



# TEST REPORT

**Test Report No. : UL-RPT-RP10066997JD01A V2.0**

**Manufacturer** : Ubisense Ltd

**Model No.** : UBIMOD30

**FCC ID** : SEAMOD30

**Technology** : Ultra WideBand (UWB)

**Test Standard(s)** : FCC Part 15.250

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. 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:** 24 February 2014

**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  
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**

<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	8
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>9</b>
4.1. Operating Modes	9
4.2. Configuration and Peripherals	9
<b>5. Measurements, Examinations and Derived Results.....</b>	<b>10</b>
5.1. General Comments	10
5.2. Test Results	11
5.2.1. Transmitter AC Conducted Spurious Emissions	11
5.2.2. Transmitter -10 dB Bandwidth	14
5.2.3. Transmitter Frequency Stability (Temperature Variation)	16
5.2.4. Transmitter Frequency Stability (Voltage Variation)	17
5.2.5. Transmitter Radiated Emissions Below 960 MHz	18
5.2.6. Transmitter Radiated Emissions Above 960 MHz	20
5.2.7. Transmitter Emissions Peak Level	27
<b>6. Measurement Uncertainty .....</b>	<b>29</b>
<b>7. Report Revision History .....</b>	<b>30</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>	47CFR15.250
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.250
<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>	09 October 2013 to 20 February 2014

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.250(a) & (b)	Transmitter -10 dB Bandwidth	✓
15.250(a)	Transmitter Frequency Stability	✓
Parts 15.250(d)(4) & 15.209(a)	Transmitter Radiated Emissions Below 960 MHz	✓
Part 15.250(d)(1) & (2)	Transmitter Radiated Emissions Above 960 MHz	✓
Part 15.250(d)(3)	Transmitter Emission Peak Level	✓
<b>Key to Results</b>		
✓ = Complied	✗ = Did not comply	

### 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
<b>Hardware Version Number:</b>	1.0
<b>Firmware 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>	064 ( <i>Conducted sample with RF port</i> )
<b>Hardware Version Number:</b>	1.0
<b>Firmware 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>	064 ( <i>Conducted sample with RF port</i> )
<b>Hardware Version Number:</b>	1.0
<b>Firmware Version Number:</b>	1.1
<b>FCC ID:</b>	SEAMOD30

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

The Equipment Under Test was an UWB location-tracking tag containing an Ultra Wideband (UWB) transmitter operating in the 5925 MHz to 7250 MHz 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**

Ubisense changed the test sample #064 firmware version from 1.0 to 1.1 on 12 February 2014. This enables the unit to power on below -15°C. Ubisense confirmed that the change in firmware had no effect on any of the parameters that were previously tested.

**3.4. Additional Information Related to Testing**

<b>Tested Technology:</b>	Ultra Wide Band (UWB)	
<b>Power Supply Requirement:</b>	Nominal	3.0 VDC via 120 VAC 60 Hz
<b>Type of Unit:</b>	Transmitter	
<b>Type of Equipment:</b>	Module	
<b>Modulation:</b>	OOK of a 1 Mpps (pulse-per-second) pulse train	
<b>Duty Cycle:</b>	100%	
<b>Transmit Frequency Range:</b>	5925 to 7250 MHz	
<b>Transmit Channel Tested:</b>	<b>Channel ID</b>	<b>Channel Frequency (MHz)</b>
	Single channel device	6416 (approximately)

### **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

<b>Description</b>	Test Fixture
<b>Brand Name:</b>	Ubisense
<b>Cable Length and Type:</b>	INDTALL7021
<b>Connected to Port:</b>	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):

- Constantly transmitting at full power with an Ultra WideBand modulated pulse train.

### **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 in an Ultra WideBand test mode with a modulated pulse train.
- For testing purposes the EUT was powered by 3 VDC via a 120 VAC 60 Hz Stontronics supply. The Stontronics power supply was connected to the EUT via the multi pin connector.
- AC conducted emissions tests were performed with the Stontronics power supply input connected to a 120 VAC 60 Hz single phase supply via a LISN. The Stontronics power supply DC output was connected to the EUT via twin core cable and multi pin connector.
- Frequency stability measurements were performed using sample with serial number 064. This sample was connected to test fixture in order to vary the voltage. This was monitored by a calibrated digital voltmeter throughout the test.

## **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 Date:	16 October 2013
Test Sample Serial Number:	0001		

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

#### Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	48

#### Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.352500	Live	33.7	58.9	25.2	Complied
0.550500	Live	24.9	56.0	31.1	Complied
0.609000	Live	30.0	56.0	26.0	Complied
0.672000	Live	27.4	56.0	28.6	Complied
1.095000	Live	27.2	56.0	28.8	Complied
1.468500	Live	25.1	56.0	30.9	Complied

#### Results: Live / Average

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.352500	Live	21.5	48.9	27.4	Complied
0.352500	Live	21.7	48.9	27.2	Complied
0.609000	Live	19.4	46.0	26.6	Complied
0.672000	Live	15.0	46.0	31.0	Complied
0.730500	Live	14.2	46.0	31.8	Complied
1.099500	Live	14.5	46.0	31.5	Complied

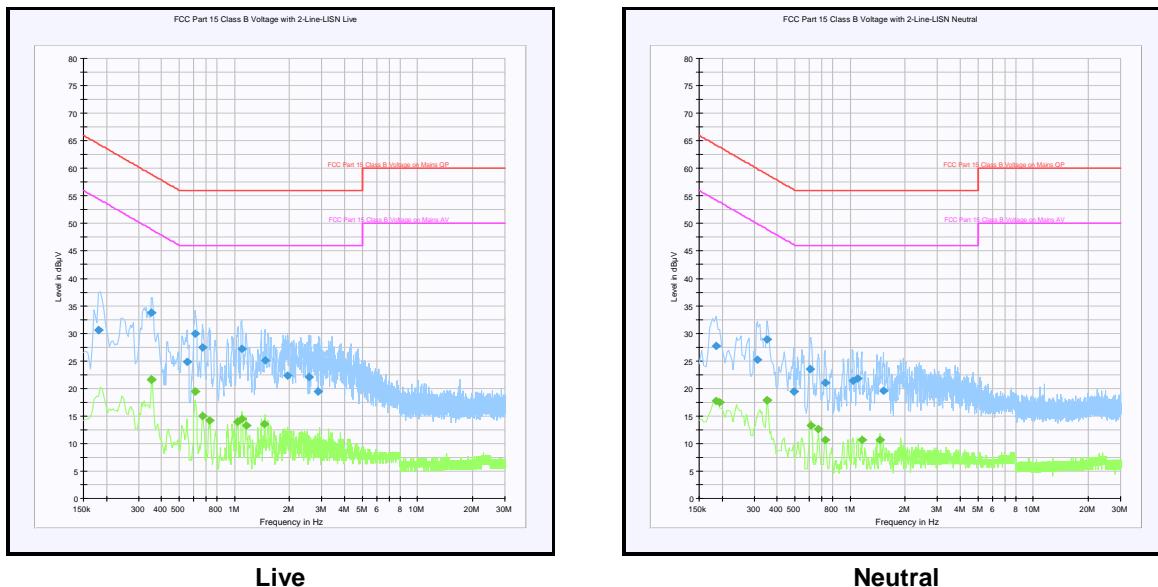
**Transmitter AC Conducted Spurious Emissions (continued)****Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.312000	Neutral	25.2	59.9	34.7	Complied
0.352500	Neutral	28.8	58.9	30.1	Complied
0.496500	Neutral	19.4	56.1	36.7	Complied
0.604500	Neutral	23.5	56.0	32.5	Complied
1.036500	Neutral	21.4	56.0	34.6	Complied
1.095000	Neutral	21.8	56.0	34.2	Complied

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.352500	Neutral	17.9	48.9	31.0	Complied
0.352500	Neutral	17.9	48.9	31.0	Complied
0.609000	Neutral	13.2	46.0	32.8	Complied
0.672000	Neutral	12.6	46.0	33.4	Complied
0.735000	Neutral	10.6	46.0	35.4	Complied
1.158000	Neutral	10.6	46.0	35.4	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 Handelpunkt	30.5015.13	None stated	09 Jan 2014	12

### **5.2.2. Transmitter -10 dB Bandwidth**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	09 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Part 15.250(a) & (b)
<b>Test Method Used:</b>	Part 15.250(e)(4)

#### **Environmental Conditions:**

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

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

1. The -10 dB bandwidth was measured using a peak detector in a 1 MHz resolution bandwidth and a video bandwidth greater than or equal to the resolution bandwidth. Markers were placed on the lower and upper -10 dB points and the frequencies recorded.

#### **Results: 15.250(a)**

<b>Lower -10 dB Frequency (MHz)</b>	<b>Upper -10 dB Frequency (MHz)</b>	<b>Lower Limit (MHz)</b>	<b>Upper Limit (MHz)</b>	<b>Result</b>
6223.981	6963.164	5925	7250	Complied

#### **Results: 15.250(b)**

<b>-10 dB Bandwidth (MHz)</b>	<b>Limit (MHz)</b>	<b>Margin (dB)</b>	<b>Result</b>
739.183	>50	689.183	Complied



**Transmitter -10 dB Bandwidth (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12

**5.2.3. Transmitter Frequency Stability (Temperature Variation)****Test Summary:**

Test Engineer:	Andrew Edwards	Test Dates:	19 February 2014 & 20 February 2014
Test Sample Serial Number:	064		

FCC Reference:	Part 15.250(a)
Test Method Used:	Parts 15.250(e)(4) and Notes below

**Environmental Conditions:**

Ambient Temperature (°C):	22 to 25
Ambient Relative Humidity (%):	36 to 40

**Note(s):**

1. The -10 dB bandwidth was measured using a peak detector in a 1 MHz resolution bandwidth and a video bandwidth greater than or equal to the resolution bandwidth. -10 dB points were measured at the manufacturer's stated minimum and maximum temperatures of -40°C and +85°C. Markers were placed on the lower and upper -10 dB points and the results recorded in the table below.
2. A sufficient stabilisation period was allowed at each temperature level and temperature was monitored throughout the test with a calibrated digital thermometer.
3. 3 VDC was the nominal voltage used throughout the test.
4. Result plots are archived on the UL VS LTD IT server and available for inspection if required.

**Results:**

Temperature	Lower -10 dB Frequency (MHz)	Upper -10 dB Frequency (MHz)	Lower Limit (MHz)	Upper Limit (MHz)	Result
-40°C	6227.956	6986.974	5925	7250	Complied
20°C	6207.916	6959.419	5925	7250	Complied
85°C	6195.391	6919.339	5925	7250	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
E0513	Environmental Chamber	TAS	LT600 Series 3	23900506	Calibrated before use	-
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
M1249	Thermometer	Fluke	52II	88800049	24 May 2014	12
M1251	Digital Multimeter	Fluke	175	89170179	31 July 2014	12
M1659	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12
S0557	DC Power Supply	TTI	EL303R	395819	Calibrated before use	-

**5.2.4. Transmitter Frequency Stability (Voltage Variation)****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	19 February 2014
Test Sample Serial Number:	064		

FCC Reference:	Part 15.250(a)
Test Method Used:	Parts 15.250(e)(4) and Notes below

**Environmental Conditions:**

Temperature (°C):	23
Relative Humidity (%):	38

**Note(s):**

1. The -10 dB bandwidth was measured using a peak detector in a 1 MHz resolution bandwidth and a video bandwidth greater than or equal to the resolution bandwidth. -10 dB points were measured at the manufacturer's stated minimum, nominal and maximum voltages. Markers were placed on the lower and upper -10 dB points and the results recorded in the table below.
2. Voltage was monitored throughout the test with a calibrated digital voltmeter.
3. Result plots are archived on the UL VS LTD IT server and available for inspection if required.

**Results:**

Voltage (DC)	Lower -10 dB Frequency (MHz)	Upper -10 dB Frequency (MHz)	Lower Limit (MHz)	Upper Limit (MHz)	Result
2.3	6195.391	6959.419	5925	7250	Complied
3.0	6207.916	6959.419	5925	7250	Complied
5.25	6207.916	6959.419	5925	7250	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
E0513	Environmental Chamber	TAS	LT600 Series 3	23900506	Calibrated before use	-
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
M1249	Thermometer	Fluke	52II	88800049	24 May 2014	12
M1251	Digital Multimeter	Fluke	175	89170179	31 July 2014	12
M1659	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12
S0557	DC Power Supply	TTI	EL303R	395819	Calibrated before use	-

**5.2.5. Transmitter Radiated Emissions Below 960 MHz****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	16 October 2013
Test Sample Serial Number:	0001		

FCC Reference:	Parts 15.250(d)(4) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	30 MHz to 1000 MHz

**Environmental Conditions:**

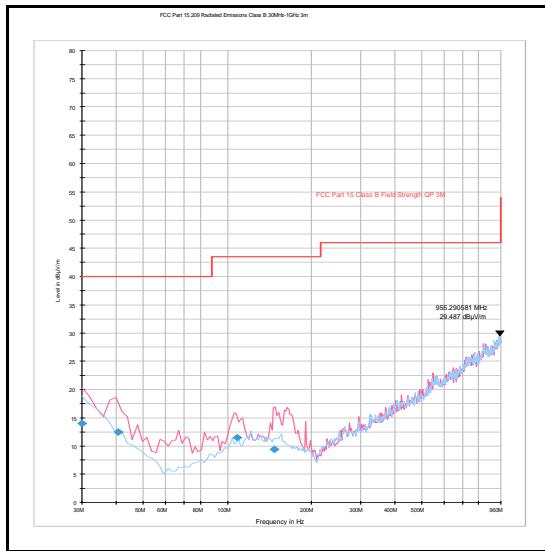
Temperature (°C):	23
Relative Humidity (%):	38

**Note(s):**

1. Any emissions were below the level of the measurement system noise floor. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
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: Quasi-Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
955.291	Vertical	29.5	46.0	16.5	Complied

**Transmitter Radiated Emissions (continued)****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 Handelpunkt	30.5015.13	Not stated	24 May 2014	12

**5.2.6. Transmitter Radiated Emissions Above 960 MHz****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	09 October 2013 & 10 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Parts 15.250(d)(1)(2)
<b>Test Method Used:</b>	Part 15.250(d)(1), 15.250(d)(2), 15.250(e)(1), ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
<b>Frequency Range</b>	960 MHz to 40 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	42 to 52

**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 emission shown on the 6 GHz to 7.25 GHz plot is the EUT fundamental at approximately 6416 MHz.
3. Where no emissions were observed across the required frequency ranges, the highest noise floor level of the measurement system was recorded and compared to the applicable limit.
4. At certain frequency ranges it was not possible to perform the measurements at the required distance due to the level of the measurement system noise floor compared with the limit. Therefore the test distance was reduced and a correction offset was applied to the measurements.
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.

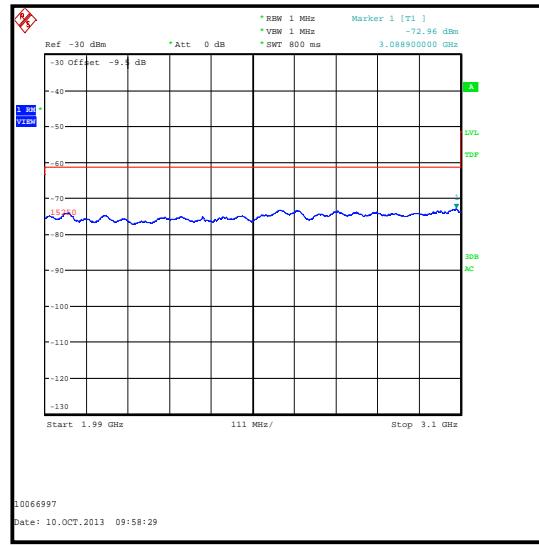
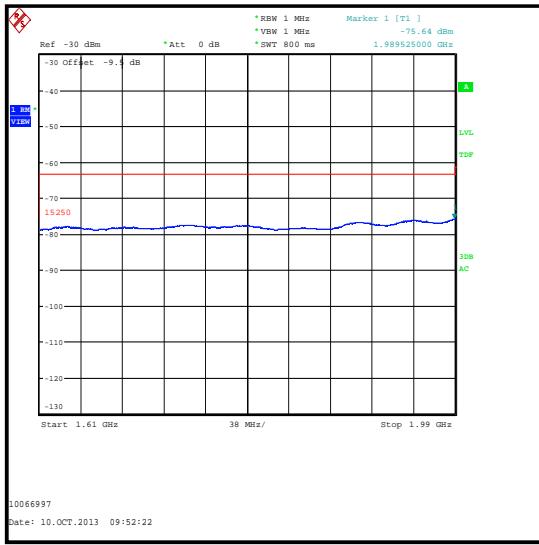
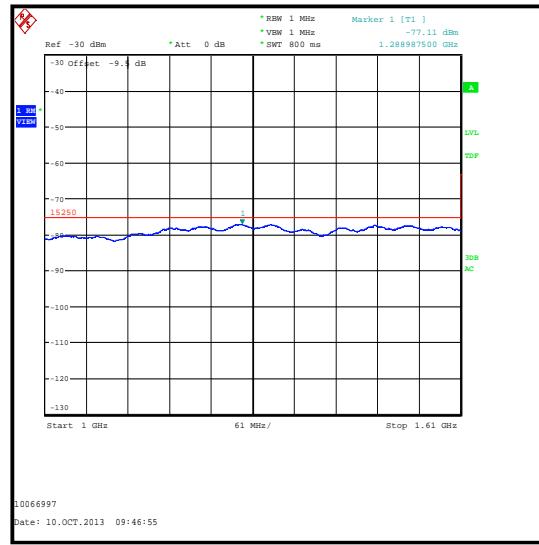
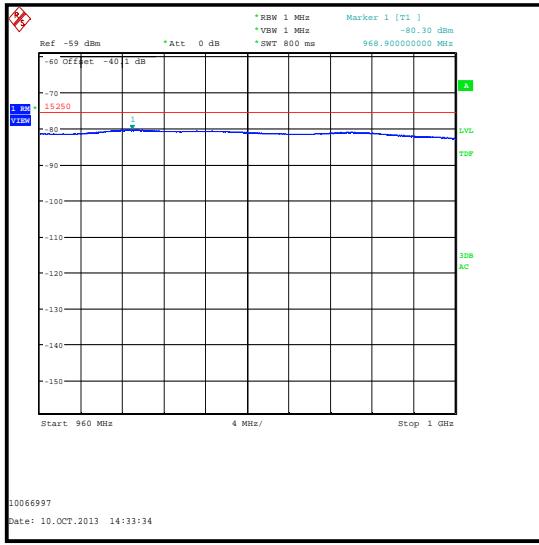
**Transmitter Radiated Emissions (continued)****Results: Part 15.250(d)(1)**

Frequency (MHz)	Antenna Polarity	RMS Level (dBm)	Limit (dBm)	Margin (dB)	Result
968.900	Vertical	-80.3	-75.3	4.7	Complied
1288.988	Vertical	-77.1	-75.3	1.8	Complied
1989.525	Vertical	-75.6	-63.3	12.3	Complied
3088.900	Vertical	-73.0	-61.3	11.7	Complied
3808.750	Vertical	-71.3	-51.3	20.0	Complied
5919.799	Vertical	-74.5	-51.3	23.2	Complied
5974.286	Vertical	-73.9	-41.3	32.6	Complied
6416.000	Vertical	-42.1	-41.3	0.8	Complied
7262.857	Vertical	-68.4	-51.3	17.1	Complied
10353.468	Vertical	-65.8	-51.3	14.5	Complied
12614.286	Vertical	-63.8	-61.3	2.5	Complied
12789.375	Vertical	-69.6	-61.3	8.3	Complied
20167.500	Vertical	-65.1	-61.3	3.8	Complied
40000.000	Vertical	-65.1	-61.3	3.8	Complied

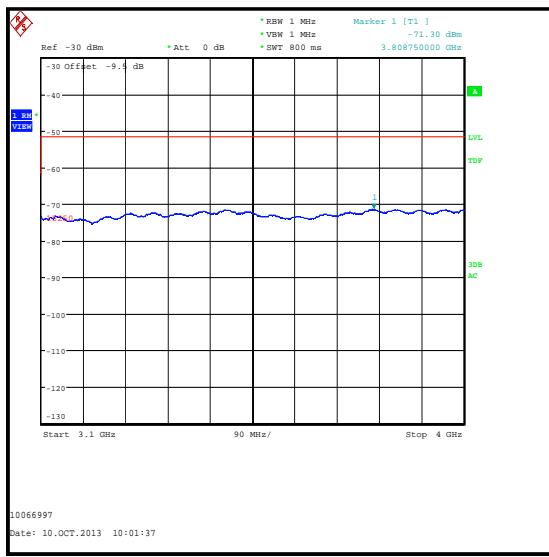
**Results: Part 15.250(d)(2)**

Frequency (MHz)	Antenna Polarity	RMS Level (dBm)	Limit (dBm)	Margin (dB)	Result
1237.150	Vertical	-92.6	-85.3	7.3	Complied
1583.161	Vertical	-92.3	-85.3	7.0	Complied

## Transmitter Radiated Emissions (continued)

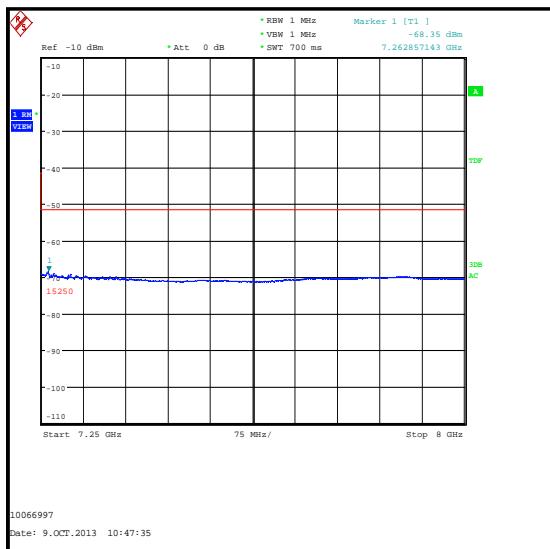


## Transmitter Radiated Emissions (continued)

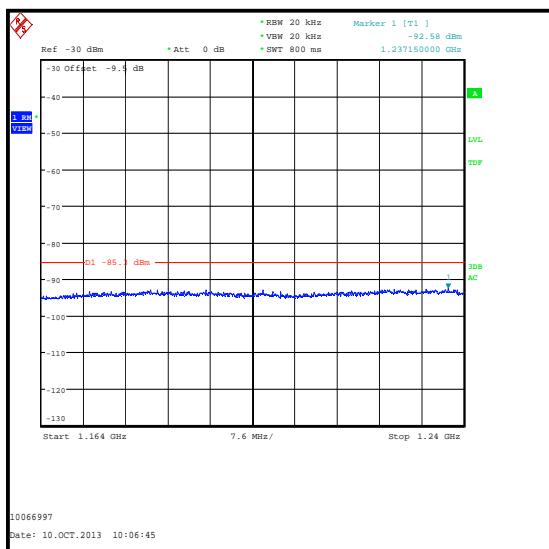


Zoom in on region of highest signal

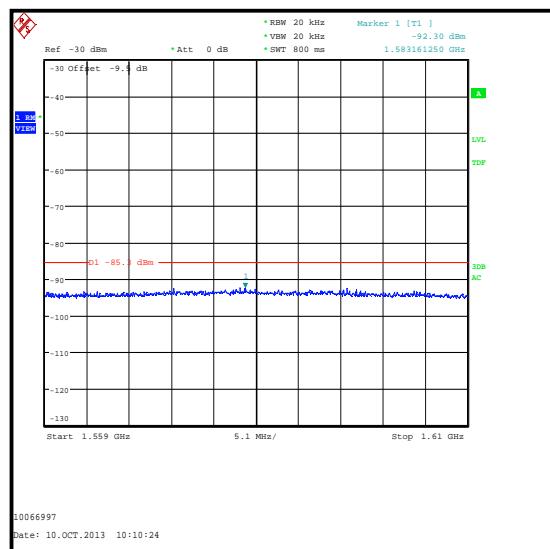
## Transmitter Radiated Emissions (continued)



## Transmitter Radiated Emissions (continued)



**1164-1240 MHz**  
**-85.3 dBm limit / 20 kHz resolution bandwidth**



**1559-1610 MHz**  
**-85.3 dBm limit / 20 kHz resolution bandwidth**

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

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
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
G0543	Pre-Amplifier	Sonoma	310N	230801	08 Jan 2014	3
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12
A203	Antenna	Flann Microwave	22240-20	343	19 May 2016	12
A1785	Pre-amplifier	Farran Technology	FLNA-28-30	FTL 6483	11 Jun 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12
M1229	Digital Multimeter	Fluke	179	87640015	26 Jun 2014	12
S0537	DC Power Supply Unit	TTI	EL302D	249928	Calibrated before use	-

### **5.2.7. Transmitter Emissions Peak Level**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	09 October 2013
<b>Test Sample Serial Number:</b>	0001		

<b>FCC Reference:</b>	Part 15.259(d)(3)
<b>Test Method Used:</b>	Part 15.250(d)(3) & 15.250(e)

#### **Environmental Conditions:**

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

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

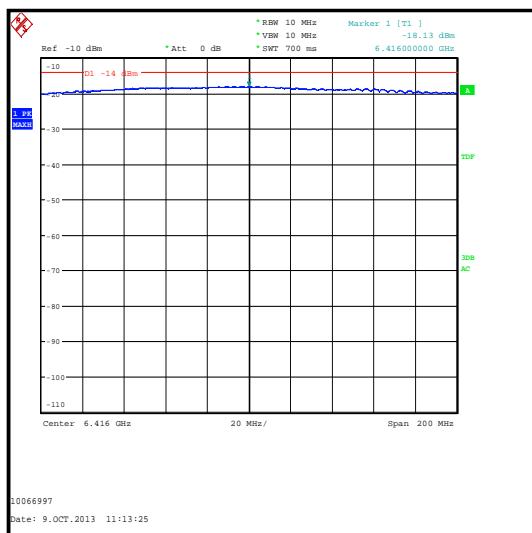
1. The test receiver was set to the maximum available resolution and video bandwidths of 10 MHz. The measurement span was set to 200 MHz and a sweep time of 700 ms with 701 sweep points were used. The test receiver was set to the centre frequency of the peak signal. A peak detector and max hold function were used.
2. The measurement was performed using a 10 MHz RBW and in accordance with Part 15.250(d)(3) the limit has been calculated as:

$$20 \log (RBW/50) \text{ dBm}$$

$$20 \log (10/50) = -14.0 \text{ dBm}/10 \text{ MHz}$$

#### **Results:**

Frequency FM (MHz)	Antenna Polarity	Level (dBm/10 MHz)	Limit (dBm/10 MHz)	Margin (dB)	Result
6416.000	Vertical	-18.1	-14.0	4.1	Complied



**Transmitter Emissions Peak Level (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12
M1656	Thermohygrometer	JM Handelpunkt	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
Transmitter -10 dB Bandwidth	5.925 GHz to 7.250 GHz	95%	±3.92 %
Frequency Stability	5.925 GHz to 7.250 GHz	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±2.94 dB
Transmitter Emissions Peak Level	5.925 GHz to 7.250 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	16 & 17	-	Added frequency stability test results and additional note relating to the test setup used.
	29		Inserted measurement uncertainty for frequency stability test.
	6		Added new sample with modified firmware information into Section 3.1 and modification details into Section 3.3

--- END OF REPORT ---