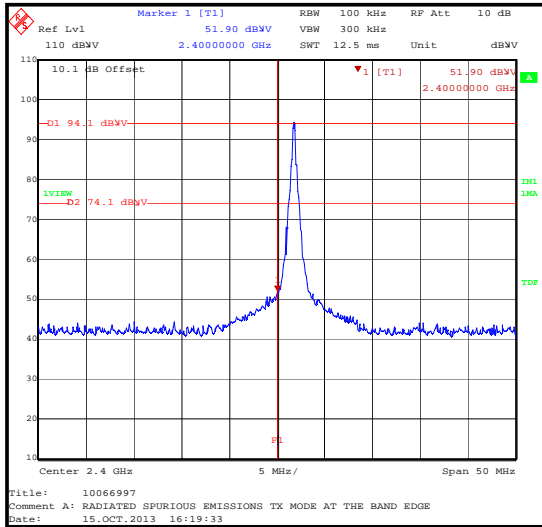
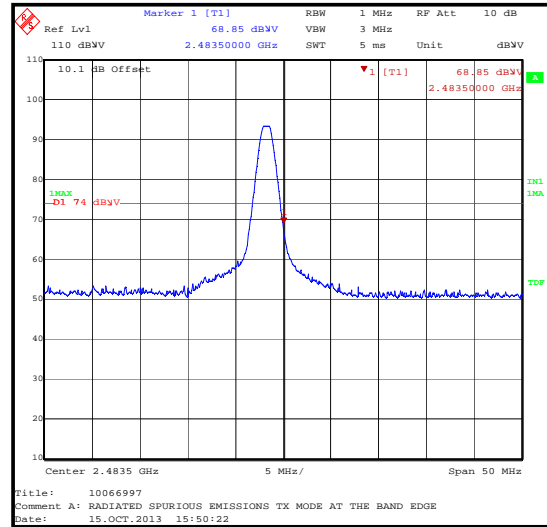
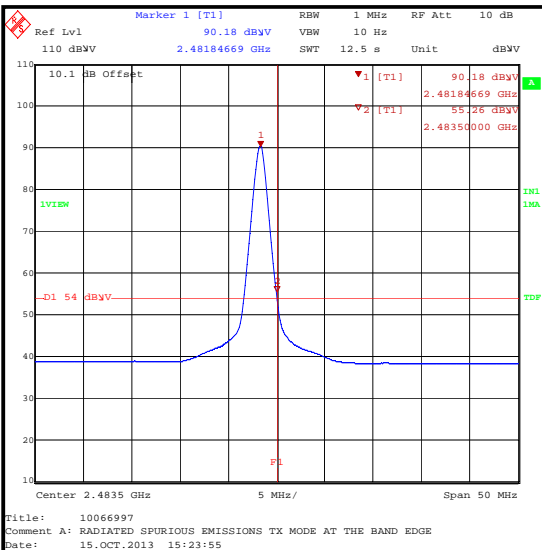
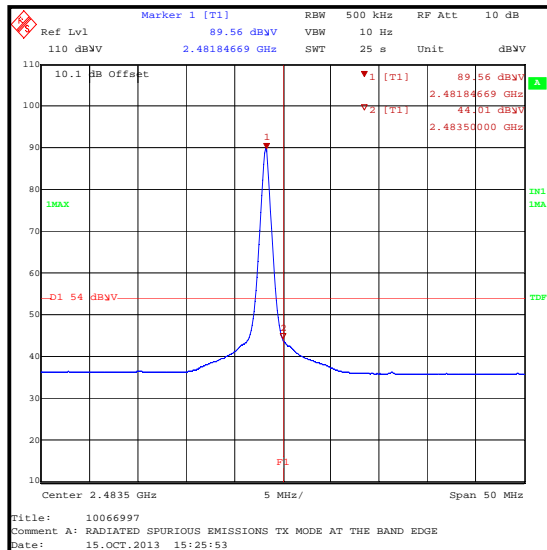
*Band edge level = 90.2 - 45.6 = 44.6 dB $\mu$ V/m*

**Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400	Vertical	51.9	74.1*	22.2	Complied
2483.5	Vertical	68.9	74.0	5.1	Complied

**Results: Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Vertical	44.6**	54.0	9.4	Complied

**Transmitter Band Edge Radiated Emissions (continued)****Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Upper Band Edge In-band Measurement****\*\*Marker-delta Method Plot1****Upper Band Edge Average Measurement****\*\*Marker-delta Method Plot 2****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1396	Attenuator	Huber + Suhner	6810.17.B	757987	10 May 2014	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	10046K	01 Oct 2014	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	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
Fundamental Field Strength	2.4 GHz to 2.4835 GHz	95%	±2.94 dB
Occupied 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