



# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Partial Test of: 511

To: FCC Part 15.247: 2008 Subpart C

**Test Report Serial No:**  
RFI/RPT1/RP76019JD03A

<b>This Test Report Is Issued Under The Authority Of Brian Watson, Operations Director:</b>	pp 
<b>Checked By:</b>	R Graham
<b>Signature:</b>	
<b>Date of Issue:</b>	04 December 2009

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**1. Customer Information**







<b>Company Name:</b>	Ezurio Ltd
<b>Address:</b>	Saturn House, Mercury Park Wycome Lane Woodburn Green Bucks HP10 0HH

## 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) 2008: Part 15 Subpart C (Radio Frequency Devices) - Section 15.247
<b>Specification Reference:</b>	47CFR15.109
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2008: Part 15 Subpart B (Radio Frequency Devices) - Section 15.109
<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>	17 November to 01 December 2009

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Port Type	Result
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	Antenna	
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	Antenna	
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	Antenna	
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	Antenna	
<b>Key to Results</b>			
 = Complied  = Did not comply			

### 2.3. Methods and Procedures

<b>Reference:</b>	ANSI C63.4 (2003)
<b>Title:</b>	American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Reference:</b>	DA00-705 (2000)
<b>Title:</b>	Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

### 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.

Only tests of Idle mode radiated emissions and transmitter EIRP and radiated spurious emissions were performed at the request of the client.

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

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

<b>Brand Name:</b>	Ezurio
<b>Model Name or Number:</b>	511
<b>Serial Number:</b>	Not stated
<b>FCC ID Number:</b>	PI4511B

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

The equipment under test was a *Bluetooth* Module.

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

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Tested Technology:</b>	<i>Bluetooth</i>		
<b>Power Supply Requirement:</b>	Nominal	5.0 V	
<b>Type of Unit:</b>	Transceiver		
<b>Mode:</b>	Basic Rate	Enhanced Data Rate	
<b>Modulation:</b>	GFSK	$\pi/4$ -DQPSK	8DQPSK
<b>Packet Type: (Maximum Payload)</b>	DH5	2DH5	3DH5
<b>Data Rate (Mbit/s):</b>	1	2	3
<b>Maximum Transmit EIRP:</b>	2.4 dBm		
<b>Transmit Frequency Range:</b>	2402 to 2480 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480
<b>Receive Frequency Range:</b>	2402 to 2480 MHz		
<b>Receive Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	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:

<b>Description:</b>	Laptop
<b>Brand Name:</b>	Sony
<b>Model Name or Number:</b>	Vaio
<b>Serial Number:</b>	218982505100620

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

### **4.1. Operating Modes**

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

- Transmit mode with Basic rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.
- Receive Mode: Standalone, with the Bluetooth mode active but not transmitting.

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

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

- EUT was connected via a radio link to a Bluetooth tester in order to place the EUT into Bluetooth test mode. The laptop PC with the client's bespoke application was used to place the EUT into Bluetooth Test mode.
- For Transmitter Radiated Spurious Emissions, both EDR/Basic rate modes were compared and tests were performed with the mode that presented a worse case result.



## **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. Receiver/Idle Mode Radiated Spurious Emissions

#### Test Summary:

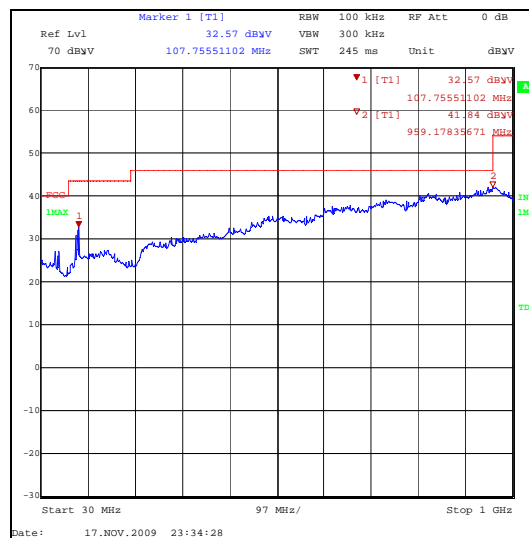
<b>FCC Part:</b>	15.109
<b>Test Method Used:</b>	As detailed in ANSI C63.4 Section 8 and relevant annexes
<b>Frequency Range:</b>	30 MHz to 1000 MHz

#### Environmental Conditions:

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

#### Results:

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
107.593	Vertical	32.6	43.5	10.9	Complied



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

**Receiver/Idle Mode Radiated Spurious Emissions (continued)****Test Summary:**

<b>FCC Part:</b>	15.109
<b>Test Method Used:</b>	As detailed in ANSI C63.4 Section 8 and relevant annexes
<b>Frequency Range:</b>	1 GHz to 12.75 GHz

**Environmental Conditions:**

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

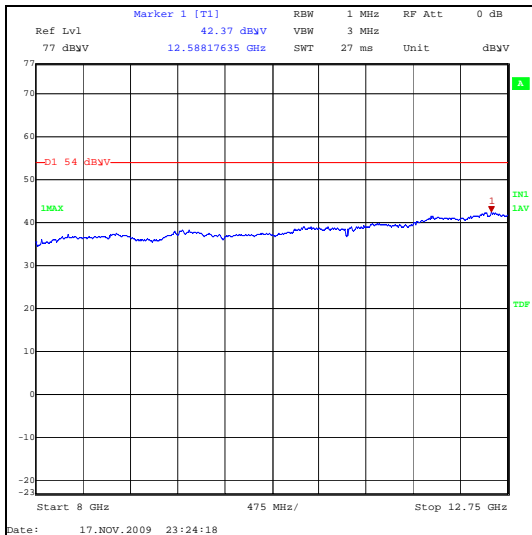
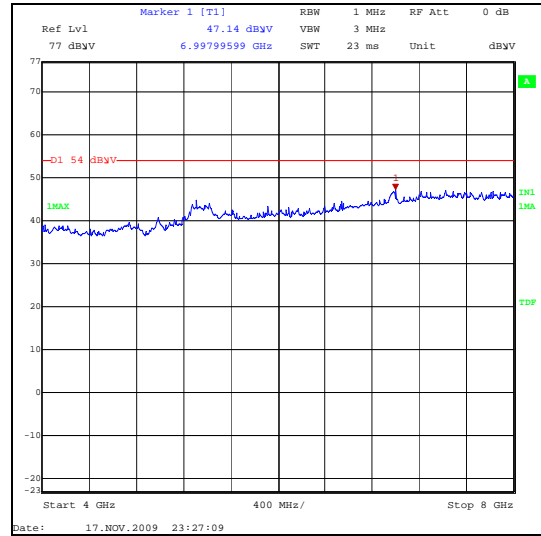
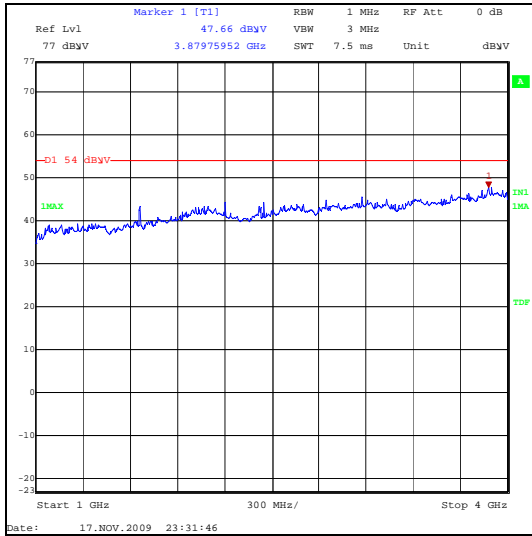
**Results:**

<b>Frequency (MHz)</b>	<b>Antenna Polarity</b>	<b>Level (dB<math>\mu</math>V/m)</b>	<b>Limit (dB<math>\mu</math>V/m)</b>	<b>Margin (dB)</b>	<b>Result</b>
3879.759	Horizontal	47.7	54.0	6.3	Complied

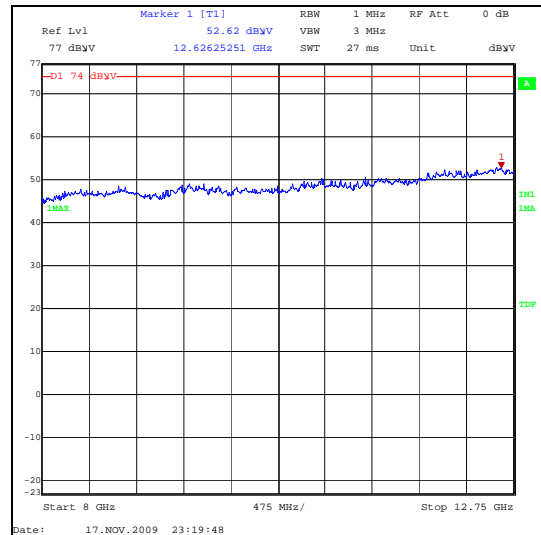
**Note(s):**

1. 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. The peak level was compared to the average limit as opposed to the peak limit because this is the more onerous limit.
2. All pre-scans were performed with a peak detector against the average limit apart from measurements made in the range of 8 to 12.75 GHz where pre-scans were performed with peak and average detectors and applicable limit applied. This was due to the noise floor exceeding the average limit when using a peak detector.

**Receiver/Idle Mode Radiated Spurious Emissions (continued)**



**AVG DETECTOR**



**PEAK DETECTOR**

**5.2.2. Transmitter Maximum Peak Output Power (EIRP)****Test Summary:**

<b>FCC Part:</b>	15.247(b)(3)
<b>Test Method Used:</b>	As detailed in Public Notice DA 00-705 (March 30, 2000), ANSI TIA-603-C-2004 and FCC CFR Part 2

**Environmental Conditions:**

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

**Results: Basic Rate DH5**

Channel	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	1.7	30.0	28.3	Complied
Middle	0.4	30.0	29.6	Complied
Top	2.4	30.0	27.6	Complied

**Results: EDR 2DH5**

Channel	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	1.1	21.0	19.9	Complied
Middle	0.2	21.0	20.8	Complied
Top	0.5	21.0	20.5	Complied

**Results: EDR 3DH5**

Channel	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2.1	21.0	18.9	Complied
Middle	0.5	21.0	20.5	Complied
Top	1.7	21.0	28.3	Complied

**Note(s):**

1. These tests were performed radiated; therefore the EUT antenna gain is encompassed in the final result and not measurable.

**5.2.3. Transmitter Radiated Emissions**

**Test Summary:**

<b>FCC Part:</b>	15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.4 Section 8 and Public Notice DA 00-705 (March 30, 2000)
<b>Frequency Range</b>	30 MHz to 1000 MHz

**Environmental Conditions:**

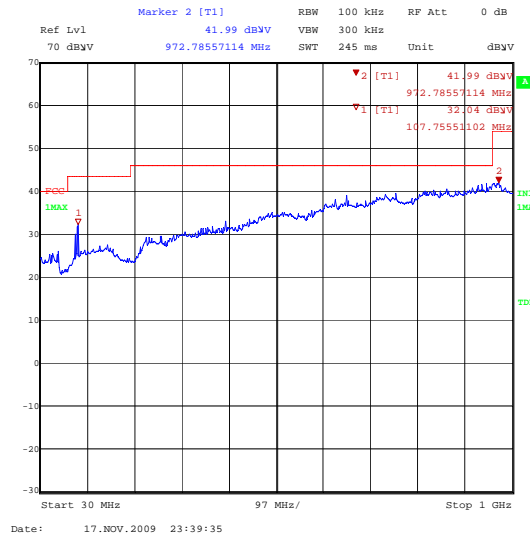
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	31

**Results: Top Channel - Top Channel DH5**

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
107.499	Vertical	32.6	43.5	10.9	Complied
973.839	Vertical	41.3	54.0	12.7	Complied

**Note(s):**

- 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.



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

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

<b>FCC Part:</b>	15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.4 Section 8 and Public Notice DA 00-705 (March 30, 2000)
<b>Frequency Range</b>	1 GHz to 26.5 GHz

**Environmental Conditions:**

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

**Results: Highest Peak Level. Bottom Channel - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4804.609	Horizontal	58.5	-1.2	59.7	74.0	14.3	Complied

**Results: Highest Average Level. Bottom Channel - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4803.858	Horizontal	50.8	-1.2	52.0	54.0	2.0	Complied

**Results: Highest Peak Level. Middle Channel - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4881.764	Horizontal	56.2	-1.2	57.8	74.0	16.2	Complied

**Results: Highest Average Level. Middle Channel - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4882.264	Horizontal	46.8	-1.2	48.0	54.0	6.0	Complied

**Results: Highest Peak Level. Top Channel - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4959.669	Horizontal	51.1	-1.2	52.3	74.0	21.7	Complied

**Results: Highest Average Level. Top Channel - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4960.170	Horizontal	48.8	-1.2	50.0	54.0	4.0	Complied

**Transmitter Radiated Emissions (continued)****Results: Highest Peak Level. Hopping Mode - DH5**

Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4881.592	Horizontal	56.3	-1.2	57.5	74.0	16.5	Complied

**Results: Highest Average Level. Hopping Mode - DH5**

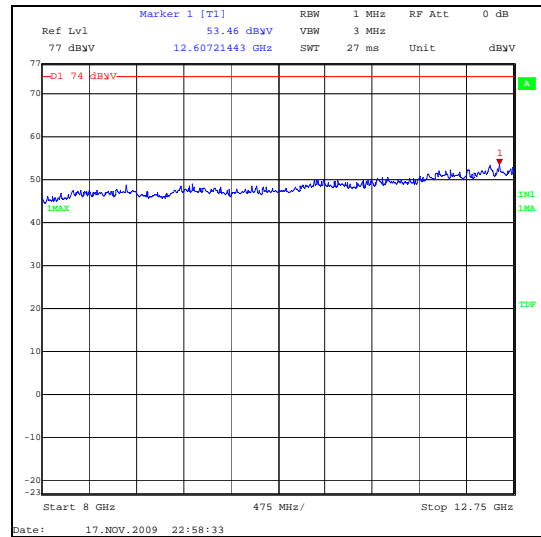
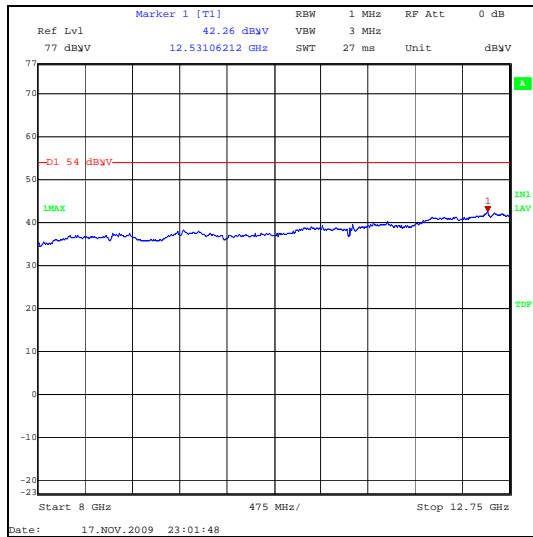
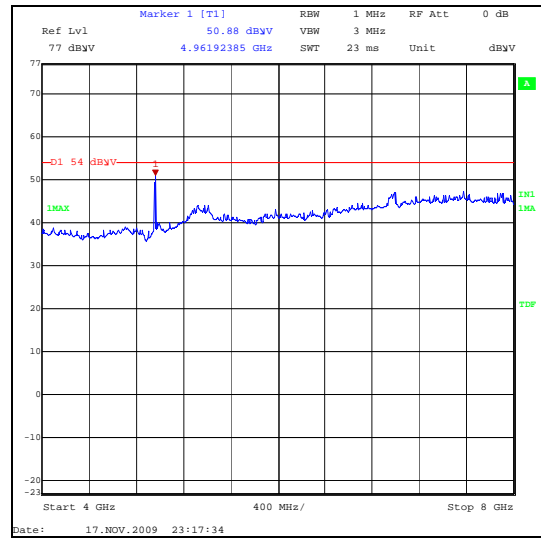
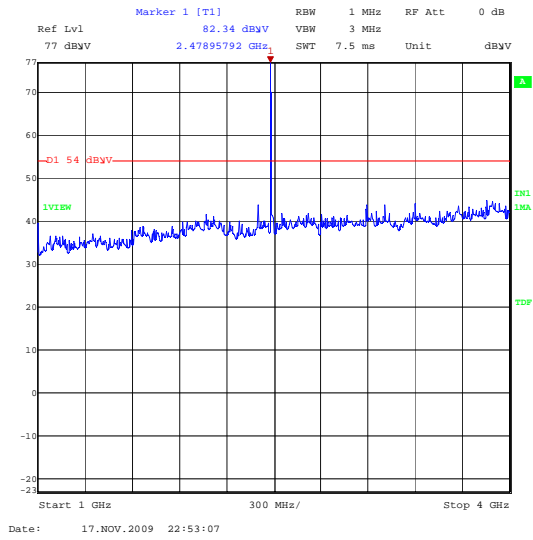
Frequency (GHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4804.112	Horizontal	46.9	-1.2	48.1	54.0	5.9	Complied

**Note(s):**

1. All pre-scans were performed with a peak detector against average limits apart from measurements made in the range 8 GHz to 26.5 GHz where pre-scans were performed with peak and average detectors and the applicable limit applied. This was due to the noise floor exceeding the average limit when using a peak detector.
2. The emission shown on the 1 GHz to 4 GHz plots is the fundamental transmit frequency at 2480 MHz.

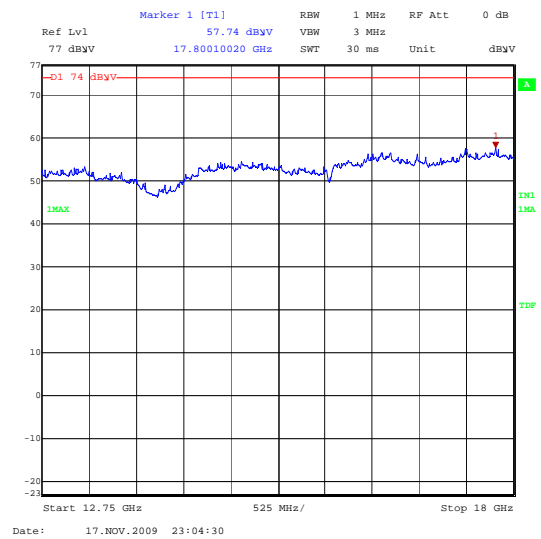
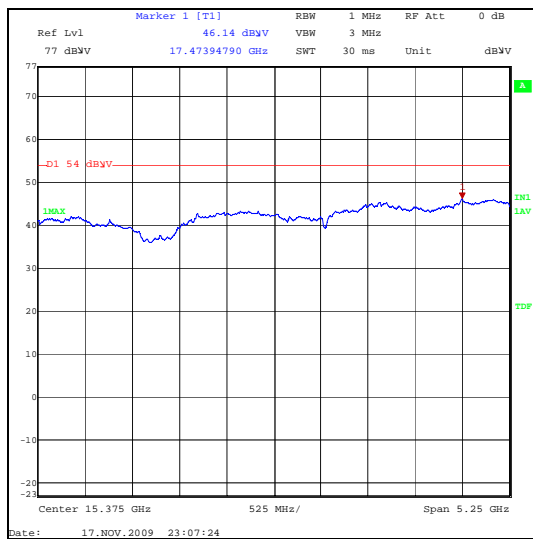


**Transmitter Radiated Emissions (continued)**



**AVG DETECTOR**

**PEAK DETECTOR**

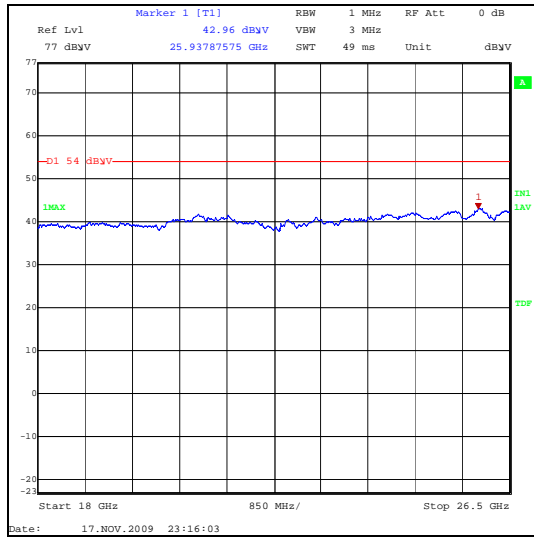


**12.75 GHz to 18 GHz AVG DETECTOR**

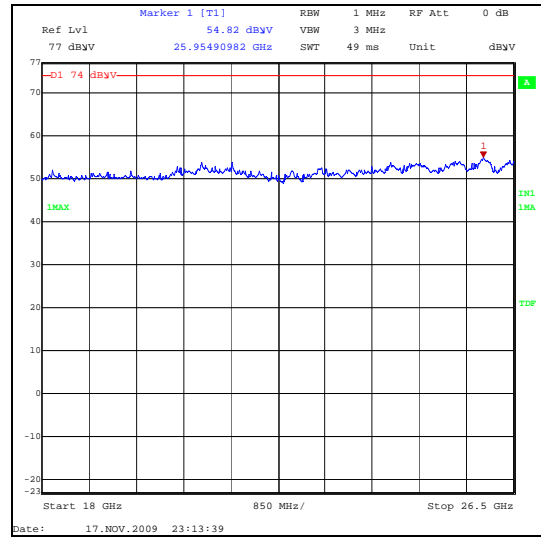
**PEAK DETECTOR**

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

**Transmitter Radiated Emissions (continued)**



**AVG DETECTOR**



**PEAK DETECTOR**

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

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

<b>FCC Part:</b>	15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.4 Section 8 and Public Notice DA 00-705 (March 30, 2000)

**Environmental Conditions:**

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

**Results: Peak Power Level Hopping Mode DH5**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Horizontal	52.6	-0.2	52.4	76.9*	24.5	Complied
2.4835	Horizontal	57.2	-0.3	56.9	74.0	17.1	Complied

**Results: Average Power Level Hopping Mode DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Horizontal	44.9	-0.3	44.6	54.0	9.4	Complied

**Results: Peak Power Level Hopping Mode 2DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Horizontal	49.5	-0.2	49.3	76.3*	27.0	Complied
2.4835	Horizontal	56.1	-0.3	55.8	74.0	18.2	Complied

**Results: Average Power Level Hopping Mode 2DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Horizontal	43.4	-0.3	43.1	54.0	10.9	Complied

**Results: Peak Power Level Hopping Mode 3DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Horizontal	50.4	-0.2	50.2	77.3*	27.1	Complied
2.4835	Horizontal	57.0	-0.3	56.7	74.0	17.3	complied

**Transmitter Band Edge Radiated Emissions (continued)****Results: Average Power Level Hopping Mode 3DH5:**

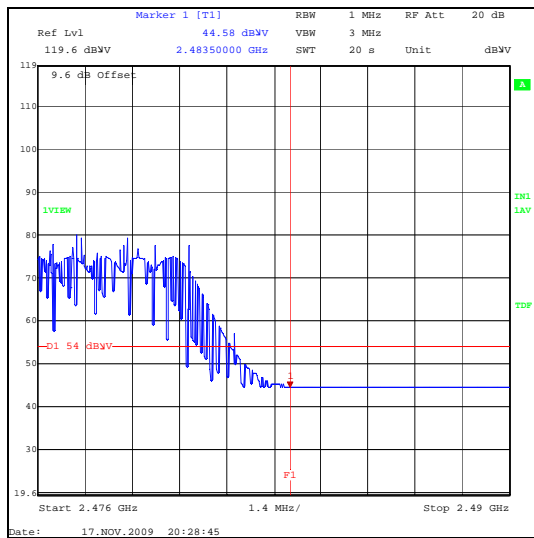
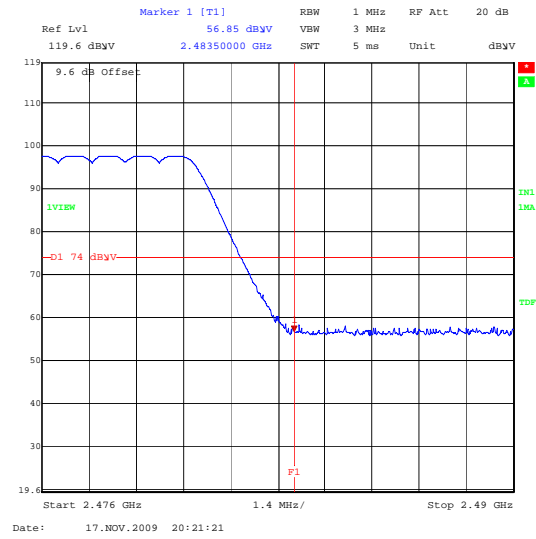
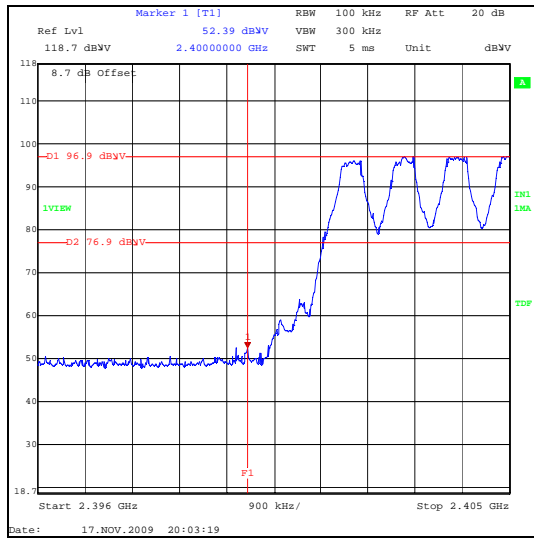
Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Horizontal	44.0	-0.3	43.7	54.0	10.3	Complied

**Note(s):**

1. \* -20 dBc limit

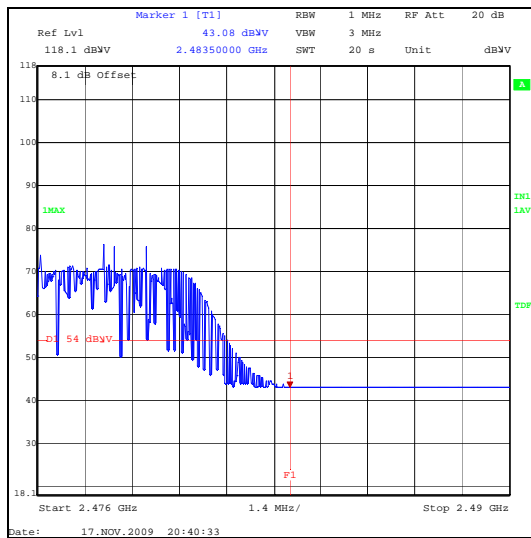
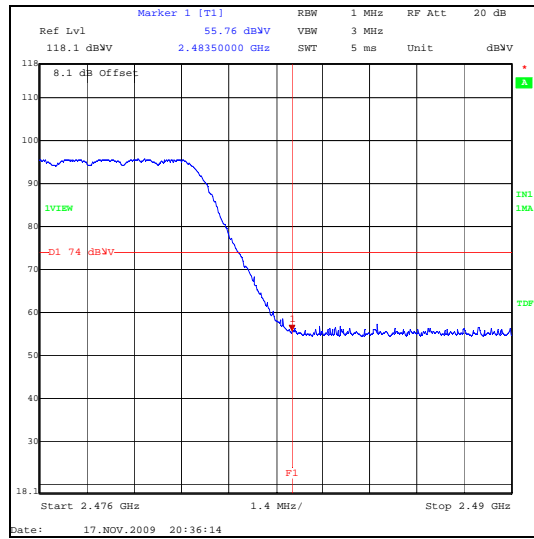
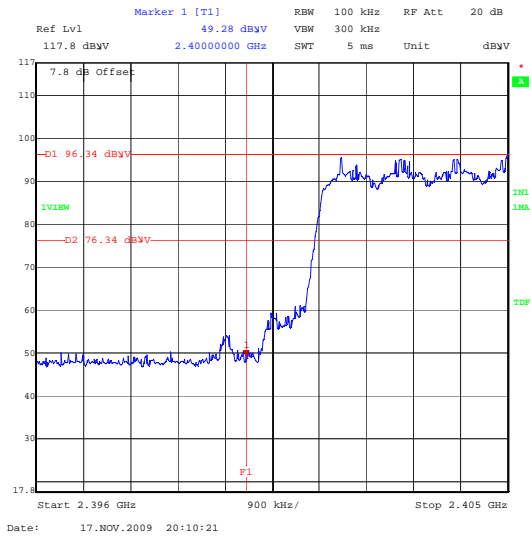
### Transmitter Band Edge Radiated Emissions (continued)

#### DH5:



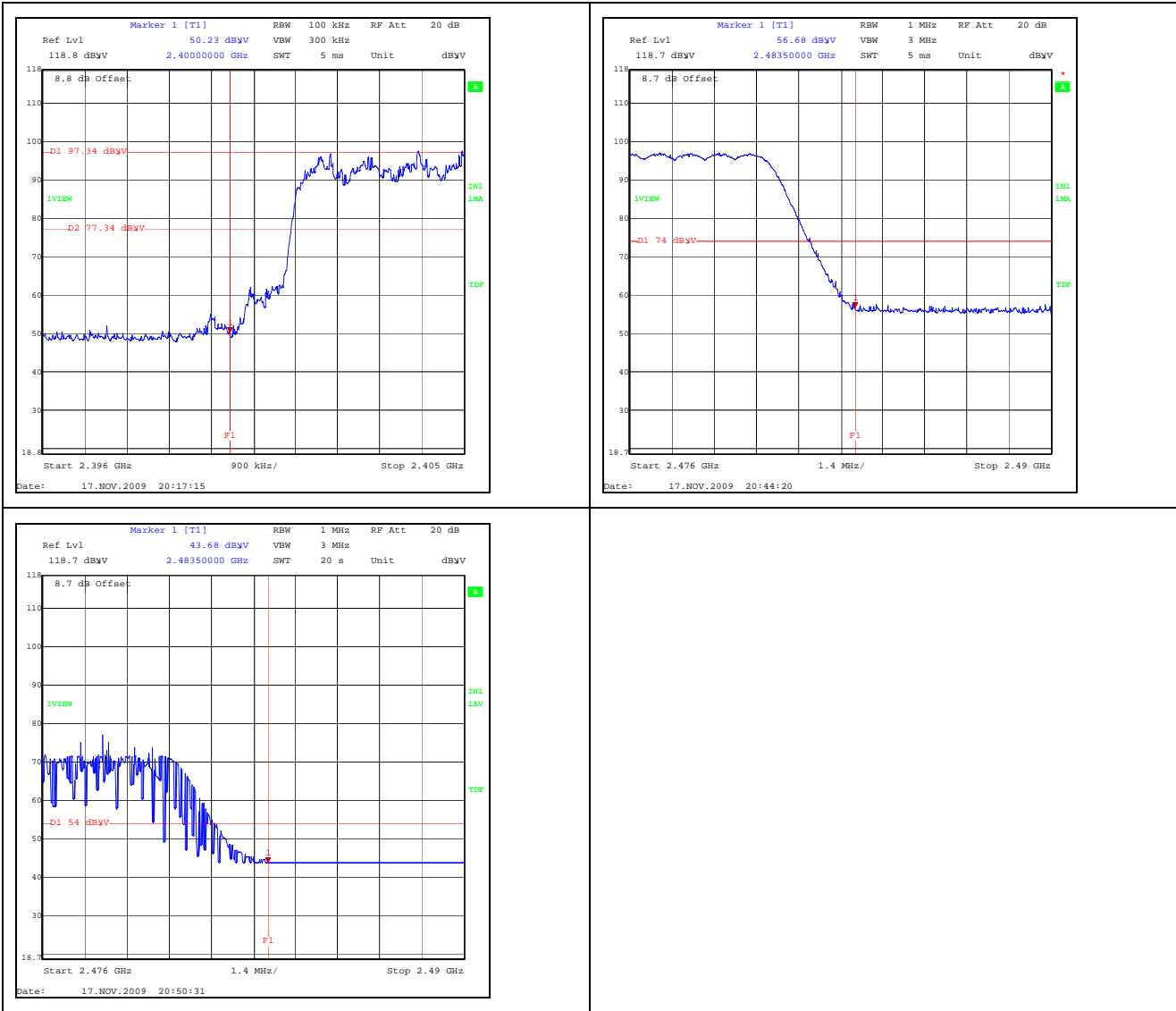
### Transmitter Band Edge Radiated Emissions (continued)

#### 2DH5



### Transmitter Band Edge Radiated Emissions (continued)

#### 3DH5



**Transmitter Band Edge Radiated Emissions (continued)****Results: Peak Power Level Static Mode DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Horizontal	56.4	-0.2	56.2	76.9*	20.5	Complied
2.4835	Horizontal	58.8	-0.3	58.5	74.0	15.5	Complied

**Results: Average Power Level Static Mode DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Horizontal	46.2	-0.3	45.9	54.0	8.1	Complied

**Results: Peak Power Level Static Mode 2DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Horizontal	53.3	-0.2	53.1	76.3*	23.2	Complied
2.4835	Horizontal	56.6	-0.3	56.3	74.0	17.3	Complied

**Results: Average Power Level Static Mode 2DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Horizontal	45.2	-0.3	44.9	54.0	9.1	Complied

**Results: Peak Power Level Static Mode 3DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4000	Horizontal	52.0	-0.2	51.8	77.3*	25.5	Complied
2.4835	Horizontal	58.8	-0.3	58.5	74.0	15.5	Complied

**Results: Average Power Level Static Mode 3DH5:**

Frequency (MHz)	Antenna Polarity	Detector Level (dB $\mu$ V)	Transducer Factor (dB)	Actual Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2.4835	Horizontal	45.3	-0.3	45.0	54.0	9.0	Complied

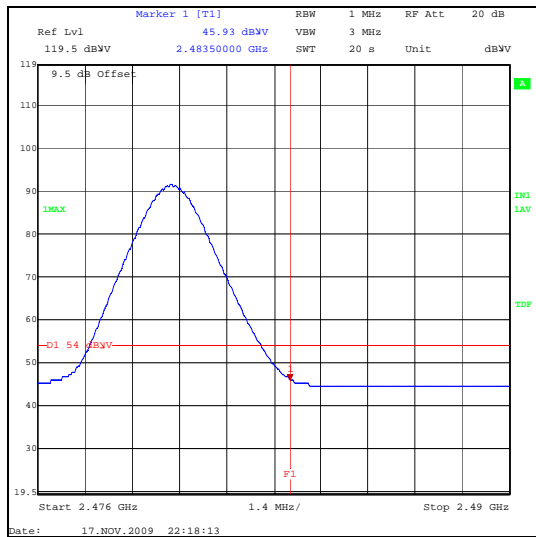
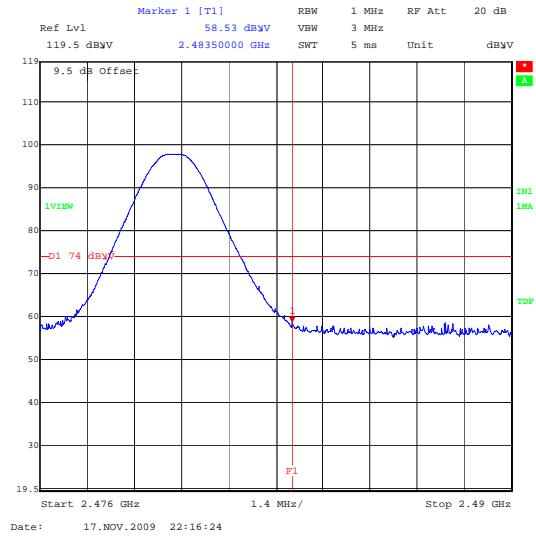
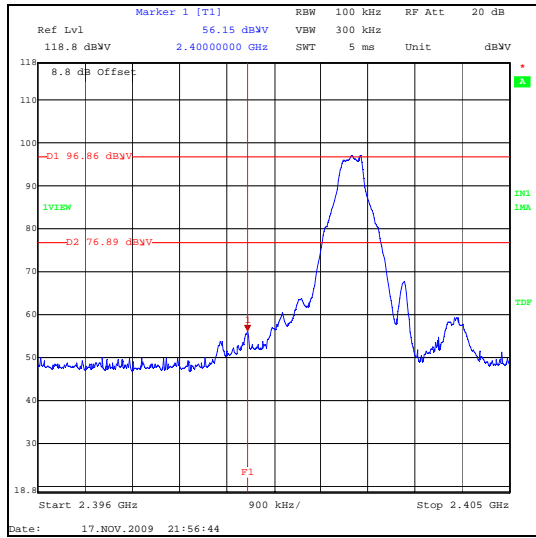
**Note(s):**

- \* -20 dBc limit



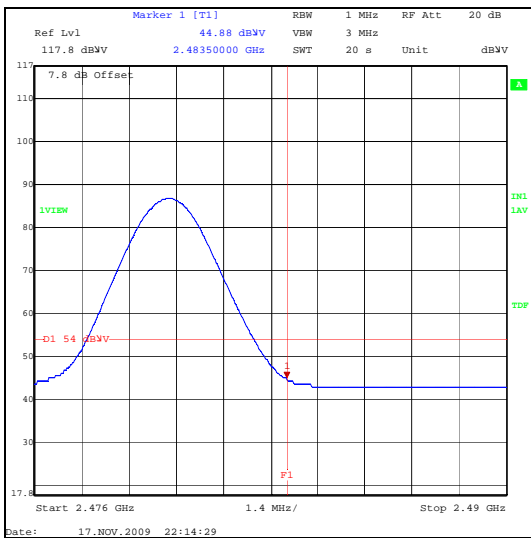
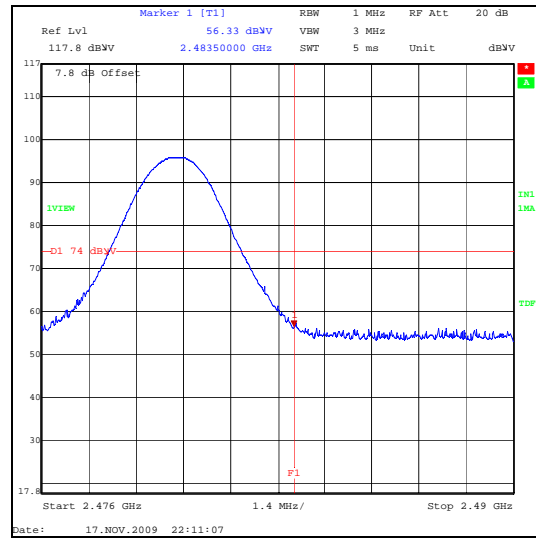
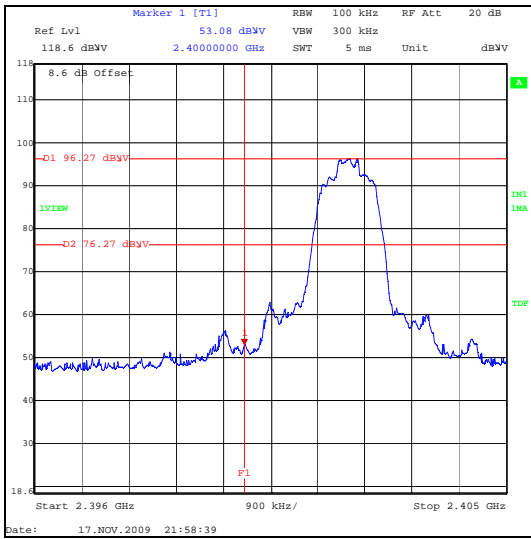
### Transmitter Band Edge Radiated Emissions (continued)

#### DH5:



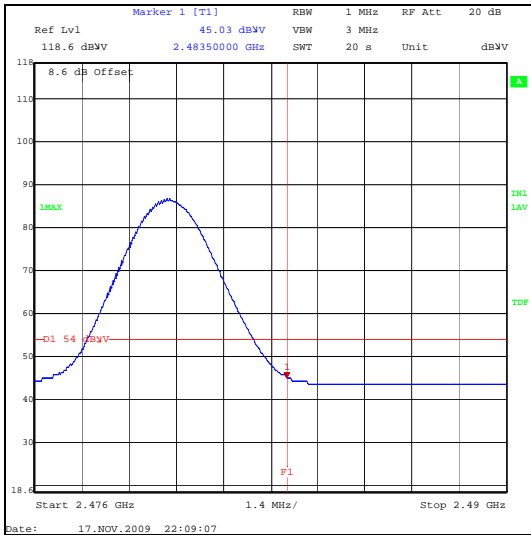
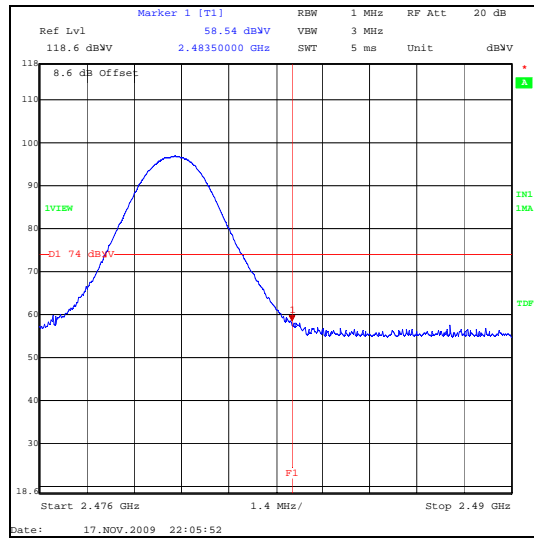
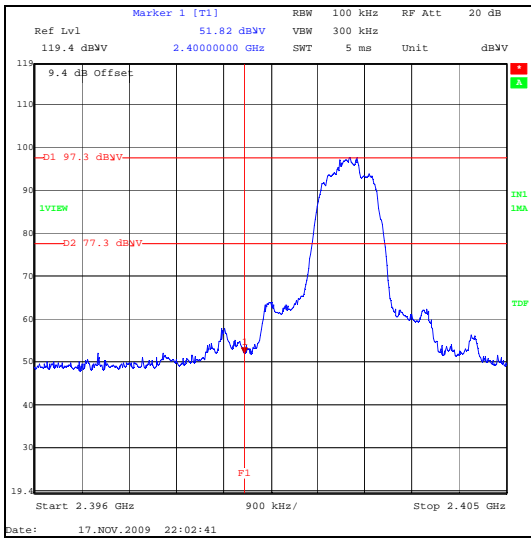
### Transmitter Band Edge Radiated Emissions (continued)

#### 2DH5:



### Transmitter Band Edge Radiated Emissions (continued)

#### 3DH5:



## **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>
Transmitter Maximum Peak Output Power	Not Applicable	95%	±2.94 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±4.64 dB
Radiated Spurious Emissions	1 GHz to 40 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 Last Calibrated	Cal. Interval
A1534	Pre Amplifier	Hewlett Packard	8449B OPT H02	3008A00405	Calibrated before use	-
A1818	Antenna	EMCO	3115	00075692	27 Nov 2009	12
A288	Antenna	Chase	CBL6111A	1589	13 Mar 2009	12
A436	Antenna	Flann	20240-20	330	24 Apr 2009	36
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 Sep 2009	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	09 Mar 2009	12
M1447	Bluetooth Tester	Rohde & Schwarz	CBT	100329	19 Jan 2009	12

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