



# TEST REPORT

**Test Report No. : UL-RPT-RP91476JD20A V3.0**

**Manufacturer** : BENTLEY MOTORS LIMITED  
**Model No.** : D189050  
**FCC ID** : 2AAKLD189050  
**IC Certification No.** : 11196A-D189050  
**Technology** : Proprietary (Wireless Audio Systems)  
**Test Standard(s)** : FCC Parts 15.207, 15.209(a) & 15.247,  
Industry Canada RSS-210 A8.2(a), A8.2(b), A8.4(4) & A8.5 and  
RSS-Gen 4.6.1, 4.6.2, 4.8 & 4.9

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 3.0 supersedes all previous versions.

**Date of Issue:** 01 April 2014

**Checked by:**   
Sarah Williams  
Engineer, Radio Performance

**Issued by :**   
pp  
John Newell  
Group Quality Manager,  
Basingstoke,  
UL VS LTD



This laboratory is accredited by UKAS.  
The tests reported herein have been  
performed in accordance with its' terms  
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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**1. Customer Information**

|                      |                                                    |
|----------------------|----------------------------------------------------|
| <b>Company Name:</b> | BENTLEY MOTORS LIMITED                             |
| <b>Address:</b>      | Pyms Lane<br>Cheshire<br>CW1 3PL<br>United Kingdom |

## **2. Summary of Testing**

### **2.1. General Information**

|                                 |                                                                                                                                |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Specification Reference:</b> | 47CFR15.247                                                                                                                    |
| <b>Specification Title:</b>     | Code of Federal Regulations Volume 47 (Telecommunications) 2012:<br>Part 15 Subpart C (Intentional Radiators) - Section 15.247 |
| <b>Specification Reference:</b> | 47CFR15.209                                                                                                                    |
| <b>Specification Title:</b>     | Code of Federal Regulations Volume 47 (Telecommunications) 2012:<br>Part 15 Subpart C (Intentional Radiators) - Section 15.209 |
| <b>Specification Reference:</b> | RSS-GEN Issue 3 December 2010                                                                                                  |
| <b>Specification Title:</b>     | General Requirements and Information for the Certification of Radio Apparatus                                                  |
| <b>Specification Reference:</b> | RSS-210 Issue 8 December 2010                                                                                                  |
| <b>Specification Title:</b>     | Licence-exempt Radio Apparatus (All Frequency Bands):<br>Category I Equipment.                                                 |
| <b>Site Registration:</b>       | FCC: 209735; Industry Canada: 3245B-2                                                                                          |
| <b>Location of Testing:</b>     | UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park,<br>Basingstoke, Hampshire, RG24 8AH, United Kingdom             |
| <b>Test Dates:</b>              | 15 May 2013 to 22 May 2013                                                                                                     |

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

| <b>FCC Reference<br/>(47CFR)</b>                                                                                                                                                                                             | <b>IC Reference</b>                | <b>Measurement</b>                       | <b>Result</b>                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------|
| Part 15.247(a)(2)                                                                                                                                                                                                            | RSS-Gen 4.6.2 /<br>RSS-210 A8.2(a) | Transmitter Minimum 6 dB Bandwidth       |  |
| N/A                                                                                                                                                                                                                          | RSS-Gen 4.6.1                      | Transmitter 99% Occupied Bandwidth       |  |
| Part 15.247(e)                                                                                                                                                                                                               | RSS-210 A8.2(b)                    | Transmitter Power Spectral Density       |  |
| Part 15.247(b)(3)                                                                                                                                                                                                            | RSS-Gen 4.8 /<br>RSS-210 A8.4(4)   | Transmitter Maximum Peak Output Power    |  |
| Part 15.247(d)/<br>15.209(a)                                                                                                                                                                                                 | RSS-Gen 4.9 /<br>RSS-210 A8.5      | Transmitter Radiated Emissions           |  |
| Part 15.247(d)/<br>15.209(a)                                                                                                                                                                                                 | RSS-Gen 4.9 /<br>RSS-210 A8.5      | Transmitter Band Edge Radiated Emissions |  |
| <b>Key to Results</b><br> = 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                                                                                                  |
| <b>Reference:</b> | KDB 558074 D01 v03r01 April 9, 2013                                                                                                                                 |
| <b>Title:</b>     | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247                                                        |

**2.4. Deviations from the Test Specification**

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

### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

|                                       |                                                  |
|---------------------------------------|--------------------------------------------------|
| Brand Name:                           | BENTLEY MOTORS LIMITED                           |
| Model Name or Number:                 | D189050                                          |
| Test Sample Serial Number:            | 621D1890501312AN50427 ( <i>Radiated sample</i> ) |
| Hardware Version Number:              | H10                                              |
| Software Version Number:              | 34                                               |
| FCC ID:                               | 2AAKLD189050                                     |
| Industry Canada Certification Number: | 11196A-D189050                                   |

|                                       |                                                                |
|---------------------------------------|----------------------------------------------------------------|
| Brand Name:                           | BENTLEY MOTORS LIMITED                                         |
| Model Name or Number:                 | D189050                                                        |
| Test Sample Serial Number:            | 621D1890501312AN50429 ( <i>Conducted sample with RF port</i> ) |
| Hardware Version Number:              | H10                                                            |
| Software Version Number:              | 34                                                             |
| FCC ID:                               | 2AAKLD189050                                                   |
| Industry Canada Certification Number: | 11196A-D189050                                                 |

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

The equipment under test was a Loader (D189050) that forms part of a Rear Seat Entertainment System. The Texas chip set is a combination of 2 TI chips: CC8530 plus CC2590 that make a proprietary 2.4 GHz system. The Loader transmits the digital audio signal to the wireless headphones.

#### **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:              | Proprietary (Digital Transmission System) |                |                         |
| Type of Unit:                   | Transceiver                               |                |                         |
| Channel Spacing:                | 4 MHz                                     |                |                         |
| Modulation:                     | FSK                                       |                |                         |
| Data Rate:                      | 5 Mbps                                    |                |                         |
| Power Supply Requirement(s):    | Nominal                                   | 12.0 VDC       |                         |
| Maximum Conducted Output Power: | 10.8 dBm                                  |                |                         |
| Antenna Gain:                   | 3.3 dBi                                   |                |                         |
| Transmit Frequency Range:       | 2406 MHz to 2474 MHz                      |                |                         |
| Transmit Channels Tested:       | Channel ID                                | Channel Number | Channel Frequency (MHz) |
|                                 | Bottom                                    | 1              | 2406                    |
|                                 | Middle                                    | 9              | 2438                    |
|                                 | Top                                       | 18             | 2474                    |

**3.5. Support Equipment**

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

|                                 |                        |
|---------------------------------|------------------------|
| <b>Brand Name:</b>              | BENTLEY MOTORS LIMITED |
| <b>Model Name or Number:</b>    | D189070                |
| <b>Description:</b>             | Body Connectivity Unit |
| <b>Serial Number:</b>           | 621D1890701306AH00141  |
| <b>Hardware Version Number:</b> | H08                    |
| <b>Software Version Number:</b> | 34                     |

|                                 |                        |
|---------------------------------|------------------------|
| <b>Brand Name:</b>              | BENTLEY MOTORS LIMITED |
| <b>Model Name or Number:</b>    | LCD screen             |
| <b>Serial Number:</b>           | 621D1890901303OS10227  |
| <b>Hardware Version Number:</b> | H07                    |
| <b>Software Version Number:</b> | 0007                   |

**Support Equipment (continued)**

|                              |                      |
|------------------------------|----------------------|
| <b>Description:</b>          | Car battery          |
| <b>Brand Name:</b>           | Optima batteries     |
| <b>Model Name or Number:</b> | 8012-254             |
| <b>Serial Number:</b>        | Not marked or stated |

|                              |                      |
|------------------------------|----------------------|
| <b>Description:</b>          | Power Harnessing     |
| <b>Brand Name:</b>           | Bentley              |
| <b>Model Name or Number:</b> | Not marked or stated |

|                              |           |
|------------------------------|-----------|
| <b>Description:</b>          | Laptop PC |
| <b>Brand Name:</b>           | Dell      |
| <b>Model Name or Number:</b> | D610      |
| <b>Serial Number:</b>        | 0062      |

|                              |                        |
|------------------------------|------------------------|
| <b>Description:</b>          | Male to male USB cable |
| <b>Brand Name:</b>           | Not marked or stated   |
| <b>Model Name or Number:</b> | Not marked or stated   |

|                              |                      |
|------------------------------|----------------------|
| <b>Description:</b>          | Cabling              |
| <b>Brand Name:</b>           | Not marked or stated |
| <b>Model Name or Number:</b> | Not marked or stated |

|                              |                      |
|------------------------------|----------------------|
| <b>Description:</b>          | HDMI cable           |
| <b>Brand Name:</b>           | Generic              |
| <b>Model Name or Number:</b> | Not marked or stated |
| <b>Serial Number:</b>        | Not marked or stated |

|                              |                                      |
|------------------------------|--------------------------------------|
| <b>Description:</b>          | High Definition Multimedia Interface |
| <b>Brand Name:</b>           | SUMVISION                            |
| <b>Model Name or Number:</b> | Cyclone Micro                        |
| <b>Serial Number:</b>        | SUM091104017                         |

|                              |                      |
|------------------------------|----------------------|
| <b>Description:</b>          | SD card              |
| <b>Brand Name:</b>           | Generic              |
| <b>Model Name or Number:</b> | Not marked or stated |
| <b>Serial Number:</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):

- Transmitting at maximum power in test mode with modulation, maximum possible data length available, with a payload set to set Pseudorandom Bit Sequence 9.

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

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

- Controlled using a software application on the laptop PC supplied by the customer. The application was used to enable continuous transmission and to select the test channels as required.
- The EUT was powered by the BCU which was connected to a car battery.
- For radiated measurements the EUT was powered via the Body Connectivity Unit which was connected to a car battery.
- For conducted measurements the EUT was powered via the Body Connectivity Unit which was connected to a bench DC power supply.
- The EUT conducted sample with serial number: 621D1890501312AN50429 was used for 6 dB bandwidth, 99% emission bandwidth, power spectral density and maximum peak output power.
- The EUT radiated sample with serial number: 621D1890501312AN50427 was used for radiated spurious emissions tests.
- For transmitter radiated emissions all active ports were terminated.

## **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 Minimum 6 dB Bandwidth**

#### **Test Summary:**

|                                   |                       |                   |             |
|-----------------------------------|-----------------------|-------------------|-------------|
| <b>Test Engineer:</b>             | Andrew Edwards        | <b>Test Date:</b> | 15 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50429 |                   |             |

|                                   |                                           |
|-----------------------------------|-------------------------------------------|
| <b>FCC Reference:</b>             | Part 15.247(a)(2)                         |
| <b>Industry Canada Reference:</b> | RSS-Gen 4.6.2 / RSS-210 A8.2(a)           |
| <b>Test Method Used:</b>          | As detailed in FCC KDB 558074 Section 8.1 |

#### **Environmental Conditions:**

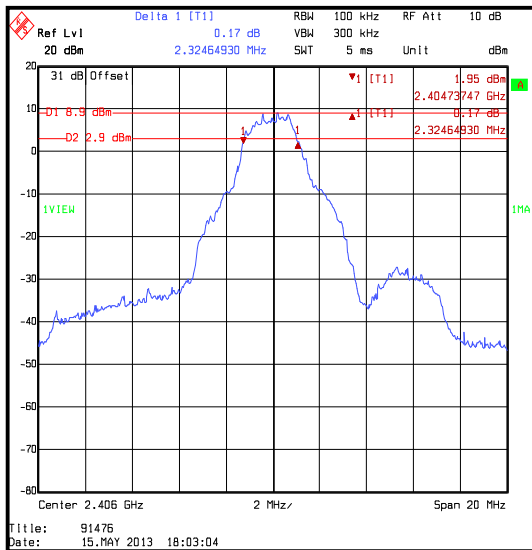
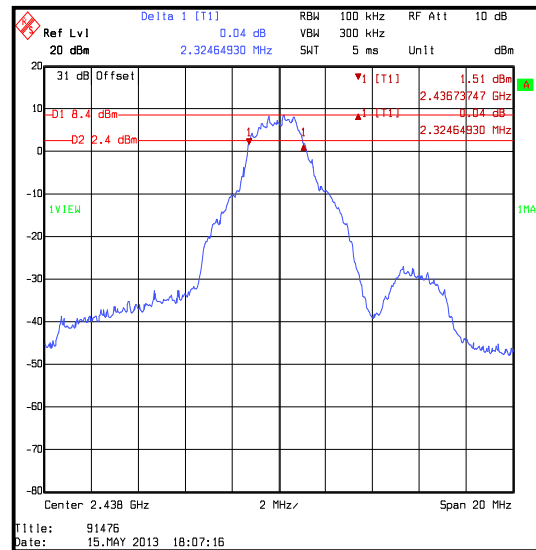
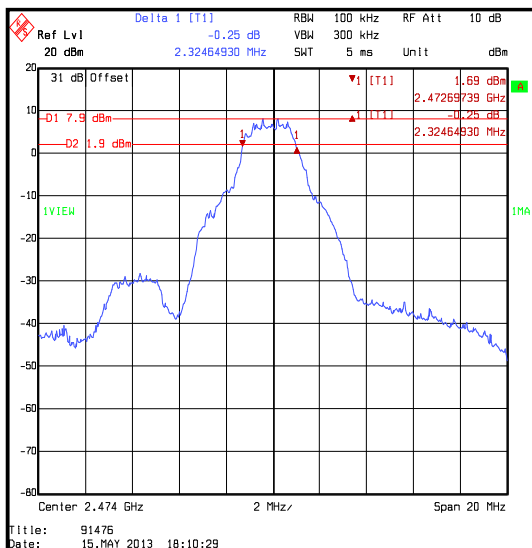
|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 23 |
| <b>Relative Humidity (%):</b> | 34 |

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

1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.1 option 1.
2. The spectrum analyser 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 Max Hold. The span was set to 20 MHz. Normal and delta markers were placed 6 dB down from the peak of the carrier. These results are documented in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

**Transmitter Minimum 6 dB Bandwidth (continued)****Results:**

| Channel | 6 dB Bandwidth (kHz) | Limit (kHz) | Margin (kHz) | Result   |
|---------|----------------------|-------------|--------------|----------|
| Bottom  | 2324.649             | ≥500        | 1824.649     | Complied |
| Middle  | 2324.649             | ≥500        | 1824.649     | Complied |
| Top     | 2324.649             | ≥500        | 1824.649     | 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) |
|-----------|--------------------------------|-----------------|------------|-------------|-----------------------|------------------------|
| A2142     | Attenuator                     | Atlan TecRF     | AN18-20    | 081120-23   | 10 May 2014           | 12                     |
| M127      | Spectrum Analyser              | Rohde & Schwarz | FSEB 30    | 842 659/016 | 13 Aug 2013           | 12                     |
| M1229     | Digital Multimeter             | Fluke           | 179        | 87640015    | 18 Jun 2013           | 12                     |
| M1658     | Thermometer Hygrometer Station | JM Handelspunkt | 30.5015.13 | Not stated  | 10 Jun 2013           | 12                     |
| S0537     | DC Power Supply Unit           | TTI             | EL302D     | 249928      | Calibrated before use | -                      |

**5.2.2. Transmitter 99% Occupied Bandwidth****Test Summary:**

|                                   |                       |                   |             |
|-----------------------------------|-----------------------|-------------------|-------------|
| <b>Test Engineer:</b>             | Andrew Edwards        | <b>Test Date:</b> | 15 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50429 |                   |             |

|                                   |                                               |
|-----------------------------------|-----------------------------------------------|
| <b>FCC Reference:</b>             | N/A                                           |
| <b>Industry Canada Reference:</b> | RSS-Gen 4.6.1                                 |
| <b>Test Method Used:</b>          | Spectrum Analyser Occupied Bandwidth function |

**Environmental Conditions:**

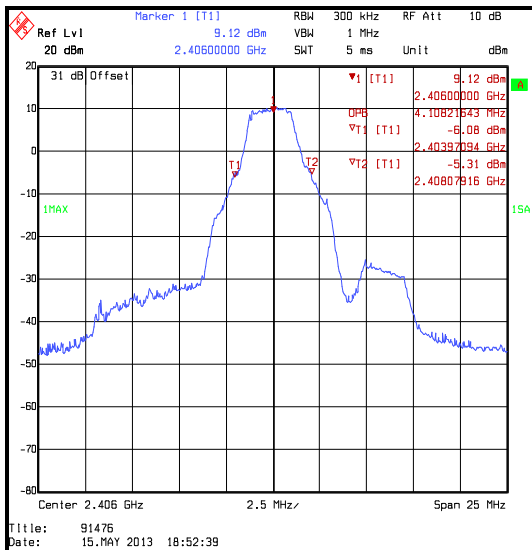
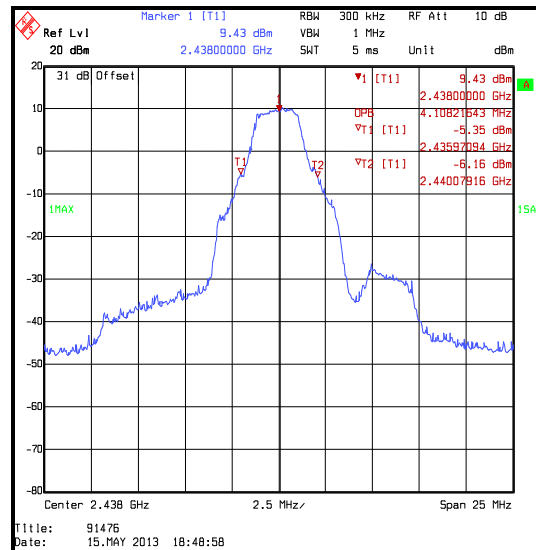
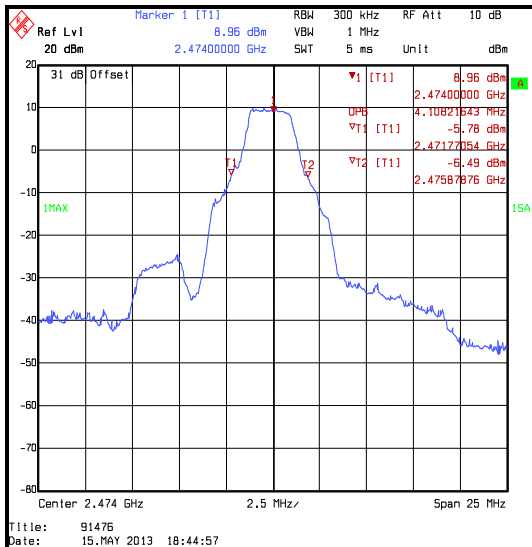
|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 24 |
| <b>Relative Humidity (%):</b> | 31 |

**Note(s):**

1. Occupied bandwidth (99% bandwidth) was measured using a spectrum analyser occupied bandwidth function. The span was wide enough to cover all possible emission skirts. The resolution bandwidth was set to 1% of the span and the video bandwidth set to 3 time the resolution bandwidth.
2. The spectrum analyser resolution bandwidth was set to 300 kHz and video bandwidth 1 MHz. A sample detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 20 MHz. The analyser function set the measurements to be made at 99% of the emission bandwidth. The results are given in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

**Transmitter 99% Occupied Bandwidth (continued)****Results:**

| Channel | 99% Occupied Bandwidth (MHz) |
|---------|------------------------------|
| Bottom  | 4.108                        |
| Middle  | 4.108                        |
| Top     | 4.108                        |

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

**Transmitter 99% Occupied Bandwidth (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> |
|------------------|--------------------------------|---------------------|-----------------|-------------------|-----------------------------|-------------------------------|
| A2142            | Attenuator                     | Atlan TecRF         | AN18-20         | 081120-23         | 10 May 2014                 | 12                            |
| M127             | Spectrum Analyser              | Rohde & Schwarz     | FSEB 30         | 842 659/016       | 13 Aug 2013                 | 12                            |
| M1229            | Digital Multimeter             | Fluke               | 179             | 87640015          | 18 Jun 2013                 | 12                            |
| M1658            | Thermometer Hygrometer Station | JM Handelspunkt     | 30.5015.13      | Not stated        | 10 Jun 2013                 | 12                            |
| S0537            | DC Power Supply Unit           | TTI                 | EL302D          | 249928            | Calibrated before use       | -                             |

**5.2.3. Transmitter Power Spectral Density****Test Summary:**

|                                   |                       |                   |             |
|-----------------------------------|-----------------------|-------------------|-------------|
| <b>Test Engineer:</b>             | Andrew Edwards        | <b>Test Date:</b> | 15 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50429 |                   |             |

|                                   |                                            |
|-----------------------------------|--------------------------------------------|
| <b>FCC Reference:</b>             | Part 15.247(e)                             |
| <b>Industry Canada Reference:</b> | RSS-210 A8.2(b)                            |
| <b>Test Method Used:</b>          | As detailed in FCC KDB 558074 Section 10.2 |

**Environmental Conditions:**

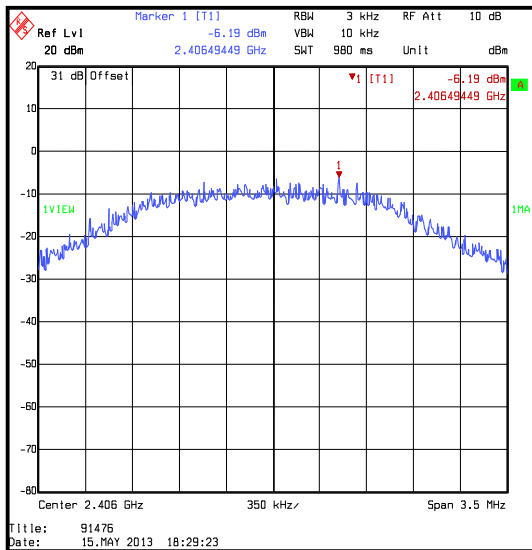
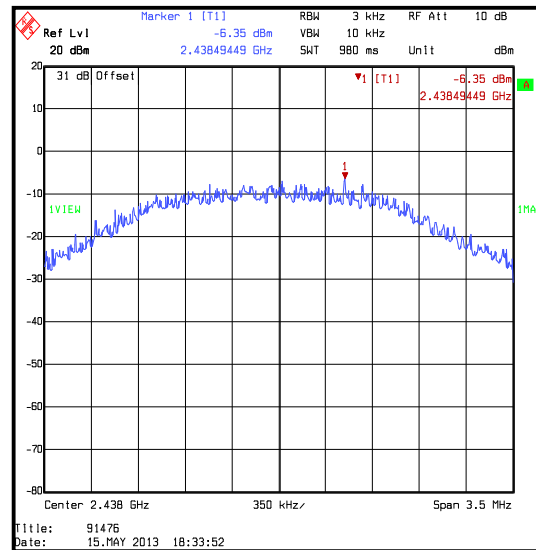
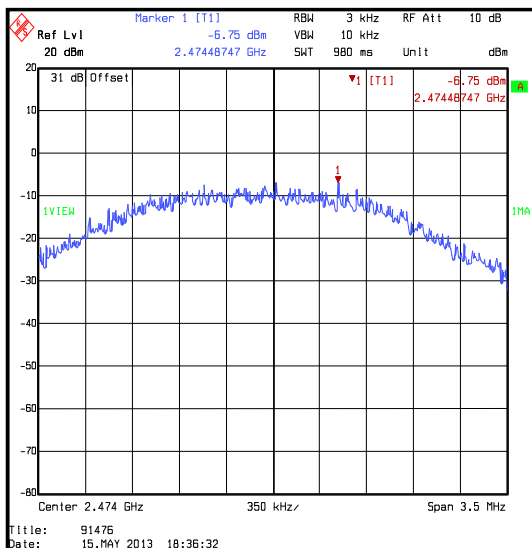
|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 24 |
| <b>Relative Humidity (%):</b> | 32 |

**Note(s):**

1. Transmitter Power Spectral Density tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 10.2 measurement method PKPSD.
2. The spectrum analyser 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 spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

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

| Channel | Output Power<br>(dBm / 3 kHz) | Limit<br>(dBm / 3 kHz) | Margin<br>(dB) | Result   |
|---------|-------------------------------|------------------------|----------------|----------|
| Bottom  | -6.2                          | 8.0                    | 14.2           | Complied |
| Middle  | -6.4                          | 8.0                    | 14.4           | Complied |
| Top     | -6.8                          | 8.0                    | 14.8           | 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) |
|-----------|--------------------------------|-----------------|------------|-------------|-----------------------|------------------------|
| A2072     | Directional Coupler            | Narda           | 4242B      | 03549       | Calibrated before use | -                      |
| A2142     | Attenuator                     | Atlan TecRF     | AN18-20    | 081120-23   | 10 May 2014           | 12                     |
| M127      | Spectrum Analyser              | Rohde & Schwarz | FSEB 30    | 842 659/016 | 13 Aug 2013           | 12                     |
| M1021     | Signal Generator               | Rohde & Schwarz | SMP02      | 833286/004  | 05 Feb 2014           | 12                     |
| M1145     | Power Meter                    | Hewlett Packard | 437B       | 3737U26557  | 12 Jun 2013           | 12                     |
| M1175     | Power Sensor                   | Hewlett Packard | 8485A      | 2942A10299  | 05 Sep 2013           | 12                     |
| M1229     | Digital Multimeter             | Fluke           | 179        | 87640015    | 18 Jun 2013           | 12                     |
| M1658     | Thermometer Hygrometer Station | JM Handelspunkt | 30.5015.13 | Not stated  | 10 Jun 2013           | 12                     |
| S0537     | DC Power Supply Unit           | TTI             | EL302D     | 249928      | Calibrated before use | -                      |

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

|                                   |                       |                   |             |
|-----------------------------------|-----------------------|-------------------|-------------|
| <b>Test Engineer:</b>             | Andrew Edwards        | <b>Test Date:</b> | 15 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50429 |                   |             |

|                                   |                                             |
|-----------------------------------|---------------------------------------------|
| <b>FCC Reference:</b>             | Part 15.247(b)(3)                           |
| <b>Industry Canada Reference:</b> | RSS-Gen 4.8 / RSS-210 A8.4(4)               |
| <b>Test Method Used:</b>          | As detailed in FCC KDB 558074 Section 9.1.1 |

**Environmental Conditions:**

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 24 |
| <b>Relative Humidity (%):</b> | 32 |

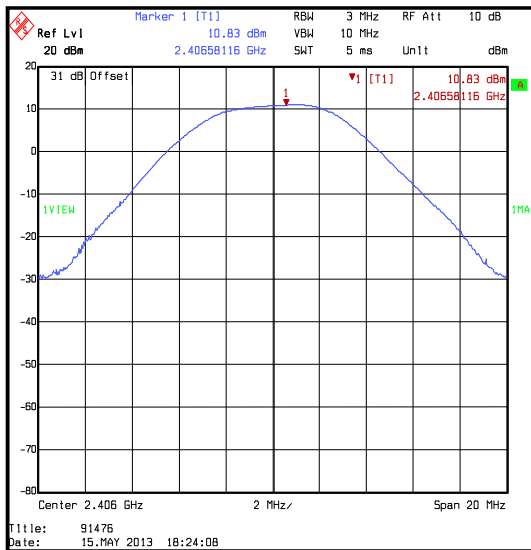
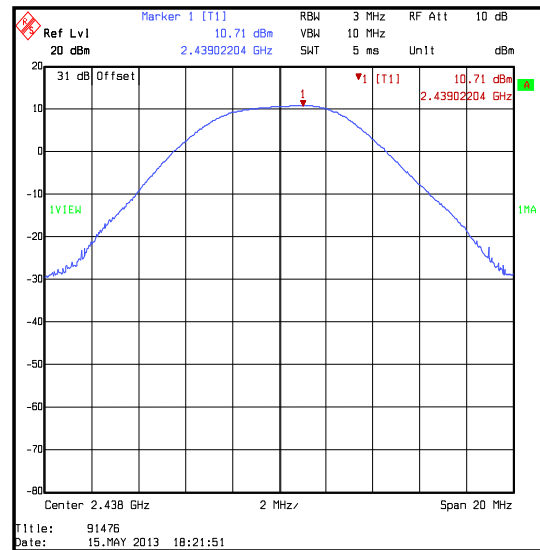
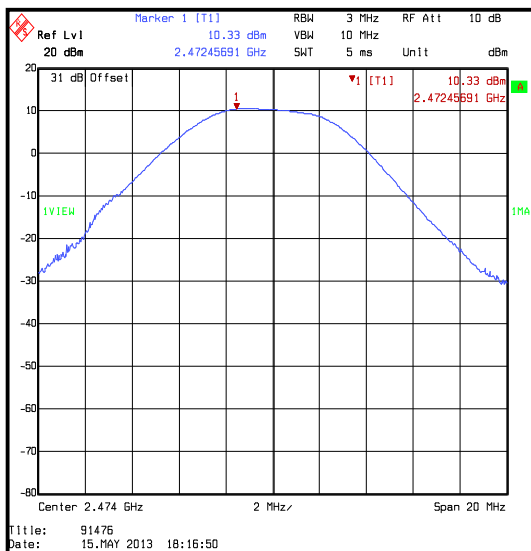
**Note(s):**

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1.1 measurement method RBW  $\geq$  DTS bandwidth.
2. The spectrum analyser 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 20 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

**Results:**

| Channel | Conducted Peak Power (dBm) | Conducted Peak Power Limit (dBm) | Margin (dB) | Result   |
|---------|----------------------------|----------------------------------|-------------|----------|
| Bottom  | 10.8                       | 30.0                             | 19.2        | Complied |
| Middle  | 10.7                       | 30.0                             | 19.3        | Complied |
| Top     | 10.3                       | 30.0                             | 19.7        | Complied |

| Channel | Conducted Peak Power (dBm) | Declared Antenna Gain (dBi) | EIRP (dBm) | De Facto EIRP Limit (dBm) | Margin (dB) | Result   |
|---------|----------------------------|-----------------------------|------------|---------------------------|-------------|----------|
| Bottom  | 10.8                       | 3.3                         | 14.1       | 36.0                      | 21.9        | Complied |
| Middle  | 10.7                       | 3.3                         | 14.0       | 36.0                      | 22.0        | Complied |
| Top     | 10.3                       | 3.3                         | 13.6       | 36.0                      | 22.4        | Complied |

**Transmitter Maximum Peak Output Power (continued)****Bottom Channel****Middle Channel****Top Channel**

**Transmitter Maximum Peak Output Power (continued)****Test Equipment Used:**

| Asset No. | Instrument                     | Manufacturer    | Type No.   | Serial No.  | Date Calibration Due  | Cal. Interval (Months) |
|-----------|--------------------------------|-----------------|------------|-------------|-----------------------|------------------------|
| A2072     | Directional Coupler            | Narda           | 4242B      | 03549       | Calibrated before use | -                      |
| A2142     | Attenuator                     | Atlan TecRF     | AN18-20    | 081120-23   | 10 May 2014           | 12                     |
| M127      | Spectrum Analyser              | Rohde & Schwarz | FSEB 30    | 842 659/016 | 13 Aug 2013           | 12                     |
| M1021     | Signal Generator               | Rohde & Schwarz | SMP02      | 833286/004  | 05 Feb 2014           | 12                     |
| M1145     | Power Meter                    | Hewlett Packard | 437B       | 3737U26557  | 12 Jun 2013           | 12                     |
| M1175     | Power Sensor                   | Hewlett Packard | 8485A      | 2942A10299  | 05 Sep 2013           | 12                     |
| M1229     | Digital Multimeter             | Fluke           | 179        | 87640015    | 18 Jun 2013           | 12                     |
| M1658     | Thermometer Hygrometer Station | JM Handelspunkt | 30.5015.13 | Not stated  | 10 Jun 2013           | 12                     |
| S0537     | DC Power Supply Unit           | TTI             | EL302D     | 249928      | Calibrated before use | -                      |

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

|                                   |                       |                   |             |
|-----------------------------------|-----------------------|-------------------|-------------|
| <b>Test Engineer:</b>             | Andrew Edwards        | <b>Test Date:</b> | 22 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50427 |                   |             |

|                                   |                                                                        |
|-----------------------------------|------------------------------------------------------------------------|
| <b>FCC Reference:</b>             | Parts 15.247(d) & 15.209(a)                                            |
| <b>Industry Canada Reference:</b> | RSS-Gen 4.9 / RSS-210 A8.5                                             |
| <b>Test Method Used:</b>          | As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4 |
| <b>Frequency Range</b>            | 30 MHz to 1000 MHz                                                     |

**Environmental Conditions:**

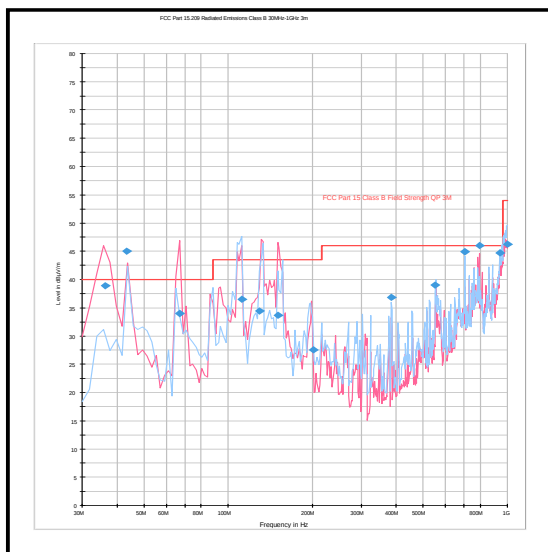
|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 22 |
| <b>Relative Humidity (%):</b> | 30 |

**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 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 noise floor of the measurement system.
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 big enough to see the whole emission.

**Results: Top Channel**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------|----------------|-------------|----------|
| 111.889         | Horizontal       | 36.5           | 43.5           | 7.0         | Complied |
| 129.711         | Vertical         | 34.5           | 43.5           | 9.0         | Complied |
| 996.271         | Horizontal       | 46.2           | 54.0           | 7.8         | 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       | 18 Apr 2014          | 12                     |
| A1834     | Attenuator                     | Hewlett Packard | 8491B      | 10444      | 27 Jan 2014          | 12                     |
| G0543     | Amplifier                      | Sonoma          | 310N       | 230801     | 04 Jul 2013          | 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                     |
| M1656     | Thermometer Hygrometer Station | JM Handelspunkt | 30.5015.13 | Not stated | 10 Jun 2013          | 12                     |

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

|                                   |                                |                    |                           |
|-----------------------------------|--------------------------------|--------------------|---------------------------|
| <b>Test Engineers:</b>            | Andrew Edwards & Mark Percival | <b>Test Dates:</b> | 16 May 2013 & 21 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50427          |                    |                           |

|                                   |                                                                                         |
|-----------------------------------|-----------------------------------------------------------------------------------------|
| <b>FCC Reference:</b>             | Parts 15.247(d) & 15.209(a)                                                             |
| <b>Industry Canada Reference:</b> | RSS-Gen 4.9 / RSS-210 A8.5                                                              |
| <b>Test Method Used:</b>          | As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing FCC KDB 558074 Section 11.0 |
| <b>Frequency Range</b>            | 1 GHz to 26.5 GHz                                                                       |

**Environmental Conditions:**

|                               |          |
|-------------------------------|----------|
| <b>Temperature (°C):</b>      | 22 to 24 |
| <b>Relative Humidity (%):</b> | 42 to 47 |

**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 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 a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their own appropriate detectors during the pre-scan measurements.
6. Final peak emissions were measured with the test receiver set to the same configuration as the pre-scan except with a span that could see the whole emission. Final average measurements that fall within the restricted bands were made with the test receiver resolution bandwidth was set to 1 MHz and video bandwidth 10 Hz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The spectrum analyser was left to sweep for a sufficient length of time in order to maximise the out-of-band emissions.
7. \*-20 dBc limit

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

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1071.543        | Horizontal       | 60.4                 | 74.0                 | 13.6        | Complied |
| 1254.649        | Horizontal       | 55.7                 | 73.2*                | 17.5        | Complied |
| 1254.649        | Horizontal       | 64.1                 | 74.0                 | 9.9         | Complied |
| 1340.217        | Horizontal       | 62.0                 | 74.0                 | 12.0        | Complied |
| 1434.219        | Horizontal       | 53.0                 | 73.2*                | 20.2        | Complied |
| 1529.298        | Vertical         | 60.9                 | 74.0                 | 13.1        | Complied |
| 1620.761        | Horizontal       | 59.1                 | 74.0                 | 14.9        | Complied |
| 1719.268        | Horizontal       | 62.9                 | 74.0                 | 11.1        | Complied |
| 2999.980        | Horizontal       | 55.9                 | 73.2*                | 17.3        | Complied |

**Results: Average / Bottom Channel**

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1071.453        | Horizontal       | 46.1                 | 54.0                 | 7.9         | Complied |
| 1259.053        | Horizontal       | 50.7                 | 54.0                 | 3.3         | Complied |
| 1339.811        | Horizontal       | 48.1                 | 54.0                 | 5.9         | Complied |
| 1436.393        | Vertical         | 44.7                 | 54.0                 | 9.3         | Complied |
| 1530.260        | Horizontal       | 47.2                 | 54.0                 | 6.8         | Complied |
| 1612.435        | Horizontal       | 46.1                 | 54.0                 | 7.9         | Complied |
| 1719.659        | Horizontal       | 40.8                 | 54.0                 | 13.2        | Complied |

**Results: Peak / Middle Channel**

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1053.387        | Horizontal       | 60.7                 | 74.0                 | 13.3        | Complied |
| 1258.434        | Horizontal       | 55.2                 | 74.1*                | 18.9        | Complied |
| 1259.579        | Horizontal       | 65.2                 | 74.0                 | 8.8         | Complied |
| 1339.886        | Horizontal       | 62.4                 | 74.0                 | 11.6        | Complied |
| 1536.061        | Vertical         | 61.4                 | 74.0                 | 12.6        | Complied |
| 1622.746        | Horizontal       | 59.1                 | 74.0                 | 14.9        | Complied |
| 1733.909        | Horizontal       | 62.9                 | 74.0                 | 11.1        | Complied |
| 2999.999        | Horizontal       | 55.5                 | 74.1*                | 18.6        | Complied |

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

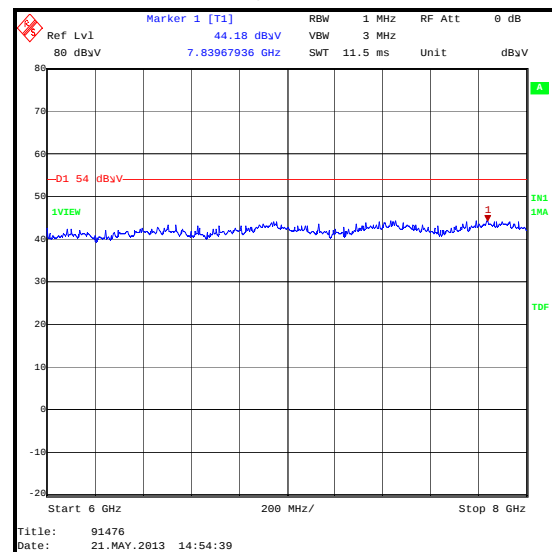
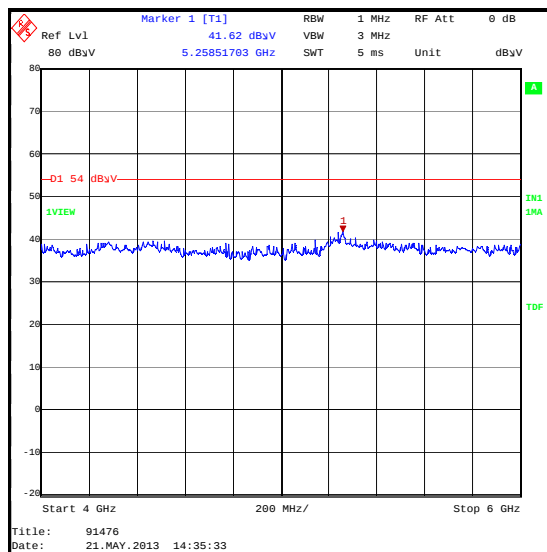
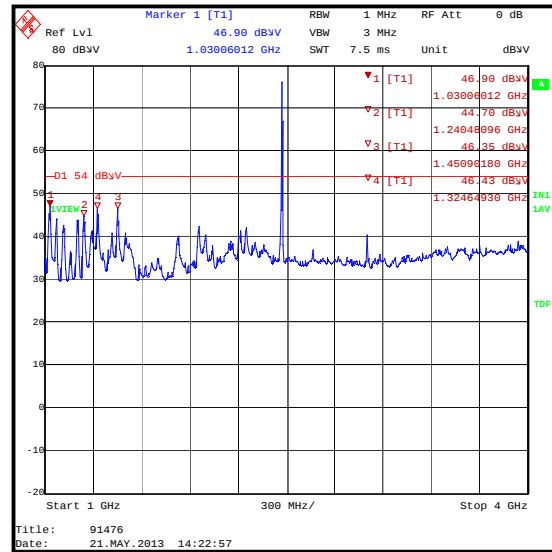
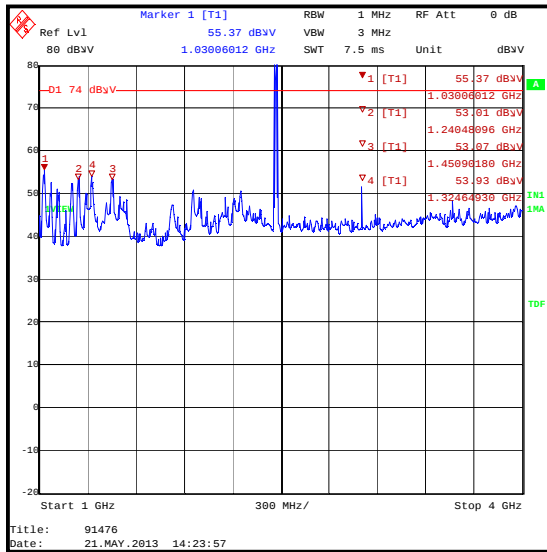
| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1055.701        | Horizontal       | 46.5                 | 54.0                 | 7.5         | Complied |
| 1259.158        | Horizontal       | 50.9                 | 54.0                 | 3.1         | Complied |
| 1339.826        | Horizontal       | 49.3                 | 54.0                 | 4.7         | Complied |
| 1530.170        | Vertical         | 47.2                 | 54.0                 | 6.8         | Complied |
| 1612.525        | Horizontal       | 46.2                 | 54.0                 | 7.8         | Complied |
| 1719.721        | Horizontal       | 49.6                 | 54.0                 | 4.4         | Complied |

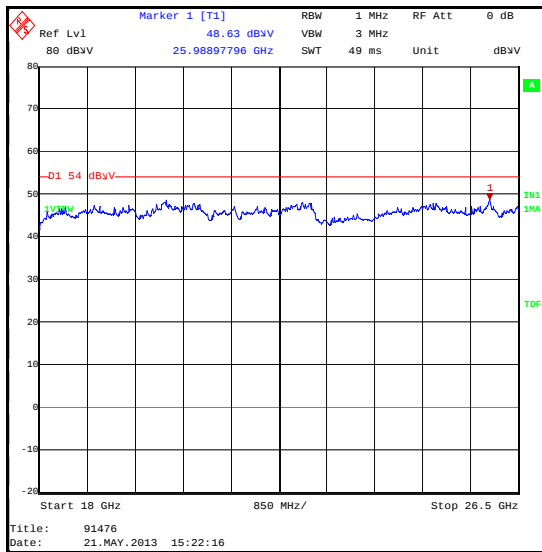
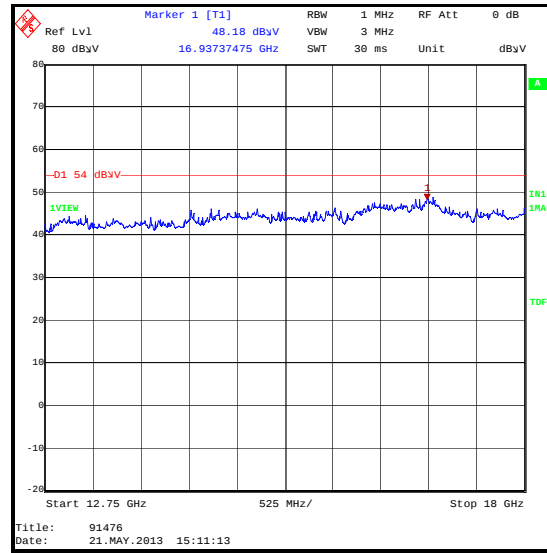
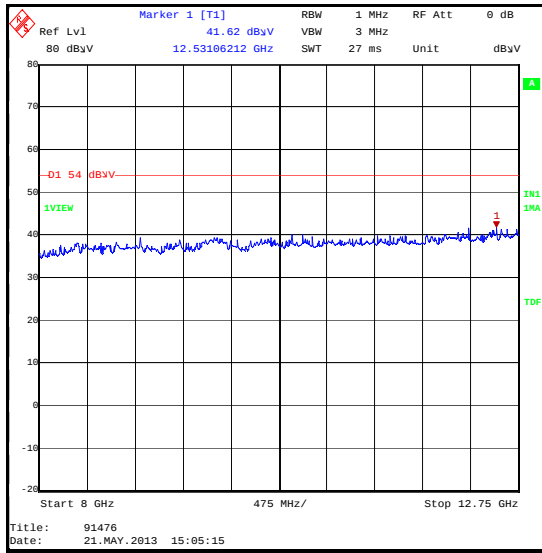
**Results: Peak / Top Channel**

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1071.543        | Horizontal       | 60.4                 | 74.0                 | 13.6        | Complied |
| 1254.649        | Horizontal       | 64.1                 | 74.0                 | 9.9         | Complied |
| 1340.217        | Horizontal       | 62.0                 | 74.0                 | 12.0        | Complied |
| 1529.298        | Vertical         | 60.9                 | 74.0                 | 13.1        | Complied |
| 1620.761        | Horizontal       | 59.1                 | 74.0                 | 14.9        | Complied |
| 1719.268        | Horizontal       | 62.9                 | 74.0                 | 11.1        | Complied |
| 2999.980        | Horizontal       | 55.9                 | 75.9*                | 20.0        | Complied |

**Results: Average / Top Channel**

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1071.453        | Horizontal       | 46.1                 | 54.0                 | 7.9         | Complied |
| 1259.053        | Horizontal       | 50.7                 | 54.0                 | 3.3         | Complied |
| 1339.811        | Horizontal       | 48.1                 | 54.0                 | 5.9         | Complied |
| 1436.393        | Vertical         | 44.7                 | 54.0                 | 9.3         | Complied |
| 1530.260        | Horizontal       | 47.2                 | 54.0                 | 6.8         | Complied |
| 1612.435        | Horizontal       | 46.1                 | 54.0                 | 7.9         | Complied |
| 1719.659        | Horizontal       | 40.8                 | 54.0                 | 13.2        | Complied |

**Transmitter Radiated Emissions (continued)**

**Transmitter Radiated Emissions (continued)**

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

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

| Asset No. | Instrument                     | Manufacturer    | Type No.   | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|-----------|--------------------------------|-----------------|------------|------------|----------------------|------------------------|
| A253      | Antenna                        | Flann           | 12240-20   | 128        | 04 Nov 2013          | 12                     |
| A254      | Antenna                        | Flann           | 14240-20   | 139        | 04 Nov 2013          | 12                     |
| A255      | Antenna                        | Flann           | 16240-20   | 519        | 04 Nov 2013          | 12                     |
| A256      | Antenna                        | Flann           | 18240-20   | 400        | 04 Nov 2013          | 12                     |
| A436      | Antenna                        | Flann           | 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                     |
| K0002     | 3m RSE Chamber                 | Rainford EMC    | N/A        | N/A        | 04 Nov 2013          | 12                     |
| L1014     | Test Receiver                  | Rohde & Schwarz | ESIB 40    | 100014     | 10 May 2014          | 24                     |
| M1656     | Thermometer Hygrometer Station | JM Handelspunkt | 30.5015.13 | Not stated | 10 Jun 2013          | 12                     |

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

|                                   |                       |                   |             |
|-----------------------------------|-----------------------|-------------------|-------------|
| <b>Test Engineer:</b>             | Andrew Edwards        | <b>Test Date:</b> | 16 May 2013 |
| <b>Test Sample Serial Number:</b> | 621D1890501312AN50427 |                   |             |

|                                   |                                                                     |
|-----------------------------------|---------------------------------------------------------------------|
| <b>FCC Reference:</b>             | Parts 15.247(d) & 15.209(a)                                         |
| <b>Industry Canada Reference:</b> | RSS-Gen 4.9 / RSS-210 A8.5                                          |
| <b>Test Method Used:</b>          | As detailed in ANSI C63.10 Section 6.9.2 referencing FCC KDB 558074 |

**Environmental Conditions:**

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 22 |
| <b>Relative Humidity (%):</b> | 35 |

**Note(s):**

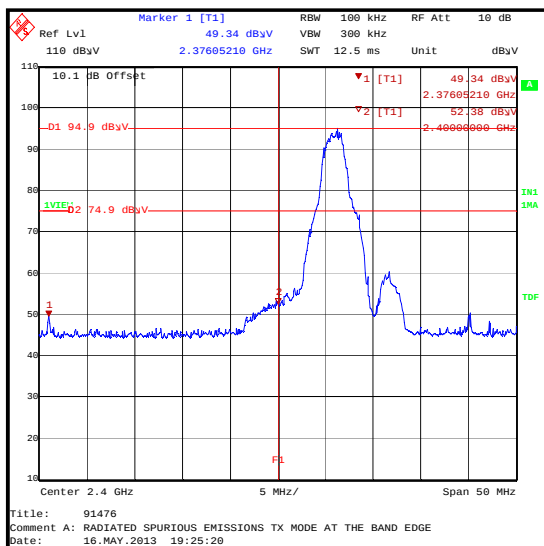
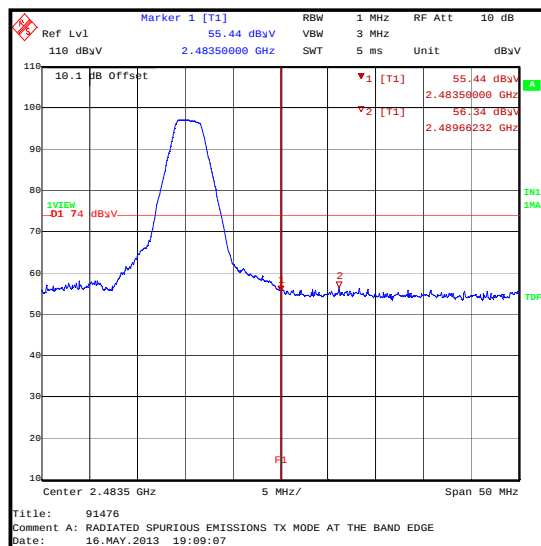
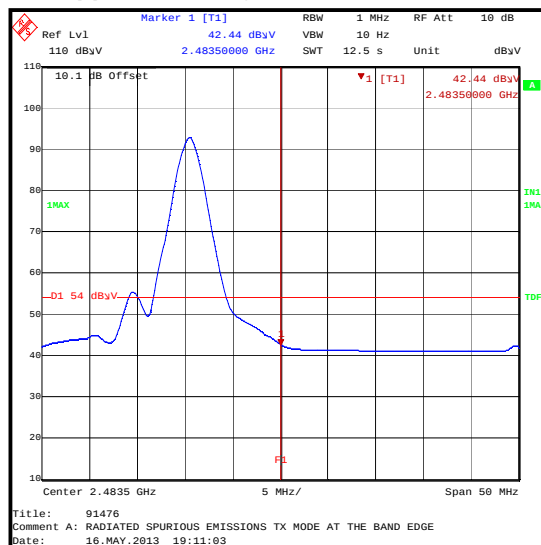
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. For the lower band edge measurements: As the lower band edge falls within the non-restricted band only peak measurements are required. The test receiver resolution bandwidth 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. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. As the maximum conducted output power was measured using a peak detector in accordance with FCC KDB 558074 Section 9.1.1 an out-of-band limit line was placed 20 dB below the peak level (FCC KDB 558074 Section 11.1(a)). A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
3. For the upper band edge measurements: As the upper band edge falls within restricted band both peak and average measurements were recorded by placing a marker at the edge of the band (2483.5 MHz). For peak measurements the test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and video bandwidth 10 Hz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
4. \* -20 dBc limit.

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

| Frequency (MHz) | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|----------------------|----------------------|-------------|----------|
| 2400.0          | 52.4                 | 74.9*                | 22.5        | Complied |
| 2483.5          | 55.4                 | 74.0                 | 18.6        | Complied |
| 2489.662        | 56.3                 | 74.0                 | 17.7        | Complied |

**Results: Average**

| Frequency (MHz) | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|----------------------|----------------------|-------------|----------|
| 2483.5          | 42.4                 | 54.0                 | 11.6        | Complied |

**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Upper Band Edge Average Measurement**

**Transmitter Band Edge Radiated Emissions (continued)****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                     |
| L1014     | Test Receiver                     | Rohde & Schwarz | ESIB 40    | 100014     | 10 May 2014          | 24                     |
| M1656     | Thermometer<br>Hygrometer Station | JM Handelspunkt | 30.5015.13 | Not stated | 10 Jun 2013          | 12                     |

## **6. Measurement Uncertainty**

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value measured (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

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

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

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

| Measurement Type                    | Range                 | Confidence Level (%) | Calculated Uncertainty |
|-------------------------------------|-----------------------|----------------------|------------------------|
| Conducted Maximum Peak Output Power | 2.4 GHz to 2.4835 GHz | 95%                  | ±1.13 dB               |
| Spectral Power Density              | 2.4 GHz to 2.4835 GHz | 95%                  | ±1.13 dB               |
| Minimum 6 dB Bandwidth              | 2.4 GHz to 2.4835 GHz | 95%                  | ±0.92 ppm              |
| 99% Occupied Bandwidth              | 2.4 GHz to 2.4835 GHz | 95%                  | ±0.92 ppm              |
| Radiated Spurious Emissions         | 30 MHz to 26.5 GHz    | 95%                  | ±2.94 dB               |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## **7. Report Revision History**

| Version Number | Revision Details |        |                                                                                         |
|----------------|------------------|--------|-----------------------------------------------------------------------------------------|
|                | Page No(s)       | Clause | Details                                                                                 |
| 1.0            | -                | -      | Initial Version                                                                         |
| 2.0            | -                | -      | Model number of Loader and BCU updated,<br>Industry Canada certification number updated |
| 3.0            | -                | -      | Updates to sections 3.2 & 4.2                                                           |