TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: IPWireless.
2600 MHz PCMCIA Modem.

(Body Measurements Only)

To: OET Bulletin 65 Supplement C: (2001-01)

Measurements were performed on the DASY4 System

Test Report Serial No:
RFI/SARE2/RP45219JD07A

Supersedes Test Report Serial No:
RFI/SARE1/RP45219JD07A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	**Checked By: Joe Lomako** 
Tested By: Richelieu Quoi 	**Release Version No: PDF001**
Issue Date: 19 August 2004	**Test Dates: 21 July 2004 to 28 July 2004**

It should be noted that the standard, OET Bulletin 65 Supplement C: (2001-01) is not listed on RFI's current UKAS schedule and is therefore "not UKAS accredited".

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Test Of: IPWireless.
2600 MHz PCMCIA Modem.
To: OET Bulletin 65 Supplement C: (2001-01)

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1. Client Information

1.1. Client Details

Company Name:	IPWireless UK Ltd.
Address:	3-6 Charlton Business Park Crudwell Road Malmesbury Wiltshire SN16 9RU
Contact Name:	Mr P Warburg

1.2. Test Laboratory

Company Name:	Radio Frequency Investigation Ltd.
Address:	Ewhurst Park Ramsdell Basingstoke Hampshire RG26 5RQ.
Contact Name:	Mr J Lomako

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification Of Equipment Under Test (EUT)

Brand Name	IPWireless Broadband Modem
Model Name or Number	FD
Serial Number:	FD5D34100F213
FCC ID Number	PKTPCMCIAFD
IMEI Number	351155000010070
Battery Serial Number	Not Applicable
Country Of Manufacture	UK
Date Of Receipt	21 July 2004

2.2. Modifications Incorporated In EUT

During the course of testing the EUT was not modified.

2.3. Additional Information Related to the EUT

Equipment Class:	PCMCIA		
FCC Rule Part(s):	OET Bulletin 65 Supplement C		
Device Category:	Portable		
Application Type:	Certification		
Maximum Power Output:	2600 MHz – 24 dBm		
Transmit Frequency Allocation Of EUT When Under Test (Channels):	**Channel Number**	**Channel Description**	**Frequency**
3.84 Mcps / 6 MHz Channel	0	Bottom	2503 MHz
	1	Middle	2596 MHz
	2	Top	2683 MHz
7.68 Mcps / 12 MHz Channel	0	Bottom	2506 MHz
	1	Middle	2596 MHz
	2	Top	2680 MHz
Modulation(s):	100 Hz		
Modulation Scheme (Crest Factor)	3 (TDCDMA)		
Battery Type(s):	Not Applicable		
Antenna Length and Type:	Internal		
Number Of Antenna Positions	1		
Intended Operating Environment:	Commercial		
Weight:	56.59 g		
Dimensions (without Antenna) mm:	116 (L) x 54 (W) x 22 (H) mm		
Power Supply Requirement:			
DC Supply (Volts/Amps)	3.3 V / 1A Supplied by Host Laptop		
AC Supply (Volts/Amps)	230V / 1A Supplied to Host Laptop via AC Mains Adapter		
Internal Battery (Volts/Amps)	Not Applicable		
Port(s):	SIN PCMCIA Conducted RF Test Connector		

2.4. Support Equipment

Description	Laptop (270 Series Travel Mate)
Brand Name:	ACer
Model Name or Number:	BY25
Serial Number:	00045-156-924-599
Cable Length And Type:	1.5 m 2 Core Cable
Connected to Port:	DC Input

Description	AC Adapter
Brand Name:	ASTEC
Model Name or Number:	SA80-3115
Serial Number:	B386490360H01B
Cable Length And Type:	1 m Mains Cable
Connected to Port:	AC Input

Description	Laptop (Action Book 345T)
Brand Name:	UMAX
Model Name or Number:	2000
Serial Number:	PC0402096
Cable Length And Type:	1.5 m 2 Core Cable
Connected to Port:	DC Input

Description	AC Adapter
Brand Name:	Lien Electronics Inc.
Model Name or Number:	LE-9702A-05
Serial Number:	None Stated
Cable Length And Type:	1.0 m Mains Cable
Connected to Port:	AC Input

Support Equipment (Continued)

Description	Laptop (Notebook Computer)
Brand Name:	SONY
Model Name or Number:	PCG-5201
Serial Number:	28308530 3101633
Cable Length And Type:	1.5 m 2 Core Cable
Connected to Port:	DC Input

Description	AC Adapter
Brand Name:	SONY
Model Name or Number:	PCGA – AC19V1
Serial Number:	0031 D 005652
Cable Length And Type:	1.5 m Mains Cable
Connected to Port:	AC Input

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	OET Bulletin 65 Supplement C: (2001-01)
Title:	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

EN 50361: 2001
Title: Basic standard for the measurement of specific absorption rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz).

ANSI/IEEE C95.1: 1999
IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz.

Federal Communications Commission, “Evaluating compliance with FCC Guidelines for human exposure to radio frequency electromagnetic fields”, OET Bulletin 65 Supplement C, FCC, Washington, D.C, 20554, 2001.

Thomas Schmid, Oliver Egger and Neils Kuster, “Automated E-field scanning system for dosimetric assessments”, IEEE Transaction on microwave theory and techniques, Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, “Dosimetric evaluation of mobile communications equipment with know precision”, IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

3.3. Definition Of Measurement Equipment

The measurement equipment used complied with the requirements as detailed in OET Bulletin 65 Supplement C, Appendix D.

4. Deviations From The Test Specification

At the clients request the EUT was exercised and tested at 2600 MHz Tranceive (5 TX and 10 RX) Mode only mounted in a body touching configuration. The 2450 MHz dipole verification system was used with 2450 MHz muscle simulating liquid. Measurements were performed with an E-field probe with conversion factors correlating to 2600 MHz band.

5. Operation Of The EUT During Testing

5.1. Operating Modes

The EUT was tested in the following operating mode:
Tranceive Mode (5 TX and 10 RX) with PCMCIA modem exercised at 3.84 Mcps / 6 MHz Channel and 7.68 Mcps / 12 MHz Channel data rates consecutively.

6. Summary Of Test Results

6.1. Summary Of Tests

Test Name	Specification Reference	Compliancy Status
Specific Absorption Rate (SAR)	OET Bulletin 65 Supplement C	Complied

6.2. Test Results For Specific Absorption Rate – 2600 MHz ACer Host: - 3.84 Mcps / 6 MHz Channel

Environmental Conditions

Temperature Variation in Lab (°C):	23.0 to 24.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

Conducted Power and De-facto EIRP before Test:	Refer to section 6.8

Position	Section	Frequency Channel No	Distance from antenna to phantom (mm)	SAR Level (W/kg) 1g	SAR Limit (W/kg) 1g	Margin (W/kg) 1g	Result
0 Degrees to Phantom, PCMCIA Modem in Top Slot	Flat	2596MHz	0	0.160	1.6	1.440	Complied
0 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	0	0.231	1.6	1.369	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	15	0.344	1.6	1.256	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2503MHz	15	0.250	1.6	1.350	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2683MHz	15	0.302	1.6	1.298	Complied

6.3. Test Results For Specific Absorption Rate – 2600 MHz UMAX Host: - 3.84 Mcps / 6 MHz Channel

Environmental Conditions

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

Conducted Power and De-facto EIRP before Test:	Refer to section 6.8

Position	Section	Frequency Channel No	Distance from antenna to phantom (mm)	SAR Level (W/kg) 1g	SAR Limit (W/kg) 1g	Margin (W/kg) 1g	Result
0 Degrees to Phantom, PCMCIA Modem in Top Slot	Flat	2596MHz	0	0.108	1.6	1.492	Complied
0 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	0	0.184	1.6	1.416	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	15	0.246	1.6	1.354	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2503MHz	15	0.203	1.6	1.397	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2683MHz	15	0.292	1.6	1.308	Complied

6.4. Test Results For Specific Absorption Rate – 2600 MHz SONY Host: - 3.84 Mcps / 6 MHz Channel

Environmental Conditions

Temperature Variation in Lab (°C):	23.0 to 24.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

Conducted Power and De-facto EIRP before Test:	Refer to section 6.8

Position	Section	Frequency Channel No	Distance from antenna to phantom (mm)	SAR Level (W/kg) 1g	SAR Limit (W/kg) 1g	Margin (W/kg) 1g	Result
0 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2596MHz	0	0.247	1.6	1.353	N/A
90 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2596MHz	15	0.307	1.6	1.293	N/A
90 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2503MHz	15	0.228	1.6	1.372	N/A
90 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2683MHz	15	0.265	1.6	1.335	N/A

6.5. Test Results For Specific Absorption Rate – 2600 MHz ACer Host: - 7.68 Mcps / 12 MHz Channel

Environmental Conditions

Temperature Variation in Lab (°C):	23.0 to 24.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

Conducted Power and De-facto EIRP before Test:	Refer to section 6.8

Position	Section	Frequency Channel No	Distance from antenna to phantom (mm)	SAR Level (W/kg) 1g	SAR Limit (W/kg) 1g	Margin (W/kg) 1g	Result
0 Degrees to Phantom, PCMCIA Modem in Top Slot	Flat	2596MHz	0	0.298	1.6	1.302	Complied
0 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	0	0.442	1.6	1.158	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	15	0.624	1.6	0.976	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2506MHz	15	0.409	1.6	1.191	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2680MHz	15	0.761	1.6	0.839	Complied

6.6. Test Results For Specific Absorption Rate – 2600 MHz UMAX Host: - 7.68 Mcps / 12 MHz Channel

Environmental Conditions

Temperature Variation in Lab (°C):	23.0 to 24.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

Conducted Power and De-facto EIRP before Test:	Refer to section 6.8

Position	Section	Frequency Channel No	Distance from antenna to phantom (mm)	SAR Level (W/kg) 1g	SAR Limit (W/kg) 1g	Margin (W/kg) 1g	Result
0 Degrees to Phantom, PCMCIA Modem in Top Slot	Flat	2596MHz	0	0.312	1.6	1.288	Complied
0 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	0	0.475	1.6	1.125	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2596MHz	15	0.643	1.6	0.957	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2506MHz	15	0.393	1.6	1.207	Complied
90 Degrees to Phantom, PCMCIA Modem in Bottom Slot	Flat	2680MHz	15	0.517	1.6	1.083	Complied

6.7. Test Results For Specific Absorption Rate – 2600 MHz SONY Host: - 7.68 Mcps / 12 MHz Channel

Environmental Conditions

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

Conducted Power and De-facto EIRP before Test:	Refer to section 6.8

Position	Section	Frequency Channel No	Distance from antenna to phantom (mm)	SAR Level (W/kg) 1g	SAR Limit (W/kg) 1g	Margin (W/kg) 1g	Result
0 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2596MHz	0	0.484	1.6	1.116	Complied
90 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2596MHz	15	0.641	1.6	0.959	Complied
90 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2506MHz	15	0.426	1.6	1.174	Complied
90 Degrees to Phantom, PCMCIA Modem in Slot, Single Slot Only	Flat	2680MHz	15	0.397	1.6	1.203	Complied

6.8. EIRP Measurement

6.8.1. Conducted Power: 21 July 2004 - ACer

The Conducted Power of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	20.5
Middle	2596	21.4
Top	2683	20.7

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	20.4
Middle	2596	21.6
Top	2680	20.7

6.8.2. De-facto EIRP: 21 July 2004 - ACer

The EIRP of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	21.3
Middle	2596	23.4
Top	2683	23.3

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	21.4
Middle	2596	23.1
Top	2680	23.3

6.8.3. Conducted Power: 22 July 2004 - ACer

The Conducted Power of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	20.5
Middle	2596	21.4
Top	2683	20.7

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	20.4
Middle	2596	21.6
Top	2680	20.7

6.8.4. De-facto EIRP: 22 July 2004 - ACer

The EIRP of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	21.3
Middle	2596	23.4
Top	2683	23.3

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	21.4
Middle	2596	23.1
Top	2680	23.3

6.8.5. Conducted Power: 22 July 2004 - UMAX

The Conducted Power of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	20.5
Middle	2596	21.4
Top	2683	20.7

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	20.4
Middle	2596	21.6
Top	2680	20.7

6.8.6. De-facto EIRP: 22 July 2004 - UMAX

The EIRP of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	21.3
Middle	2596	23.4
Top	2683	23.3

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	21.4
Middle	2596	23.1
Top	2680	23.3

Conducted Power and De-facto EIRP Measurement (continued)

6.8.7. Conducted Power: 23 July 2004 - UMAX

The Conducted Power of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	20.5
Middle	2596	21.4
Top	2683	20.7

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	20.4
Middle	2596	21.6
Top	2680	20.7

6.8.8. De-facto EIRP: 23 July 2004 - UMAX

The EIRP of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	21.3
Middle	2596	23.4
Top	2683	23.3

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	21.4
Middle	2596	23.1
Top	2680	23.3

6.8.9. Conducted Power: 23 July 2004 - SONY

The Conducted Power of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	20.5
Middle	2596	21.4
Top	2683	20.7

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	20.4
Middle	2596	21.6
Top	2680	20.7

6.8.10. De-facto EIRP: 23 July 2004 - SONY

The EIRP of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	21.3
Middle	2596	23.4
Top	2683	23.3

7.68 Mcps / 12 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2506	21.4
Middle	2596	23.1
Top	2680	23.3

6.8.11. Conducted Power: 28 July 2004 - SONY

The Conducted Power of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	20.5
Middle	2596	21.4
Top	2683	20.7

6.8.12. De-facto EIRP: 28 July 2004 - SONY

The EIRP of the EUT is as follow: -

3.84 Mcps / 6 MHz Channel

Channel	Frequency (MHz)	Level (dBm)
Bottom	2503	21.3
Middle	2596	23.4
Top	2683	23.3

Note: The Conducted Power measurements were performed pre-testing. The De-facto EIRP measurement was calculated using the antenna gain.

7. SAR Measurement System

7.1. Radio Frequency Investigation SAR measurement facility utilises the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, and the SAM phantom containing brain or muscle equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilises a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching mulitplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

8. SAR Safety Limits

Exposure Limits (General populations/Uncontrolled Exposure Environment)	**SAR** (W/Kg)
Spatial Peak (averaged over any 1 g of tissue)	1.60

Notes:

1. The FCC SAR safety limits specified in the table above apply to devices operated in the General Population / Uncontrolled Exposure Environment.

2. Uncontrolled environments are defined as locations where there is exposure of individuals who have no knowledge or control of their exposure.

9. Details of SAR Evaluation

9.1. The equipment under test was found to be compliant for localised specific absorption rate (SAR) based on the following provisions and conditions:

a) The PCMCIA Modem was exercised via a host laptop and positioned under the flat section of the phantom.

b) Measurements were performed with the EUT, 0 degrees to the phantom and 90 degrees to the phantom consecutively.

c) Where the EUT had multiple slots, both slots were measured to determine the worst case. Band edge frequencies were measured for the overall worst case configuration.

d) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

e) The device was keyed to operate continuously in the transmit mode for the duration of the test.

f) The location of the maximum spatial SAR distribution (Hot Spot) was determined relative to the PCMCIA modem and its antenna.

g) The EUT was tested via a host laptop, powered by AC Mains Adapter. The Host Laptop supplied a 3.3V / 1A supply to the PCMCIA Modem.

10. Evaluation Procedures

10.1. The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by FCC OET bulletin 65 Supplement C.

(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the phantom was used. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.

b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.

c) A 7x7x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

11. System Validation

11.1. Prior to the assessment, the system was verified in the flat region of the phantom. A 2450 MHz dipole was used. A forward power of 250 mW was applied to the dipole and system was verified to a tolerance of ±5% for the 2450MHz dipole. The applicable verification (normalised to 1 Watt) is as follows:

Dipole Validation Kit	Target SAR 1g (W/kg)	Measured SAR 1g (W/kg)
D2450V2 / 750 (21/07/04)	52.1	50.8
D2450V2 / 750 (22/07/04)	52.1	50.8
D2450V2 / 750 (23/04/04)	52.1	51.2
D2450V2 / 750 (28/04/04)	52.1	50.4

12. Simulated Tissues

12.1. The body mixture consists of water and glycol. Visual inspection is made to ensure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

	Frequency
	2450 MHz Muscle
Water	68.64%
DGMBE	31.37%

13. Tissue Parameters

13.1. The dielectric parameters of the fluids were verified prior to the SAR evaluation using a 58070C Dielectric Probe Kit and an 8753E Network Analyser. The dielectric parameters of the fluid are as follows:

Frequency (MHz)	Equivalent Tissue	Dielectric Constant ε_r	Conductivity σ (mho/m)
2450 (21/03/04)	Muscle	53.56	2.01
2450 (22/03/04)	Muscle	54.09	1.99
2450 (23/03/04)	Muscle	54.06	1.98
2450 (28/03/04)	Muscle	53.60	2.00

14. DASY4 Systems Specifications

Robot System

Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of axis:	6
Serial Number:	F00/SD89A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+

Data Acquisition Electronic (DAE) System

Cell Controller

PC:	Dell Precision 340
Operating System:	Windows NT
Data Card:	DASY4 Measurement Server
Serial Number:	1080

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter and control logic.
Software:	DASY4 Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16 nit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.

E-Field Probe

Model:	ET3DV6
Serial No:	1529
Construction:	Triangular core fibre optic detection system
Frequency:	10 MHz to 3 GHz
Linearity:	±0.2 dB (30 MHz to 3 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	12
Tip Length (mm):	10
Tip Diameter (mm):	6.8
Sensor X Offset (mm):	2.7
Sensor Y Offset (mm):	2.7
Sensor Z Offset (mm):	2.7

Phantom

Phantom:	SAM Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

15. Validation results - 2450 MHz MSL Body

15.1. System Validation - 21 July 2004

15.1.1. Validation of the system test configuration was carried out prior to testing.

Validation Dipole Type and Serial No.	Calibrated Value of SAR in 1g volume (W/kg) at 2450 MHz	Measured Value of SAR in 1g volume (W/kg) at 2450 MHz	Percentage Difference (≤5%)
D2450V2 / 725	52.10	50.80	(2.50%)Yes

15.2. Liquid Properties

15.2.1. Properties of the tissue simulating liquid were measured prior to testing.

Property	Target Value (2450 MHz)	Measured/Calculated Value (2450 MHz)	Percentage Difference (≤5%)
Relative Permittivity	52.70	53.56	(2.63%)Yes
Conductivity	1.95	2.01	(3.19%)Yes

15.3. Temperature Variation

15.3.1. The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15ºC to +30ºC.

15.3.2. The actual temperature measured at the beginning and end of each test was recorded and the maximum range is shown below:

Measurement	Maximum Temperature	Minimum Temperature
Laboratory	24.0	24.0
Tissue Simulating Liquid	23.0	23.0

16. Validation results - 2450 MHz MSL Body

16.1. System Validation - 22 July 2004

16.1.1. Validation of the system test configuration was carried out prior to testing.

Validation Dipole Type and Serial No.	Calibrated Value of SAR in 1g volume (W/kg) at 2450 MHz	Measured Value of SAR in 1g volume (W/kg) at 2450 MHz	Percentage Difference (≤5%)
D2450V2 / 725	52.10	50.80	(2.50%)Yes

16.2. Liquid Properties

16.2.1. Properties of the tissue simulating liquid were measured prior to testing.

Property	Target Value (2450 MHz)	Measured/Calculated Value (2450 MHz)	Percentage Difference (≤5%)
Relative Permittivity	52.70	54.09	(2.64%)Yes
Conductivity	1.95	1.99	(2.51%)Yes

16.3. Temperature Variation

16.3.1. The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15ºC to +30ºC.

16.3.2. The actual temperature measured at the beginning and end of each test was recorded and the maximum range is shown below:

Measurement	Maximum Temperature	Minimum Temperature
Laboratory	24.0	23.0
Tissue Simulating Liquid	23.0	23.0

17. Validation results - 2450 MHz MSL Body

17.1. System Validation - 23 July 2004

17.1.1. Validation of the system test configuration was carried out prior to testing.

Validation Dipole Type and Serial No.	Calibrated Value of SAR in 1g volume (W/kg) at 2450 MHz	Measured Value of SAR in 1g volume (W/kg) at 2450 MHz	Percentage Difference (≤5%)
D2450V2 / 725	52.10	51.20	(1.73%)Yes

17.2. Liquid Properties

17.2.1. Properties of the tissue simulating liquid were measured prior to testing.

Property	Target Value (2450 MHz)	Measured/Calculated Value (2450 MHz)	Percentage Difference (≤5%)
Relative Permittivity	52.70	54.60	(2.58%)Yes
Conductivity	1.95	1.98	(1.54%)Yes

17.3. Temperature Variation

17.3.1. The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15ºC to +30ºC.

17.3.2. The actual temperature measured at the beginning and end of each test was recorded and the maximum range is shown below:

Measurement	Maximum Temperature	Minimum Temperature
Laboratory	23.0	23.0
Tissue Simulating Liquid	23.0	23.0

18. Validation results - 2450 MHz MSL Body

18.1. System Validation - 28 July 2004

18.1.1. Validation of the system test configuration was carried out prior to testing.

Validation Dipole Type and Serial No.	Calibrated Value of SAR in 1g volume (W/kg) at 2450 MHz	Measured Value of SAR in 1g volume (W/kg) at 2450 MHz	Percentage Difference (≤5%)
D2450V2 / 725	52.10	50.80	(3.26%)Yes

18.2. Liquid Properties

18.2.1. Properties of the tissue simulating liquid were measured prior to testing.

Property	Target Value (2450 MHz)	Measured/Calculated Value (2450 MHz)	Percentage Difference (≤5%)
Relative Permittivity	52.70	53.60	(1.70%)Yes
Conductivity	1.95	2.00	(2.69%)Yes

18.3. Temperature Variation

18.3.1. The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15ºC to +30ºC.

18.3.2. The actual temperature measured at the beginning and end of each test was recorded and the maximum range is shown below:

Measurement	Maximum Temperature	Minimum Temperature
Laboratory	24.0	23.0
Tissue Simulating Liquid	23.0	23.0

19. Measurement Uncertainty

19.1. 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.

19.2. The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

19.3. The uncertainty of the result may need to be taken into account when interpreting the measurement results.

19.4. 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
Specific Absorption Rate	2600 MHz	95%	+17.70%

19.5. 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.

19.6. Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environment. However, the estimated measurement uncertainties in SAR are less than 30%.

19.7. According to ANSI/IEEE C95.3, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy’s of ±1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ±2 dB can be expected.

19.8. According to CENELEC, typical worst-case uncertainty of field measurements is ±5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ±3 dB.

Measurement Uncertainty (Continued)

Specific Absorption Rate Uncertainty at 2600 MHz, TDCDMA Modulation Scheme calculated in accordance with IEEE 1528-200X

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c_i	Standard Uncertainty		υ_i or υ_{eff}	Note
							+ u (%)	- u (%)		
B	Probe calibration	10.000	10.000	normal (k=2)	2.0000	1.0000	5.000	5.000	∞	
B	Axail Isotropy	0.100	0.100	normal (k=2)	2.0000	1.0000	0.050	0.050	∞	
B	Hemispherical Isotropy	0.100	0.100	normal (k=2)	2.0000	1.0000	0.050	0.050	∞	
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞	
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞	
B	Linearity	2.330	2.330	Rectangular	1.7321	1.0000	1.345	1.345	∞	
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞	
B	Readout Electronics	0.650	0.650	normal (k=2)	2.0000	1.0000	0.325	0.325	∞	
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞	
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞	
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞	
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞	
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞	
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞	
A	Test Sample Positioning	0.584	0.584	normal (k=1)	1.0000	1.0000	0.584	0.584	10	
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10	
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞	
B	Drit of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞	
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞	
B	Liquid Conductivity (measured value)	2.440	2.440	Rectangular	1.7321	1.0000	1.409	1.409	∞	
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞	
B	Liquid Permittivity (measured value)	2.440	2.440	Rectangular	1.7321	1.0000	1.409	1.409	∞	
	Combined standard uncertainty			t-distribution			9.03	9.03	>500	
	Expanded uncertainty			k = 1.96			17.70	17.70	>500	

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Model Number
A034	Narda 20W Termination	Narda	374BNM
A1094	Sony MVC FD-81	Sony	MVC - FD81
A1097	SMA Directional Coupler	MiDISCO	MDC6223-30
A1174	Dielectric Probe Kit	Agilent Technologies	85070C
A1184	Data Acquisition Electronics	Schmid & Partner	DAE3
A1186	Probe	Schmid & Partner	ET3 DV6
A1225	Low noise Amplifier	Mini Circuits	ZHL-42
A1238	SAM Phantom	Schmid & Partner	001
A1322	2450 MHz Validation Dipole	Schmid & Partner	D2450V2
A1410	DC-4.0GHz 3dB	Omni Spectra	FSC 16179
A215	20 dB Attenuator	Narda	766-20
C1025	Cable	Rosenberger	FA210A-1-020m
C1052	Cable	Utiflex	FA210A0030M3030
C1053	Cable	Utiflex	FA210A0003M3030
C1054	Cable	Utiflex	FA210A0001M3050A
C1090	Cable	Rosenberger	FA210A1050005050
G046	Signal Generator	Gigatronics	7100/.01-20
G0528	Robot Power Supply	Schmid & Partner	DASY
G088	PSU	Thurlby Thandar	CPX200
M1015	Network Analyser	Agilent Technologies	8753ES
M103	URY Power Meter	Rohde & Schwarz	URY
M1047	Robot Arm	Staubli	RX908 L
M1069	Diode Power Sensor	Rohde & Schwarz	NRV-Z2
M1123	Power Meter	Boonton	4531
M1130	Rohde & Schwarz	Rohde & Schwarz	URY-Z2
M136	Temperature/Humidity/Pressure Meter	RS Components	None
M509	Thermometer	Testo	110
S256	Site 56	RFI	-

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