REPORT ON

Specific Absorption Rate Testing of the RTX Telecom A/S
NSM Technology DECT Phone (Belt Clip and Headset Configurations)

Report Number: WS609286 FCC ID Number: PT4COMPASS March 2002

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REPORT ON	Specific Absorption Rate Testing of the RTX Telecom NSM Technology DECT Phone (Belt clip and headset configurations)
	Report No: WS609286
	5th March 2002
PREPARED FOR	RTX Telecom A/S Stroemmen 6 Noerresundby DK-9400 DENMARK
APPROVED BY	**M JENKINS** Wireless Group Leader

DISTRIBUTION:	RTX Telecom A/S	Copy No : 1
	RTX Telecom A/S (CD ROM).	Copy No's : 2
	BABT	Copy No. : 3
		Copy No. :

Note: The test results reported herein relate only to the item tested as identified above and on the Status Page.

CONTENTS:-

For copyright details see page 28 of 28.

EXECUTIVE SUMMARY

Specific Absorption Rate Testing of the
RTX Telecom NSM Technology DECT Phone
(Belt Clip and Headset Configurations)

Project Manager : M. Osborne

1.1 **STATUS**

1.1.1	MANUFACTURING DESCRIPTION	NSM Technology DECT Phone
1.1.2	STATUS OF TEST	Specific Absorption Rate Testing (Belt Clip and Headset testing only).
1.1.3	APPLICANT	RTX Telecom A/S Stroemmen 6 Noerresundby DK-9400 DENMARK
1.1.4	CLASS	Direct Sequence Spread Spectrum
1.1.5	MANUFACTURER	NSM Technology Limited 22nd Floor, Times Tower 928 Cheung Sha Wan Road Kowloon, Hong Kong
1.1.6	TYPE OR MODEL NUMBER	Compass
1.1.7	HARDWARE VERSION	2
1.1.8	SOFTWARE VERSION	0.152
1.1.9	SERIAL NUMBER	OEBCA0012D

1.1.10 TEST SPECIFICATIONS:

Federal Communications Commission, Code of Federal Regulations, Title 47 (CFR47), Vol. 1, Chapter 1, Part 2 (§2.1091 and §2.1093).

Federal Communications Commission (FCC) OET Bulletin 65c, Edition 01-01, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields - Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions

1.1 **STATUS** continued

1.1.11 REFERENCES:

IEEE 1528 –200X: DRAFT Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques

1.1.12	BABT REGISTRATION NUMBER	WS609286.
1.1.13	RECEIPT OF TEST SAMPLES	22nd February 2002.
1.1.14	START OF TEST	22nd February 2002.
1.1.14	FINISH OF TEST	22nd February 2002.

1.2 SUMMARY

The RTX Telecom A/S, NSM Technology DECT Phone supplied for Specific Absorption Rate (SAR) testing is a 2.4 GHz Spread Spectrum Device. SAR Testing was only performed with the handset in the belt clip (flat phantom) position and headset configuration. No SAR testing of the handset against the SAM phantom is contained in this test report.

Testing was performed using a SAR Flat Phantom and the handset with a Belt Clip attached (See Figure 5). Prior to commencement of testing a 2.4 GHz Dipole was used for verification purposes. Testing was performed at the top, middle and bottom frequencies of the device under test. The maximum 1g volume averaged SAR detected was 0.121 W/kg.

Headset SAR testing was performed using a Specific Anthropomorphic Mannequin (SAM) Phantom as specified in IEEE1528 filled with a liquid with dielectric properties. SAR testing was performed only on the Left Hand Side of the head, but at the top middle and bottom frequencies of the device under test. No SAR was detected in any configuration. Experiments were performed such as wrapping the headset cable around the antenna of the handset to maximize coupling, but none occurred (See Figure 6). No SAR was detected in the SAM Phantom above the SARA2 System Noise floor of 0.001 W/kg for 1g Volume Averaged SAR.

The maximum 1g volume averaged SAR for all testing did not exceed the 1.6 W/kg General Population (Uncontrolled Exposure) limits defined in FCC Specifications.

TEST DETAILS

Specific Absorption Rate Testing of the
RTX Telecom NSM Technology DECT Phone
(Belt Clip and Headset Configurations)

Test Engineers: **J. Lea**

2.1 TEST EQUIPMENT

2.1.1 The following test equipment was used at BABT:

Instrument Description	Manufacturer	Model Type	Inventory No.	Serial Number	Calibration Dates
Bench-top Robot	Mitsubishi	RV-E2	4691	EA009006	N/A
SAM Phantom		SAM	N/A	51/01 FT01	N/A
2450 MHz (Head) Tissue Simulant	BABT	Batch 1	N/A	N/A	16/01/02*
2450 MHz (Body) Tissue Simulant	BABT	Batch 2	N/A	N/A	21/02/02
2450 MHz Dipole	IndexSAR	IEEE1528	N/A	N/A	N/A
RF Pre-Amplifier	Vectawave	10M-2.5G	4697	N/A	N/A
20dB Attenuator	Weinschel	46-20-34	4653	AT9195	23/08/02 (due)
Power Meter	Rohde and Schwarz	NRV	2472	860327/025	03/05/02 (due)
Hygrometer	Rotronic	Series 1-1000	4066	N/A	07/05/02 (due)
Thermometer	Fluke	51 K/J	4221	73860001	09/12/02 (due)
SAR Probe	IndexSAR	65	N/A	65	24/01/03 (due)
Flat Phantom box (200mm cube)	SARTest Ltd.	N/A	N/A	N/A	N/A

* Verified at time of test.

2.2 TEST SOFTWARE

2.2.1 The following software was used to control the BABT SAR System:-
SARA2 v0.234, 23rd February 2002

Mitsubishi Robot Software:-
RV-E2 Version C9a

2.3 DIELECTRIC PROPERTIES OF SIMULANT LIQUIDS

2.3.1 The dielectric properties of the tissue simulant liquids used for the SAR testing at BABT are as follows:-

Parameter	2450 MHz (Head) Fluid (Actual)	2450 MHz (Head) Fluid (Required)
Relative Permittivity, ε_r (ε')	30.8 F/m	39.2 F/m
Conductivity, σ	1.81 S/m	1.8 S/m
Mass Density, ρ	1000 kg/m^3	1000 kg/m^3

Parameter	2450 MHz (Body) Fluid (Actual)	2450 MHz (Body) Fluid (Required)
Relative Permittivity, ε_r (ε')	54.7 F/m	52.7 F/m
Conductivity, σ	2.08 S/m	1.95 S/m
Mass Density, ρ	1000 kg/m^3	1000 kg/m^3

This fluid was calibrated at the National Physical Laboratory and re-checked prior to any measurements being made against reference fluids stated in IEEE 1528-200X of 0.9% NaCl (Salt Solution) at 20ºC or 25ºC and also for Dimethylsulphoxide (DMS) at 20ºC.

2.3.2 The fluids were made at BABT under controlled conditions to the following IEEE 1528-200X and FCC Bulletin 65c formula:

<u>2450 MHz Head Solution</u>
53.3% DGBE
46.7% Water

<u>2450 MHz Body Solution</u>
26.7% DGBE
73.2% Water
0.04% Salt

2.4 TEST CONDITIONS

2.4.1 Ambient Temperature: Within +15°C to +35°C at 20% RH to 75% RH.
The actual Temperature during the testing ranged from 22.4°C to 24°C.
The actual Humidity during the testing ranged from 27.3% to 37% RH.

2.4.2 Tissue simulating liquid temperature: +20°C to +23°C.
The actual tissue simulating liquid temperature was recorded to be between 21°C to 21.2°C

2.4.3 Drift in Mobile power during scans. The mobile power levels were monitored before and after each full 3D scan. The before and after power levels recorded were within +/-2dB of each other for all of the testing.

2.5 MEASUREMENT UNCERTAINTY

2.5.1 Overall Uncertainty is +/- 26.03 % for a 95% Confidence Level with a coverage Factor of K=2.

ERROR SOURCES	Uncertainty (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Measurement Equipment					
Calibration	10	Normal	2	1	5.00
Isotropy	5.3	Rectangular	1.73	1	3.06
Linearity	2.92	Rectangular	1.73	1	1.69
Probe Stability	2.46	Rectangular	1.73	1	1.42
Detection limits	0	Rectangular	1.73	1	0.00
Boundary effect	1.7	Rectangular	1.73	1	0.98
Measurement device	0	Normal	1	1	0.00
Response time	0	Normal	1	1	0.00
Noise	0	Normal	1	1	0.00
Integration time	2.3	Normal	1	1	2.30
Mechanical constraints					
Scanning system	0.57	Rectangular	1.73	1	0.33
Phantom shell	1.43	Rectangular	1.73	1	0.83
Matching between probe and phantom	2.86	Rectangular	1.73	1	1.65
Positioning of the phone	10	Normal	1	1	10.00
Physical Parameters					
Liquid conductivity (deviation from target)	1.6	Rectangular	1.73	0.5	0.92
Liquid conductivity (measurement error)	5	Rectangular	1.73	0.5	2.89
Liquid permittivity (deviation from target)	21	Rectangular	1.73	0.5	12.12
Liquid permittivity (measurement error)	5	Rectangular	1.73	0.5	2.89
Drifts in output power of the phone, probe, temperature and humidity	5	Rectangular	1.73	1	2.89
Perturbation by the environment	3	Rectangular	1.73	1	1.73
Post-Processing					
SAR interpolation and extrapolation	2.4	Rectangular	1.73	1	1.39
Maximum SAR evaluation	2.4	Rectangular	1.73	1	1.39

Expanded uncertainty = 28.66 % (Using a Coverage Factor of K=2) (confidence interval of 95 %)

2.6 GENERAL DESCRIPTION FOR MEASURING SAR

2.6.1 MEASUREMENT SYSTEM

SARA2 System Specifications

Robot/Controller

Model	Mitsibishi Movemaster RV-2E 6 Axis Robot
Repeatability	+/-0.04mm
Speed	Up to 3500mm/sec

E-Field Probe

Probe Construction	Three orthogonal dipole sensors on triangular prism
Isotropy	+/-0.45dB Hemispherical.
Dynamic Range	0.01W/kg to 100W/kg
Linearity	+/-0.125dB
Frequency Band	150 to 2500MHz
Dimensions	
Overall Length	350mm
Tip Length	10mm
Body Diameter	12mm
Tip Diameter	5mm
Sensor Offset	2.5mm

Interface Amplifier

Battery Life	150 Hours
Inputs	High Impedance to 3-channel multiplexer and selectable gain amp.
Conversion	16bit A to D Converter
Cable	2m Fiber Optic with RS232 converter

Phantoms

SAM Upright Phantom per IEEE 1528X.

The SAM Upright Phantom is fabricated to the CAD files as specified by IEEE 1528X. It is mounted on the base table, which holds the robotic positioner. It is assembled from LH and RH moulds produced from the CAD files defining the SAM shape. It is glued together in the saggital plane and truncated below the neck to a height of 320mm and mounted on a 5mm thick PVC baseplate. It is aligned by both a mechanical and laser registration system. Each head shell is potentially a different shape and therefore each head is individually digitized on a Mitutoyo test bench to a precision of 0.001mm.

The arrangement used for SAR tests is shown below.

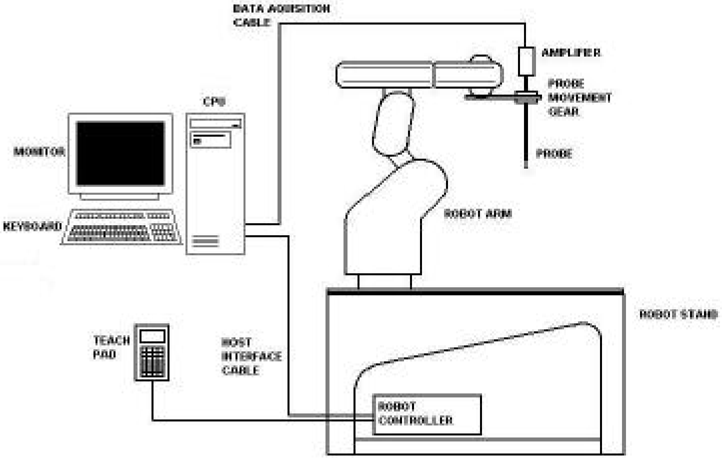
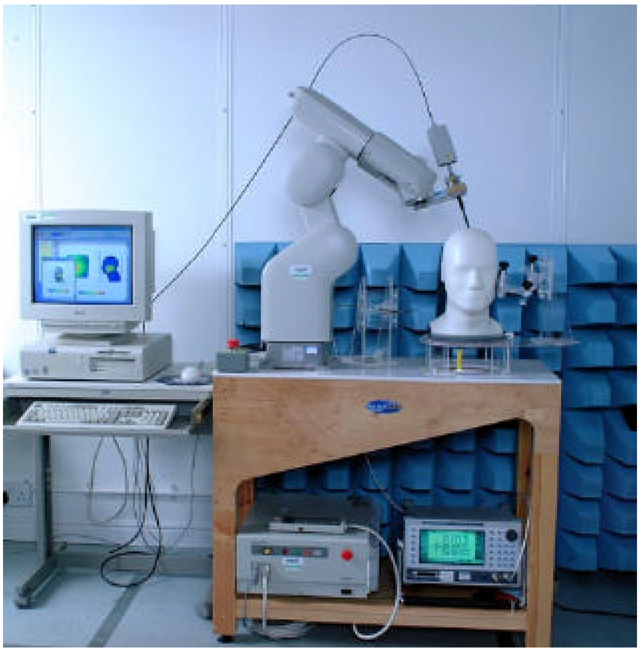


Figure 1. Robot set up for measuring SAR.

2.6 GENERAL DESCRIPTION FOR MEASURING SAR

Figure 2. SAR System with SAM Phantom in operation.



Co-ordinate systems
A Cartesian co-ordinate system is used for the software control of the E-field robe position. The scheme selected is that utilized by the Mitsubishi 6-axis robot. [Ref.1] In this scheme, the positive X-axis extends away form the robot base horizontally in the direction of the phantom support. The Z-axis is defined as being vertical with the positive direction ascending. The y-axis is horizontal with the positive direction away from an observer when the robot is on the left and the phantom support on the right.

SARA2 Interpolation and Extrapolation schemes
SARA2 software contains support for both 2D cubic B-spline interpolation as well as 3D cubic B-spline interpolation. A 4th order polynomial fit is used by default for data extrapolation, but a linear-logarithmic fitting function can be selected as an option.

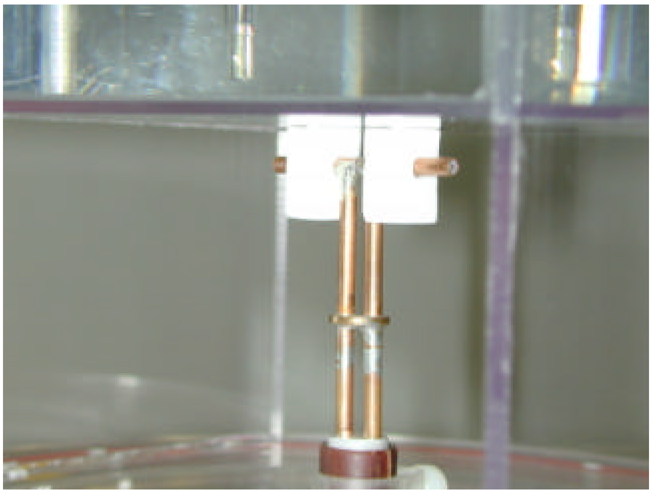
Interpolation of 2D area scan
The 2D cubic B-spline interpolation is used after the initial area scan at fixed distance from the phantom shell wall. The initial scan data are collected with approx. 10mm spatial resolution and spline interpolation is used to find the location of the local maximum to within a 1mm resolution for subsequent 3D scanning.

Extrapolation of 3D scan
For the 3D scan, data are collected on a spatially regular 3D grid having (by default) 6.4 mm steps in the lateral dimensions and 3.5 mm steps in the depth direction (away from the source). SARA2 enables full control over the selection of alternative step sizes in all directions.
The digitized shape of the head is available to the SARA2 software, which decides which points In the 3D array are sufficiently well within the shell wall to be 'visited' by the SAR probe. After the data collection, the data are extrapolated in the depth direction to assign values to points in the 3D-array closer to the shell wall. A notional extrapolation value is also assigned to the first point outside the shell wall so those subsequent interpolation schemes will be applicable right up to the shell wall boundary.

2.7 TEST RESULT SUMMARY

2.7.1 System Performance / Validation Check Results

Prior formal too formal testing being performed a system check was performed using a 2.4 GHz Dipole as specified in IEEE 1528X.
Figure 3. 2.4 GHz Dipole against base of flat phantom used for verification of system.



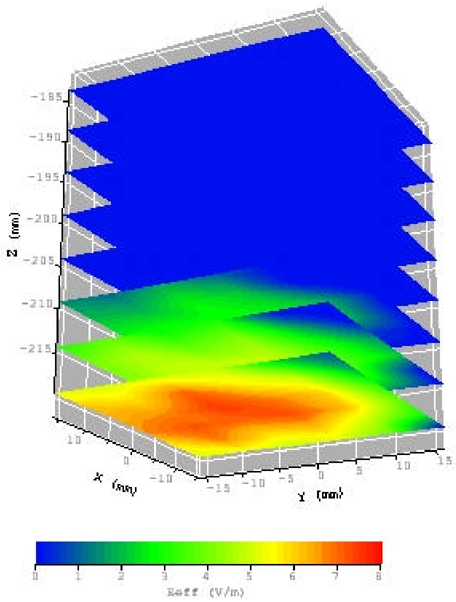
2.7.2 GSM 900 Specific Absorption Rate (SAR) 10g Results for Super

Description	Position	Frequency (MHz)	Max spot SAR (W/Kg)	Max 1g SAR (W/kg)
2.4 GHz Handset	With Belt Clip attached next to flat phantom	2401	0.110	0.121
2.4 GHz Handset	With Belt Clip attached next to flat phantom	2442	0.107	0.063
2.4 GHz Handset	With Belt Clip attached next to flat phantom	2481	0.054	0.021
	Limit for General Population (Uncontrolled Exposure)			1.6W/kg

2.8 SAR DISTRIBUTIONS

2.8.1 The following is an example SAR distribution for the 2.4 GHz Handset next to the Flat Phantom with the Belt Clip attached.

Figure 4: 2.4 GHz Handset next to flat Phantom with Belt Clip attached at 2401 MHz.



2.9 TEST PHOTOGRAPHS

Figure 5. 2.4 GHz Handset with belt clip attached under Flat Phantom

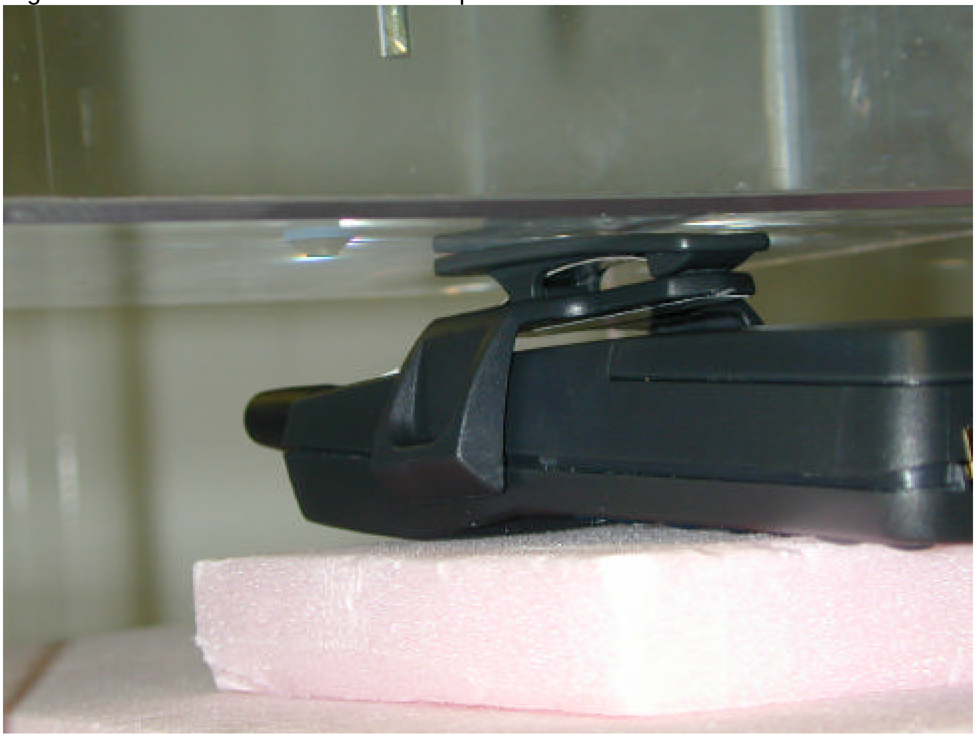
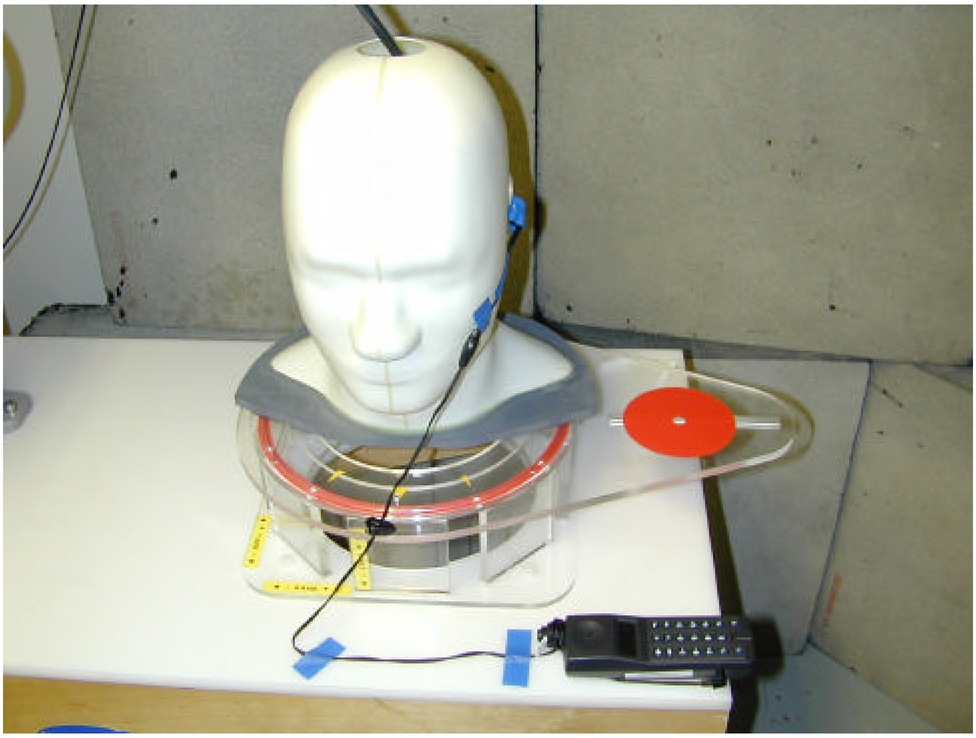


Figure 6. Headset mounted on SAM Phantom with headset wire wrapped around 2.4 GHz



handset antenna to maximize coupling

2.9 TEST PHOTOGRAPHS

Figure 7. 2.4 GHz Handset with belt clip attached, handsfree headset, data cord and desk unit used in the SAR testing.

Figure 8. Front and rear views of 2.4 GHz Handset.

2.9 **TEST PHOTOGRAPHS**

Figure 9. Side view of 2.4 GHz handset with belt clip attached.

APPENDICES

Specific Absorption Rate Testing of the
RTX Telecom NSM Technology DECT Phone

A.1 **Probe Calibration Information**

IMMERSIBLE SAR PROBE

CALIBRATION REPORT

Part Number: IXP – 050

S/N 0065

January 2002

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INTRODUCTION

This Report presents measured calibration data for a particular Indexsar SAR probe (S/N 0065) and describes the procedures used for characterisation and calibration.

Indexsar probes are characterised using procedures that, where applicable, follow the recommendations of CENELEC [1] and IEEE [2] standards. The procedures incorporate techniques for probe linearisation, isotropy assessment and determination of liquid factors. Calibrations are determined by comparing probe readings with theoretical computations in canonical test geometries, using normalised power inputs.

Each step of the calibration procedure and the equipment used is described in the sections below.

CALIBRATION PROCEDURE

1. Equipment Used

For the first part of the calibration procedure, the probe is placed in a calibration jig as pictured in Figure 1. In this position the probe can be rotated about its axis by a belt driven by a stepper motor.

The probe is attached to an amplifier that is connected via an optical cable to a PC. A schematic representation of the test geometry is illustrated in Figure 2.

A balanced dipole (900 or 1800 MHz) is inserted horizontally into the bracket attached to a second belt (Figure 1). The dipole also can be rotated about its axis. A cable connects the dipole to a signal generator, via a coupler and power meter. The signal generator is used to output a signal of 900 (or 1800) MHz at constant power, which is monitored on the power meter. The probe is positioned so that its sensors line up with the rotation center of the dipole. By recording E-field measurements as both the probe and the dipole are rotated, the spherical isotropy of the probe can be determined.

The calibration process requires E-field measurements to be taken in air, in 900 MHz simulated brain liquid and in 1800 MHz simulated brain liquid. When it is necessary to place the probe in liquid, a rectangular box made from PMMA (200mm internal width, 200mm internal height and 100mm internal depth; wall thickness 4mm) is filled with the appropriate liquid and positioned on the stand so that the probe tip is centered within the liquid (Figure 1). The box is positioned so that its outer surface is 2mm from the dipole.

2. Linearising probe output

The probe channel output signals are linearised in the manner set out in Refs [1] and [2]. The following equation is utilized for each channel:

$$U_{lin} = U_{o/p} + U_{o/p}^{\ 2} / DCP \qquad (1)$$

where U_{lin} is the linearised signal, $U_{o/p}$ is the raw output signal in voltage units and DCP is the diode compression potential in similar voltage units.

DCP is determined from fitting equation (1) to measurements of U_{lin} versus source feed power over the full dynamic range of the probe. The DCP is a characteristic of the schottky diodes used as the sensors. For the IXP-050 probes the DCP values are typically 0.10V (or 20 in the voltage units used by Indexsar software, which are V*200).

3. Optimizing channel sensitivity factors in air

The first step of the calibration process is to calibrate the Indexsar probe to a W&G EMR300 E-field meter in air. The principal reasons for this are to balance the channels in air and to obtain air factors that are used in subsequent steps of the calibration procedure.

The probe and a 900 MHz standard dipole are positioned in the calibration jig as outlined in the section above. With the Indexsar probe located in air, individual channel output voltages are recorded as probe and dipole are rotated. An 'air factor' is applied to each of the probe's three channels in order to equilibrate the peak magnitudes of each channel. A multiplier is applied to factors to bring the magnitudes of the average E-field measurements as close as possible to those of the W&G probe.

The following equation is used (where output voltages are in units of V*200):

$$E_{air}^{2}\ (V/m) = U_{linx} * Air\ Factor_{x} + U_{liny} * Air\ Factor_{y} + U_{linz} * Air\ Factor_{z} \qquad (2)$$

It should be noted that the IXP-050 probes are optimised for use in tissue simulating liquids and do not behave isotropically in air.

4. 900 MHz Liquid Calibration

The second phase of calibration requires the channel output voltages of the Indexsar probe to be measured in a box filled with 900 MHz simulated brain liquid. The box of liquid is placed on the stand as described above and as pictured in Figure 1. Channel outputs for the different orientations of probe and dipole are recorded and entered into a spreadsheet. These measurements are multiplied by the previously determined air factors. Another factor, referred to as the 'liquid factor' is also applied to the measurements of each channel. The magnitude of the liquid factor for each channel is selected so as to optimise the isotropy of the probe (i.e. equilibrate the peak magnitudes of the three channels) in the liquid. The following equation is used (where output voltages are in units of V*200):

$$E_{liq}^{2}\ (V/m) = U_{linx} * Air\ Factor_{x} * Liq\ Factor_{x} + U_{liny} * Air\ Factor_{y} * Liq\ Factor_{y} + U_{linz} * Air\ Factor_{z} * Liq\ Factor_{z} \qquad (3)$$

A chart of the spherical isotropy for probe 0065 is shown in Figure 3.

The rotational isotropy is also determined. With the dipole at 90? to the probe axis the rotational isotropy for probe 0065 is +/- 0.24 dB (Figure 4).

The final step of the 900 MHz calibration requires the measurement of SAR decay in a generic, spherical phantom and fitting the measured data to one of the two following theoretical predictions of the decay profile:

a) SAR decay curve modelled using a 200mm diameter sphere energised by a balanced dipole in a 'benchmark configuration' developed as part of an Eureka Project [3]; or,

b) SAR decay curve modelled by Flomerics [4] using a sphere and a balanced dipole in a similar test configuration.

To measure SAR decay the probe is inserted through the neck of a spherical phantom filled with 900 MHz simulant liquid, and the tip is positioned at the inside surface of the flask. A 900 MHz balanced dipole is aligned with the probe tip and placed a specific distance from the outer surface of the sphere (depending on whether comparison is made with calculated results from [3] or [4]). As the probe is progressively withdrawn along the centre line of the sphere, E-field measurements are taken. A multiplier is applied to the liquid factors so as to equilibrate the resultant decay function with the modelled results (e.g. Figure 5).

The final calibration factors for the probe are listed below:

S/N 0065 at 900 MHz	X	Y	Z
Air Factors	400	370	410
DCP (V*200)	20	20	20
Liquid Factors	0.355	0.367	0.355

Note: see equation (3) for guidance on how to apply these factors

5. 1800 MHz Liquid Calibration

The calibration process is then repeated for 1800 MHz. The test set up is modified slightly to use 1800 MHz simulant liquid and a standard 1800 MHz balanced dipole.

As with the 900 MHz calibration SAR decay is measured and the resultant function fitted to modelled results. The final calibration factors for 1800 MHz are as follows:

Probe S/N 0065 at 1800 MHz	X	Y	Z
Air Factors	400	370	410
DCP (V*200)	20	20	20
Liquid Factors	0.375	0.414	0.376

Note: see equation (3) for guidance on how to apply these factors

PROBE SPECIFICATIONS

Indexsar probe 0065, along with its calibration, is compared with CENELEC and IEEE standards recommendations (Refs [1] and [2]) in the Tables below. A listing of relevant specifications is contained in the tables below:

Dimensions	S/N 0065	CENELEC [1]	IEEE [2]
Overall length (mm)	350		
Tip length (mm)	10		
Body diameter (mm)	12		
Tip diameter (mm)	5.2	8	8
Distance from probe tip to dipole centers (mm)	2.5		

Dynamic range	S/N 0065	CENELEC [1]	IEEE [2]
Minimum (W/kg)	0.01	<0.02	0.01
Maximum (W/kg) N.B. only measured to 35 W/kg	>35	>100	100

Linearity of response	S/N 0065	CENELEC [1]	IEEE [2]
Over range 0.01 – 100 W/kg (+/- dB)	0.125	0.50	0.25

Isotropy (measured at 900MHz)	S/N 0065	CENELEC [1]	IEEE [2]
Axial rotation with probe normal to source (+/- dB)	0.24	0.5	0.25
Spherical isotropy covering all orientations to source (+/- dB)	0.44	1.0	0.50

Construction	Each probe contains three orthogonal dipole sensors arranged on a triangular prism core, protected against static charges by built-in shielding, and covered at the tip by PMMA cylindrical enclosure material. No adhesives are used in the immersed section. Outer case materials are PMMA and heat-shrink sleeving.
Chemical resistance	Tested to be resistant to glycol and alcohol containing simulant liquids but should be removed, cleaned and dried when not in use.

GSM RESPONSE

To measure the GSM response of the probe and amplifier, the probe is held vertically in a cube phantom 30mm from the side of the cube at which the balanced dipole is presented. The dipole is oriented vertically (parallel to the probe axis) for tests at 900MHz.

An RF amplifier is allowed to warm up and stabilise before use. A spectrum analyser is used to demonstrate that the peak power of the RF amplifier for the CW signals and the pulsed signals are within 0.1dB of each other when the signal generator is switched from CW to GSM. Subsequently, the power levels recorded are read from a power meter when a CW signal is being transmitted.

The test sequence involves manually stepping the power up in 1 dB steps from the lowest power that gives a measurable reading on the SAR probe up to the maximum that the amplifiers can deliver.

At each power level, the individual channel outputs from the SAR probe are recorded at CW and then recorded again with the GSM setting. The results are entered into a spreadsheet. Using the spreadsheets, the GSM power is calculated by taking 9dB from the measured CW power.

The probe channel output signals are linearised in the manner set out in Section 1 above using equation (1) with the DCPs determined from the linearisation procedure. Calibration factors for the probe are used to determine the E-field values corresponding to the probe readings using equation (3). SAR is determined from the equation

$$\text{SAR (W/kg)} = E_{liq}^2 \text{ (V/m)} * \sigma\text{(S/m)} / 1000 \qquad (4)$$

Where σ is the conductivity of the simulant liquid employed.

Using this procedure, the results obtained for the GSM response are shown in Figure 6. Additional tests have shown that the GSM response is similar at 1800MHz and is not affected by the orientation between the source and the probe.

Tests such as in Figure 6 indicate that the probe plus amplifier combination correctly reflect the power level of pulsed GSM signals without the need for any specific scheme of correction. The minor deviations from equivalence shown in Figure 6 can be allowed for if required.

REFERENCES

[1] CENELEC, EN 50361, July 2001. Basic Standard for the measurement of specific absorption rate related to human exposure to electromagnetic fields from mobile phones. TC211.

[2] IEEE 1528, Recommended practice for determining the spatial-peak specific absorption rate (SAR) in the human body due to wireless communications devices: Experimental techniques.

[3] Stevens, N. *et al*., Comparison of the numerical and experimental evaluation of the SAR employing a spherical benchmark configuration. *To be published*.

[4] Maggs, J., Modelling of the E-field distribution within a lossy spherical phantom energised by balanced dipole sources. *Flomerics, unpublished*.

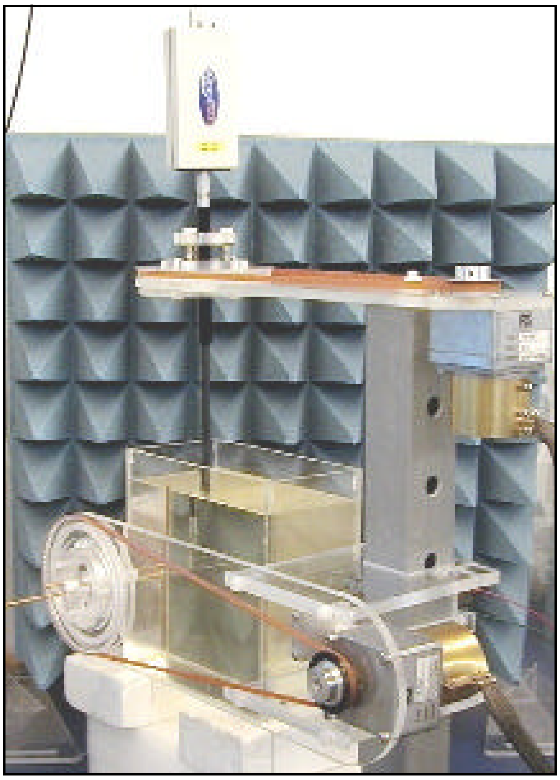

Figure 1. Calibration jig showing probe, dipole and box filled with simulated brain liquid

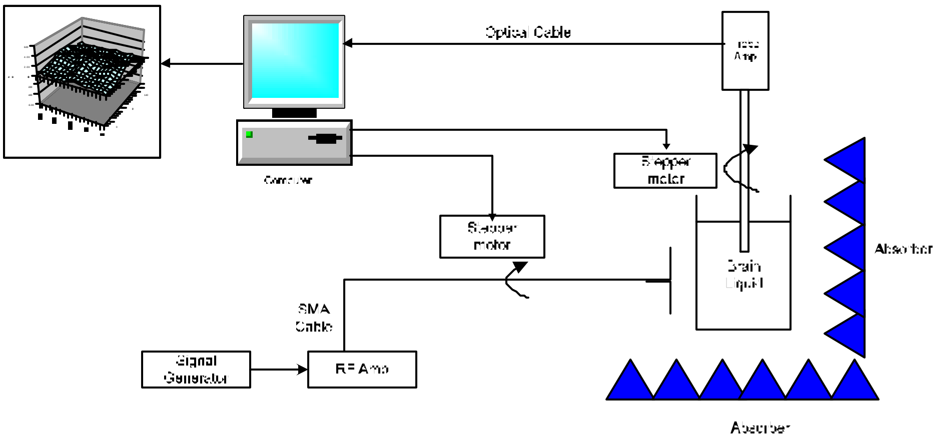

Figure 2. Schematic diagram of the test geometry used for isotropy determination

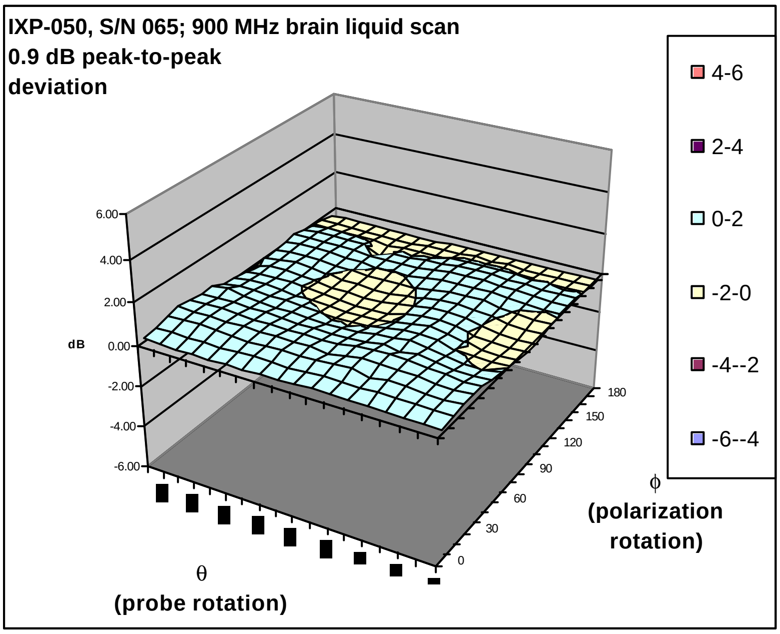

Figure 3. Spherical isotropy for probe S/N 0065. The peak-to-peak deviation of E-field measurements has a range of +/- 0.44 dB

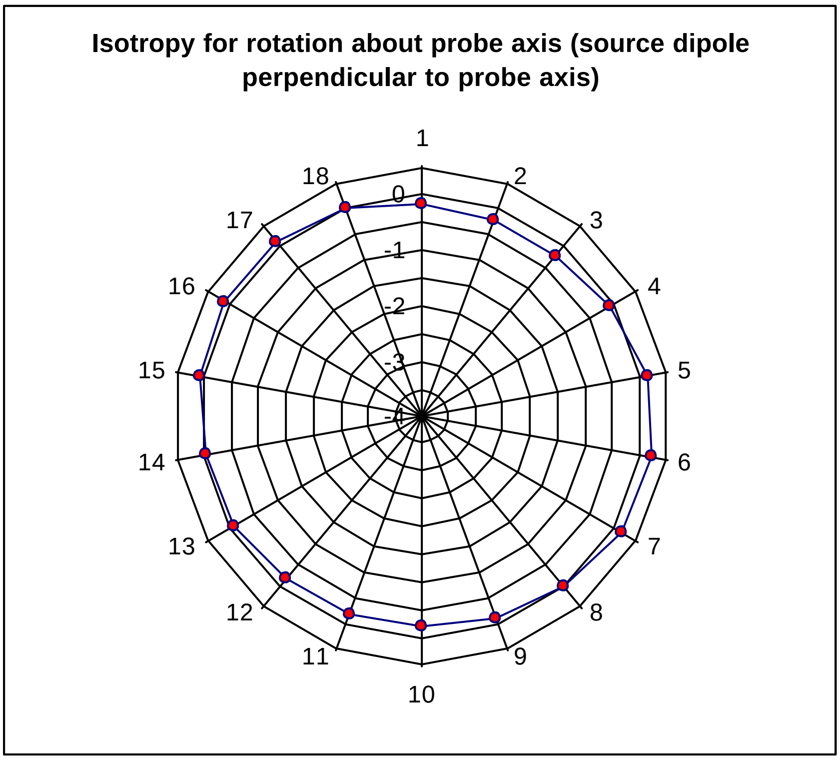

Figure 4. Rotational isotropy of probe 0065 with source dipole perpendicular to probe and to the side (probe in a field gradient).

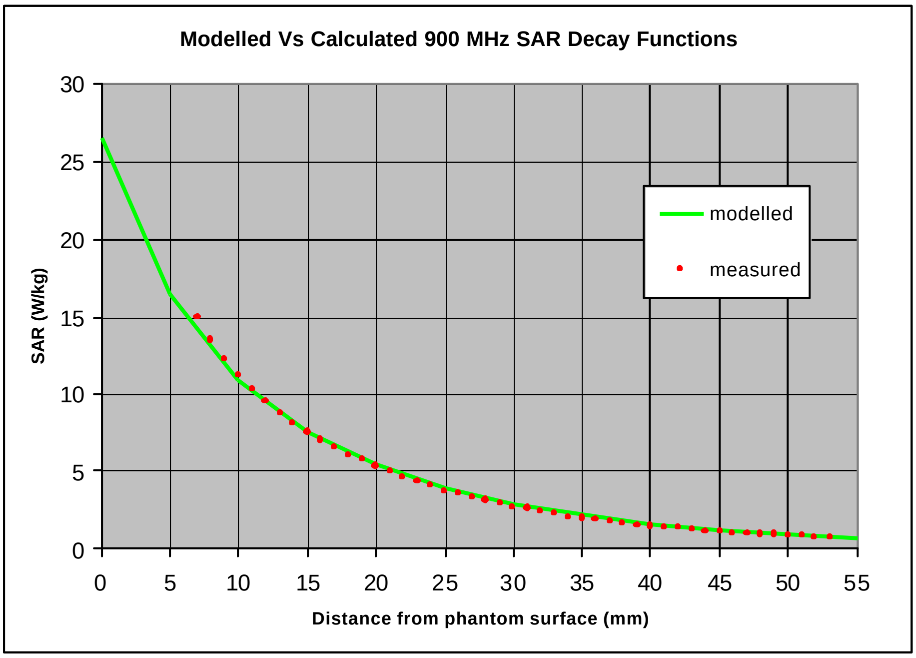

Figure 5. The measured SAR decay function along the axis of a sphere with channel factor magnitudes adjusted to fit to the theoretical function for the canonical test geometry employed.

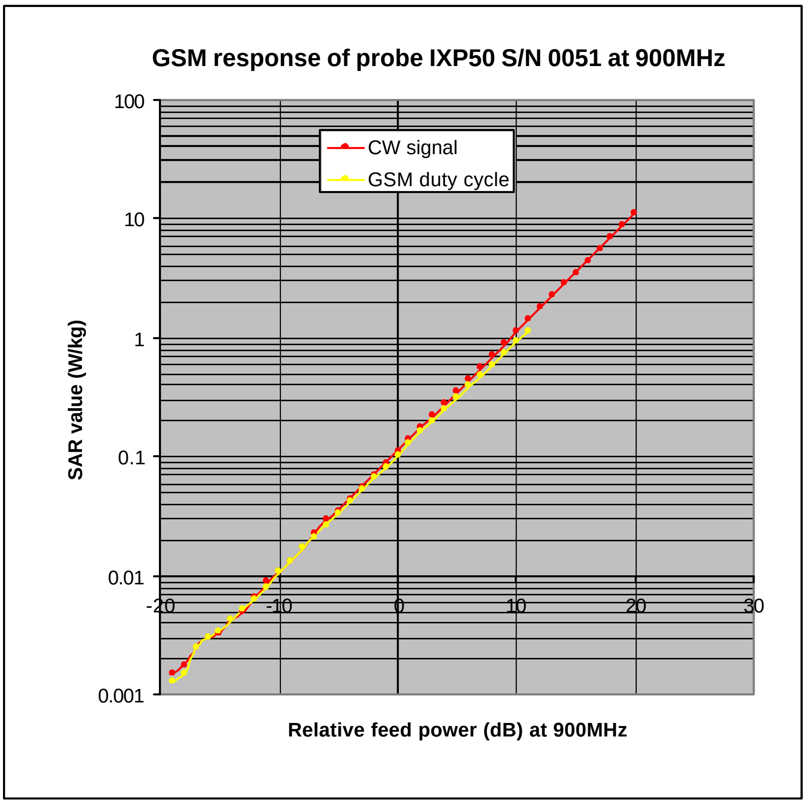

Figure 6. The GSM response of representative IXP-050 probe at 900MHz.