



TEST REPORT

Test Report No. : UL-RPT-RP91476JD11A V3.0

Manufacturer : BENTLEY MOTORS LIMITED
Model No. : D189070
FCC ID : 2AAKLD189070
IC Certification No. : 11196A-D189070
Technology : *Bluetooth – Basic Rate & EDR*
Test Standard(s) : FCC Parts 15.209(a) & 15.247,
Industry Canada RSS-210 A8.1(a), A8.1(b), A8.1(d), A8.4(2) & A8.5
and RSS-Gen 4.6.3, 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: 22 November 2013

Checked by:

Sarah Williams
WiSE Engineer

Issued by :

pp

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



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The tests reported herein have been
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Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
3. Equipment Under Test (EUT)	7
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	8
3.5. Support Equipment	9
Support Equipment (continued)	10
4. Operation and Monitoring of the EUT during Testing	11
4.1. Operating Modes	11
4.2. Configuration and Peripherals	11
5. Measurements, Examinations and Derived Results	12
5.1. General Comments	12
5.2. Test Results	13
5.2.1. Transmitter 20 dB Bandwidth	13
5.2.2. Transmitter Carrier Frequency Separation	18
5.2.3. Transmitter Number of Hopping Frequencies and Average Time of Occupancy	21
5.2.4. Transmitter Maximum Peak Output Power	24
5.2.5. Transmitter Radiated Emissions	32
5.2.6. Transmitter Band Edge Radiated Emissions	37
6. Measurement Uncertainty	48
7. Report Revision History	49

1. Customer Information

Company Name:	BENTLEY MOTORS LIMITED
Address:	Pyms Lane Cheshire CW1 3PL United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.247
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.209
Specification Reference:	RSS-Gen Issue 3 December 2010
Specification Title:	General Requirements and Information for the Certification of Radio Apparatus
Specification Reference:	RSS-210 Issue 8 December 2010
Specification Title:	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
Site Registration:	FCC: 209735; Industry Canada: 3245B-2
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	02 May 2013 to 20 May 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Result
Part 15.247(a)(1)	RSS-Gen 4.6.3 / RSS-210 A8.1(a)	Transmitter 20 dB Bandwidth	✓
Part 15.247(a)(1)	RSS-210 A8.1(b)	Transmitter Carrier Frequency Separation	✓
Part 15.247(a)(1)(iii)	RSS-210 A8.1(d)	Transmitter Number of Hopping Frequencies and Average Time of Occupancy	✓
Part 15.247(b)(1)	RSS-Gen 4.8 RSS-210 A8.4(2)	Transmitter Maximum Peak Output Power	✓
Part 15.247(d) / 15.209(a)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Radiated Emissions	✓
Part 15.247(d) / 15.209(a)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Band Edge Radiated Emissions	✓
Key to Results			
✓ = Complied	✗ = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	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
Reference:	ANSI C63.10 (2009)
Title:	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)

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	D189070
Description:	Body Connectivity Unit
Test Sample Serial Number:	621D1890701306AH00141
Hardware Version Number:	H08
Software Version Number:	34
FCC ID:	2AAKLD189070
Industry Canada Certification Number:	11196A-D189070

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	4W0.962.131
Description:	WLAN & <i>Bluetooth</i> Antenna (maximum antenna gain 3.2 dBi)
Test Sample Serial Number:	00076

3.2. Description of EUT

The equipment under test was the Body Connectivity Unit (BCU), the main system to vehicle interface of a Vehicle Rear Seat Entertainment System. The EUT includes hard wired and wireless interfaces to various media sources as well as connecting to BY621 Loader Units (DVD players) which are mounted in the rear seats of the vehicle. The EUT supports multiple technologies consisting of GSM/GPRS/UMTS, *Bluetooth* and WLAN 802.11 b/g/n 2.4 GHz. The EUT has external antenna ports. The model number of the BCU is D189070.

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:	<i>Bluetooth</i>		
Power Supply Requirement:	Nominal	12 VDC	
Type of Unit:	Transceiver		
Channel Spacing:	1 MHz		
Mode:	Basic Rate	Enhanced Data Rate	
Modulation:	GFSK	$\pi/4$ -DQPSK	8DQPSK
Packet Type: (Maximum Payload)	DH5	2DH5	3DH5
Data Rate (Mbit/s):	1	2	3
Maximum Conducted Output Power:	1.9 dBm		
Antenna Gain:	3.2 dBi		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480
Receive Frequency Range:	2402 MHz to 2480 MHz		
Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480

3.5. Support Equipment

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

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	D189050
Description:	Loader
Test Sample Serial Number:	621D1890501303OS50222
Hardware Version Number:	H10
Software Version Number:	34

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	D189050
Description:	Loader
Test Sample Serial Number:	621D18905013070S50273
Hardware Version Number:	H10
Software Version Number:	34

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	LCD screen
Test Sample Serial Number:	621D18909013030S10222
Hardware Version Number:	H07
Software Version Number:	0007

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	LCD screen
Test Sample Serial Number:	621D18909013070S10302
Hardware Version Number:	H07
Software Version Number:	0007

Brand Name:	BENTLEY MOTORS LIMITED
Model Name or Number:	3W7.035.524.A
Description:	GSM / UMTS antenna (maximum antenna gain 2.15 dBi)
Test Sample Serial Number:	KW 472012 3435

Description:	Car battery
Brand Name:	Optima batteries
Model Name or Number:	8012-254
Serial Number:	Not marked or stated

Support Equipment (continued)

Description:	Power Harnessing
Brand Name:	Bentley
Model Name or Number:	Not marked or stated

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	D610
Serial Number:	0062

Description:	MDI Mitsumi
Brand Name:	Bentley
Model Name or Number:	5N0 035 341A
Serial Number:	1000003-002

Description:	2 x Male to male USB cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated

Description:	Termination Cabling
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated

Description:	HDMI cable
Brand Name:	Generic
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Cyclone Micro Media Player Adaptor
Brand Name:	SUMVISION
Model Name or Number:	Cyclone Micro
Serial Number:	SUM091104017

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Continuously transmitting at maximum power on bottom, middle and top channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.

4.2. Configuration and Peripherals

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

- For Transmit tests: Standalone, connected via a radio link to a *Bluetooth* tester in order to place the EUT into *Bluetooth* test mode. The laptop PC with putty terminal application was used to place the EUT into *Bluetooth* mode.
- Both EDR/Basic rate modes were compared and tests were performed with the mode that presented the worst case result. For output power, bandwidth, band edge and channel separation, all modes were tested.
- For Transmitter Radiated Spurious Emissions the GSM/UMTS antenna, Loaders and LCD screens were connected to the BCU for termination of active ports. The Loaders and LCD screens were not powered on. The BCU was powered by a car battery in the relevant test mode.
- For radiated measurements a car battery was used to power the EUT.
- For conducted measurements a DC bench power supply was used to power the EUT.
- For radiated measurements the *Bluetooth* Antenna was connected to the EUT via a 5m cable. This is representative of what will be used when the system is installed in the car.

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 20 dB Bandwidth

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	20 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

FCC Reference:	Part 15.247(a)(1)
Industry Canada Reference:	RSS-Gen 4.6.3 / RSS-210 A8.1(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.1

Environmental Conditions:

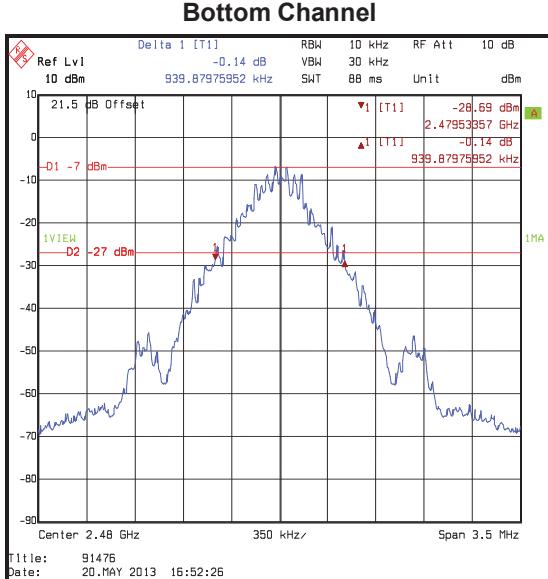
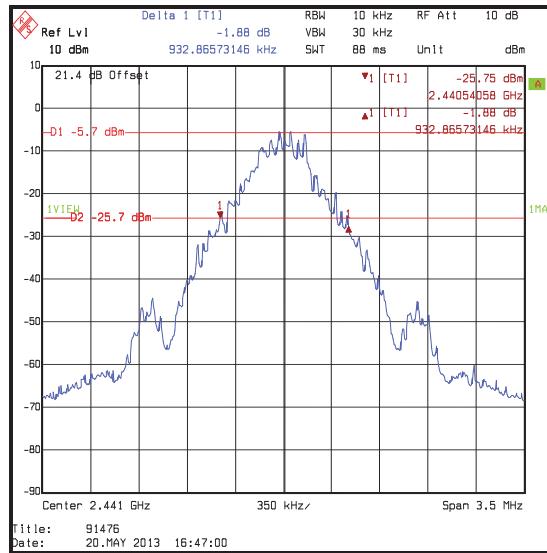
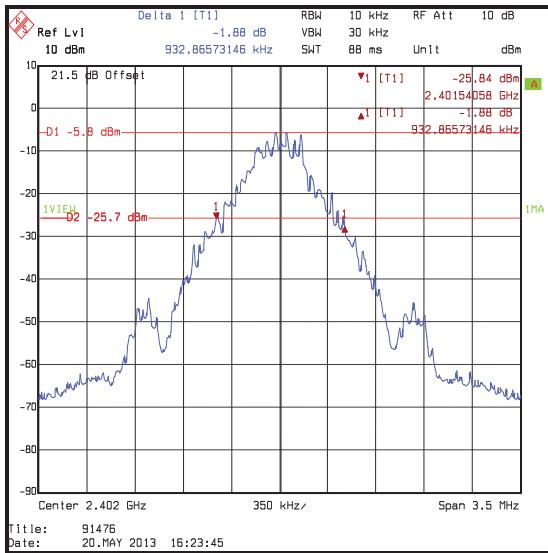
Temperature (°C):	24
Relative Humidity (%):	42

Note(s):

1. The spectrum analyser resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 3.5 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the tables below.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

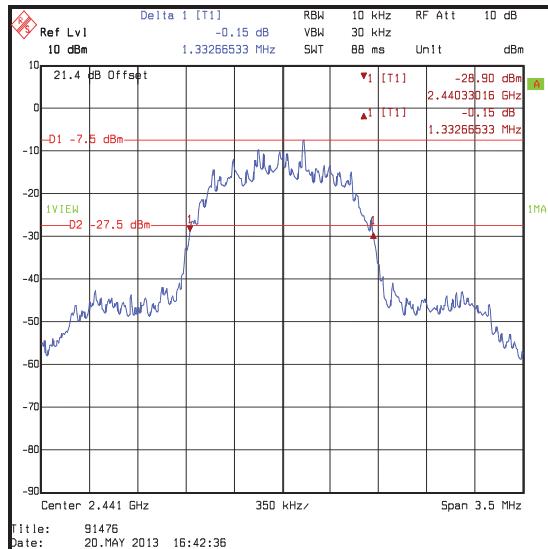
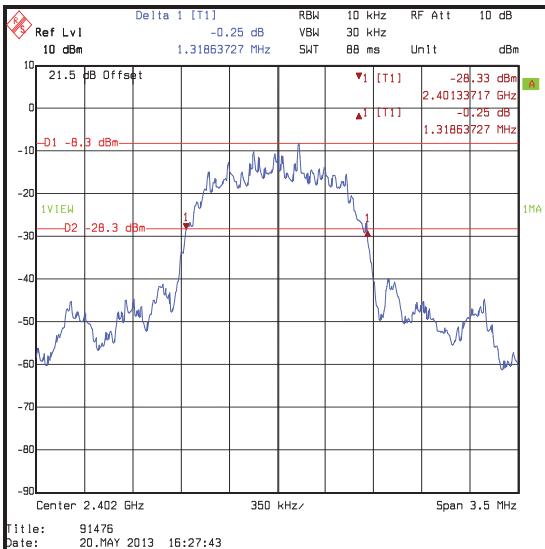
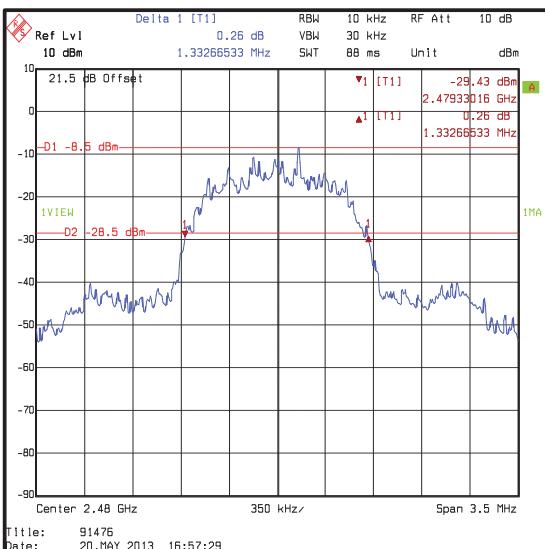
Transmitter 20 dB Bandwidth (continued)**Results DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	932.866
Middle	932.866
Top	939.880



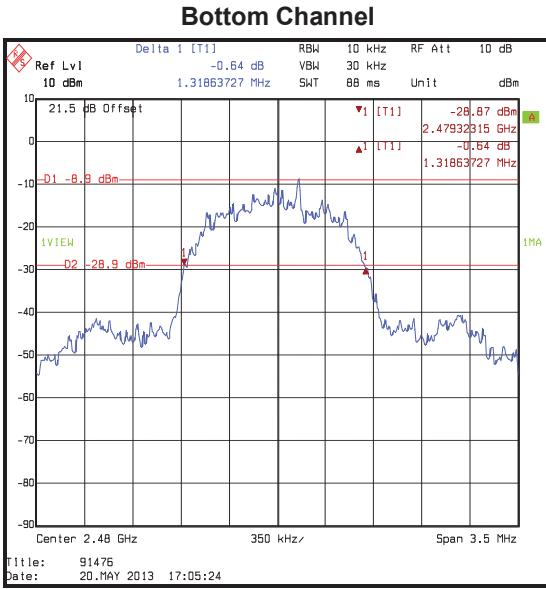
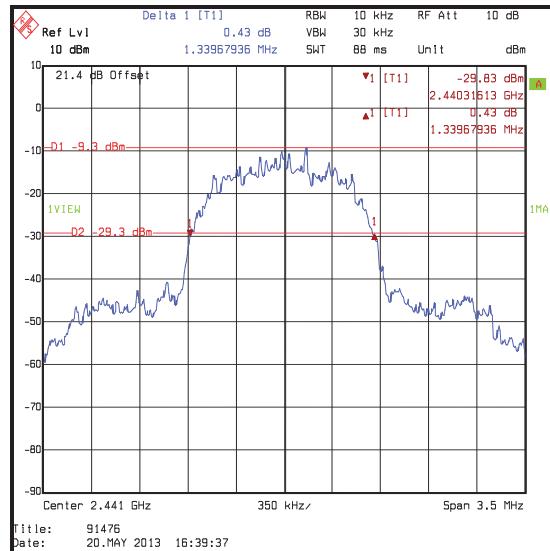
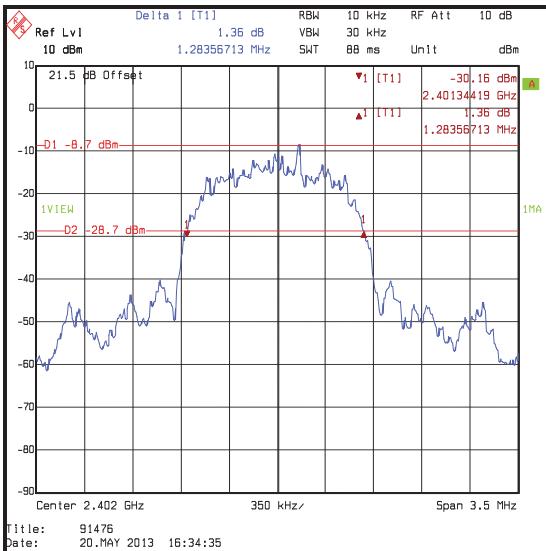
Transmitter 20 dB Bandwidth (continued)**Results 2DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1318.637
Middle	1332.665
Top	1332.665

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

Transmitter 20 dB Bandwidth (continued)**Results 3DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1283.567
Middle	1339.679
Top	1318.637



Transmitter 20 dB Bandwidth (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2138	Directional Coupler	Atlan TecRF	A4224-10	2681	Calibrated before use	-
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	Calibrated before use	-
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 Handelpunkt	30.5015.13	Not stated	10 Jun 2013	12
S0537	DC Power Supply Unit	TTI	EL302D	249928	Calibrated before use	-

5.2.2. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	02 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

FCC Reference:	Part 15.247(a)(1)
Industry Canada Reference:	RSS-210 A8.1(b)
Test Method Used:	As detailed in ANSI C63.10 Section 7.7.2

Environmental Conditions:

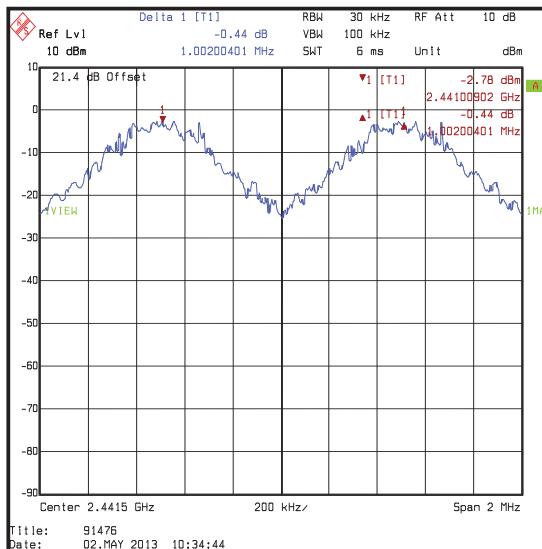
Temperature (°C):	26
Relative Humidity (%):	27

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The spectrum analyser resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 2 MHz. A marker was placed at the centre of one signal and then a delta marker was placed in the same place on the second signal, the results are recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results: DH5

Carrier Frequency Separation (kHz)	Limit ($\frac{2}{3}$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1002.004	621.911	380.093	Complied

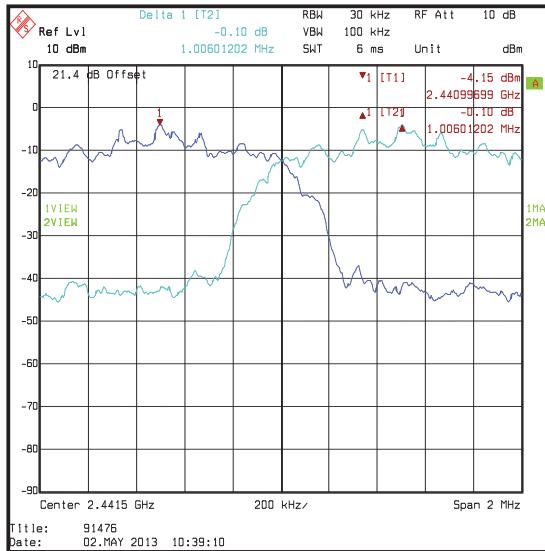


Transmitter Carrier Frequency Separation (continued)**Note(s):**

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The spectrum analyser resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 2 MHz. A marker was placed at the centre of one signal and then a delta marker was placed in the same place on the second signal, the results are recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results: 2DH5

Carrier Frequency Separation (kHz)	Limit $\frac{2}{3}$ of 20 dB BW (kHz)	Margin (kHz)	Result
1006.012	888.443	117.569	Complied

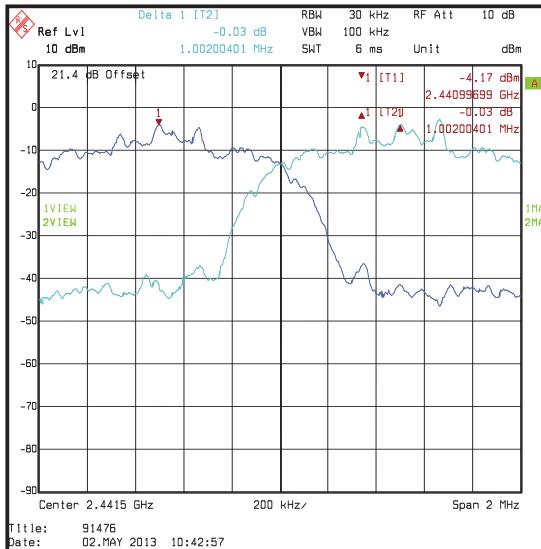


Transmitter Carrier Frequency Separation (continued)**Note(s):**

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The spectrum analyser resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 2 MHz. A marker was placed at the centre of one signal and then a delta marker was placed in the same place on the second signal, the results are recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results: 3DH5

Carrier Frequency Separation (kHz)	Limit $\frac{2}{3}$ of 20 dB BW (kHz)	Margin (kHz)	Result
1002.004	893.119	108.885	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2138	Directional Coupler	Atlan TecRF	A4224-10	2681	Calibrated before use	-
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	Calibrated before use	-
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 Number of Hopping Frequencies and Average Time of Occupancy**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	02 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

FCC Reference:	Part 15.247(a)(1)(iii)
Industry Canada Reference:	RSS-210 A8.1(d)
Test Method Used:	As detailed in ANSI C63.10 Section 7.7.3 & 7.7.4

Environmental Conditions:

Temperature (°C):	27
Relative Humidity (%):	27

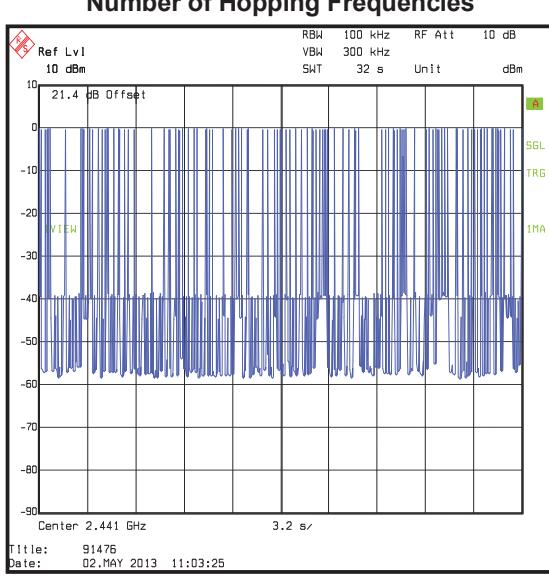
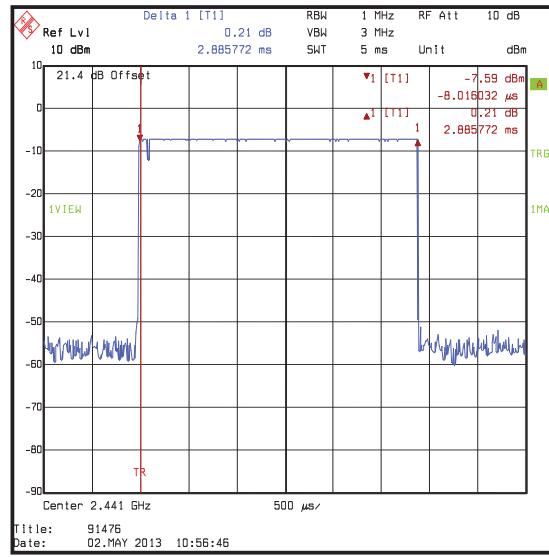
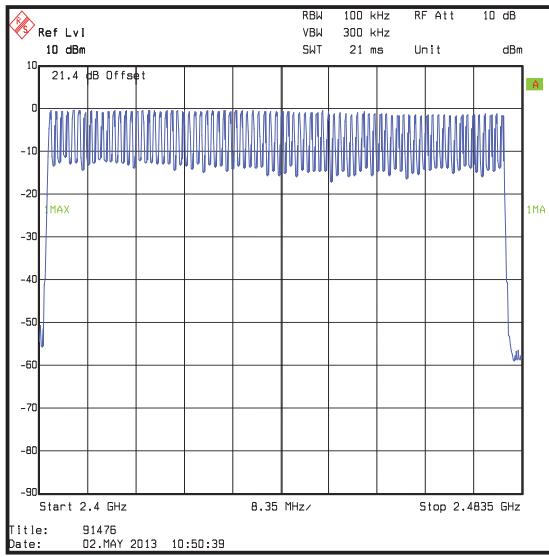
Note(s):

1. Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.
2. The spectrum analyser was set up for the Number of Hopping Frequencies measurement as follows: the resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 83.5 MHz.
3. The spectrum analyser was set up for the Emission Width measurement as follows: the resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The spectrum analyser was set to trigger at 1 ms, with a marker placed at the start of the emission and a delta marked place at the end of the emission. The emission width is recorded in the table below.
4. The spectrum analyser was set up for the Number of Hopping Frequencies in 32 seconds measurement as follows: the resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used and sweep time was set to 32 seconds. The EUT was set to transmit in a hopping frequency mode with zero span. The total number of hopping frequencies were recorded in the table below.
5. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results:

Emission Width (μs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2885.772	92	0.265	0.4	0.135	Complied

Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)



Number of Hopping Frequencies in 32 s

Emission Width

Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2138	Directional Coupler	Atlan TecRF	A4224-10	2681	Calibrated before use	-
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	Calibrated before use	-
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 Handelpunkt	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:**

Test Engineer:	Andrew Edwards	Test Date:	02 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

FCC Reference:	Part 15.247(b)(1)
Industry Canada Reference:	RSS-Gen 4.8 / RSS-210 A8.4(2)
Test Method Used:	As detailed in ANSI C63.10 Section 6.10.1

Environmental Conditions:

Temperature (°C):	26
Relative Humidity (%):	27

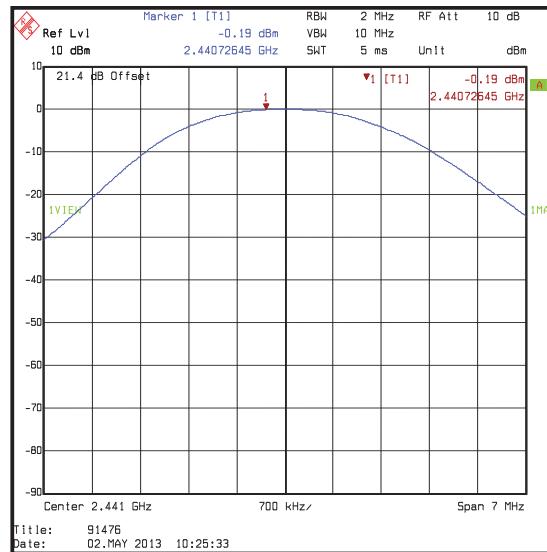
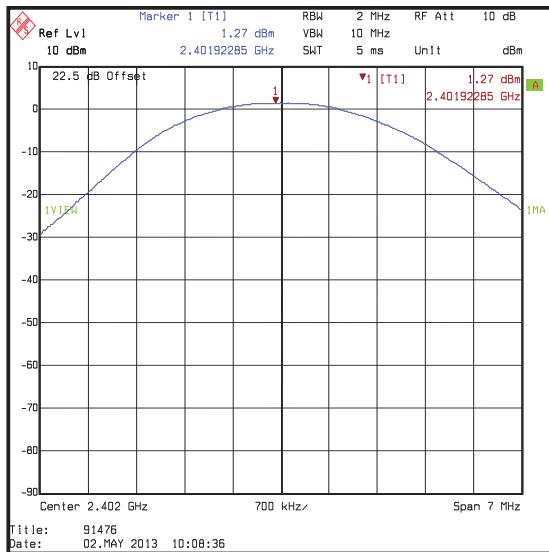
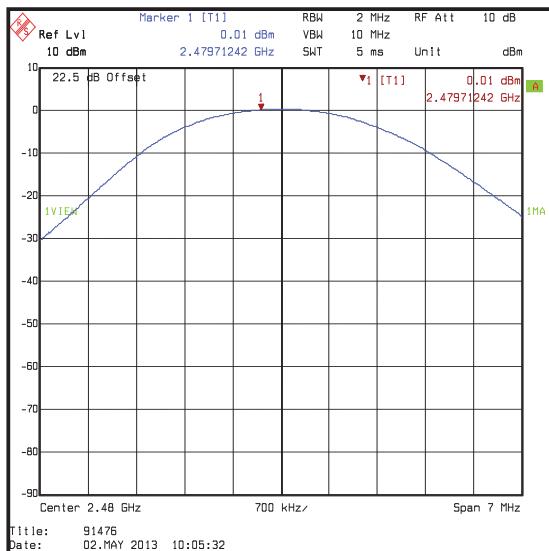
Note(s):

1. The spectrum analyser resolution bandwidth was set to 2 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 7 MHz. A marker was placed at the peak of the signal and the results recorded in the tables below.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

Transmitter Maximum Peak Output Power (continued)**Results: DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.3	30.0	28.7	Complied
Middle	-0.2	30.0	30.2	Complied
Top	0.0	30.0	30.0	Complied

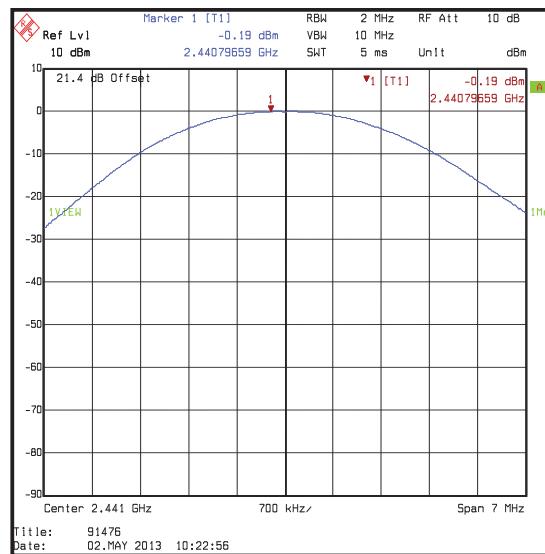
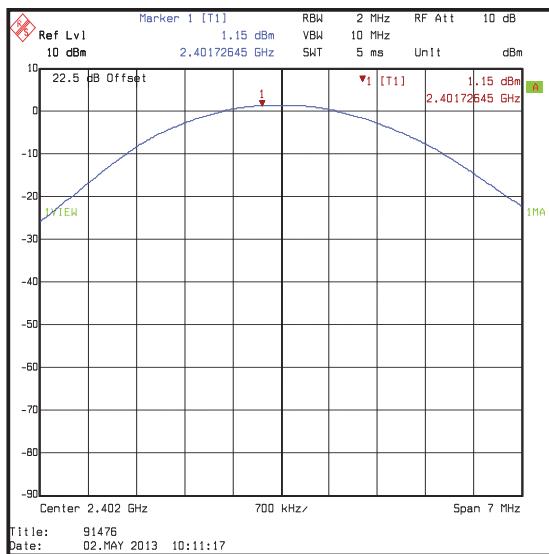
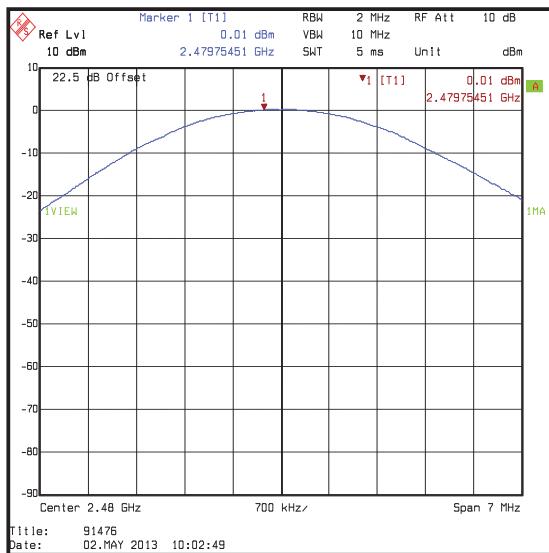
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.3	3.2	4.5	36.0	31.5	Complied
Middle	-0.2	3.2	3.0	36.0	33.0	Complied
Top	0.0	3.2	3.2	36.0	32.8	Complied

Transmitter Maximum Peak Output Power (continued)**Results: DH5****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: 2DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.2	21.0	19.8	Complied
Middle	-0.2	21.0	21.2	Complied
Top	0.0	21.0	21.0	Complied

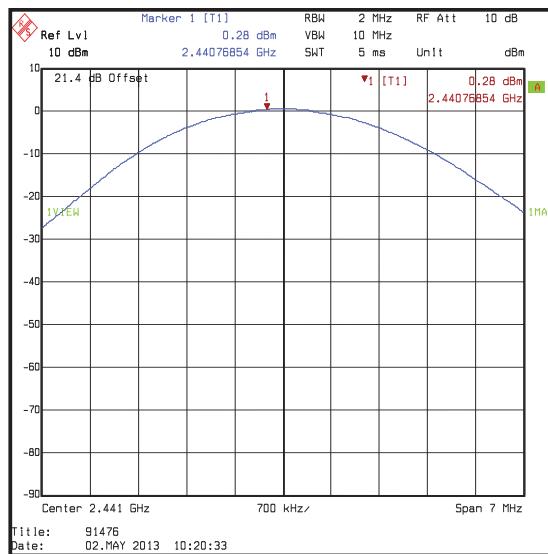
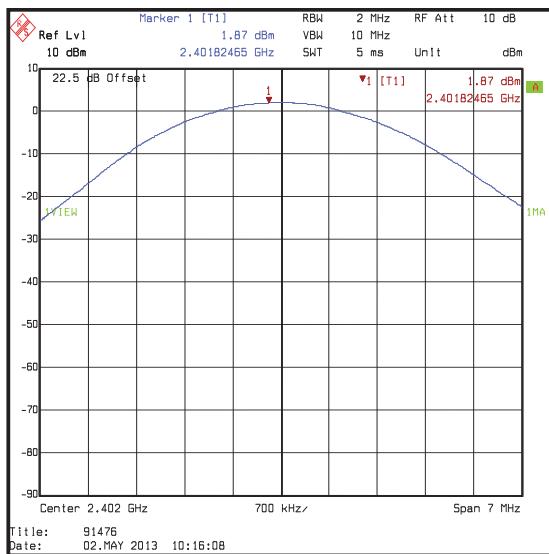
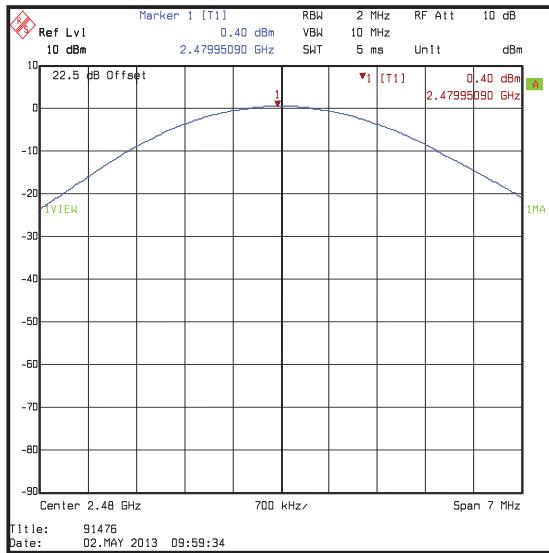
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.2	3.2	4.4	27.0	22.6	Complied
Middle	-0.2	3.2	3.0	27.0	24.0	Complied
Top	0.0	3.2	3.2	27.0	23.8	Complied

Transmitter Maximum Peak Output Power (continued)**Results: 2DH5****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: 3DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.9	21.0	19.1	Complied
Middle	0.3	21.0	20.7	Complied
Top	0.4	21.0	20.6	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.9	3.2	5.1	27.0	21.9	Complied
Middle	0.3	3.2	3.5	27.0	23.5	Complied
Top	0.4	3.2	3.6	27.0	23.4	Complied

Transmitter Maximum Peak Output Power (continued)**Results: 3DH5****Bottom Channel****Top Channel****Middle Channel**

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2138	Directional Coupler	Atlan TecRF	A4224-10	2681	Calibrated before use	-
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	Calibrated before use	-
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	19 Sep 2013	12
M1229	Digital Multimeter	Fluke	179	87640015	18 Jun 2013	12
M1658	Thermometer/ Hygrometer Station	JM Handelpunkt	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:

Test Engineer:	Andrew Edwards	Test Date:	08 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

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

Environmental Conditions:

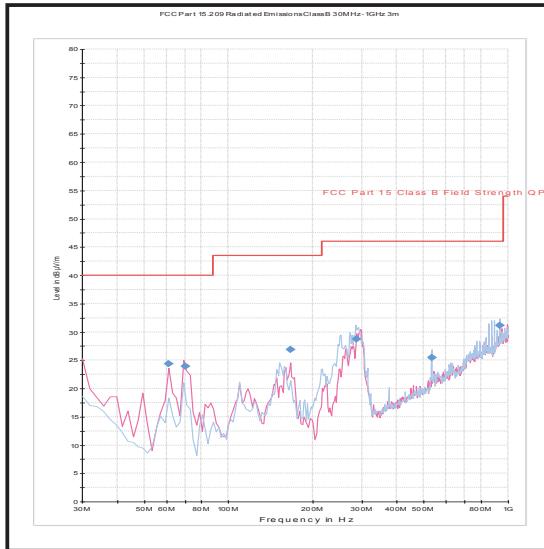
Temperature (°C):	27
Relative Humidity (%):	35

Note(s):

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 3DH5 mode as this mode was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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: Quasi-Peak / 3DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
166.240	Vertical	26.9	43.5	16.6	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	Bilog Antenna	Chase	CBL6111	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
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
M1656	Thermometer/ Hygrometer Station	JM Handelspunkt	30.5015.13	Not stated	10 Jun 2013	12

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

Test Engineer:	Mark Percival	Test Date:	07 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9 / RSS-210 A8.5
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	35

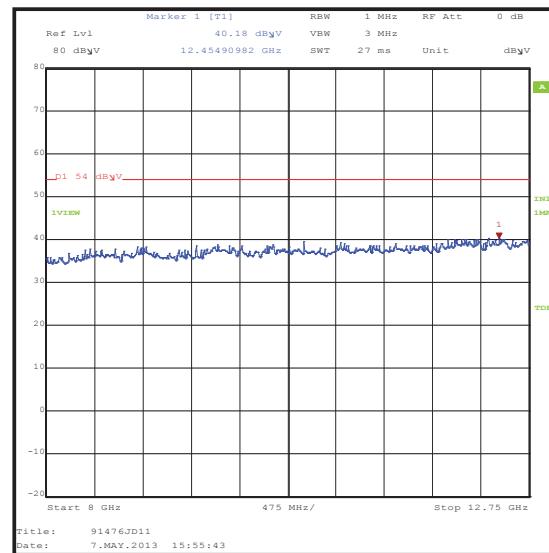
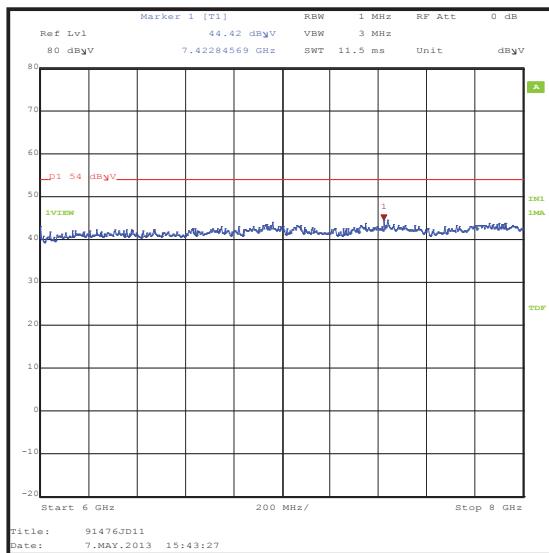
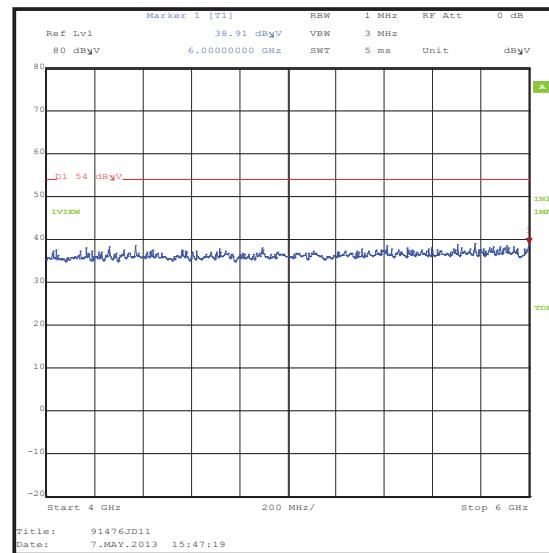
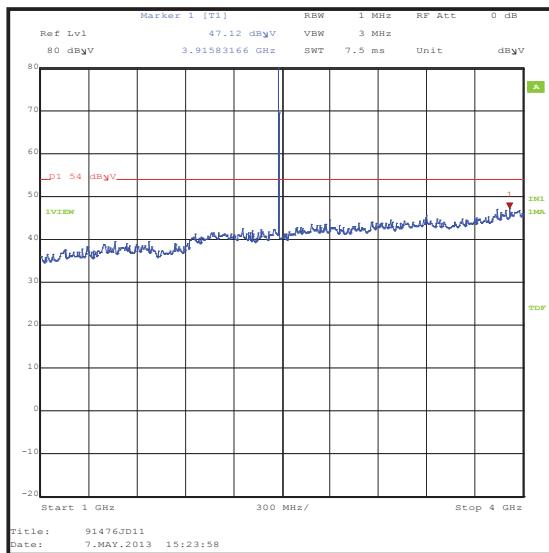
Note(s):

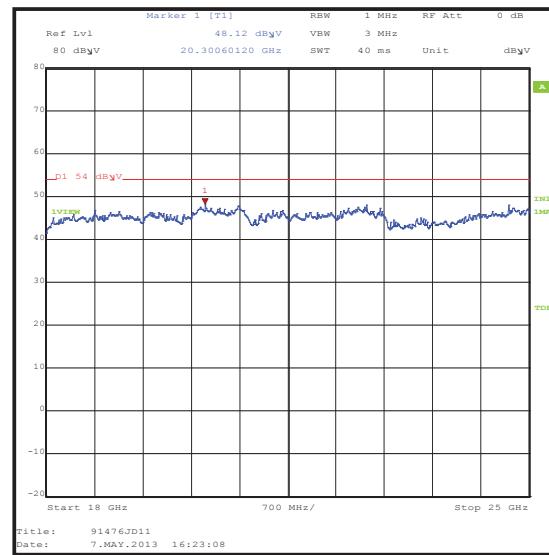
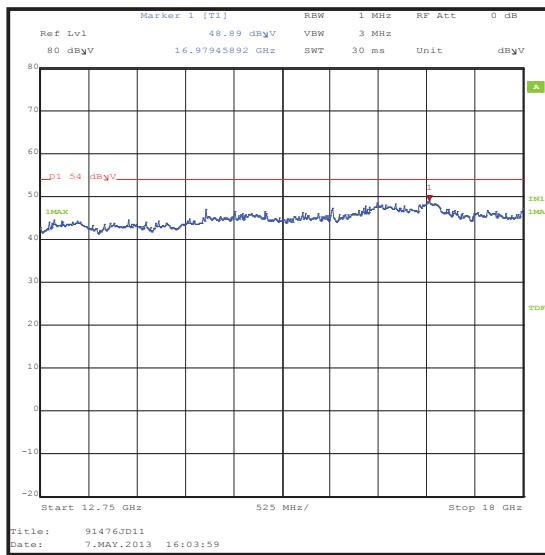
1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 3DH5 mode as this mode was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental at 2480 MHz.
4. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
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.
6. As the EUT operates below 10 GHz Transmitter Radiated Spurious Emissions pre-scans were performed up to the 10th harmonic frequency (25 GHz).
7. 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.

Results:

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
16979.459	Horizontal	48.9	54.0	5.1	Complied

Transmitter Radiated Emissions (continued)



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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermometer/ Hygrometer Station	JM Handelpunkt	30.5015.13	Not stated	10 Jun 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
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

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

Test Engineers:	Mark Percival & Sandeep Bharat	Test Dates:	07 May 2013 & 10 May 2013
Test Sample Serial Number:	621D1890701306AH00141		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9 / RSS-210 A8.5
Test Method Used:	As detailed in ANSI C63.10 Sections 6.9.2

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	35 to 39

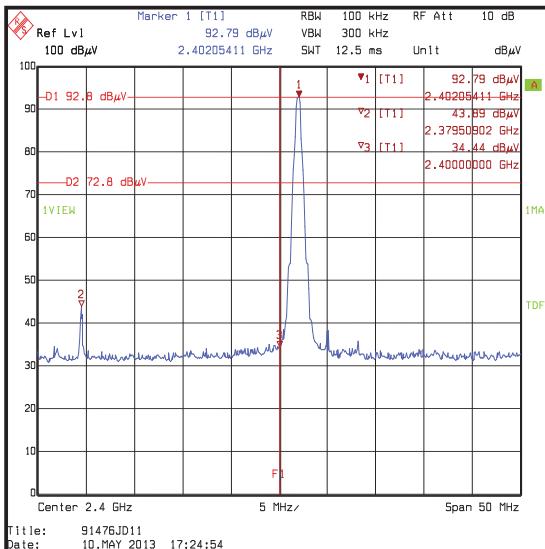
Note(s):

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. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent band (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 band (where a higher level emission was present). Marker frequencies and levels were recorded.
4. * -20 dBc limit.
5. ** The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.

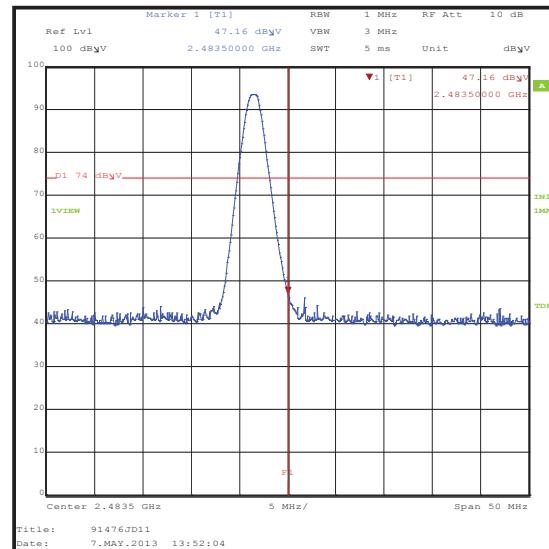
Transmitter Band Edge Radiated Emissions (continued)Results: Static Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2379.678	Vertical	49.7	54.0**	4.3	Complied
2400.0	Vertical	34.4	72.8*	38.4	Complied
2483.5	Horizontal	47.2	74.0	26.8	Complied

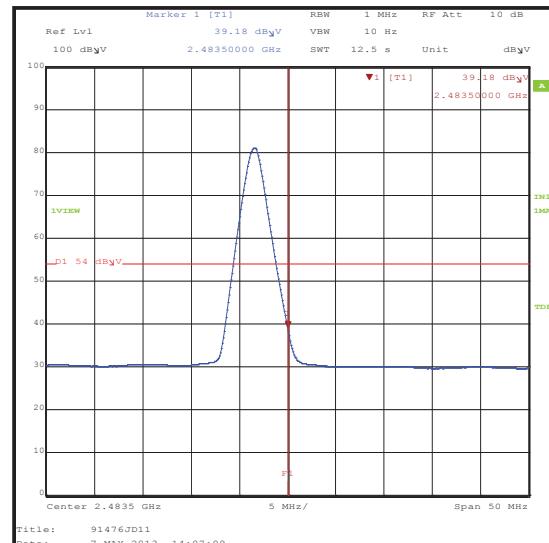
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	39.2	54.0	14.8	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static

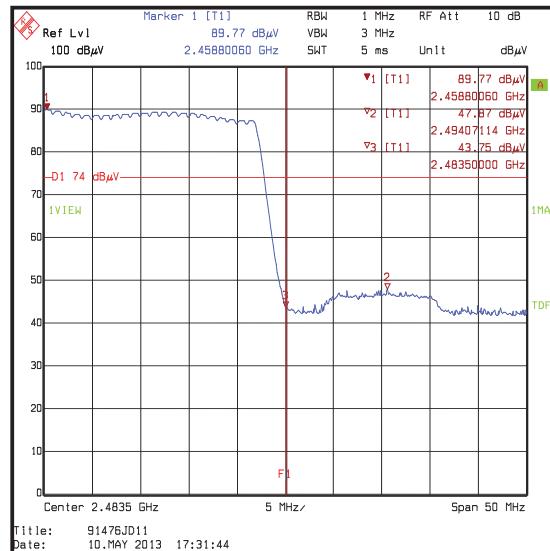
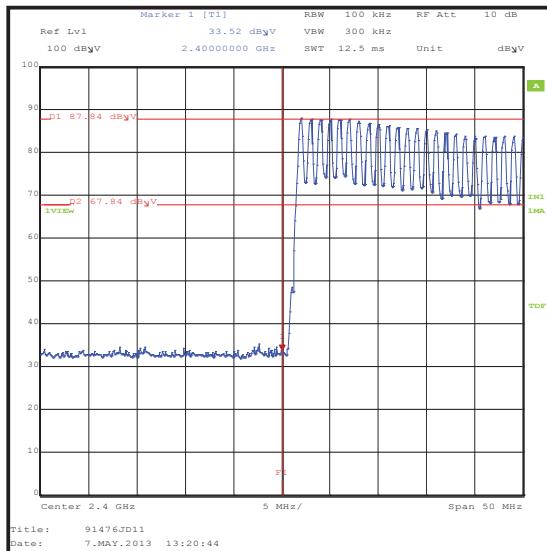


Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)Results: Hopping Mode / DH5

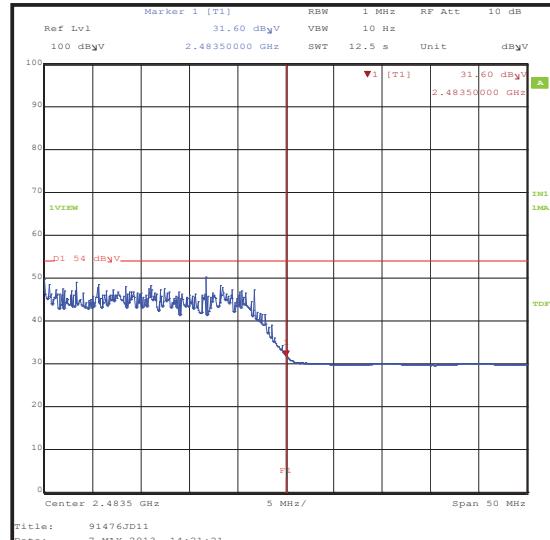
Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Horizontal	33.5	67.8*	34.3	Complied
2483.5	Vertical	43.8	74.0	30.2	Complied
2494.071	Vertical	47.9	74.0	26.1	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	31.6	54.0	22.4	Complied



Lower Band Edge Peak Hopping

Upper Band Edge Peak Hopping



Upper Band Edge Average Hopping

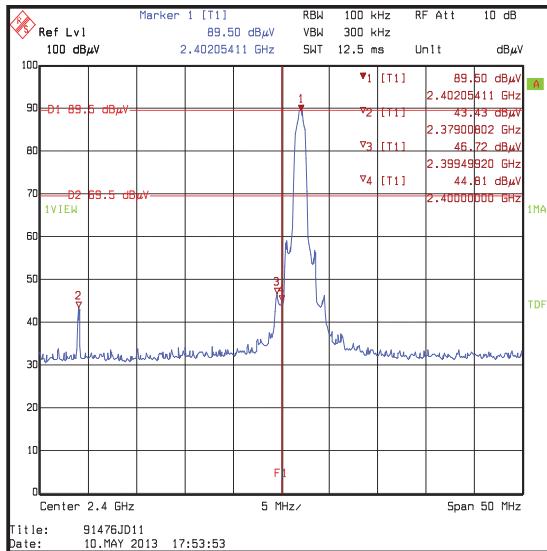
Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2379.678	Vertical	49.7	54.0**	4.3	Complied
2399.499	Vertical	46.7	69.5*	22.8	Complied
2400.0	Vertical	44.8	69.5*	24.7	Complied
2483.5	Horizontal	58.1	74.0	15.9	Complied

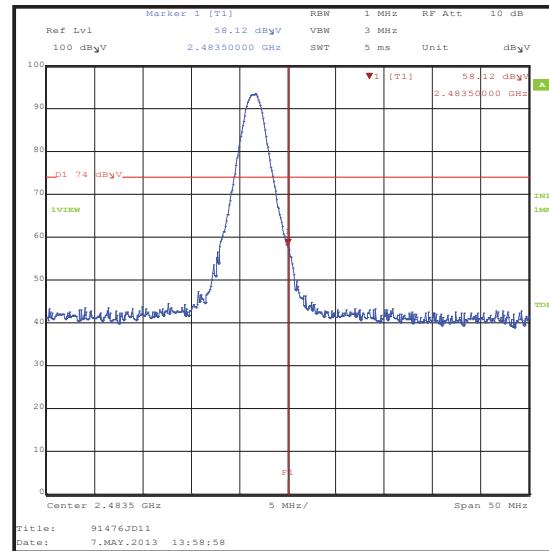
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	40.1	54.0	13.9	Complied

Transmitter Band Edge Radiated Emissions (continued)

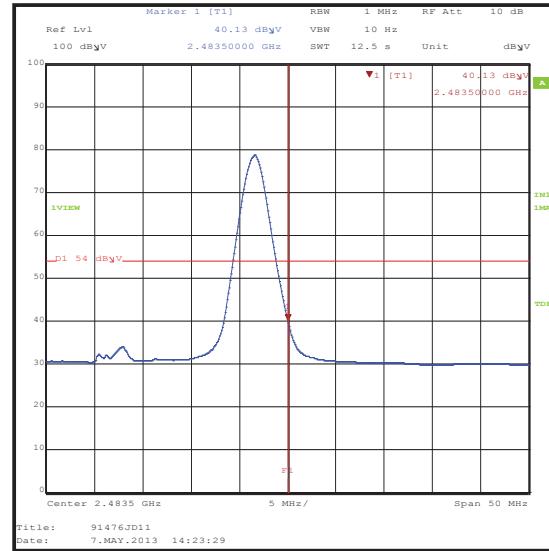
Results: Static Mode / 2DHS



Lower Band Edge Peak Static



Upper Band Edge Peak Static



Upper Band Edge Average Static

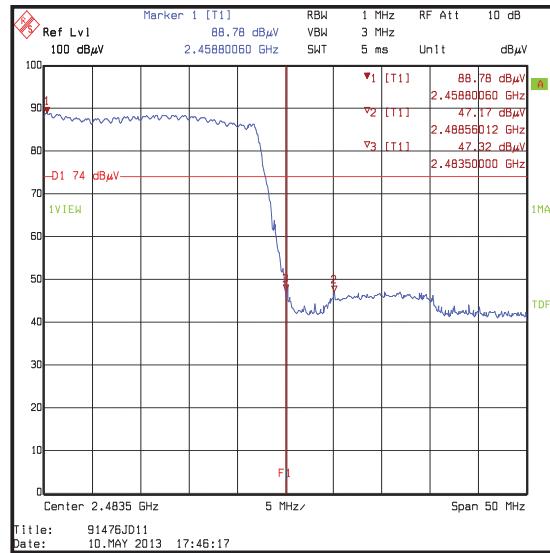
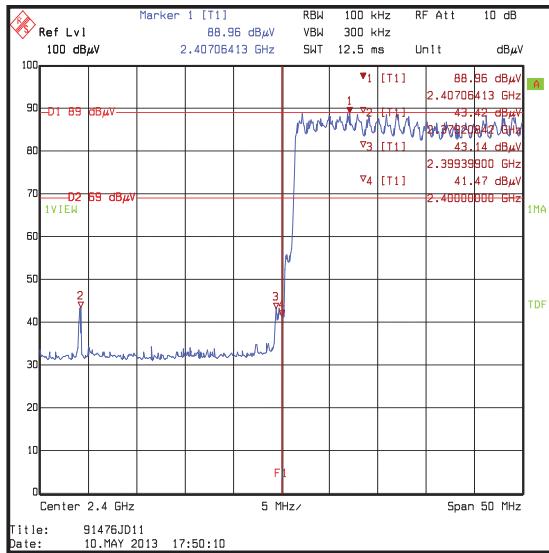
Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2379.678	Vertical	49.7	54.0**	4.3	Complied
2399.4	Vertical	43.1	69.0*	25.9	Complied
2400.0	Vertical	41.5	69.0*	27.5	Complied
2483.5	Vertical	47.3	74.0	26.7	Complied
2488.560	Vertical	47.2	74.0	26.8	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	31.8	54.0	22.2	Complied

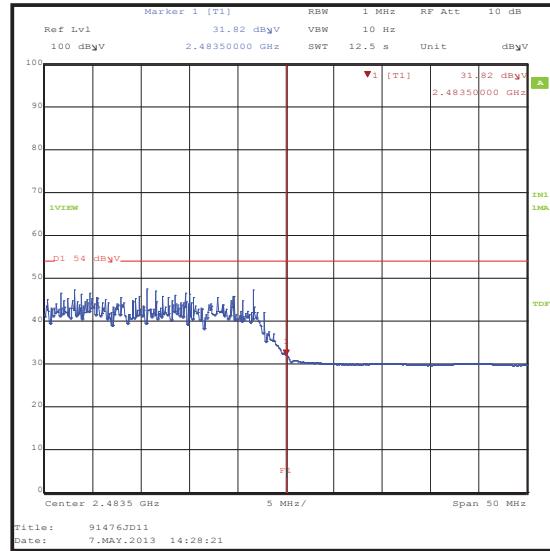
Transmitter Band Edge Radiated Emissions (continued)

Results: Hopping Mode / 2DH5



Lower Band Edge Peak Hopping

Upper Band Edge Peak Hopping

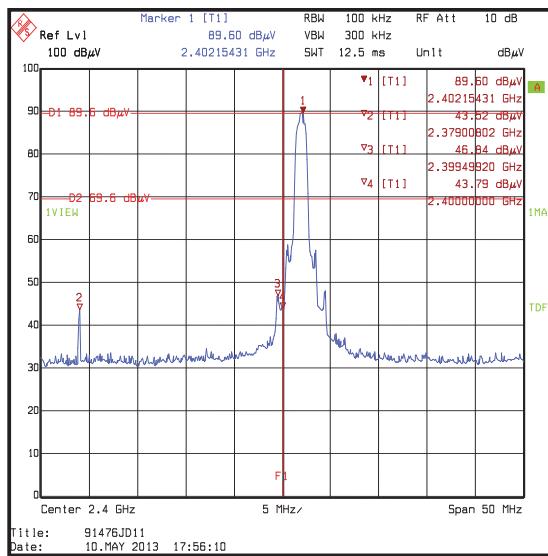
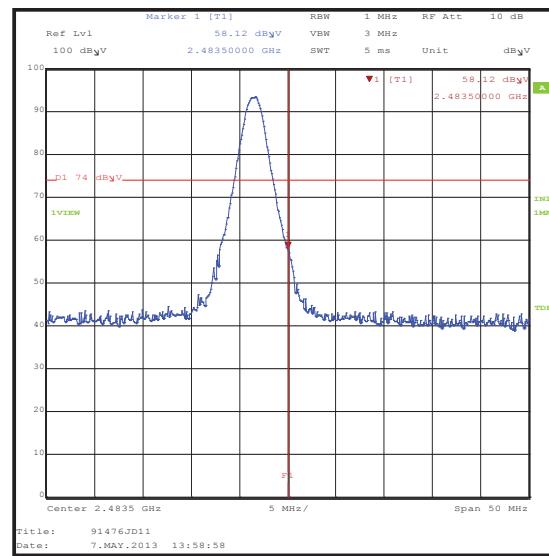
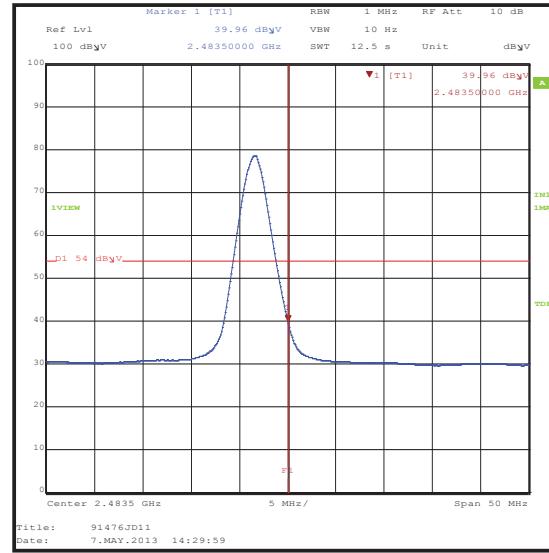


Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2379.678	Vertical	49.7	54.0**	4.3	Complied
2399.499	Vertical	46.8	69.6*	22.8	Complied
2400.0	Vertical	43.8	69.6*	25.8	Complied
2483.5	Horizontal	58.1	74.0	15.9	Complied

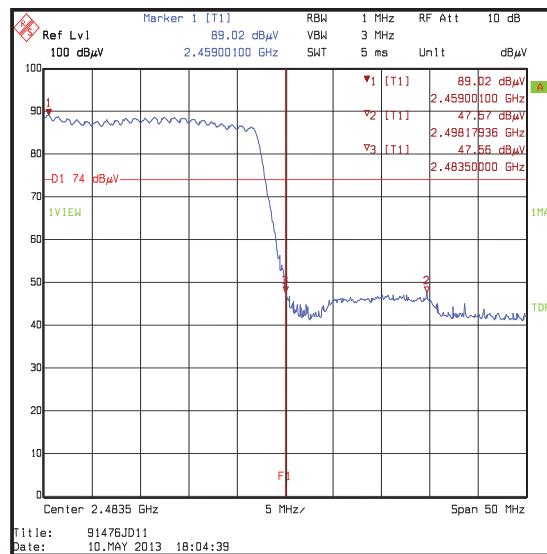
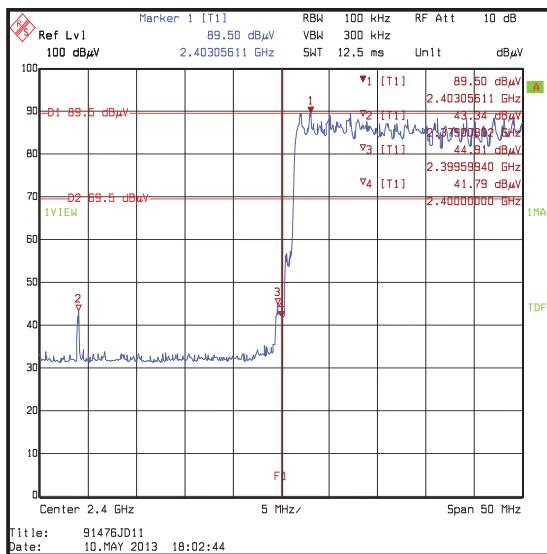
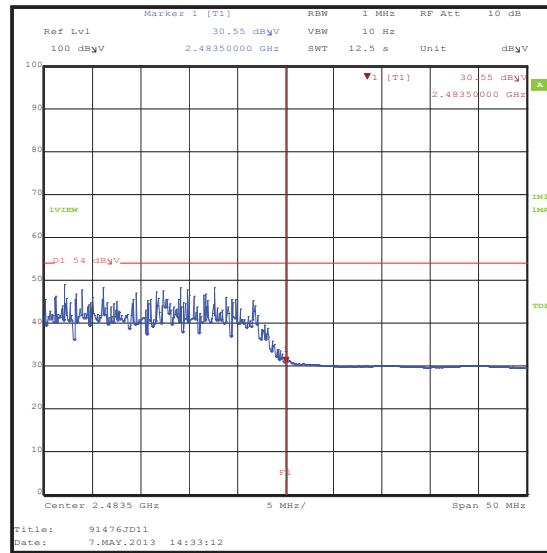
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	40.0	54.0	14.0	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 3DH5****Lower Band Edge Peak Static****Upper Band Edge Peak Static****Upper Band Edge Average Static**

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2379.678	Vertical	49.7	54.0**	4.3	Complied
2399.599	Vertical	44.9	69.5*	24.6	Complied
2400.0	Vertical	41.8	69.5*	27.7	Complied
2483.5	Vertical	47.6	74.0	26.4	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	30.6	54.0	23.4	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 3DH5****Lower Band Edge Peak Hopping****Upper Band Edge Peak Hopping****Upper Band Edge Average Hopping****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermometer/ Hygrometer Station	JM Handelpunkt	30.5015.13	Not stated	10 Jun 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842659/016	13 Aug 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

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
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Carrier Frequency Separation	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
Average Time of Occupancy	2.4 GHz to 2.4835 GHz	95%	±0.3 ns
20 dB 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 BCU and Loader updated, Industry Canada certification number updated
3.0	-	-	Minor updates to sections 3.1, 3.2, 3.5 & 4.2