

## SAR measurement Data

ALSAS-10U VER 2.3.6 APREL Laboratories

SAR Test Report-PCS 1900

Report Date : 03-Nov-2008  
Measurement Date : 03-Nov-2008

### Product Data

Device Name : Bestpower  
Type : Std Form Cell Phone  
Model : V90+  
Frequency : 1900.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 114.7 mm  
Width : 52.3 mm  
Depth : 17.7 mm  
Antenna Type : Internal

### Phantom Data

Type : SAM-Left  
Size (mm) : 280 x 280 x 280  
Location : Left

### Tissue Data

Type : HEAD  
Serial No. : 324-H  
Frequency : 1900.00 MHz  
Last Calib. Date : 03-Nov-2008  
Temperature : 20.70 °C  
Ambient Temp. : 21.80 °C  
Humidity : 51.00 RH%  
Epsilon : 40.37 F/m  
Sigma : 1.43 S/m  
Density : 1000.00 kg/cu. m

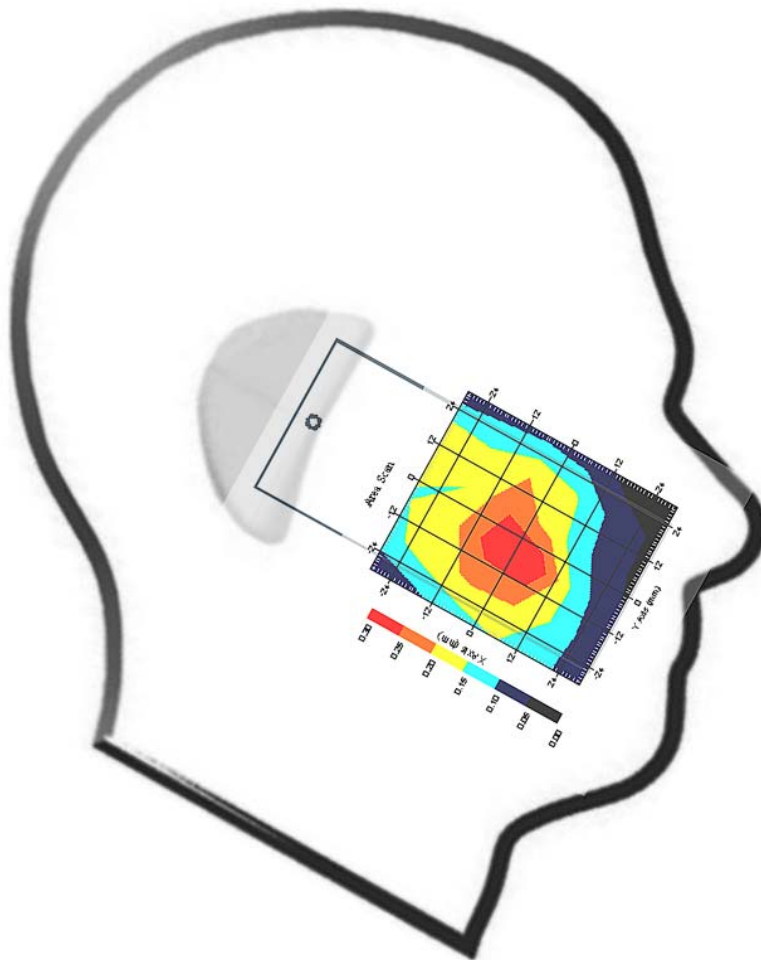
### Probe Data

Name : Probe 265  
Model : E020  
Type : E-Field Triangle  
Serial No. : 265  
Last Calib. Date : 09-May-2008  
Frequency : 1900.00 MHz  
Duty Cycle Factor: 8  
Conversion Factor: 4.51  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

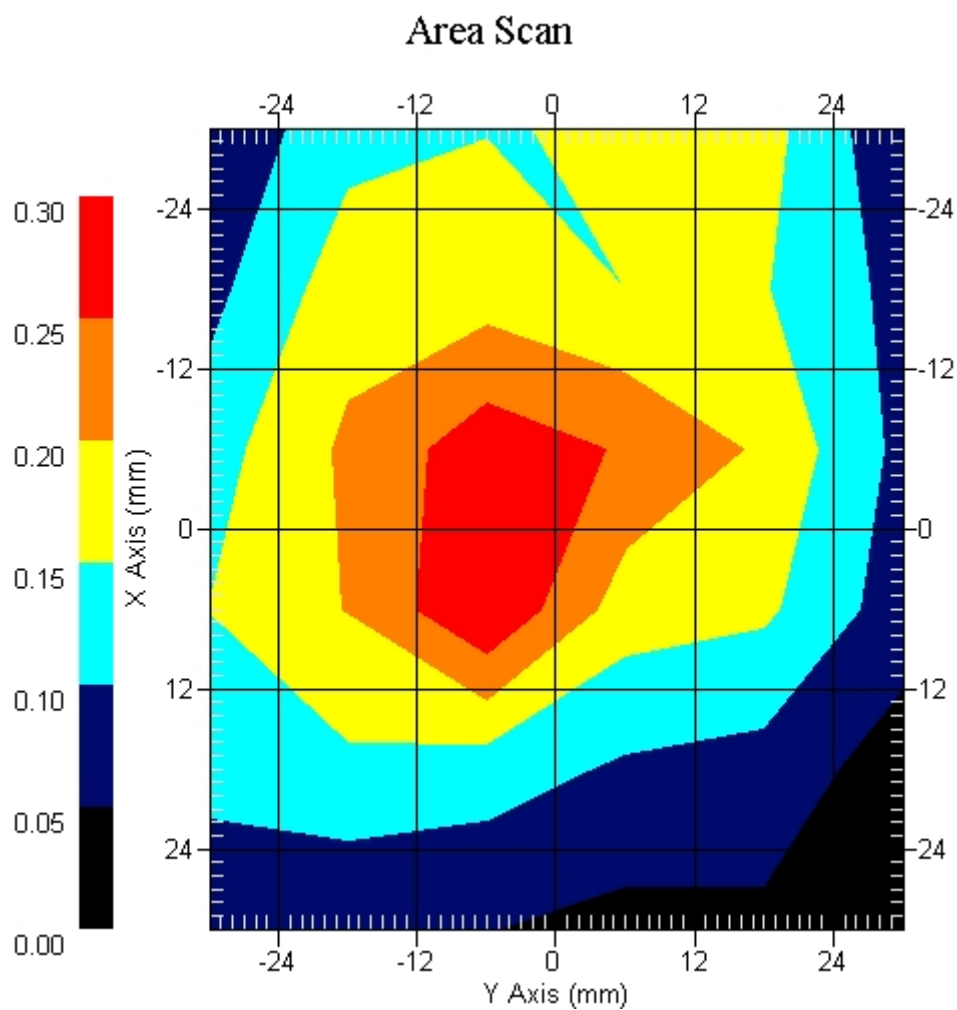
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.064 W/kg  
 Power Drift-Finish: 0.062 W/kg  
 Power Drift (%) : -3.125

DUT Position : Touch  
 Channel : 512



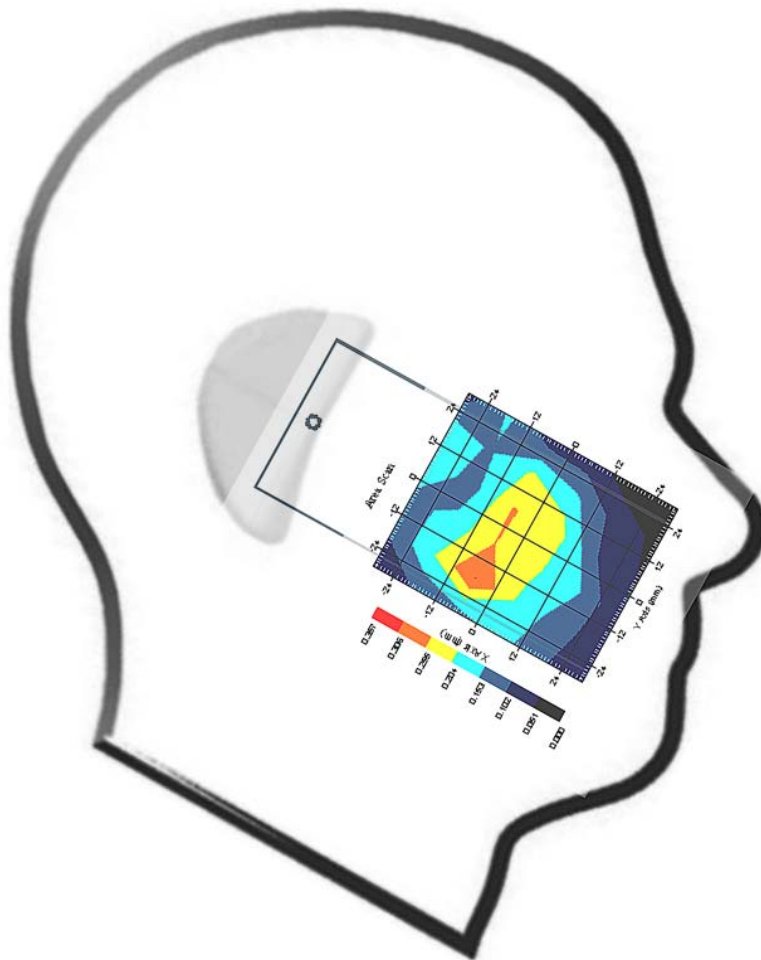
1 gram SAR value : 0.283 W/kg  
 10 gram SAR value : 0.157 W/kg  
 Area Scan Peak SAR : 0.300 W/kg  
 Zoom Scan Peak SAR : 0.640 W/kg



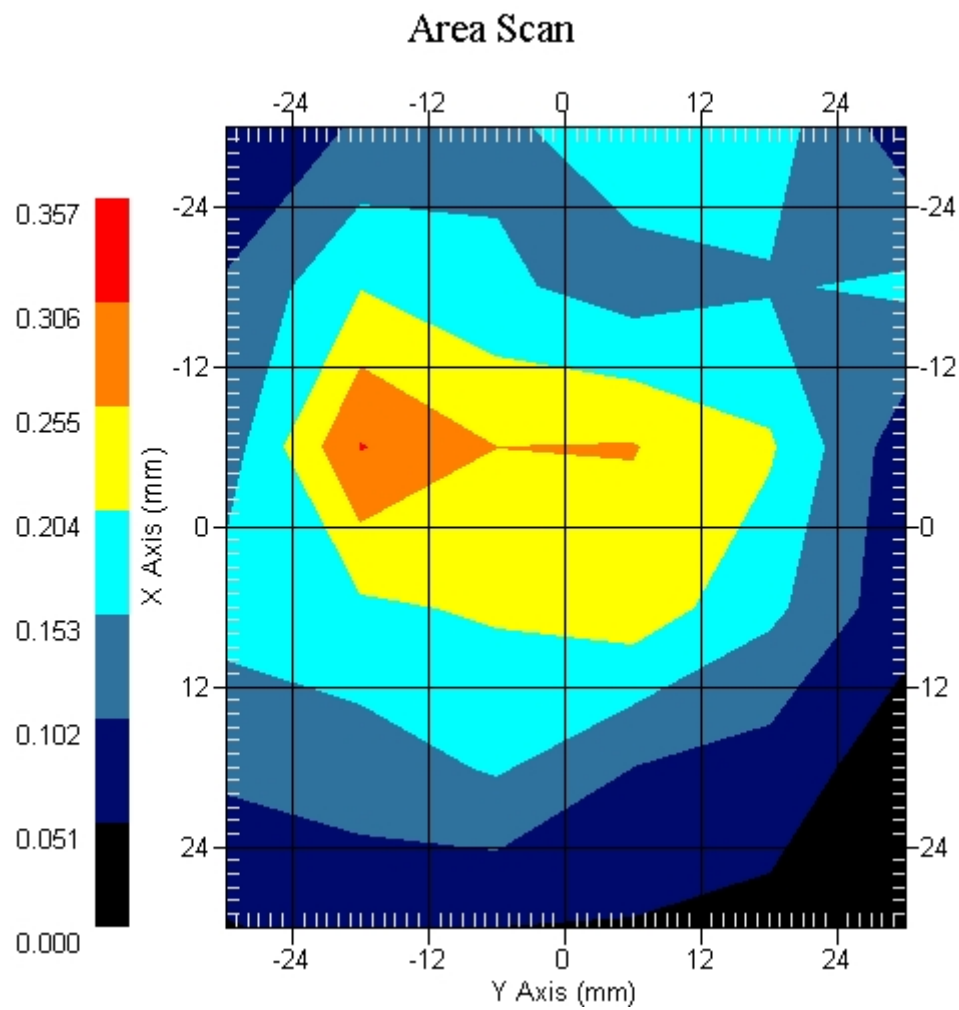
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.048 W/kg  
 Power Drift-Finish: 0.048 W/kg  
 Power Drift (%) : -0.720

DUT Position : Touch  
 Channel : 661



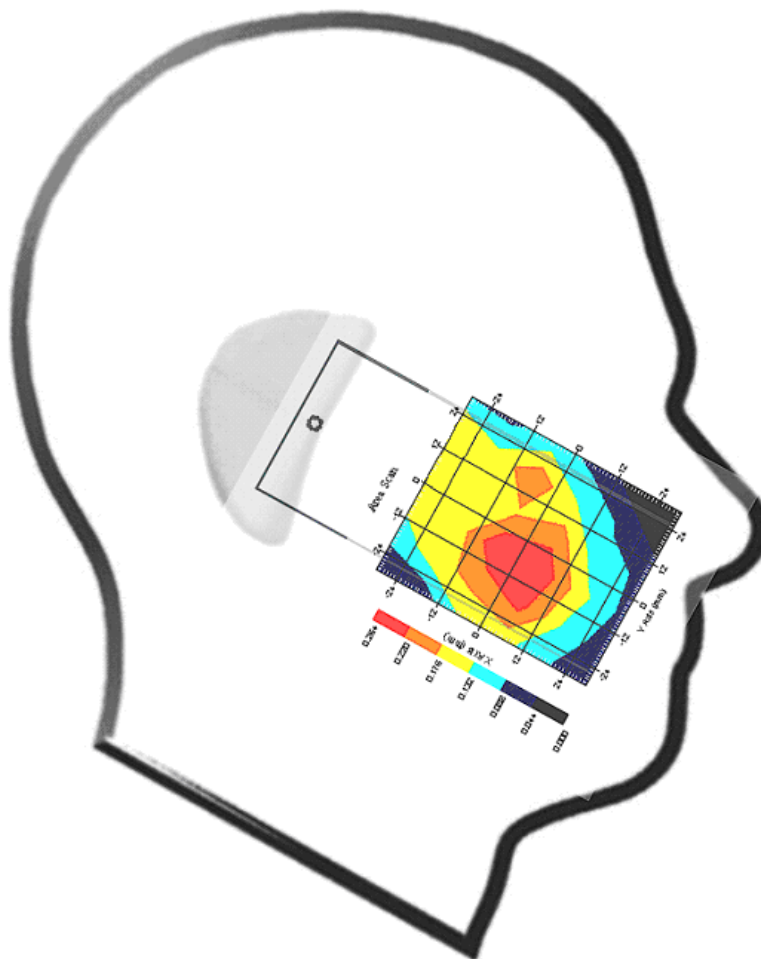
1 gram SAR value : 0.257 W/kg  
 10 gram SAR value : 0.202 W/kg  
 Area Scan Peak SAR : 0.308 W/kg  
 Zoom Scan Peak SAR : 0.510 W/kg



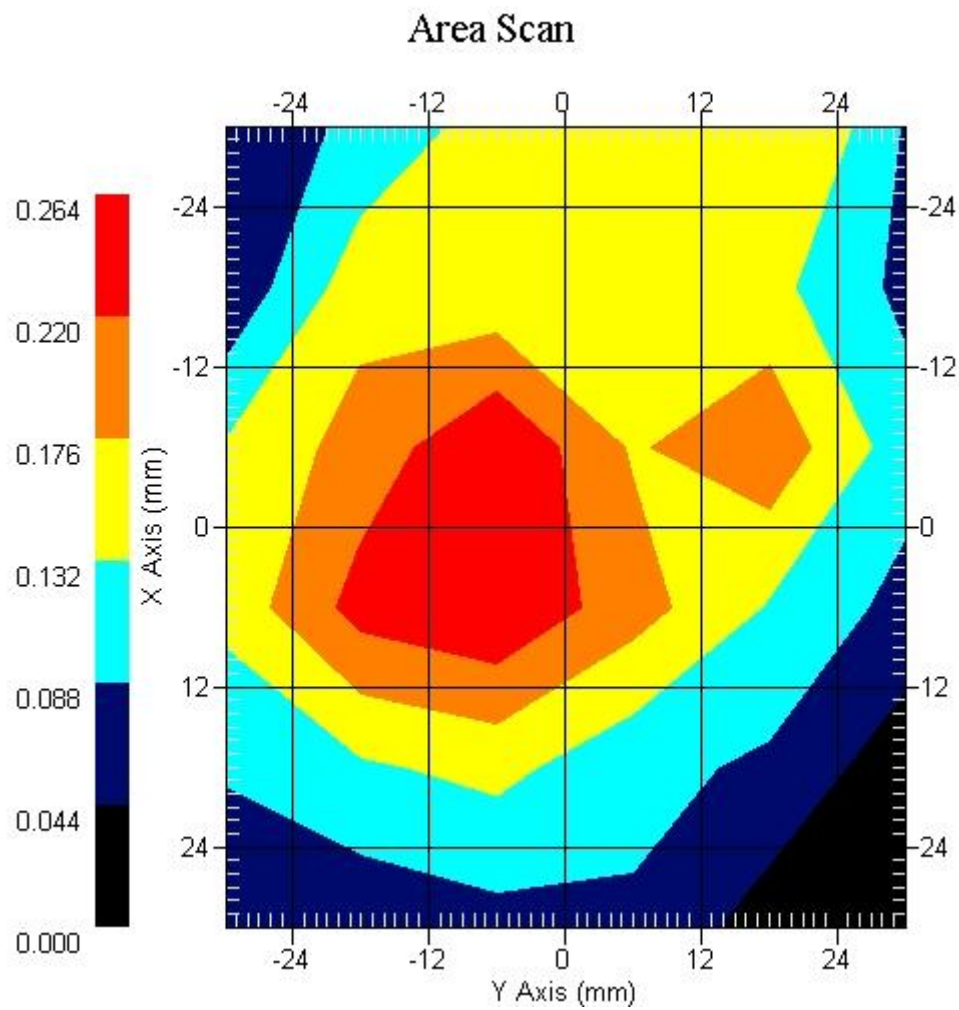
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.042 W/kg  
 Power Drift-Finish: 0.042 W/kg  
 Power Drift (%) : 0.278

DUT Position : Touch  
 Channel : 810



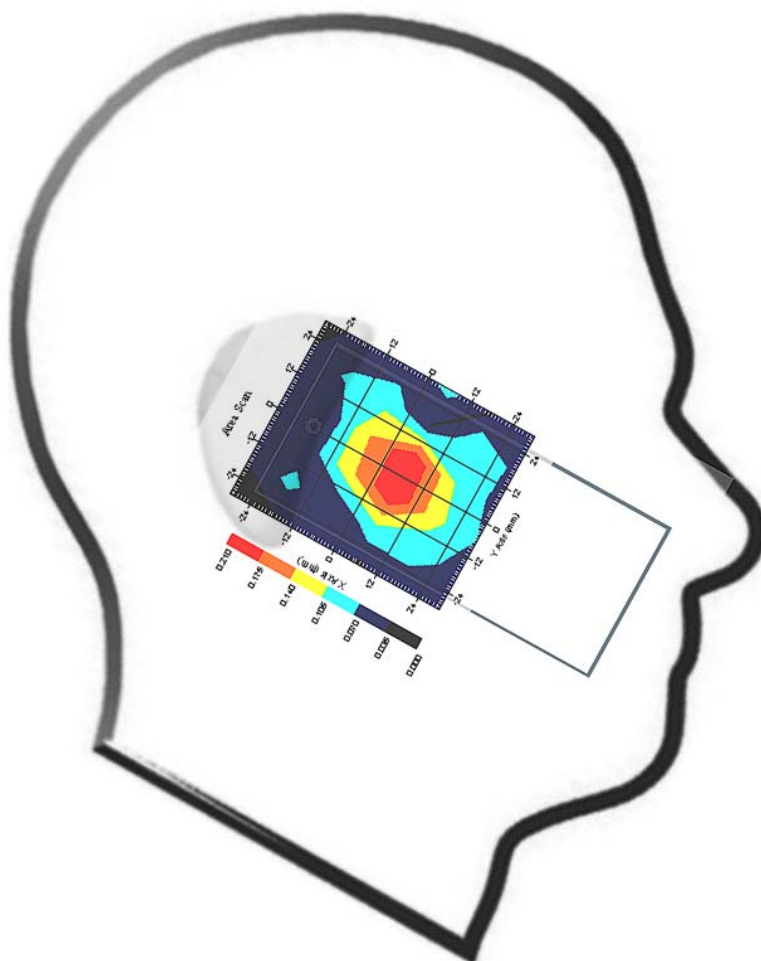
1 gram SAR value : 0.240 W/kg  
 10 gram SAR value : 0.139 W/kg  
 Area Scan Peak SAR : 0.261 W/kg  
 Zoom Scan Peak SAR : 0.370 W/kg



## Measurement Data

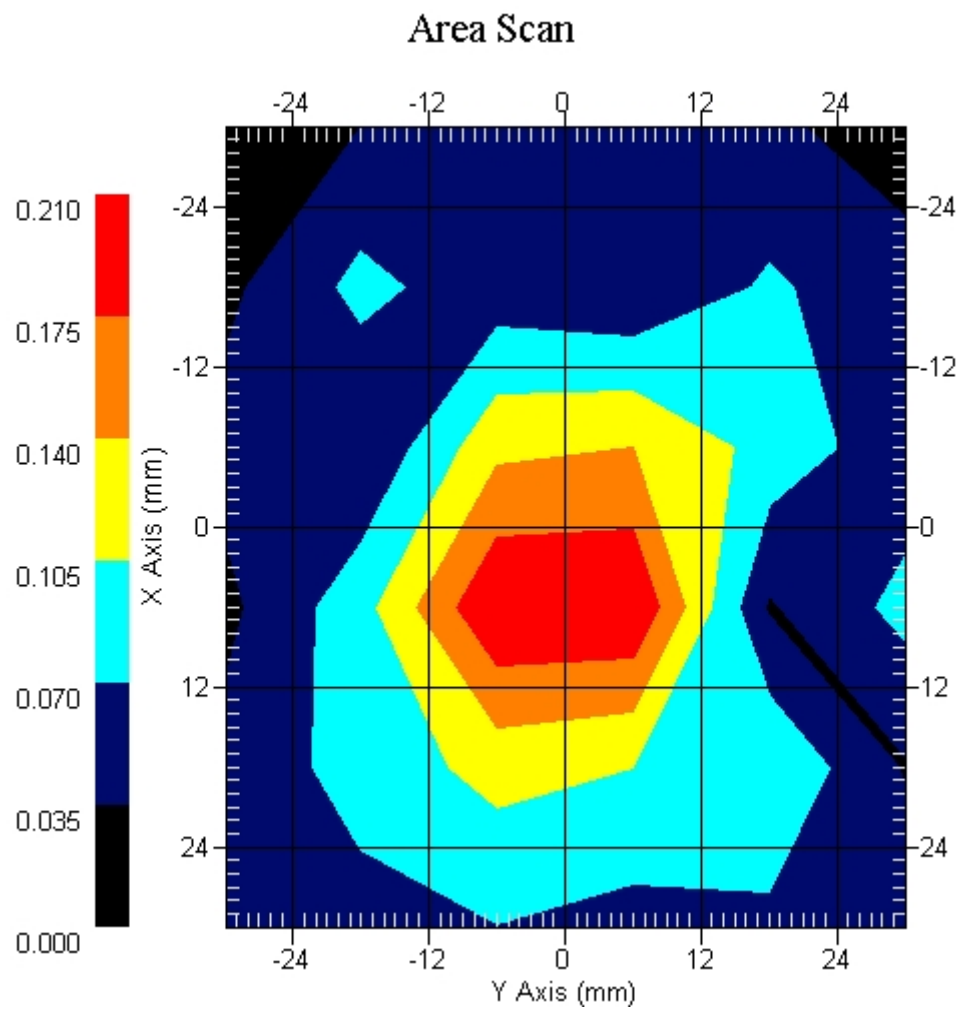
Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.070 W/kg  
 Power Drift-Finish: 0.069 W/kg  
 Power Drift (%) : -1.428

DUT Position : 15° Tilt  
 Channel : 512



1 gram SAR value : 0.174 W/kg  
 10 gram SAR value : 0.108 W/kg  
 Area Scan Peak SAR : 0.209 W/kg  
 Zoom Scan Peak SAR : 0.250 W/kg

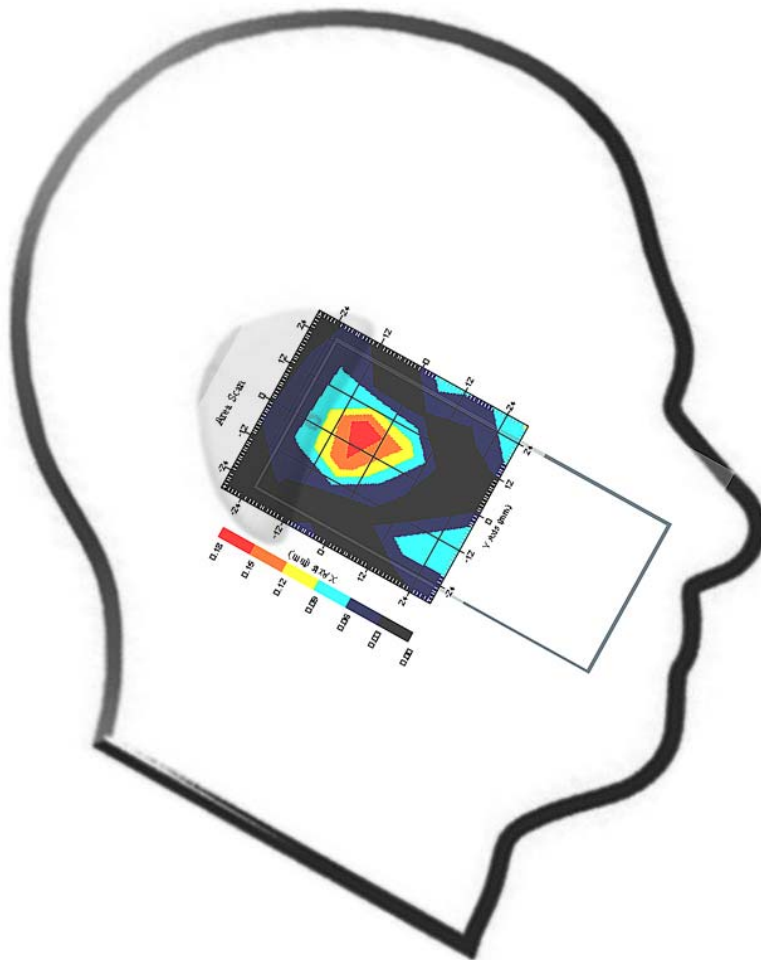




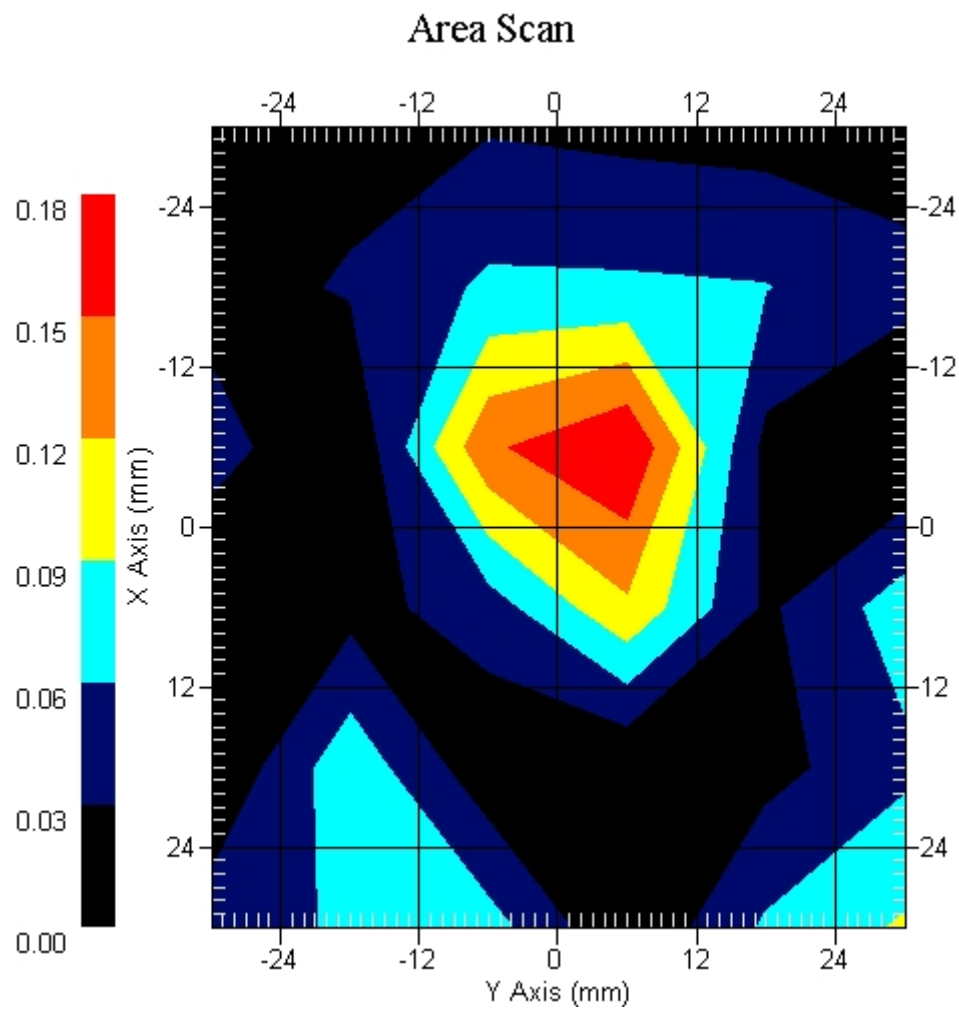
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.062 W/kg  
 Power Drift-Finish: 0.062 W/kg  
 Power Drift (%) : -0.770

DUT Position : 15° Tilt  
 Channel : 661



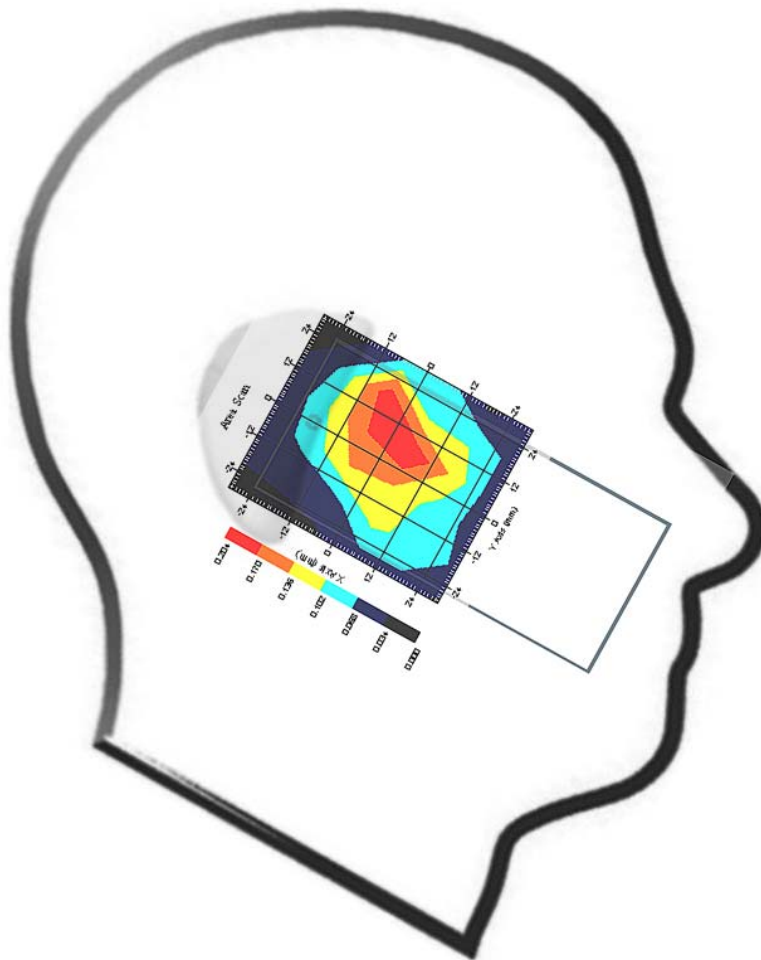
1 gram SAR value : 0.162 W/kg  
 10 gram SAR value : 0.096 W/kg  
 Area Scan Peak SAR : 0.179 W/kg  
 Zoom Scan Peak SAR : 0.380 W/kg



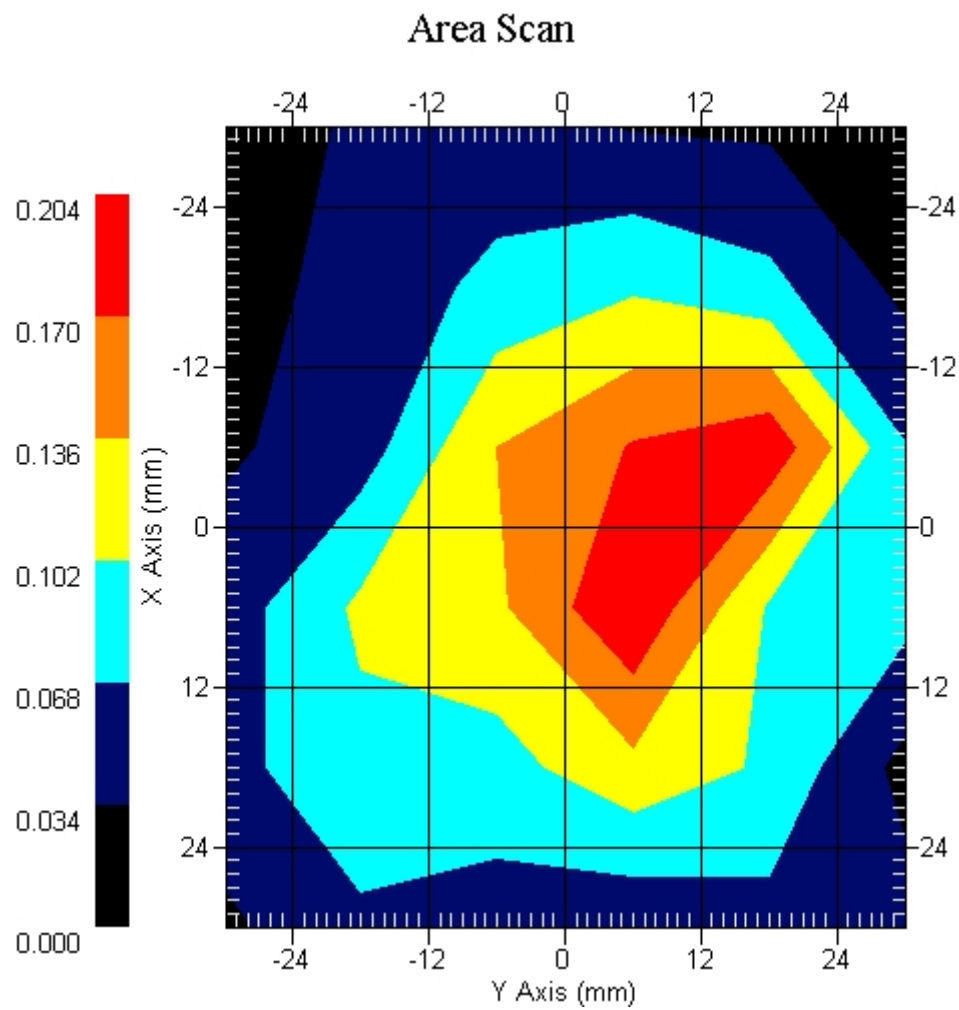
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.083 W/kg  
 Power Drift-Finish: 0.084 W/kg  
 Power Drift (%) : 1.204

DUT Position : 15° Tilt  
 Channel : 810



1 gram SAR value : 0.140 W/kg  
 10 gram SAR value : 0.086 W/kg  
 Area Scan Peak SAR : 0.201 W/kg  
 Zoom Scan Peak SAR : 0.320 W/kg



## ALSAS-10U VER 2.3.6 APREL Laboratories

### SAR Test Report-PCS 1900

Report Date : 03-Nov-2008  
Measurement Date : 03-Nov-2008

#### Product Data

Device Name : Bestpower  
Type : Std Form Cell Phone  
Model : V90+  
Frequency : 1900.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 114.7 mm  
Width : 52.3 mm  
Depth : 17.7 mm  
Antenna Type : Internal

#### Phantom Data

Type : SAM-Right  
Size (mm) : 280 x 280 x 280  
Location : Right

#### Tissue Data

Type : HEAD  
Serial No. : 324-H  
Frequency : 1900.00 MHz  
Last Calib. Date : 03-Nov-2008  
Temperature : 20.70 °C  
Ambient Temp. : 21.80 °C  
Humidity : 51.00 RH%  
Epsilon : 40.37 F/m  
Sigma : 1.43 S/m  
Density : 1000.00 kg/cu. m

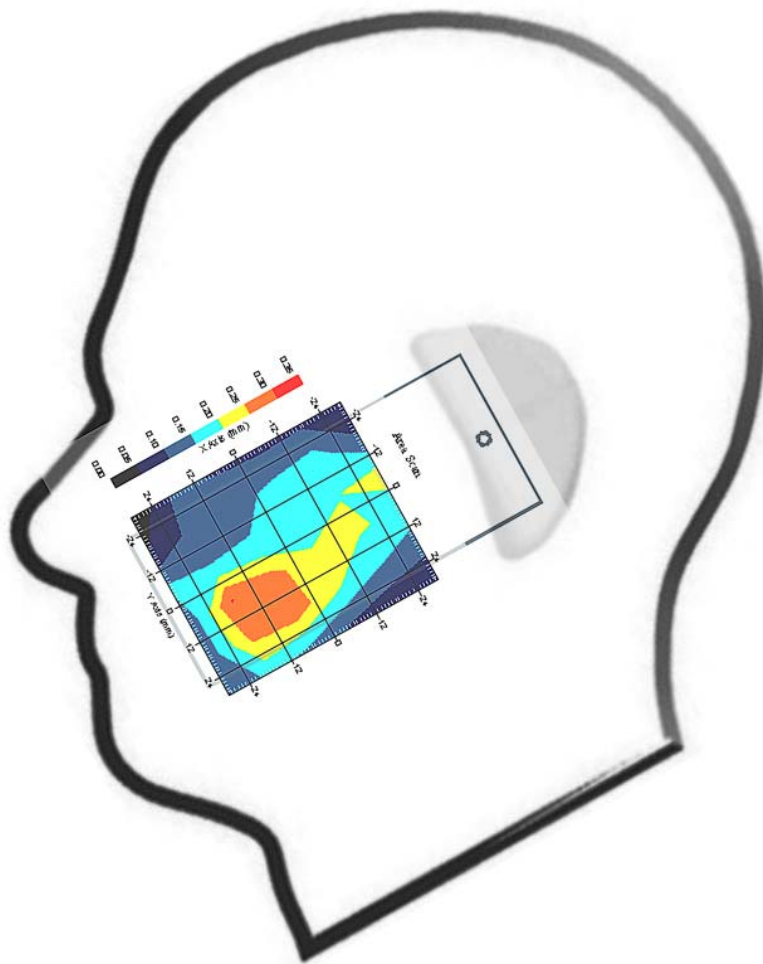
#### Probe Data

Name : Probe 265  
Model : E020  
Type : E-Field Triangle  
Serial No. : 265  
Last Calib. Date : 09-May-2008  
Frequency : 1900.00 MHz  
Duty Cycle Factor: 8  
Conversion Factor: 4.51  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

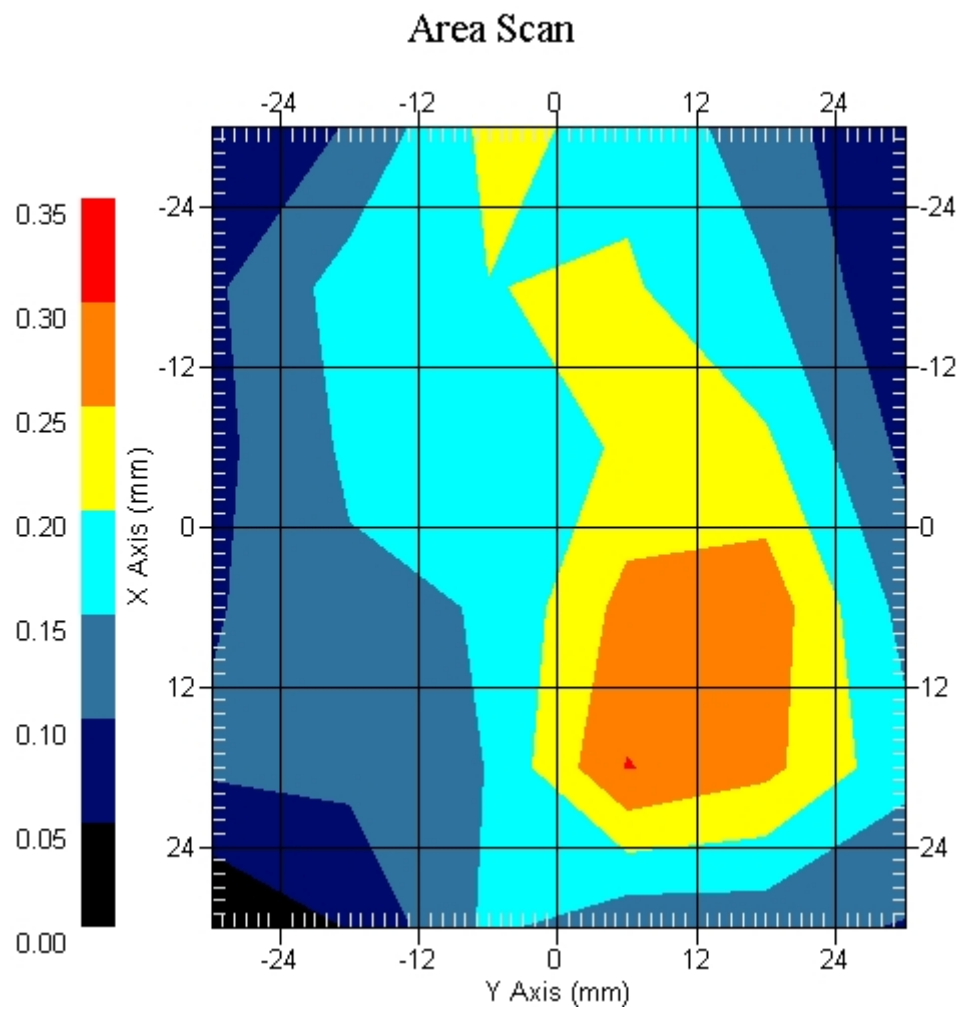
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.041 W/kg  
 Power Drift-Finish: 0.041 W/kg  
 Power Drift (%) : 0.830

DUT Position : Touch  
 Channel : 512



1 gram SAR value : 0.195 W/kg  
 10 gram SAR value : 0.114 W/kg  
 Area Scan Peak SAR : 0.302 W/kg  
 Zoom Scan Peak SAR : 0.350 W/kg

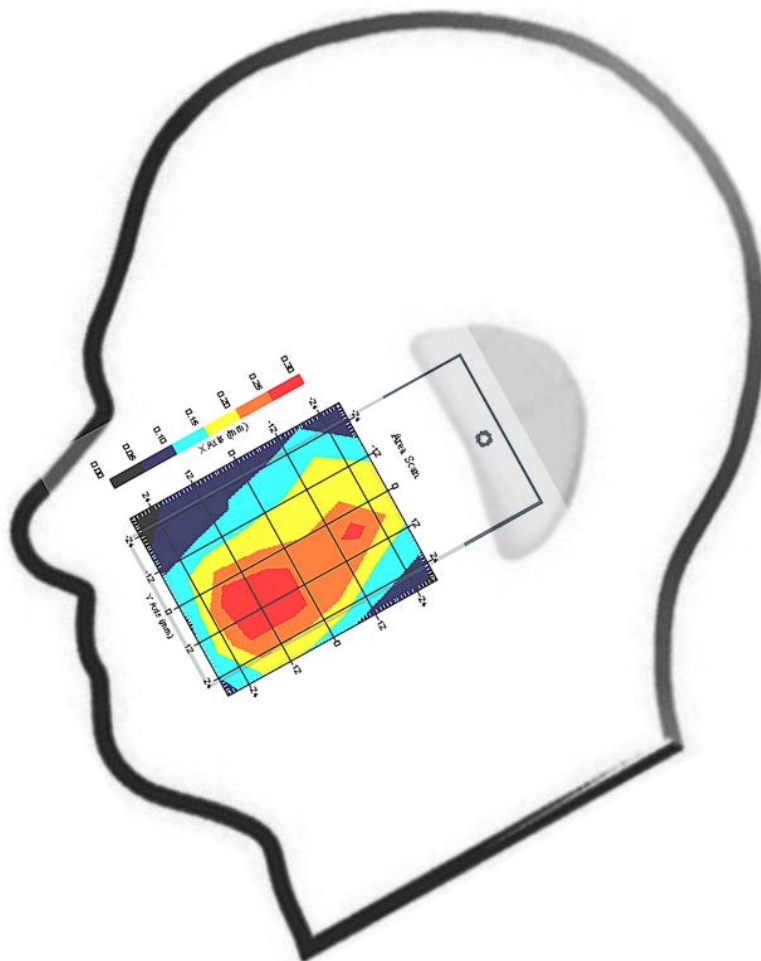




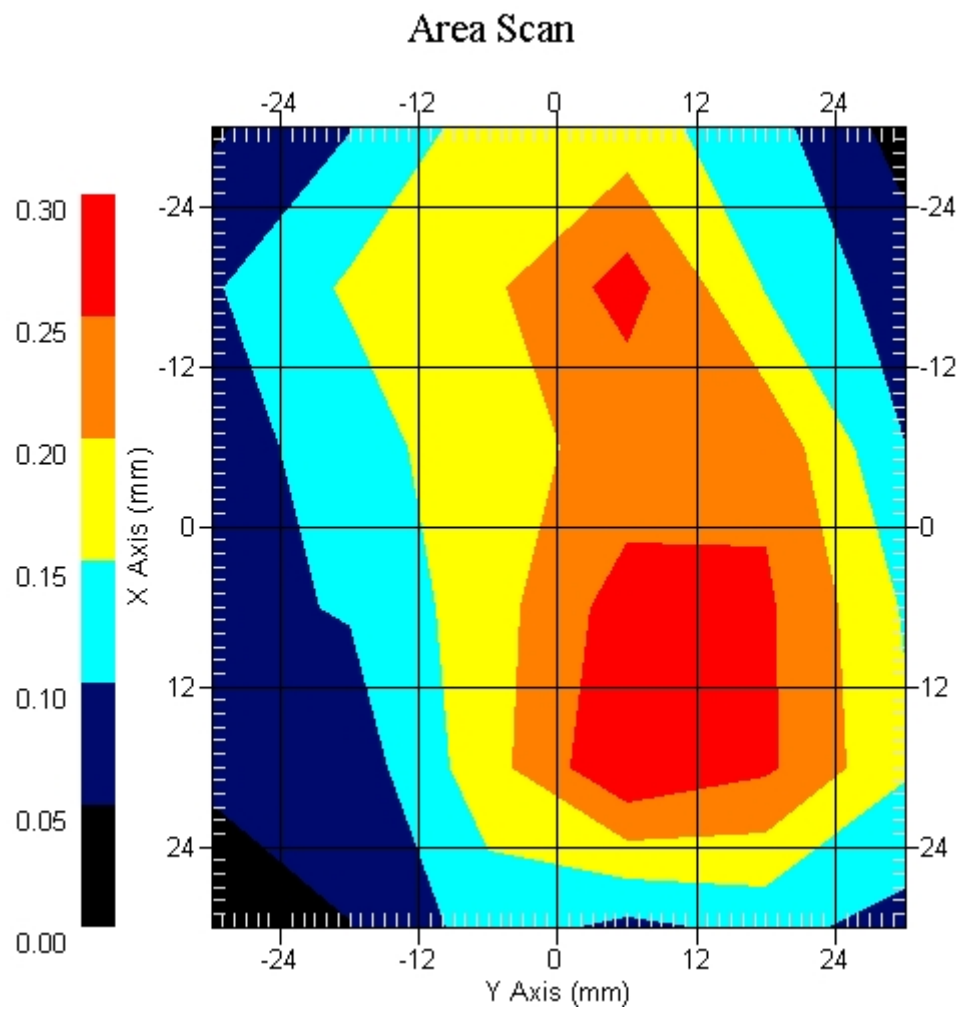
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.044 W/kg  
 Power Drift-Finish: 0.043 W/kg  
 Power Drift (%) : -2.272

DUT Position : Touch  
 Channel : 661



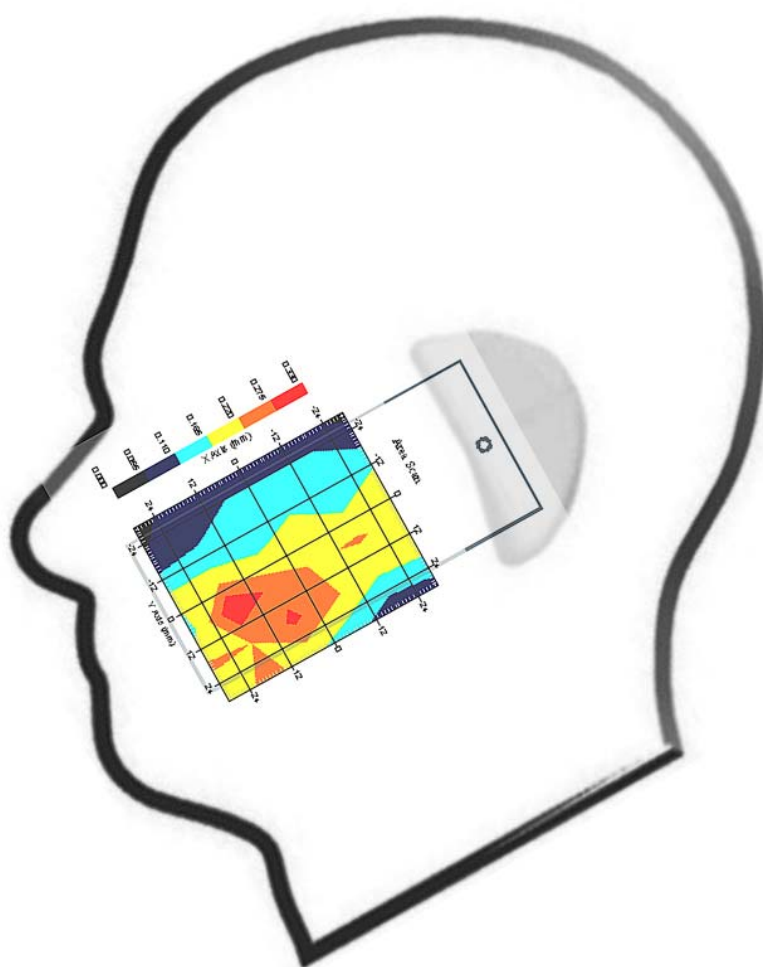
1 gram SAR value : 0.254 W/kg  
 10 gram SAR value : 0.152 W/kg  
 Area Scan Peak SAR : 0.298 W/kg  
 Zoom Scan Peak SAR : 0.430 W/kg



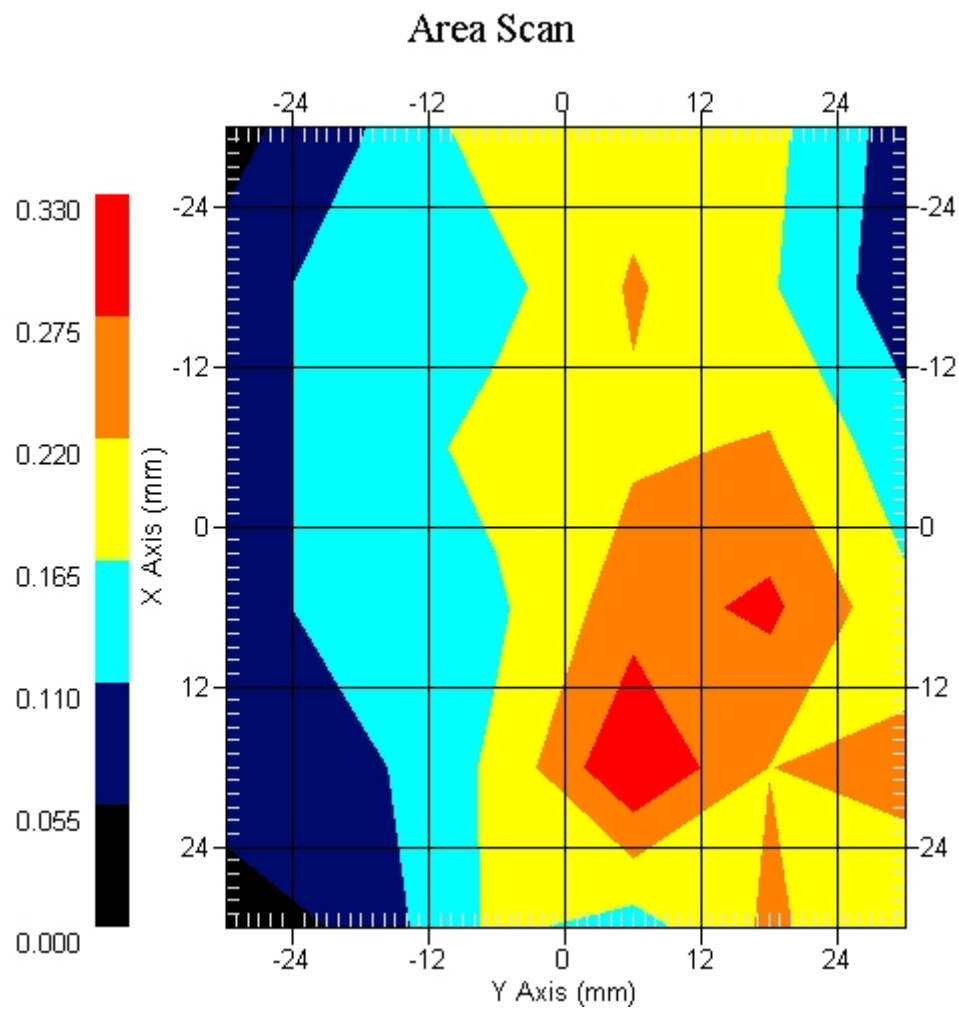
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.030 W/kg  
 Power Drift-Finish: 0.030 W/kg  
 Power Drift (%) : -0.312

DUT Position : Touch  
 Channel : 810



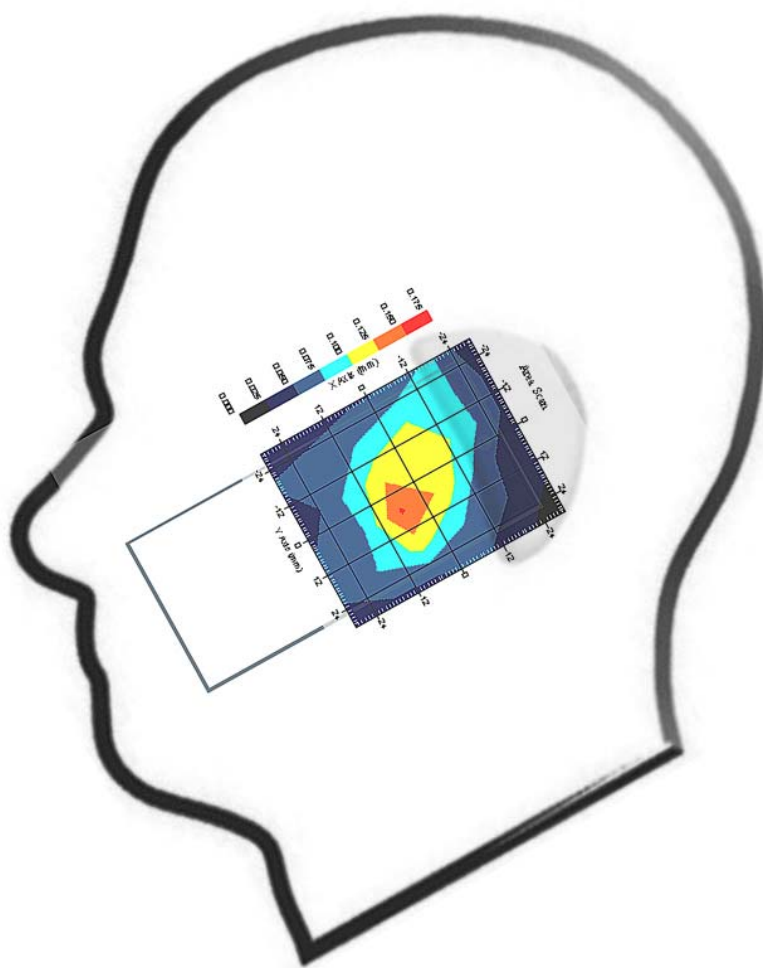
1 gram SAR value : 0.309 W/kg  
 10 gram SAR value : 0.224 W/kg  
 Area Scan Peak SAR : 0.329 W/kg  
 Zoom Scan Peak SAR : 0.350 W/kg



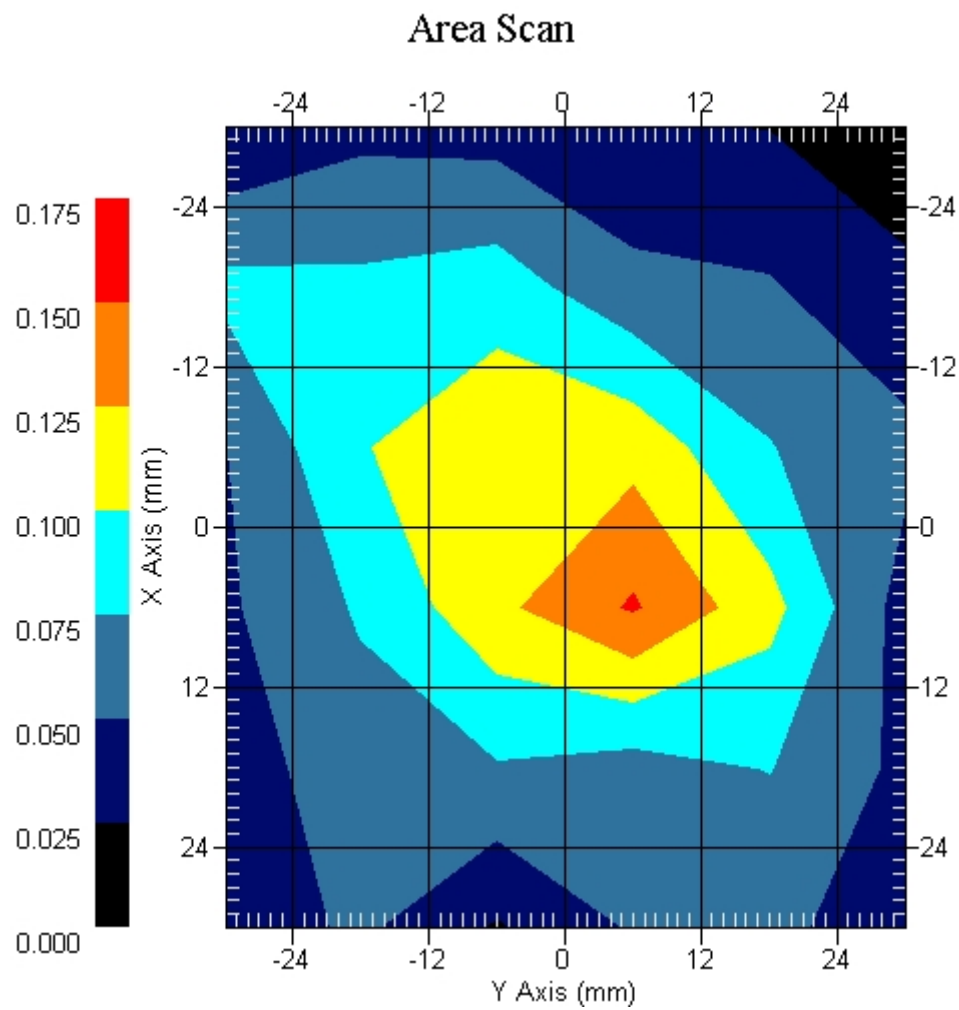
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.054 W/kg  
 Power Drift-Finish: 0.054 W/kg  
 Power Drift (%) : 0.925

DUT Position : 15° Tilt  
 Channel : 512



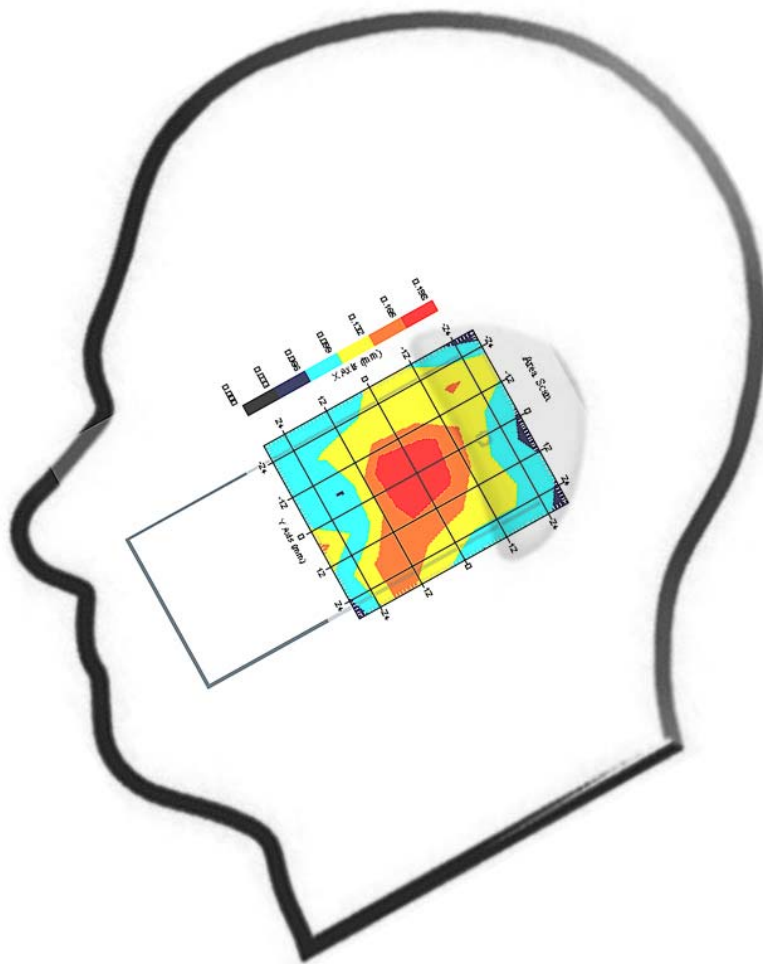
1 gram SAR value : 0.172 W/kg  
 10 gram SAR value : 0.121 W/kg  
 Area Scan Peak SAR : 0.153 W/kg  
 Zoom Scan Peak SAR : 0.290 W/kg



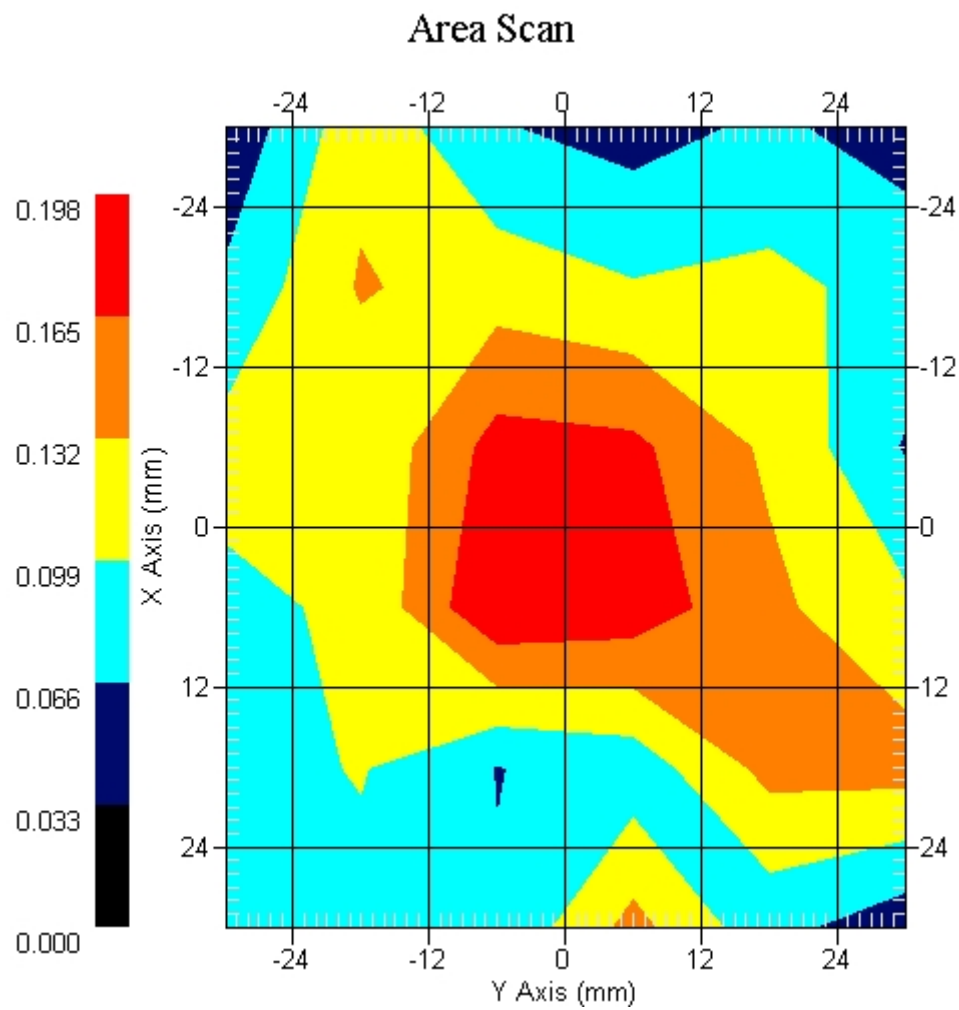
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.075 W/kg  
 Power Drift-Finish: 0.075 W/kg  
 Power Drift (%) : 0.605

DUT Position : 15° Tilt  
 Channel : 661



1 gram SAR value : 0.181 W/kg  
 10 gram SAR value : 0.131 W/kg  
 Area Scan Peak SAR : 0.196 W/kg  
 Zoom Scan Peak SAR : 0.230 W/kg

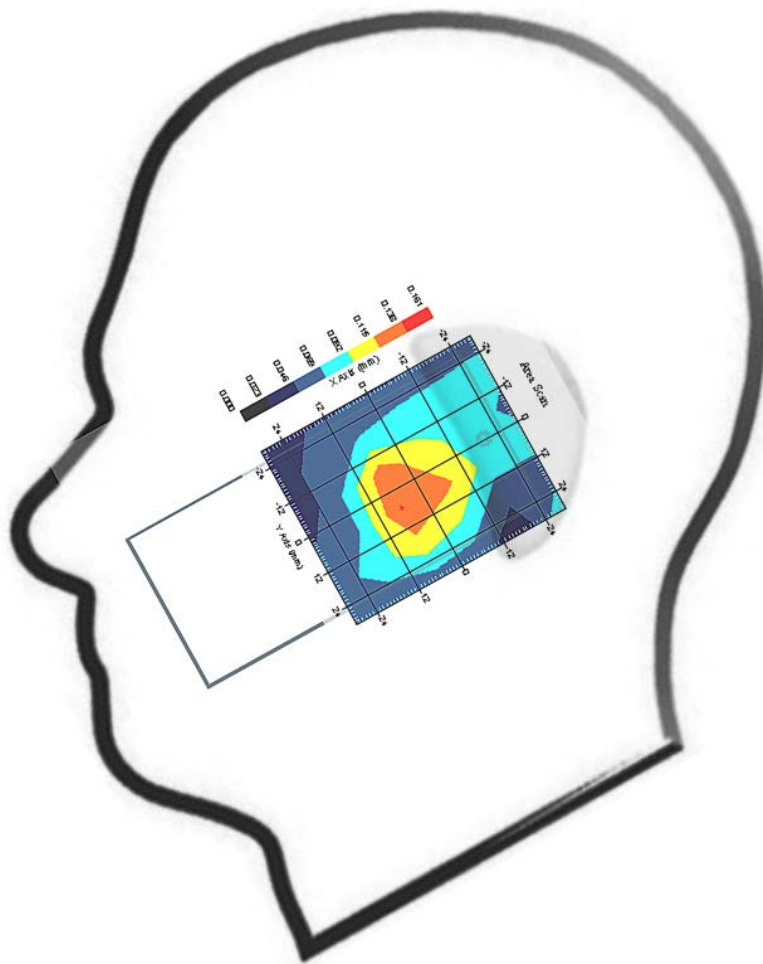




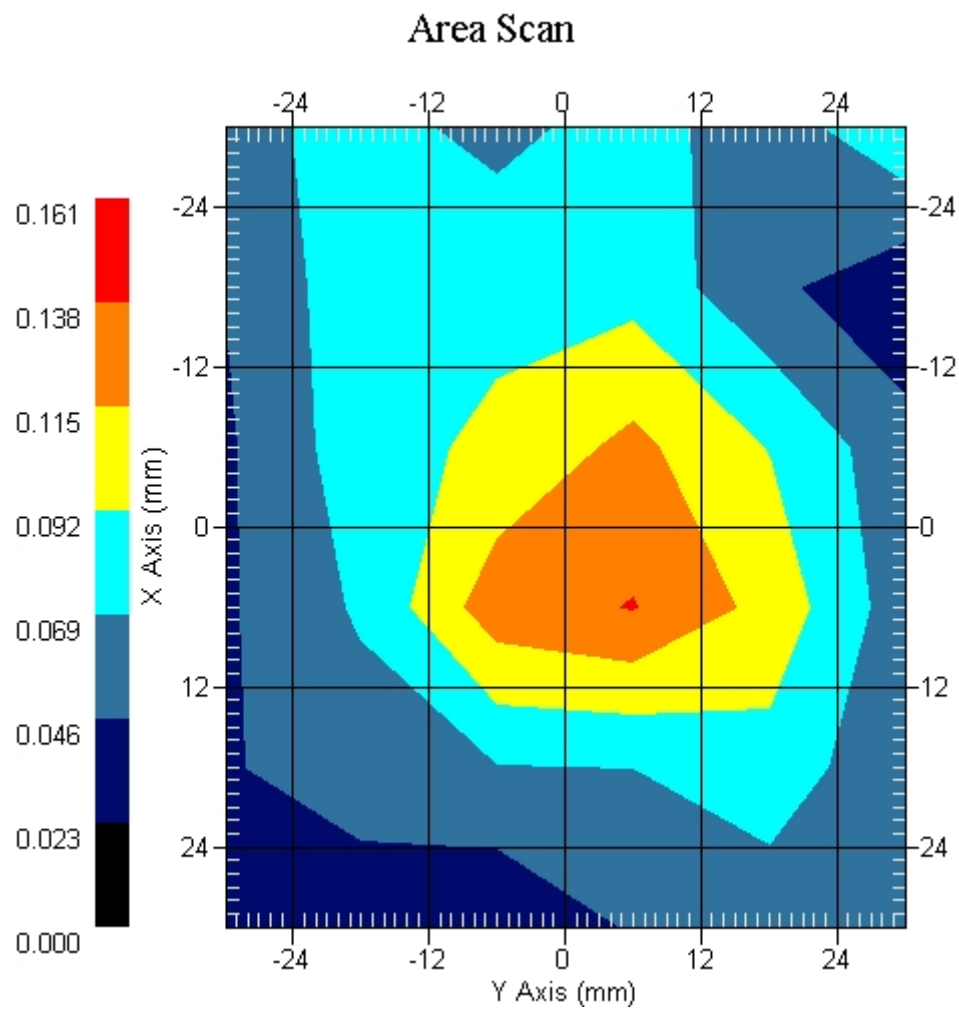
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.096 W/kg  
 Power Drift-Finish: 0.096 W/kg  
 Power Drift (%) : -0.191

DUT Position : 15° Tilt  
 Channel : 810



1 gram SAR value : 0.116 W/kg  
 10 gram SAR value : 0.066 W/kg  
 Area Scan Peak SAR : 0.139 W/kg  
 Zoom Scan Peak SAR : 0.210 W/kg



ALSAS-10U VER 2.3.6 APREL Laboratories

SAR Test Report-PCS 1900

Report Date : 03-Nov-2008  
Measurement Date : 03-Nov-2008

## Product Data

Device Name : Bestpower  
Type : Std Form Cell Phone  
Model : V90+  
Frequency : 1900.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 114.7 mm  
Width : 52.3 mm  
Depth : 17.7 mm  
Antenna Type : Internal

## Phantom Data

Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Location : Center

## Tissue Data

Type : BODY  
Serial No. : 324-B  
Frequency : 1900.00 MHz  
Last Calib. Date : 03-Nov-2008  
Temperature : 20.70 °C  
Ambient Temp. : 21.80 °C  
Humidity : 51.00 RH%  
Epsilon : 53.41 F/m  
Sigma : 1.53 S/m  
Density : 1000.00 kg/cu. m

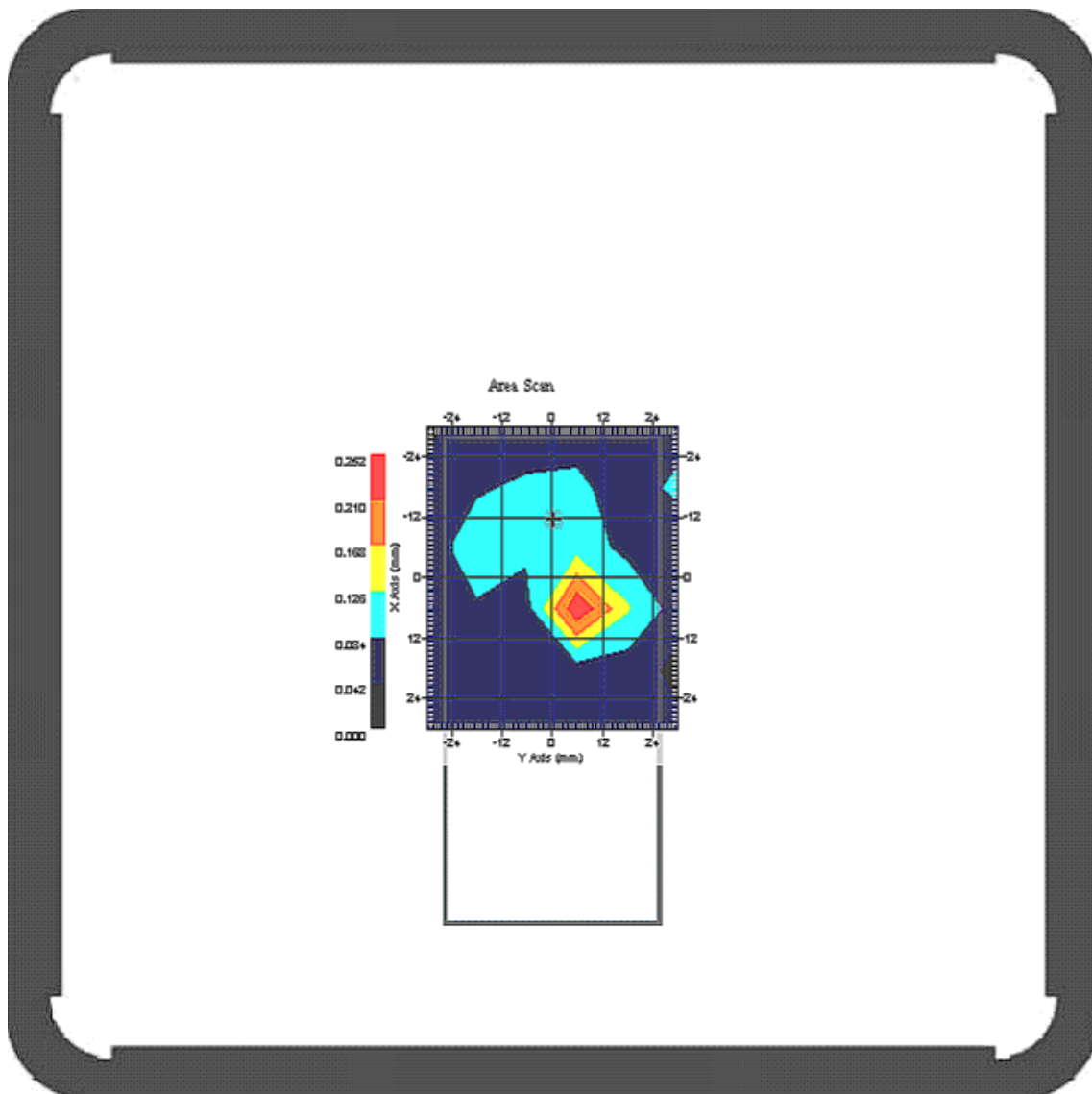
## Probe Data

Name : Probe 265  
Model : E020  
Type : E-Field Triangle  
Serial No. : 265  
Last Calib. Date : 09-May-2008  
Frequency : 1900.00 MHz  
Duty Cycle Factor: 8  
Conversion Factor: 5.1  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

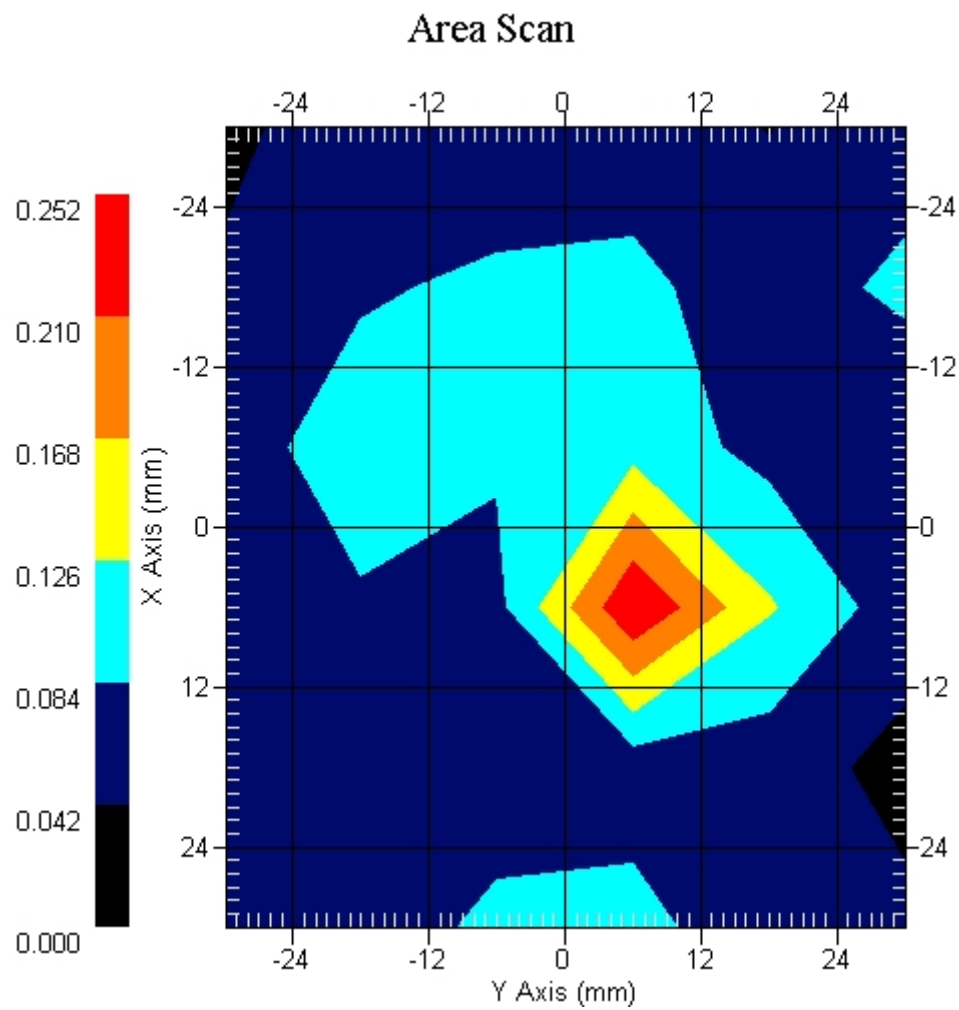
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.137 W/kg  
 Power Drift-Finish: 0.137 W/kg  
 Power Drift (%) : 0.593

DUT Position : Touch  
 Channel : 512



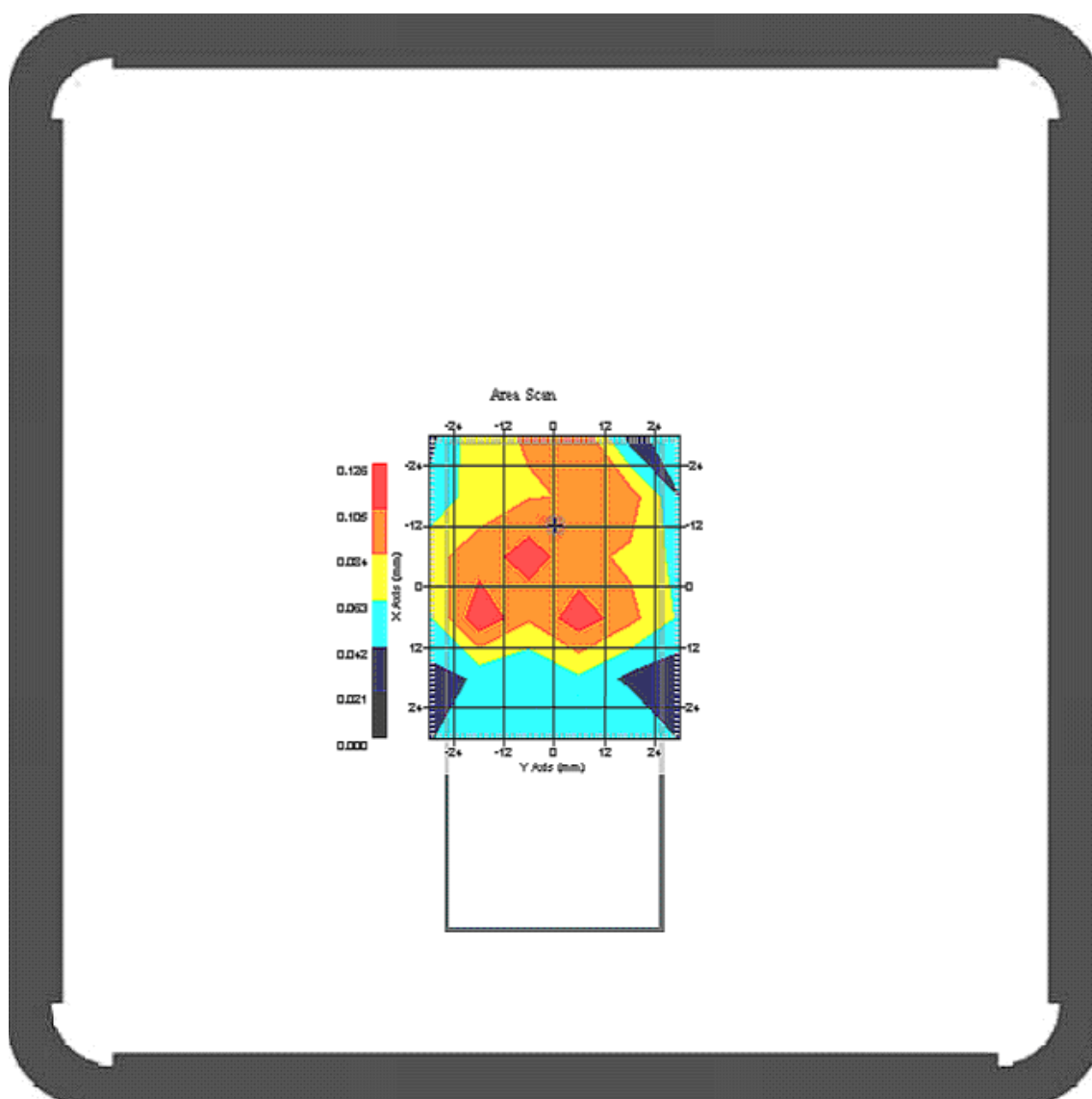
1 gram SAR value : 0.154 W/kg  
 10 gram SAR value : 0.090 W/kg  
 Area Scan Peak SAR : 0.291 W/kg  
 Zoom Scan Peak SAR : 0.300 W/kg



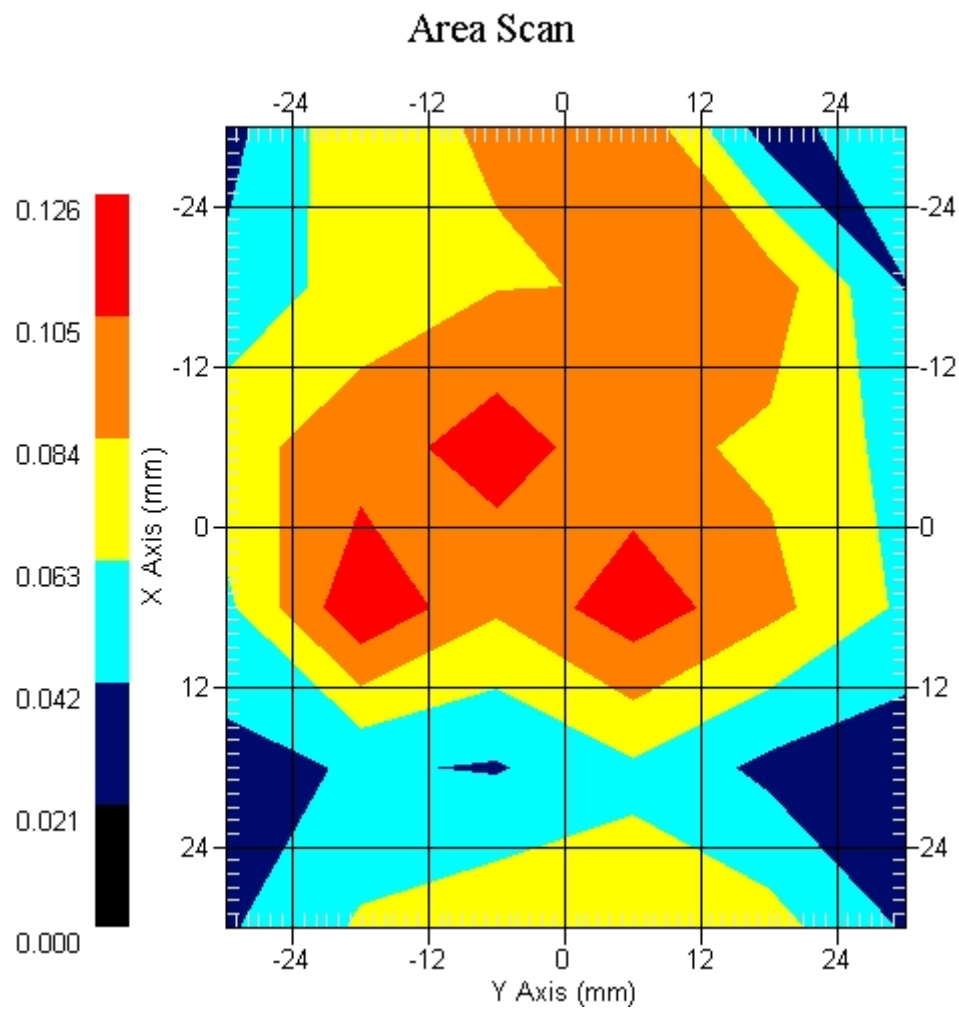
## Measurement Data

Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.124 W/kg  
 Power Drift-Finish: 0.124 W/kg  
 Power Drift (%) : 0.456

DUT Position : Touch  
 Channel : 661



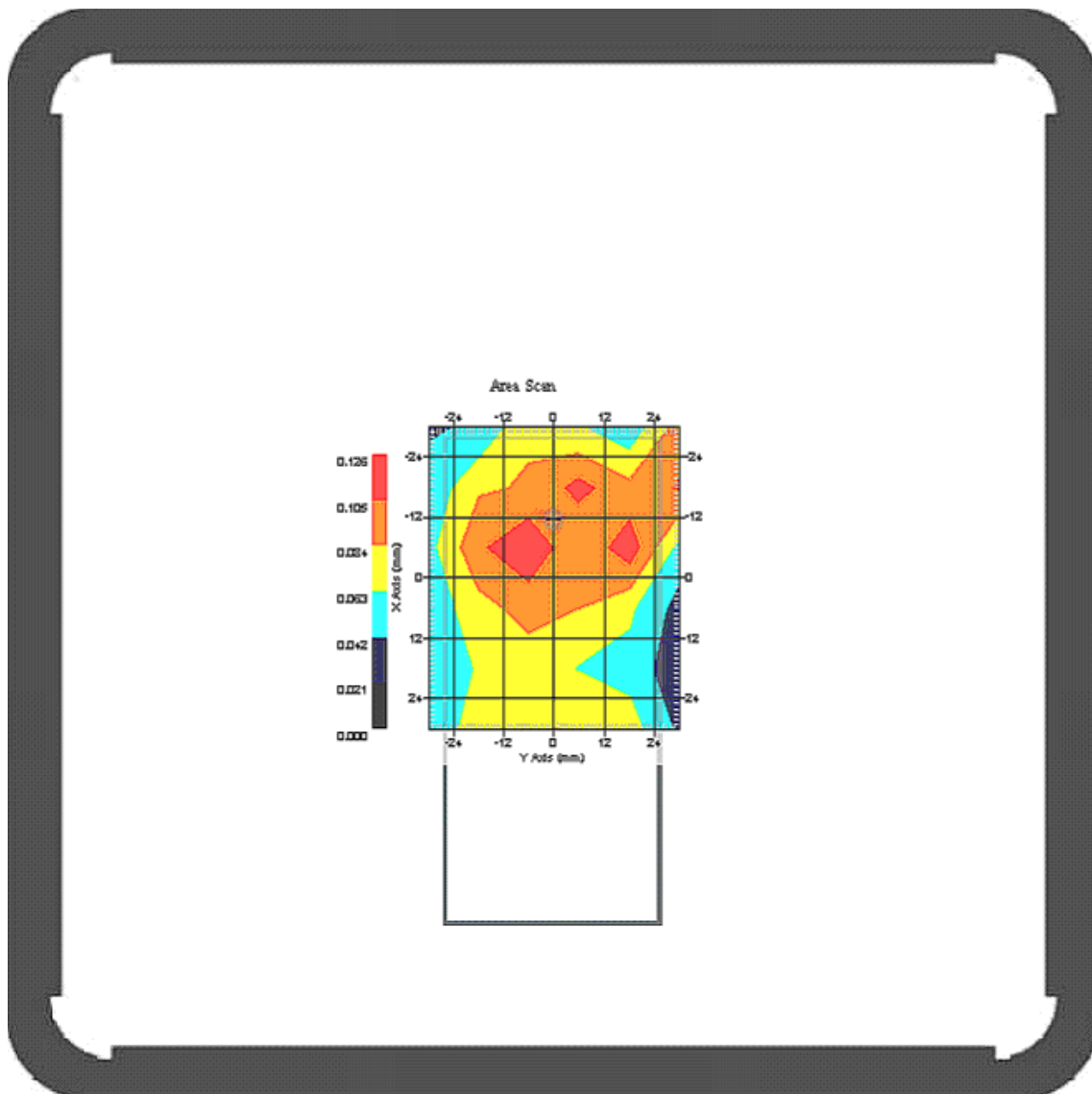
1 gram SAR value : 0.148 W/kg  
 10 gram SAR value : 0.073 W/kg  
 Area Scan Peak SAR : 0.123 W/kg  
 Zoom Scan Peak SAR : 0.290 W/kg



## Measurement Data

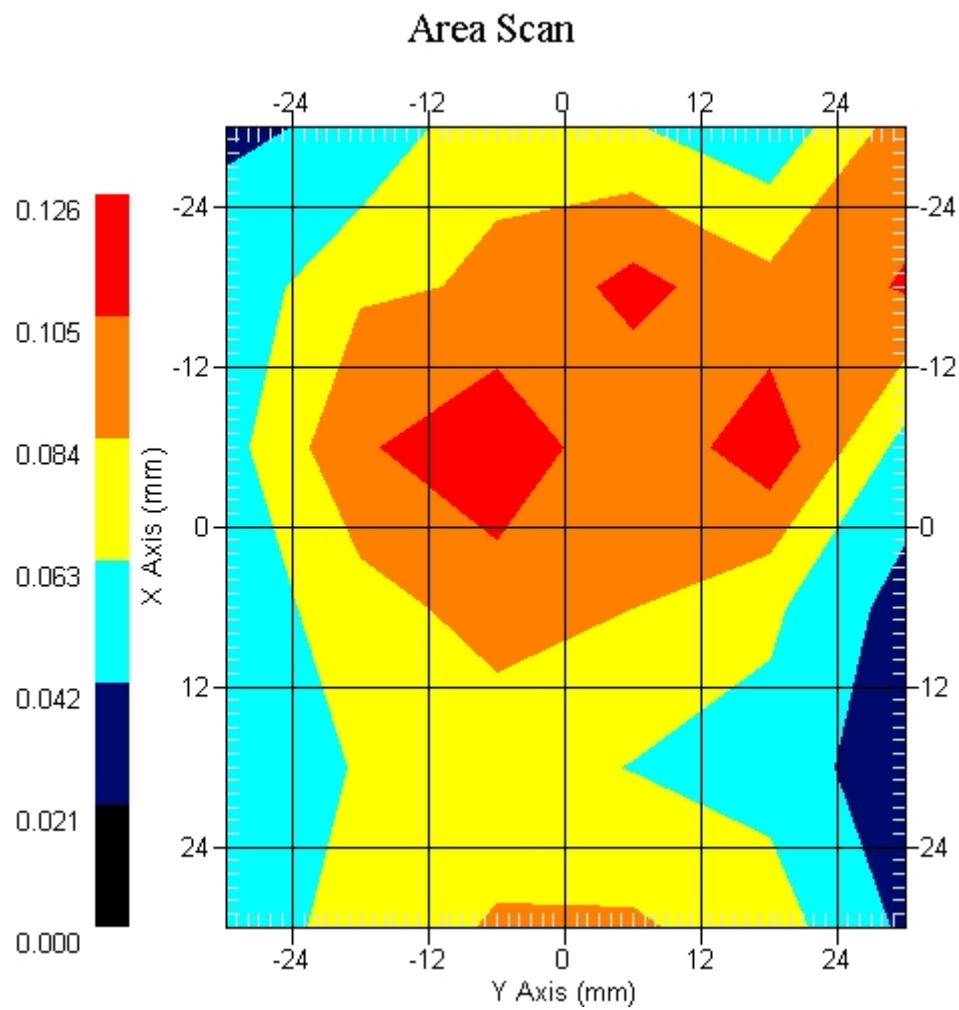
Crest Factor : 8  
 Tissue Temp. : 20.70 °C  
 Ambient Temp. : 21.80 °C  
 Area Scan : 6x6x1 : Measurement x=12mm, y=12mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm  
 Power Drift-Start : 0.134 W/kg  
 Power Drift-Finish: 0.134 W/kg  
 Power Drift (%) : 0.868

DUT Position : Touch  
 Channel : 810

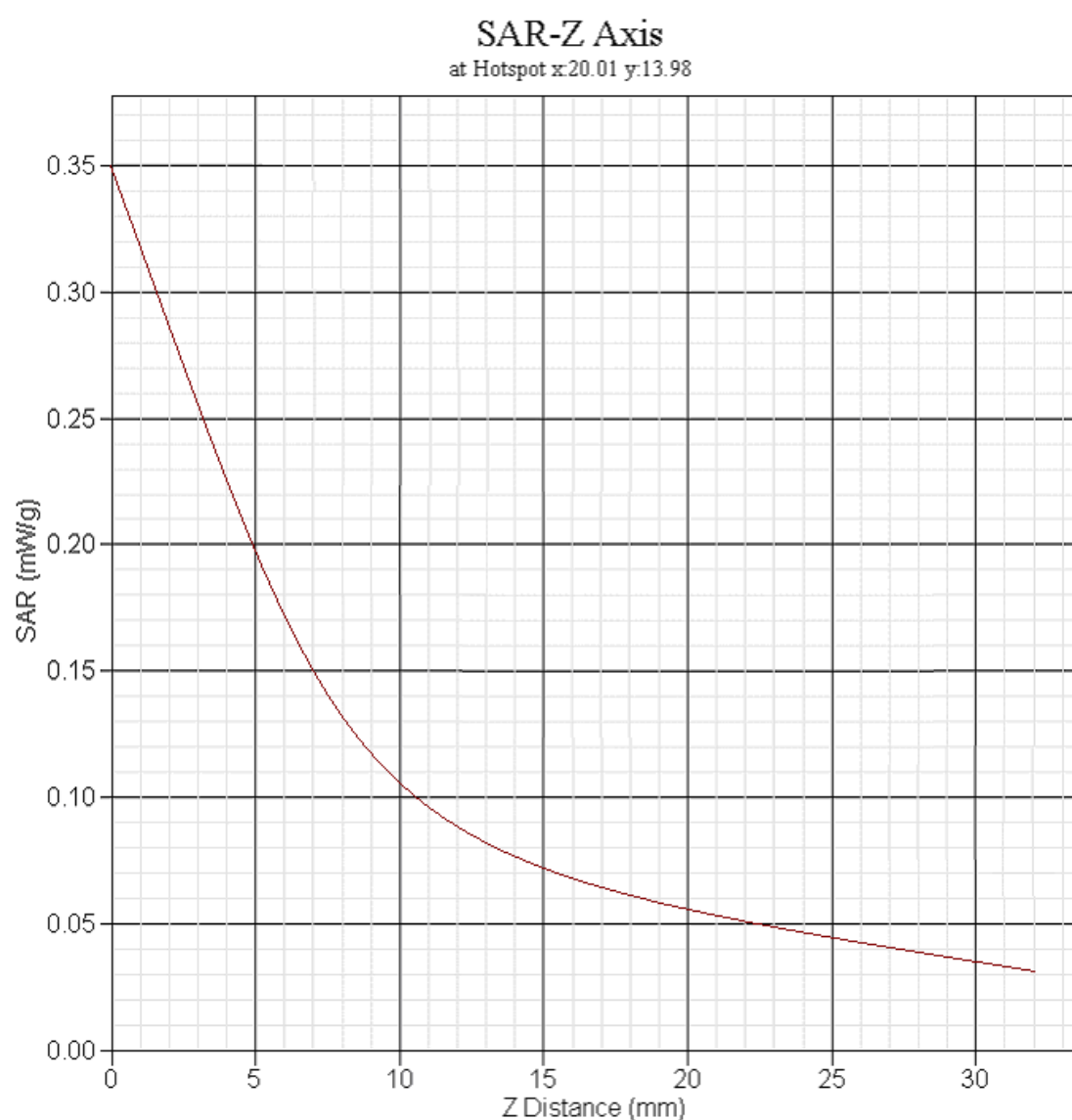


1 gram SAR value : 0.122 W/kg  
 10 gram SAR value : 0.073 W/kg  
 Area Scan Peak SAR : 0.132 W/kg  
 Zoom Scan Peak SAR : 0.270 W/kg





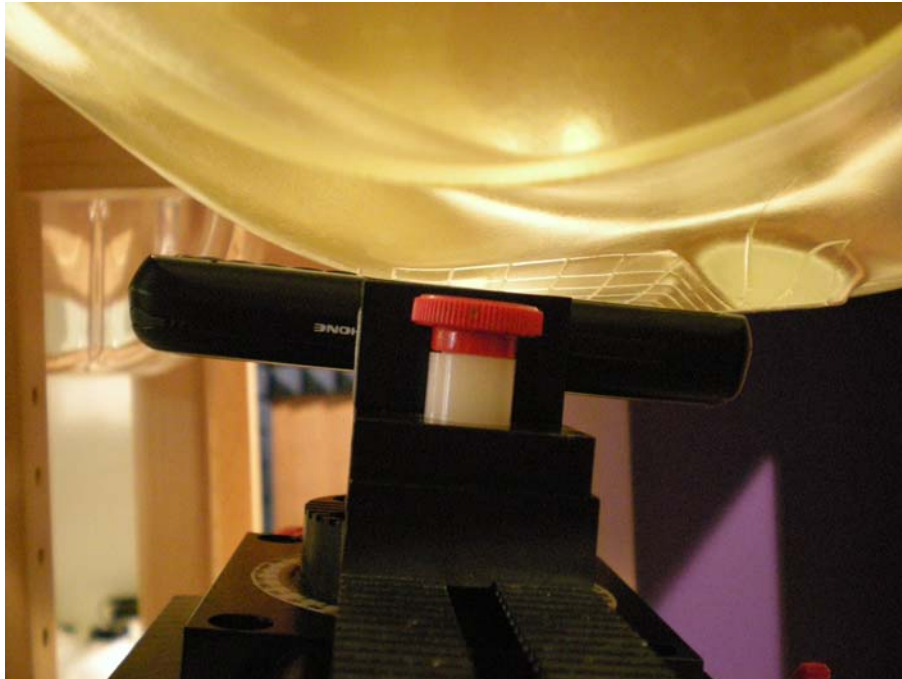
PCS 1900 EUT Right-Cheek Z-Axis plot  
Channel: 810



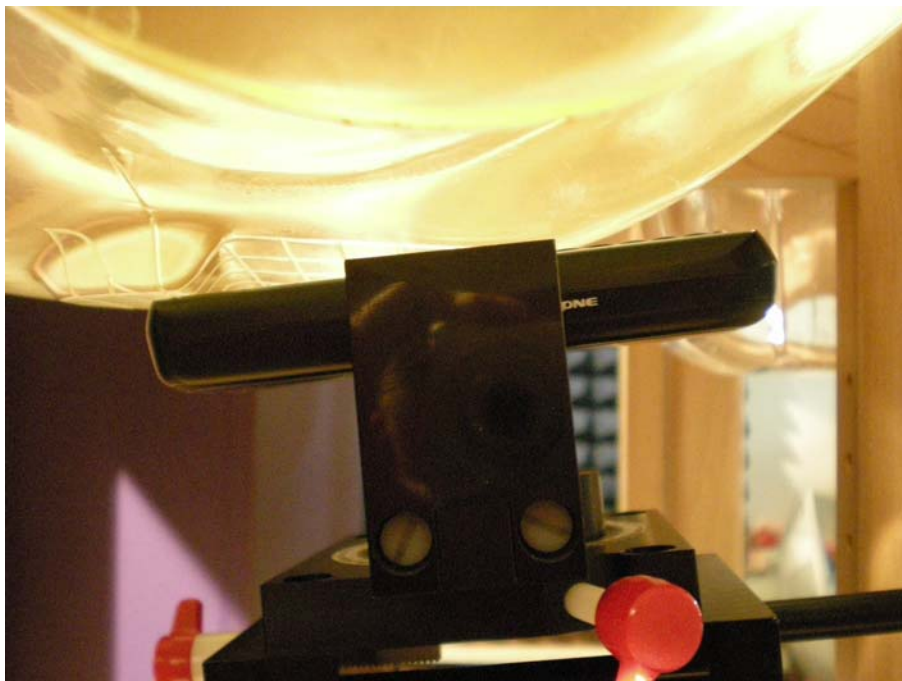
## Appendix C. Test Setup Photographs & EUT Photographs

### Test Setup Photographs

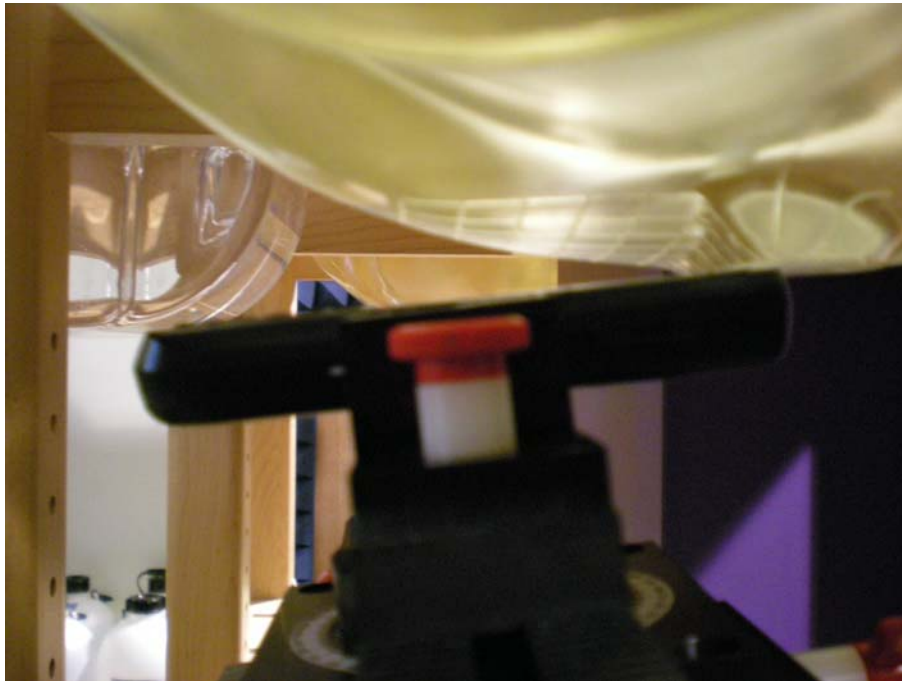
**Right Head (EUT Cheek)**



**Left Head (EUT Cheek)**



**Right Head (EUT Tilted)**



**Left Head (EUT Tilted)**



**Body**

Note: The positions used in the measurements were according to IEEE 1528-2003.



## Test EUT Photographs







## **Appendix D. Probe Calibration Data**

**Miniature Isotropic RF Probe**

**M/N: ALS-E-020**

**S/N: 265**

**835 MHz Head Calibration**

**835 MHz Body Calibration**



# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-871

Client: QUIETEK

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 835 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 265

HEAD Calibration

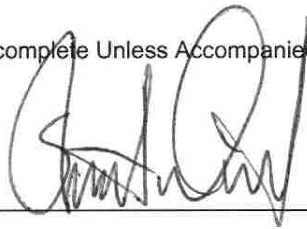
Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: QTKB-ALS-E20-CAL-5335

Calibrated: 9<sup>th</sup> May 2008  
Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_



**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161

## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 265.

## References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Experimental Techniques"

SSI-TP-011 Tissue Calibration Procedure

IEC 62209 "Human exposure to radio frequency fields from hand-held and Head-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"

IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

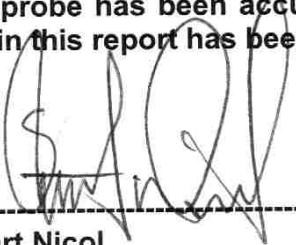
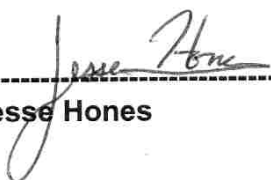
## Conditions

Probe 265 is a re-calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C

**Temperature of the Tissue:** 21 °C +/- 0.5°C

**We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.**

  
-----  
**Stuart Nicol**  
-----  
**Jesse Hones**

## **Calibration Results Summary**

<b>Probe Type:</b>	E-Field Probe E-020
<b>Serial Number:</b>	265
<b>Frequency:</b>	835 MHz
<b>Sensor Offset:</b>	1.56 mm
<b>Sensor Length:</b>	2.5 mm
<b>Tip Enclosure:</b>	Ertalyte*
<b>Tip Diameter:</b>	<5 mm
<b>Tip Length:</b>	60 mm
<b>Total Length:</b>	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

## **Sensitivity in Air**

<b>Channel X:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Y:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Z:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Diode Compression Point:</b>	95 mV

## **Sensitivity in Head Tissue**

**Frequency:** 835 MHz

**Epsilon:** 41.5 (+/-5%)      **Sigma:** 0.90 S/m (+/-5%)

### **ConvF**

**Channel X:** 6.2

**Channel Y:** 6.2

**Channel Z:** 6.2

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

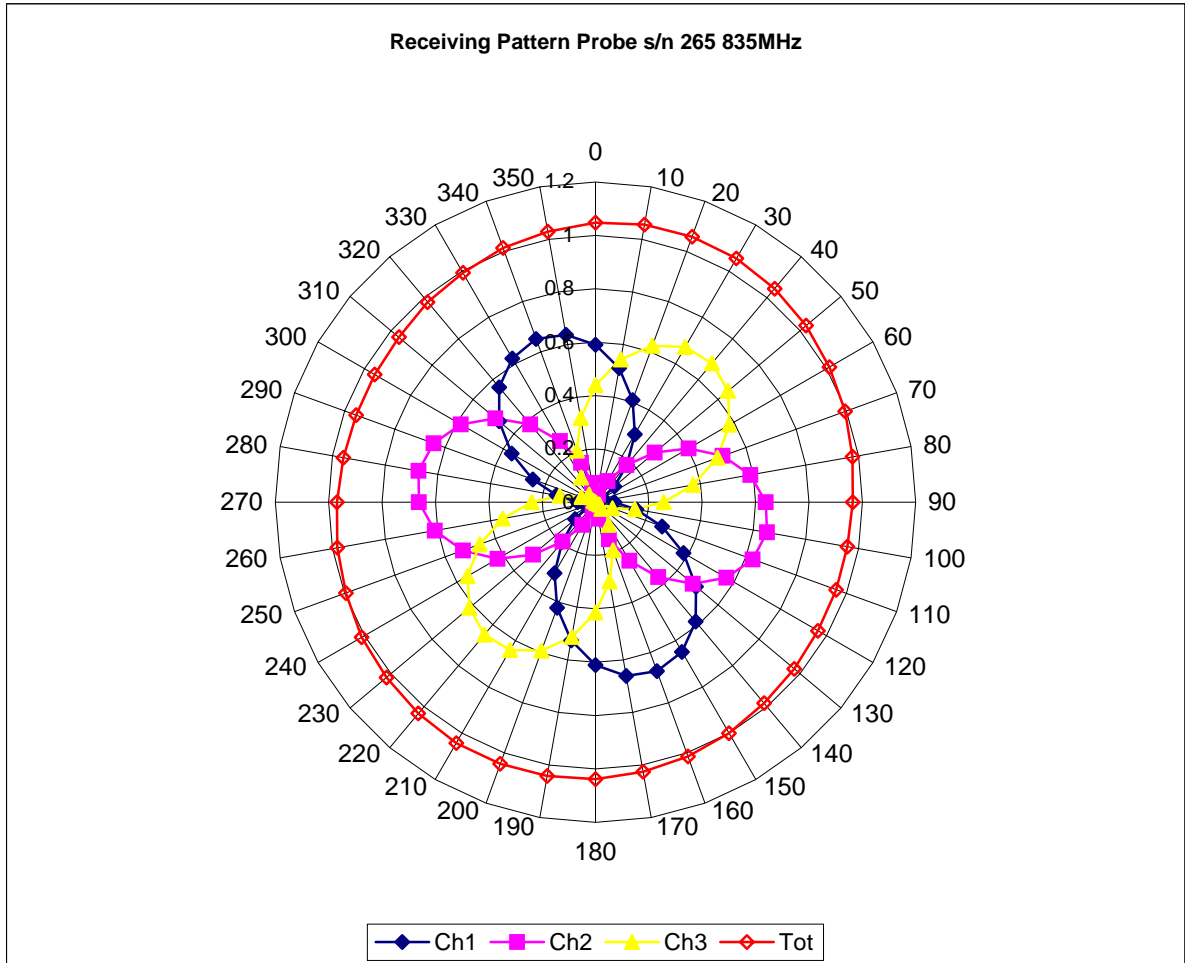
## **Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

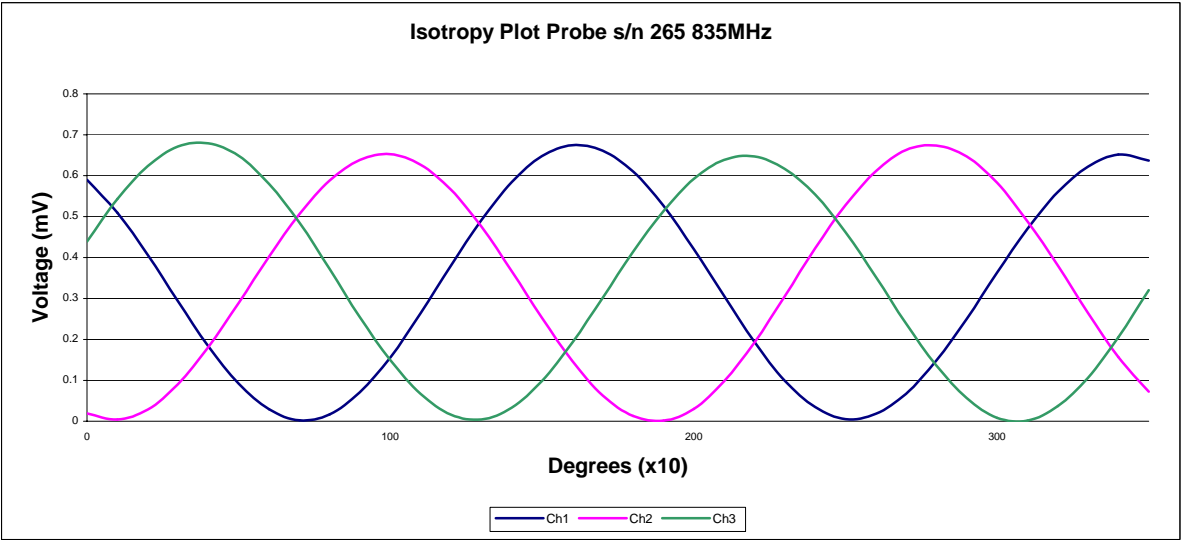
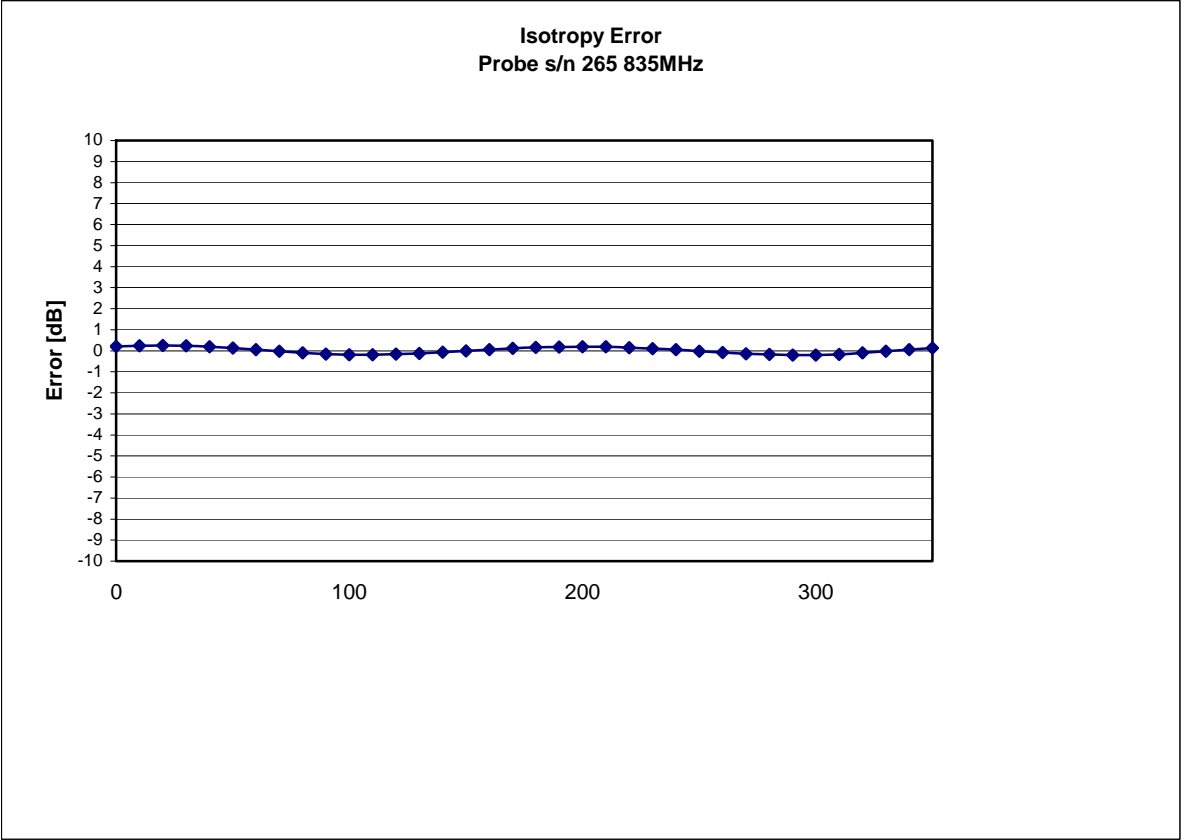
## **Spatial Resolution:**

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

## Receiving Pattern 835 MHz (Air)



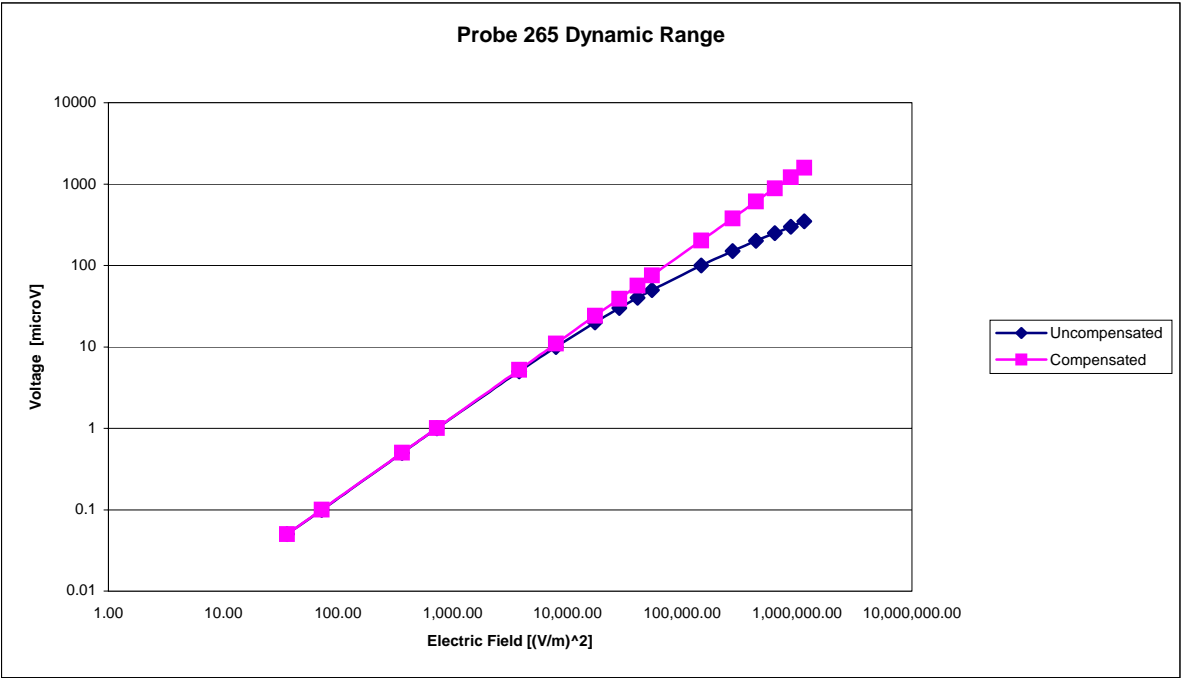
Isotropy Error 835 MHz (Air)



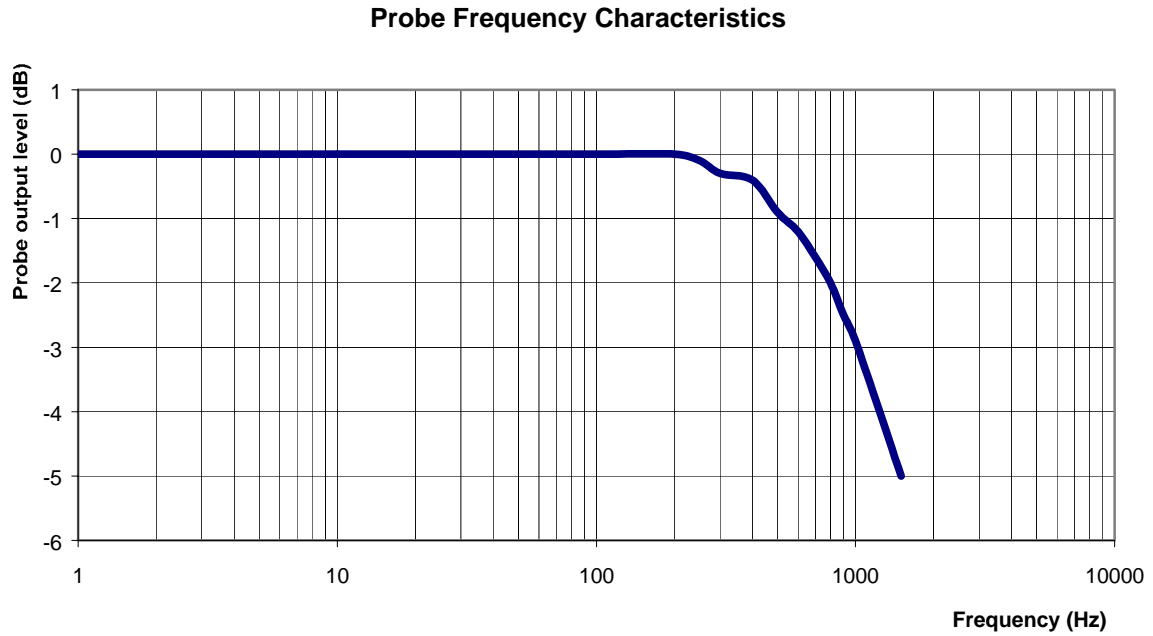
Isotropicity Tissue:

0.10 dB

Dynamic Range



## Video Bandwidth



<b>Video Bandwidth at 500 Hz</b>	<b>1 dB</b>
<b>Video Bandwidth at 1000 Hz</b>	<b>3 dB</b>



## **Conversion Factor Uncertainty Assessment**

**Frequency:** 835MHz

**Epsilon:** 41.5 (+/-5%)      **Sigma:** 0.90 S/m (+/-5%)

### **ConvF**

**Channel X:** 6.2      7%(K=2)

**Channel Y:** 6.2      7%(K=2)

**Channel Z:** 6.2      7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

### **Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## **Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.

# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-872

Client: QUIETEK

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 835 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 265

BODY Calibration

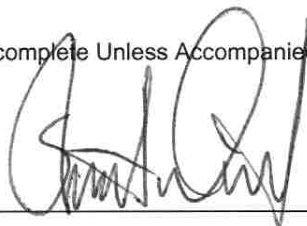
Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: QTKB-ALS-E20-CAL-5335

Calibrated: 9<sup>th</sup> May 2008  
Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_



**NCL** CALIBRATION LABORATORIES

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NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161

## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 265.

## References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Experimental Techniques"

SSI-TP-011 Tissue Calibration Procedure

IEC 62209 "Human exposure to radio frequency fields from hand-held and Head-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"

IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

## Conditions

Probe 265 is a re-calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C

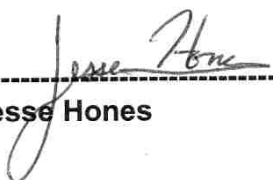
**Temperature of the Tissue:** 21 °C +/- 0.5°C

**We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.**



---

**Stuart Nicol**



---

**Jesse Hones**

## Calibration Results Summary

<b>Probe Type:</b>	E-Field Probe E-020
<b>Serial Number:</b>	265
<b>Frequency:</b>	835 MHz
<b>Sensor Offset:</b>	1.56 mm
<b>Sensor Length:</b>	2.5 mm
<b>Tip Enclosure:</b>	Ertalyte*
<b>Tip Diameter:</b>	<5 mm
<b>Tip Length:</b>	60 mm
<b>Total Length:</b>	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

## Sensitivity in Air

<b>Channel X:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Y:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Z:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Diode Compression Point:</b>	95 mV

## **Sensitivity in Body Tissue**

**Frequency:** 835 MHz

**Epsilon:** 55.2 (+/-5%)      **Sigma:** 0.97 S/m (+/-5%)

### **ConvF**

**Channel X:** 6.6

**Channel Y:** 6.6

**Channel Z:** 6.6

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

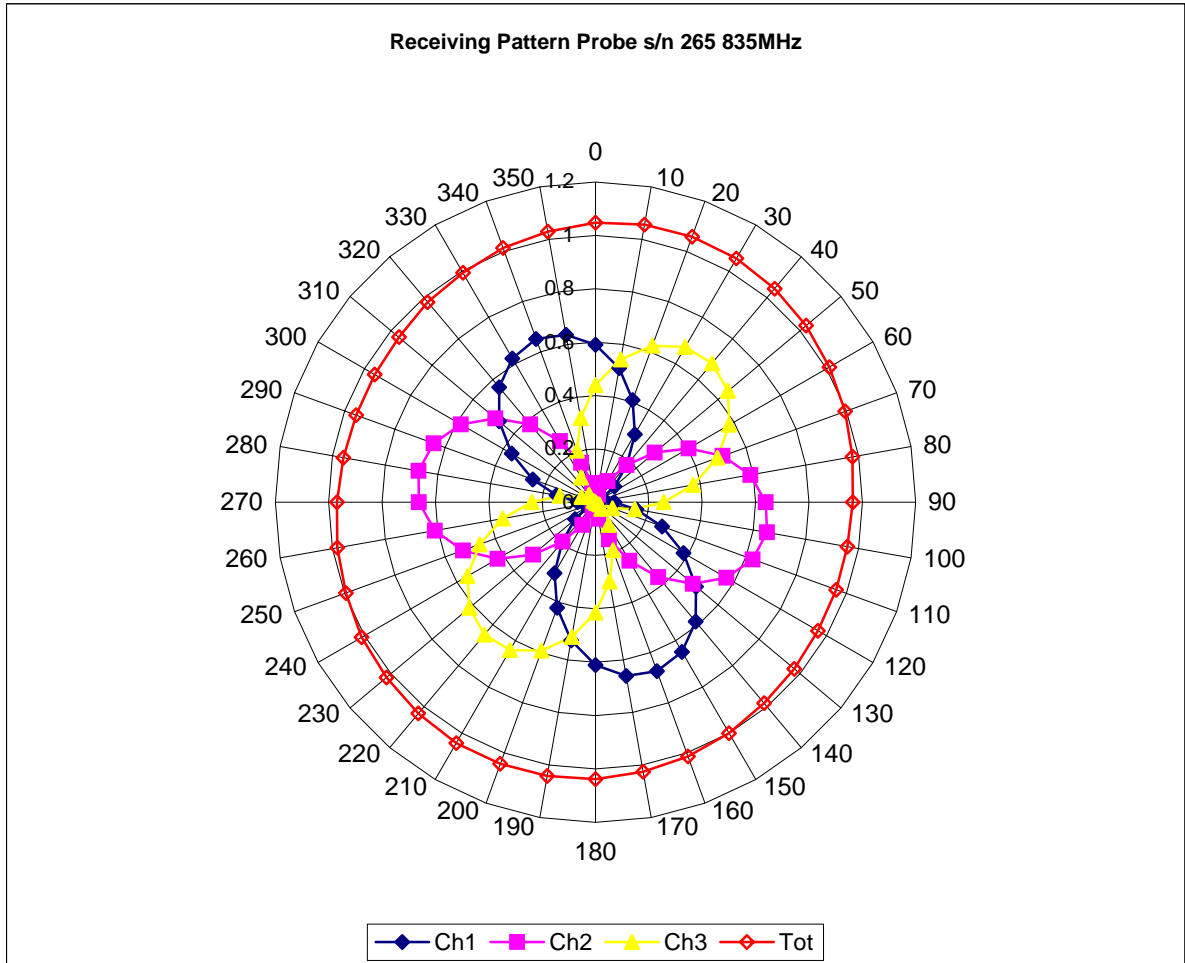
## **Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

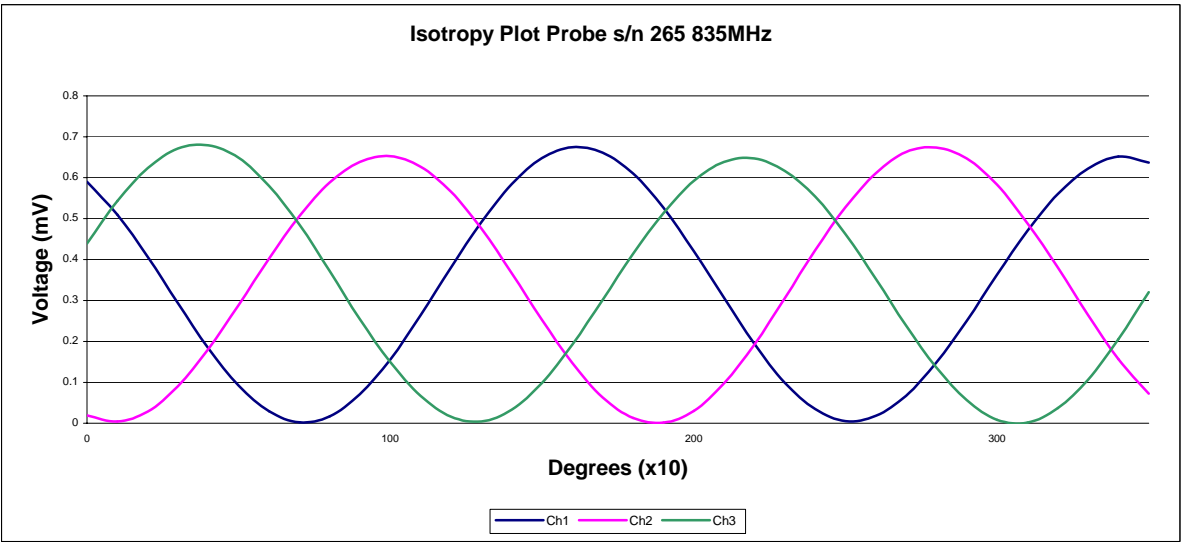
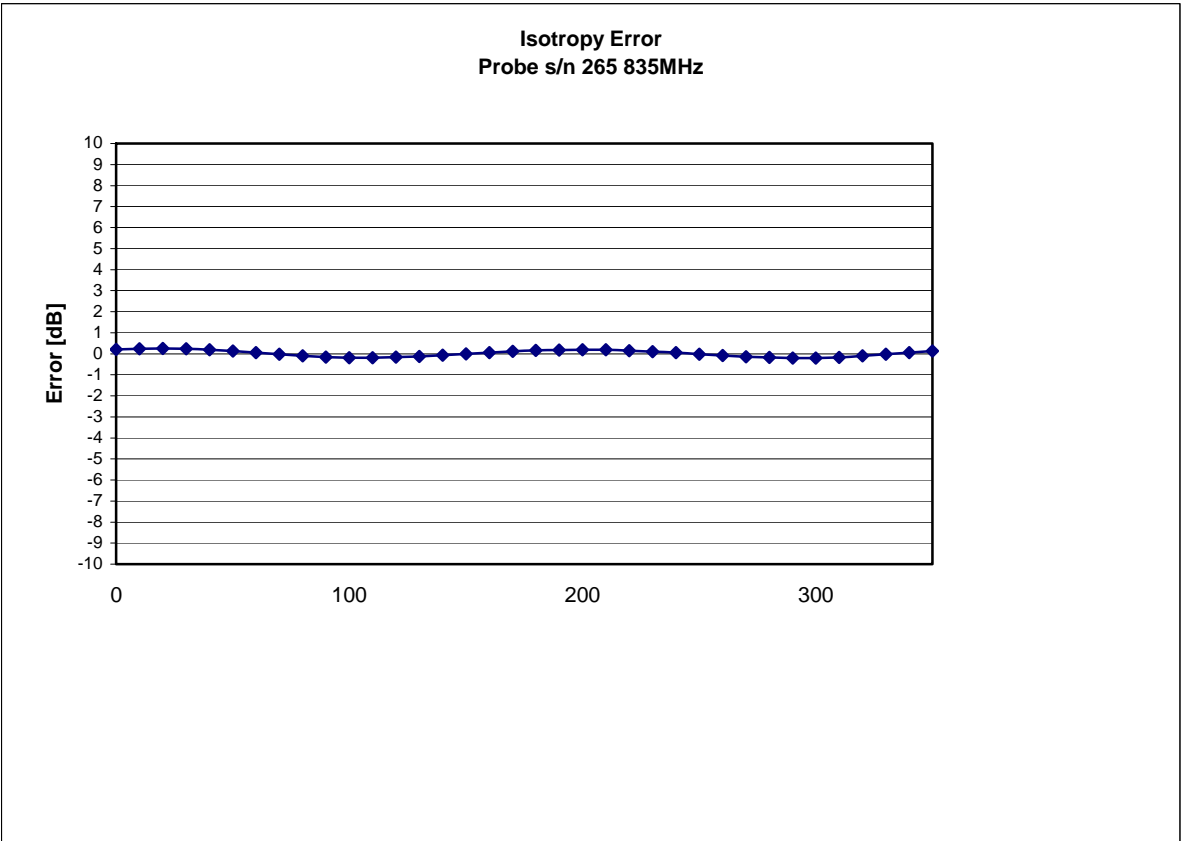
## **Spatial Resolution:**

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

## Receiving Pattern 835 MHz (Air)



Isotropy Error 835 MHz (Air)

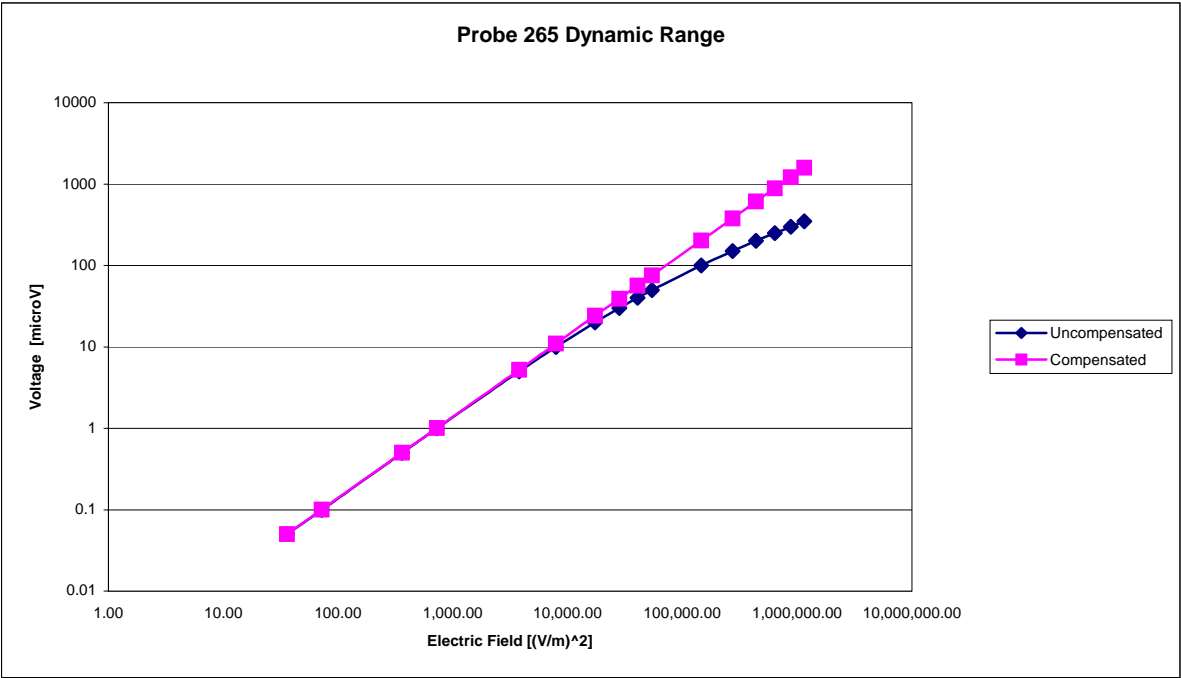


Isotropicity in Tissue:

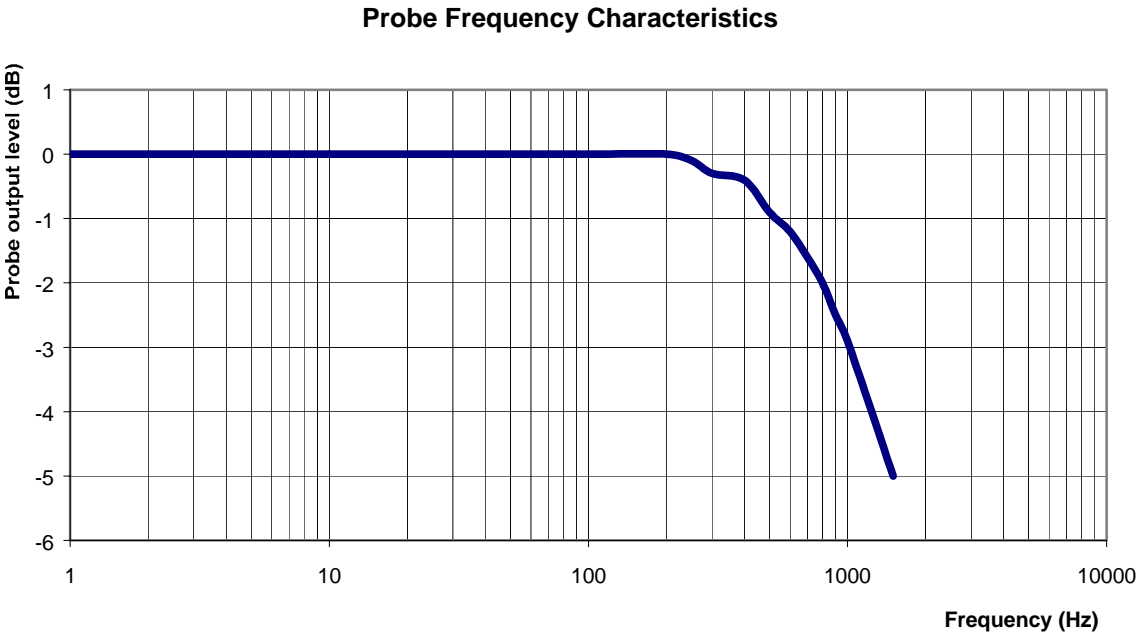
0.10 dB



Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz	1 dB
Video Bandwidth at 1000 Hz	3 dB

## **Conversion Factor Uncertainty Assessment**

**Frequency:** 835MHz

**Epsilon:** 55.2 (+/-5%)      **Sigma:** 0.97 S/m (+/-5%)

### **ConvF**

**Channel X:** 6.6      7%(K=2)

**Channel Y:** 6.6      7%(K=2)

**Channel Z:** 6.6      7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

### **Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## **Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.



## **Appendix D. Probe Calibration**

**Miniature Isotropic RF Probe**

**M/N: ALS-E-020**

**S/N: 264**

**1900MHz Head Calibration**

**1900MHz Body Calibration**

# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-877

Client: QUIETEK

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 1900 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 265

HEAD Calibration

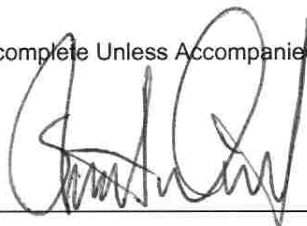
Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: QTKB-ALS-E20-CAL-5335

Calibrated: 9<sup>th</sup> May 2008  
Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_



**NCL** CALIBRATION LABORATORIES

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NEPEAN, ONTARIO  
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Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161

## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 265.

## References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Experimental Techniques"

SSI-TP-011 Tissue Calibration Procedure

IEC 62209 "Human exposure to radio frequency fields from hand-held and Head-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"

IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

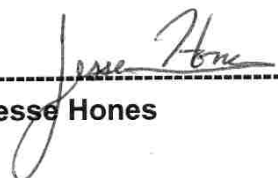
## Conditions

Probe 265 is a re-calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C

**Temperature of the Tissue:** 21 °C +/- 0.5°C

**We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.**

  
-----  
**Stuart Nicol**  
-----  
**Jesse Hones**

## **Calibration Results Summary**

<b>Probe Type:</b>	E-Field Probe E-020
<b>Serial Number:</b>	265
<b>Frequency:</b>	1900 MHz
<b>Sensor Offset:</b>	1.56 mm
<b>Sensor Length:</b>	2.5 mm
<b>Tip Enclosure:</b>	Ertalyte*
<b>Tip Diameter:</b>	<5 mm
<b>Tip Length:</b>	60 mm
<b>Total Length:</b>	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

## **Sensitivity in Air**

<b>Channel X:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Y:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Z:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Diode Compression Point:</b>	95 mV



## **Sensitivity in Head Tissue**

**Frequency:** 1900 MHz

**Epsilon:** 40.0 (+/-5%)      **Sigma:** 1.40 S/m (+/-5%)

### **ConvF**

**Channel X:** 4.51

**Channel Y:** 4.51

**Channel Z:** 4.51

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

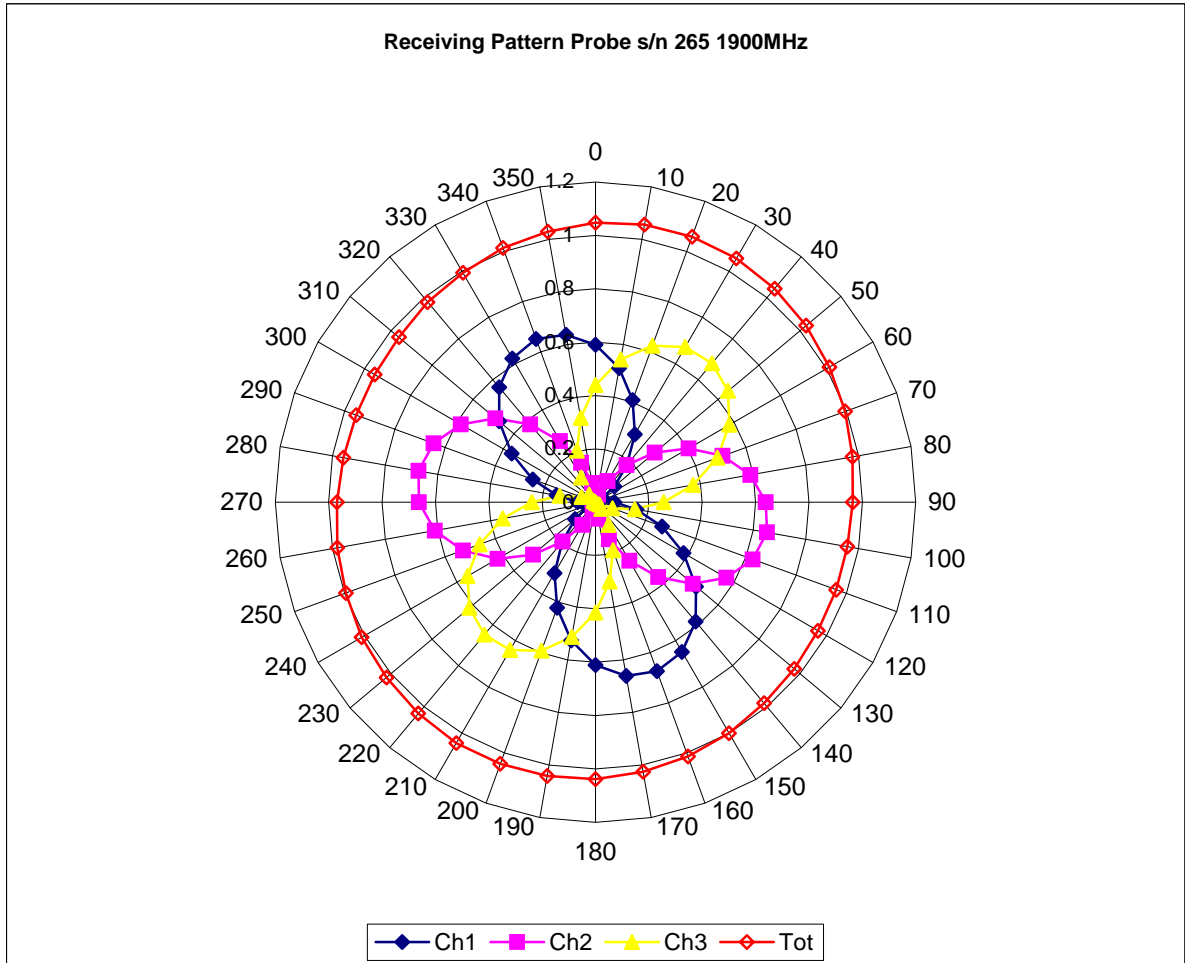
## **Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

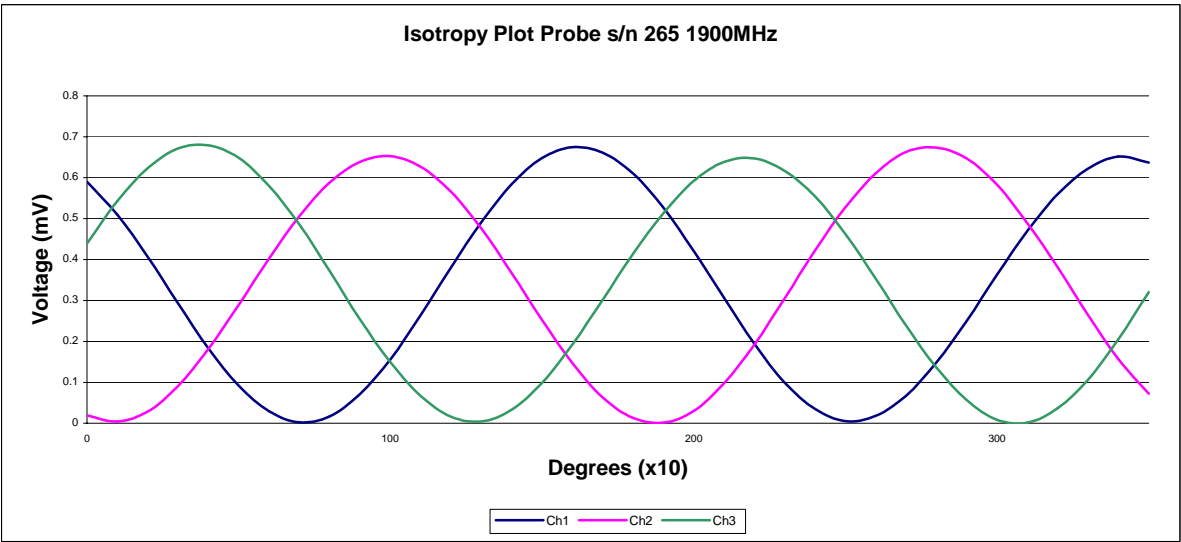
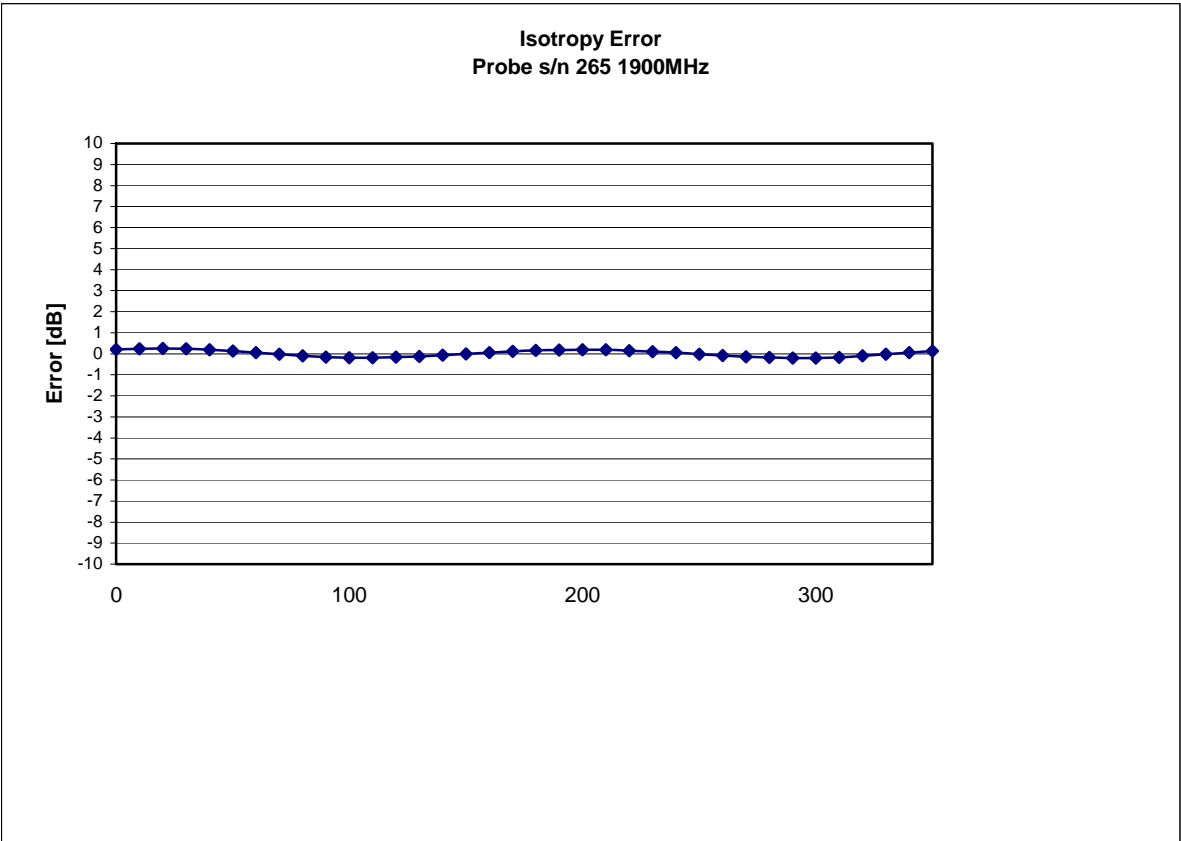
## **Spatial Resolution:**

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

## Receiving Pattern 1900 MHz (Air)



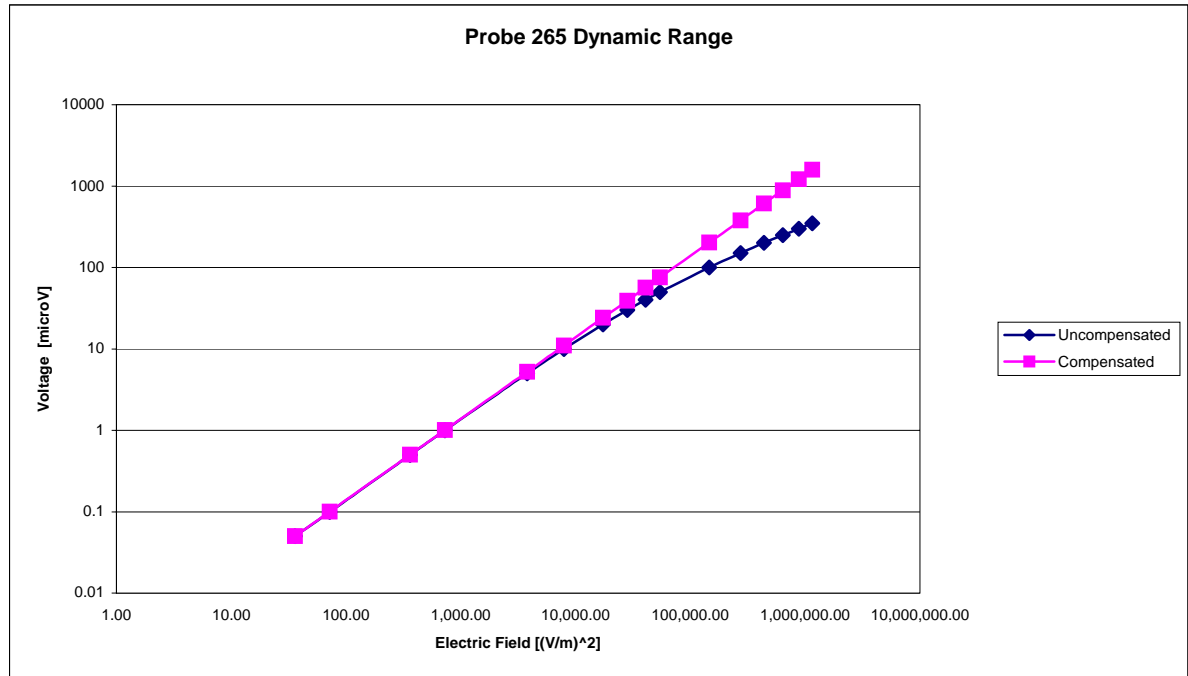
Isotropy Error 1900 MHz (Air)



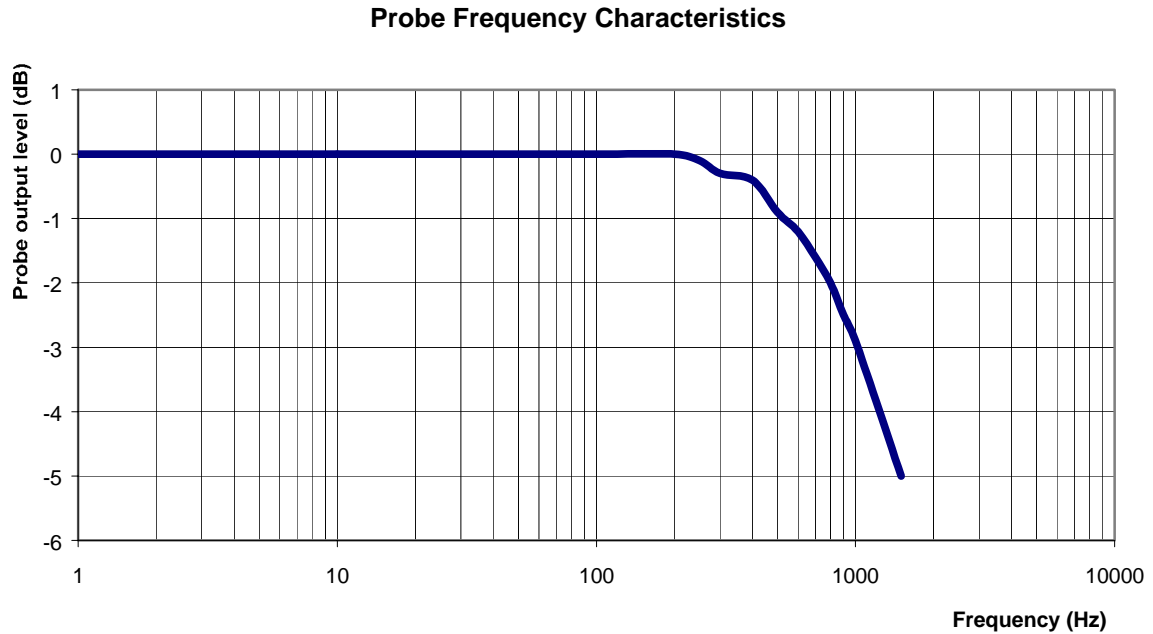
Isotropicity in Tissue:

0.10 dB

## Dynamic Range



## Video Bandwidth



Video Bandwidth at 500 Hz	1 dB
Video Bandwidth at 1000 Hz	3 dB

## **Conversion Factor Uncertainty Assessment**

<b>Frequency:</b>	1900MHz
<b>Epsilon:</b> 40.0 (+/-5%)	<b>Sigma:</b> 1.40 S/m (+/-5%)

### **ConvF**

<b>Channel X:</b> 4.51	7%(K=2)
<b>Channel Y:</b> 4.51	7%(K=2)
<b>Channel Z:</b> 4.51	7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

### **Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## **Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.

# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-878

Client: QUIETEK

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 1900 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 265

BODY Calibration

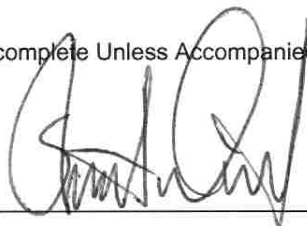
Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: QTKB-ALS-E20-CAL-5335

Calibrated: 9<sup>th</sup> May 2008  
Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_



**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161



## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 265.

## References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Experimental Techniques"

SSI-TP-011 Tissue Calibration Procedure

IEC 62209 "Human exposure to radio frequency fields from hand-held and Head-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"

IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

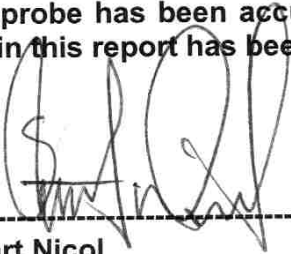
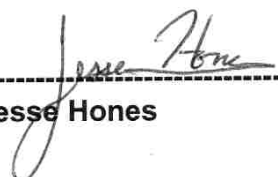
## Conditions

Probe 265 is a re-calibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C

**Temperature of the Tissue:** 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

  
-----  
**Stuart Nicol**  
-----  
**Jesse Hones**

## **Calibration Results Summary**

<b>Probe Type:</b>	E-Field Probe E-020
<b>Serial Number:</b>	265
<b>Frequency:</b>	1900 MHz
<b>Sensor Offset:</b>	1.56 mm
<b>Sensor Length:</b>	2.5 mm
<b>Tip Enclosure:</b>	Ertalyte*
<b>Tip Diameter:</b>	<5 mm
<b>Tip Length:</b>	60 mm
<b>Total Length:</b>	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

## **Sensitivity in Air**

<b>Channel X:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Y:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Channel Z:</b>	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
<b>Diode Compression Point:</b>	95 mV

## **Sensitivity in Body Tissue**

**Frequency:** 1900 MHz

**Epsilon:** 53.3 (+/-5%) **Sigma:** 1.52 S/m (+/-5%)

### **ConvF**

**Channel X:** 5.1

**Channel Y:** 5.1

**Channel Z:** 5.1

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

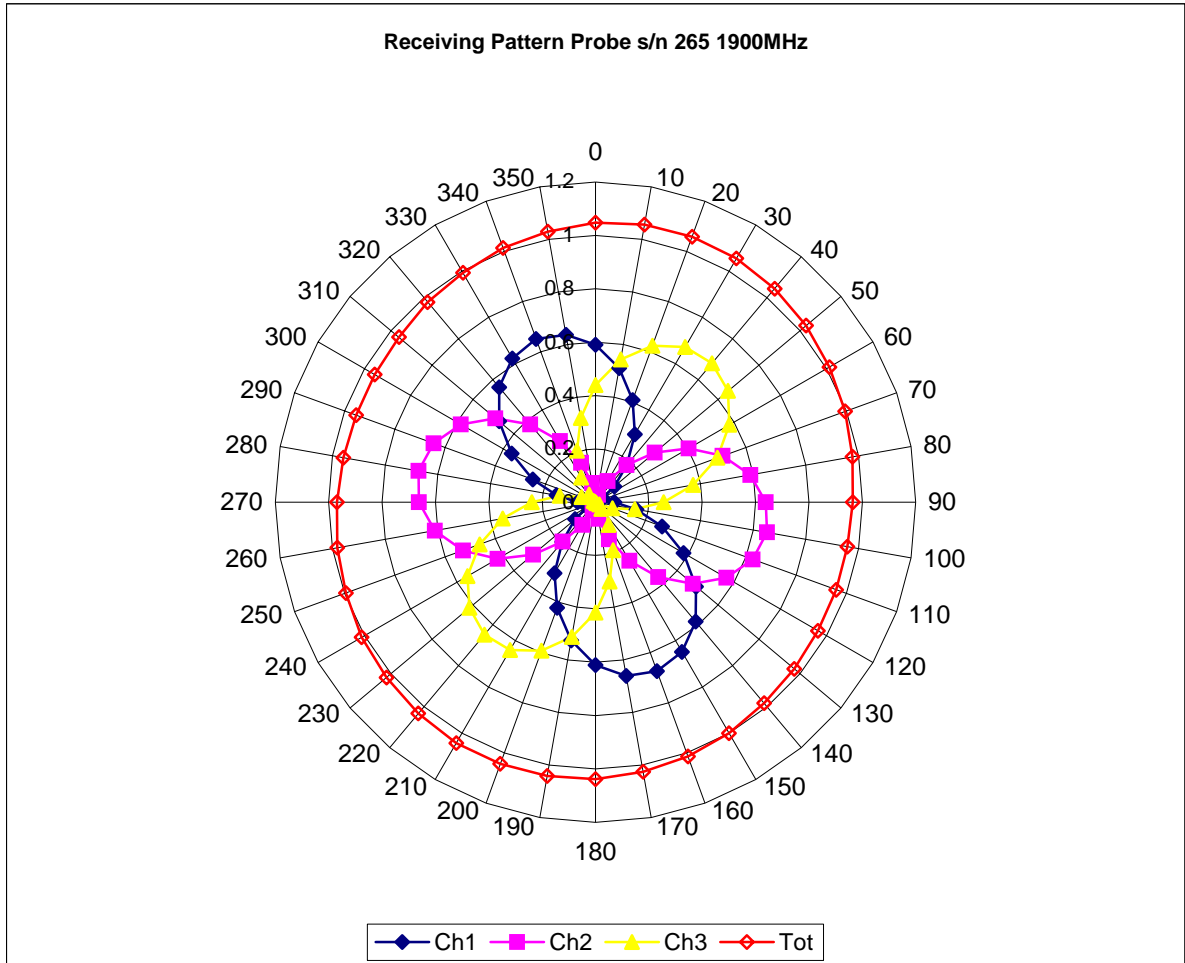
## **Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

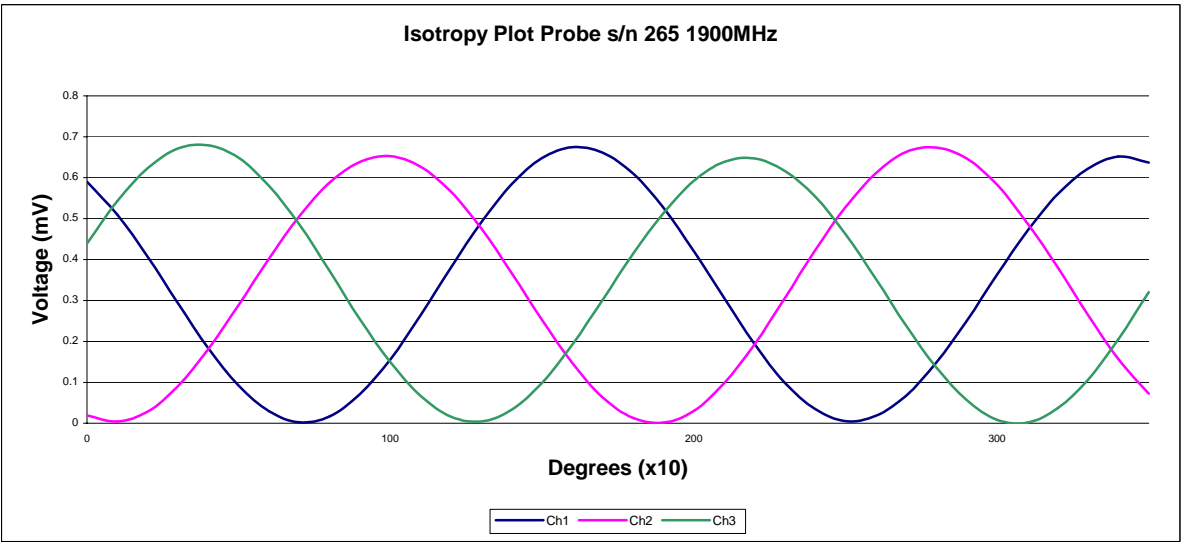
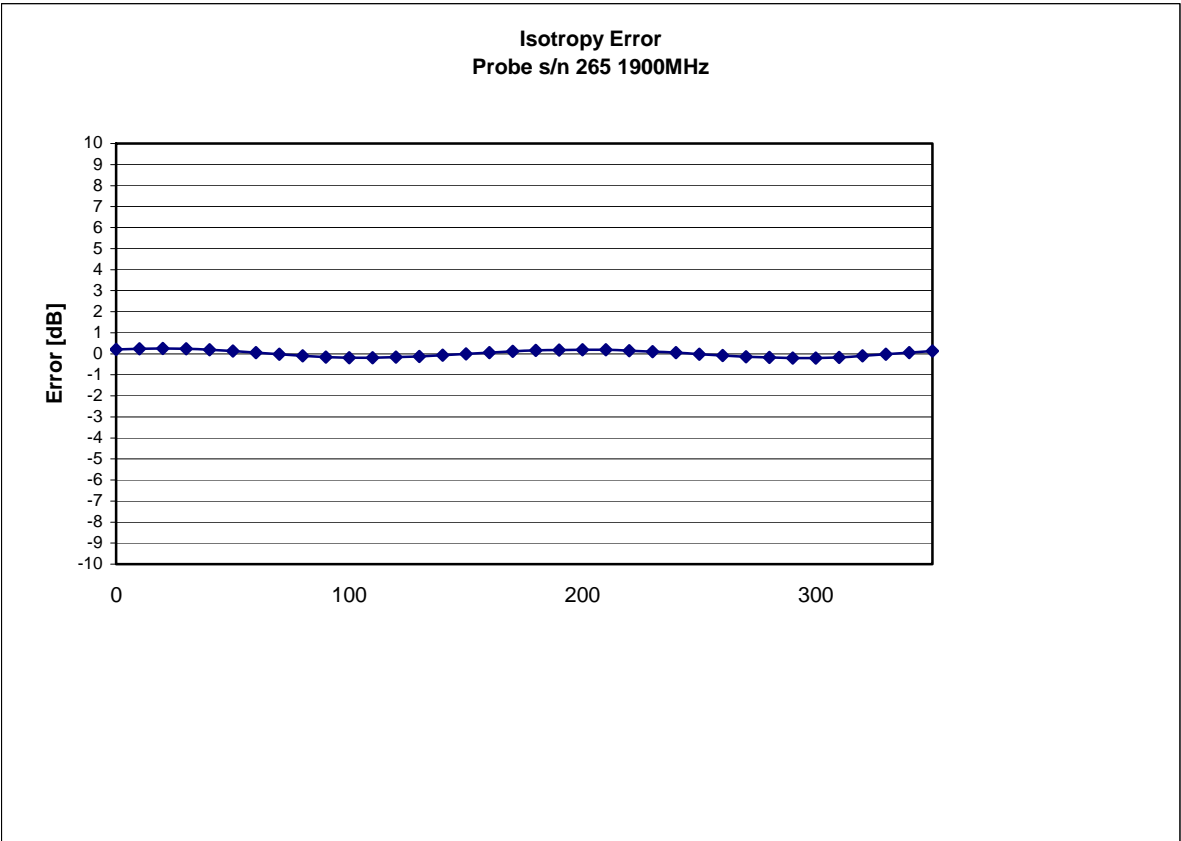
## **Spatial Resolution:**

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

## Receiving Pattern 1900 MHz (Air)



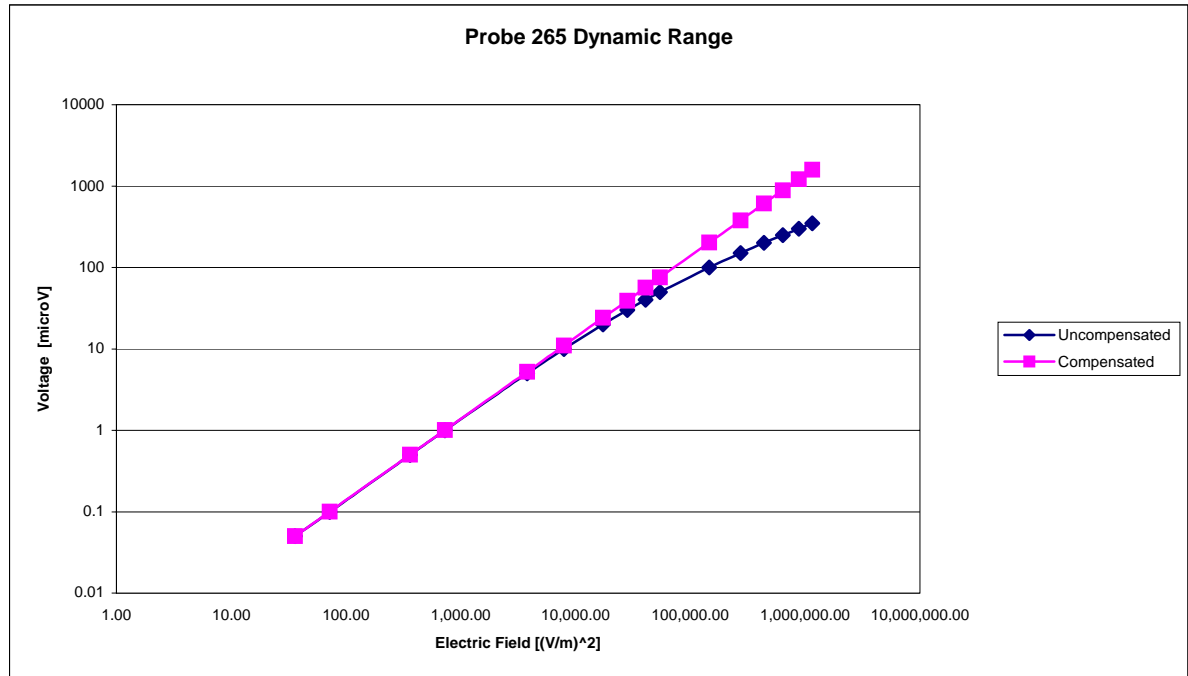
Isotropy Error 1900 MHz (Air)



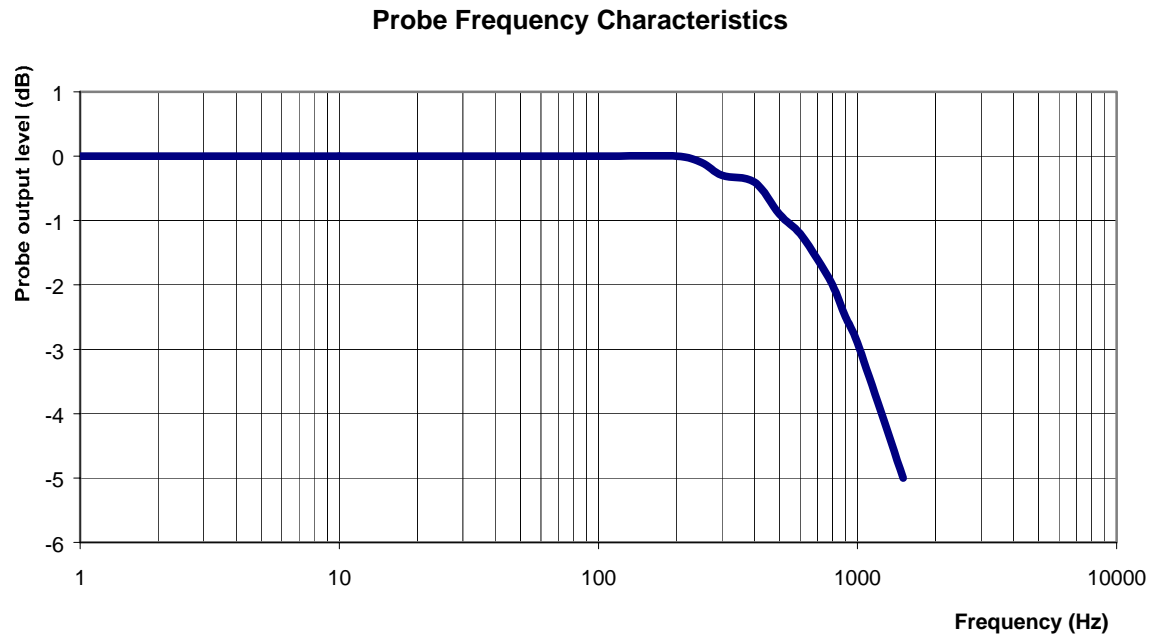
Isotropicity in Tissue:

0.10 dB

## Dynamic Range



## Video Bandwidth



<b>Video Bandwidth at 500 Hz</b>	<b>1 dB</b>
<b>Video Bandwidth at 1000 Hz</b>	<b>3 dB</b>

## **Conversion Factor Uncertainty Assessment**

**Frequency:** 1900MHz

**Epsilon:** 53.3 (+/-5%)

**Sigma:** 1.52 S/m (+/-5%)

### **ConvF**

**Channel X:** 5.1 7%(K=2)

**Channel Y:** 5.1 7%(K=2)

**Channel Z:** 5.1 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

### **Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.



## **Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.



## **Appendix E. Dipole Calibration**

**Validation Dipole 835 MHz**

**M/N: ALS-D-835-S-2**

**S/N: QTK-316**

**Validation Dipole 1900 MHz**

**M/N: ALS-D-1900-S-2**

**S/N: QTK-318**

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-887

## C E R T I F I C A T E   O F   C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Quietek Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-835-S-2

Frequency: 835 MHz

Serial No: QTK-315

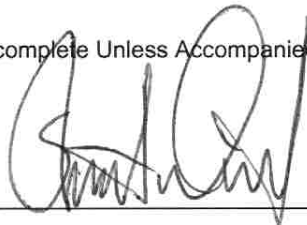
Customer: Quietek

Project Number: QTKB-Dipole-CAL-5336

Calibrated: 9<sup>th</sup> May 2008  
Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_



**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4162

## Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

### Mechanical Dimensions

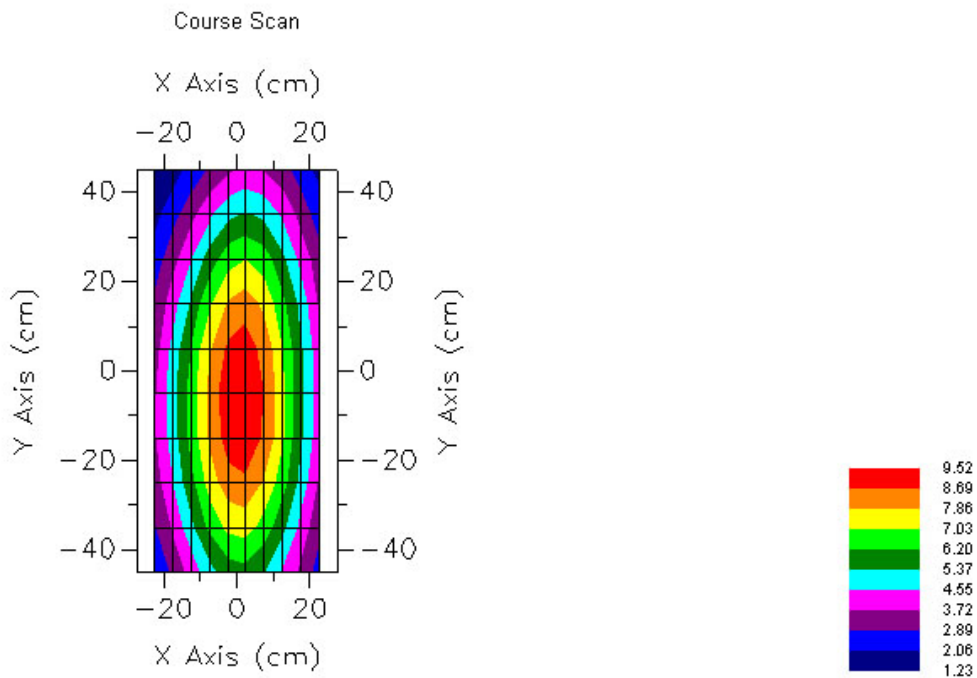
**Length:** 165.0 mm  
**Height:** 90.0 mm

### Electrical Specification

**SWR:** 1.04 U  
**Return Loss:** -32.9 dB  
**Impedance:** 51.1  $\Omega$

### System Validation Results

Frequency	1 Gram	10 Gram	Peak
835 MHz	9.33W/Kg	6.42W/Kg	15.0W/Kg



## Conditions

Dipole 315 is a recalibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 21 °C +/- 0.5°C

## References

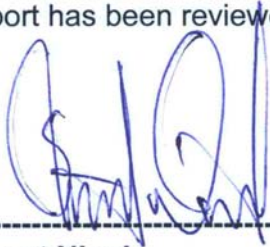
SSI-TP-018-ALSAS Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

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

IEC 62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & Part 2: Procedure to determine the specific absorption rate (SAR) for mobile wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)"

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.



Stuart Nicol



C. Teodorian

## **Dipole Calibration Results**

### **Mechanical Verification**

<b>IEEE Length</b>	<b>IEEE Height</b>	<b>Measured Length</b>	<b>Measured Height</b>
161.0 mm	89.8 mm	165.0 mm	90.0 mm

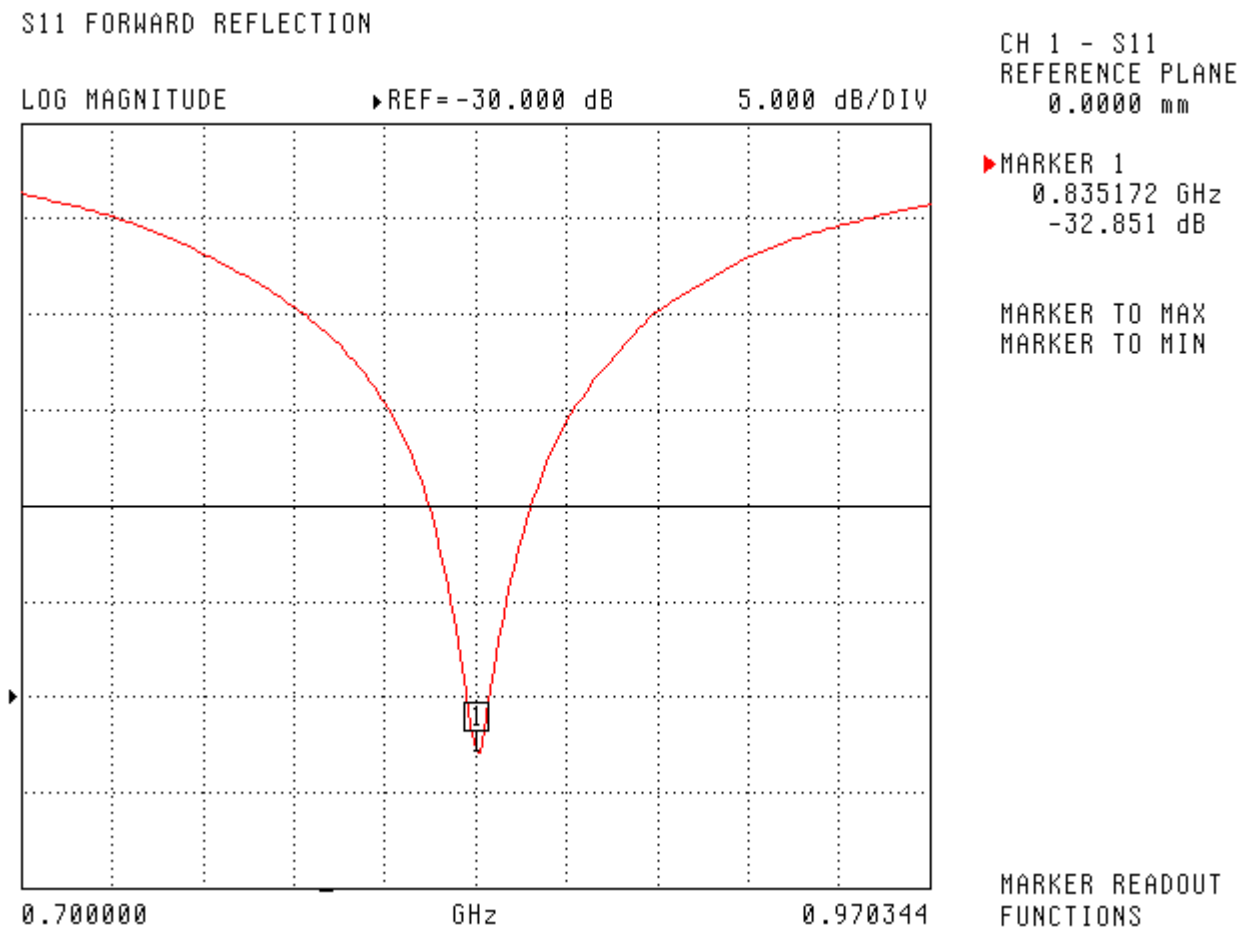
### **Tissue Validation**

<b>Head Tissue 835 MHz</b>	<b>Measured</b>
<b>Dielectric constant, <math>\epsilon_r</math></b>	42.54
<b>Conductivity, <math>\sigma</math> [S/m]</b>	0.91

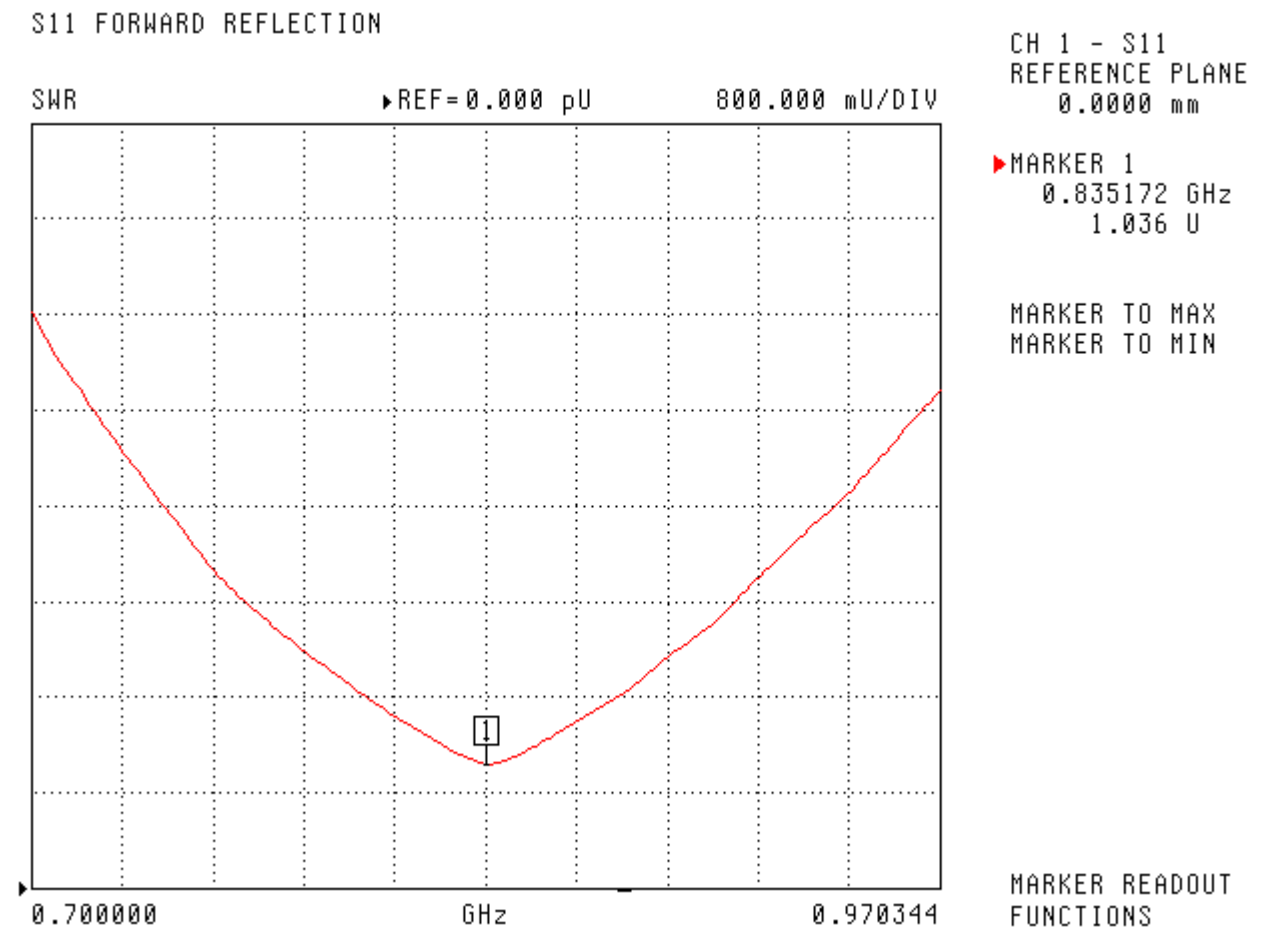
**Electrical Calibration**

Test Result	
S11 R/L	-32.9 dB
SWR 1.04	U
Impedance	51.1 $\Omega$

The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

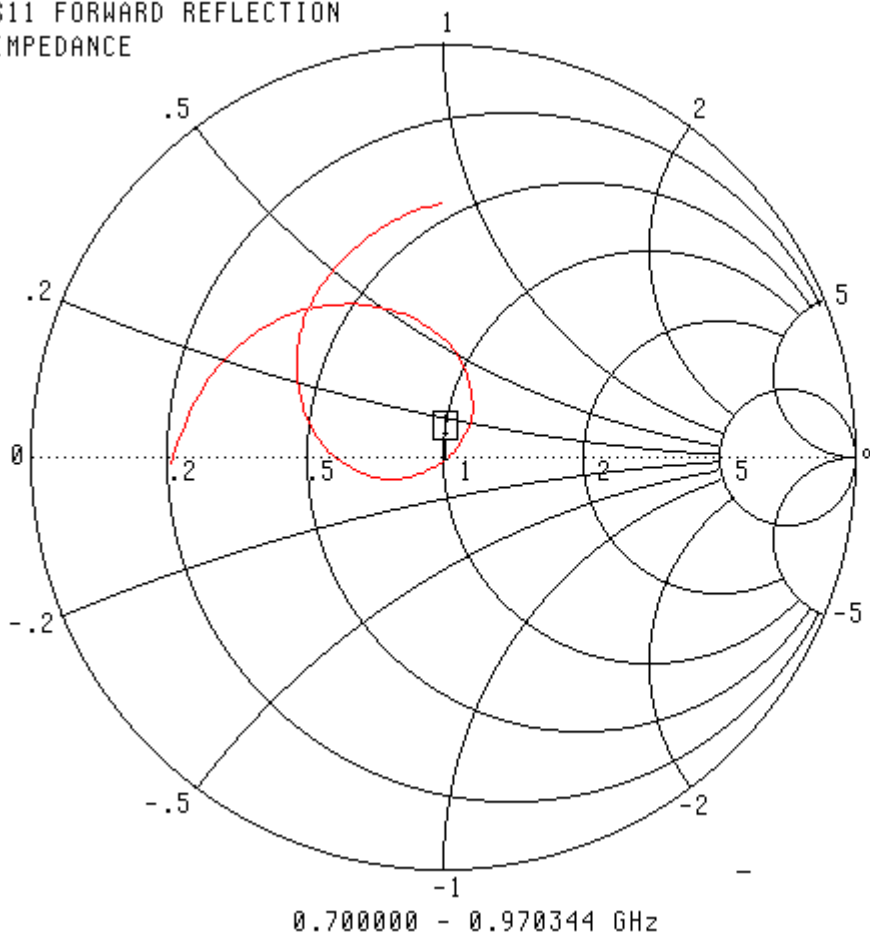
## SWR





## Smith Chart Dipole Impedance

S11 FORWARD REFLECTION  
IMPEDANCE



CH 1 - S11  
REFERENCE PLANE  
0.0000 mm

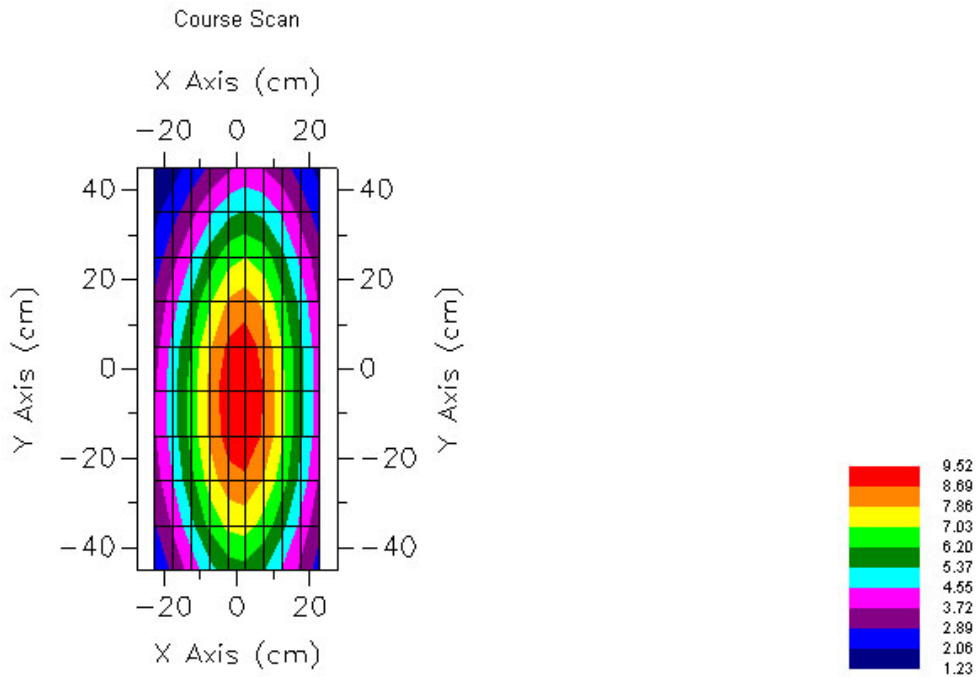
▶ MARKER 1  
0.835172 GHz  
51.124  $\Omega$   
-920.979  $j\Omega$

MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS

## System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
835 MHz	9.33W/Kg	6.42W/Kg	15.0W/Kg



## **Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-890

## C E R T I F I C A T E   O F   C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Quietek Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-1900-S-2

Frequency: 1.9 GHz

Serial No: QTK-318

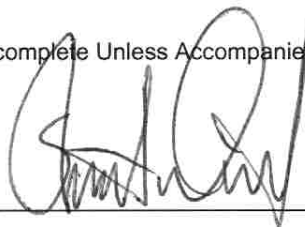
Customer: Quietek

Project Number: QTKB-Dipole-CAL-5336

Calibrated: 9<sup>th</sup> May 2008  
Released on: 9<sup>th</sup> May 2008

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_



**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161

## Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

### Mechanical Dimensions

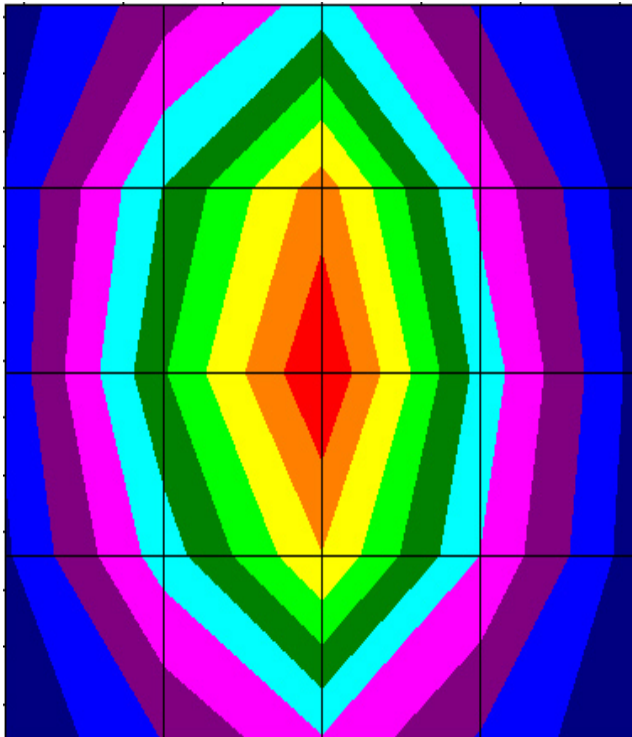
**Length:** 70.0 mm  
**Height:** 39.5 mm

### Electrical Specification

**SWR:** 1.1 U  
**Return Loss:** -25.8 dB  
**Impedance:** 47.8  $\Omega$

### System Validation Results

Frequency	1 Gram	10 Gram	Peak
1.9 GHz	36.0W/Kg	20.78W/Kg	67.7W/Kg



## Conditions

Dipole 318 is a recalibration.

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 21 °C +/- 0.5°C

## References

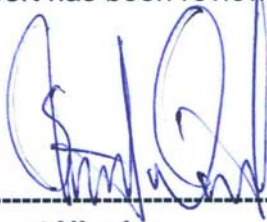
SSI-TP-018-ALSAS Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

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

IEC 62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & Part 2: Procedure to determine the specific absorption rate (SAR) for mobile wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)"

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.



Stuart Nicol



C. Teodorian

20 °C +/- 0.5°C

## **NCL Calibration Laboratories**

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Division of APREL Laboratories.

## **Dipole Calibration Results**

### **Mechanical Verification**

<b>IEEE Length</b>	<b>IEEE Height</b>	<b>Measured Length</b>	<b>Measured Height</b>
68.0 mm	39.5 mm	70.0 mm	39.5 mm

### **Tissue Validation**

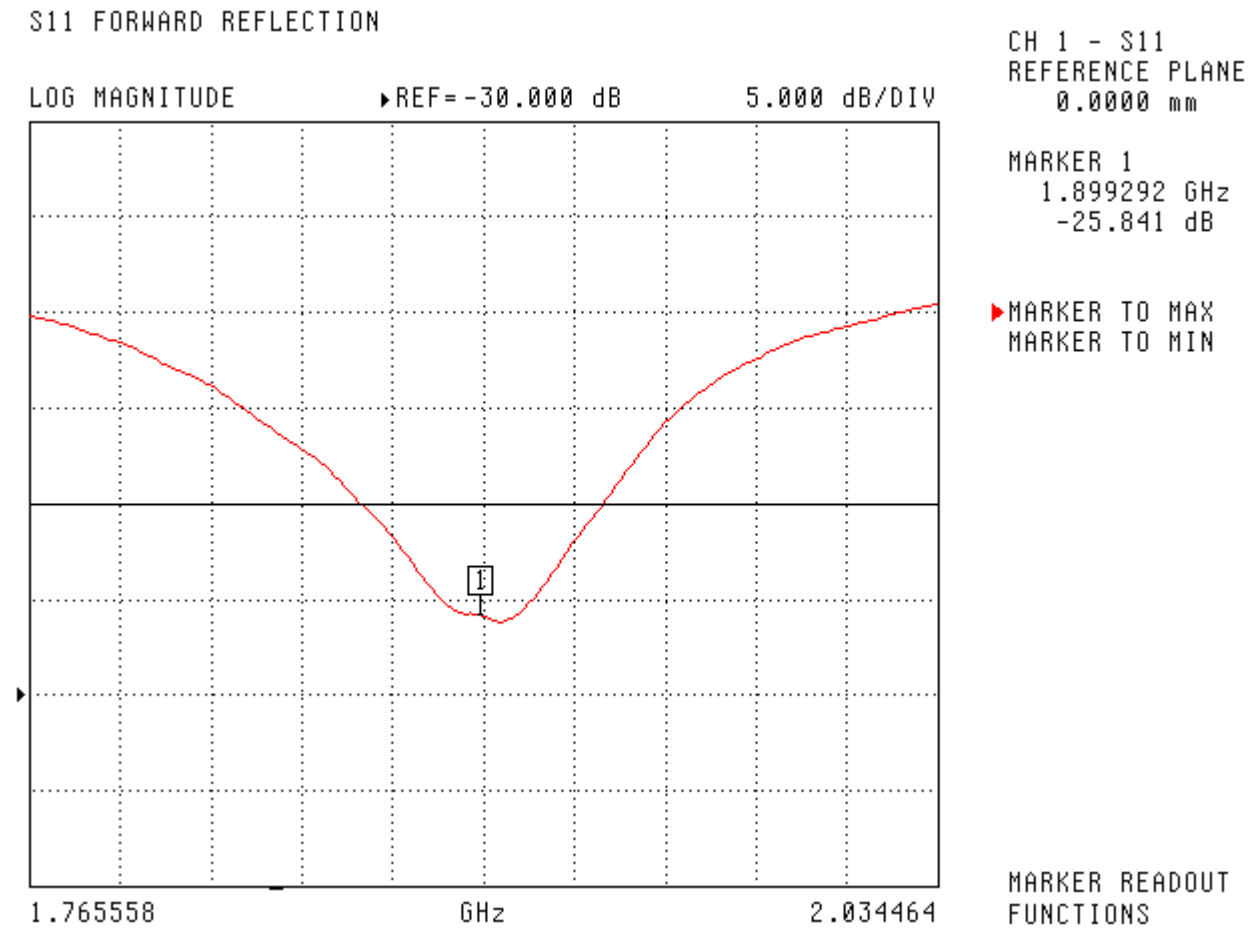
<b>Head Tissue 1900 MHz</b>	<b>Measured</b>
<b>Dielectric constant, <math>\epsilon_r</math></b>	39.9
<b>Conductivity, <math>\sigma</math> [S/m]</b>	1.42



**Electrical Calibration**

Test Result	
S11 R/L	-25.8 dB
SWR 1.1	U
Impedance	47.8 $\Omega$

The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

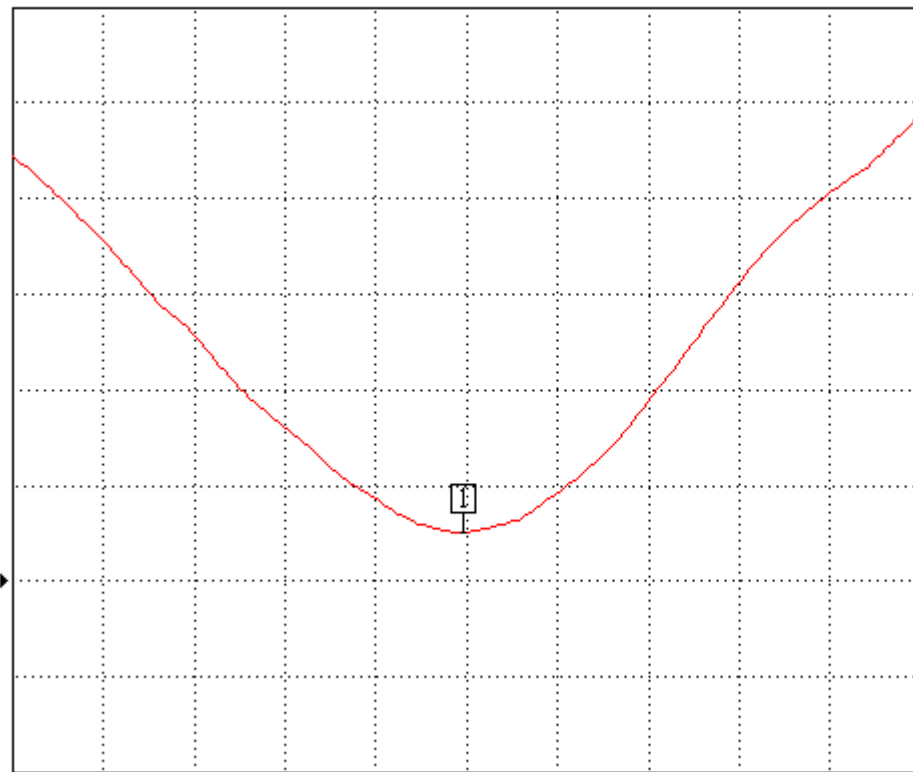
## SWR

S11 FORWARD REFLECTION

SWR

REF=1.000 U

200.000 mU/DIV



1.76558

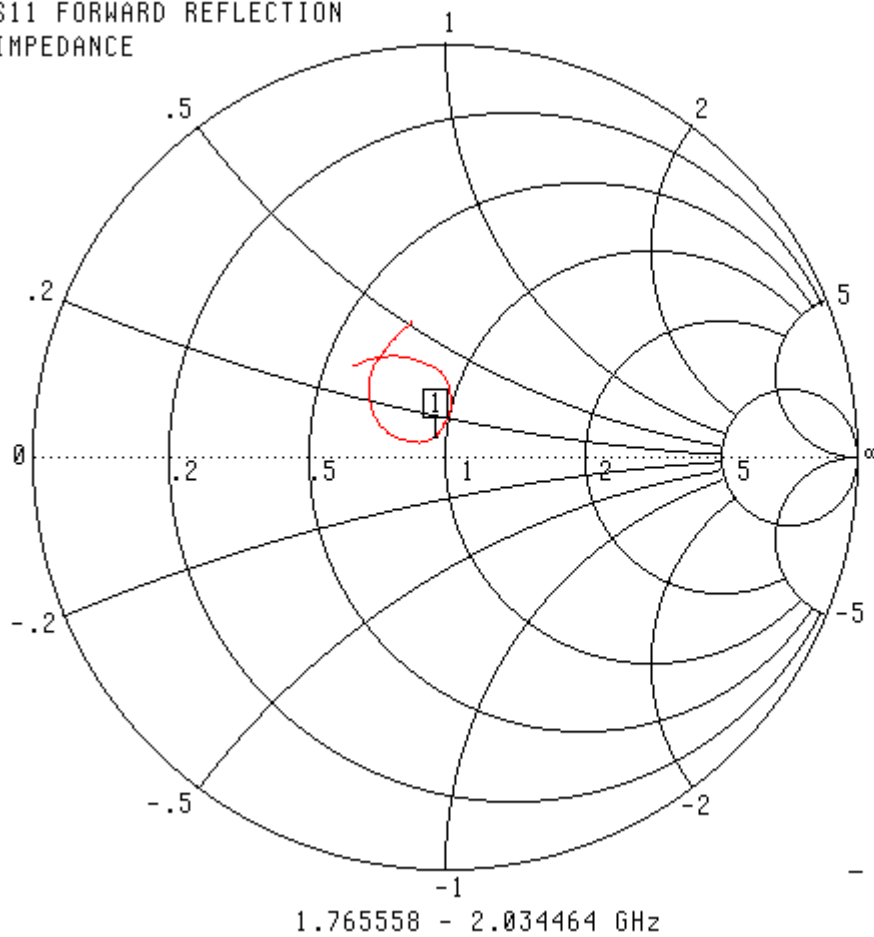
GHz

2.034464

MARKER READOUT  
FUNCTIONS

## Smith Chart Dipole Impedance

S11 FORWARD REFLECTION  
IMPEDANCE



CH 1 - S11  
REFERENCE PLANE  
0.0000 mm

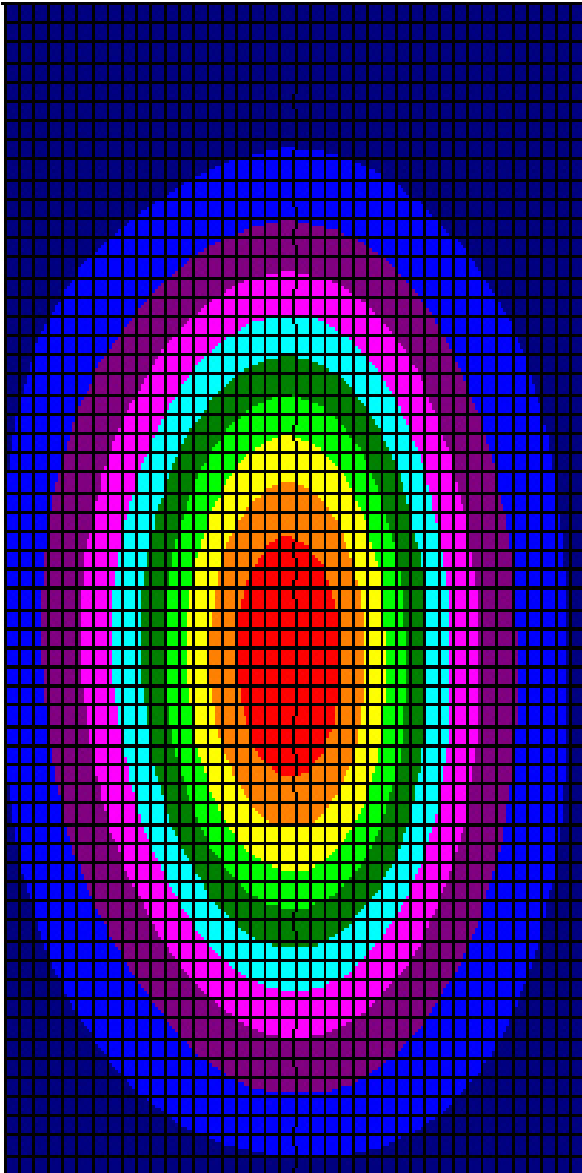
MARKER 1  
1.899292 GHz  
47.748  $\Omega$   
4.401  $j\Omega$

▶ MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS

## System Validation Results Using the Electrically Calibrated Dipole

Frequency	1 Gram	10 Gram	Peak Above Feed Point
1.9 GHz	36.0W/Kg	20.78W/Kg	67.7W/Kg



## **Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2008.