IMMERSIBLE SAR PROBE

CALIBRATION REPORT

Part Number: IXP – 050

S/N 0082

Calibration factors for 2450 MHz

July 2002

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INTRODUCTION

The calibration Report [1] supplied with this probe (S/N 0082) included the following calibration factors for 900MHz:

Probe S/N 0082 at 900 MHz	X	Y	Z
Air Factors	300	290	330
DCP (V*200)	20	20	20
Liquid Factors	0.336	0.347	0.347

At the time of the probe calibration report (March 2002) facilities were not available for probe calibration at 2450MHz. Indexsar have recently established waveguide-based probe calibration apparatus for this frequency and have now performed 2450MHz calibrations on seven probes similar to S/N 0082. The probes are less sensitive at 2450MHz than at 900MHz and the measured calibration factors reflect this.

Based on the calibration measurements of seven similar probes in brain liquid (relative permittivity 38.13, conductivity 1.818 S/m), conversion factors that can be applied to the 900MHz calibration for use at 2450MHz have been deduced as below.

The average of the factors required to convert a 900MHz calibration into a 2450MHz calibration for brain liquids was 1.53 with a standard deviation of 0.17. Based on these waveguide-based calibration data, the following factors would be appropriate for use with probe S/N 0082 at 2450MHz until the probe receives its next periodic calibration:

Probe S/N 0082 at 2450 MHz	X	Y	Z
Air Factors	300	290	330
DCP (V*200)	20	20	20
Liquid Factors	0.52	0.53	0.53

Prior to use, the validity of these factors should be confirmed by performing a validation measurement using a box phantom and 2450MHz dipole as described in IEEE1528 [1].

For use in body fluids, equivalent conversion factors can be deduced from calibration data for the same seven probes performed in body liquid (relative permittivity 55.28, conductivity 1.92 S/m). The average of the factors required to convert a 900MHz calibration into a 2450MHz calibration for body liquids was 1.71 with a standard deviation of 0.10.

Other features of the probe calibration are as detailed in the previous probe calibration Report [1]. In particular, the axial and rotational isotropies listed for 900MHz are appropriate at 2450MHz.

WAVEGUIDE PERFORMANCE ASSESSMENT

The waveguide apparatus referred to above has been constructed according to the guidelines offered in [2]. In particular, the dimensions and electrical properties of the matching windows have been accurately reproduced and the matching of the waveguides has been checked. Two waveguides with overlapping frequency ranges were compared at a frequency of 2000MHz and the uncertainty in the calibration factors between the two waveguides was 1%. The matching of the waveguides is indicated by return losses of typically –20dB over the frequency bands employed.

Separately, the waveguides have been used to repeat calibrations on an Indexsar probe calibrated at the National Physical Laboratory [3]. The same calibration factors have been obtained in the Indexsar waveguides as with those reported by NPL using their own waveguides traceable to national standards. The agreement is within 2% for calibrations at 1800 and 1900MHz at which frequencies the NPL calibrations were performed.

UNCERTAINTIES

The uncertainties expected of waveguide calibrations are described in IEEE1528 [2]. Liquid properties used in the calibrations were measured at the time of calibration using the Indexsar DiLine dielectric measurement kit, which has uncertainties of around +/- 2% for both permittivity and conductivity for the types of simulant liquids used.

REFERENCES

[1] Immersible SAR probe calibration report Part No. IXP-050 S/N 0082. Indexsar Ltd. March 2002.

[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] Calibration report on SAR probe IXP-050 S/N 0071 from National Physical Laboratory. Test Report EF07/2002/03/IndexSAR. Dated 20 February 2002.