

## NCL Calibration Laboratories

Division of APREL Laboratories.

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### **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.

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This page has been reviewed for content and attested to on Page 2 of this document.

## NCL CALIBRATION LABORATORIES

Calibration File No.: CP-635

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 5200 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 294

HEAD Calibration

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

Project No: QUIB-Probe-Cal-5210

Calibrated: 21<sup>st</sup> March 2006

Released on: 21<sup>st</sup> March 2006

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

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

**NCL CALIBRATION LABORATORIES**

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E8

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

## NCL Calibration Laboratories

Division of APREL Laboratories.

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### 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-020 264.

### 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 Body Due to Wireless Communications Devices: Experimental Techniques"  
SSI-TP-011 Tissue Calibration Procedure

### Conditions

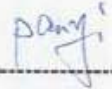
Probe 264 was a new probe taken from stock prior to calibration.

**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.



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Stuart Nicol



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Yi Pan

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This page has been reviewed for content and attested to on Page 2 of this document.

## NCL Calibration Laboratories

Division of APREL Laboratories.

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### Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	264
Frequency:	5200 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

### Sensitivity in Air

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

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## NCL Calibration Laboratories

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Division of APREL Laboratories

### Sensitivity in Head Tissue

Frequency: 5200 MHz

Epsilon: 35.9 (+/-10%)

Sigma: 4.7 S/m (+/-5%)

### ConvF

Channel X: 3.9

Channel Y: 3.9

Channel Z: 3.9

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

### Boundary Effect:

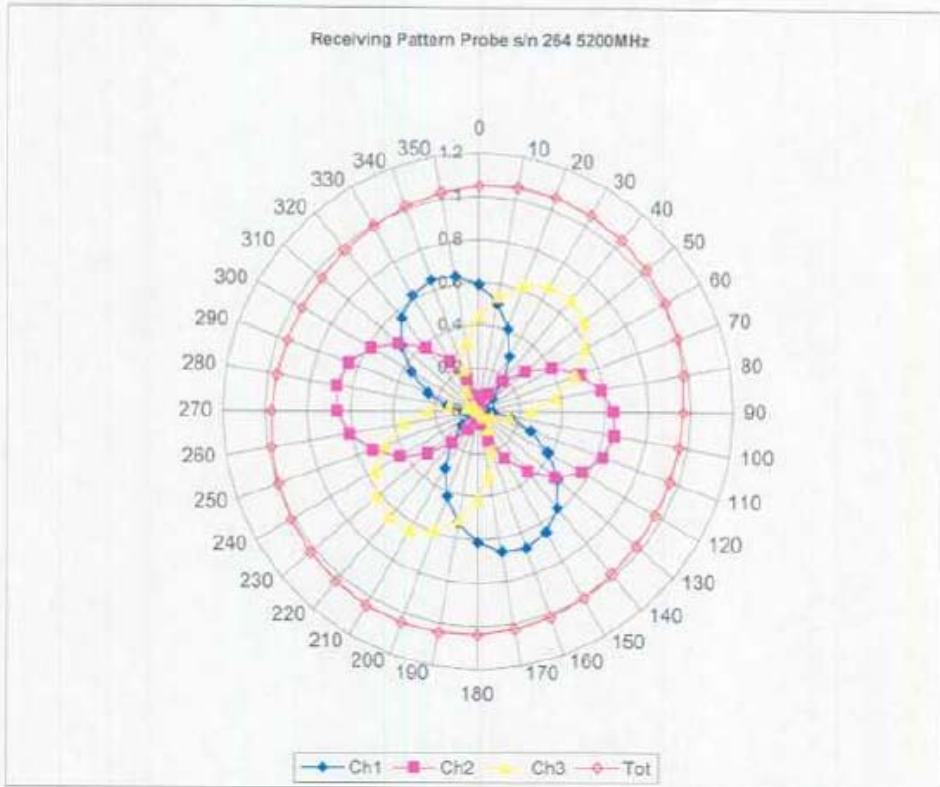
Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

### 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.

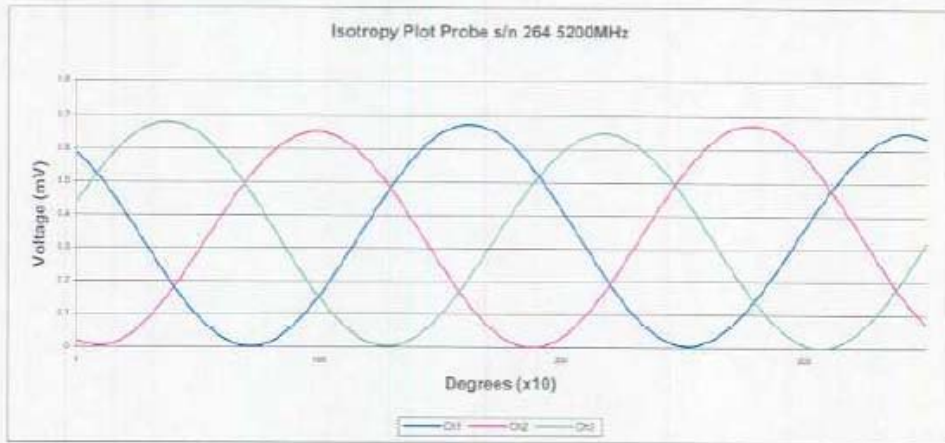
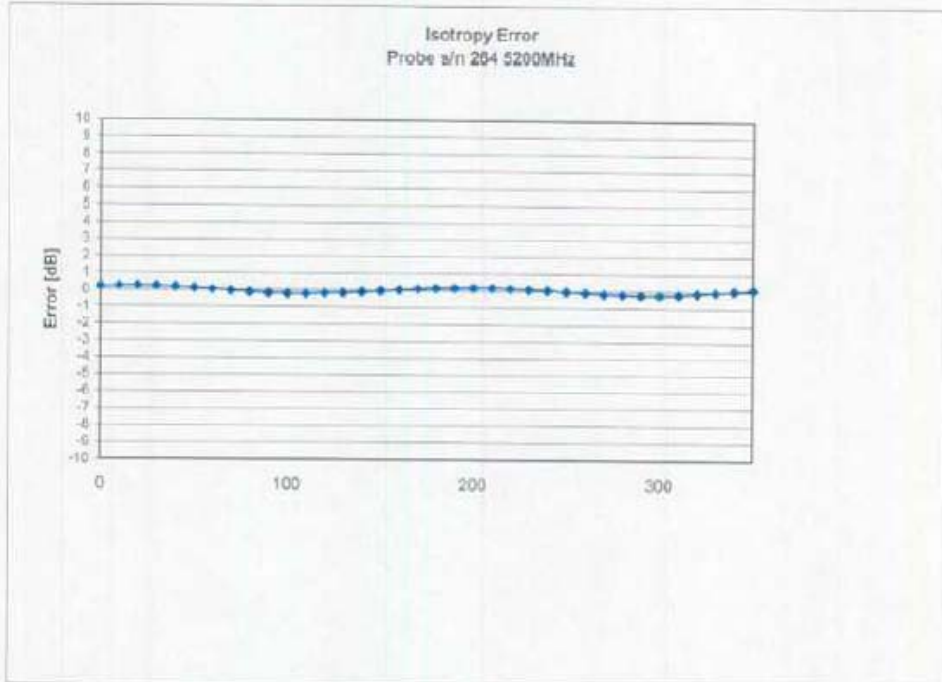


## Receiving Pattern 5200 MHz (Air)



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## Isotropy Error 5200 MHz (Air)



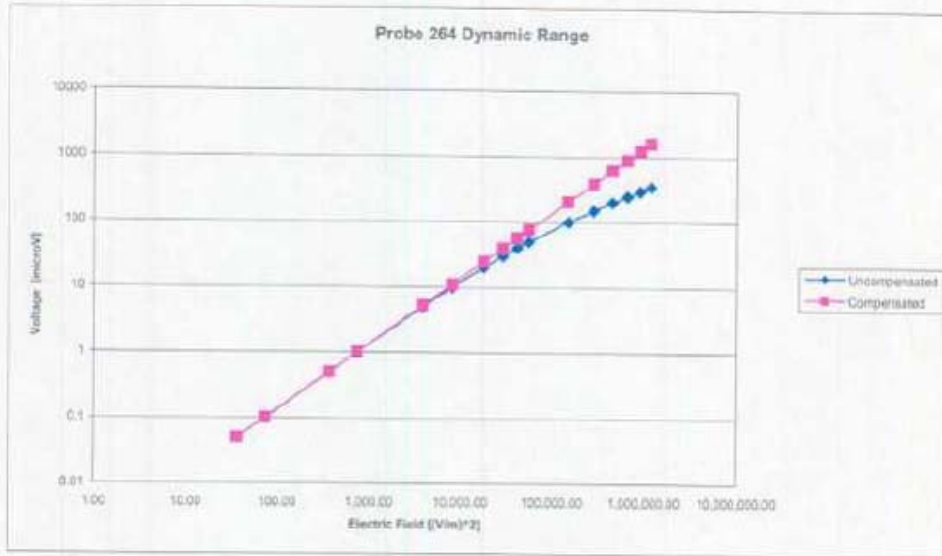
Isotropicity in Tissue:

0.10 dB

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## Dynamic Range



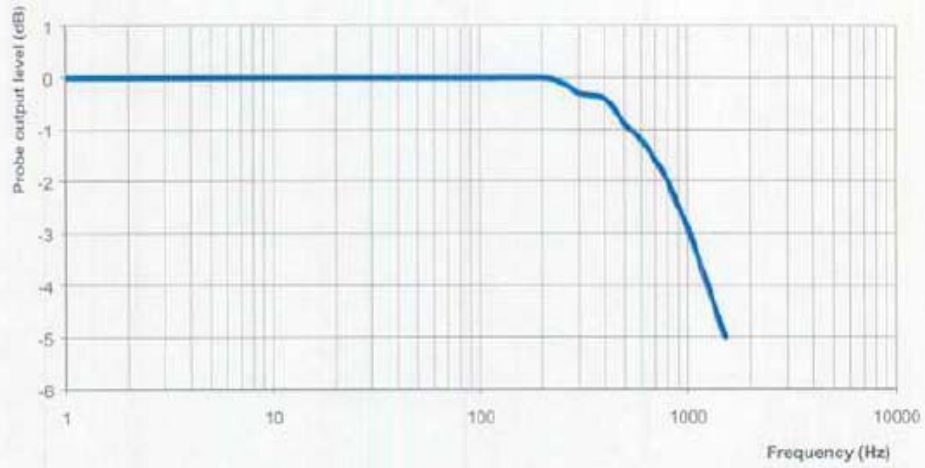


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## Video Bandwidth

Probe Frequency Characteristics



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

## NCL Calibration Laboratories

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Division of APREL Laboratories.

### Conversion Factor Uncertainty Assessment

Frequency:	5200MHz
Epsilon: 35.9 (+/-10%)	Sigma: 4.7 S/m (+/-5%)
ConvF	
Channel X: 3.9	7%(K=2)
Channel Y: 3.9	7%(K=2)
Channel Z: 3.9	7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

#### Boundary Effect:

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

## NCL Calibration Laboratories

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Division of APREL Laboratories.

### **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.

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## NCL CALIBRATION LABORATORIES

Calibration File No.: CP-642

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 5200 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 204

BODY Calibration

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

Project No: QUIB-Probe-Cal-5210

Calibrated: 21<sup>st</sup> March 2006

Released on: 21<sup>st</sup> March 2006

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

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



**NCL** CALIBRATION LABORATORIES

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FAX: (613) 820-4161

## NCL Calibration Laboratories

Division of APREL Laboratories.

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### 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-020 264.

### References

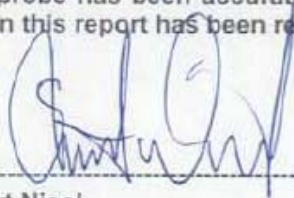
SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"  
SSI-TP-011 Tissue Calibration Procedure

### Conditions


Probe 264 was a new probe taken from stock prior to 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.



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Stuart Nicol



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Yi Pan

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## NCL Calibration Laboratories

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Division of APREL Laboratories.

### Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	264
Frequency:	5200 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

### Sensitivity in Air

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

## NCL Calibration Laboratories

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Division of APREL Laboratories.

### Sensitivity in Body Tissue

**Frequency:** 5200 MHz

**Epsilon:** 48.9 (+/-10%)

**Sigma:** 5.35 S/m (+/-5%)

### ConvF

**Channel X:** 4.5

**Channel Y:** 4.5

**Channel Z:** 4.5

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:

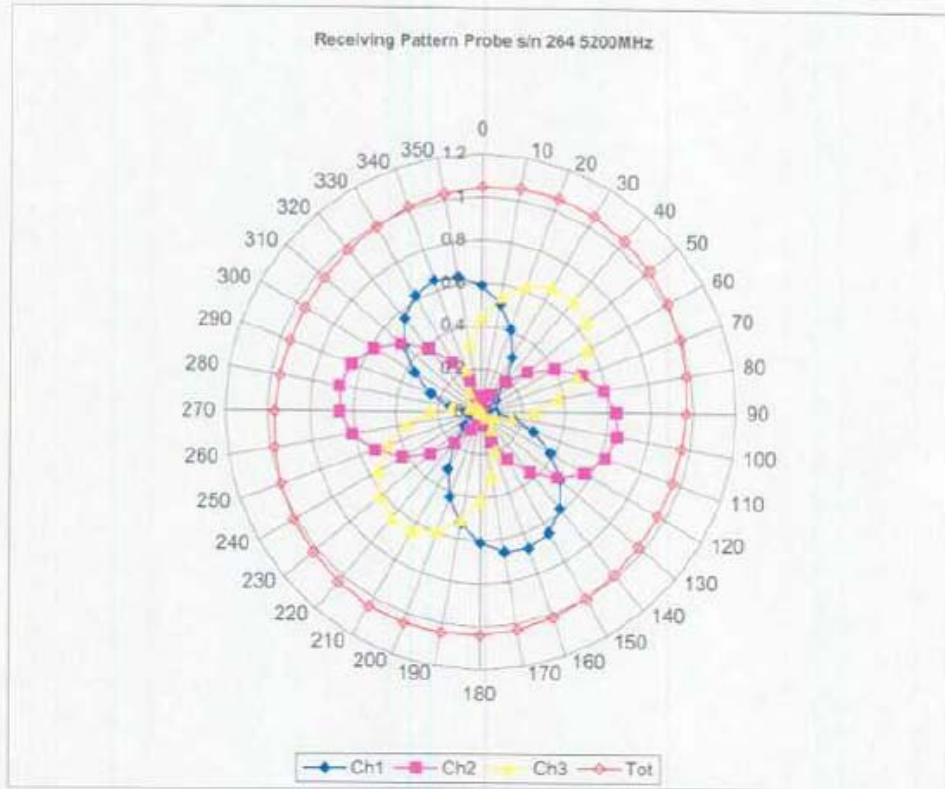
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

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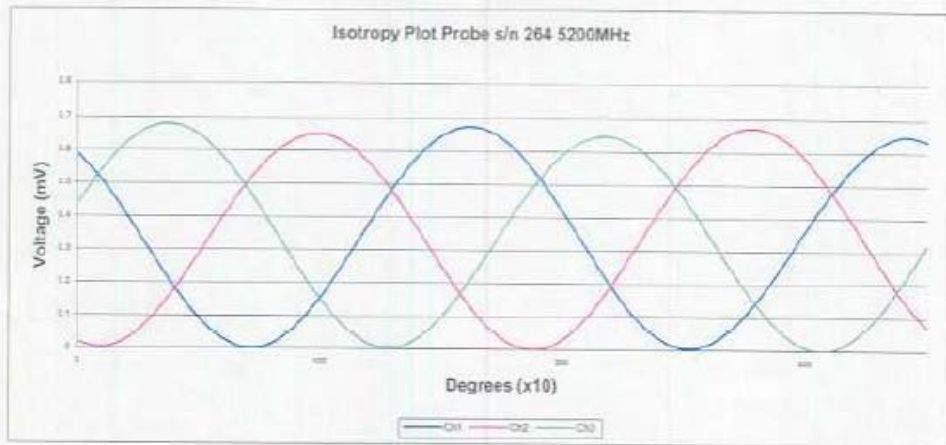
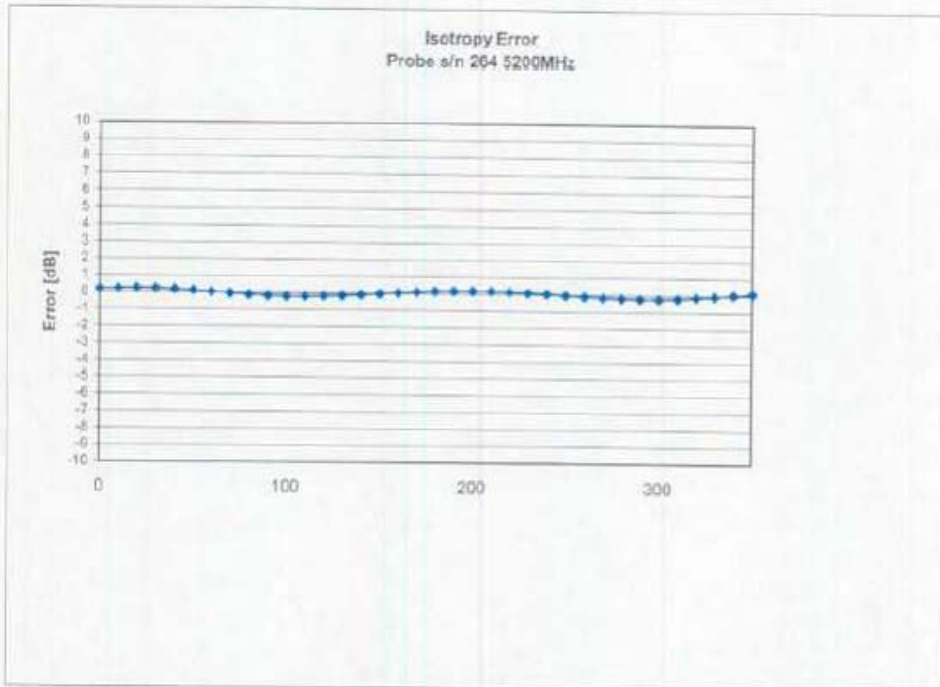
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This page has been reviewed for content and attested to on Page 2 of this document.

## Receiving Pattern 5200 MHz (Air)



## Isotropy Error 5200 MHz (Air)



Isotropicity in Tissue:

0.10 dB

## Dynamic Range



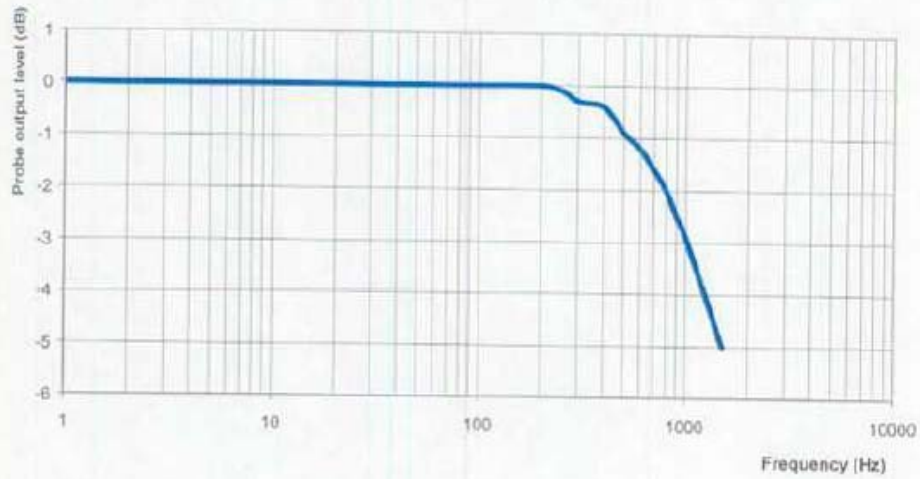


NCL Calibration Laboratories  
Division of APREL Laboratories

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## Video Bandwidth

Probe Frequency Characteristics



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

## NCL Calibration Laboratories

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Division of APREL Laboratories.

### Conversion Factor Uncertainty Assessment

<b>Frequency:</b>		5200MHz	
<b>Epsilon:</b>	48.9 (+/-10%)	<b>Sigma:</b>	5.35 S/m (+/-5%)
<b>ConvF</b>			
<b>Channel X:</b>	4.5		7%(K=2)
<b>Channel Y:</b>	4.5		7%(K=2)
<b>Channel Z:</b>	4.5		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%.

## NCL Calibration Laboratories

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Division of APREL Laboratories

### **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.

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# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-636

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 5800 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 264

HEAD Calibration

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

Project No: QUIB-Probe-Cal-5210

Calibrated: 21<sup>st</sup> March 2006  
Released on: 21<sup>st</sup> March 2006

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

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

### **NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
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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-020 264.

## 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 Body Due to Wireless Communications Devices: Experimental Techniques"  
SSI-TP-011 Tissue Calibration Procedure

## Conditions

Probe 264 was a new probe taken from stock prior to 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.

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Stuart Nicol

  
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Yi Pan



## Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	264
Frequency:	5800 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

### Sensitivity in Air

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

## Sensitivity in Head Tissue

<b>Frequency:</b>		5800 MHz	
<b>Epsilon:</b>	35.3 (+/-10%)	<b>Sigma:</b>	5.27 S/m (+/-5%)

### ConvF

**Channel X:** 3.3

**Channel Y:** 3.3

**Channel Z:** 3.3

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

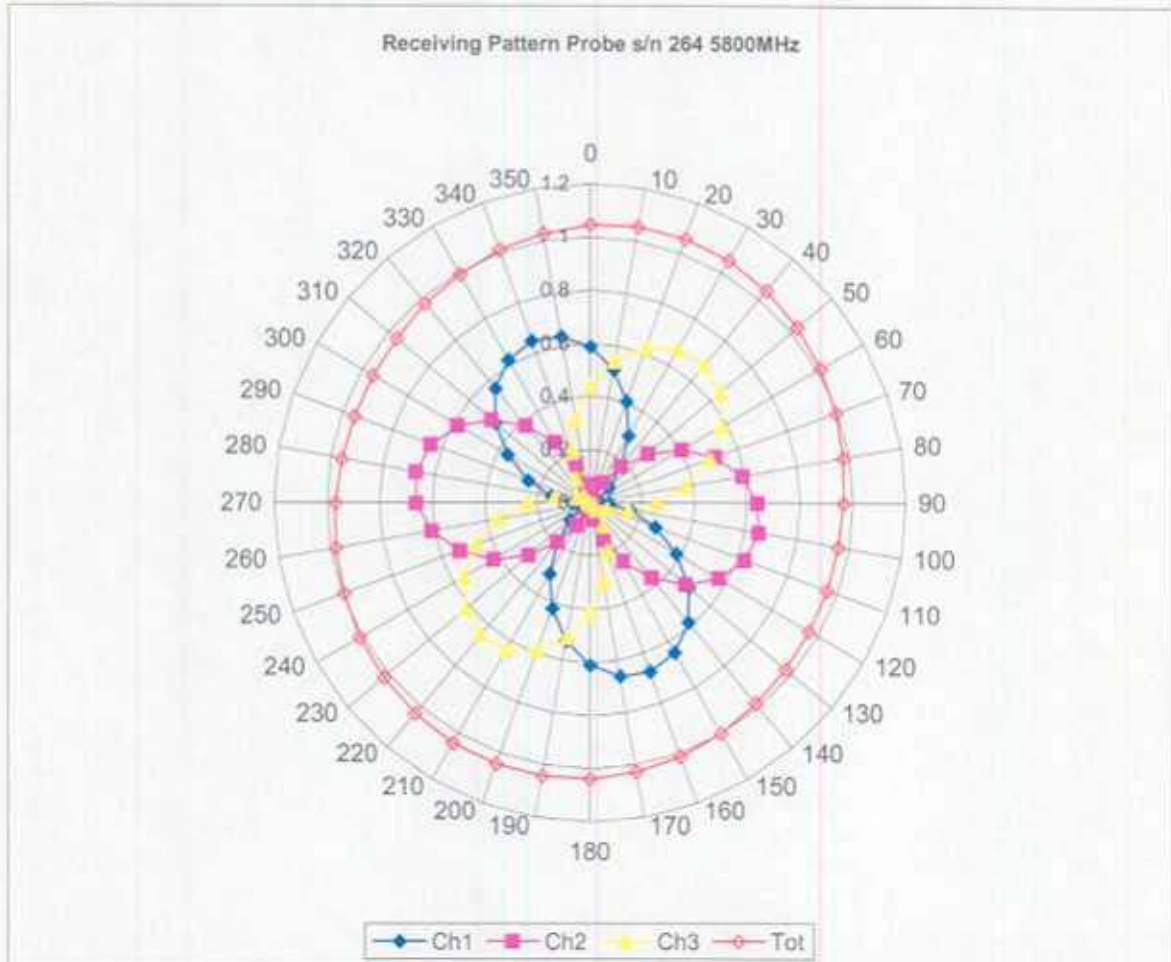
## Boundary Effect:

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.

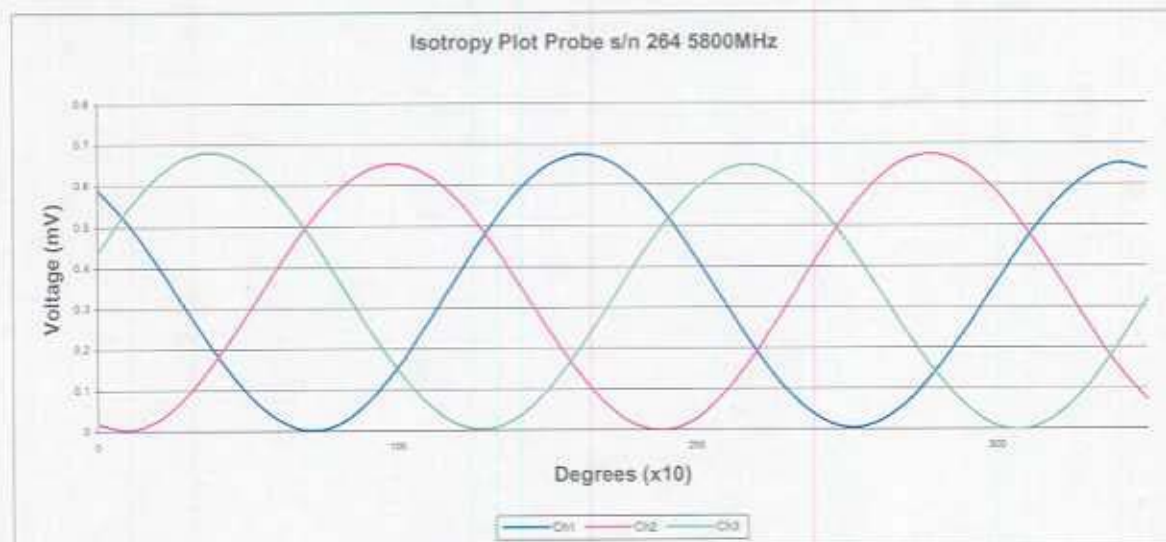
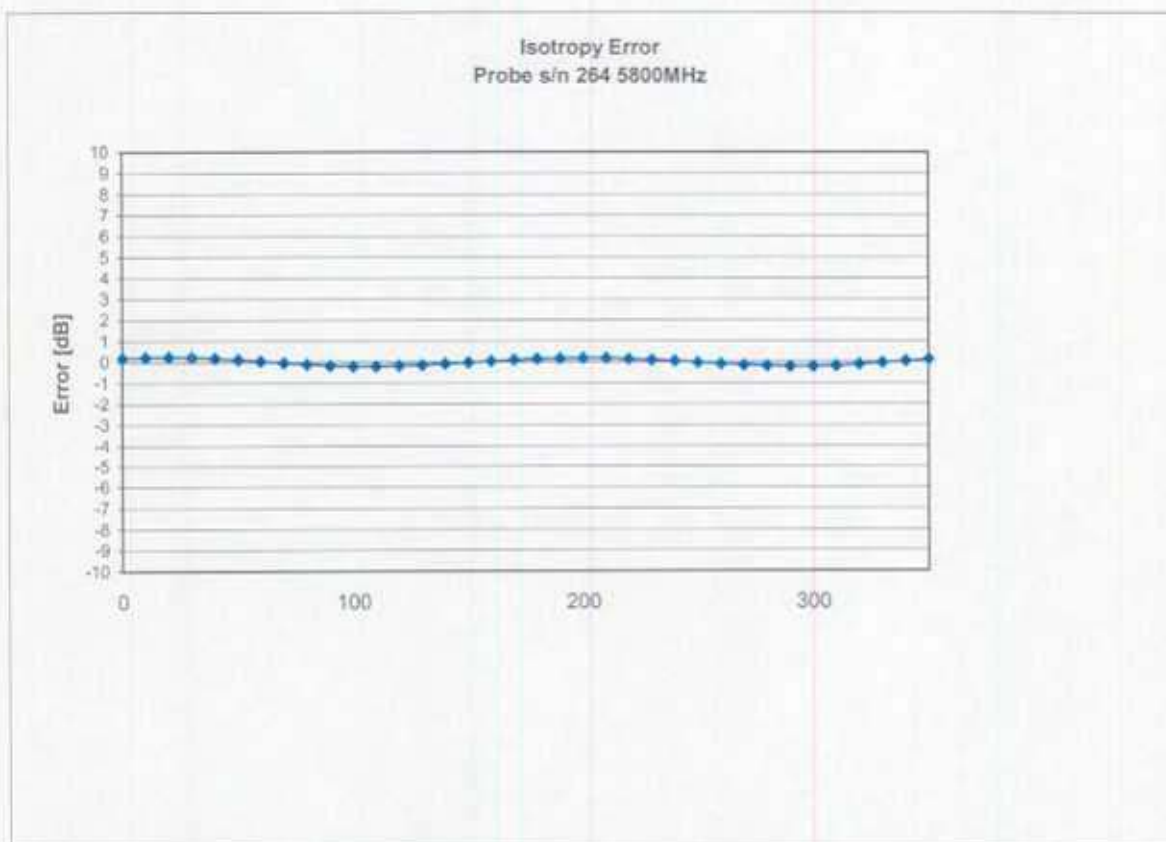
## Spatial Resolution:

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 5800 MHz (Air)



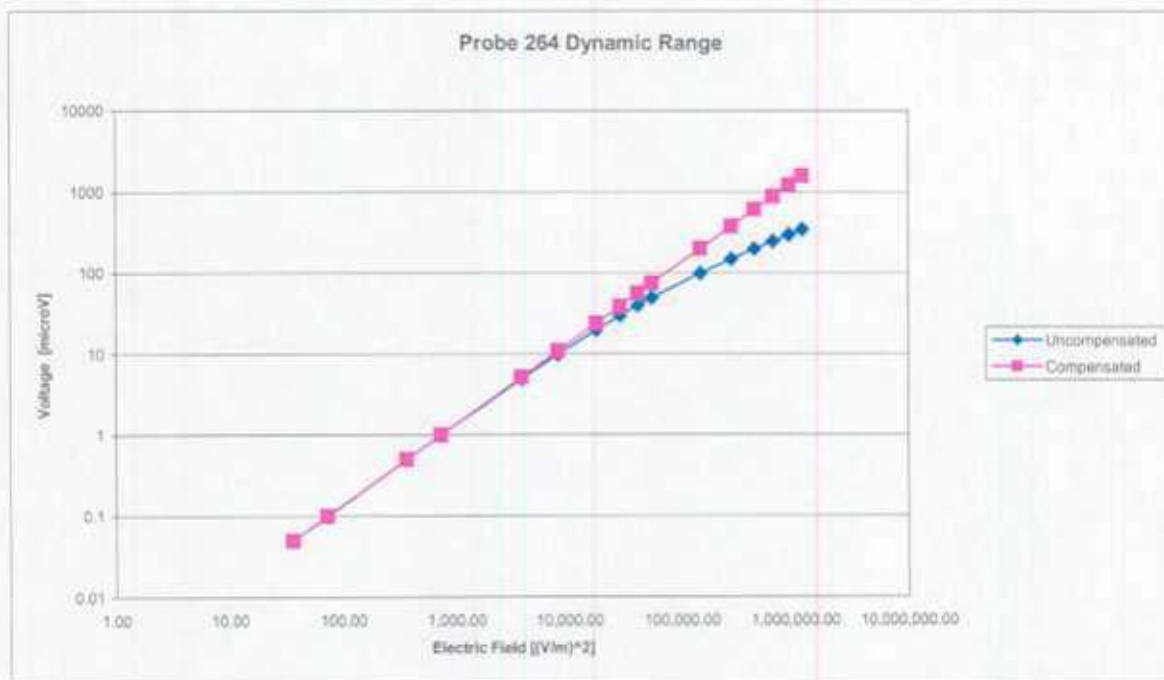
### Isotropy Error 5800 MHz (Air)



Isotropy in Tissue:

0.10 dB

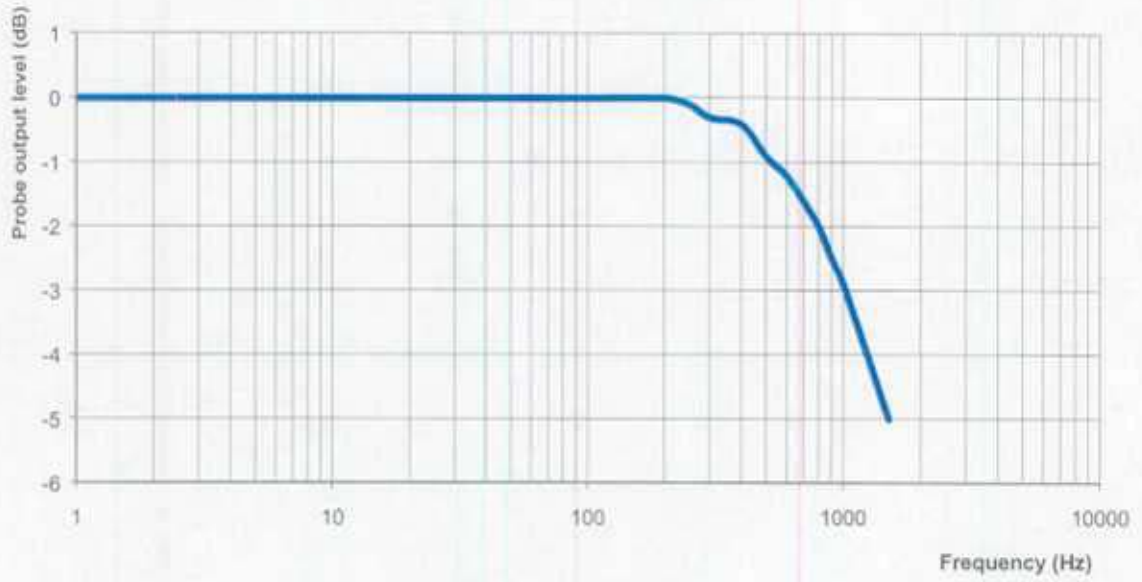
## Dynamic Range





## Video Bandwidth

Probe Frequency Characteristics



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

## Conversion Factor Uncertainty Assessment

Frequency:		5800MHz
Epsilon:	35.3 (+/-10%)	<b>Sigma:</b> 5.27 S/m (+/-5%)
ConvF		
Channel X:	3.3	7%(K=2)
Channel Y:	3.3	7%(K=2)
Channel Z:	3.3	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**

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