

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-607  
Project Number: INKB-D1900-cal-5443

## 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.

Inventec Validation Dipole

Manufacturer: APREL Laboratories

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

Frequency: 1900 MHz

Serial No: 1900-210-00707

Customer: IAC

Calibrated: May 28, 2010  
Released on: May 28, 2010

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

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

**NCL** CALIBRATION LABORATORIES

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Division of APREL Lab.  
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## Conditions

Dipole 1900-210-00707 client 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 device 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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**C. Teodorian**

## Calibration Results Summary

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

### Mechanical Dimensions

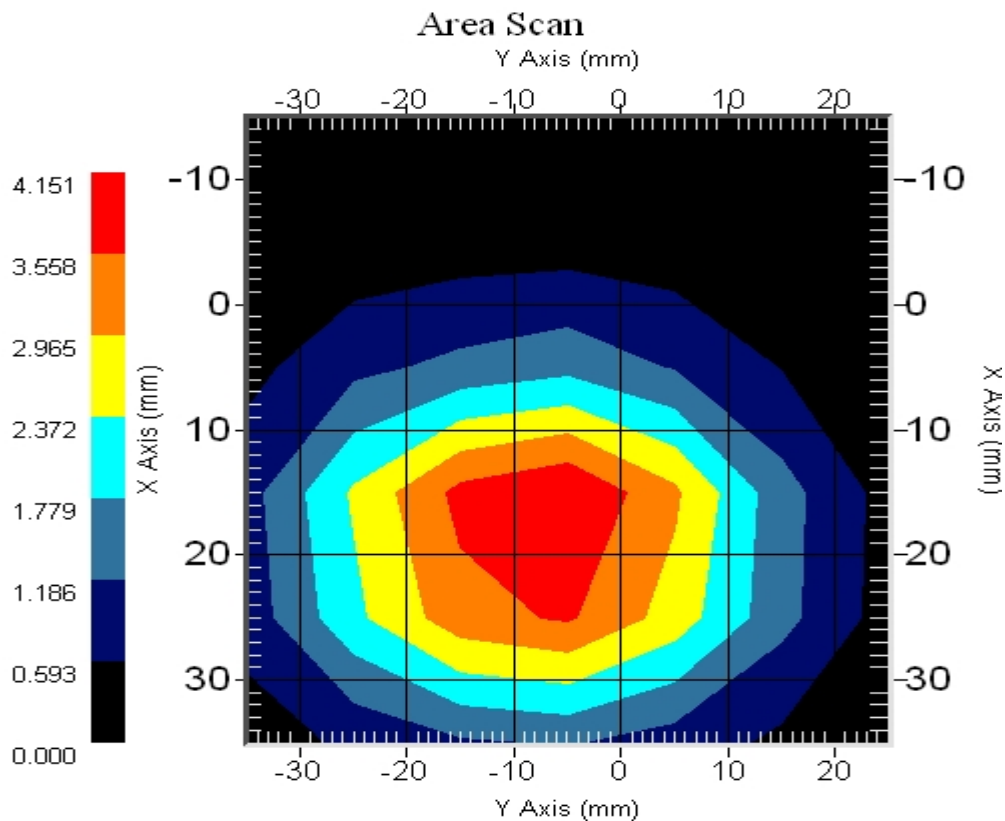
**Length:** 67.1 mm  
**Height:** 38.9 mm

### Electrical Specification

**SWR:** 1.09 U  
**Return Loss:** -27.6 dB  
**Impedance:** 54.3  $\Omega$

### System Validation Results

Frequency	1 Gram	10 Gram	Peak
1900 MHz	37.96	19.81	70.56



## **Introduction**

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 1900-210-00707. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

## **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"

## **Conditions**

Dipole 1900-210-00707 was client's.

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

**Temperature of the Tissue:** 20 °C +/- 0.5°C

## **Dipole Calibration Results**

### **Mechanical Verification**

<b>APREL Length</b>	<b>APREL Height</b>	<b>Measured Length</b>	<b>Measured Height</b>
68.0 mm	39.5 mm	67.1mm	38.9 mm

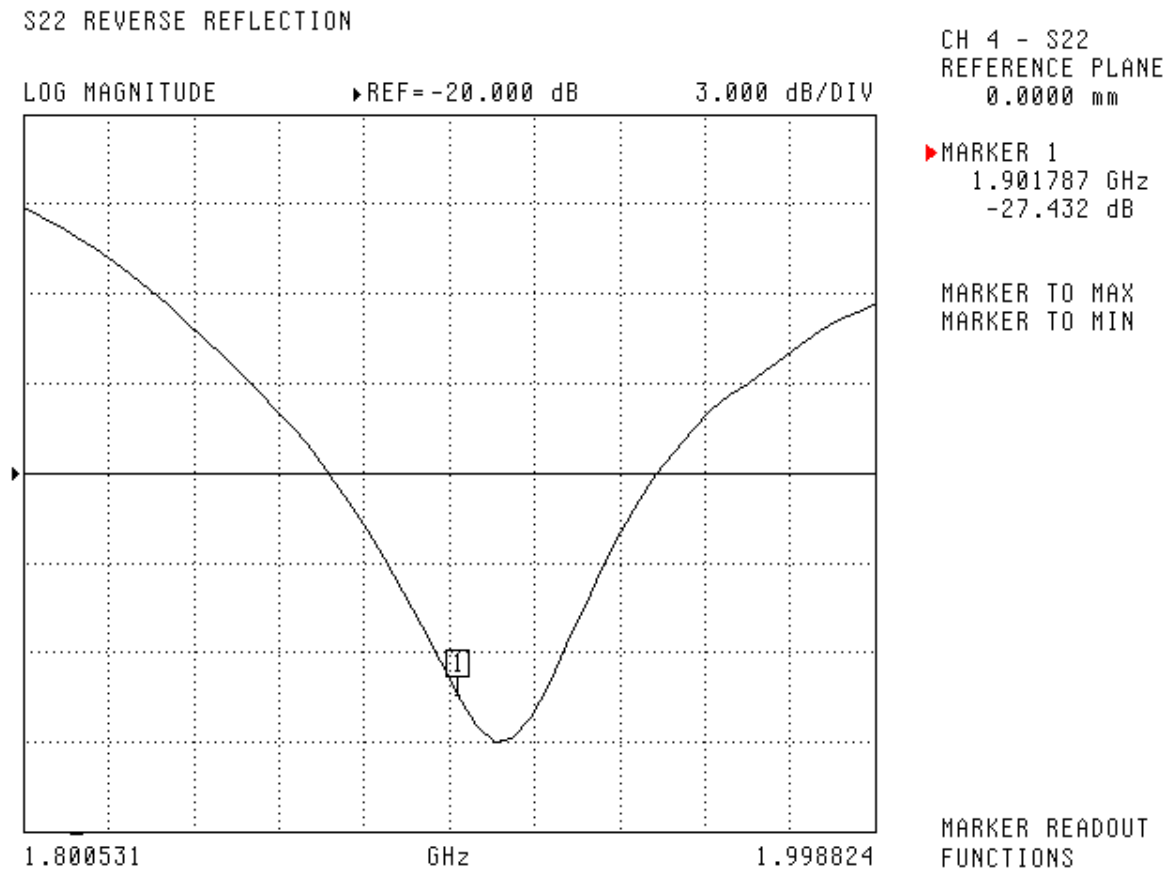
### **Tissue Validation**

<b>Head Tissue 1900 MHz</b>	<b>Measured</b>
<b>Dielectric constant, <math>\epsilon_r</math></b>	40.0
<b>Conductivity, <math>\sigma</math> [S/m]</b>	1.40

**Electrical Calibration**

Test	Result
S11 R/L	-27.6 dB
SWR	1.09 U
Impedance	54.3 $\Omega$

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

**S11 Parameter Return Loss**

## SWR

S22 REVERSE REFLECTION

SWR

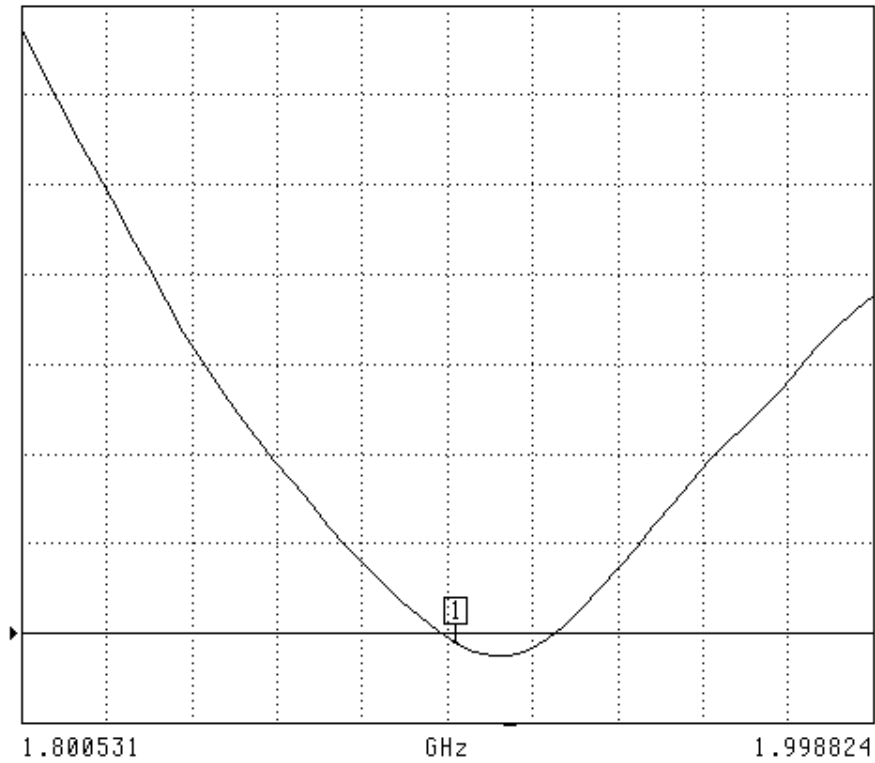
REF=1.100 U

100.000 mU/DIV

CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

▶ MARKER 1  
1.901787 GHz  
1.089 U

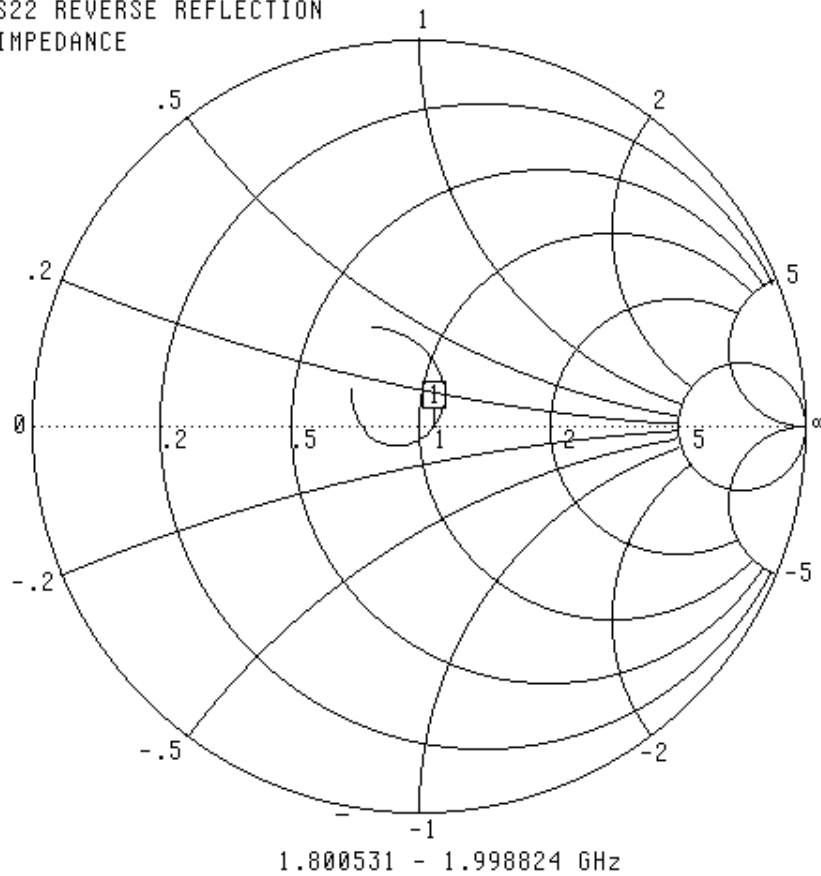
MARKER TO MAX  
MARKER TO MIN



MARKER READOUT  
FUNCTIONS

## Smith Chart Dipole Impedance

S22 REVERSE REFLECTION  
IMPEDANCE



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

▶ MARKER 1  
1.901787 GHz  
54.386  $\Omega$   
-636.363  $j\Omega$

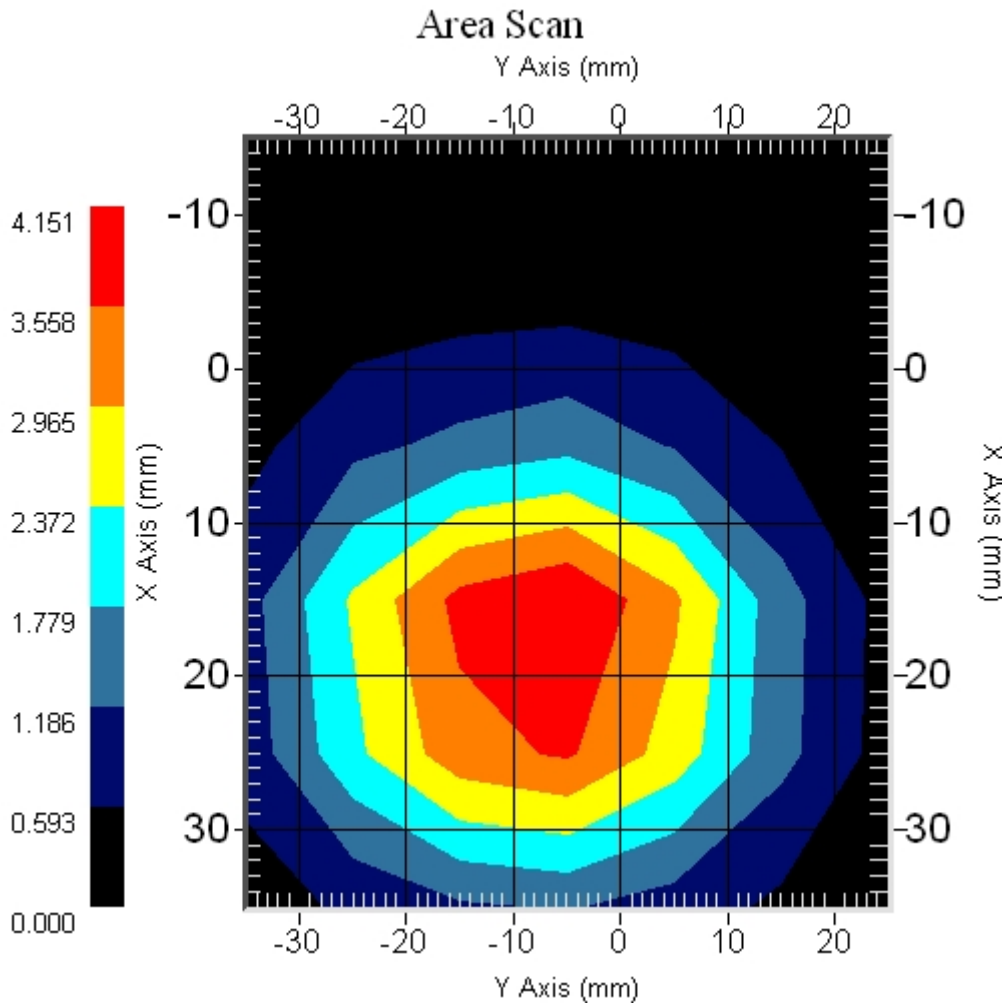
MARKER TO MAX  
MARKER TO MIN

MARKER READOUT  
FUNCTIONS



System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
1900 MHz	37.96	19.81	70.56



## **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