



IXP-050

**3-Channel Isotropic
SAR Probe**

INDEX SAR

SAR Mapping



3 Channel Isotropic SAR Probe

- 400MHz - 6GHz Range
- Isotropic measurements of E-Fields in air and liquid
- Wide range of calibrations available
- 2 x Isotropy enhancement with 'VPM' virtual probe miniaturisation software option
- Glycol resistant



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 PEEK cylindrical enclosure material. No adhesives are used in the immersed section. Outer case materials are PEEK and heat-shrink sleeving.

CHEMICAL RESISTANCE

Tested to be resistant to glycol and alcohol containing simulant liquids but probes should be removed, cleaned and dried when not in use.

CALIBRATION

All Indexsar probes are calibrated independently at standard frequencies of 900 and 1800MHz, in brain and body liquids at CW (Many other frequencies and modulation schemes can be accommodated to order). Great care is taken in the calibration of Indexsar probes, A waveguide method is used for all rotational isotropy callibrations. According to CENELEC, this calibration technique provides excellent accuracy, with standard uncertainty of less than 3.6% depending on the frequency and medium. The calibration itself is reduced to power measurements traceable to a standard calibration procedure.

SPECIFICATIONS

Dynamic Range	Specified	Typical Results	CENELEC Limits	IEEE Limits
Minimum (W/kg):	0.01	0.01	<0.02	0.01
Maximum (W/kg):	150		>100	100
<hr/>				
Linearity of response	Specified			
Over range 0.01 - 100 W/kg (+/- dB)	0.2	0.125	0.50	0.25
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Isotropy (measured at 900MHz)	Specified			
Axial rotation with probe normal to source (+/- dB) at 835, 900, 1800, 1900 and 2450MHz	0.25	0.1	0.5	0.25
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Spherical isotropy covering all orientations to source (+/- dB)	0.5	0.43	1.0	0.50

MECHANICAL

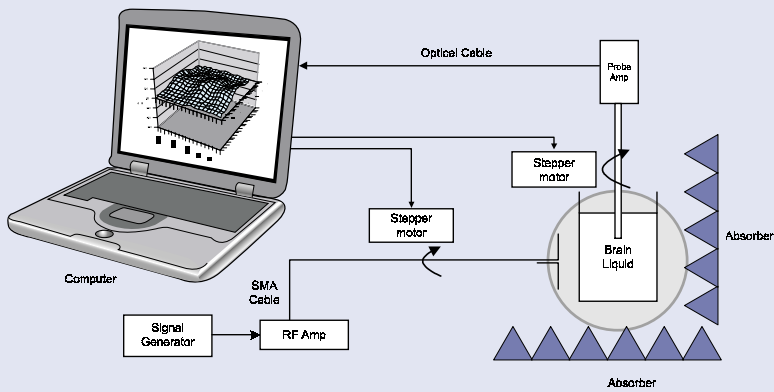
Dimensions

Overall length:	350mm
Tip length:	10mm
Body diameter:	12mm
Tip diameter:	5.2mm
Distance from probe tip to dipole centers:	2.5mm

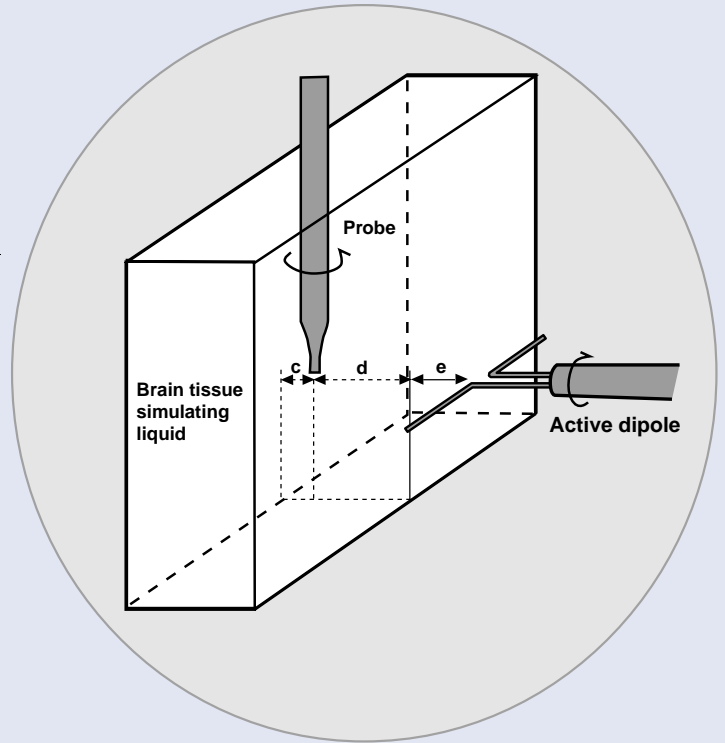
INDEX SAR

Spherical Isotropy

Schematic diagram of the test geometry used for spherical isotropy determination

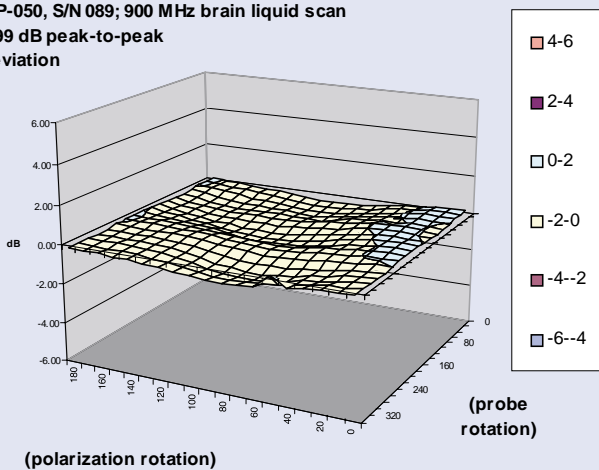


Spherical isotropy jig showing probe, dipole and box filled with simulated brain liquid

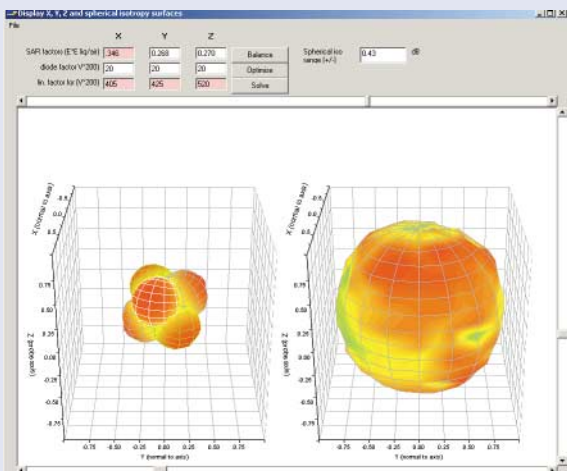


2 Dimensional surface representation

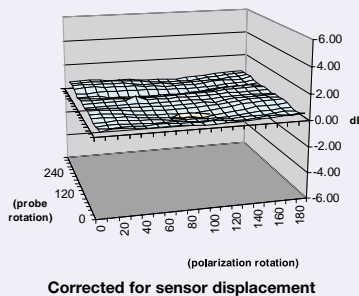
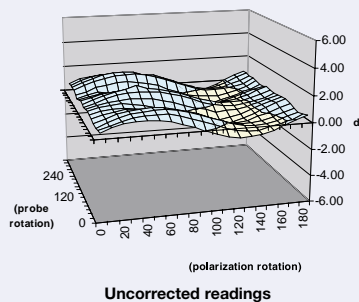
IXP-050, S/N 089; 900 MHz brain liquid scan
0.99 dB peak-to-peak deviation



3 Dimensional Representation



Virtual probe miniaturisation (VPM)



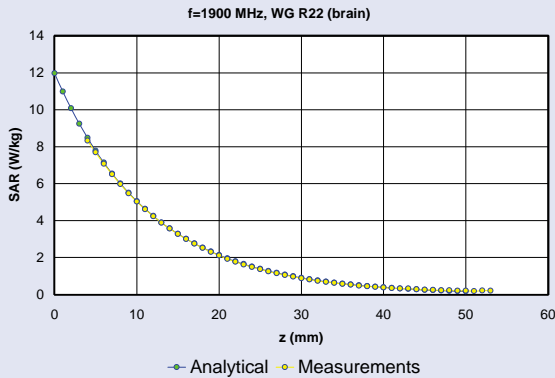
A unique feature of Indexsar's post processing software in the compliant SARA2 System.

VPM is a breakthrough in reducing probe measurement uncertainties particularly at higher frequencies

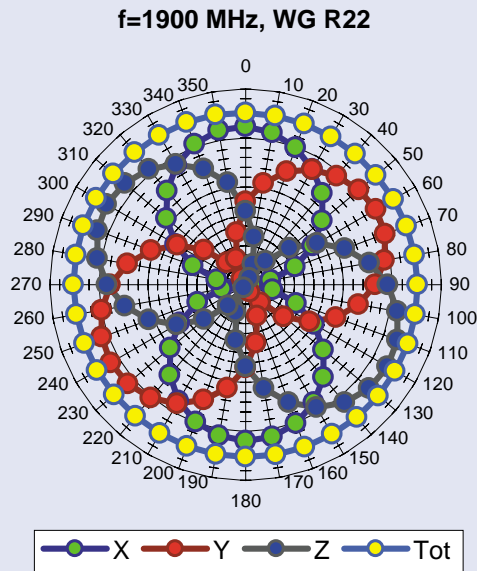
Graphs show probe isotropy at 2450MHz with probe oriented at 90 degrees to field gradient direction.

Rotational Isotropy

Calibration factor determination from Waveguide measurements

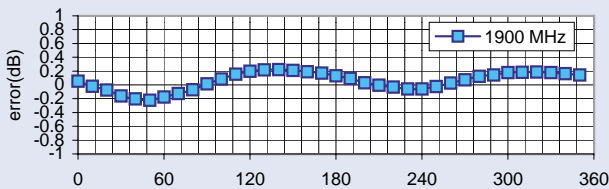


Typical rotational Isotropy (x,y,z and combined axes) measured in Waveguide F= 1900MHz WG R22



Example of the rotational isotropy of a typical probe obtained by rotating the probe in a liquid-filled waveguide at 1900MHz. Similar distributions are obtained at the other test frequencies (1800 and 1900MHz) both in brain liquids and body fluids.

Isotropy Error (), = 0°



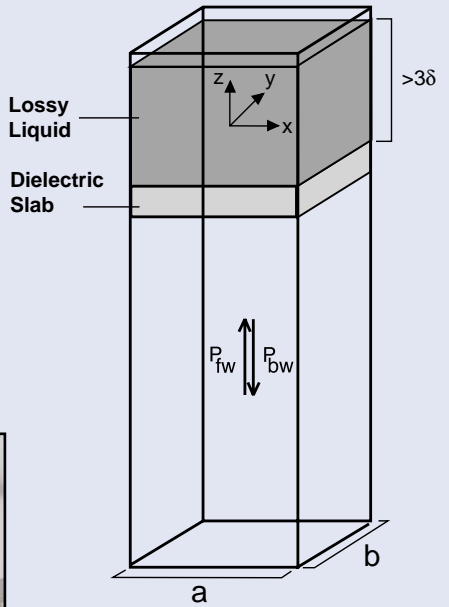
WAVEGUIDE MEASUREMENT PROCEDURE

The calibration method is based on setting up a calculable specific absorption rate (SAR) in a vertically-mounted waveguide section. The waveguide has an air-filled, launcher section and a liquid-filled section separated by a matching window that is designed to minimise reflections at the liquid interface. A TE₀₁ mode is launched into the waveguide by means of a N-type-to-waveguide adapter. The power delivered to the liquid section is calculated from the forward power and reflection coefficient measured at the input to the waveguide. At the centre of the cross-section of the waveguide, the local spot SAR in the liquid as a function of distance from the window is given by functions set out in IEEE1528 as below:

Because of the low cutoff frequency, the field inside the liquid nearly propagates as a TEM wave. The depth of the medium (greater than three penetration depths) ensures that reflections at the upper surface of the liquid are negligible. The power absorbed in the liquid is determined by measuring the waveguide forward and reflected power. The equation (below) shows the relationship between the SAR at the cross-sectional centre of the lossy waveguide and the longitudinal distance (z) from the dielectric separator.

$$SAR(z) = \frac{4(P_f - P_b)}{\rho a b \delta} e^{-2z/\delta}$$

Waveguide with robot arm



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