



TEST REPORT

Test Report No. : UL-RPT-RP90828JD03A

Manufacturer : Multitone Electronics Plc
Model No. : EkoTek 2WRFOB
FCC ID : E86EKOFOB
IC Certification No. : 225A-EKOFOB
Test Standard(s) : FCC Part 15.109, 15.209(a), 15.247 and Industry Canada RSS-Gen 4.6.1, 4.6.2, 4.8, 4.9, 4.10/6, RSS-210 A8.2(a), A8.2(b), A8.4(4), A8.5

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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: 21 December 2012

Checked by:

Sarah Williams
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Issued by :

pp

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This laboratory is accredited by UKAS.
The tests reported herein have been
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1. Customer Information










Company Name:	Multitone Electronics Plc
Address:	Multitone House Shortwood Copse Lane, Kempshott Basingstoke Hampshire RG23 7NL United Kingdom

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:	47CFR15.109
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart B (Unintentional Radiators) - Section 15.109
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: 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:	RFI Global Services Ltd trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	13 December 2012 to 17 December 2012

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Result
Part 15.109	RSS-Gen 4.10/6	Receiver/Idle Mode Radiated Spurious Emissions	
Part 15.247(a)(2)	RSS-Gen 4.6.2 RSS-210 A8.2(a)	Transmitter Minimum 6 dB Bandwidth	
N/A	RSS-Gen 4.6.1	Transmitter 99% Occupied Bandwidth	
Part 15.247(e)	RSS-210 A8.2(b)	Transmitter Power Spectral Density	
Part 15.247(b)(3)	RSS-Gen 4.8 RSS-210 A8.4(4)	Transmitter Maximum Peak Output Power	
Part 15.247(d)/ 15.209(a)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Radiated Emissions	
Part 15.35(c)	RSS-Gen 4.5/4.8	Transmitter Duty Cycle	Note 1
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			

Note 1: The measurement was performed to assist in the calculation of the level of average fieldstrength emissions as the EUT employs pulsed operation.

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
Reference:	KDB 558074 D01 v02 10/04/2012
Title:	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices operating Under 15.247

2.4. Deviations from the Test Specification

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

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Multitone
Model Name or Number:	EkoTek 2WRFOB
Serial Number:	110-0010007 (<i>Radiated sample #1</i>)
Hardware Version Number:	4
Software Version Number:	57
FCC ID:	E86EKOFOB
Industry Canada Certification Number:	225A-EKOFOB

Brand Name:	Multitone
Model Name or Number:	EkoTek 2WRFOB
Serial Number:	110-0010006 (<i>Radiated sample #2</i>)
Hardware Version Number:	4
Software Version Number:	57
FCC ID:	E86EKOFOB
Industry Canada Certification Number:	225A-EKOFOB

Brand Name:	Multitone
Model Name or Number:	EkoTek 2WRFOB
Serial Number:	110-0099001 (<i>Conducted sample RF port</i>)
Hardware Version Number:	4
Software Version Number:	57
FCC ID:	E86EKOFOB
Industry Canada Certification Number:	225A-EKOFOB

3.2. Description of EUT

The equipment under test was a 2 Way Wireless Fob/Alarm.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	IEEE 802.15.4 Digital Transmission System		
Type of Unit:	Transceiver		
Modulation:	O-QPSK		
Data Rate:	250 kb/s		
Power Supply Requirement(s):	Nominal	1.5 V	
Maximum Conducted Output Power:	5.8 dBm		
Antenna Gain:	0 dBi		
Transmit Frequency Range:	2405 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2405
	Middle	9	2445
	Top	16	2480
Receive Frequency Range:	2405 MHz to 2480 MHz		
Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2405
	Middle	9	2445
	Top	16	2480

3.5. Support Equipment

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

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	inspiron 510m
Serial Number:	CN-0H1908-48643-54H-0489

Description:	Ethernet Hub
Brand Name:	Netgear
Model Name or Number:	Prosafe GS108T
Serial Number:	29S4135T00006

Description:	AC-DC power supply
Brand Name:	Netgear
Model Name or Number:	T012HB1209
Serial Number:	Not marked or stated

Description:	2 Ethernet cables
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Hub
Brand Name:	Multitone
Model Name or Number:	EkoTek Hub
Serial Number:	1000001

Description:	AC-DC power supply
Brand Name:	Moscot
Model Name or Number:	2126
Serial Number:	Not marked or stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Continuously transmitting at maximum power on the bottom, middle and top channels as required.
- Receive/Idle Mode.

4.2. Configuration and Peripherals

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

- The Customer supplied a constant transmit sample, with modulation applied. Channels were selected by pressing a button on the front of the EUT and the frequency verified on a spectrum analyser.
- The Customer supplied a constant receive sample.
- Sample with serial number 110-0099001 was used for 6 dB bandwidth, 99% occupied bandwidth, power spectral density and conducted power tests.
- Sample with serial number 110-0010007 was used for Transmitter Radiated emissions tests.
- Sample with serial number 110-0010006 was used for Receiver Radiated emissions tests.
- In order to measure the duty cycle the Customer set up the EUT to access a laptop PC using their access point. The access point then sent data to the laptop PC once every 4 seconds. Sample with serial number 110-0099001 was used for this test.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	Nick Steele	Test Date:	17 December 2012
Test Sample Serial Number:	110-0010006		

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:

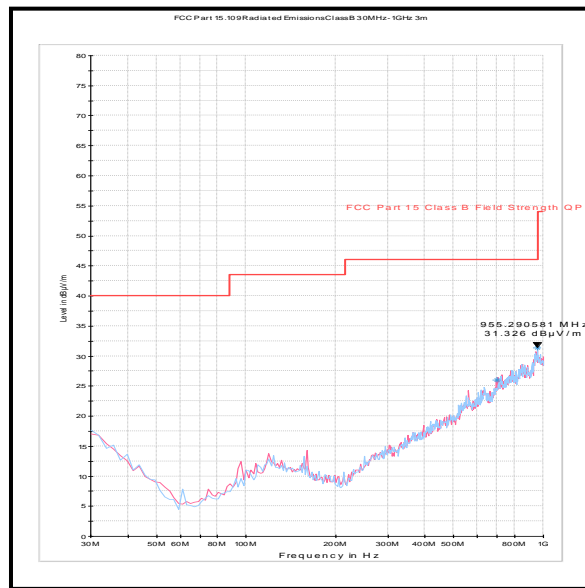
Temperature (°C):	23
Relative Humidity (%):	33

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 above.
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 (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
955.291	Vertical	31.3	46.0	14.7	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)
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A553	Bi-log 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:	Nick Steele	Test Date:	13 December 2012
Test Sample Serial Number:	110-0010006		

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:

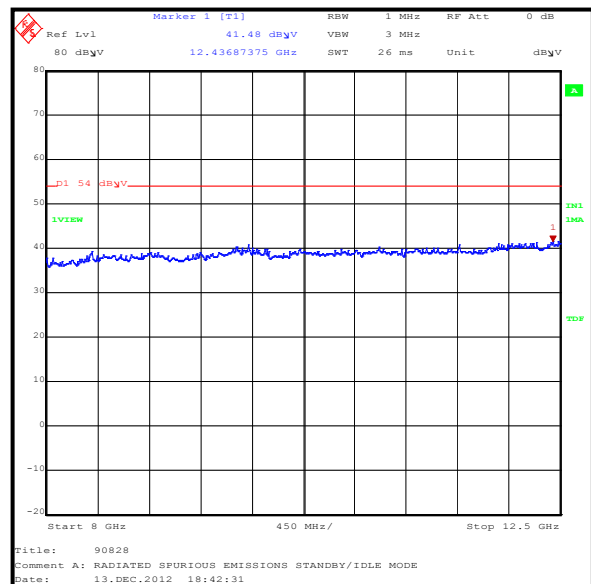
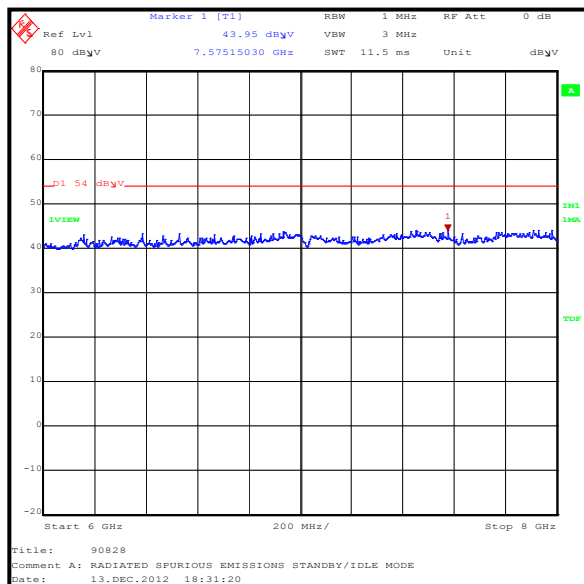
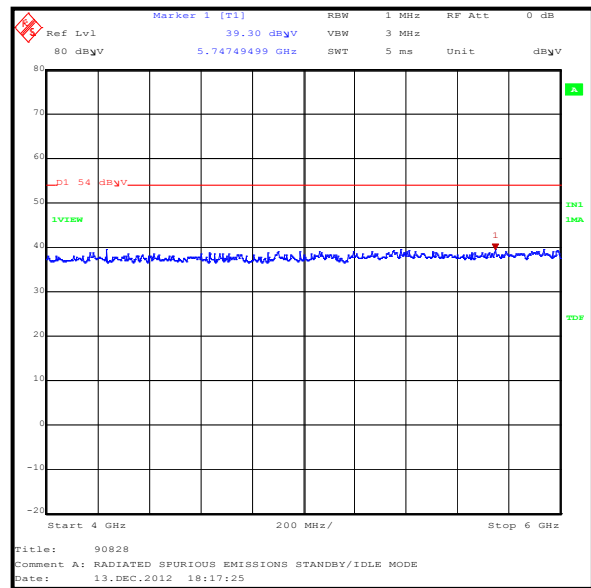
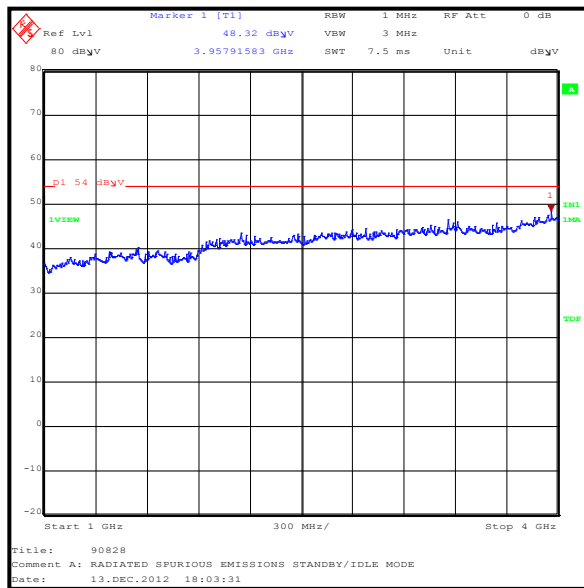
Temperature (°C):	23
Relative Humidity (%):	29

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
3957.916	Vertical	48.3	54.0	5.7	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
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
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

5.2.2. Transmitter Minimum 6 dB Bandwidth**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	14 December 2012
Test Sample Serial Number:	110-0099001		

FCC Reference:	Part 15.247(a)(2)
Industry Canada Reference:	RSS-Gen 4.6.2 / RSS-210 A8.2(a)
Test Method Used:	As detailed in FCC KDB 558074 Section 7.1

Environmental Conditions:

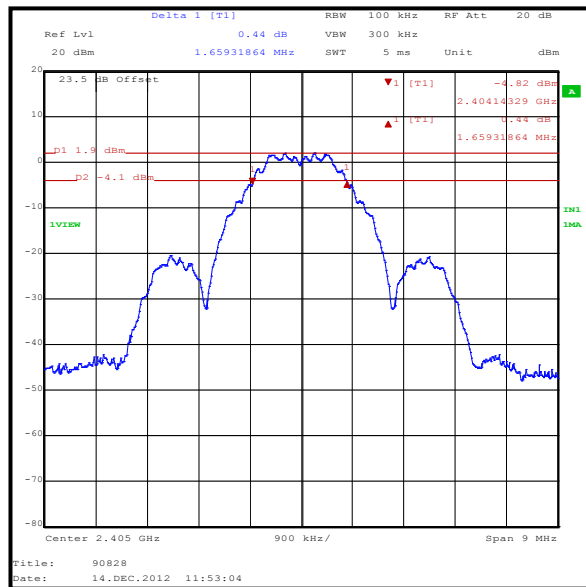
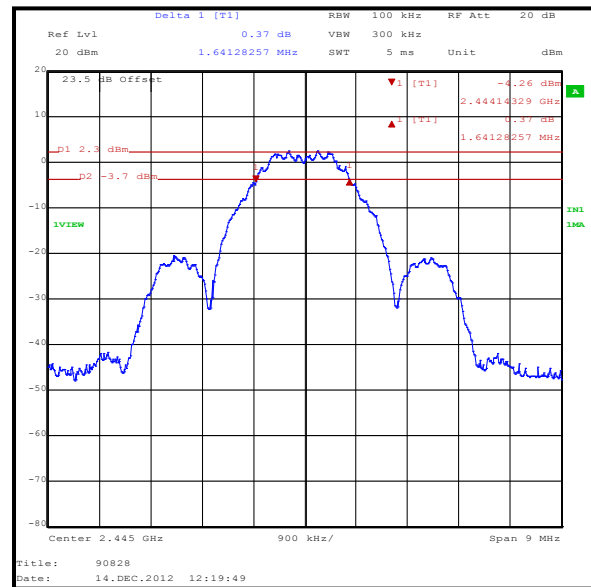
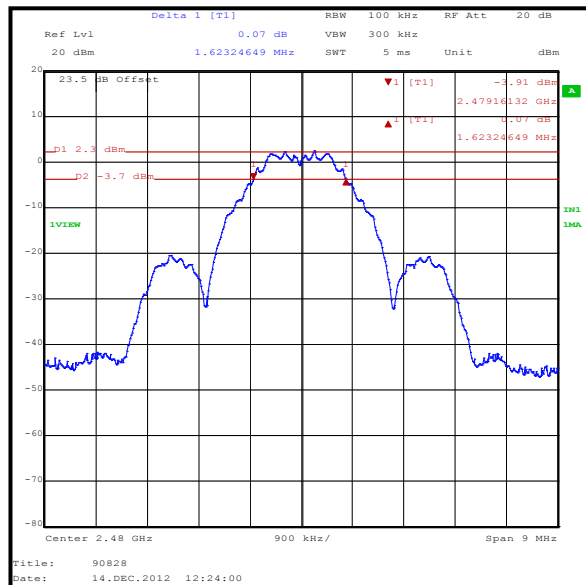
Temperature (°C):	24
Relative Humidity (%):	30

Note(s):

1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 7.1 option 1.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

Results:

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1659.319	≥500	1159.319	Complied
Middle	1641.283	≥500	1141.283	Complied
Top	1623.246	≥500	1123.246	Complied

Transmitter Minimum 6 dB Bandwidth (continued)**Results:****Bottom channel****Middle channel****Top channel****Test Equipment Used:**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1999	Attenuator	Huber + Suhner	6820.17.B	07101	03 Apr 2013	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12

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

Test Engineer:	Andrew Edwards	Test Date:	14 December 2012
Test Sample Serial Number:	110-0099001		

FCC Reference:	N/A
Industry Canada Reference:	RSS-Gen 4.6.1
Test Method Used:	Test Receiver Occupied Bandwidth function

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

Note(s):

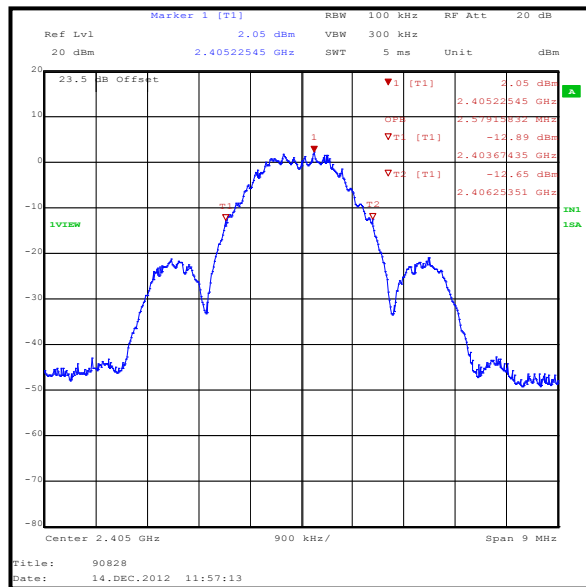
1. Occupied bandwidth (99% bandwidth) was measured using a test receiver occupied bandwidth function with the test receiver set to the appropriate bandwidth according to the channel width under test. Measurement bandwidths were set automatically by the test receiver.

Results:

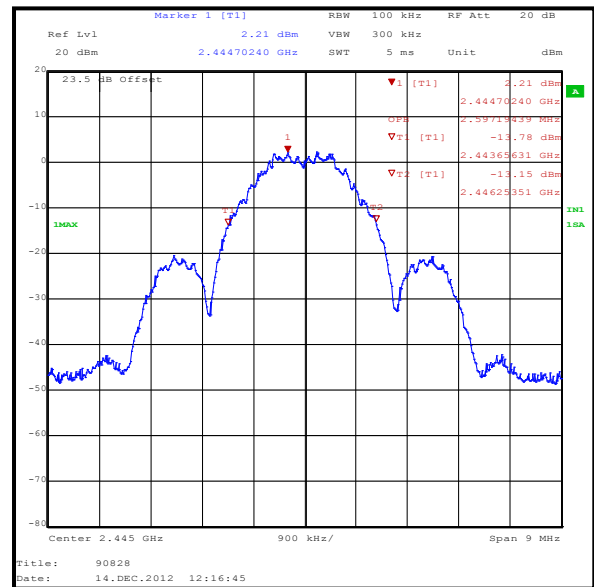
Channel	99% Occupied Bandwidth (MHz)
Bottom	2.579
Middle	2.597
Top	2.579

Transmitter 99% Occupied Bandwidth (continued)

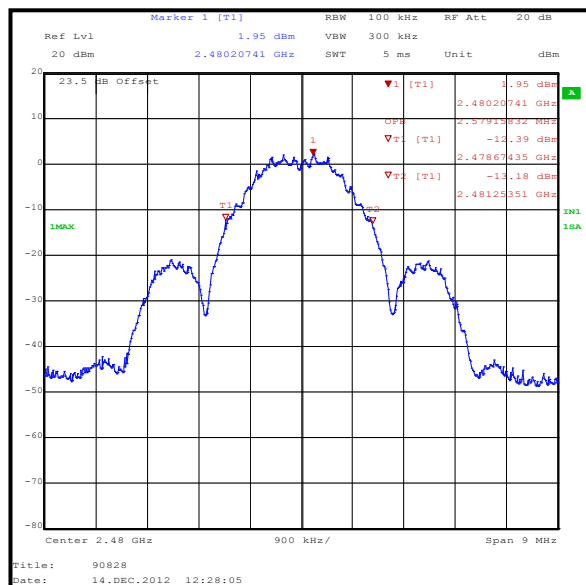
Results:



Bottom channel



Middle channel



Top channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1999	Attenuator	Huber + Suhner	6820.17.B	07101	03 Apr 2013	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12

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

Test Engineer:	Andrew Edwards	Test Date:	14 December 2012
Test Sample Serial Number:	110-0099001		

FCC Reference:	Part 15.247(e)
Industry Canada Reference:	RSS-210 A8.2(b)
Test Method Used:	As detailed in FCC KDB 558074 Section 9.1

Environmental Conditions:

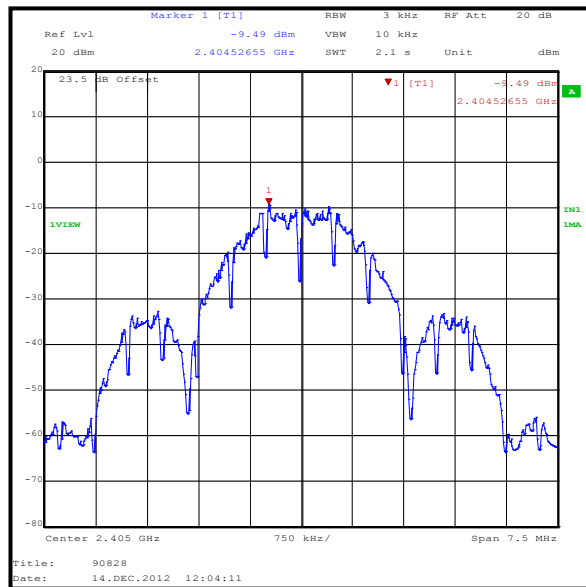
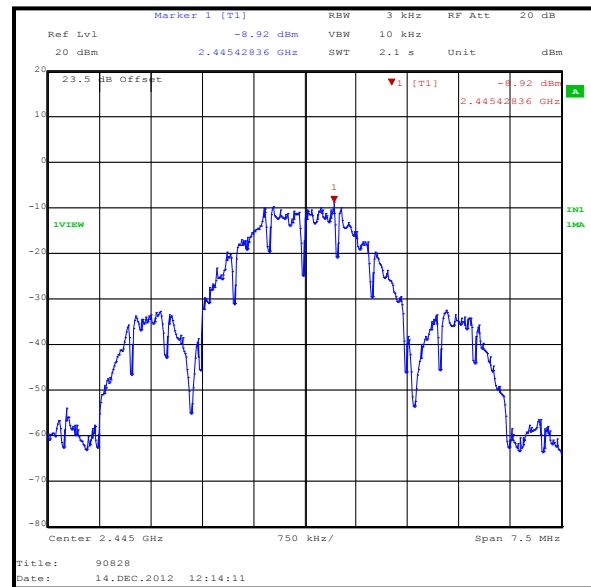
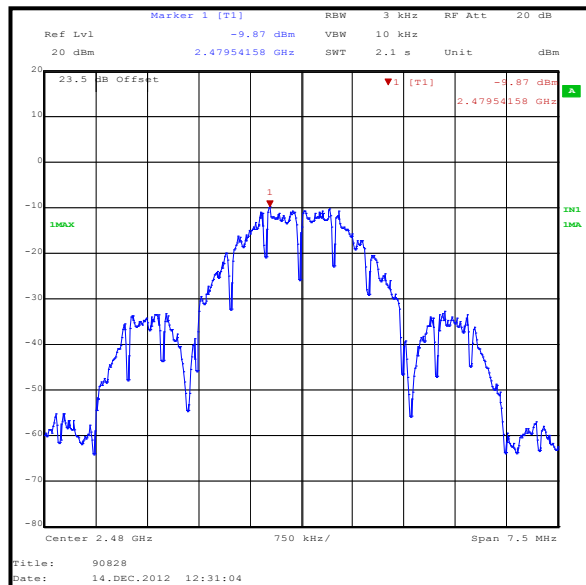
Temperature (°C):	24
Relative Humidity (%):	30

Note(s):

1. Transmitter Power Spectral Density tests in all bands were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1 option 1.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

Results:

Channel	Output Power (dBm)	Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-9.5	8.0	17.5	Complied
Middle	-8.9	8.0	16.9	Complied
Top	-9.9	8.0	17.9	Complied

Transmitter Power Spectral Density (continued)**Results:****Bottom channel****Middle channel****Top channel****Test Equipment Used:**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1999	Attenuator	Huber + Suhner	6820.17.B	07101	03 Apr 2013	12
M1009	RF Power Meter	Hewlett Packard	437B	3125U13706	01 Feb 2013	12
M1021	Signal Generator	Rohde & Schwarz	SMP02	833286/004	09 Jan 2013	12
M1175	Power Sensor	Hewlett Packard	8485A	2942A10299	19 Sep 2013	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12

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

Test Engineer:	Andrew Edwards	Test Date:	14 December 2012
Test Sample Serial Number:	110-0099001		

FCC Reference:	Part 15.247(b)(3)
Industry Canada Reference:	RSS-Gen 4.8 / RSS-210 A8.4(4)
Test Method Used:	As detailed in FCC KDB 558074 Section 8.1.1

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

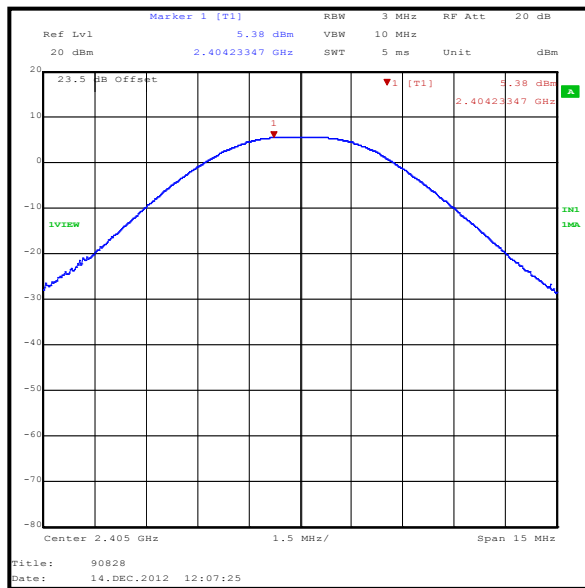
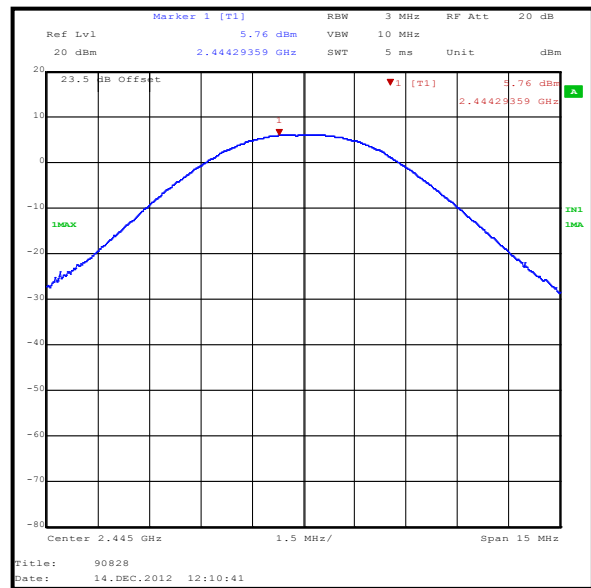
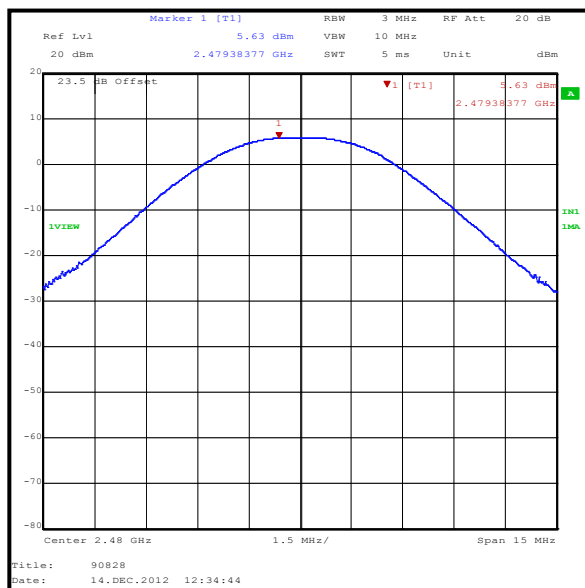
Note(s):

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.1.1 Option 1.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

Results:

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	5.4	30.0	24.6	Complied
Middle	5.8	30.0	24.2	Complied
Top	5.6	30.0	24.4	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	5.4	0.0	5.4	36.0	30.6	Complied
Middle	5.8	0.0	5.8	36.0	30.2	Complied
Top	5.6	0.0	5.6	36.0	30.4	Complied

Transmitter Maximum Peak Output Power (continued)**Bottom channel****Middle channel****Top channel****Test Equipment Used:**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1999	Attenuator	Huber + Suhner	6820.17.B	07101	03 Apr 2013	12
M1009	RF Power Meter	Hewlett Packard	437B	3125U13706	01 Feb 2013	12
M1021	Signal Generator	Rohde & Schwarz	SMP02	833286/004	09 Jan 2013	12
M1175	Power Sensor	Hewlett Packard	8485A	2942A10299	19 Sep 2013	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12

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

Test Engineer:	Andrew Edwards	Test Date:	15 December 2012
Test Sample Serial Number:	110-0010007		

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:

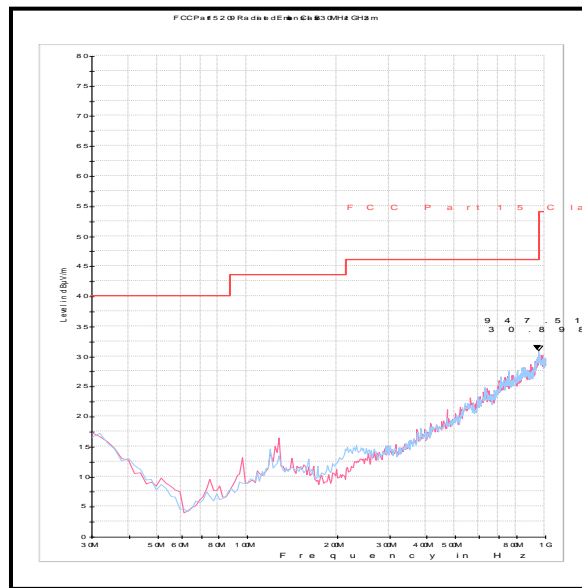
Temperature (°C):	26
Relative Humidity (%):	28

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. 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.
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: Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
947.515	Vertical	30.9	46.0	15.1	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	Bi-log 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:	13 December 2012
Test Sample Serial Number:	110-0010007		

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 (%):	30

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss
2. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.
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.
4. Average measurements were obtained by subtracting the calculated duty cycle from the measured peak levels. Please refer to section 5.2.7 for duty cycle calculations.

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4810.974	Horizontal	63.6	74.0	10.4	Complied
7213.943	Vertical	59.5	74.0	14.5	Complied
12022.379	Horizontal	60.9	74.0	13.1	Complied

Results: Average / Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4810.974	Horizontal	19.2	54.0	34.8	Complied
7213.943	Vertical	15.1	54.0	38.9	Complied
12022.379	Horizontal	16.5	54.0	37.5	Complied

Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4891.009	Horizontal	62.4	74.0	11.6	Complied
7333.847	Vertical	55.6	74.0	18.4	Complied
12222.379	Horizontal	56.3	74.0	17.7	Complied

Results: Average / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4891.009	Horizontal	18.0	54.0	36.0	Complied
7333.847	Vertical	11.2	54.0	42.8	Complied
12222.379	Horizontal	11.9	54.0	42.1	Complied

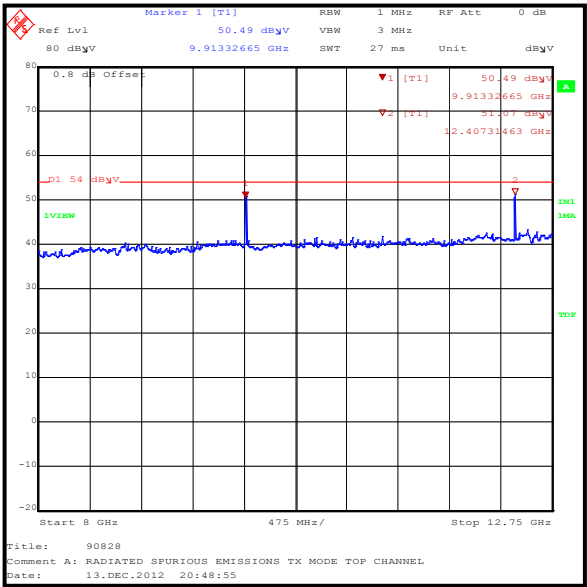
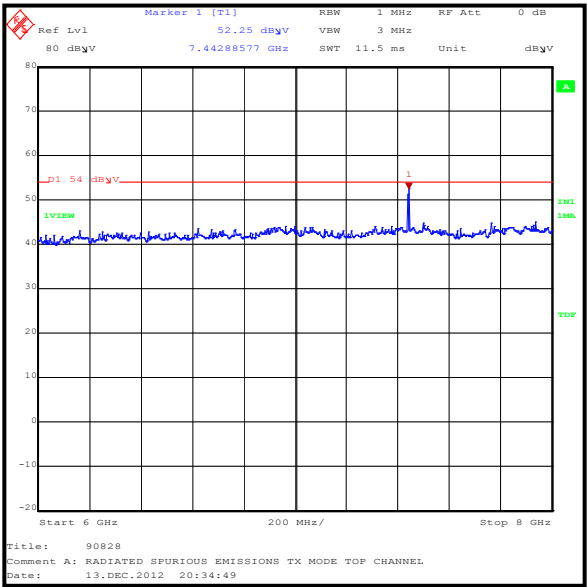
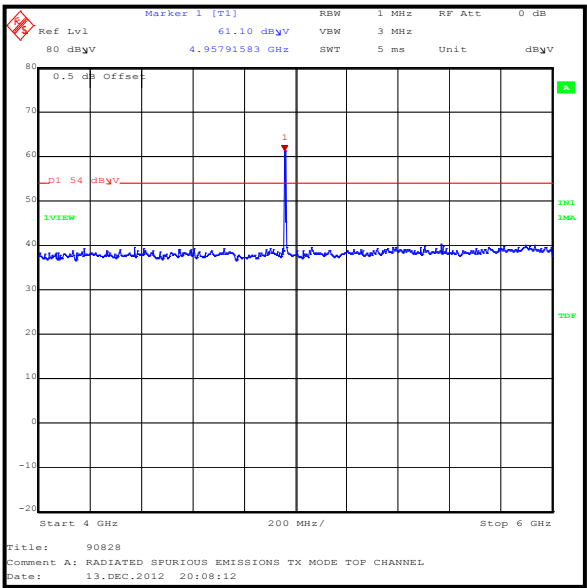
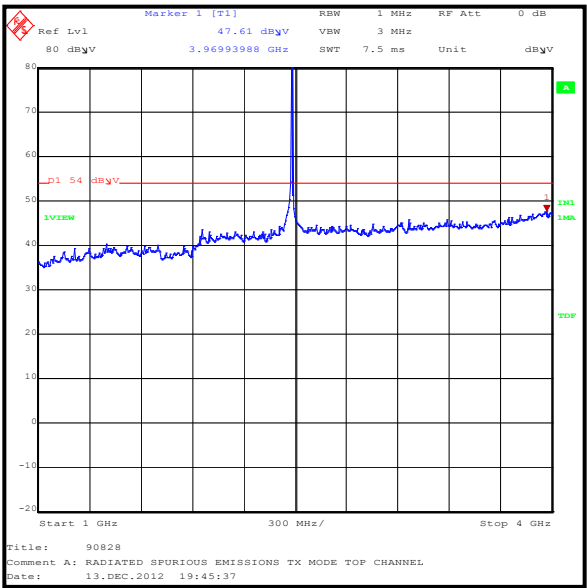
Results: Peak / Top Channel

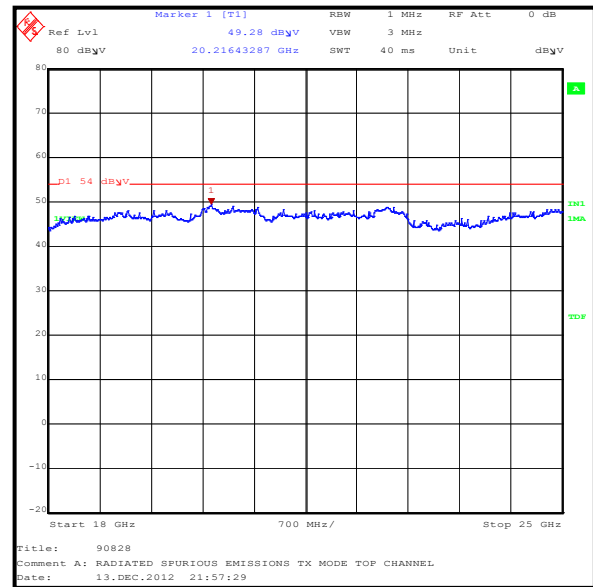
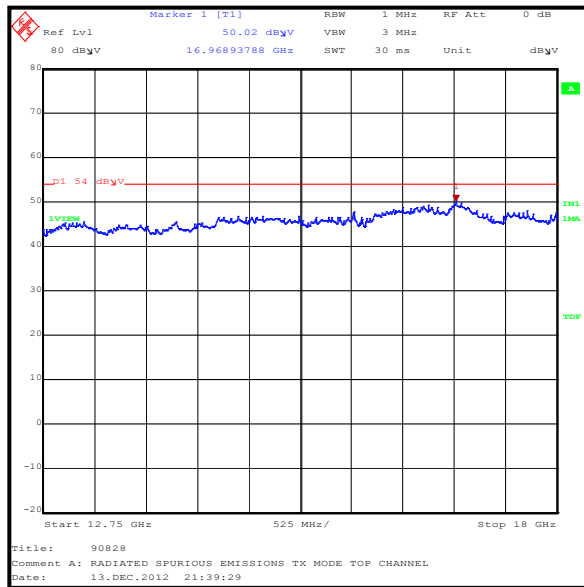
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4959.004	Horizontal	61.5	74.0	12.5	Complied
7438.854	Vertical	52.4	74.0	21.6	Complied
12397.284	Horizontal	52.4	74.0	21.6	Complied

Results: Average / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4959.004	Horizontal	17.1	54.0	36.9	Complied
7438.854	Vertical	8.0	54.0	46.0	Complied
12397.284	Horizontal	8.0	54.0	46.0	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 (Month s)
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
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20240-20	330	04 Nov 2013	12
A1975	High Pass Filter	Atlan TecRF	AFH-03000	090424010	15 Mar 2013	12

5.2.7. Transmitter Duty Cycle**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	14 December 2012
Test Sample Serial Number:	110-0099001		

FCC Part:	15.35(c)
Test Method Used:	As detailed in ANSI C63.10 Section 7.5

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

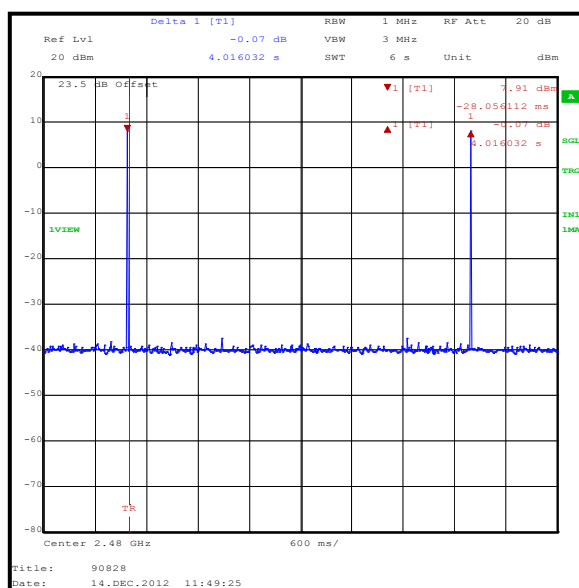
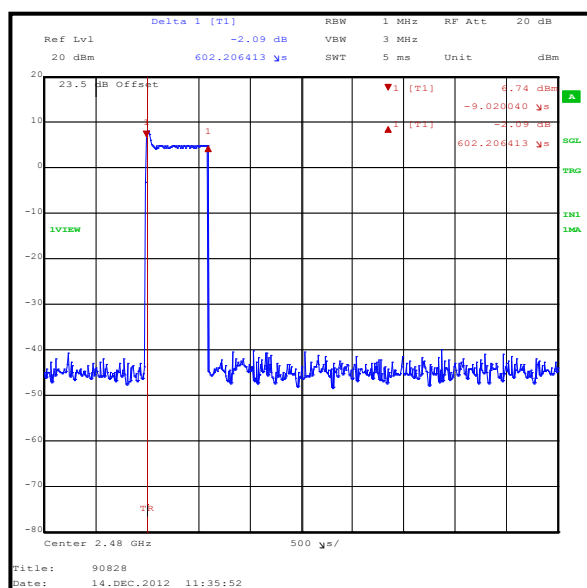
Results:

Pulse Duration (mS)	Duty Cycle (dB)
0.602	44.4

Silent Period (seconds)
4.016

Note(s):

- In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by $20 \log(\text{On Time} / [\text{Period or } 100\text{mS whichever is the lesser}])$.



Transmitter Duty Cycle (continued)**Test Equipment Used:**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1999	Attenuator	Huber + Suhner	6820.17.B	07101	03 Apr 2013	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12

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

Test Engineer:	Nick Steele	Test Date:	17 December 2012
Test Sample Serial Number:	110-0010007		

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 Section 6.9.2

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	33

Note(s):

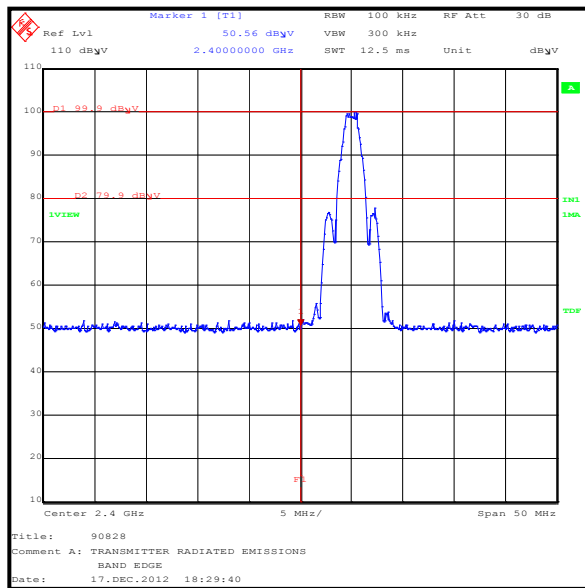
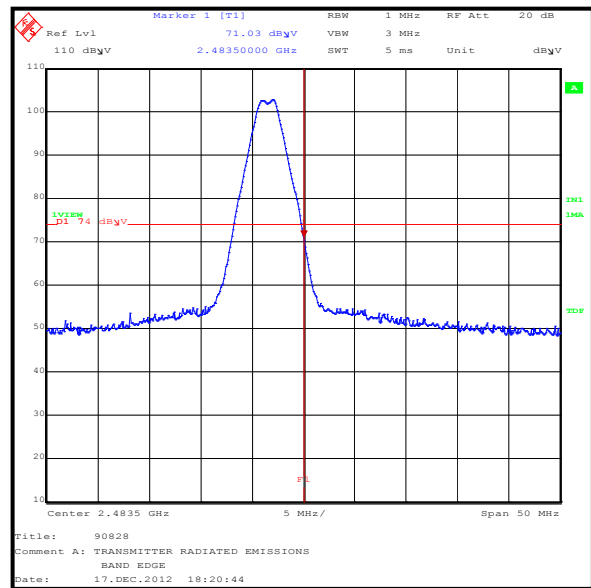
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. * -20 dBc limit.
3. The average measurement has been calculated by subtracting the duty cycle correction factor measured in section 5.2.7 from the measured peak level.

Results: Peak

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400	50.6	79.9*	29.3	Complied
2483.5	71.0	74.0	3.0	Complied

Results: Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	26.6	54.0	27.4	Complied

Transmitter Band Edge Radiated Emissions (continued)**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****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
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±0.28 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±0.28 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
99% Occupied Bandwidth	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz to 25 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