TEST REPORT

Test Report No. : UL-RPT-RP90575JD03A

Manufacturer	:	Bluegiga Technologies OY
Model No.	:	BT111
FCC ID	:	QOQBT111
IC Certification No.	:	5123A-BGTBT111
Technology	:	Bluetooth – Basic Rate & EDR
Test Standard(s)	:	FCC Parts 15.107(a), 15.109, 15.207, 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 4.6.1, 4.6.2, 4.6.3, 4.8, 4.9, 4.10, 6.1 & 7.2.4

1. This test report shall not be reproduced in full or partial, without the written approval of RFI Global Services Ltd trading as UL.
2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0

Date of Issue: 07 December 2012

Checked by:

Sarah Williams
WiSE Laboratory Engineer

Issued by :

pp

John Newell
Group Quality Manager, WiSE
Basingstoke,
UL Verification Services

0644

This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its' terms of accreditation.

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Table of Contents

1. Customer Information

Company Name:	Bluegiga Technologies OY
Address:	Sinikalliontie 5A FIN - 02631 Espoo Finland

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.107 and 47CFR15.109
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart B (Unintentional Radiators) - Sections 15.107 and 15.109
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 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:	RFI Global Services Ltd trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	08 November 2012 to 05 December 2012

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Result
Part 15.107(a)	RSS-Gen 7.2.4	Receiver/Idle Mode AC Conducted Emissions	✓
Part 15.109	RSS-Gen 4.10/6.1	Receiver/Idle Mode Radiated Spurious Emissions	✓
Part 15.207	RSS-Gen 7.2.4	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(1)	RSS-Gen 4.6.1/4.6.3 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:	Bluegiga Technologies OY
Model Name or Number:	BT111
Test Sample Serial Number:	2 *(Radiated sample)*
Hardware Version Number:	1.0
Software Version Number:	1.0
FCC ID:	QOQBT111
Industry Canada Certification Number:	5123A-BGTBT111

Brand Name:	Bluegiga Technologies OY
Model Name or Number:	BT111
Test Sample Serial Number:	1 *(Conducted sample with RF port)*
Hardware Version Number:	1.0
Software Version Number:	1.0
FCC ID:	QOQBT111
Industry Canada Certification Number:	5123A-BGTBT111

3.2. Description of EUT

The equipment under test was a *Bluetooth* Smart Ready HCI Module.

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:	*Bluetooth*		
Power Supply Requirement:	Nominal	5 VDC	
Type of Unit:	Transceiver		
Channel Spacing:	1 MHz		
Mode:	Basic Rate	Enhanced Data Rate	
Modulation:	GFSK	π/4-DQPSK	8DQPSK
Packet Type: (Maximum Payload)	DH5	2DH5	3DH5
Data Rate (Mbit/s):	1	2	3
Maximum Conducted Output Power:	7.65 dBm		
Antenna Gain:	0.5 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:

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	D610
Serial Number:	PCXX

Description:	Dual DC power supply
Brand Name:	TTi
Model Name or Number:	EL3020D
Serial Number:	249928

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Receive/Idle Mode.
- 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):

- Receive/Idle tests: Standalone, with the Bluetooth mode active but not transmitting.
- The EUT was powered via an external DC power supply.
- Controlled using a software application on the laptop PC supplied by the Customer. The application was used to enable continuous transmission and idle mode (enabled but not transmitting) and to select the test channels as required.
- For Transmit tests: A test computer with the above mentioned software application was used to place the EUT into Bluetooth modes.
- The EUT conducted sample was used for 6dB bandwidth, 99% emission bandwidth, power spectral density and maximum peak output power.
- The EUT radiated sample was used for AC conducted emissions and radiated spurious emissions tests.

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. Receiver/Idle Mode AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	03 December 2012
Test Sample Serial Number:	2		

FCC Reference:	Part 15.107(a)
Industry Canada Reference:	RSS-Gen 7.2.4
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	37

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.784	Live	36.6	56.0	19.4	Complied
1.788	Live	36.7	56.0	19.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.788	Live	31.4	46.0	14.6	Complied
2.679	Live	27.9	46.0	18.1	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)

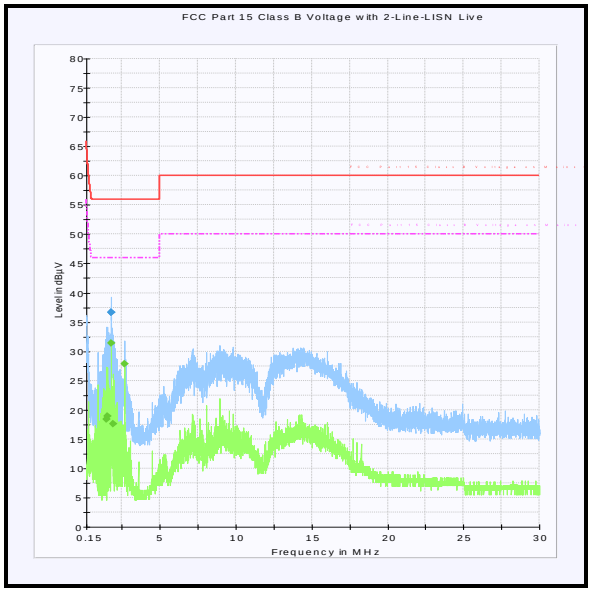
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.599	Neutral	32.8	56.0	23.2	Complied
1.694	Neutral	32.1	56.0	23.9	Complied
1.698	Neutral	32.6	56.0	23.4	Complied
1.725	Neutral	33.6	56.0	22.4	Complied
1.743	Neutral	32.1	56.0	23.9	Complied
1.788	Neutral	37.9	56.0	18.1	Complied
1.847	Neutral	33.1	56.0	22.9	Complied

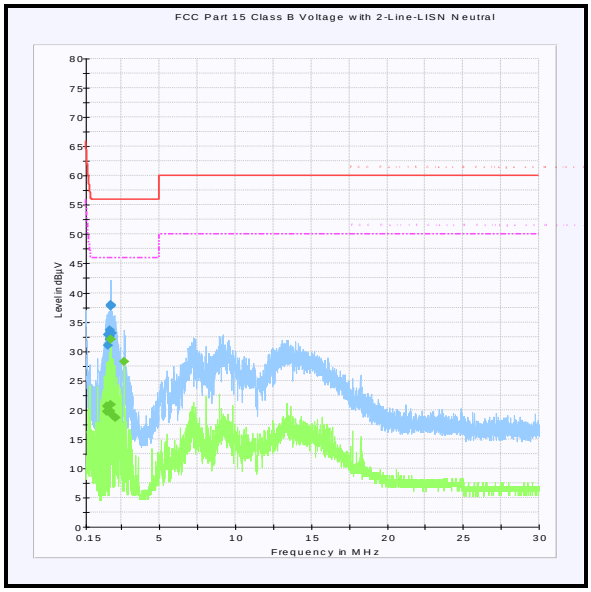
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.766	Neutral	20.9	46.0	25.1	Complied
1.784	Neutral	32.0	46.0	14.0	Complied
2.679	Neutral	28.2	46.0	17.8	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)



Live



Neutral

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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Feb 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	25 Feb 2013	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	09 Aug 2013	12

5.2.2. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	08 November 2012
Test Sample Serial Number:	2		

FCC Reference:	Part 15.109
Industry Canada Reference:	RSS-Gen 4.10/6
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 (%):	30

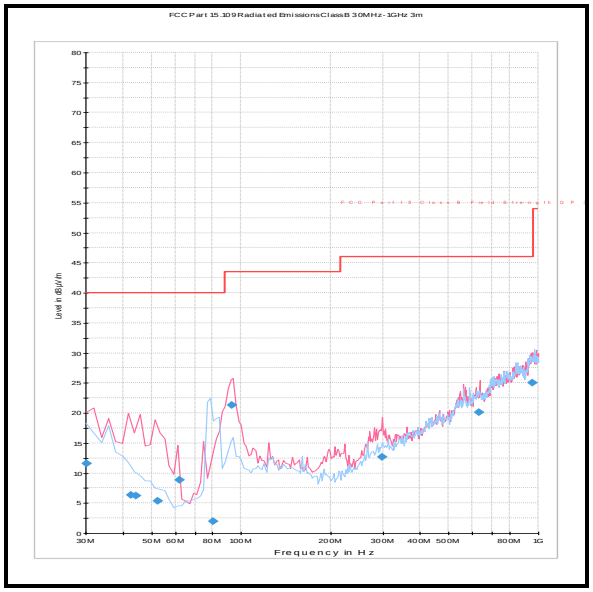
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. 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. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Results: Quasi Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
633.352	Vertical	20.1	46.0	25.9	Complied
953.035	Vertical	25.0	46.0	21.0	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)



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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
G0543	Amplifier	Sonoma	310N	230801	02 Jan 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	03 Feb 2013	12

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	21 November 2012
Test Sample Serial Number:	2		

FCC Reference:	Part 15.109
Industry Canada Reference:	RSS-Gen 4.10/6
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range:	1 GHz to 12.5 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	31

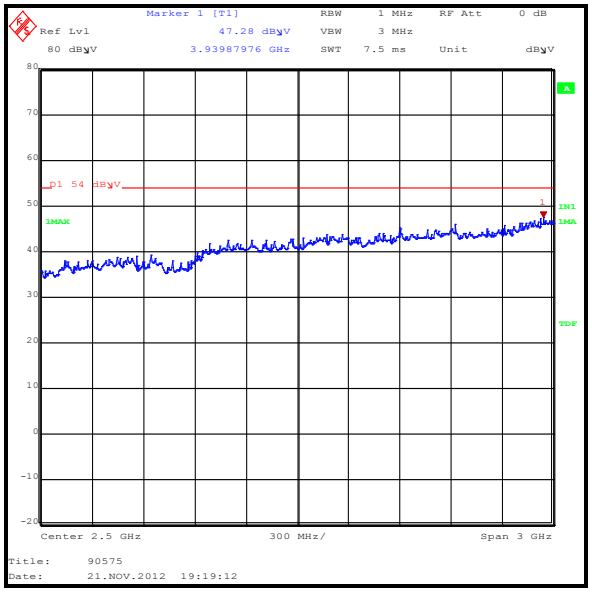
Note(s):

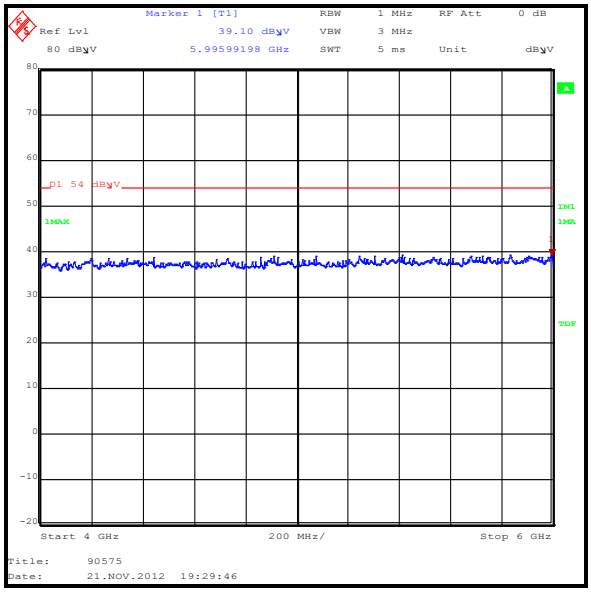
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded 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.
3. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI 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 (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

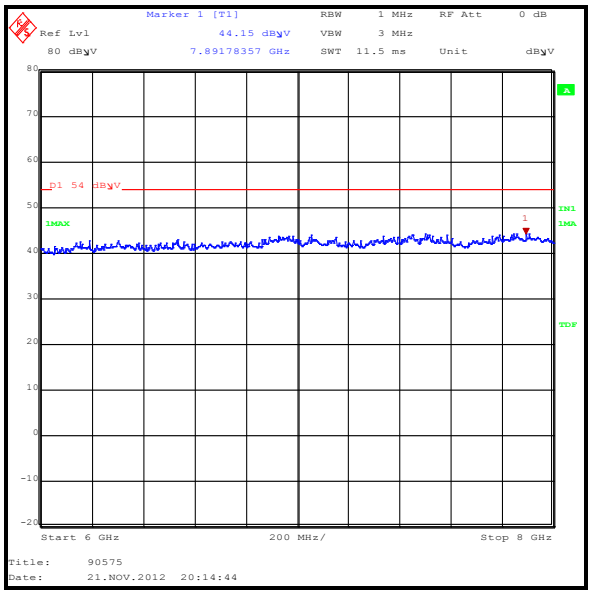
Results:

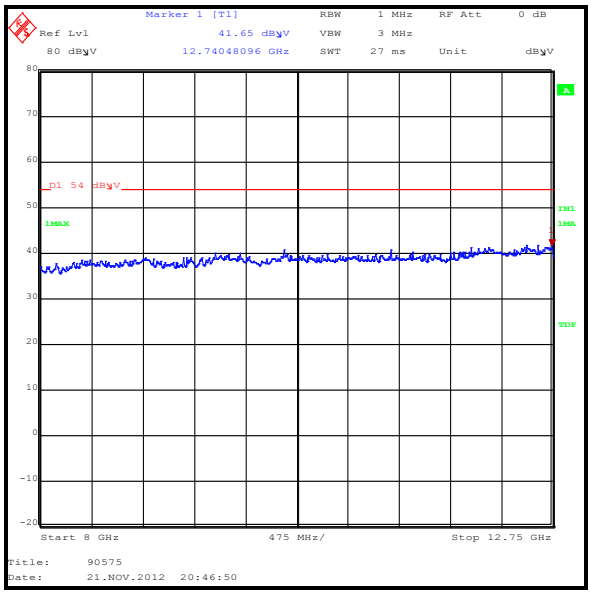
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3939.880	Vertical	47.3	54.0	6.7	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)









Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A288	Antenna	Chase	CBL6111A	1589	15 Aug 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12

5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	03 December 2012
Test Sample Serial Number:	2		

FCC Reference:	Part 15.207
Industry Canada Reference:	RSS-Gen 7.2.4
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	37

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.712	Live	35.3	56.0	20.7	Complied
1.784	Live	39.6	56.0	16.4	Complied
1.802	Live	37.7	56.0	18.3	Complied
1.815	Live	36.5	56.0	19.5	Complied
1.878	Live	34.5	56.0	21.5	Complied
1.923	Live	36.0	56.0	20.0	Complied
1.928	Live	36.6	56.0	19.4	Complied
1.937	Live	35.3	56.0	20.7	Complied
1.968	Live	35.7	56.0	20.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.671	Live	22.6	46.0	23.4	Complied
1.712	Live	23.3	46.0	22.7	Complied
1.784	Live	32.7	46.0	13.3	Complied
1.842	Live	28.7	46.0	17.3	Complied
1.900	Live	23.9	46.0	22.1	Complied
1.964	Live	22.9	46.0	23.1	Complied
1.973	Live	22.9	46.0	23.1	Complied
2.027	Live	23.7	46.0	22.3	Complied
2.054	Live	22.0	46.0	24.0	Complied

Transmitter AC Conducted Spurious Emissions (continued)

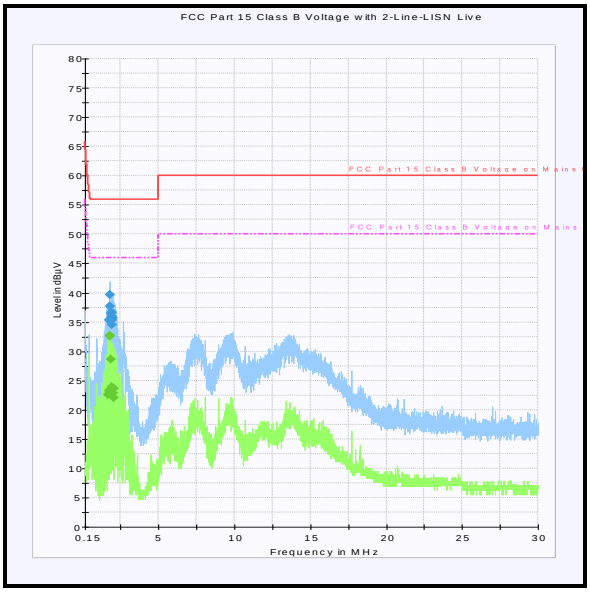
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.626	Neutral	32.9	56.0	23.1	Complied
1.698	Neutral	34.0	56.0	22.0	Complied
1.707	Neutral	34.6	56.0	21.4	Complied
1.716	Neutral	34.2	56.0	21.8	Complied
1.761	Neutral	34.0	56.0	22.0	Complied
1.806	Neutral	35.7	56.0	20.3	Complied
1.824	Neutral	34.0	56.0	22.0	Complied
1.941	Neutral	32.7	56.0	23.3	Complied
2.013	Neutral	33.7	56.0	22.3	Complied
2.036	Neutral	32.3	56.0	23.7	Complied

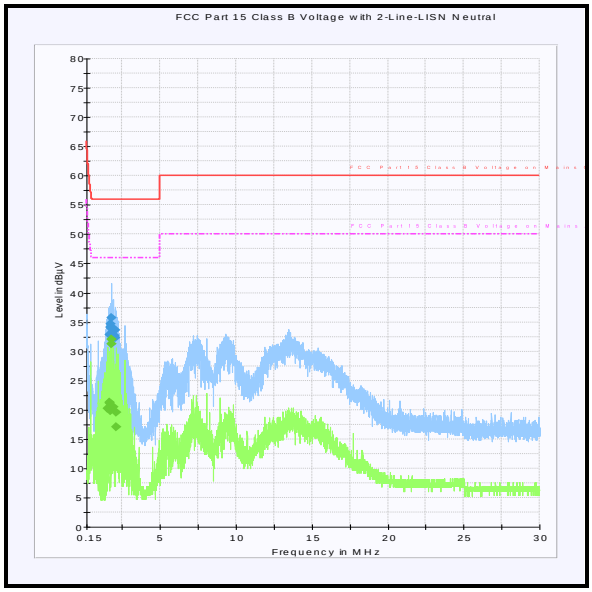
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.536	Neutral	20.2	46.0	25.8	Complied
1.640	Neutral	21.3	46.0	24.7	Complied
1.667	Neutral	21.1	46.0	24.9	Complied
1.712	Neutral	20.0	46.0	26.0	Complied
1.734	Neutral	19.9	46.0	26.1	Complied
1.784	Neutral	32.0	46.0	14.0	Complied
1.788	Neutral	31.3	46.0	14.7	Complied
1.901	Neutral	20.5	46.0	25.5	Complied
2.081	Neutral	19.6	46.0	26.4	Complied
2.094	Neutral	17.1	46.0	28.9	Complied

Transmitter AC Conducted Spurious Emissions (continued)



Live



Neutral

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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Feb 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	25 Feb 2013	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	09 Aug 2013	12

5.2.4.Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	19 November 2012
Test Sample Serial Number:	1		

FCC Reference:	Part 15.247(a)(1)
Industry Canada Reference:	RSS-Gen 4.6.2, RSS-210 A8.2(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.1

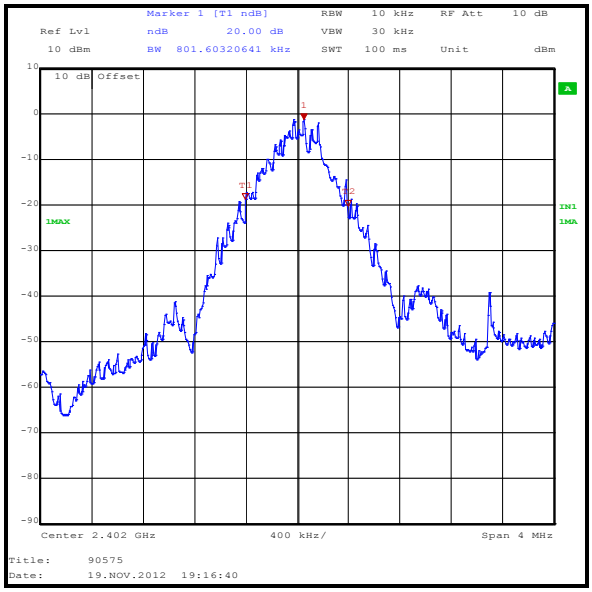
Environmental Conditions:

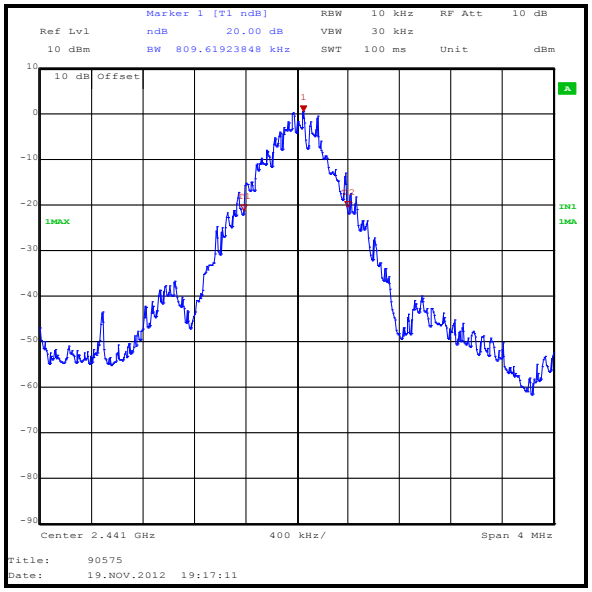
Temperature (°C):	24
Relative Humidity (%):	37

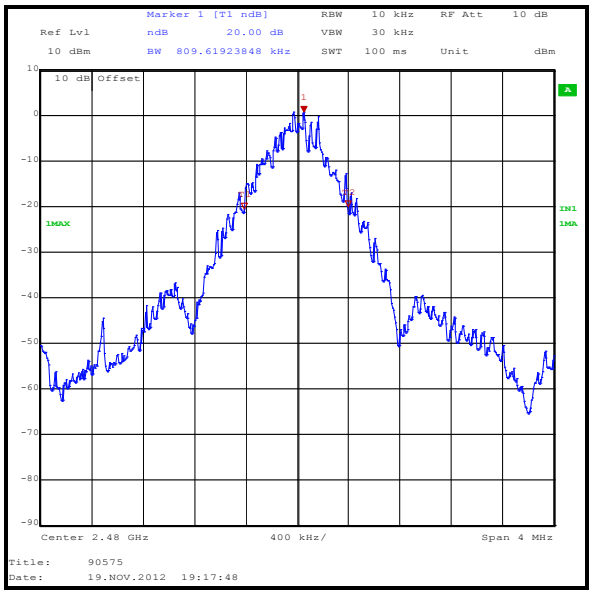
Transmitter 20 dB Bandwidth (continued)

Results DH5:

Channel	20 dB Bandwidth (kHz)
Bottom	801.603
Middle	809.619
Top	809.619



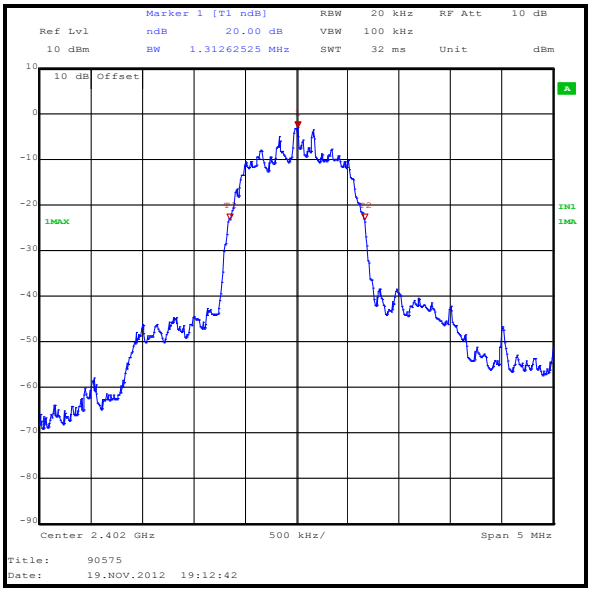


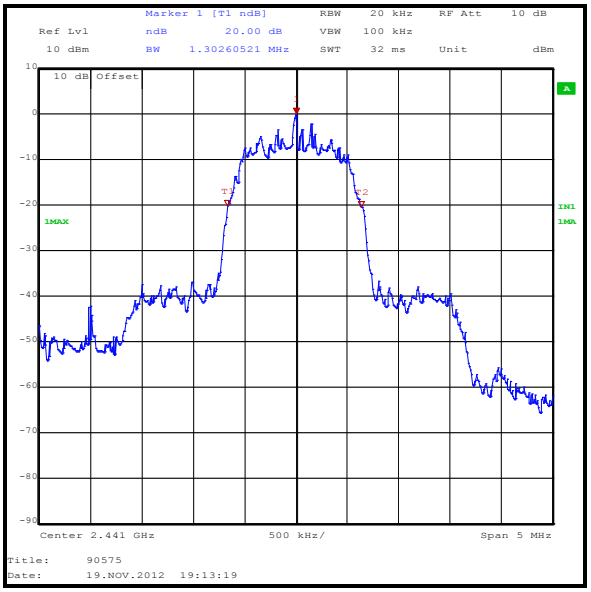


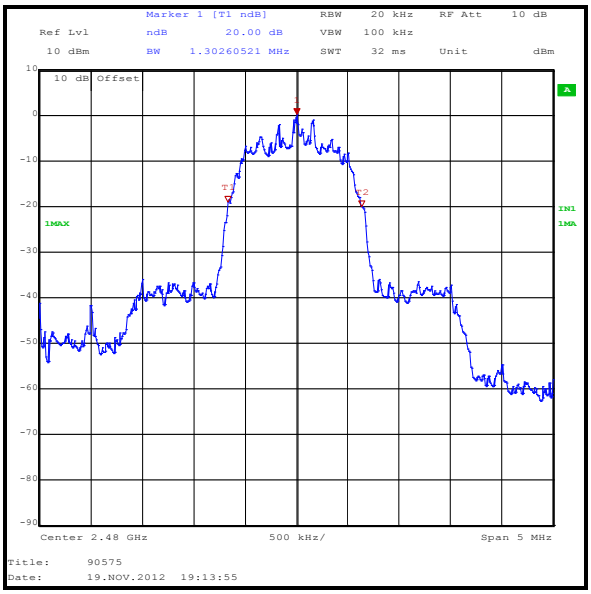
Transmitter 20 dB Bandwidth (continued)

Results 2DH5:

Channel	20 dB Bandwidth (kHz)
Bottom	1312.625
Middle	1302.605
Top	1302.605



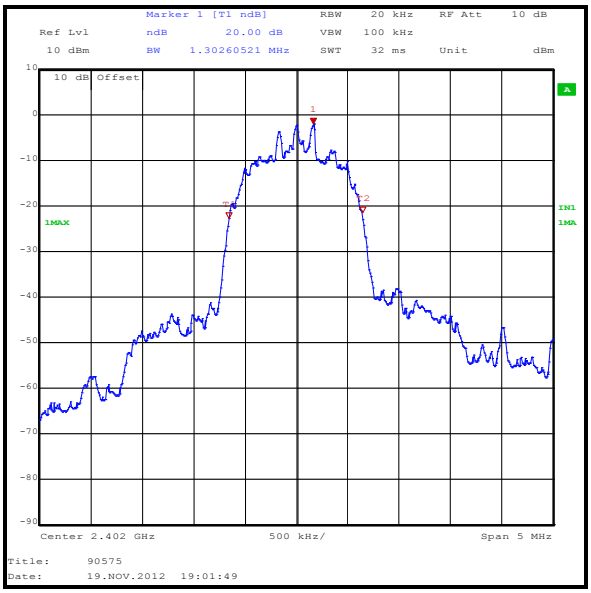


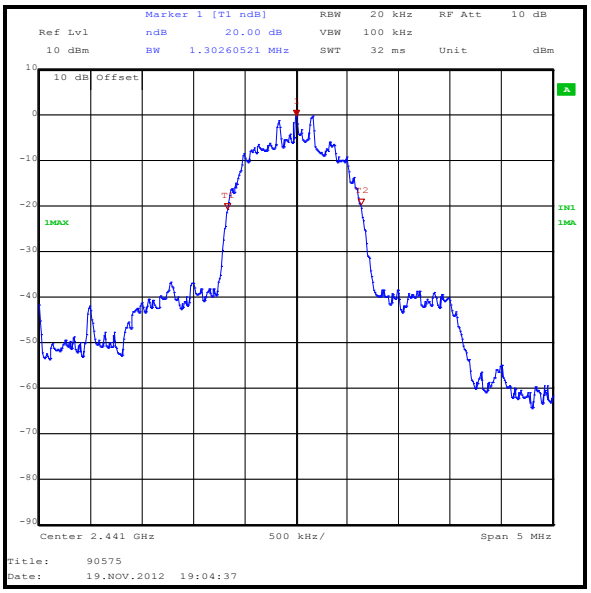


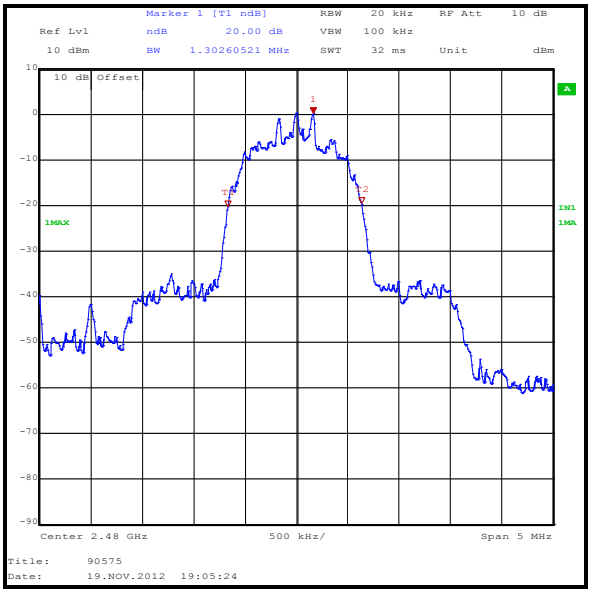
Transmitter 20 dB Bandwidth (continued)

Results 3DH5:

Channel	20 dB Bandwidth (kHz)
Bottom	1302.605
Middle	1302.605
Top	1302.605







Transmitter 20 dB Bandwidth (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12
A1555	RF Attenuator	Weinschel Engineering	6	L8652	04 Apr 2013	12
A2137	Directional Coupler	Atlan TecRF	A4224-10	26861	Calibrated before use	-
S021	DC Power Supply Unit	TTI	CPX200	061034	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	30 Jul 2013	12

5.2.5. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	19 November 2012
Test Sample Serial Number:	1		

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:

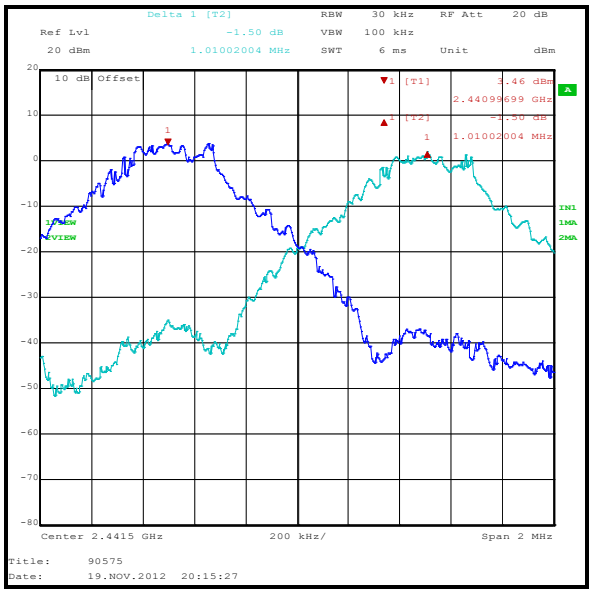
Temperature (°C):	24
Relative Humidity (%):	37

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.

Results: DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1010.020	539.746	470.274	Complied



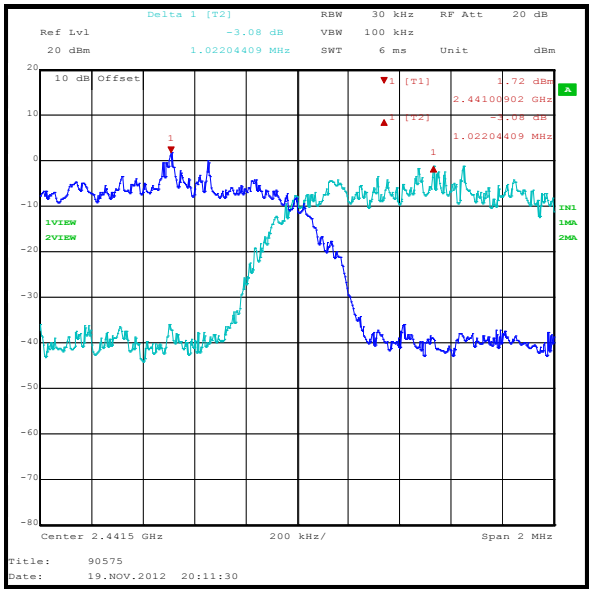
Transmitter Carrier Frequency Separation (continued)

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.

Results: 2DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1022.044	868.403	153.641	Complied



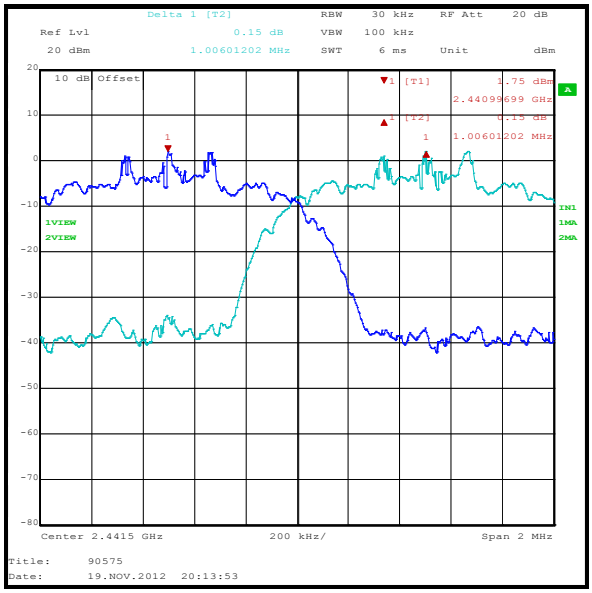
Transmitter Carrier Frequency Separation (continued)

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.

Results: 3DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1006.012	868.403	137.609	Complied



Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12
A1555	RF Attenuator	Weinschel Engineering	6	L8652	04 Apr 2013	12
A2137	Directional Coupler	Atlan TecRF	A4224-10	26861	Calibrated before use	-
S021	DC Power Supply Unit	TTI	CPX200	061034	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	30 Jul 2013	12

5.2.6. Transmitter Number of Hopping Frequencies and Average Time of Occupancy

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	19 November 2012
Test Sample Serial Number:	1		

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):	24
Relative Humidity (%):	37

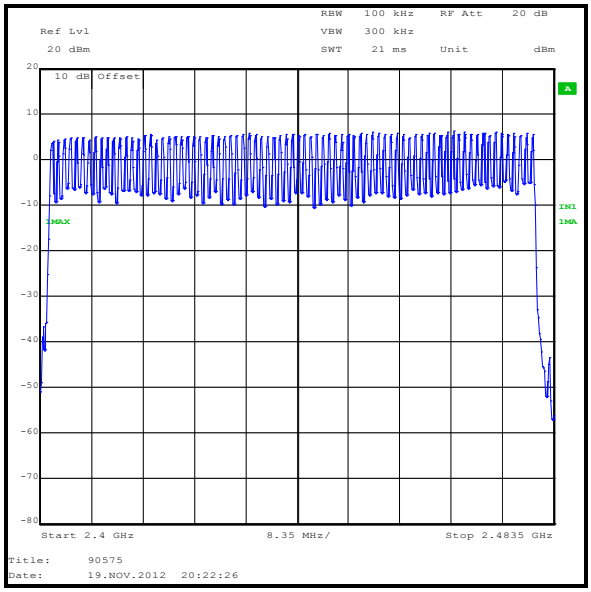
Note(s):

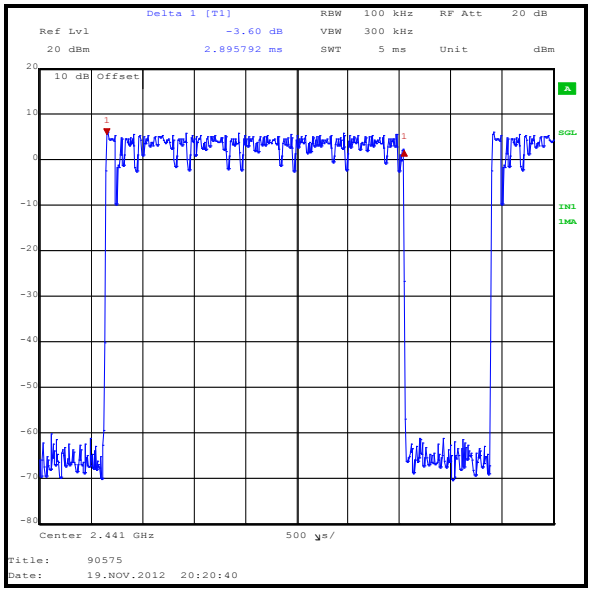
1. Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.

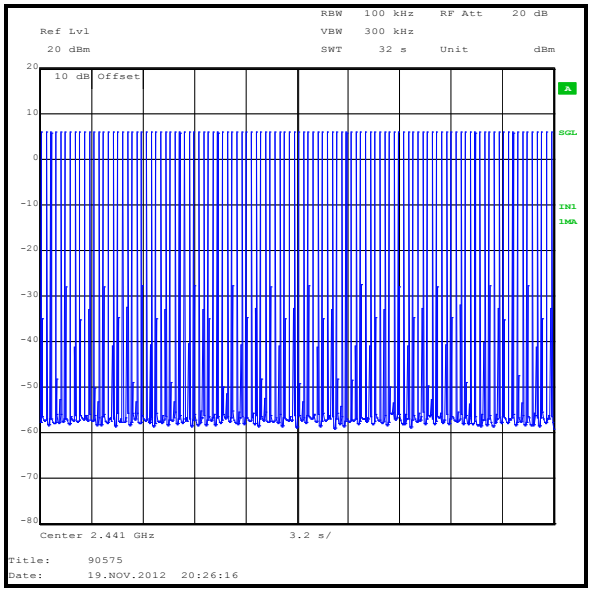
Results:

Emission Width (μs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2895.792	110	0.319	0.4	0.081	Complied

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







Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12
A1555	RF Attenuator	Weinschel Engineering	6	L8652	04 Apr 2013	12
A2137	Directional Coupler	Atlan TecRF	A4224-10	26861	Calibrated before use	-
S021	DC Power Supply Unit	TTI	CPX200	061034	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	30 Jul 2013	12

5.2.7. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	20 November 2012
Test Sample Serial Number:	1		

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):	24
Relative Humidity (%):	37

Transmitter Maximum Peak Output Power (continued)

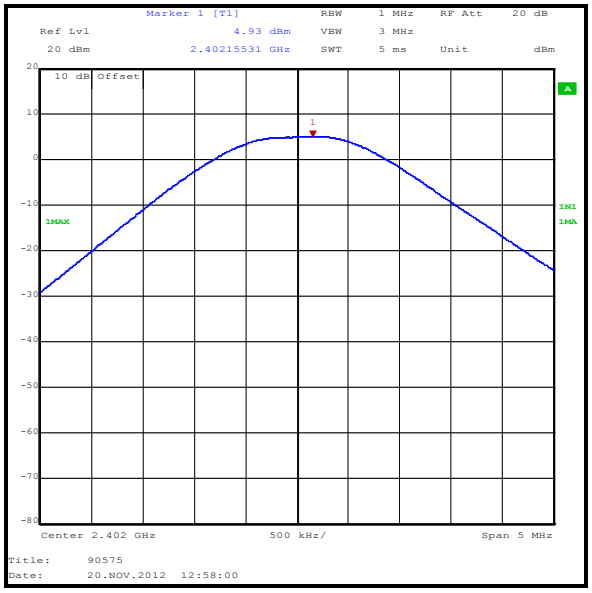
Results: DH5

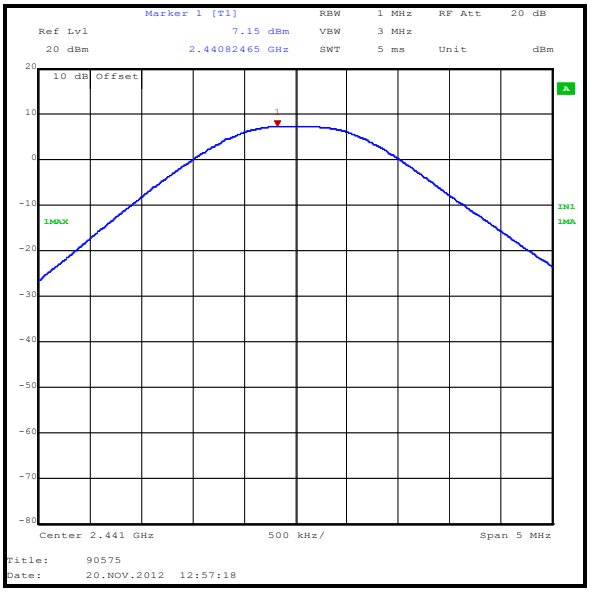
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.9	30.0	25.1	Complied
Middle	7.2	30.0	22.8	Complied
Top	7.2	30.0	22.8	Complied

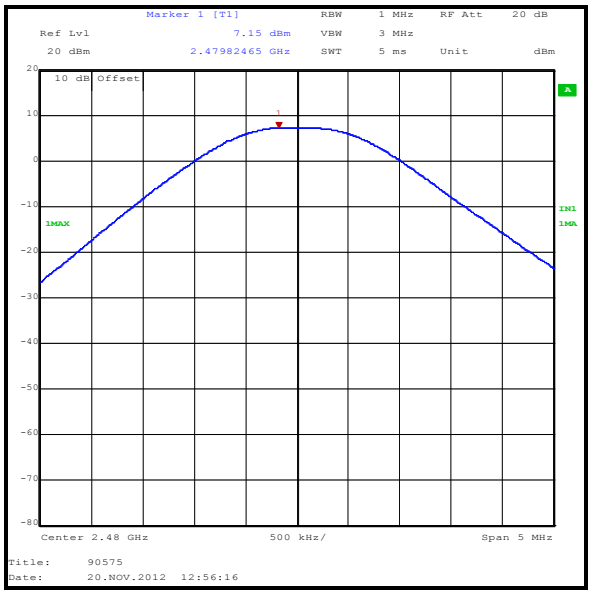
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.9	0.5	5.4	36.0	30.6	Complied
Middle	7.2	0.5	7.7	36.0	28.3	Complied
Top	7.2	0.5	7.7	36.0	28.3	Complied

Transmitter Maximum Peak Output Power (continued)

Results: DH5







Transmitter Maximum Peak Output Power (continued)

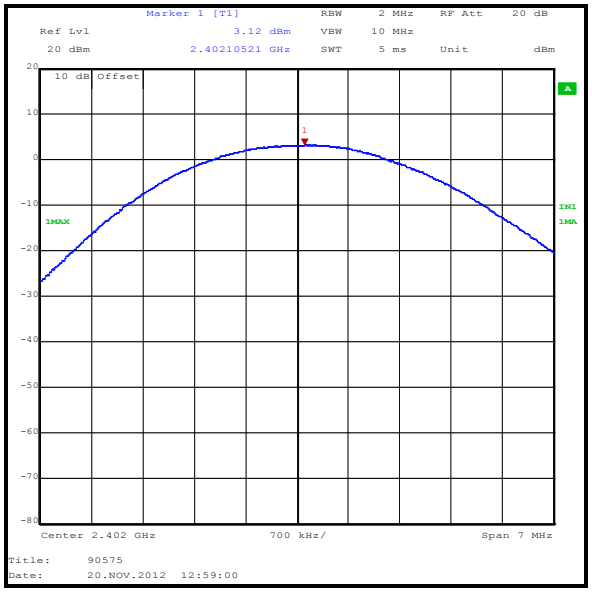
Results: 2DH5

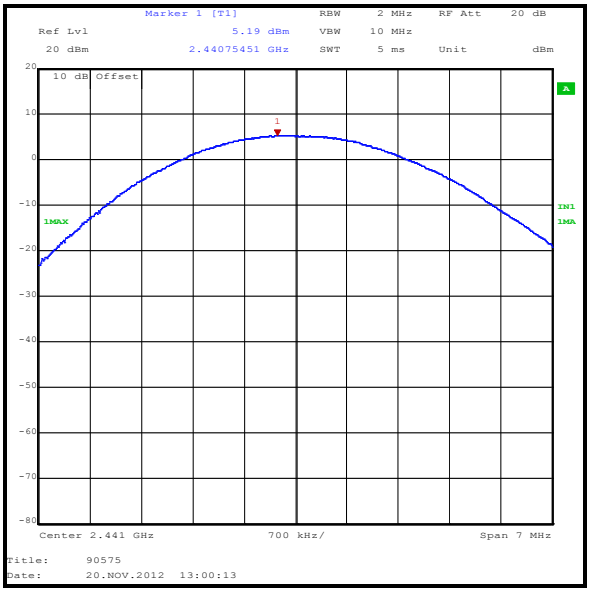
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	3.1	21.0	17.9	Complied
Middle	5.2	21.0	15.8	Complied
Top	5.4	21.0	15.6	Complied

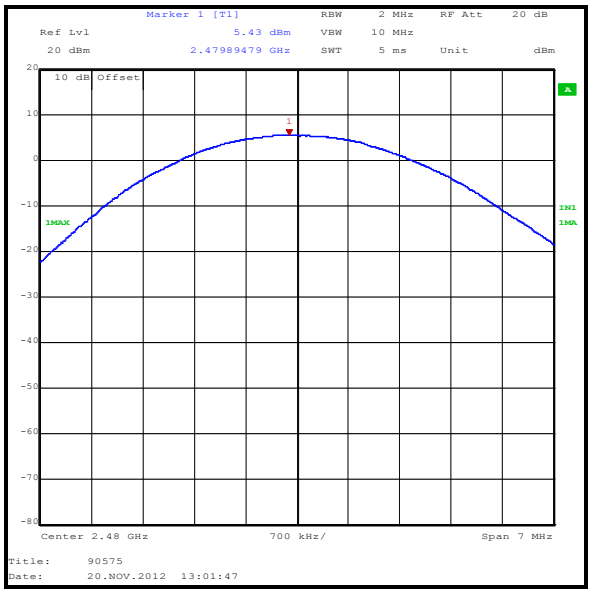
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3.1	0.5	3.6	27.0	23.4	Complied
Middle	5.2	0.5	5.7	27.0	21.3	Complied
Top	5.4	0.5	5.9	27.0	21.1	Complied

Transmitter Maximum Peak Output Power (continued)

Results: 2DH5







Transmitter Maximum Peak Output Power (continued)

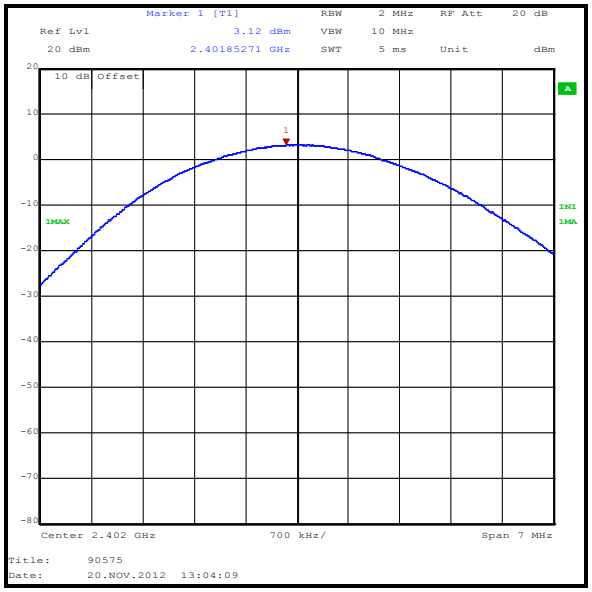
Results: 3DH5

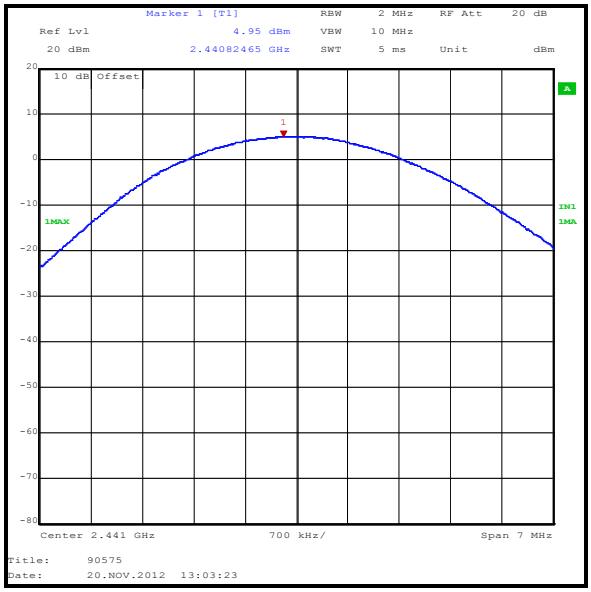
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	3.1	21.0	17.9	Complied
Middle	5.0	21.0	16.0	Complied
Top	5.7	21.0	15.3	Complied

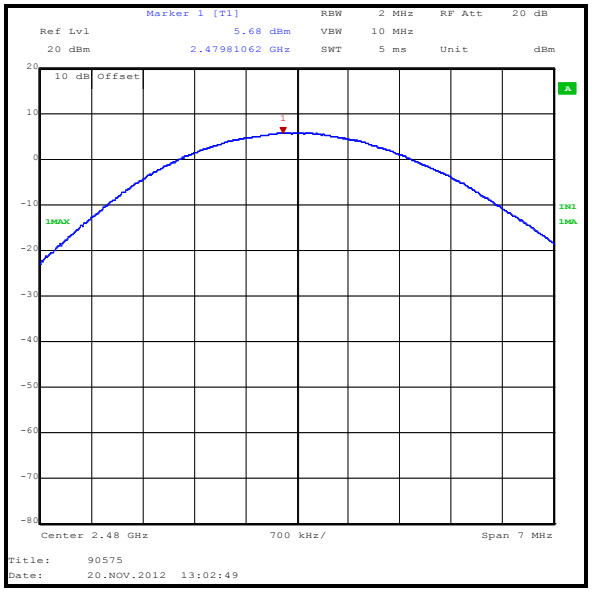
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3.1	0.5	3.6	27.0	23.4	Complied
Middle	5.0	0.5	5.5	27.0	21.5	Complied
Top	5.7	0.5	6.2	27.0	20.8	Complied

Transmitter Maximum Peak Output Power (continued)

Results: 3DH5







Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12
A1555	RF Attenuator	Weinschel Engineering	6	L8652	04 Apr 2013	12
A2137	Directional Coupler	Atlan TecRF	A4224-10	26861	Calibrated before use	-
S021	DC Power Supply Unit	TTI	CPX200	061034	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	30 Jul 2013	12

5.2.8. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	08 November 2012
Test Sample Serial Number:	2		

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):	26
Relative Humidity (%):	31

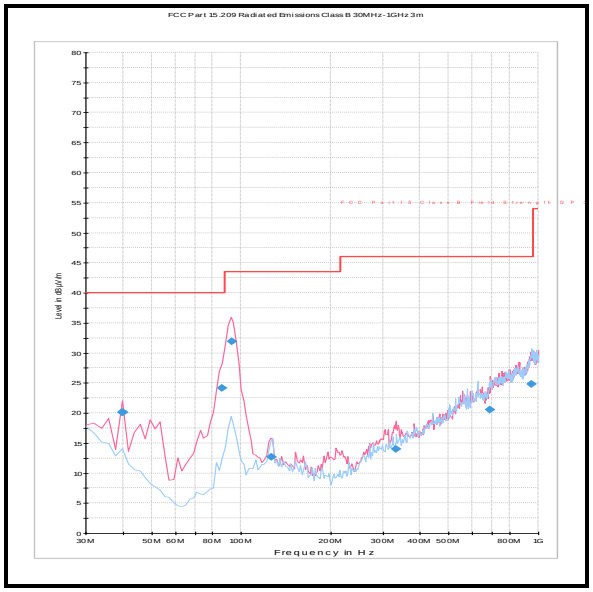
Note(s):

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 measurement system noise floor.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Results: Quasi-Peak / DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
126.852	Vertical	12.7	43.5	30.8	Complied
332.058	Vertical	14.0	46.0	32.0	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:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
G0543	Amplifier	Sonoma	310N	230801	02 Jan 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	03 Feb 2013	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	08 November 2012
Test Sample Serial Number:	2		

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. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental at 2480 MHz.
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 measurement system noise floor.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI 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 (RFI Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Radiated Emissions (continued)

Results: Peak Bottom Channel DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4804.346	Horizontal	56.8	74.0	17.2	Complied
7206.036	Horizontal	41.8	74.0	32.2	Complied

Results: Average Bottom Channel DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4804.346	Horizontal	46.8	54.0	7.2	Complied
7206.036	Horizontal	31.9	54.0	22.1	Complied

Results: Peak Middle Channel DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4882.035	Horizontal	60.5	74.0	13.5	Complied
7322.293	Horizontal	43.5	74.0	30.5	Complied

Results: Average Middle Channel DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4882.035	Horizontal	49.9	54.0	4.1	Complied
7322.293	Horizontal	35.6	54.0	18.4	Complied

Results: Peak Top Channel DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4959.694	Horizontal	59.1	74.0	14.9	Complied
7439.402	Horizontal	47.1	74.0	26.9	Complied

Results: Average Top Channel DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4959.694	Horizontal	49.1	54.0	4.9	Complied
7439.402	Horizontal	38.4	54.0	15.6	Complied

Transmitter Radiated Emissions (continued)

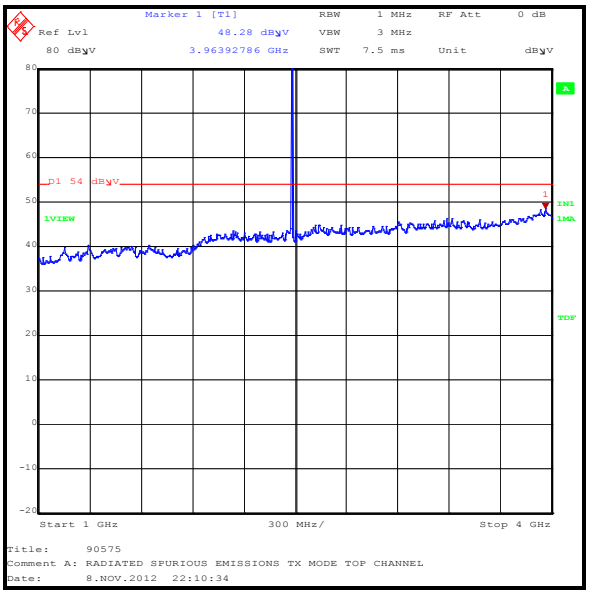
Results: Peak Hopping Mode DH5

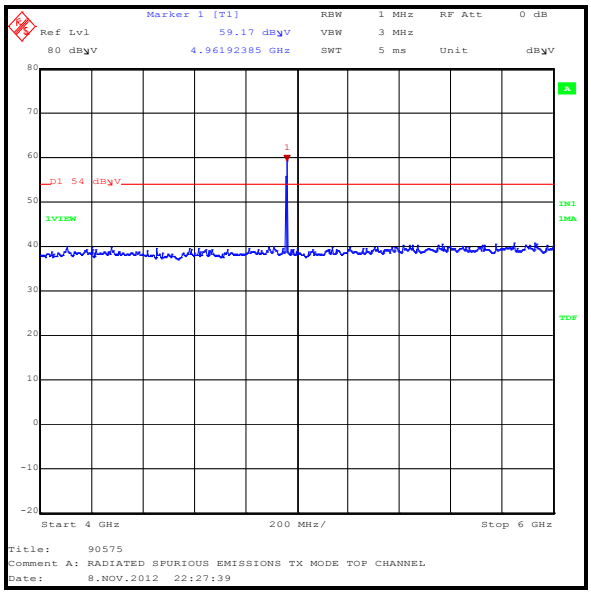
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4957.621	Horizontal	59.3	74.0	14.7	Complied
7439.495	Horizontal	46.4	74.0	27.6	Complied

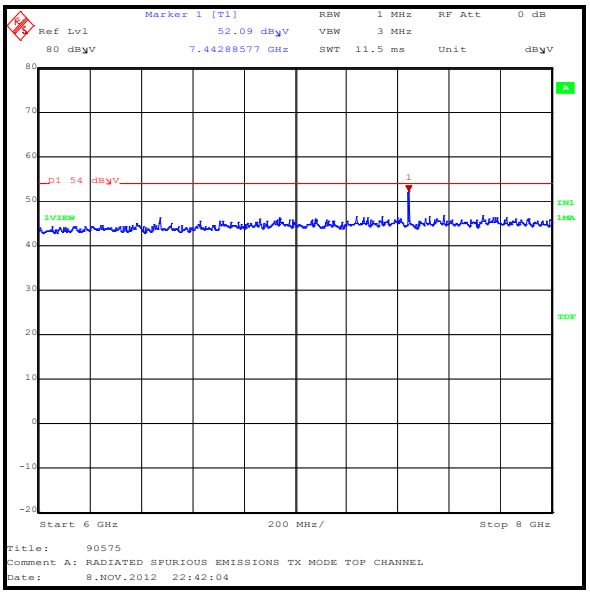
Results: Average Hopping Mode DH5

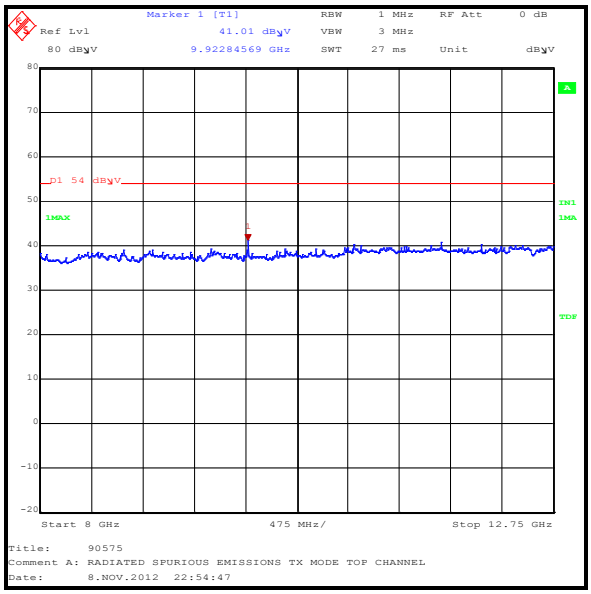
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4957.621	Horizontal	25.3	54.0	28.7	Complied
7439.495	Horizontal	23.8	54.0	30.2	Complied

Transmitter Radiated Emissions (continued)

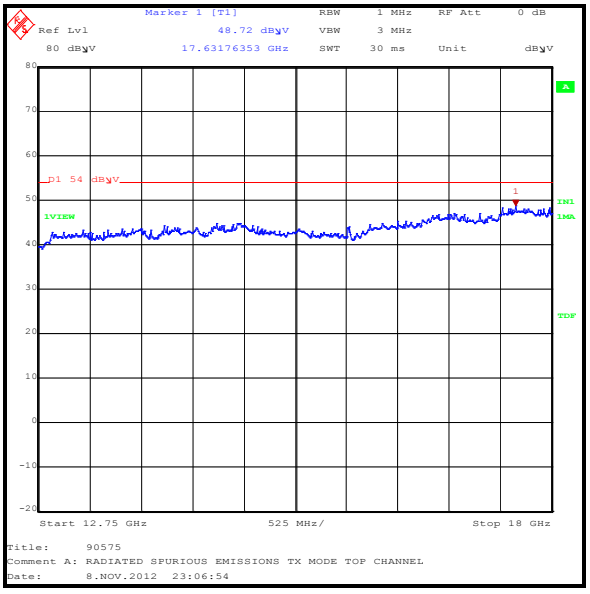


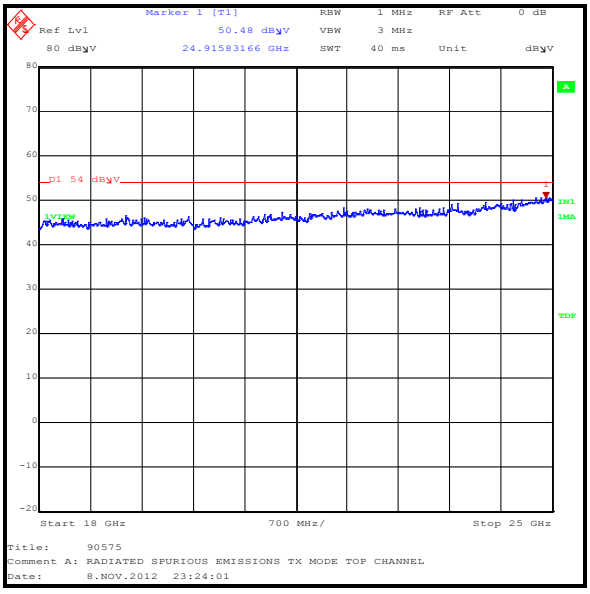






Transmitter Radiated Emissions (continued)





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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A288	Antenna	Chase	CBL6111A	1589	15 Aug 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12

5.2.9. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	05 December 2012
Test Sample Serial Number:	2		

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):	23
Relative Humidity (%):	30

Note(s):

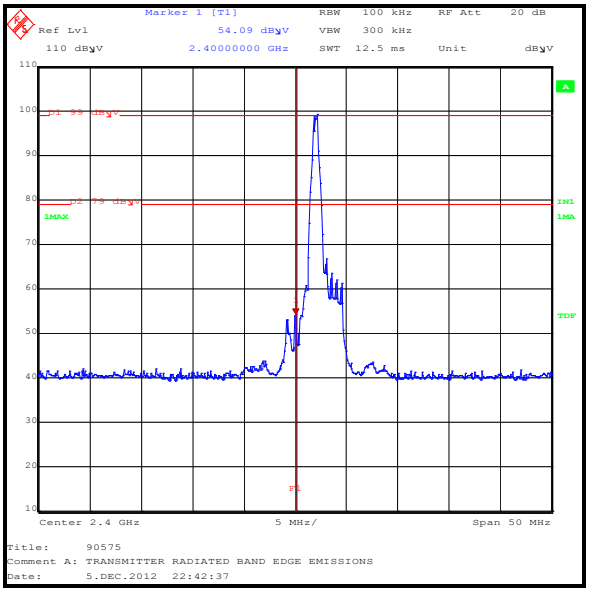
1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
2. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)

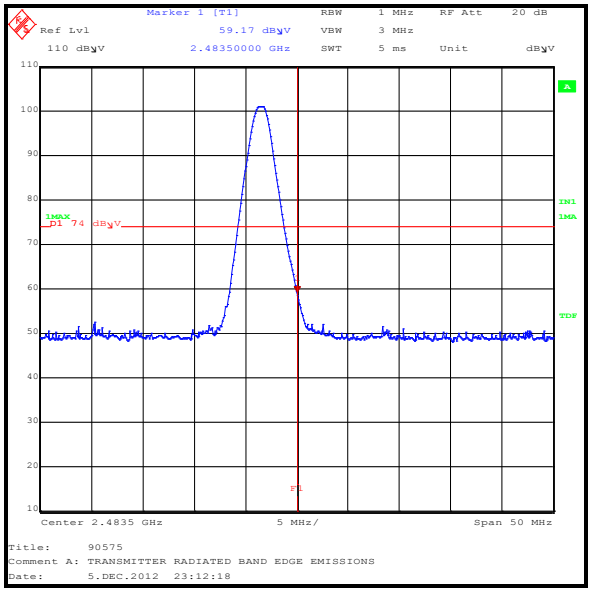
Results: Static Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Vertical	54.1	79.0*	24.9	Complied
2483.5	Vertical	59.2	74.0	14.8	Complied

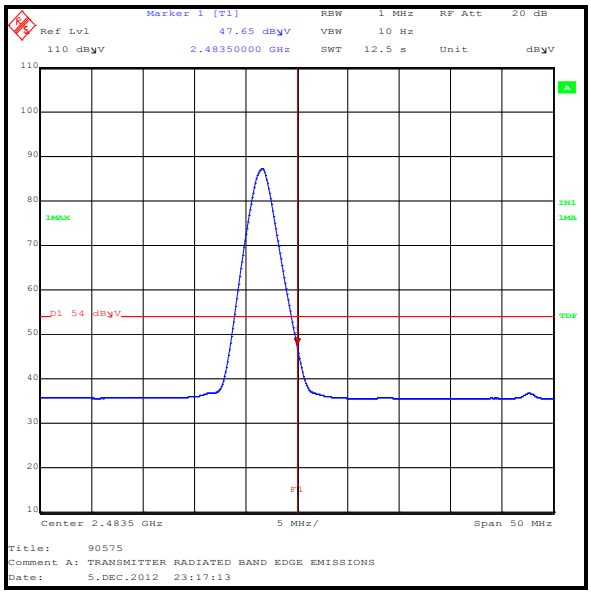
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	47.7	54.0	6.3	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



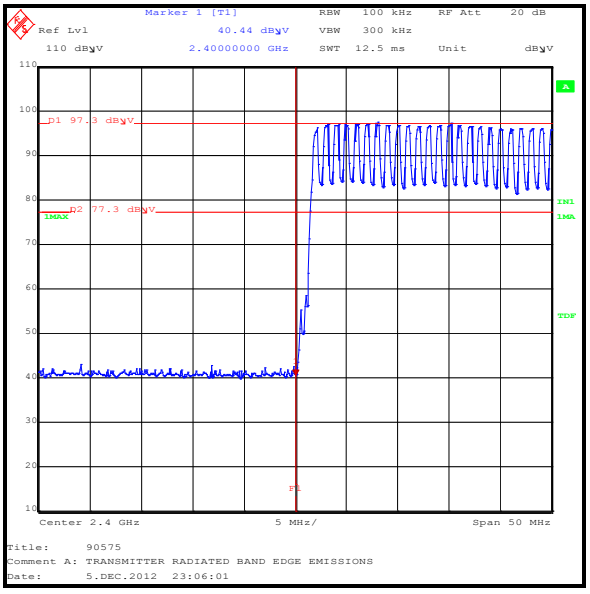
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

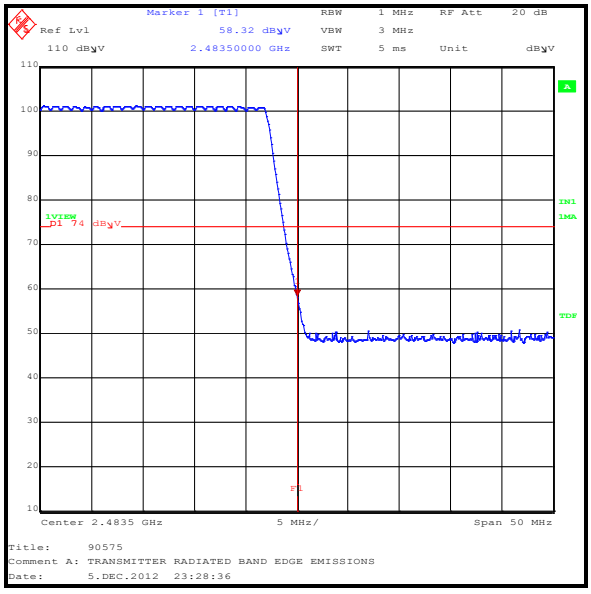
Results: Hopping Mode DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Vertical	40.4	77.3*	36.9	Complied
2483.5	Vertical	58.3	74.0	15.7	Complied

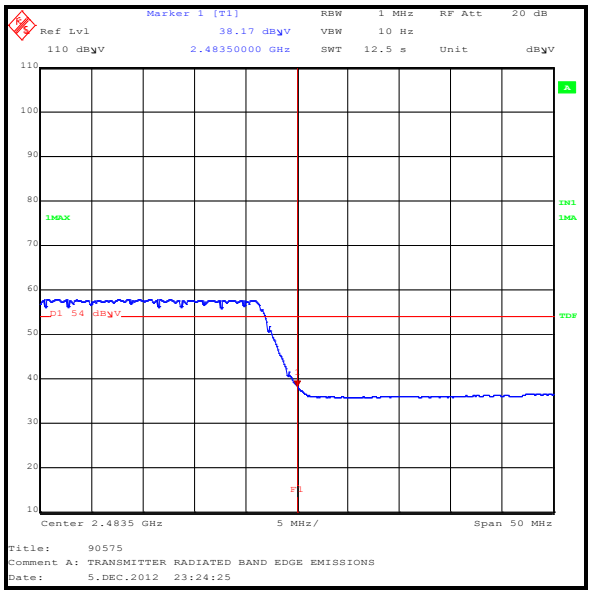
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	38.2	54.0	15.8	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



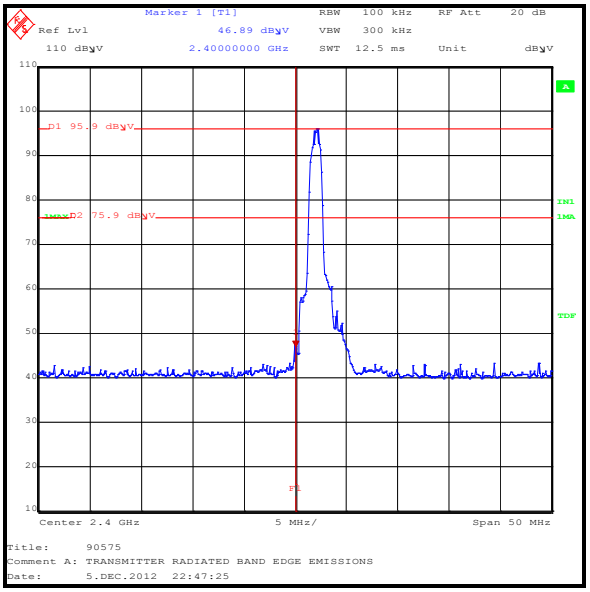
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

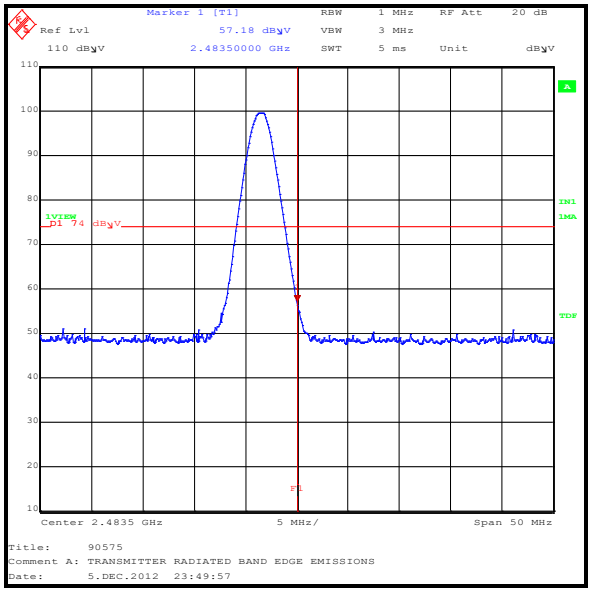
Results: Static Mode 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Vertical	46.9	75.9*	29.0	Complied
2483.5	Vertical	57.2	74.0	16.8	Complied

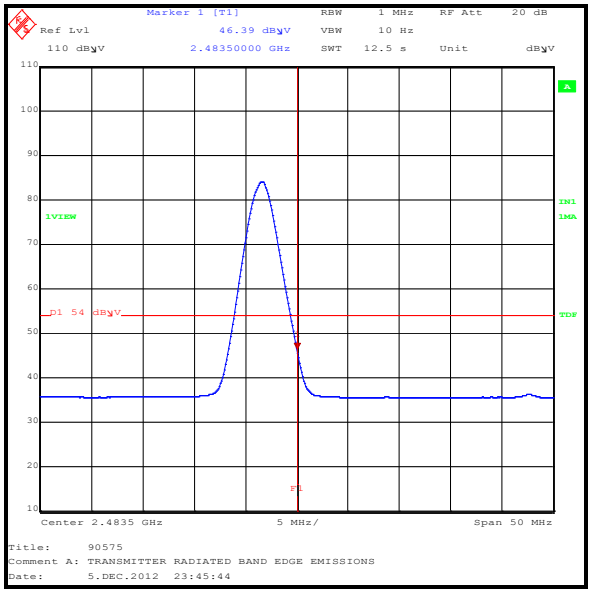
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	46.4	54.0	7.6	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



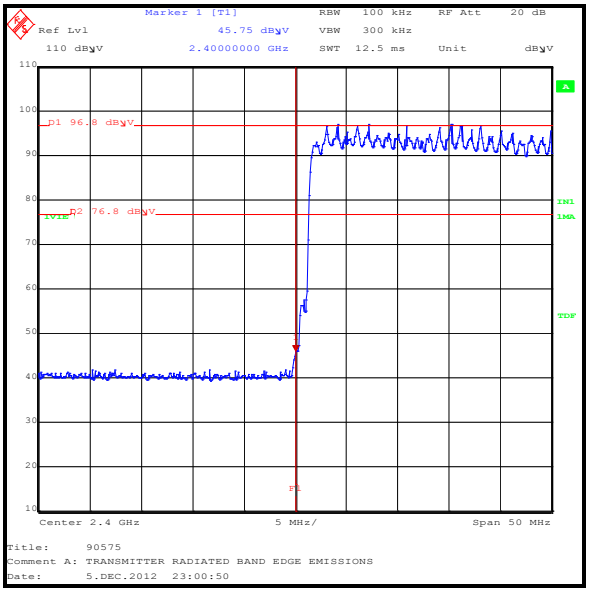
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

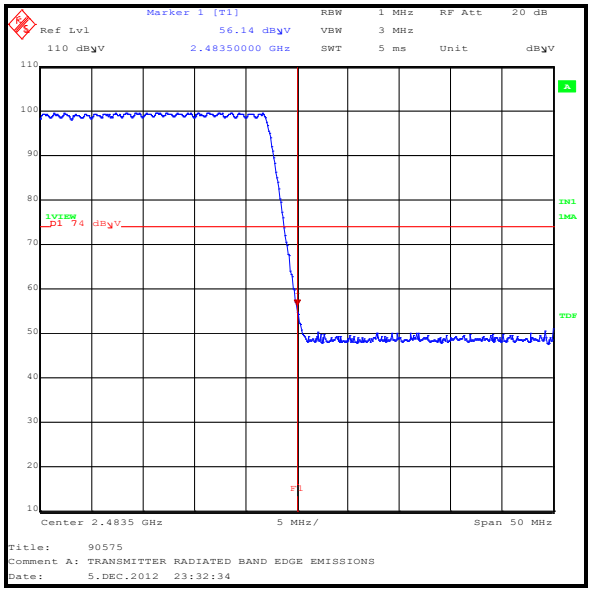
Results: Hopping Mode 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Vertical	45.8	76.8*	31.0	Complied
2483.5	Vertical	56.1	74.0	17.9	Complied

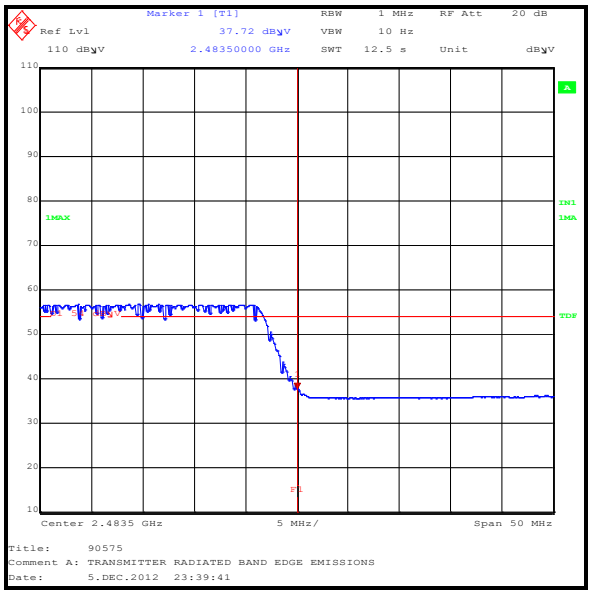
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	37.7	54.0	16.3	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



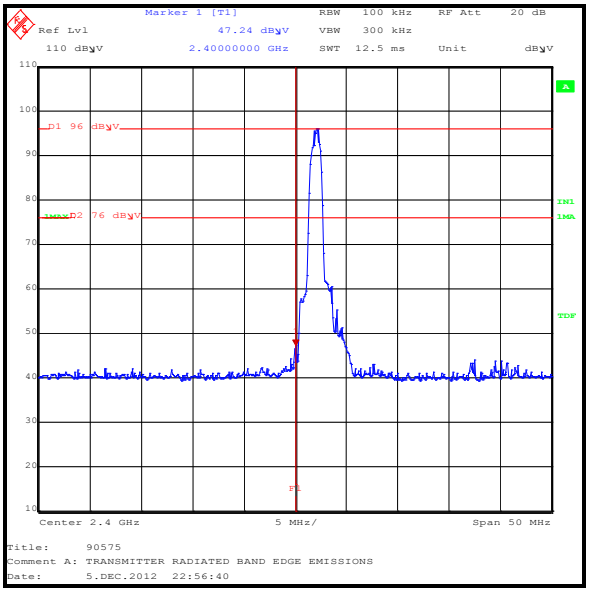
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

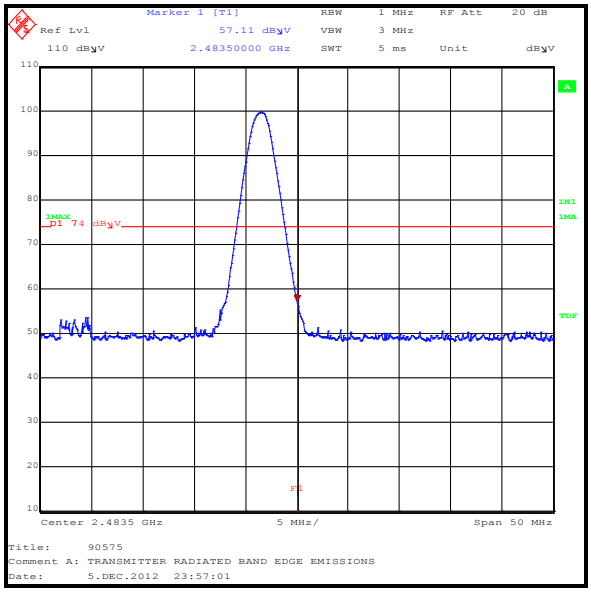
Results: Static Mode 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Vertical	47.2	76.0*	28.8	Complied
2483.5	Vertical	57.1	74.0	16.9	Complied

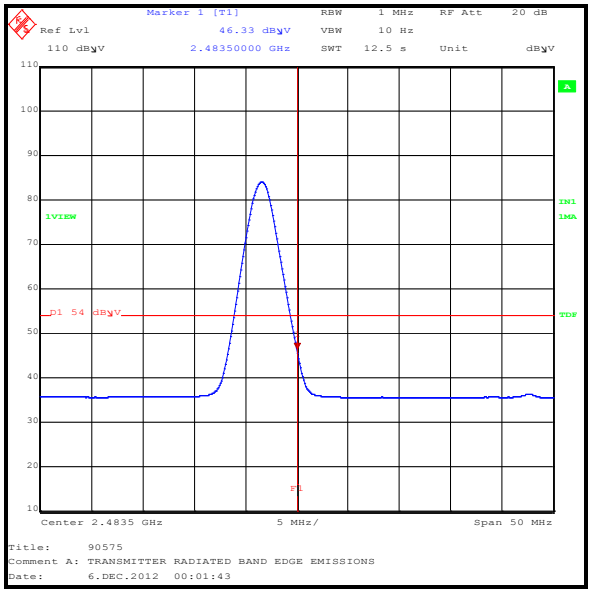
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	46.3	54.0	7.7	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



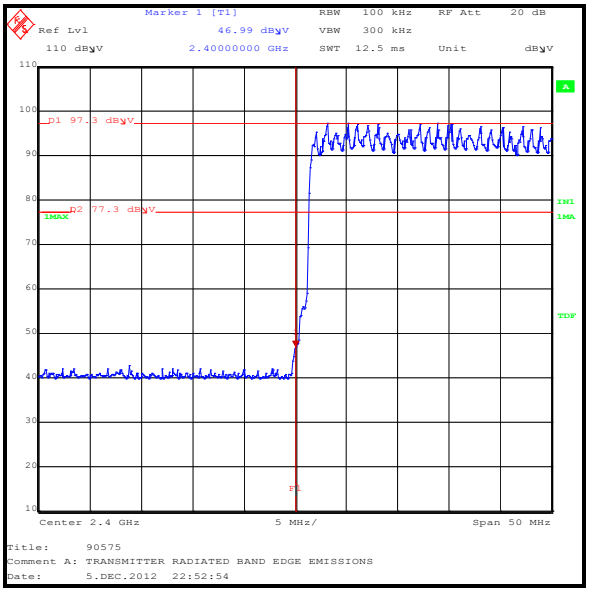
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

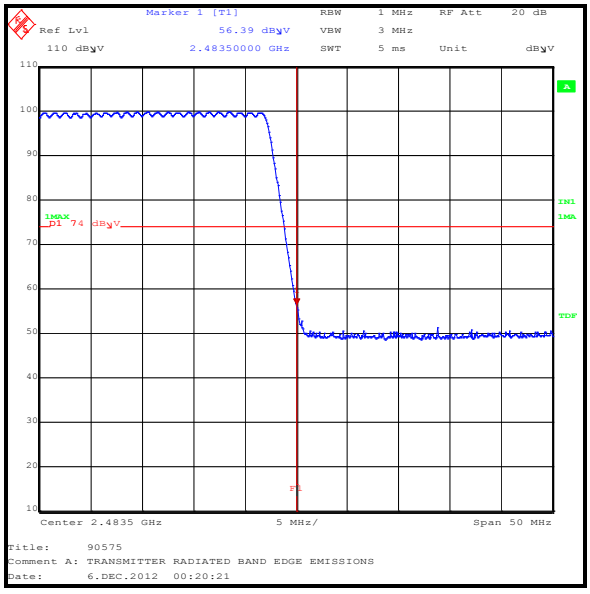
Results: Hopping Mode 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Vertical	47.0	77.3*	30.3	Complied
2483.5	Vertical	56.4	74.0	17.6	Complied

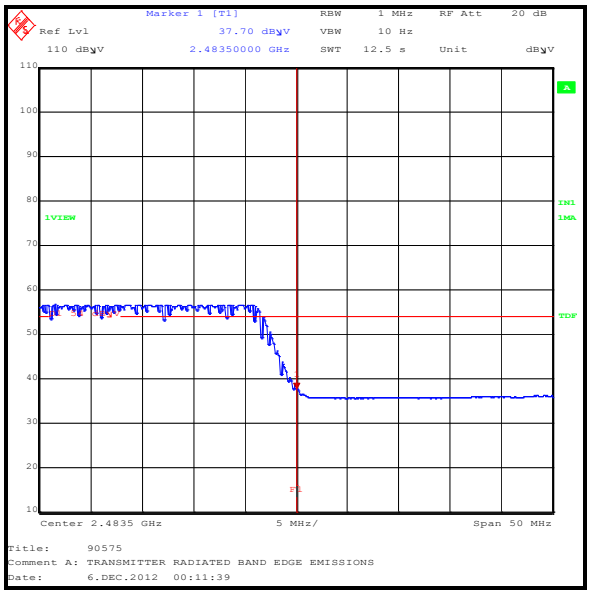
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	37.7	54.0	16.3	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 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
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.25 dB
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±0.28 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