





# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Torch (EVDO Rev A) DCM300C

FCC ID: JUP-WCDCM300C

To: FCC Parts 15.209 and 15.247 (b)(d)

**Test Report Serial No:**  
RFI-RPT-RP79038JD11A

<b>This Test Report Is Issued Under The Authority Of Chris Guy, Head of Global Approvals:</b>  	
<b>Checked By:</b>	Ian Watch
<b>Signature:</b>	
<b>Date of Issue:</b>	25 January 2011

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## **1. Customer Information**






<b>Company Name:</b>	Trimble Navigation Ltd.
<b>Address:</b>	10355 Westmoor Dr Westminster Colo 80021 United States

## 2. Summary of Testing

### 2.1. General Information

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 15 Subpart C (Intentional Radiators) - Section 15.247
<b>Specification Reference:</b>	47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 15 Subpart C (Intentional Radiators) - Sections 15.209
<b>Site Registration:</b>	FCC: 209735
<b>Location of Testing:</b>	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
<b>Test Dates:</b>	20 December 2010 to 19 January 2011

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	
Part 15.247(d)/15.209(a)	Transmitter Radiated Emissions	
Part 15.247(d)/15.209(a)	Transmitter Band Edge Radiated Emissions	
<b>Key to Results</b>		
 = Complied  = Did not comply		

### 2.3. Methods and Procedures

<b>Reference:</b>	ANSI C63.4 (2009)
<b>Title:</b>	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>Reference:</b>	ANSI C63.10 (2009)
<b>Title:</b>	American National Standard for Testing Unlicensed Wireless Devices

### 2.4. Deviations from the Test Specification

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

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

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

<b>Brand Name:</b>	Trimble Navigation DCM300C
<b>Model Name or Number:</b>	Torch / DCM300C
<b>Serial Number:</b>	5042Z00083
<b>Hardware Version Number:</b>	A
<b>Software Version Number:</b>	0.1.5
<b>FCC ID::</b>	JUP-WCDCM300C

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

The equipment under test was a data communications module (DCM) for use in construction vehicles. It contains a Sierra Wireless CDMA module (FCC ID: N7N-MC5728) capable of 1xEV-DO and a Wi2Wi Wi-Fi module (FCC ID: U9R-W2CBW009DI) capable of 802.11b and 802.11g.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Technology Tested:</b>	Digital Transmission System		
<b>Type of Unit:</b>	Transceiver		
<b>Modulation:</b>	DSSS and OFDM		
<b>Data Rate:</b>	802.11b 11 Mbps and 802.11g 24 Mbps		
<b>Power Supply Requirement(s):</b>	Nominal	13.8 V	
<b>Maximum Peak Output Power:</b>	19.6 dBm		
<b>Transmit Frequency Range:</b>	2412 MHz to 2462 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462
<b>Receive Frequency Range:</b>	2412 MHz to 2462 MHz		
<b>Receive Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462

**3.5. Support Equipment**

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

<b>Description:</b>	Laptop
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	Latitude D610
<b>Serial Number:</b>	RFI Asset Number PC 344NT

<b>Description:</b>	DC Power Supply
<b>Brand Name:</b>	TTi
<b>Model Name or Number:</b>	EL301D
<b>Serial Number:</b>	249944

## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

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

- All 802.11b and 802.11g modes were initially tested in order to establish which operating modes produced the highest EIRP and highest emission levels. 802.11b 11 Mbps and 802.11g 24 Mbps modes were found to be worst case modes. Final measurements were performed in these modes.
- Transmitting on bottom, middle and top channels.

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

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

- NMO5E2400B Pulse Wi-Fi Antenna was used during testing.
- Power was supplied from a bench power supply.
- All cabling present on the wiring harness was correctly terminated when not in use.
- Manufacturing Mode of the software was enabled to allow control of Wi-Fi settings. This was enabled and controlled via the serial port of the wiring harness connected to a PC equipped with any generic terminal software. It enabled manual setup of the EUT Wi-Fi channel, data rate and power for test purposes.



## **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.

**5.2. Test Results****5.2.1. Transmitter Maximum Peak Output Power****Test Summary:**

<b>Test Engineer:</b>	Nick Steele	<b>Test Date:</b>	21 December 2010 & 19 January 2011
<b>Test Sample Serial No:</b>	5042Z00083		

<b>FCC Part:</b>	15.247(b)(3)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.10.2 and Sections 6.3 and 6.6 referencing ANSI C63.4 (see note below)

**Environmental Conditions:**

<b>Temperature (°C):</b>	21 to 22
<b>Relative Humidity (%):</b>	22 to 23

**Results: 802.11b / 11 Mbps**

Channel	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	17.2	36.0	18.8	Complied
Middle	15.6	36.0	20.4	Complied
Top	16.9	36.0	19.1	Complied

**Results: 802.11g / 24 Mbps**

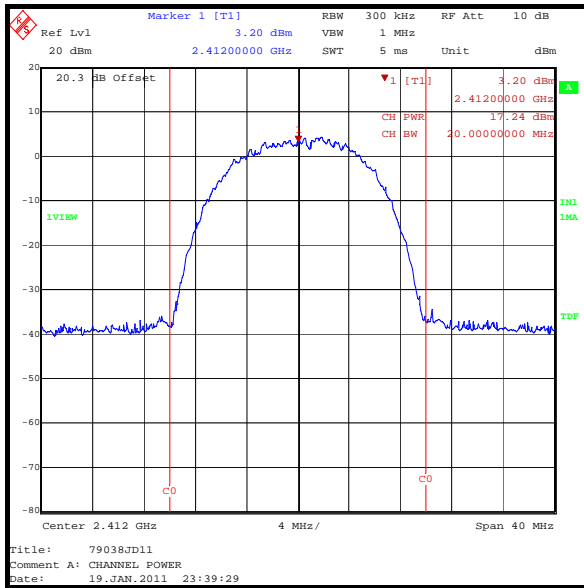
Channel	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	18.3	36.0	17.7	Complied
Middle	19.0	36.0	17.0	Complied
Top	19.6	36.0	16.4	Complied

**Note(s):**

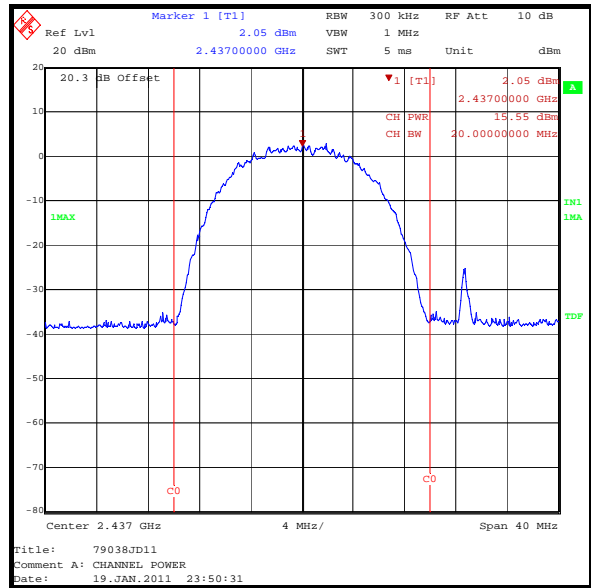
- Tests were performed using a combination of the conducted test method described in ANSI C63.10 Section 6.10.2 and the test methods for radiated emissions measurements described in Sections 6.3 and 6.6. The reason for this being that the measurements were performed radiated as the EUT has an external antenna and the Customer requested that all measurements were performed with the antenna connected.
- EIRP was measured using the channel power function of a spectrum analyser. Measurement bandwidths were set automatically by the spectrum analyser.

### Transmitter Maximum Peak Output Power (continued)

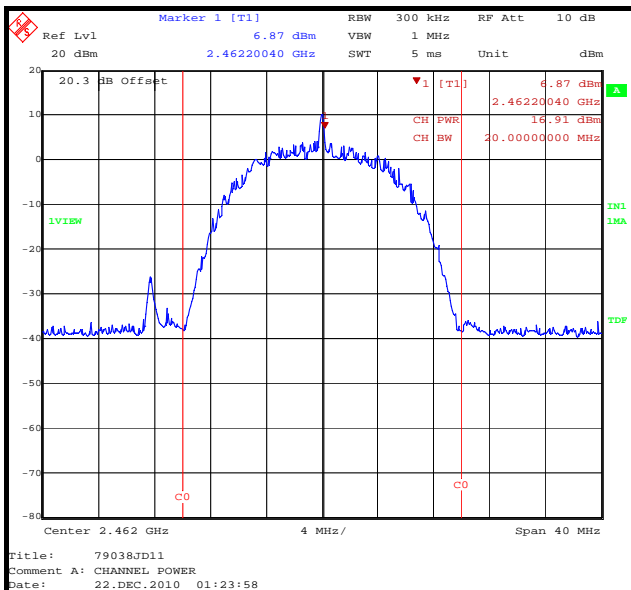
#### Results: 802.11b / 11 Mbps



Bottom channel



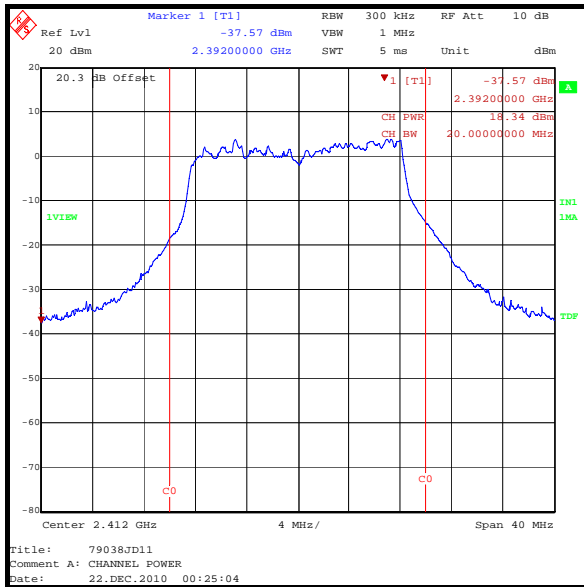
Middle channel



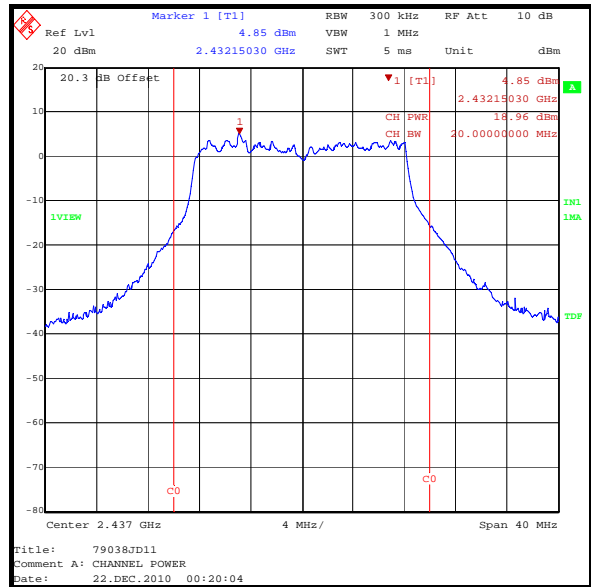
Top channel

### Transmitter Maximum Peak Output Power (continued)

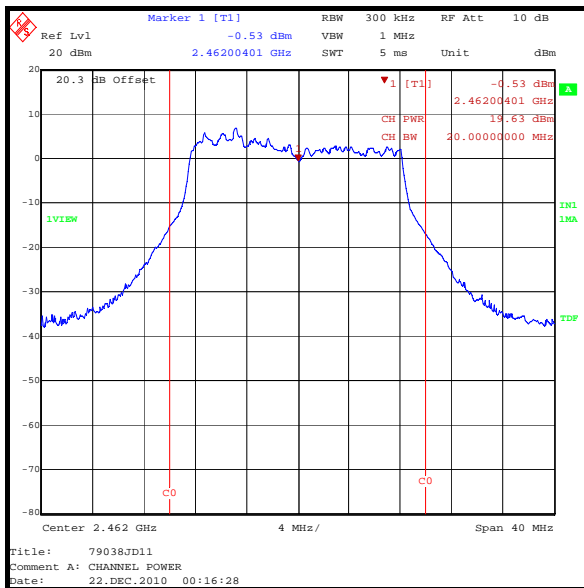
#### Results: 802.11g / 24 Mbps



Bottom channel



Middle channel



Top channel

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

<b>Test Engineer:</b>	Nick Steele	<b>Test Date:</b>	20 December 2010
<b>Test Sample Serial No:</b>	5042Z00083		

<b>FCC Part:</b>	15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
<b>Frequency Range</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	22

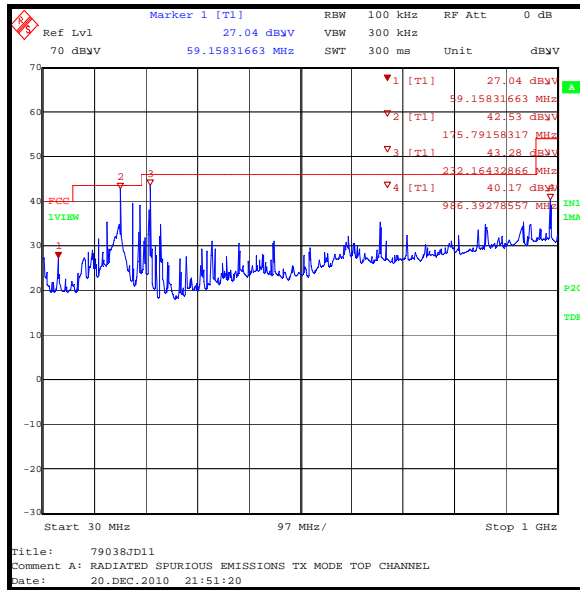
**Results: Quasi Peak / Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
59.884	Vertical	21.6	40.0	18.4	Complied
150.224	Horizontal	34.6	43.5	8.9	Complied
173.988	Horizontal	31.8	43.5	11.7	Complied
199.318	Horizontal	23.4	43.5	20.1	Complied
232.059	Vertical	40.8	46.0	5.2	Complied
665.818	Vertical	31.8	46.0	14.2	Complied
986.064	Vertical	40.3	54.0	13.7	Complied

**Note(s):**

1. The final measured value, for the given emission, in the table above 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 were at least 20 dB below the appropriate limit or below the noise floor of the measurement system.
4. Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 24 Mbps, as this was seen to have the highest power level and therefore deemed to be worst case

**Transmitter Radiated Emissions (continued)**



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

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

<b>Test Engineer:</b>	Nick Steele	<b>Test Date:</b>	20 December 2010
<b>Test Sample Serial No:</b>	5042Z00083		

<b>FCC Part:</b>	15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	21 to 22
<b>Relative Humidity (%):</b>	22 to 23

**802.11b / 11 Mbps****Results: Peak Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4823.661	Vertical	42.4	74.0	31.6	Complied

**Results: Average Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4823.661	Vertical	36.7	54.0	17.3	Complied

**Results: Peak Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4873.698	Vertical	43.4	74.0	30.6	Complied

**Results: Average Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4873.698	Vertical	39.2	54.0	14.8	Complied

**Results: Peak Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4924.053	Vertical	46.5	74.0	27.5	Complied

**Results: Average Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4924.053	Vertical	43.4	54.0	10.6	Complied

**Transmitter Radiated Emissions (continued)****802.11g / 24 Mbps****Results: Peak Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4823.661	Vertical	51.3	74.0	22.7	Complied

**Results: Average Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4823.661	Vertical	44.8	54.0	9.2	Complied

**Results: Peak Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4873.698	Vertical	47.9	74.0	26.1	Complied

**Results: Average Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4873.698	Vertical	40.2	54.0	13.8	Complied

**Results: Peak Top Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4924.053	Vertical	52.6	74.0	21.4	Complied

**Results: Average Top Channel**

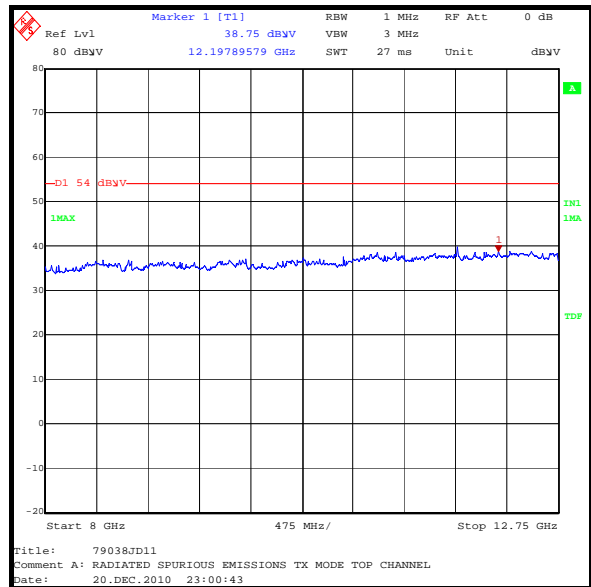
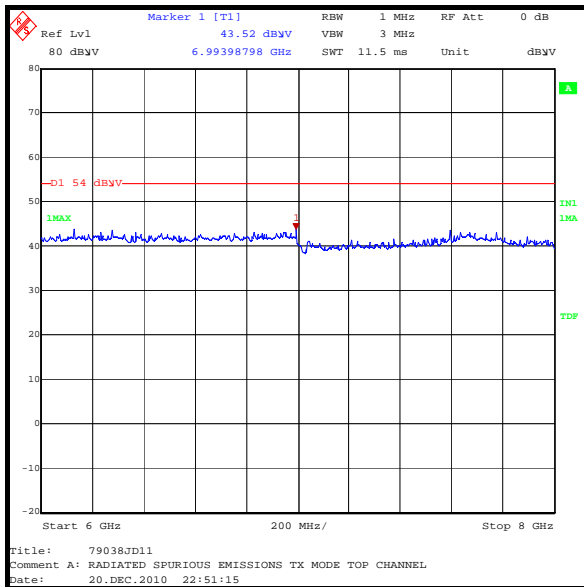
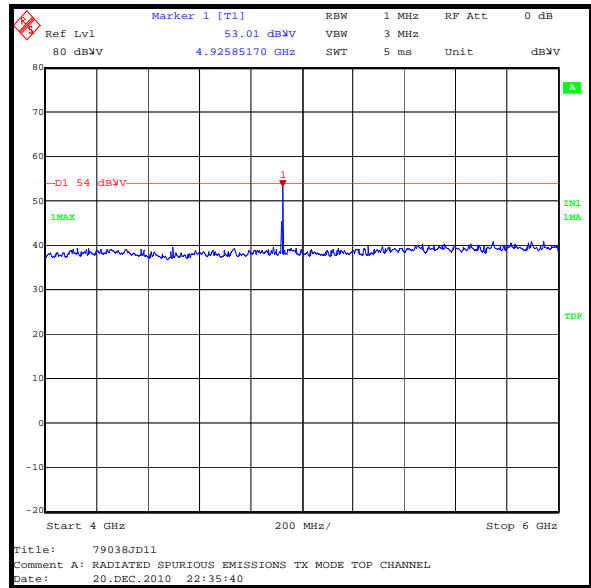
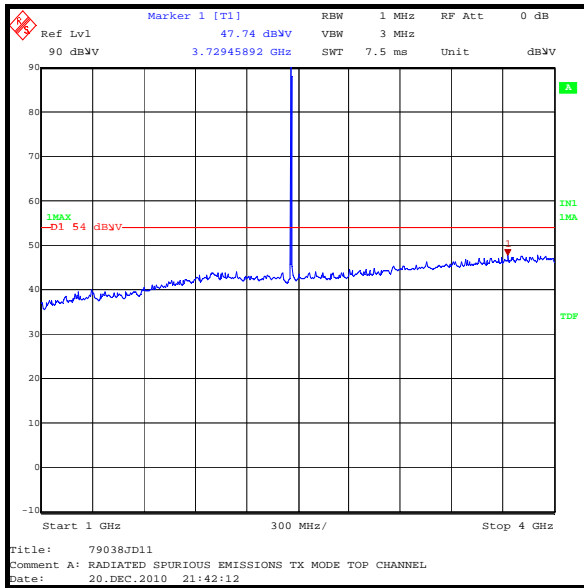
Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4924.053	Vertical	46.4	54.0	7.6	Complied

**Note(s):**

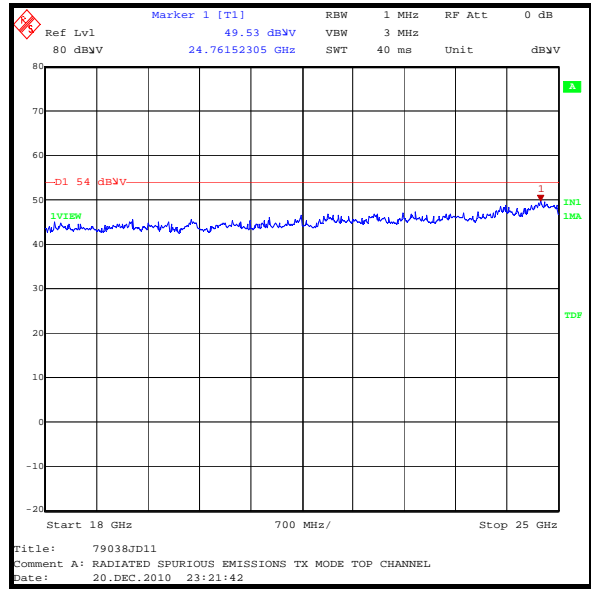
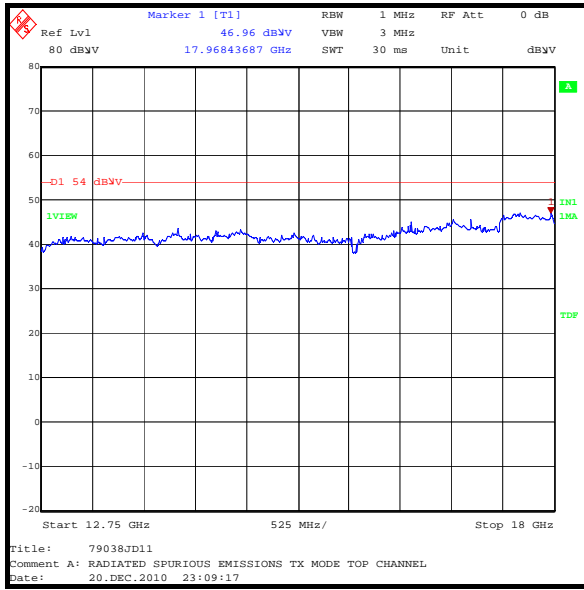
1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.
4. Transmitter spurious emissions were performed with the EUT transmitting with a data rate 11 Mbps in 802.11b mode and 24 Mbps in 802.11g mode, as these were seen to have the highest power level and therefore deemed to be worst case
5. Final measurements were made using appropriate RF attenuators and RF filters where required.



### 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.

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

<b>Test Engineer:</b>	Nick Steele	<b>Test Date:</b>	22 December 2010
<b>Test Sample Serial No:</b>	5042Z00083		

<b>FCC Part:</b>	15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.9.2

**Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	23

**Results: 802.11b / 11 Mbps - Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400	50.0	78.4*	28.4	Complied
2483.5	58.6	74.0	15.4	Complied

**Results: 802.11b / 11 Mbps - Average**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	39.5	54.0	14.5	Complied

**Results: 802.11g / 24 Mbps - Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400	71.1	78.6*	7.5	Complied
2483.5	64.1	74.0	9.9	Complied

**Results: 802.11g / 24 Mbps - Average**

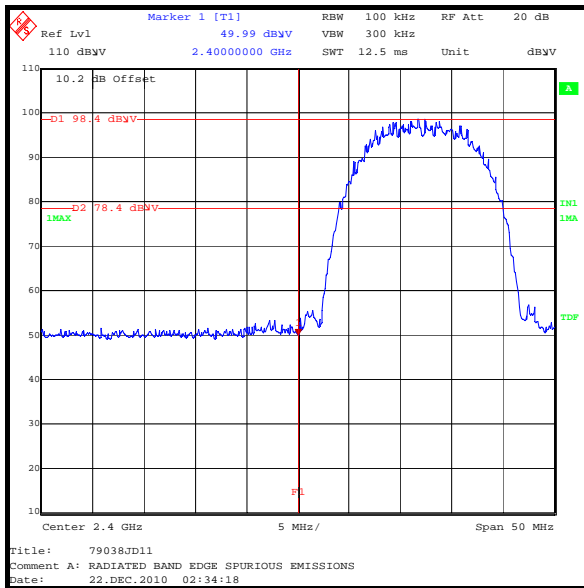
Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	39.6	54.0	14.4	Complied

**Note(s):**

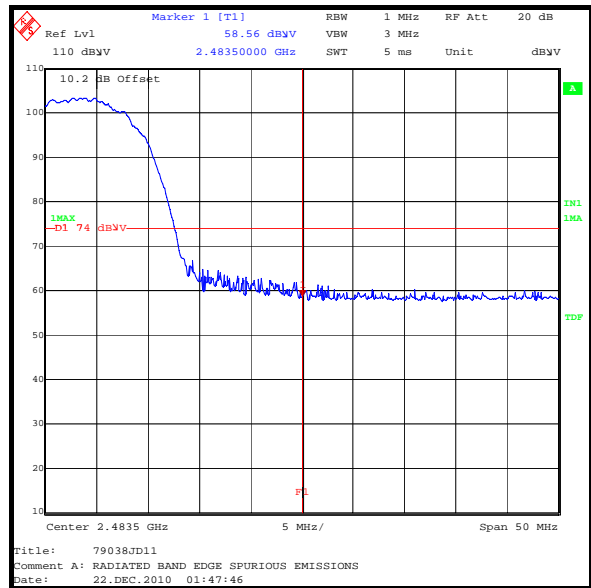
1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
2. \* -20 dBc limit.

### Transmitter Band Edge Radiated Emissions (continued)

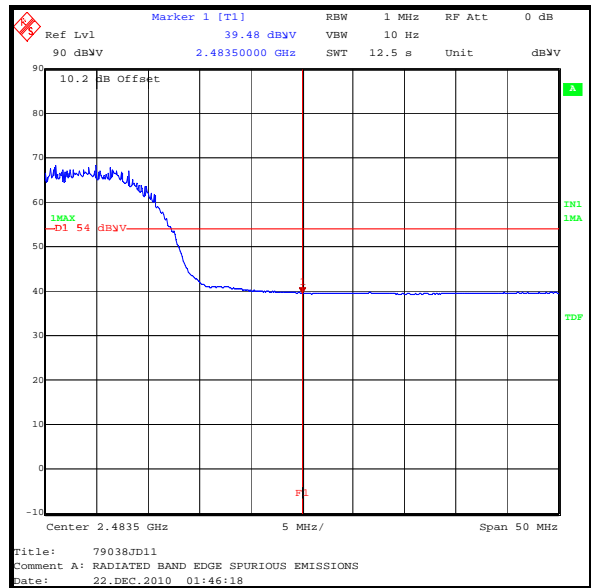
#### Results: 802.11b / 11 Mbps



Lower Band Edge Peak Measurement



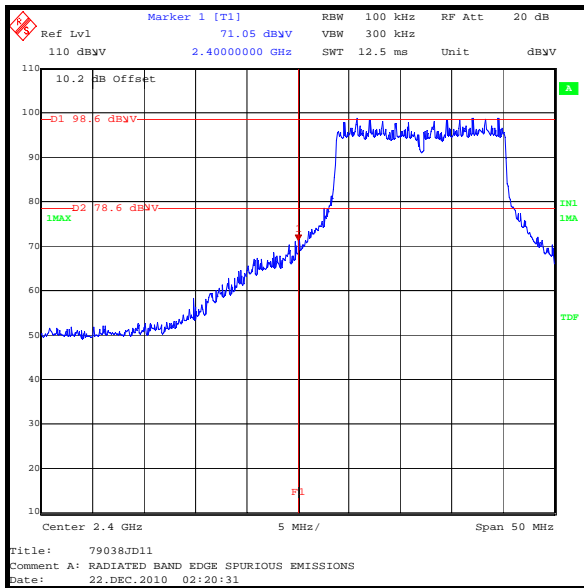
Upper Band Edge Peak Measurement



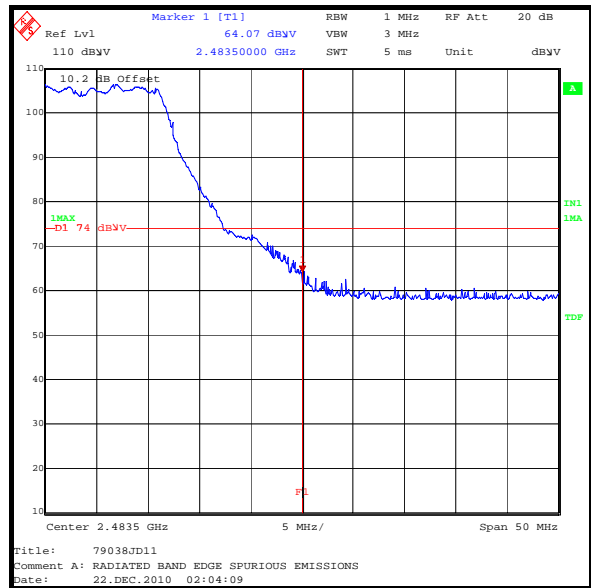
Upper Band Edge Average Measurement

### Transmitter Band Edge Radiated Emissions (continued)

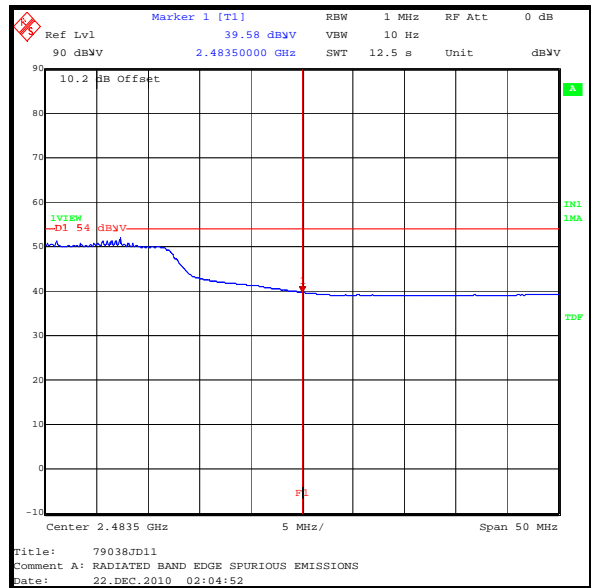
#### Results: 802.11g / 24 Mbps



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

## **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”.

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
Radiated Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±2.94 dB
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.

## Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (months)
A1393	Attenuator	Huber & Suhner	757456	6820.17.B	06 Jul 2011	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	06 Jun 2011	12
A1818	Antenna	EMCO	3115	00075692	05 Sep 2011	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	29 Dec 2011	12
A253	Antenna	Flann Microwave	12240-20	128	05 Sep 2011	12
A254	Antenna	Flann Microwave	14240-20	139	05 Sep 2011	12
A255	Antenna	Flann Microwave	16240-20	519	05 Sep 2011	12
A256	Antenna	Flann Microwave	18240-20	400	05 Sep 2011	12
A288	Antenna	Chase	CBL6111A	1589	05 Sep 2011	12
A436	Antenna	Flann	20240-20	330	05 Sep 2011	12
A553	Antenna	Chase	CBL6111A	1593	16 Mar 2011	12
G0543	Amplifier	Sonoma	310N	230801	30 Jun 2011	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	25 Apr 2011	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	05 Sep 2011	12
L1001	ESU26	Rohde & Schwarz	ESU26	100239	28 Jan 2011	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	22 Apr 2011	12

**NB** In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.