
REPORT ON

Limited FCC CFR 47: Parts 15 B and C Testing in Support of an
Application for Grant of Equipment Authorisation
of a Loc8tor Ltd Loc8tor Tag (2.4GHz transceiver)

COMMERCIAL-IN-CONFIDENCE

FCC ID: TUW-LOT11

Report No OR615060/03 Issue 3

May 2006



Product Service





Product Service

Competence. Certainty. Quality.

ASH Communications Ltd. – Confidential

TUV Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk; www.babt.com

REPORT ON

Limited FCC CFR 47: Parts 15 B and C Testing in Support of an
Application for Grant of Equipment Authorisation of a
Loc8tor Ltd Loc8tor Tag (2.4GHz transceiver)

FCC ID: TUW-LOT11

Report No OR615060/03 Issue 3

May 2006

PREPARED FOR

ASH Communications Ltd
5 Shaftesbury Avenue
Highfield
Southampton
SO17 1SB

PREPARED BY

J Plummer
Technical Author

APPROVED BY

J Adams
Authorised Signatory

M Jenkins
Authorised Signatory

DATED

16th May 2006

This report has been re-issued as Issue 3 to update typographical errors in the original report and to add some additional explanation where required. The Test Results are unaffected.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Parts 15 B & C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;

J Holcombe

A Guy





CONTENTS

Section		Page No
1	REPORT SUMMARY	
1.1	Status.....	4
1.2	Introduction.....	5
1.3	Product Information	6
1.4	Brief Summary of Results.....	8
1.5	Test Conditions.....	9
1.6	Deviations from the Standard.....	9
1.7	Modification Record.....	9
2	TEST DETAILS	
	Part 15 B	
2.1	Spurious Radiated Emissions	11
	Part 15 C	
2.2	Measurement at the Band Edge.....	13
2.3	6dB Bandwidth	19
2.4	Maximum Peak Output Power (Radiated).....	21
2.5	Spurious Radiated Emissions	23
2.6	Peak Power Spectral Density.....	26
3	TEST EQUIPMENT	
3.1	Test Equipment	30
3.2	Measurement Uncertainty	31
4	PHOTOGRAPHS	
4.1	Photographs of Equipment Under Test (EUT)	33
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT	
5.1	Accreditation, Disclaimers and Copyright	35



SECTION 1

REPORT SUMMARY

Limited FCC CFR 47: Parts 15 B and C Testing in Support of an
Application for Grant of Equipment Authorisation
of a Loc8tor Ltd Loc8tor Tag (2.4GHz transceiver)



1.1 STATUS

Equipment Under Test	Loc8tor Tag (2.4GHz transceiver)
Objective	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
Name and Address of Client	ASH Communications Ltd 5 Shaftesbury Avenue Highfield Southampton SO17 1SB
Manufacturers Name and Address	Loc8tor Ltd Devonshire House 404-406 Finchley Rd London NW2 2HZ
Part Number	LOC1200
Serial Number	101 (cont Tx) 202 (cont Rx)
Hardware Version	Issue E
Declared Variants	None
Test Specification/Issue/Date	FCC CFR 47: Part 15, Subparts B and C: 2003 and 2005
Number of Items Tested	One
Security Classification of EUT	Commercial-in-Confidence
Incoming Release Date	Declaration of Build Status 8 th February 2006
Disposal Reference Number Date	Held pending disposal Not Applicable Not Applicable
Order Number Date	ASH066 30 th January 2006
Start of Test	8 th February 2006
Finish of Test	10 th February 2006
Related Documents	ANSI C63.4: 2001 FCC 03-287: 2003 FCC 04-165: 2004



1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Loc8tor Ltd Loc8tor Tag (2.4GHz transceiver) to the requirements of FCC Specification Parts 15 B and C.

Testing was carried out in support of an application for Grant of Equipment Authorisation in the name of Loc8tor Ltd.



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Loc8tor Ltd Loc8tor Tag which is a 2.4GHz transceiver.

In accordance with Part 15.207(c), Conducted Emissions testing has not been performed as the EUT is battery powered only.

Maximum Peak Output Power was measured Radiated only as this unit does not have an antenna port.

1.3.2 Modes of Operation

The EUT was operated in Transmitting and Receiving modes at 2.4GHz.

Applicable testing was carried out with the EUT transmitting at maximum power or receiving as detailed in Section 1.3.3 "Test Configuration".

1.3.3 Test Configuration

Transmitting on 2.445GHz

Receiving on 2.445GHz

The Output Power level was set to full power 0dB.



1.3 PRODUCT INFORMATION

1.3.4 Declaration of Build Status

MAIN EUT			
MANUFACTURING DESCRIPTION	Loc8tor Tag		
MANUFACTURER	Loc8tor Ltd		
TYPE			
PART NUMBER	LOC1200		
SERIAL NUMBER	201 (cont Tx) 202 (cont Rx)		
HARDWARE VERSION	Iss E		
SOFTWARE VERSION	Test transmit/receive		
TRANSMITTER OPERATING RANGE	400m		
RECEIVER OPERATING RANGE	400m		
COUNTRY OF ORIGIN	UK		
INTERMEDIATE FREQUENCIES			
ITU DESIGNATION OF EMISSION	20MOG1D		
HIGHEST INTERNALLY GENERATED FREQUENCY	2.445GHz Fixed Frequency		
OUTPUT POWER	0dBm		
FCC ID	TUW-LOT11		
INDUSTRY CANADA ID			
TECHNICAL DESCRIPTION	Asset tag – wakes up asset via transmissions from handheld and transmits ready for being found. DSSS		
BATTERY/POWER SUPPLY			
MANUFACTURING DESCRIPTION	2 x SR54 Silver oxide button cells		
MANUFACTURER			
TYPE			
PART NUMBER			
VOLTAGE			
COUNTRY OF ORIGIN			
MODULES			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
POWER			
FCC ID			
COUNTRY OF ORIGIN			
INDUSTRY CANADA ID			
EMISSION DESIGNATOR			
DHSS/FHSS/COMBINED OR OTHER			
ANCILLARIES			
MANUFACTURING DESCRIPTION			
MANUFACTURER			
TYPE			
PART NUMBER			
SERIAL NUMBER			
HARDWARE VERSION			
COUNTRY OF ORIGIN			

BABT formally certifies that the manufacturer's declaration as reproduced in this report, is a true and accurate record of the original received from the applicant.



1.4 BRIEF SUMMARY OF RESULTS

This report relates only to the actual item/items tested.

A brief summary of the tests carried out is shown below.

Test	Spec Clause	Test Description	Result	Levels/ Comments
2.1	15.109(a) *	Spurious Radiated Emissions	Pass	
2.2	15.205 *	Measurement at Band Edge	Pass	
2.3	15.247(a)(2)	6dB Bandwidth	Pass	
2.4	15.247(b)(3)	Maximum Peak Output Power (Radiated)	Pass	
	15.247(d)	Spurious Conducted Emissions on Antenna Port	N/T	
2.5	15.247(d)	Spurious Radiated Emissions	Pass	
2.6	15.247(e)	Peak Power Spectral Density	Pass	

* These tests were conducted to the 2003 version of FCC CFR 47. However the test clauses are identical to the 2005 version.

N/T Not Tested



1.5 TEST CONDITIONS

The EUT was set-up simulating a typical user installation and was tested in accordance with the applicable specification.

For all tests, the Loc8tor Ltd Loc8tor Tag (2.4GHz transceiver) was powered by its own internal battery.

1.6 DEVIATIONS FROM THE STANDARD

Limited tests were applied as applicable to the unit.

1.7 MODIFICATION RECORD

Not Applicable.



SECTION 2

TEST DETAILS

Limited FCC CFR 47: Part 15 B Testing in Support of an
Application for Grant of Equipment Authorisation
of a Loc8tor Ltd Loc8tor Tag (2.4GHz transceiver)



2.1 SPURIOUS RADIATED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47: Part 15 Subpart B, Section 15.109(a)

2.1.2 Equipment Under Test

Loc8tor Tag

2.1.3 Date of Test

9th February 2006

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Anechoic Chamber (3 metres) conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 12.3GHz were then formally measured using a CISPR Quasi-Peak detector.

The measurements were performed at a 3m distance unless otherwise stated.



2.1 SPURIOUS RADIATED EMISSIONS

2.1.6 Test Results

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 (a) for Spurious Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in Receive Mode (see Section 1.3.3 for details).

Only noise floor measurements were detected, therefore no table of results is presented.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.109 (a) for Spurious Radiated Emissions (1GHz – 12.3GHz).

Measurements were made with the EUT in Receive Mode (see Section 1.3.3 for details).

Frequency	Polarisation	Height	Azimuth	Peak Field Strength at 3m dBµV/m	Peak Limit dBµV/m	Average Field Strength at 3m dBµV/m	Average Limit dBµV/m
MHz		cm	degree				
4.88	Vertical	100	095	47.7	74.0	43.0	54.0



2.2 MEASUREMENT AT THE BAND EDGE

2.2.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.205

2.2.2 Equipment Under Test

Loc8tor Tag

2.2.3 Date of Test

8th February 2006

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000).

Test Performed in accordance with ANSI C63.4.

Measurements were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The emission was then confirmed or updated under Anechoic Chamber (3 metres) conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The measurements were performed at a 3m distance unless otherwise stated.



2.2 MEASUREMENT AT THE BAND EDGE

2.2.6 Test Results

There were no emissions detected at the edges of the restricted bands given in FCC CFR 47: Part 15 Subpart C, Section 15.205 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 1.

As the unit transmits on 2.445GHz measurements of the noise floor were taken at 2390MHz and 2438.5MHz to show that it does not interfere in the restricted bands 2310-2390MHz and 2483.5-2500MHz.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 and Industry Canada Radio Standard RSS-210, A8.5 and 2.7, Table 1 for Band Edge Measurements.

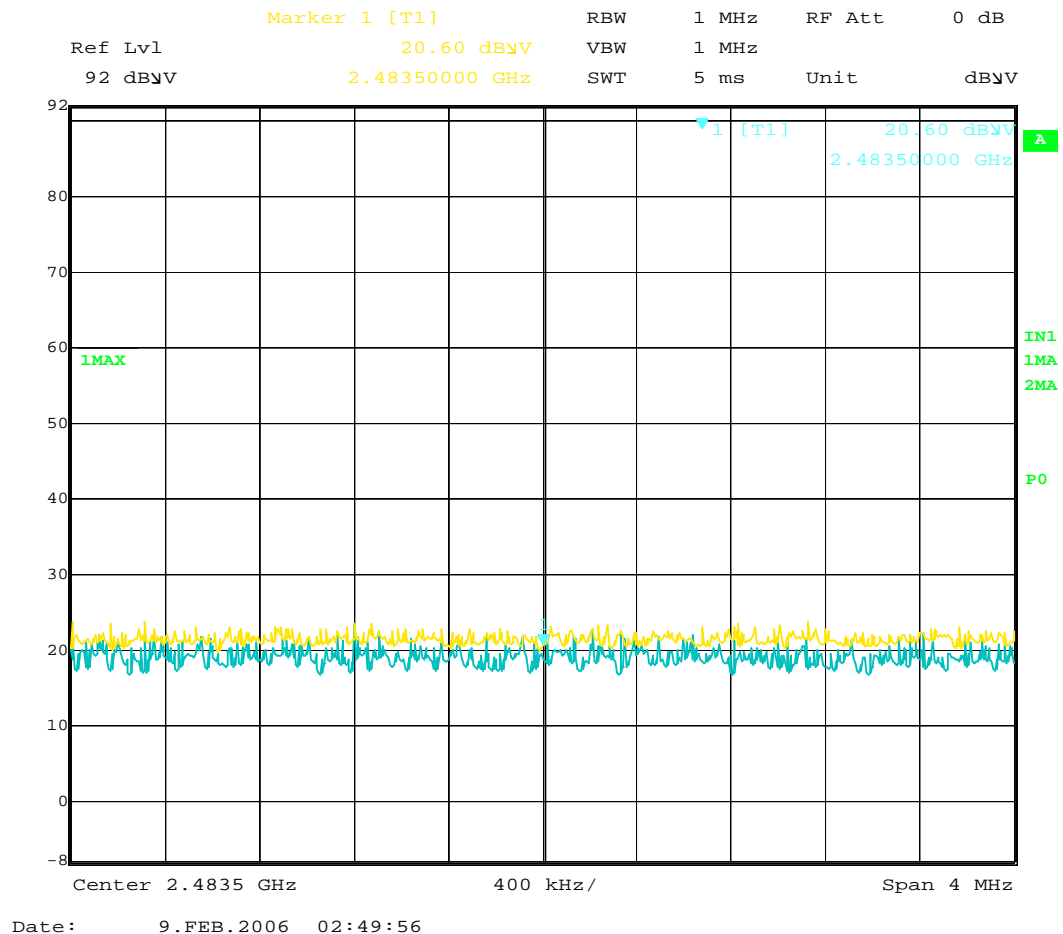
Measurements were made with the EUT in Transmit Mode (see Section 1.3.3 for details).

No emissions were detected therefore no table of results is presented.



2.2 MEASUREMENT AT THE BAND EDGE

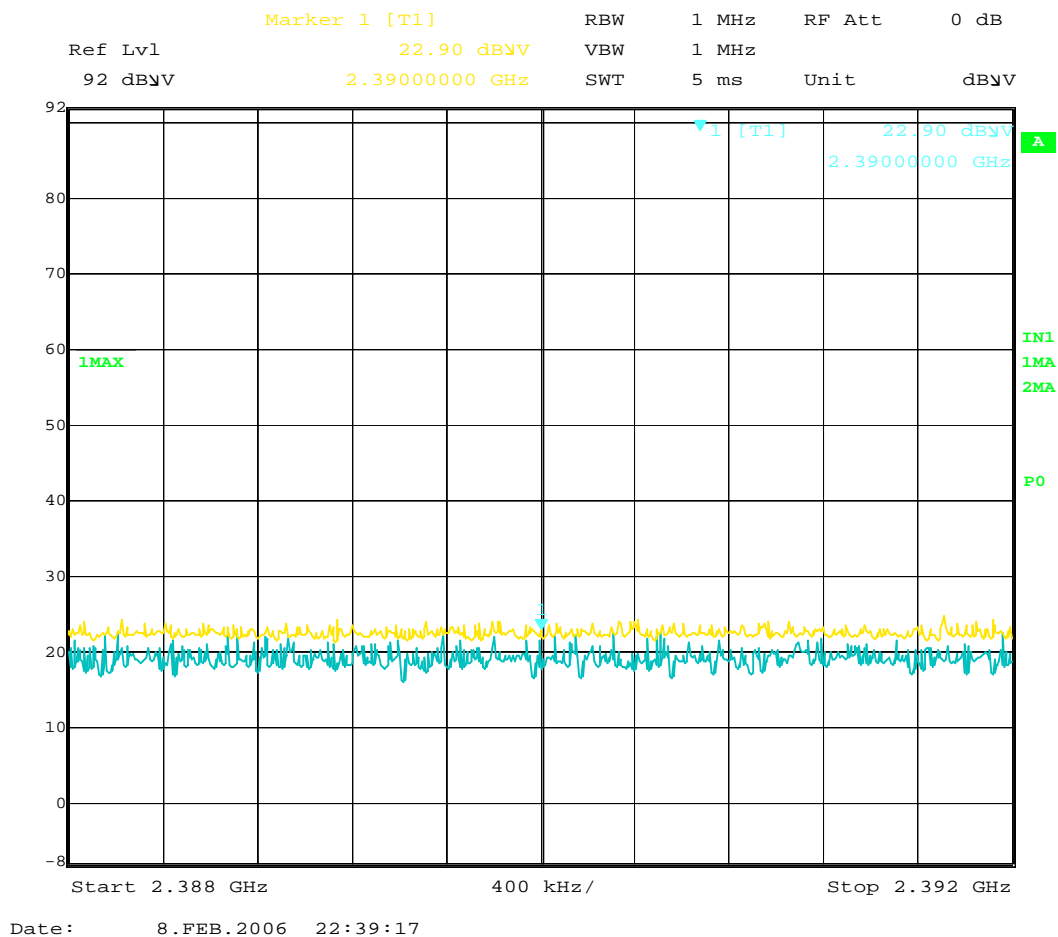
2.2.6 Test Results



Upper Band Edge Vertical Polarisation

2.2 MEASUREMENT AT THE BAND EDGE

2.2.6 Test Results

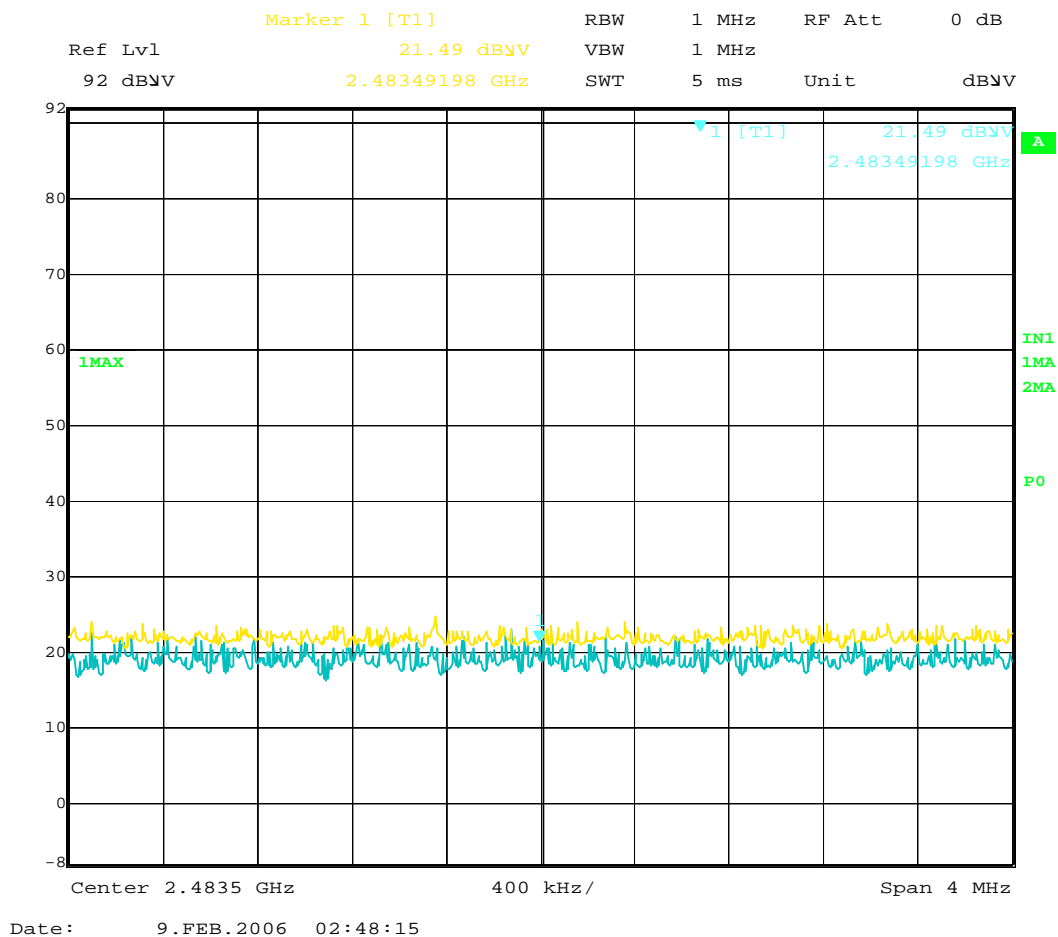


Lower Band Edge Vertical Polarisation



2.2 MEASUREMENT AT THE BAND EDGE

2.2.6 Test Results

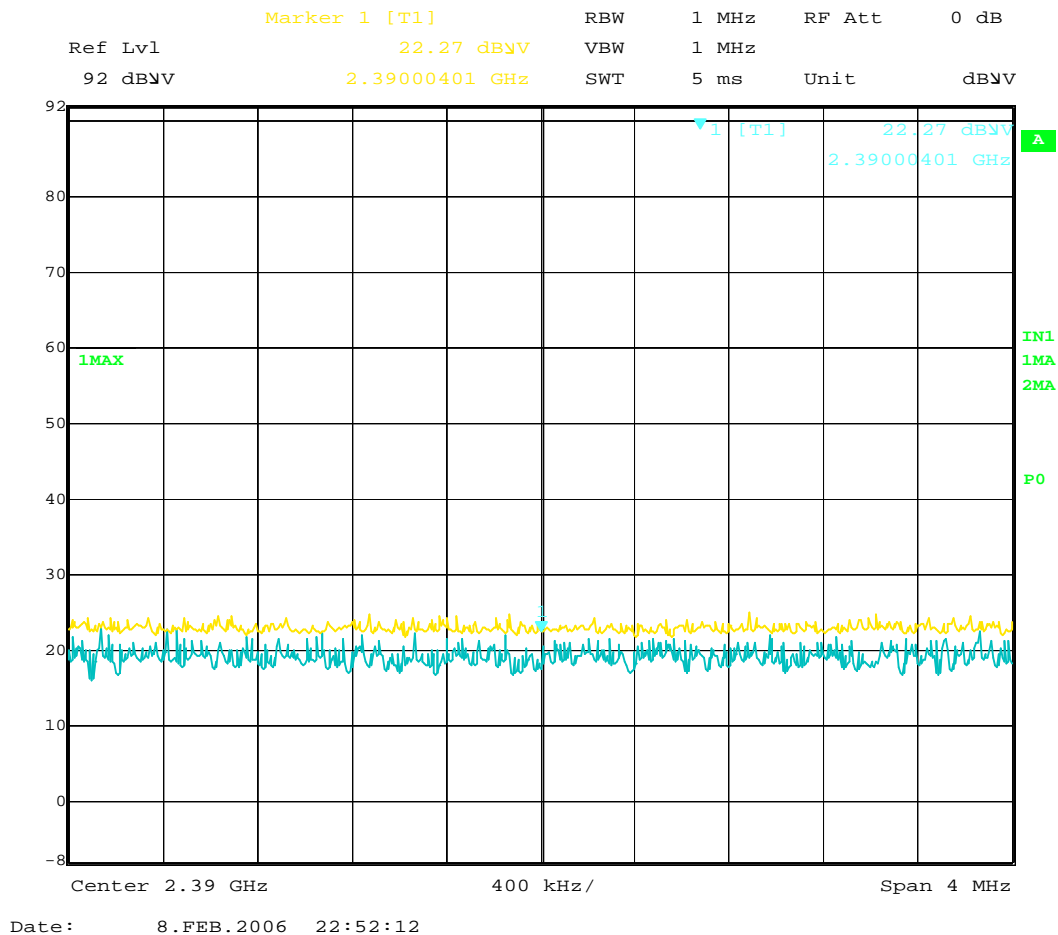


Upper Band Edge Horizontal Polarisation



2.2 MEASUREMENT AT THE BAND EDGE

2.2.6 Test Results



Lower Band Edge Horizontal Polarisation



2.3 6dB BANDWIDTH

2.3.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(a) (2)

2.3.2 Equipment Under Test

Loc8tor Tag

2.3.3 Date of Test

10th February 2006

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

The system loss was calculated by simulating a signal level of -10dBm EIRP using a signal generator and substitution horn. A 10dB attenuator was inserted between the cable and substitution antenna to improve matching between the two items. A level of -18.6dBm was measured to the input of the substitution antenna. The antenna gain being +8.6dB, equated to a radiated level of -10dBm EIRP. The measuring antenna was scanned between 1 and 4m to establish the maximum level. The level on the spectrum analyser was recorded and the difference used as the system loss. The substitution antenna was replaced with the EUT. The spectrum analyser was tuned to the carrier frequency and the emission maximised. The system loss was entered into the spectrum analyser as a reference level offset.

The RBW was set to 100kHz with a peak detector. The trace was set to max hold. The peak value was found based on the peak value, the 6dB points were established and the result trace recorded.

Test Performed in accordance with 15.247.

The result trace can be seen on the following pages.

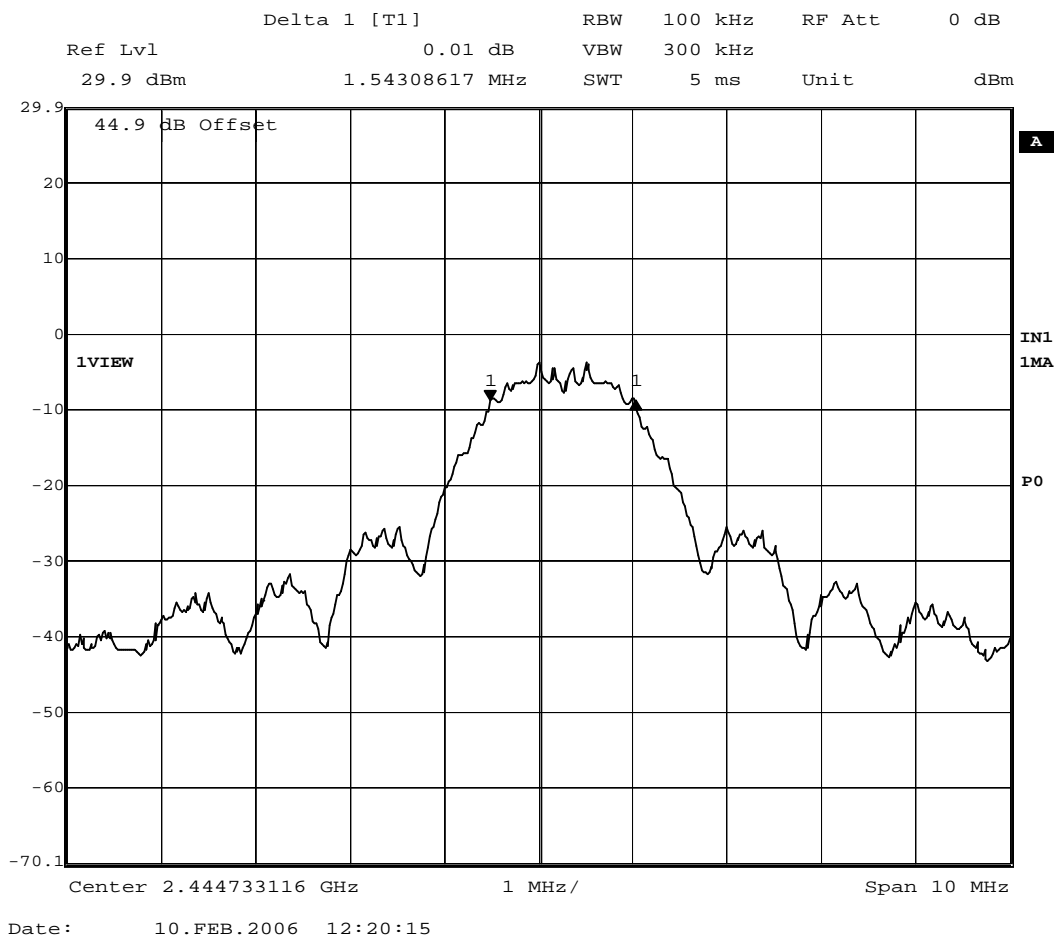
2.3.6 Test Results

Frequency (MHz)	Data Rate kbps	6dB Bandwidth (MHz)
2445	250	1.543



2.3 6dB BANDWIDTH

2.3.6 Test Results - continued



2445MHz – Maximum Power 0dB



2.4 MAXIMUM PEAK OUTPUT POWER (Radiated Method)

2.4.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2)

2.4.2 Equipment Under Test

Loc8tor Tag

2.4.3 Date of Test

8th February 2006

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

The EUT contains an integral antenna and therefore the Maximum Peak Output Power was made using the EIRP method.

The Spectrum Analyser was tuned to the test frequency. The device Output Power setting was controlled as specified in the Product Information, Section 1.5 of this document. The device was then rotated through 360 degrees until the highest power level was observed in both horizontal and vertical polarisation. The device was then replaced with a substitution antenna, whose input signal level into the antenna was adjusted until the received level matched that of the previously detected emission.



2.4 MAXIMUM PEAK OUTPUT POWER (Radiated Method)

2.4.5 Test Results - continued

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(b)(2) for Maximum Peak Output Power.

Measurements were made with the EUT operating as per Section 1.3.3.

Frequency (MHz)	Result EIRP (dBm)	Result EIRP (mW)
2445	-0.3	0.9
Limit	<+36dBm or <4W	



2.5 SPURIOUS RADIATED EMISSIONS

2.5.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(d)

2.5.2 Equipment Under Test

Loc8tor Tag

2.5.3 Date of Test

8th February 2006

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

FCC CFR 47: Part 15 Subpart C, Section 15.247(d), for Radiated Emissions also requires Sections 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Anechoic Chamber (3 metres) conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 25GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.



2.5 SPURIOUS RADIATED EMISSIONS

2.5.5 Test Procedure - continued

The limits for Spurious Emissions Outside the Restricted Bands have been measured and calculated as shown in the table below:

Test Mode	Carrier Frequency GHz	Carrier Field Strength dB μ V/m	Limit for Spurious Outside Restricted Band (Carrier F S -20dB) dB μ V/m
Transmit	2.445	93.7	74.0

The limits for Spurious Emissions Inside the Restricted Bands are in accordance with 15.205(a) & (b), which call up the limits in 15.209 (a)

Frequency Range MHz	Field Strength μ V/m	Quasi Peak Field Strength dB μ V/m	
30-88	100	40.0	
88-216	150	43.5	
216-960	200	46.0	
960-1000	500	54.0	
Above 1000	500	Average Field Strength dB μ V/m	Peak Field Strength dB μ V/m
		54.0	74.0



2.6 SPURIOUS RADIATED EMISSIONS

2.6.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(d), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in Transmit Mode (see Section 1.3.3 for details).

EUT Transmitting (2445MHz)

No emissions were detected therefore no table of results is presented.

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(d), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

Measurements were made with the EUT in Transmit Mode (see Section 1.3.3 for details).

EUT Transmitting (2445MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz		cm	degree	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.889	Horizontal	116	200	58.7	74.0	48.6	54.0
7.333	Horizontal	100	285	60.8	74.0	48.9	54.0

EIRP Results are only taken for frequencies that fall Outside the Restricted Band in accordance 15.247(d)



2.6 PEAK POWER SPECTRAL DENSITY

2.6.1 Specification Reference

FCC CFR 47: Part 15 Subpart C, Section 15.247(e)

2.6.2 Equipment Under Test

Loc8tor Tag

2.6.3 Date of Test

10th February 2006

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

The system loss was calculated by simulating a signal level of -10dBm EIRP using a signal generator and substitution horn. A 10dB attenuator was inserted between the cable and substitution antenna to improve matching between the two items. A level of -18.6dBm was measured to the input of the substitution antenna. The antenna gain being +8.6dB, equated to a radiated level of -10dBm EIRP. The measuring antenna was scanned between 1 and 4m to establish the maximum level. The level on the spectrum analyser was recorded and the difference used as the system loss. The substitution antenna was replaced with the EUT. The spectrum analyser was tuned to the carrier frequency and the emission maximised. The system loss was entered into the spectrum analyser as a reference level offset.

The RBW was set to 3kHz and the peak response of the emission found. The peak point was then centred and the span set to zero hertz with a peak detector. The trace was set to max hold. The peak response was found and the result recorded.

Test Performed in accordance with 15.247(e).

The result trace can be seen on the following pages.



2.6 PEAK POWER SPECTRAL DENSITY

2.6.6 Test Results

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, 15.247(e) for Peak Power Spectral Density).

Measurements were made with the EUT in Transmit Mode (see Section 1.3.3 for details).

The results are recorded in the table below.

Frequency (MHz)	Data Rate (kbps)	Measurement Bandwidth (kHz)	Result (dBm)
2445	250	3	-15.71

Limit	$\leq +8\text{dBm}/3\text{kHz}$
-------	---------------------------------

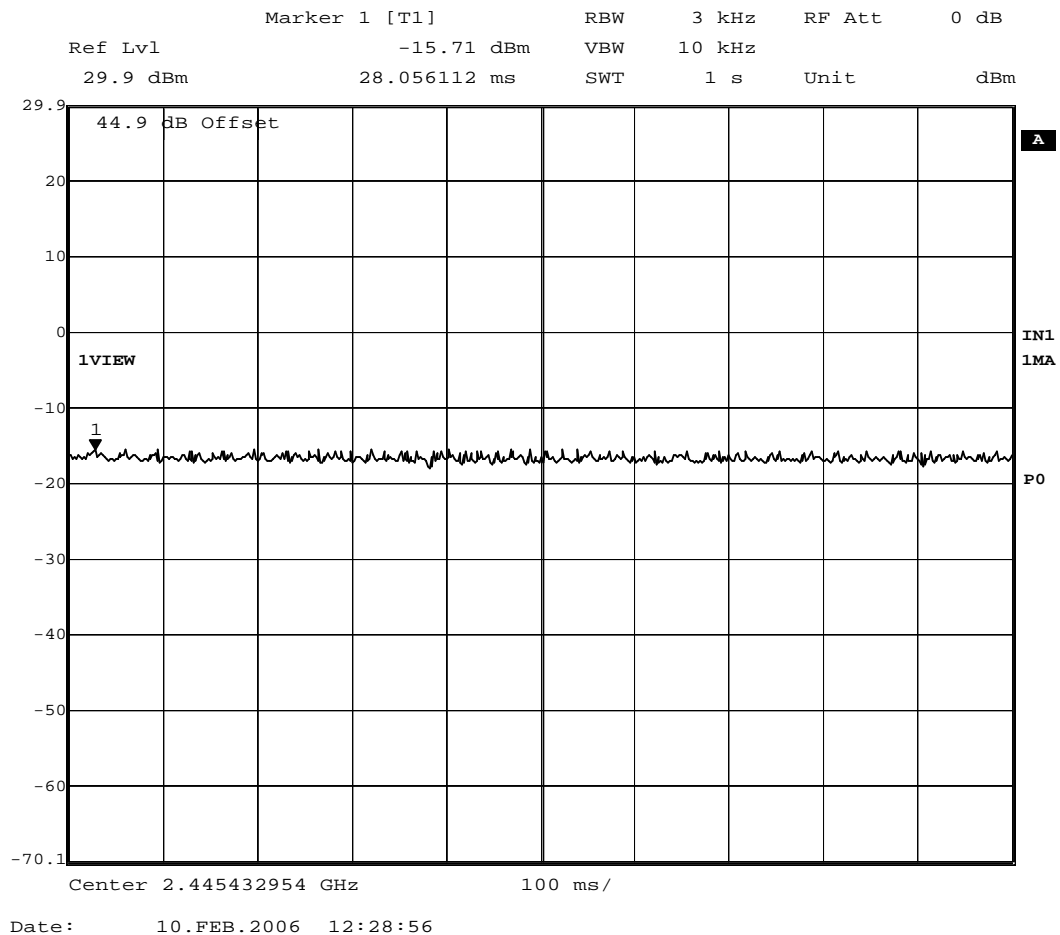
Remarks

The EUT met the requirements specified in Clause 15.247(e). The Peak Power Spectral Density was below the $\pm 8\text{dBm}/3\text{kHz}$ limit.



2.7 PEAK POWER SPECTRAL DENSITY

2.7.6 Test Results - continued



2445MHz – Maximum Power 0dB



SECTION 3

TEST EQUIPMENT

3.1 TEST EQUIPMENT

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Sections 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 EMC - Radiated Emissions				
Signal Generator	Rohde & Schwarz	SWM 02	62	15/03/2006
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24/06/2006
Amplifier	Miteq Corp	AMF-3d-001080-18-13P	231	O/P MON
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	01/07/2006
Amplifier (Low Noise, 18GHz-40GHz)	Narda	NARDA DB02-0447	237	02/06/2006
Filter (High Pass, 3GHz)	RLC Electronics	E100-300-5-R	565	O/P MON
Attenuator (10dB, 10W)	Marconi	6534/3	1048	O/P MON
Screened Room (5)	Rainford	Rainford	1545	01/03/2008
Mast Controller	Inn-Co GmbH	CO 1000	1606	O/P MON
Turntable/Mast Controller	EMCO	2090	1607	O/P MON
EMI Test Receiver	Rohde & Schwarz	ESIB26	2028	06/05/2006
Amplifier (8GHz-18GHz)	Avantec	AWT-18036	2821	O/P MON
Bilog Antenna	Chase	CBL6143	2904	10/11/2007
Peak Power Analyser	Hewlett Packard	8990A	107	12/10/2006



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are: -

Test Discipline	Frequency / Parameter	MU
Maximum Output Power	Not Applicable	±0.5dB
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .

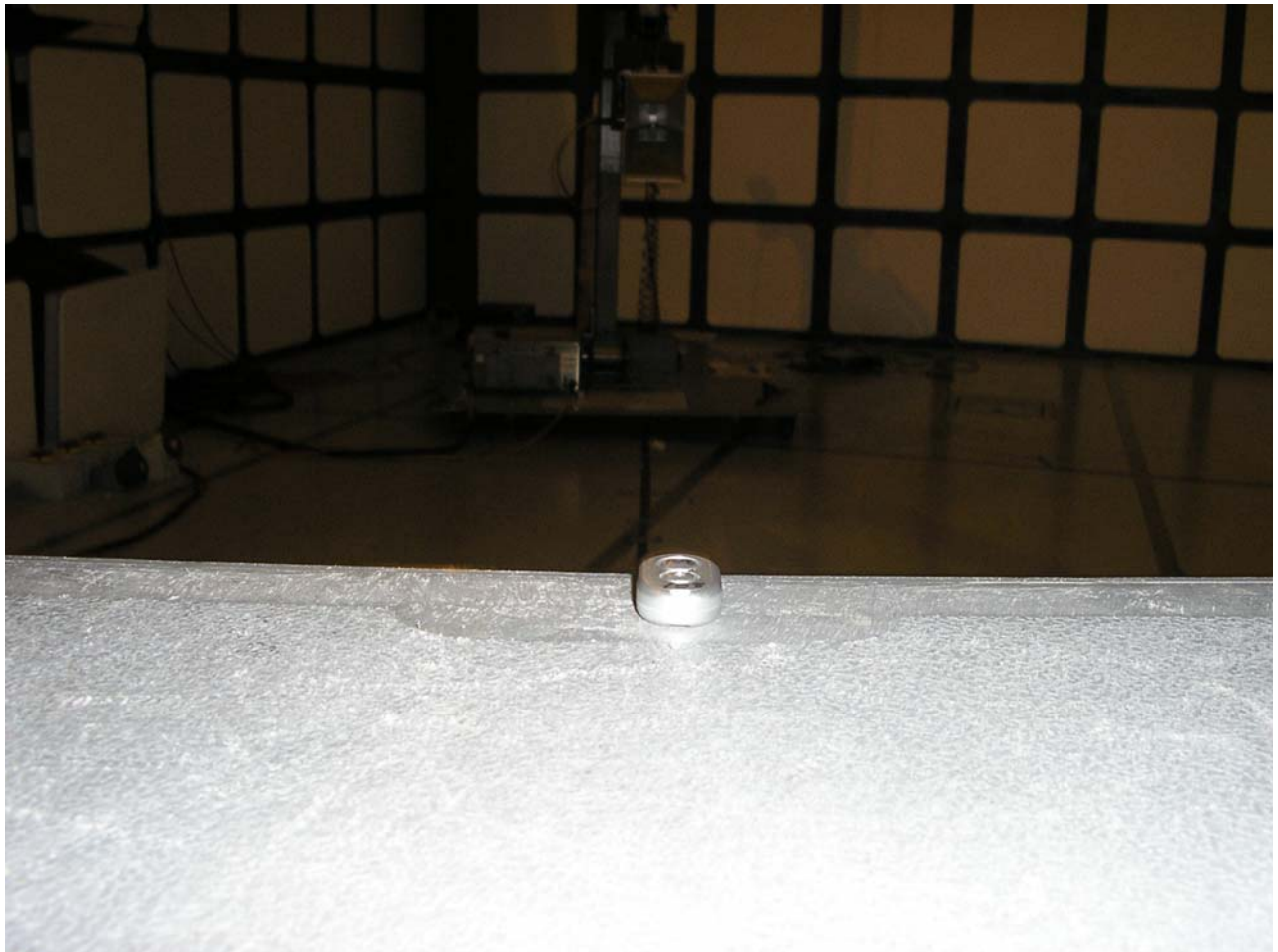
- * In accordance with CISPR 16-4
- † In accordance with UKAS Lab 34



SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Radiated Emissions Test Setup



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
(Not UKAS Accredited).

This report must not be reproduced, except in its entirety, without the written permission of
TUV Product Service Limited

© 2006 TUV Product Service Limited