

## **NCL CALIBRATION LABORATORIES**

Calibration File No.: C-P-0252

### **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.

Equipment: Miniature Isotropic RF Probe 1900 MHz

Manufacturer: APREL Laboratories

Model No.: E-010

Serial No.: 163

Calibration Procedure: SSI/DRB-TP-D01-032  
Project No: Probe Cal Internal

Calibrated: May 9<sup>th</sup> 2002  
Recalibration required: May 8<sup>th</sup> 2003  
Released on: May 9<sup>th</sup> 2002

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

## **NCL Calibration Laboratories**

---

Division of APREL Laboratories.

### **Introduction**

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-010 163.

### **References**

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

IEEE P1528 *DRAFT* "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-014 Tissue Calibration Procedure

### **Conditions**

Calibration of Probe 163 was a new calibration.

**Ambient Temperature of the Laboratory:** 23 °C +/- 0.5 °C

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

## **NCL Calibration Laboratories**

---

Division of APREL Laboratories.

### **Calibration Results Summary**

**Probe Type:** E-Field Probe E-010  
**Serial Number:** 163  
**Frequency:** 1900 MHz  
**Sensor Offset:** 2.4 mm  
**Sensor Length:** 2.5 mm  
**Tip Enclosure:** Glass\*  
**Tip Diameter:** 7 mm  
**Tip Length:** 40 mm  
**Total Length:** 290 mm

\*Resistive to recommended tissue recipes per IEEE-P1528

### **Sensitivity in Air**

**Channel X:**  $0.58 \text{ } \ddot{\text{A}} \text{ V}/(\text{V}/\text{m})^2$   
**Channel Y:**  $0.58 \text{ } \ddot{\text{A}} \text{ V}/(\text{V}/\text{m})^2$   
**Channel Z:**  $0.58 \text{ } \ddot{\text{A}} \text{ V}/(\text{V}/\text{m})^2$   
**Diode Compression Point:** 76 mV

## **NCL Calibration Laboratories**

---

Division of APREL Laboratories.

### **Sensitivity in Body Tissue**

**Frequency:** 1900 MHz

**Epsilon:** 54 (+/-5%) **Sigma:** 1.45 S/m (+/-10%)

### **ConvF**

**Channel X:** 5.9

**Channel Y:** 5.9

**Channel Z:** 5.9

Tissue sensitivity values were calculated using a load impedance of 5 MΩ.

### **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 2.6mm.

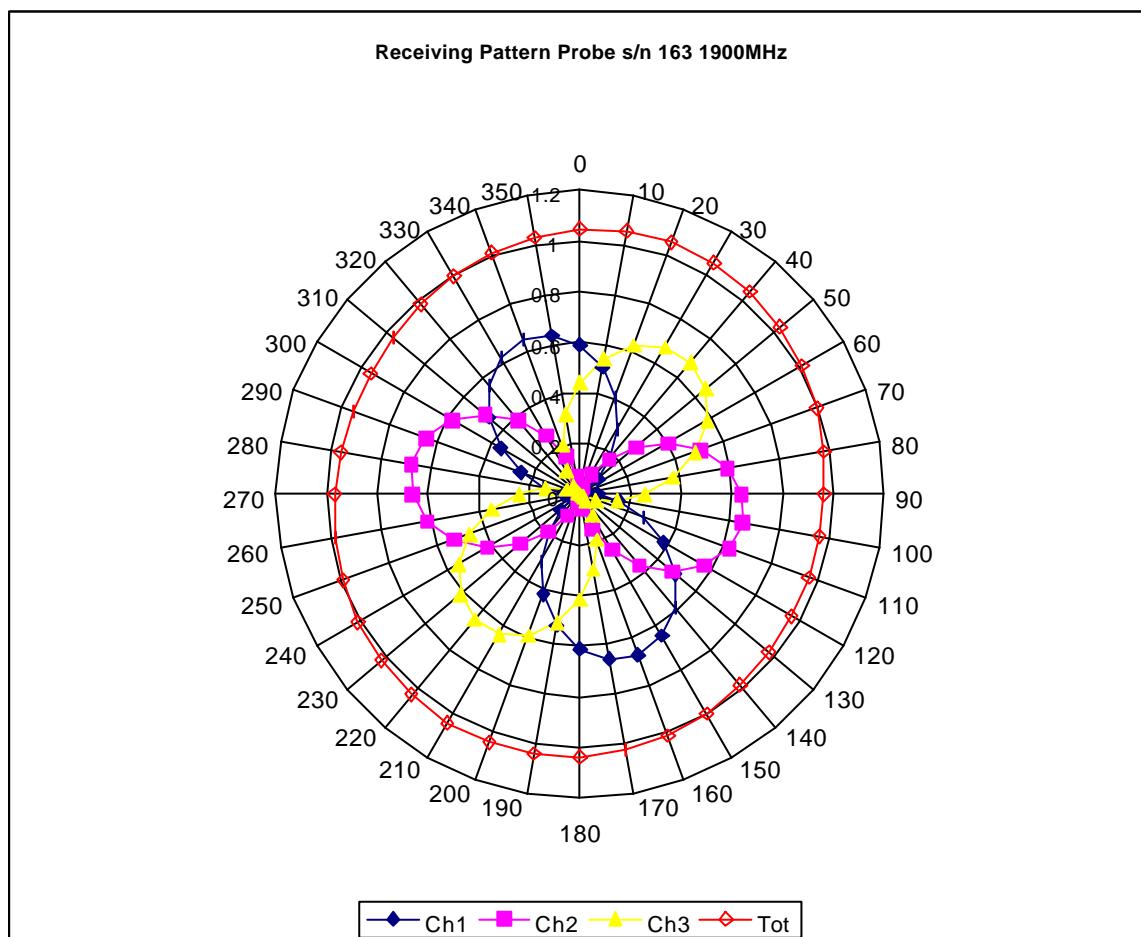
### **Spatial Resolution:**

The measured probe tip diameter is 7 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

# NCL Calibration Laboratories

Division of APREL Laboratories.

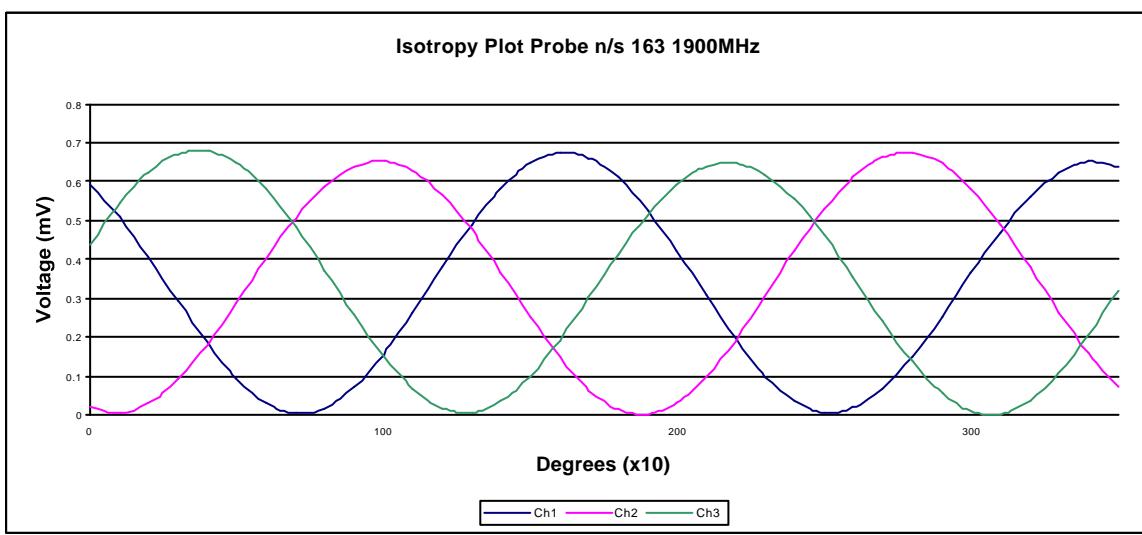
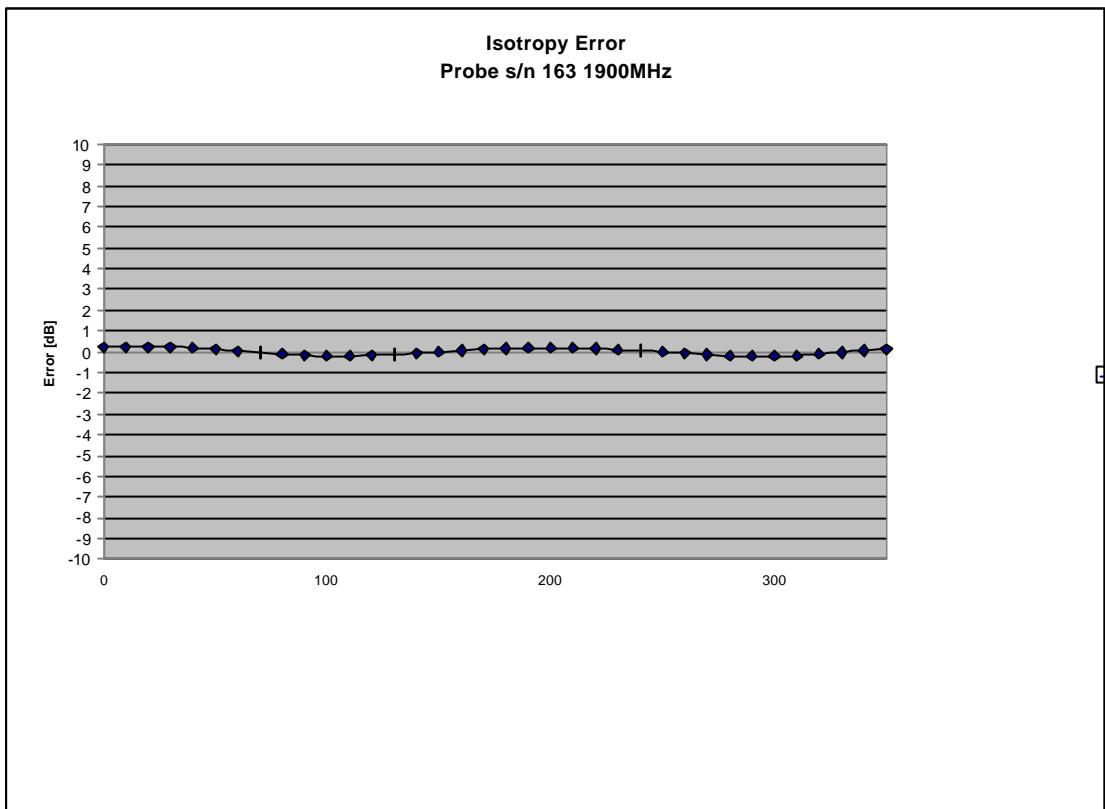
## Receiving Pattern 1900 MHz (Air)



# NCL Calibration Laboratories

Division of APREL Laboratories.

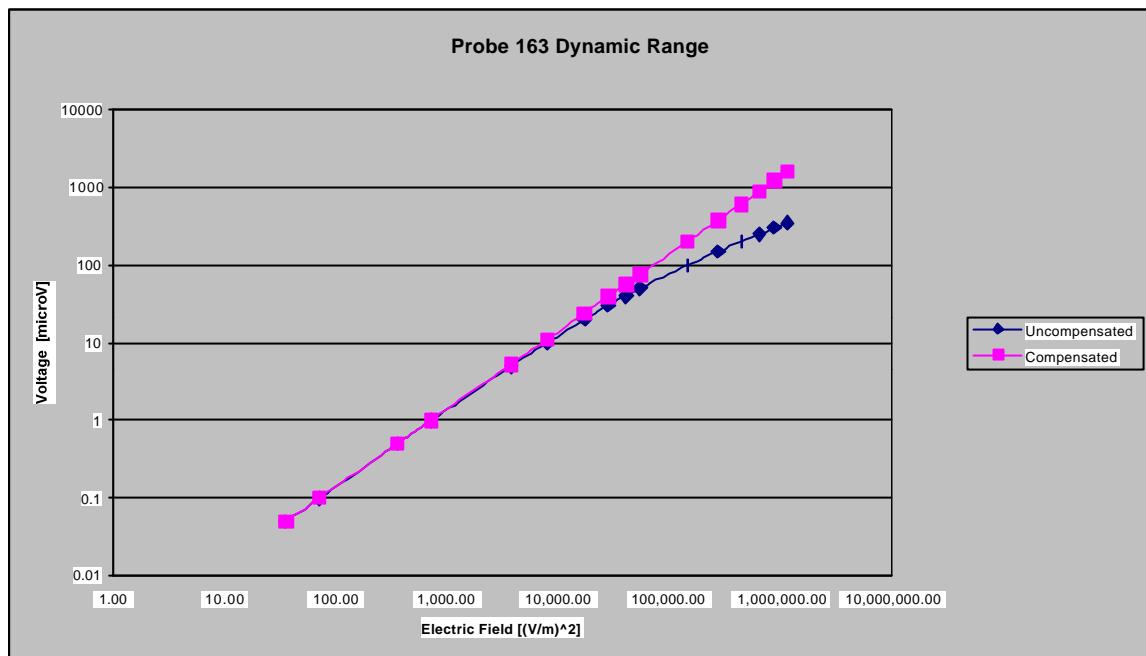
## Isotropy Error 1900 MHz (Air)



## NCL Calibration Laboratories

Division of APREL Laboratories.

### Dynamic Range

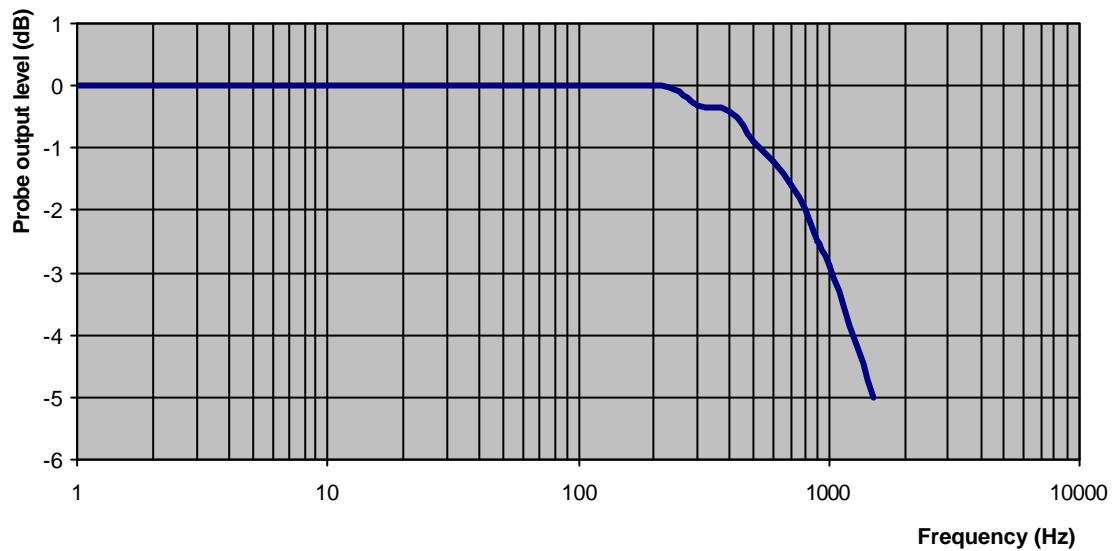


# NCL Calibration Laboratories

Division of APREL Laboratories.

## Video Bandwidth

Probe Frequency Characteristics



**Video Bandwidth at 500 Hz**

1 dB

**Video Bandwidth at 1.02 KHz:**

3 dB

## **NCL Calibration Laboratories**

---

Division of APREL Laboratories.

### **Conversion Factor Uncertainty Assessment**

**Frequency:** 1900 MHz

**Epsilon:** 54.0 (+/-5%) **Sigma:** 1.45 S/m (+/-10%)

#### **ConvF**

**Channel X:** 5.9 7%(K=2)

**Channel Y:** 5.9 7%(K=2)

**Channel Z:** 5.9 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 2.6mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## **NCL Calibration Laboratories**

---

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 May 2002