

## TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Datalogic S.p.A.  
KYMAN Module

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

**Test Report Serial No:**  
RFI/SARE3/RP48332JD01B

**Supersedes Test Report Serial No:**  
RFI/SARE2/RP48332JD01B

**This Test Report Is Issued Under The Authority  
Of Andrew Brown, Operations Manager:**



**Tested By: Richelieu Quoi**



**Checked By: Joe Lomako**

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**Issue Date: 25 August 2006**

**Test Dates: 05 June 2006 to 29 June 2006**

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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**RFI GLOBAL SERVICES LTD**

**TEST REPORT**

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## **1. Client Information**

<b>Company Name:</b>	Datalogic S.p.A
<b>Address:</b>	Via Candini, 2 Lippo di Calderara di Reno Bologna Italy 40012
<b>Contact Name:</b>	Mr P Guerzoni

## **Test Laboratory**

<b>Company Name:</b>	RFI Global Services Ltd
<b>Address:</b>	Ewhurst Park Ramsdell Basingstoke Hampshire RG26 5RQ.
<b>Contact Name:</b>	Mr A Brown

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## **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:	Datalogic
Model Name or Number:	KYMAN-Net 511-102
Unique Type Identification:	PIN: 944501012
Serial Number:	D05N01101
IMEI Number:	35202100563450
Country of Manufacture:	Italy
Date of Receipt:	05 June 2006

### **2.2. Description of EUT**

The equipment under test is a KYMAN-Net 511-102 (WiFi) Radio card with Tri-band and GPRS Class 10 capabilities. The EUT operates at GSM900, DCS1800, PCS1900, GPRS900, GPRS1800, and GPRS1900 Bands with *Bluetooth* active).

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

During the course of testing the EUT was not modified.

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**2.4. Additional Information Related to the EUT**

Equipment Class:	GSM/GPRS1900 and WiFi		
FCC Rule Part(s):	OET Bulletin 65 Supplement C		
Device Category:	Portable (Standalone battery powered device)		
Application Type:	Certification		
Maximum Power Output:	PCS1900	30 dBm	
	WIFI	17 dBm	
Transmitter Frequency Range:	PCS/GPRS1900	1850 to 1910 MHz	
Transmit Frequency Allocation of EUT When Under Test:	Channel Number	Channel Description	Frequency (MHz)
PCS/GPRS1900:	660	Middle	1879.8
	512	Low	1850.2
	810	High	1909.8
WiFi	6	Middle	2437.0
Modulation(s):	GSM/GPRS	217 Hz	
	WiFi	0 Hz	
Modulation Scheme (Crest Factor):	GSM	8	
	GPRS	4	
	WiFi	1	
Battery Type(s):	None Stated		
Antenna Length and Type:	Unknown Length / Internal Type		
Number Of Antenna Positions:	1 Fixed		
Intended Operating Environment:	Within GSM and WiFi Coverage		
Power Supply Requirement:			
DC Supply (Volts/Amps)	Not Applicable		
AC Supply (Volts/Amps)	Not Applicable		
Internal Battery Supply:	7.4 V/2200 mAh		

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## **2.5. Support Equipment**

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

<b>Description:</b>	Radio Communication Test Set
<b>Brand Name:</b>	Anritsu
<b>Model Name or Number:</b>	MT8820A
<b>Serial Number:</b>	6K00000647
<b>Cable Length and Type:</b>	1.5m UTIFLEX
<b>Connected to Port:</b>	RF (Input/Output) Air link to antenna

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### **3. Test Specification, Methods and Procedures**

#### **3.1. Test Specification**

<b>Reference:</b>	OET Bulletin 65 Supplement C: (2001-01)
<b>Title:</b>	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

#### **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.



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#### **4. Deviations from the Test Specification**

At the customer request the EUT was tested at EGSM900 / DCS1800 Bands with *Bluetooth* active in the Head and GPRS900 / GPRS1800 / WiFi with *Bluetooth* active in the Body-worn configuration.

The EUT was tested with a holster, Personal Hands-free and a belt-clip in the body worn configuration.

These configurations were in accordance with the methods detailed in FCC OET Bulletin 65 Supplement C: (2001-01).

The applied SAR test limits are taken from the Council Recommendations for general exposure, 1999/519/EC.

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## **5. Operation of the EUT During Testing**

### **5.1. Operating Modes**

At the client's request the EUT was tested in the following operating mode(s):

PCS1900 call allocated with *Bluetooth* active.

GPRS1900 with *Bluetooth* active.

WiFi with *Bluetooth* active.

The reason for choosing this configuration was that it has been defined by the customer as being typical of normal use and likely to be a worst case.

### **5.2. Configuration and Peripherals**

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

Standalone Mobile Radio Card Tri-band module without Personal Hands-Free in head configuration.

Standalone Mobile Radio Card Tri-band module with Personal Hands-Free in Body-worn configuration.

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## **6. Summary of Test Results**

Test Name	Specification Reference	Compliance Status
Specific Absorption Rate (SAR)	OET Bulletin 65 Supplement C: (2001-01)	Complied

### **6.1. Location of Tests**

All the measurements described in this report were performed at the premises of RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ.

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## **7. Measurements, Examinations and Derived Results**

### **7.1. General Comments**

This section contains test results only.

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 18 for details of measurement uncertainties.

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## **7.2. Test Results**

### **7.2.1. Test Results for Specific Absorption Rate PCS1900 Head**

#### **Test Summary:**

Maximum Level 1g (W/kg):	0.016
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#### **Environmental Conditions:**

Temperature Variation in Lab (°C):	24.0 to 25.0
Temperature Variation in Liquid (°C):	24.1 to 23.0

EIRP before Test:	Refer to section 7.3.2
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#### **Results:**

Position	Side of Head	Channel Number	Level 1g (W/kg)	Limit 1g (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	660	0.013	1.600	1.587	-	Complied
Tilt	Left	660	0.011	1.600	1.589	-	Complied
Touch	Right	660	0.011	1.600	1.589	-	Complied
Tilt	Right	660	0.016	1.600	1.584	-	Complied

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### 7.3. Test Results for Specific Absorption Rate GPRS1900 Body

#### Test Summary:

Maximum Level 1g (W/kg):	1.340
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#### Environmental Conditions:

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

EIRP before Test:	Refer to section 7.3.2
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#### Results:

Position	Section	Channel Number	Level 1g (W/kg)	Limit 1g (W/kg)	Margin (W/kg)	Note(s)	Result
EUT in Holster Rear Facing Phantom	Flat	660	0.353	1.600	1.247	1	Complied
EUT in Holster Front Facing Phantom	Flat	660	0.016	1.600	1.584	1	Complied
EUT With Belt Clip Rear Facing Phantom	Flat	660	1.200	1.600	0.400	1	Complied
EUT With Belt Clip & PHF Rear Facing Phantom	Flat	660	1.230	1.600	0.370	1	Complied
EUT With Belt Clip & PHF Rear Facing Phantom	Flat	512	1.340	1.600	0.260	1	Complied
EUT With Belt Clip & PHF Rear Facing Phantom	Flat	810	1.120	1.600	0.480	1	Complied
EUT With Belt Clip Rear Facing Phantom	Flat	512	1.310	1.600	0.290	1	Complied
EUT With Belt Clip Rear Facing Phantom	Flat	810	1.090	1.600	0.51	1	Complied

#### Note(s):

1. SAR measurements were performed with the EUT at a separation distance of 0mm from the SAM phantom flat section.

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### 7.3.1. Test Results for Specific Absorption Rate WiFi

#### Test Summary:

Maximum Level 1g (W/kg):	0.0010600
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#### Environmental Conditions:

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

EIRP before Test:	Refer to section 7.3.3
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#### Results:

Position	Section	Channel Number	Level 1g (W/kg)	Limit 1g (W/kg)	Margin (W/kg)	Note(s)	Result
EUT in Holster Rear Facing Phantom	Flat	6	0.0002580	1.600	1.600	1	Complied
EUT in Holster Display Facing Phantom	Flat	6	0.0000018	1.600	1.600	1	Complied
EUT With Belt Clip Rear Facing Phantom	Flat	6	0.0000103	1.600	1.600	1	Complied
EUT With Belt Clip & PHF Rear Facing Phantom	Flat	6	0.0010600	1.600	1.599	1	Complied

#### Note(s):

1. SAR measurements were performed with the EUT at a separation distance of 0mm from the SAM phantom flat section.
2. SAR measurement levels were close to noise floor.

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**7.3.2. EIRP Measurement – 1900 MHz****Date: 29 June 2006**

Channel	Frequency (MHz)	TX Power before Test (dBm)
Low	1850.2	30.3
Middle	1879.8	29.8
High	1909.8	28.6

**Note(s):**

- EIRP measurements are performed before testing only.*



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**7.3.3. EIRP Measurement – WiFi****Date: 29 June 2006**

Channel	Frequency (MHz)	TX Power before Test (dBm)
Middle	2437.0	15.5

**Note(s):**

1. *EIRP measurements are performed before testing only.*
2. *The measurement is performed on a spectrum analyser using the channel power function with a peak detector and trace max hold. The channel bandwidth was set to 20 MHz in order to capture the power across the whole emission 20 dB bandwidth.*

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## **8. SAR Measurement System**

RFI Global Services Ltd, 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. This is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. The data acquisition electronics (DAE) performs signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection etc. The DAE 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 multiplexer, 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.

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## **9. SAR Safety Limits**

<b>Exposure Limits (General Populations/Uncontrolled Exposure Environment)</b>	<b>SAR (W/Kg)</b>
Spatial Peak (averaged over any 1g of tissue)	1.6

### **Note(s):**

- OET Bulletin 65 Supplement C SAR safety limits specified in the table above applies to devices operated in the general population / uncontrolled exposure environment.*
- Uncontrolled environments are defined as locations where there is exposure of individuals who have no knowledge or control of their exposure.*

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## **10. Details of SAR Evaluation**

The equipment under test was found to be compliant for localised Specific Absorption Rate (SAR) based on the following provisions and conditions:

- a) The handset was placed in a normal operating position with the centre of the ear-piece aligned with the ear canal on the phantom.
- b) With the ear-piece touching the phantom the centre line of the handset was aligned with an imaginary plane (X and Y axis) consisting of three lines connecting both ears and the mouth.
- c) For the cheek position the handset was gradually moved towards the cheek until any point of the mouth-piece or keypad touched the cheek.
- d) For the tilted position the EUT was positioned as for the cheek position, and then the horizontal angle was increased by fifteen degrees (the phone keypad was moved away from the cheek by fifteen degrees).
- e) 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.
- f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
- g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the handset and its antenna.
- h) The EUT was tested with a fully charged battery.

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## **11. Evaluation Procedures**

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.

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## **12. System Validation**

Prior to the assessment, the system was verified in the flat region of the phantom. 1900MHz and 2450 MHz dipoles were used. A forward power of 250 mW was applied to the dipoles and the system was verified to a tolerance of  $\pm 5\%$  for the 1900 MHz and 2480 MHz dipoles. The applicable verification (normalised to 1 Watt) is as follows:

Dipole Validation Kit	Target SAR 1g (W/kg)	Measured SAR 1g (W/kg)
D1900V2/SN:540	39.10	40.40
D1900V2/SN:540	38.10	37.84
D2450V2/SN:725	52.90	55.20

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### **13. Simulated Tissues**

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.

Ingredient	Frequency
	1900 MHz Brain
De-Ionised Water	54.90%
DGMBE	44.90%
Salt	0.18%

Ingredient	Frequency
	1900 MHz Body
De-Ionised Water	69.79%
DGMBE	30.00%
Salt	0.20%

Ingredient	Frequency
	2450 MHz Body
De-Ionised Water	55.00%
DGMBE	45.00%

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#### **14. Tissue Parameters**

The dielectric parameters of the fluids were verified prior to the SAR evaluation using a 85070C Dielectric Probe Kit and an 8753E network analyser. The dielectric parameters of the fluid are as follows:

Frequency (MHz)	Equivalent Tissue	Dielectric Constant $\epsilon_r$	Conductivity $\sigma$ (mho/m)
1900	Head	53.95	1.59
1900	Body	39.45	1.44
2450	Body	51.61	2.03



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## **15. 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 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
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### **E-Field Probe**

Model:	ET3DV6
Serial No:	1529 and 1528
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

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## **16. Validation Results – 1900 MHz Band (Body)**

**Date: 05 June 2006**

### **16.1. System Validation**

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 1900 MHz	Measured Value of SAR in 1g volume (W/kg) at 1900 MHz	Percentage Difference ( $\pm 5\%$ )
D1900V2/SN:540	39.10	40.40	3.32%

### **16.2. Liquid Properties**

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

Property	Target Value (1900 MHz)	Measured/Calculated Value (1900 MHz)	Percentage Difference ( $\pm 5\%$ )
Relative Permittivity	53.30	53.95	1.21%
Conductivity	1.52	1.59	4.68%

### **16.3. Temperature Variation**

The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15.0 °C to +30.0 °C.

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

Measurement	Maximum Temperature (°C)	Minimum Temperature (°C)
Laboratory	24.0	23.0
Tissue Simulating Liquid	24.0	23.0

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## **17. Validation Results – 1900 MHz Band (Head)**

**Date: 06 June 2006**

### **17.1. System Validation**

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 1900 MHz	Measured Value of SAR in 1g volume (W/kg) at 1900 MHz	Percentage Difference (±5%)
D1900V2/SN:540	38.10	37.84	-0.68%

### **17.2.Liquid Properties**

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

Property	Target Value (1900 MHz)	Measured/Calculated Value (1900 MHz)	Percentage Difference (±5%)
Relative Permittivity	40.00	39.45	-1.37
Conductivity	1.40	1.44	2.66

### **17.3.Temperature Variation**

The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15.0 °C to +30.0 °C.

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

Measurement	Maximum Temperature (°C)	Minimum Temperature (°C)
Laboratory	25.0	25.0
Tissue Simulating Liquid	24.1	24.0

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## **18. Validation Results – 2450 MHz Band (Body)**

**Date: 30 June 2006**

### **18.1. System Validation**

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 ( $\pm 5\%$ )
D2450V2/SN:725	52.90	55.20	4.35%

### **18.2. Liquid Properties**

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

Property	Target Value (2450 MHz)	Measured/Calculated Value (2450 MHz)	Percentage Difference ( $\pm 5\%$ )
Relative Permittivity	52.70	51.61	-2.07%
Conductivity	1.95	2.03	4.21%

### **18.3. Temperature Variation**

The temperature of the laboratory and within the tissue simulating liquid for this test shall not exceed the range +15.0 °C to +30.0 °C.

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

Measurement	Maximum Temperature (°C)	Minimum Temperature (°C)
Laboratory	23.0	23.0
Tissue Simulating Liquid	23.5	23.5

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## **19. 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
Specific Absorption Rate	PCS 1900 MHz	95%	±17.12%
Specific Absorption Rate	GPRS 1900 MHz	95%	±17.12%

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.

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%.

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  $\pm 1$  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  $\pm 2$  dB can be expected.

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

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**Measurement Uncertainty (Continued)**

**Specific Absorption Rate Uncertainty at 1900 MHz, PCS Modulation Scheme calculated in  
 accordance with IEEE 1528-200X**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c <sub>i</sub>	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>	Note
							+ u (dBμV)	- u (dBμV)		
B	Probe calibration	8.900	8.900	normal (k=2)	2.0000	1.0000	4.450	4.450	∞	
B	Axial 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	0.005	0.005	Rectangular	1.7321	1.0000	0.003	0.003	∞	
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	Drift 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			8.74	8.74	>500	
	Expanded uncertainty			k = 1.96			17.12	17.12	>500	

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**Measurement Uncertainty (Continued)**

**Specific Absorption Rate Uncertainty at 1900 MHz, GPRS Modulation Scheme calculated in accordance with IEEE 1528-200X**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c <sub>i</sub>	Standard Uncertainty		U <sub>i</sub> or U <sub>eff</sub>	Note
							+ u (dBμV)	- u (dBμV)		
B	Probe calibration	8.900	8.900	normal (k=2)	2.0000	1.0000	4.450	4.450	∞	
B	Axial 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	0.005	0.005	Rectangular	1.7321	1.0000	0.003	0.003	∞	
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	Drift 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			8.74	8.74	>500	
	Expanded uncertainty			k = 1.96			17.12	17.12	>500	

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## **Appendix 1. Test Equipment Used**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A034	Narda 20W Termination	Narda	374BNM	8706
A1094	Sony MVC FD-81	Sony	MVC - FD81	125805
A1097	SMA Directional Coupler	MiDISCO	MDC6223-30	None
A1137	3dB Attenuator	Narda	779	04690
A1174	Dielectric Probe Kit	Agilent Technologies	85070C	Us99360072
A1182	Handset Positioner	Schmid & Partners	V3.0	None
A1184	Data Acquisition Electronics	Schmid & Partner	DAE3	394
A1185	Probe	Schmid & Partner	ET3 DV6	1528
A1234	Data Acquisition Electronics	Schmid & Partner	DAE3	450
A1237	1900MHz Validation Dipole	Schmid & Partners	D1900V2	540
A1238	SAM Phantom	Schmid & Partners	001	001
A1322	Schmid & Partner Engineering AG	Schmid & Partner Engineering AG	D2450V2	725
A1323	Insertion Unit	Rohde and Schwarz	URV5-Z2	830755/032
A1410	Omni Spectra	Omni Spectra	FSC 16179	20510-3
A1497	Mini-Circuits	Mini-Circuits	zh1-42w (sma)	e020105
A1531	Hyper LOG 7025	AARONIA AG	7025	02458
A1566	SAM Phantom	SPEAG	002	002
A215	20 dB Attenuator	Narda	766-20	9402
C1144	Cable	MICRO-COAX	FA147AF001503030	41842-1
C1145	Cable	MICRO-COAX	FA147AF003003030	41843-1
C1146	Cable	MICRO-COAX	FA147AF030003030	41752-1
C1092	Cable	RS	293-334	1087200-3 3402
G0528	Robot Power Supply	Schmid & Partner	DASY	None
G087	PSU	Thurlby Thandar	CPX200	100701
M011	NRV-Z1 Power Sensor	Rohde & Schwarz	NRV-Z1	882 321/004
M053	HP 8594A Spectrum Analyser	HP	8594A	3108U00205



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**Test Equipment Used (Continued)**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
M095	URY Power Meter	Rohde & Schwarz	URY	891 491/078
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406
M1047	Robot Arm	Staubli	RX908 L	F00/SD89A1/A/01
M1129	URY-Z2	Rohde & Schwarz	URY-Z2	890242/16
M1140	Radio Communications Analyser	Anritsu	MT8820A	6K0000647
M1270	Thermometer	RS	N/A	N/A
M136	Temperature/Humidity/Pressure Meter	RS Components	None	None
M509	Thermometer	Testo	110	40378800433
S256	Site 56	RFI	N/A	N/A

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