



TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Wideband Modular Ubitag V2.3

To: FCC Part 15.249: 2009 Subpart C

Test Report Serial No:
RFI/RPT3/RP76541JD03A

Supersedes Test Report Serial No:
RFI/RPT2/RP76541JD03A

This Test Report Is Issued Under The Authority Of Brian Watson, Operations Director:	
	
Checked By:	Nigel Davison
Signature:	
Date of Issue:	26 March 2010

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1. Customer Information








Company Name:	Ubisense Ltd.
Address:	St Andrew's House St Andrew's Road Chesterton, Cambridge Cambridgeshire CB4 1DL England

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.249
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2009: Part 15 Subpart C (Radio Frequency Devices) - Section 15.249
Site Registration:	209735
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	08 February 2010 to 09 February 2010

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Port Type	Result
FCC Part 15.107	Idle Mode AC Conducted Emissions	AC Mains	
FCC Part 15.109	Idle Mode Radiated Spurious Emissions	Antenna	
FCC Part 15.207	Transmitter AC Conducted Emissions	AC Mains	
Part 15.249(a)	Transmitter Fundamental Field Strength	Antenna	
Part 2.1049	Transmitter 20 dB Bandwidth	Antenna	
Part 15.249(a)(d)(e) & 15.209	Transmitter Radiated Spurious Emissions	Antenna	
Part 15.249(d) & 15.209	Transmitter Band Edge Radiated Emissions	Antenna	

Key to Results

 = Complied  = Did not comply

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2003)
Title:	American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

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)

Description:	Modular Wideband Tag
Brand Name:	Ubisense
Model Name:	Modular Ubitag V2.3
Model Number:	UBIMOD7023
Serial Number:	06
Hardware Version Number:	2.1
Software Version Number:	Test software
FCC ID Number:	SEAMOD23

3.2. Description of EUT

The equipment under test was a location tag.

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:	Wide Band (WB)	
Category of Equipment:	Transmitter	
Type of Equipment	Module	
Intended Operating Environment:	Industrial, Commercial and Domestic	
Highest Internally Generated Clock or Oscillator Frequency:	2480.5 MHz	
Modulation Type:	MSK	
Duty Cycle	100%	
Antenna Connection Type:	Integral	
Antenna Type:	Internal ceramic	
Antenna Gain:	1 dBi	
Power Supply Requirement:	Nominal	3.3V
Transmit Frequency Range:	2.4 GHz to 2.4835 GHz	
Transmit Channels Tested:	Channel ID	Channel Frequency (MHz)
	Bottom	2402.5
	Centre	2442.0
	Top	2480.5
Receive Frequency Range:	2.4 GHz to 2.4835 GHz	
Receive Channels Tested:	Channel ID	Channel Frequency (MHz)
	Bottom	2402.5
	Centre	2442.0
	Top	2480.5

3.5. Port Identification

Port	Description	Type	Applicable
1	DC power	Multi-pin	Y

3.6. Support Equipment

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

Description:	Mains Power Supply Unit (AC to DC converter)
Brand Name:	STONTRONICS
Model Name or Number:	3A-061WP03
Serial Number:	T3915ST
Cable Length and Type:	1 Metre / twin core
Connected to Port:	Power cable

Description:	Power cable with multi pin connector and Light Emitting Diode
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated
Cable Length and Type:	1.8 Metre / twin core
Connected to Port:	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):

- Transmit Mode - Constantly transmitting on the top, centre or bottom channel at full power with 125 kbit/s MSK modulation.
- Idle mode.

4.2. Configuration and Peripherals

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

- Powered from a DC power supply through the multi pin connector on the EUT.
- The power supply was connected to a 120 VAC 60 Hz source. A Light Emitting Diode on the multi pin connector was used to monitor the transmit channel or receive mode in accordance with Client's instructions.

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.

5.2. Test Results

5.2.1. Idle Mode AC Conducted Spurious Emissions

Test Summary:

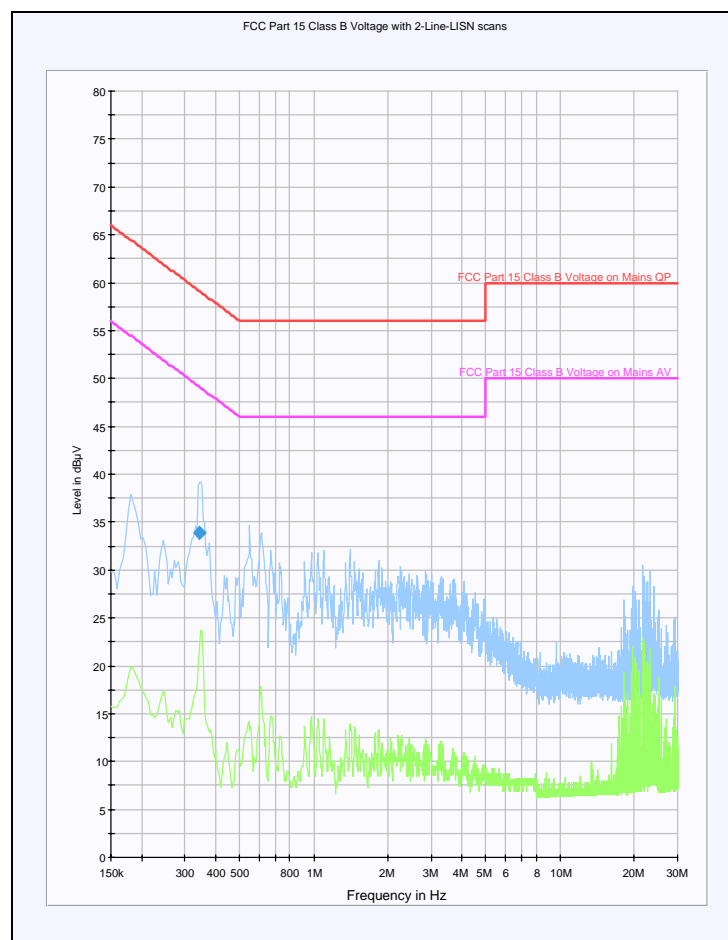
FCC Part:	15.107
Test Method Used:	As detailed in ANSI C63.4 Section 7 and relevant annexes

Environmental Conditions:

Temperature Range (°C):	20
Relative Humidity Range (%):	25

Note(s):

1. All emissions were greater than 20dB below the applicable limits therefore numerical results were not required or recorded.



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

5.2.2. Idle Mode Radiated Spurious Emissions**Test Summary:**

FCC Part:	15.109
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

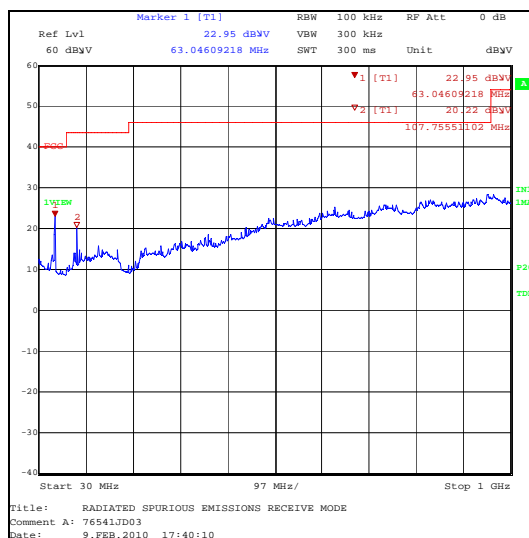
Temperature Range (°C):	20
Relative Humidity Range (%):	25

Results:

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Refer to Note 1					

Note(s):

1. All emissions were at least 20 dB below the specification limit or below the measurement system noise floor.
2. Final measurements were performed with a quasi-peak detector.



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

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

FCC Part:	15.109
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes
Frequency Range:	1000MHz to 12.75 GHz

Environmental Conditions:

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

Results: Peak

Frequency (GHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12.550	Vertical	53.5	74.0	20.5	Complied
Refer to note 1					

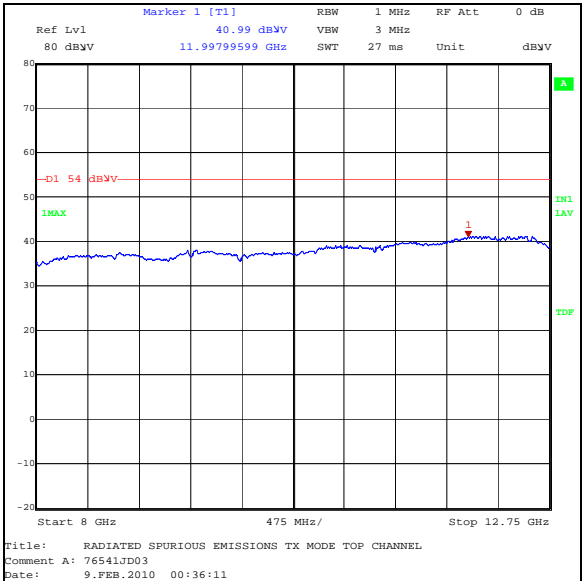
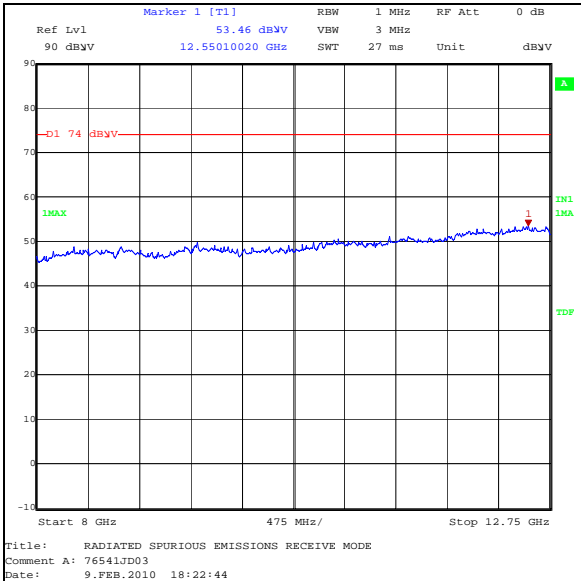
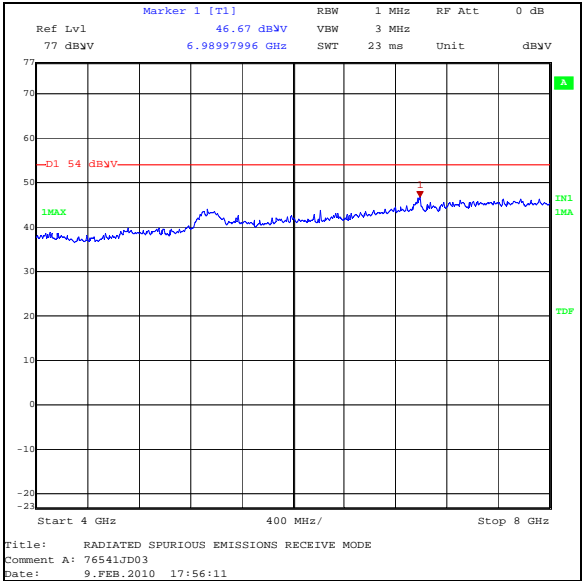
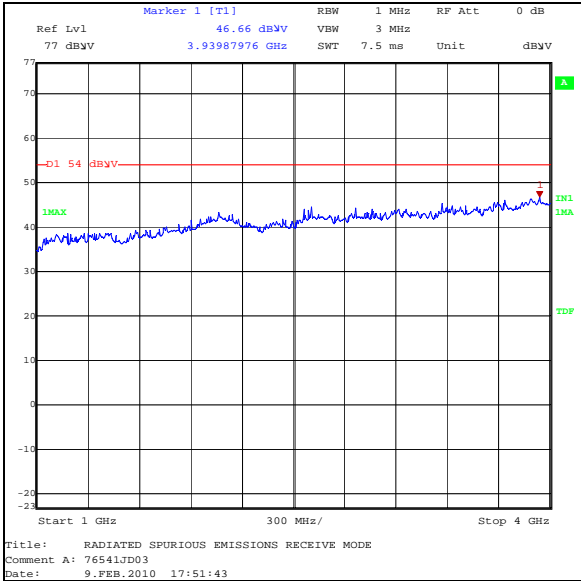
Results: Average

Frequency (GHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
11.998	Vertical	41.0	54.0	13.0	Complied

Note(s):

1. All emissions were at least 20 dB below the specification limit or below the measurement system noise floor.
2. The peak noise floor was recorded against average limits as this presented the worst case, where the peak noise floor exceeded the average limit peak and average scan were made in accordance with the standard and can seen on the pre-scan plots.

Idle Mode Radiated Spurious Emissions (continued)



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

5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

FCC Part:	15.207
Test Method Used:	As detailed in ANSI C63.4 Section 7 and relevant annexes

Environmental Conditions:

Temperature Range (°C):	22
Relative Humidity Range (%):	26

Note(s):

1. All emissions were greater than 20dB below the applicable limits therefore numerical results were not required or recorded.



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

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

FCC Part:	Section 15.249(a)
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

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

Results Bottom Channel: Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2402.5	Horizontal	88.9	114.0	25.1	Complied

Results Bottom Channel: Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2402.5	Horizontal	88.5	94.0	5.5	Complied

Results Centre Channel: Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2442.0	Horizontal	89.4	114.0	24.6	Complied

Results Centre Channel: Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2442.0	Vertical	89.3	94.0	4.7	Complied

Results Top Channel: Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2480.5	Vertical	90.2	114.0	23.8	Complied

Results Top Channel: Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2480.5	Vertical	90.1	94.0	3.9	Complied

Note(s):

1. Measurements were made with the test system antenna in the vertical and horizontal planes. The highest levels were recorded in the above tables.

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

FCC Part:	2.1049
Test Method Used:	Rohde & Schwarz ESIB26 - Occupied Bandwidth function

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	22

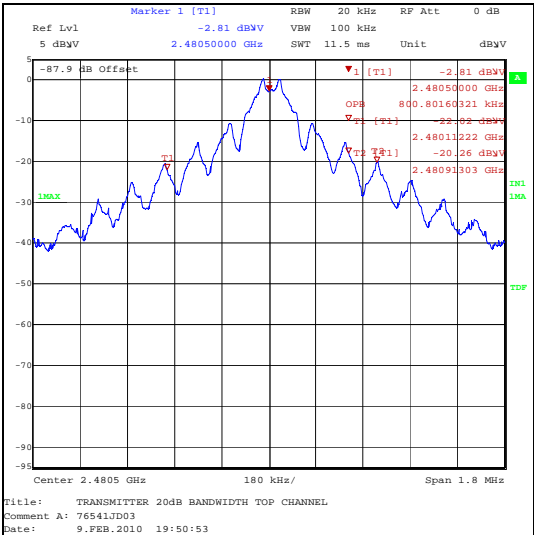
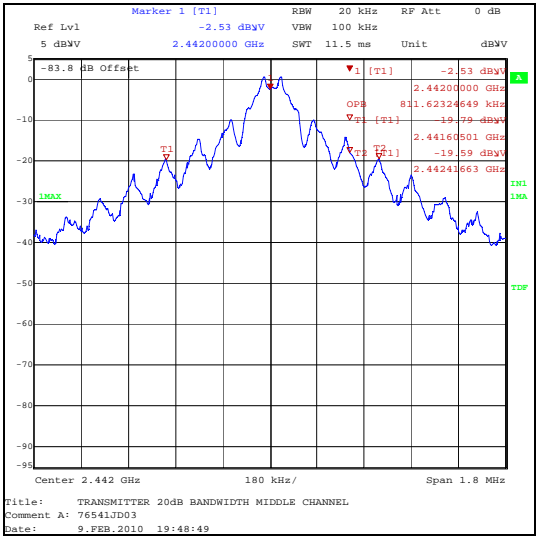
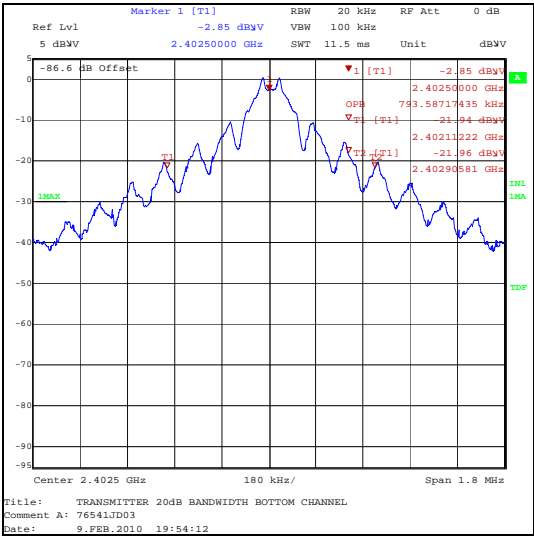
Results: Bottom

Channel	Transmitter 20 dB Bandwidth (MHz)	Emission Remained within frequency band
Bottom	0.793587	Complied
Middle	0.811623	Complied
Top	0.800802	Complied

Limit:

The 20dB bandwidth must remain within the designated frequency band 2400 to 2483.5 MHz.

Transmitter 20 dB Bandwidth (continued)



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

FCC Part:	15.249(a)(d)(e) & 15.209
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes
Frequency Range:	30 MHz to 26 GHz

Environmental Conditions:

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

Results Bottom Channel:

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4804.490	Horizontal	47.6	54.0	6.4	Complied

Results Middle Channel:

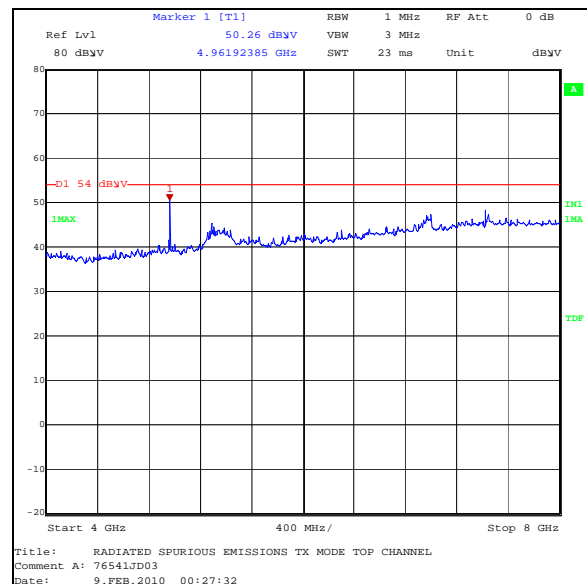
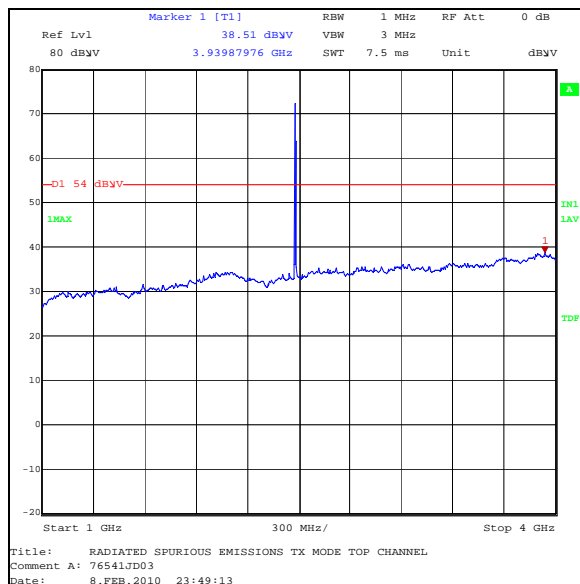
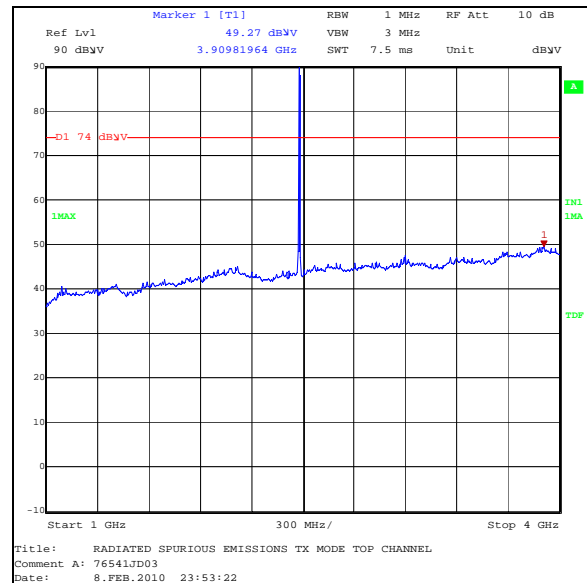
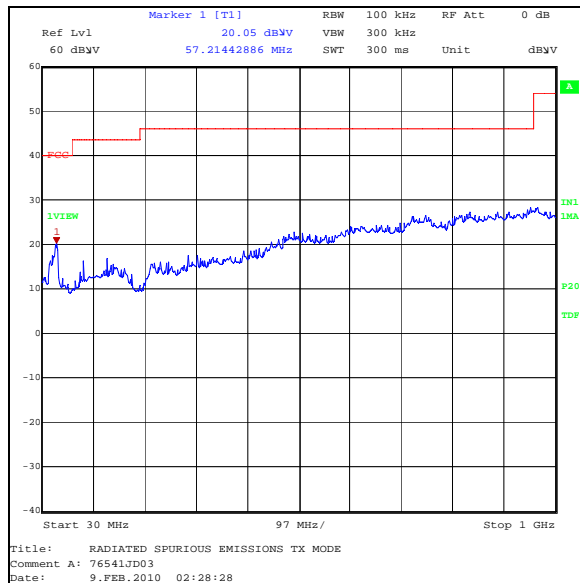
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4884.050	Horizontal	48.2	54.0	5.8	Complied

Results Top Channel:

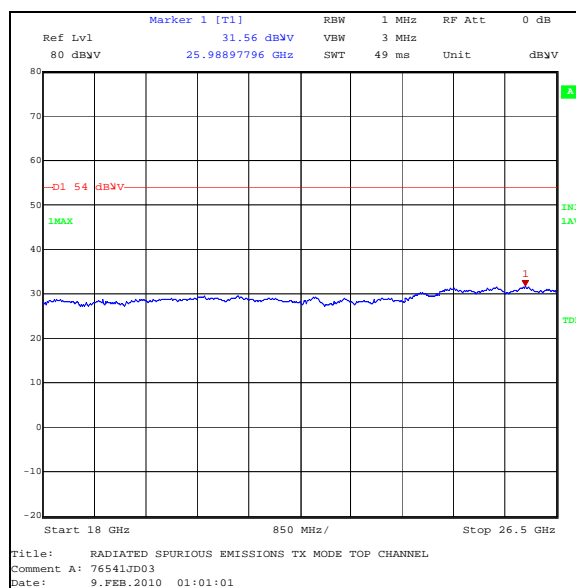
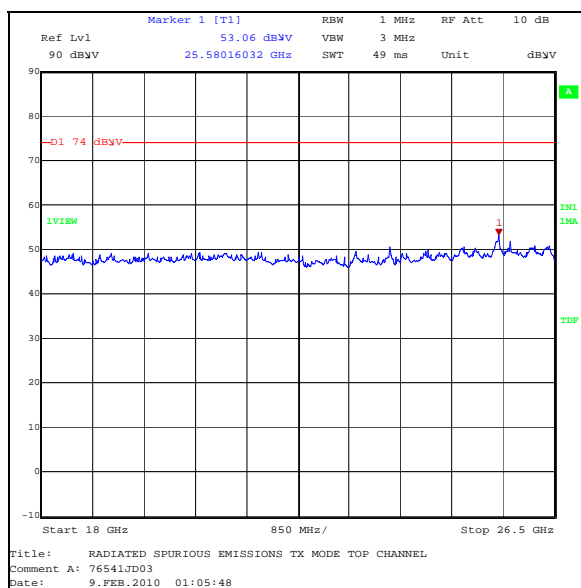
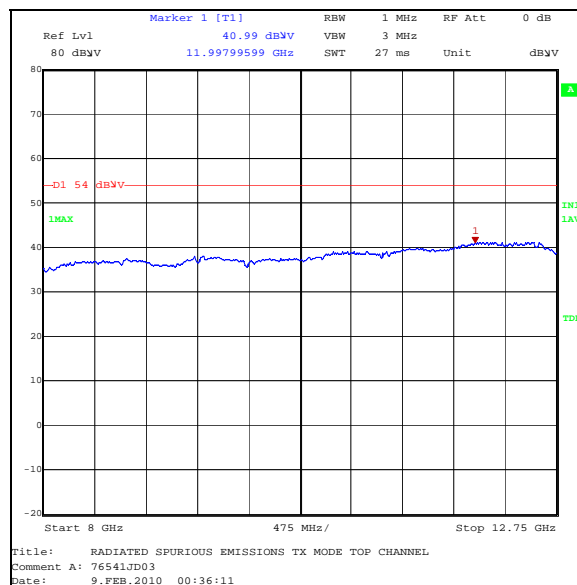
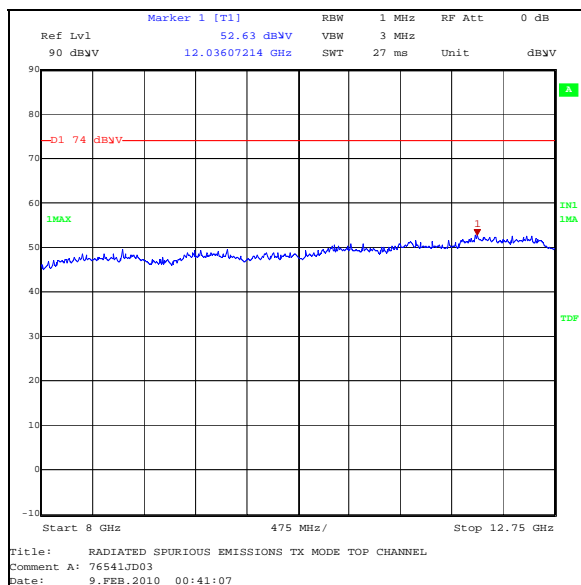
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4960.982	Horizontal	49.3	54.0	4.7	Complied

Note(s):

1. Measurements were made with the test system antenna in the vertical and horizontal planes. The highest levels were recorded in the above tables.
2. The emission shown at approximately 2480 MHz on the 1 GHz to 4 GHz pre-scan is the EUT carrier.
3. Final measurements were made using appropriate filters and attenuators where required.
4. The peak noise floor was recorded against average limits as this presented the worst case, where the peak noise floor exceeded the average limit peak and average scan were made in accordance with the standard and can be seen on the pre-scan plots.
5. As the emissions in the tables above were measured with a peak detector complied with the average limit, no average measurements were performed.

Transmitter Radiated Spurious Emissions (continued)

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

Transmitter Radiated Spurious Emissions (continued)

5.2.7. Transmitter Radiated Emissions at Band Edges**Test Summary:**

FCC Part:	15.249(d) & 15.209
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	22

Results: Bottom Band Edge - Peak

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400	57.9	74.0	16.1	Complied

Results: Bottom Band Edge - Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400	49.3	54.0	4.7	Complied

Results: Top Band Edge - Peak

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	58.3	74	15.7	Complied

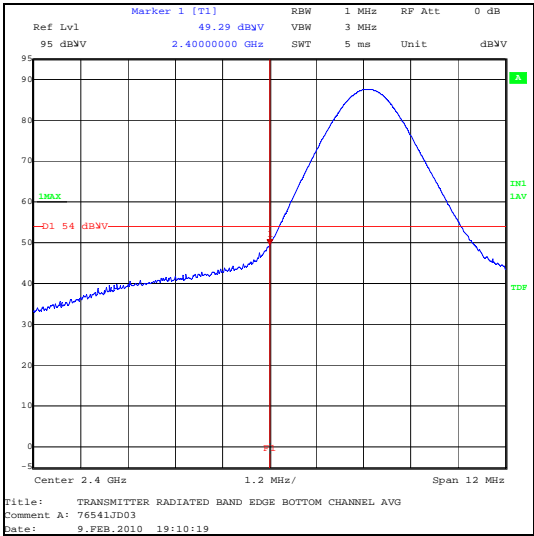
Results: Top Band Edge - Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	49.5	54	4.5	Complied

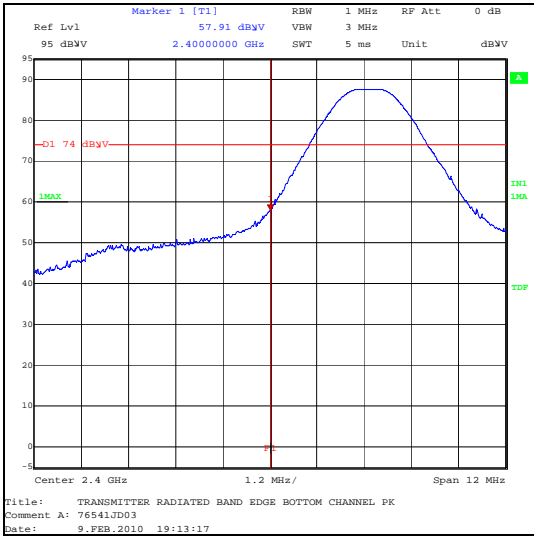
Note(s):

1. *-20dBc Limit.

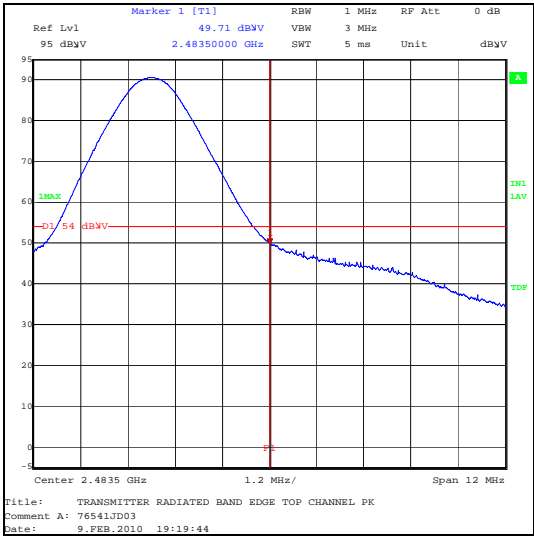
Transmitter Radiated Emissions at Band Edges (continued)



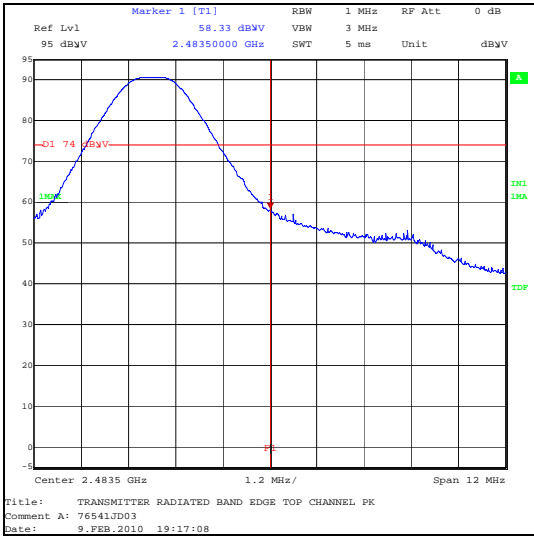
Average detector



Peak detector



Average detector



Peak detector

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	Confidence Level (%)	Calculated Uncertainty
20 dB Bandwidth	95%	±0.92 ppm
Radiated Spurious Emissions	95%	±3.53 dB
Radiated Spurious Emissions	95%	±4.64 dB
Transmitter Fundamental Field Strength	95%	±4.64 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.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A1534	Pre Amplifier	Hewlett Packard	8449B OPT H02	3008A00405	Calibrated before use	-
A1818	Antenna	EMCO	3115	00075692	27 Nov 2009	12
A1830	Pulse Limiter	Rhode & Schwarz	ESH3-Z2	100668	01 Mar 2010	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	Calibrated before use	-
A288	Antenna	Chase	CBL6111A	1589	13 Mar 2009	12
A436	Antenna	Flann	20240-20	330	24 Apr 2009	36
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Mar 2009	12
C363	Cable	Rosenberger	RG142	None	29 Mar 2009	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 Sep 2009	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	09 Mar 2009	12
M1244	GSM Test Set	HP	8922M	4012U04465	Calibration not required	-
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	22 Apr 2009	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	03 Aug 2006	12
M208	Thermometer /Hygrometer	RS Components	RS212-124	M208-RS212-124	30 Apr 2009	12

NB In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.