

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-737  
Project Number: QTKB-ALS-D-1900-5275

## 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.

QuieTek Validation Dipole

Manufacturer: APREL Laboratories

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

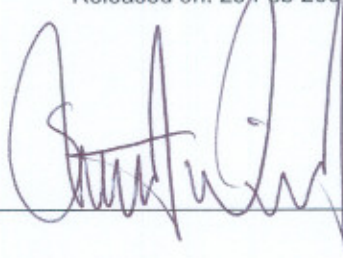
Frequency: 1900 MHz

Serial No: 1900-210-00703

Customer: QuieTek Corporation

Calibrated: 20 Feb 2007  
Released on: 23 Feb 2007

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



### **NCL** CALIBRATION LABORATORIES

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NEPEAN, ONTARIO  
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TEL: (613) 820-2730  
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**NCL Calibration Laboratories**

Division of APREL Laboratories.

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**Conditions**

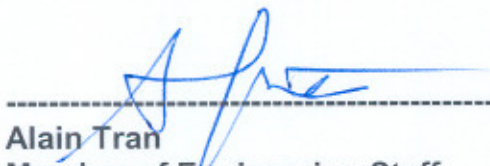
Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 21 °C +/- 0.5°C

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**  
Director Product Development



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**Alain Tran**  
Member of Engineering Staff  
(Calibration Engineer)

## Calibration Results Summary

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

### Mechanical Dimensions

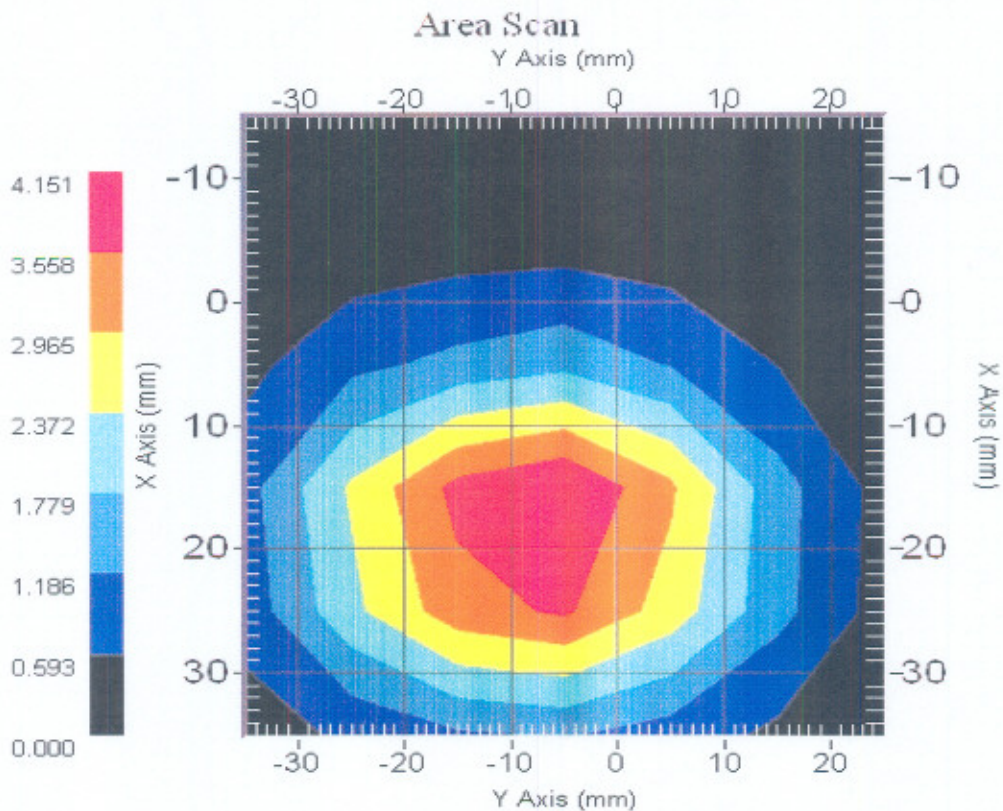
**Length:** 68.0 mm  
**Height:** 39.5 mm

### Electrical Specification

**Return Loss:** -29.23 dB  
**SWR:** 1.07 U  
**Impedance:** 49.99  $\Omega$

### 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 1900-210-00703. 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**

**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C  
**Temperature of the Tissue:** 20 °C +/- 0.5°C

## Dipole Calibration Results

### Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
68.0 mm	39.5 mm	68.7mm	40.0 mm

### Tissue Validation

Head Tissue 1900 MHz	Measured
Dielectric constant, $\epsilon_r$	40.0
Conductivity, $\sigma$ [S/m]	1.40

**Electrical Calibration**

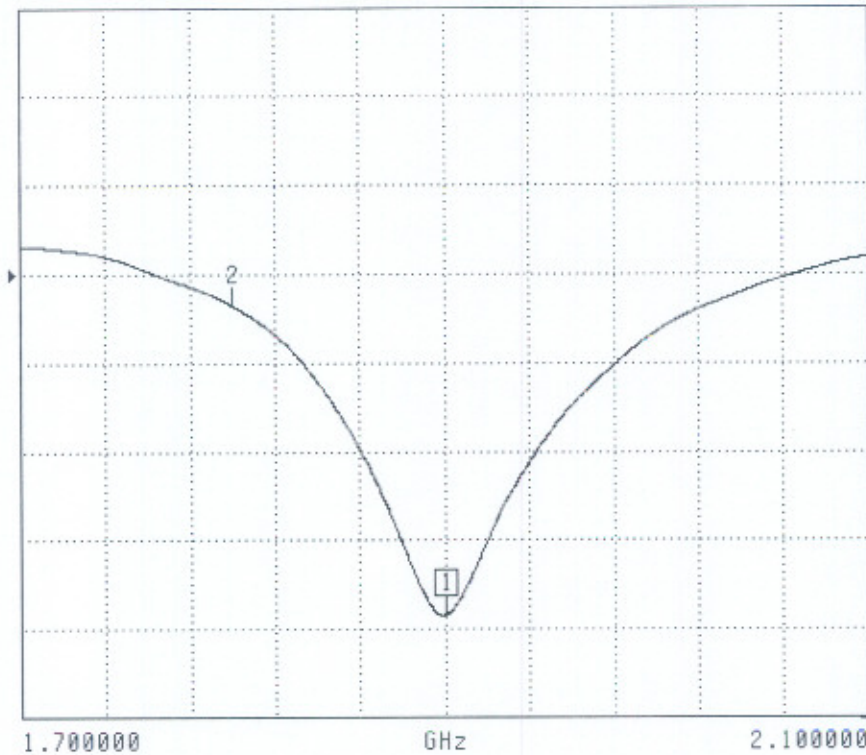
Test	Results
S11 R/L	-29.23 dB
SWR	1.07 U
Impedance	49.99 $\Omega$

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

**S11 Parameter Return Loss**

S11 FORWARD REFLECTION

LOG MAGNITUDE      ▶REF=-10.000 dB      5.000 dB/DIV



CH 1 - S11  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
1.900340 GHz  
-29.233 dB

MARKER TO MAX  
MARKER TO MIN

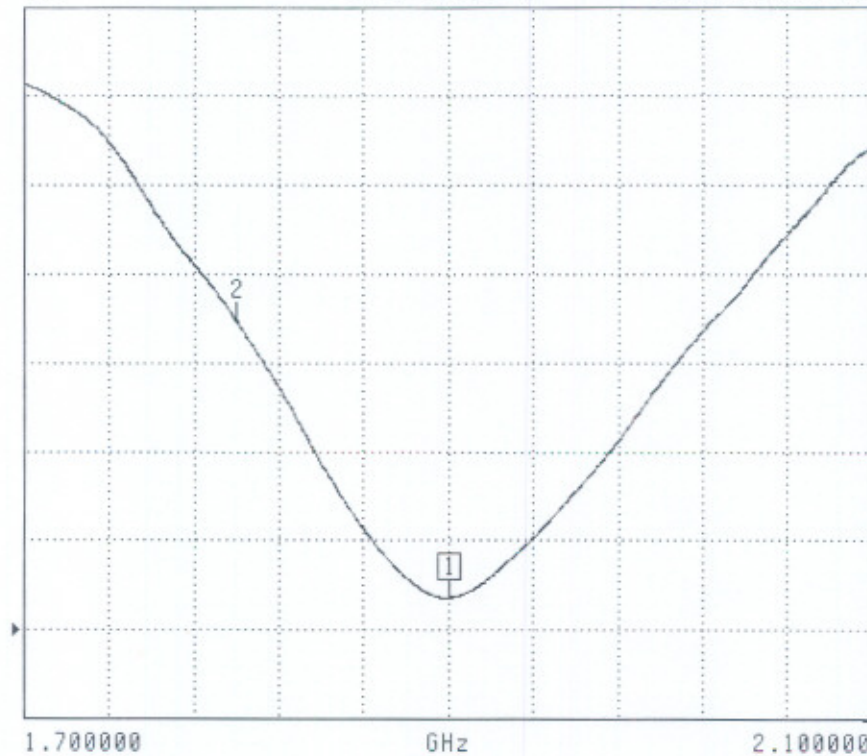
2 1.800044 GHz  
-11.767 dB

▶MARKER READOUT  
FUNCTIONS

SWR

S11 FORWARD REFLECTION

SWR      ▶ REF=1.000 U      200.000 mU/DIV



CH 1 - S11  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
1.900340 GHz  
1.072 U

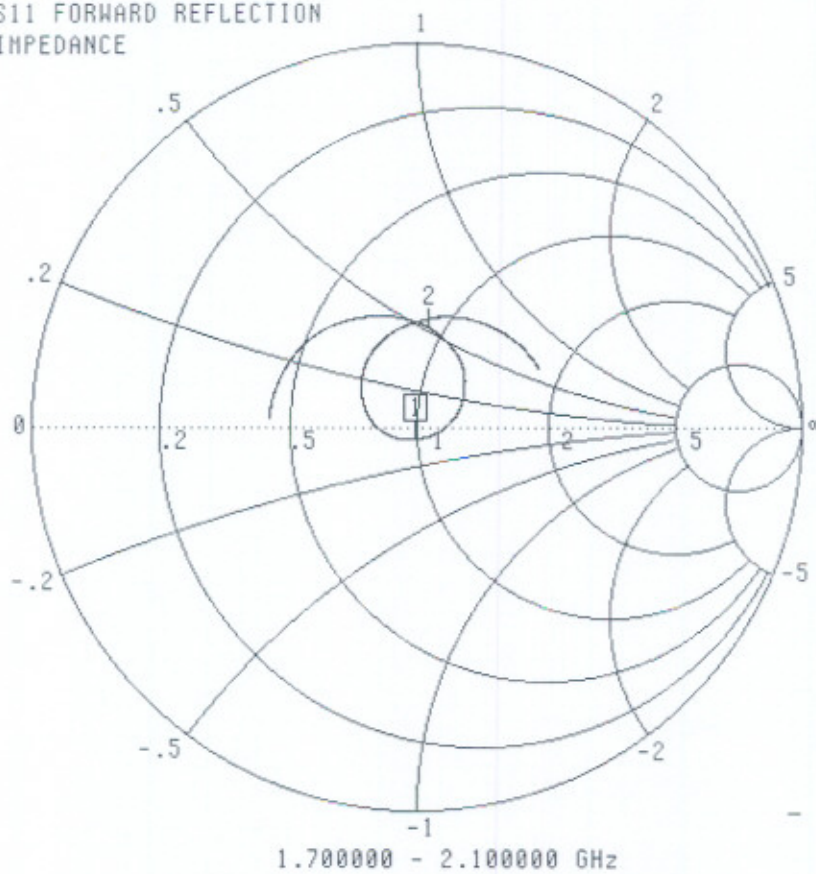
MARKER TO MAX  
MARKER TO MIN

2 1.800044 GHz  
1.695 U

▶ MARKER READOUT  
FUNCTIONS

### Smith Chart Dipole Impedance

S11 FORWARD REFLECTION  
IMPEDANCE



CH 1 - S11  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
1.900340 GHz  
49.992  $\Omega$   
-3.456  $j\Omega$

MARKER TO MAX  
MARKER TO MIN

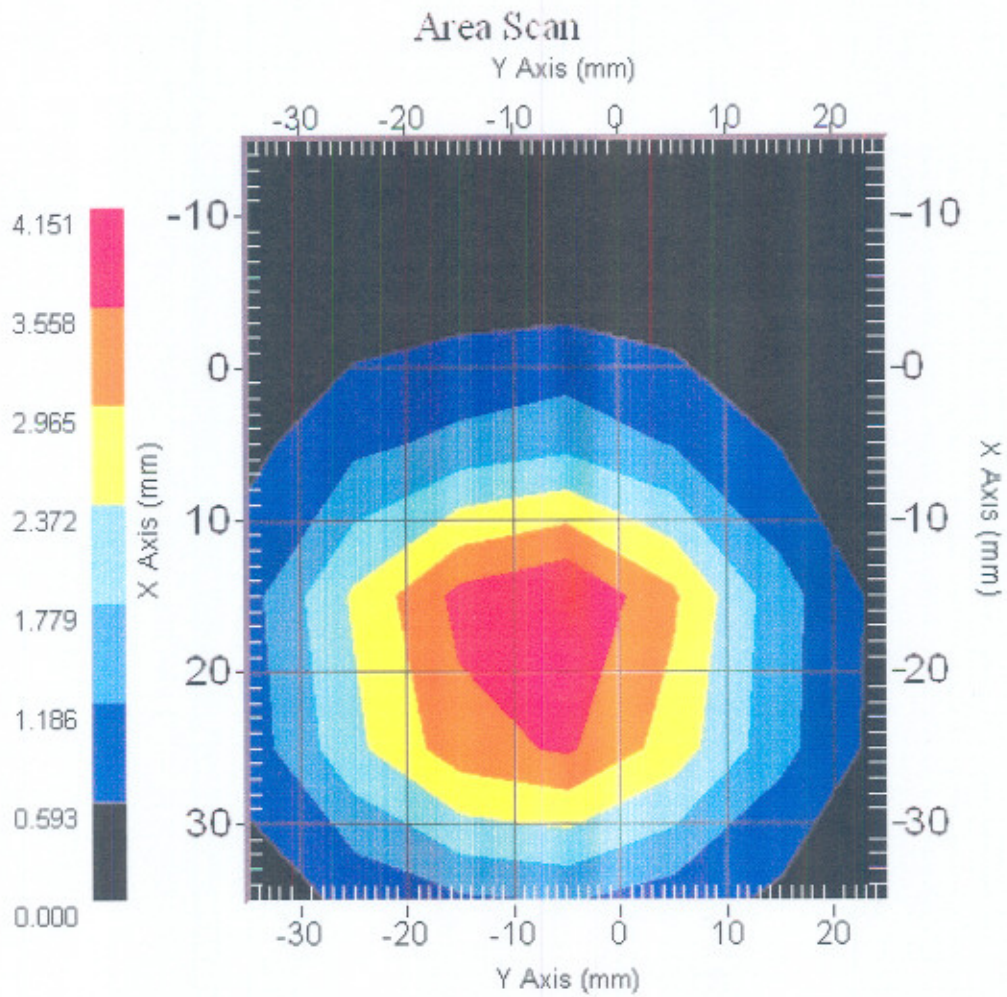
2 1.800044 GHz  
46.736  $\Omega$   
25.611  $j\Omega$

▶ 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



## **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 May 2006