



TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: WearLink Hybrid

To: FCC Part 15.249: 2008 Subpart C, RSS-210 Issue 7 June 2007
& RSS-Gen Issue 2 June 2007

Test Report Serial No:
RFI/RPT1/RP75126JD05A

This Test Report Is Issued Under The Authority Of Brian Watson, Operations Director:	pp 
Checked By:	R. Graham
Signature:	
Date of Issue:	17 July 2009

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Table of Contents

1. Customer Information 4

2. Summary of Testing 5

3. Equipment Under Test (EUT) 6

4. Operation and Monitoring of the EUT during Testing 7

5. Measurements, Examinations and Derived Results 8

6. Measurement Uncertainty 24

Appendix 1. Test Equipment Used 25

1. Customer Information






Company Name:	Polar Electro Oy
Address:	Professorintie 5 Kempele 90440 Finland

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.249
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2008: Part 15 Subpart C (Radio Frequency Devices) - Section 15.249
Specification Reference:	RSS-210 Issue 7 June 2007
Specification Title:	Low-power Licence-exempt Radio communication Devices (All Frequency Bands): Category I Equipment.
Specification Reference:	RSS-GEN Issue 2 June 2007
Specification Title:	General Requirements and Information for the Certification of Radio communication Equipment
Site Registration:	FCC: 209735; Industry Canada: 3245B-2
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	22 June 2009 to 16 July 2009

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Port Type	Result
Part 15.109	RSS-Gen 4.10/6	Idle Mode Radiated Spurious Emissions	Enclosure	
Part 15.249(a)	RSS-Gen 4.8 RSS-210 A2.9	Transmitter Fundamental Field Strength	Antenna	
Part 2.1049	RSS-Gen 4.6.1	Transmitter 20 dB Bandwidth	Antenna	
Part 15.249(a)(d)(e) & 15.209	RSS-Gen 4.9 RSS-210 A2.9	Transmitter Radiated Spurious Emissions	Antenna	
Part 15.249(d) & 15.209	RSS-Gen 4.9 RSS-210 A2.9	Transmitter Band Edge Radiated Emissions	Antenna	
Part 15.35(c)	Not Applicable	Transmitter Duty Cycle	N/A	N/A

Key to Results

 = Complied  = Did not comply

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2003)
Title:	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.

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:	Polar
Model Name or Number:	WearLink Hybrid
Serial Number:	None stated
Hardware Version Number:	81038297
Software Version Number:	71038487.00
FCC ID Number:	INWT4
Industry Canada ID Number:	6248A-T4

3.2. Description of EUT

The equipment under test was a heart rate transmitter.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Power Supply Requirement:	3 VDC internal battery	
Channel Spacing:	1 MHz	
Modulation:	GFSK	
Transmit Frequency Range:	2409 MHz to 2473 MHz	
Transmit Channels Tested:	Channel ID	Channel Frequency (MHz)
	Bottom	2409
	Middle	2441
	Top	2473

3.5. Support Equipment

No support equipment was used to exercise the EUT during testing.

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Idle Mode.
- Transmit Mode operating at maximum output power with a modulated carrier at bottom, middle and top channel.

4.2. Configuration and Peripherals

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

- For transmitter tests the EUT was tested standalone and connected to internal battery of 3.0V. Electrodes were connected on the EUT to allow the EUT to transmit continues carrier with modulation. The electrodes were then removed once the EUT start transmitting.
- For Idle mode test, the EUT was tested standalone and connected to internal battery of 3.0V.

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. Idle Mode Radiated Spurious Emissions

Test Summary:

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

Environmental Conditions:

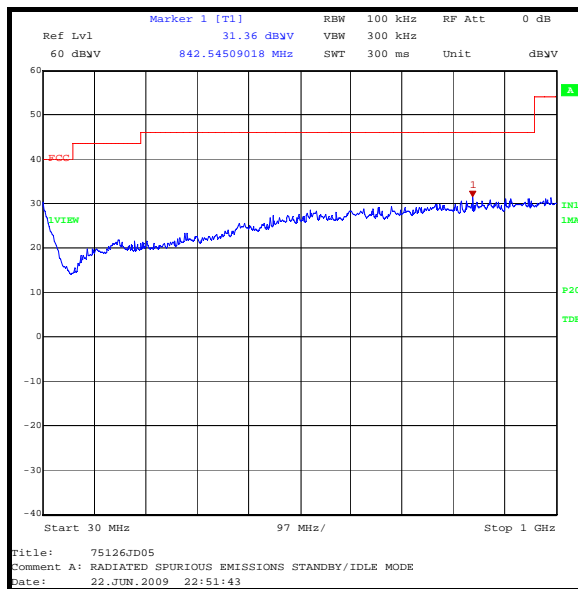
Temperature (°C):	29
Relative Humidity (%):	30

Results:

Frequency (MHz)	Antenna Polarity	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
842.545	Vertical	31.4	45.0	13.6	Complied

Note(s):

- 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.



5.2.2. Idle Mode Radiated Spurious Emissions**Test Summary:**

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

Environmental Conditions:

Temperature (°C):	29
Relative Humidity (%):	30

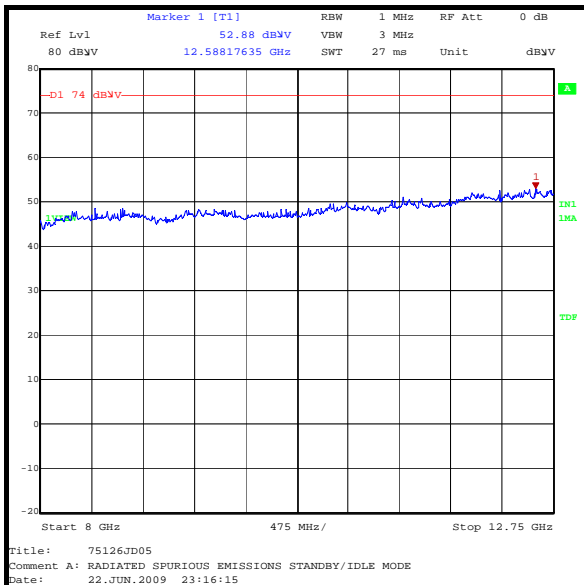
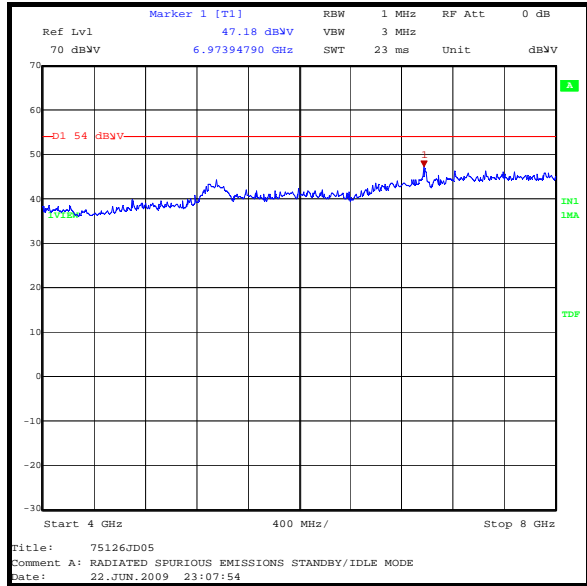
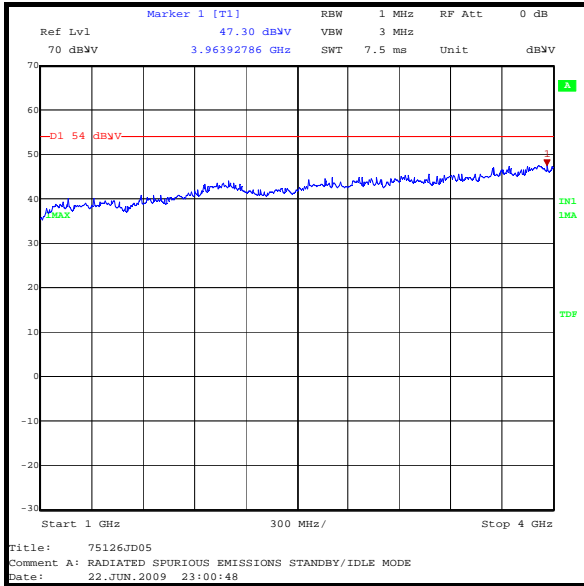
Results: Highest Level

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Transducer Factor (dB)	Peak Level (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
12.597	Vertical	40.0	13.1	53.1	54.0	0.9	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 being compared to the peak limit because this is the more onerous limit.

Idle Mode Radiated Spurious Emissions: Section 15.109 (continued)



5.2.3. Transmitter Fundamental Field Strength**Test Summary:**

FCC Part:	Section 15.249(a)
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Temperature (°C):	29
Relative Humidity (%):	30

Results: Bottom Channel - Peak Level

Antenna Polarity	Level (dB μ V/m)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Vertical	93.2	-0.2	93.0	114.0	11.0	Complied

Results: Bottom Channel - Average Level

Antenna Polarity	Level (dB μ V/m)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Vertical	42.7	-0.2	42.5	94.0	51.5	Complied

Results: Middle Channel - Peak Level

Antenna Polarity	Level (dB μ V/m)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Vertical	92.9	-0.2	92.7	114.0	11.3	Complied

Results: Middle Channel - Average Level

Antenna Polarity	Level (dB μ V/m)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Vertical	42.4	-0.2	42.2	94.0	51.8	Complied

Results: Top Channel - Peak Level

Antenna Polarity	Level (dB μ V/m)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Vertical	94.0	-0.2	93.8	114.0	10.2	Complied

Results: Top Channel - Average Level

Antenna Polarity	Level (dB μ V/m)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Vertical	43.5	-0.2	43.3	94.0	50.7	Complied

Note(s):

1. The peak level was measured with the EUT in continuous transmit mode as it was impractical to measure the emission with EUT transmitting a 0.299 ms burst every 1 seconds.
The average level was determined by subtracting the duty cycle correction factor (based on the measured transmission interval of 0.299 ms) from the measured peak level. The duty cycle correction factor was calculated using formula $20 \log (\text{On Time} / 100 \text{ ms})$ as per FCC Part 15.35 (c).
 $20 \log (0.299/100) = -50.5$, therefore 50.5 dB was subtracted from the peak level to give the average level.

5.2.4. Transmitter 20 dB Bandwidth

Test Summary:

FCC Part:	2.1049
Test Method Used:	As detailed in ANSI C63.4 Section 13.1.7 and relevant annexes (see note below)

Environmental Conditions:

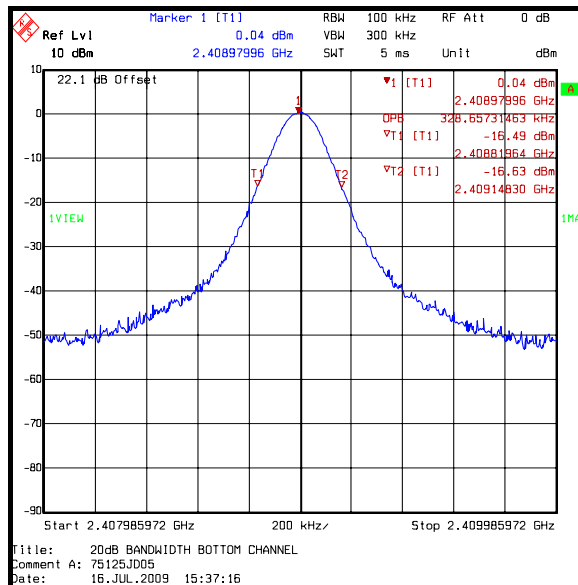
Temperature (°C):	29
Relative Humidity (%):	30

Results: Bottom Channel

Transmitter 20 dB Bandwidth (kHz)
328.657

Note(s):

- In lieu of the test method detailed in ANSI C63.4 Section 13.1.7 the 99% occupied bandwidth was measured using the Occupied Bandwidth function of the spectrum analyser



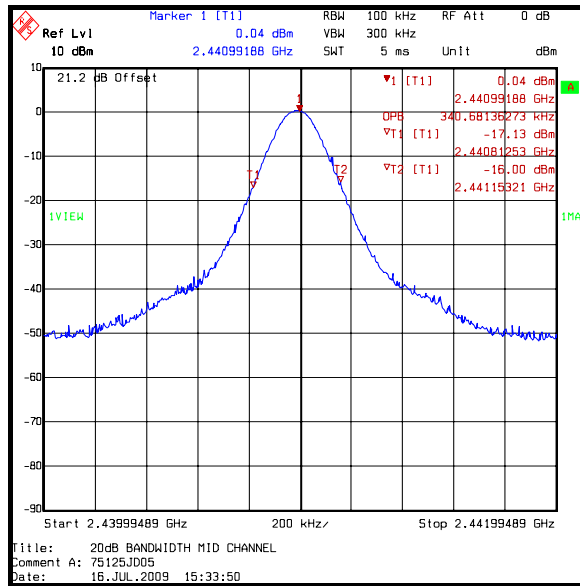
Transmitter 20 dB Bandwidth (continued)

Results: Middle Channel

Transmitter 20 dB Bandwidth (kHz)
340.681

Note(s):

- In lieu of the test method detailed in ANSI C63.4 Section 13.1.7 the 99% occupied bandwidth was measured using the Occupied Bandwidth function of the spectrum analyser



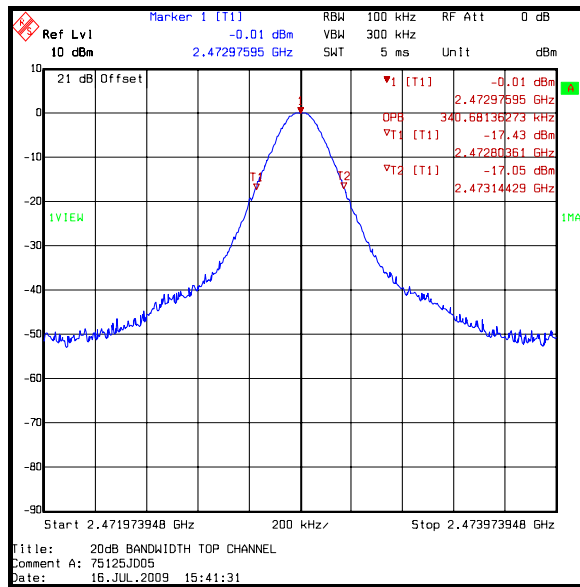
Transmitter 20 dB Bandwidth (continued)

Results: Top Channel

Transmitter 20 dB Bandwidth (kHz)
340.681

Note(s):

- In lieu of the test method detailed in ANSI C63.4 Section 13.1.7 the 99% occupied bandwidth was measured using the Occupied Bandwidth function of the spectrum analyser



5.2.5. Transmitter Radiated Spurious Emissions

Test Summary:

FCC Part:	15.249(a)(d)(e) & 15.209
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes
Frequency Range:	30 to 1000 MHz

Environmental Conditions:

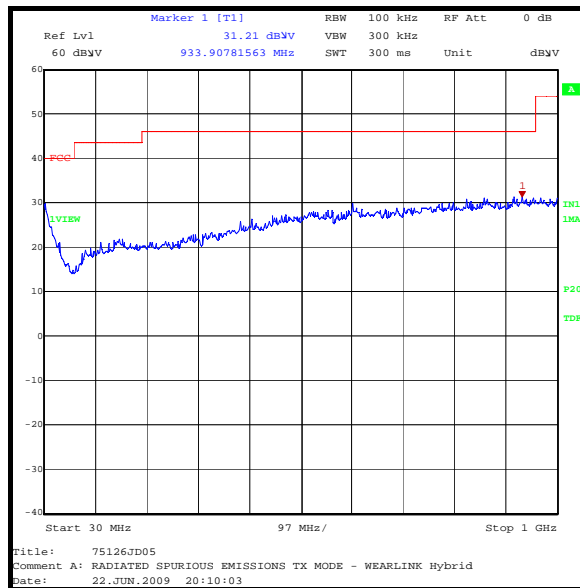
Temperature (°C):	29
Relative Humidity (%):	30

Results:

Frequency (MHz)	Antenna Polarity	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
933.908	Vertical	31.2	46.0	14.8	Complied

Note(s):

- 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.



5.2.6. Transmitter Radiated Spurious Emissions (continued)**Test Summary:**

FCC Part:	15.249(a)(d)(e) & 15.209
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes
Frequency Range:	1 to 26.5 GHz

Environmental Conditions:

Temperature (°C):	29
Relative Humidity (%):	30

Results: Bottom Channel - Highest Peak Level

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4818.008	Vertical	58.5	-0.2	58.3	74.0	15.7	Complied
7227.223	Vertical	46.9	-0.2	46.7	74.0	27.3	Complied

Results: Bottom Channel - Highest Average Level

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4818.008	Vertical	8.0	-0.2	7.8	54.0	46.0	Complied
7227.223	Vertical	-4.0	-0.2	-3.8	54.0	57.8	Complied

Results: Middle Channel - Highest Peak Level

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4881.984	Vertical	61.8	-0.2	61.6	74.0	12.4	Complied
7322.874	Vertical	48.7	-0.2	48.5	74.0	25.5	Complied

Results: Middle Channel - Highest Average Level

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4881.984	Vertical	11.3	-0.2	11.1	54.0	42.9	Complied
7322.874	Vertical	-2.2	-0.2	-2.0	54.0	56.0	Complied

Transmitter Radiated Spurious Emissions (continued)**Results: Top Channel - Highest Peak Level**

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4946.052	Vertical	63.5	-0.2	63.3	74.0	10.7	Complied
7418.895	Vertical	50.1	-0.2	49.9	74.0	24.1	Complied

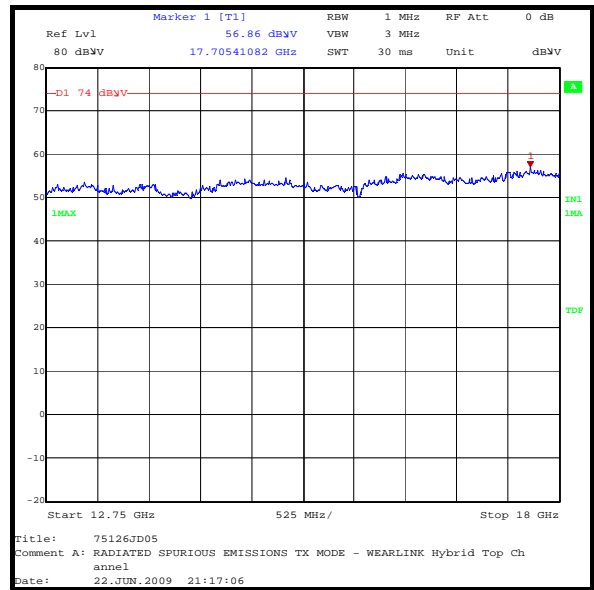
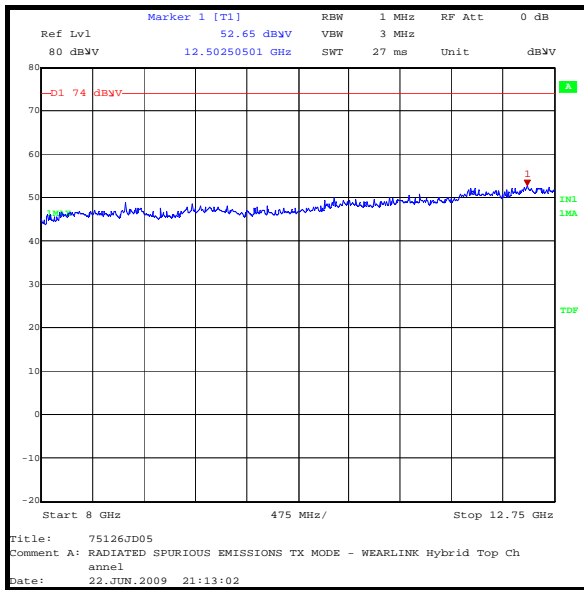
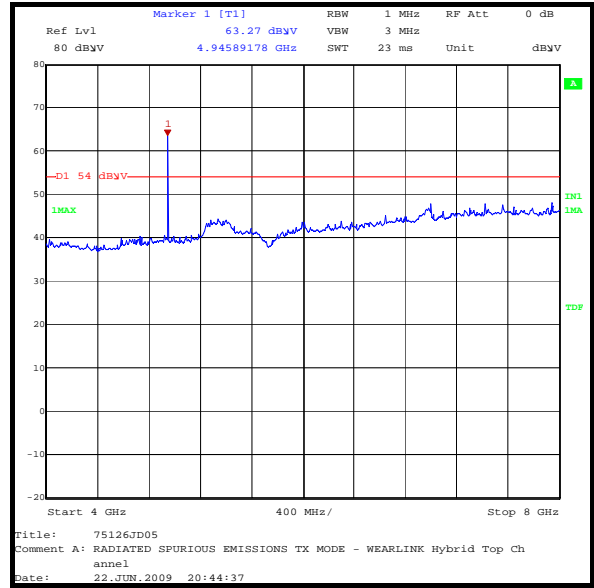
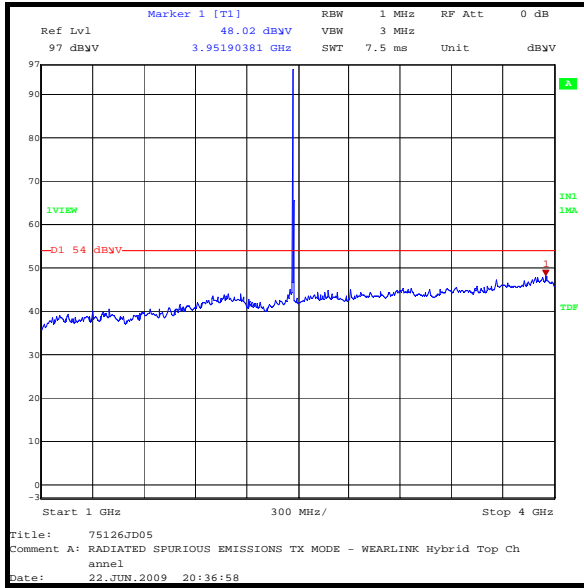
Results: Top Channel - Highest Average Level

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Transducer Factor (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4946.052	Vertical	13.0	-0.2	12.8	54.0	41.2	Complied
7418.895	Vertical	-0.8	-0.2	-0.6	54.0	54.6	Complied

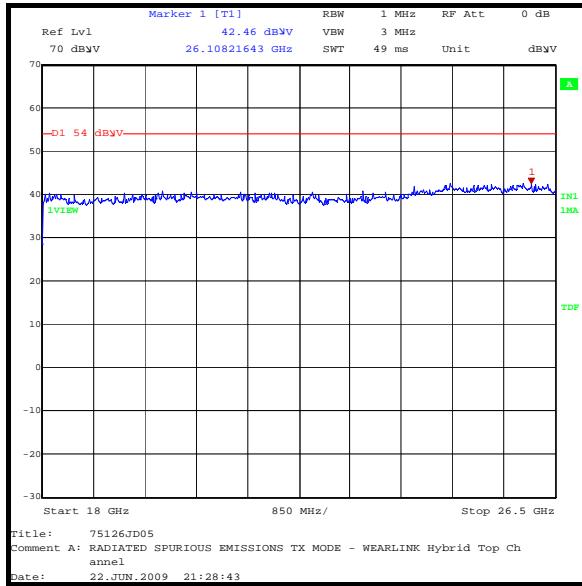
Note(s):

1. The average level was obtained by subtracting the duty cycle correction (50.5 dB) from the peak level measured with the EUT constantly transmitting.
2. FCC Part 15.209 general limits are shown on the pre-scan plots.

Transmitter Radiated Spurious Emissions (continued)



Transmitter Radiated Spurious Emissions (continued)



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

5.2.7. Transmitter Radiated Emissions at Band Edges

Test Summary:

FCC Part:	15.249(d) & 15.209
Test Method Used:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	36

Results: Peak Power Level

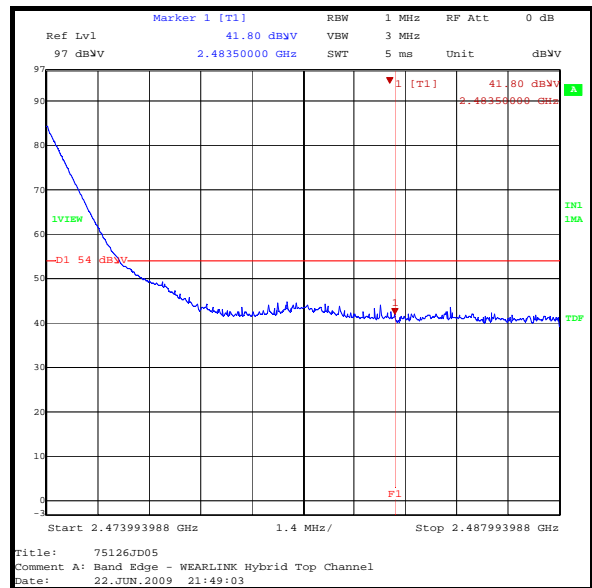
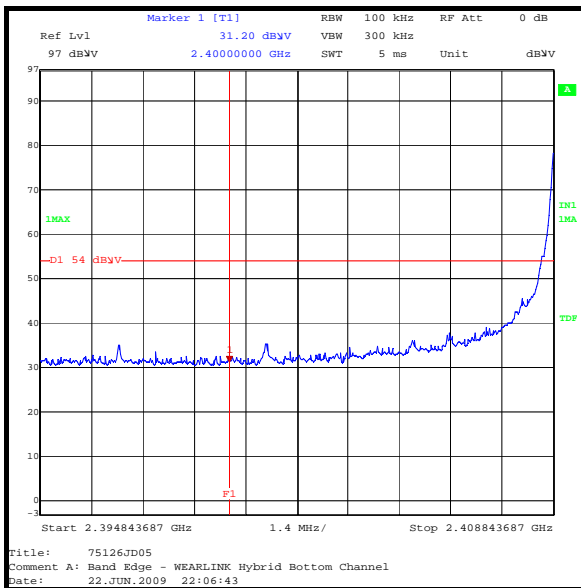
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Transducer Factors (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2.4000	Vertical	31.2	-0.2	31.0	74.0	43.0	Complied
2.4835	Vertical	41.8	-0.2	41.6	74.0	32.4	Complied

Results: Average Power Level

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Transducer Factors (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2.4835	Vertical	41.8	-0.2	41.6	54.0	12.4	Complied

Note(s):

1. The 20 dBc limit was not applicable as it would fall below the general limits as specified in FCC Part 15.209.



5.2.8. Transmitter Duty Cycle

Test Summary:

FCC Part:	15.35(c)
Test Method Used:	The transmitter duty cycle was measured using a spectrum analyser and calculated by 20 log(On Time / Period)

Environmental Conditions:

Temperature (°C):	27
Relative Humidity (%):	30

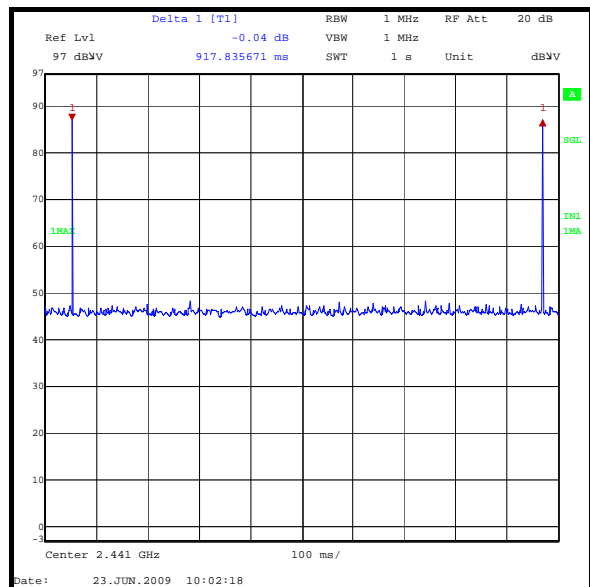
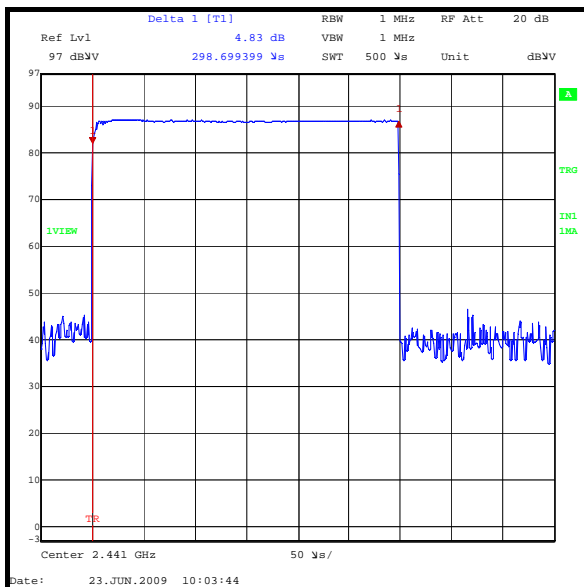
Results:

Pulse Duration (mS)		Duty Cycle (dB)
Measured	0.299	50.5

Silent Period (mS)
917.8

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.



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
Fundamental Fieldstrength	Not Applicable	95%	±2.94 dB
Transmitter 20 dB Bandwidth	Not Applicable	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz 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 (Months)
A1299	Antenna	Schaffner	CBL6143	5094	28 Jul 2008	12
A1534	Pre Amplifier	Hewlett Packard	8449B OPT H02	3008A00405	Calibrated before use	12
A1818	Antenna	EMCO	3115	00075692	25 Oct 2008	12
K0001	5m SA Chamber	Rainford EMC	N/A	N/A	04 May 2009	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	13 Aug 2008	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	09 Mar 2009	12

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