



## **Appendix E. Dipole Calibration Data**

**Validation Dipole 1900MHz**

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

**S/N: QTK-318**

## NCL CALIBRATION LABORATORIES

Calibration File No: DC-408-1  
Project Number: QTKB-Dipole Cal-5230

# 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: 1.9 GHz

Serial No: QTK-318

Customer: Quietek

Calibrated: 15 June 2006  
Released on: 15 June 2006

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



## **NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
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## NCL Calibration Laboratories

Division of APREL Laboratories.

### Calibration Results Summary

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

#### Mechanical Dimensions

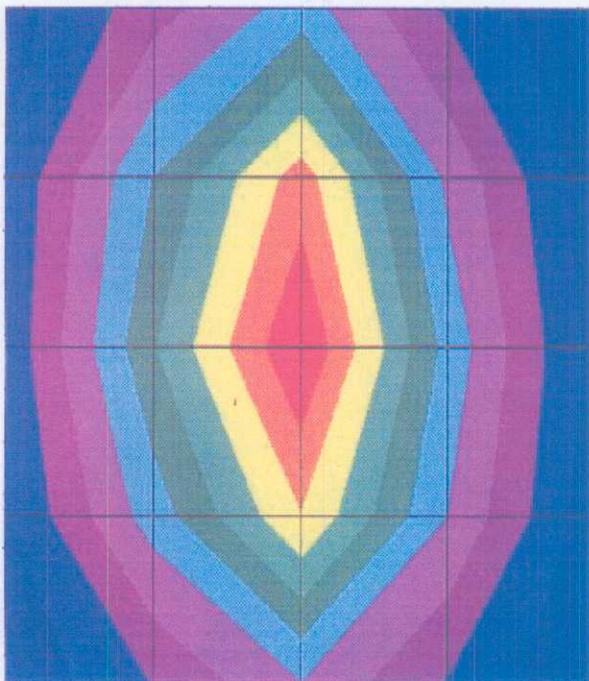
Length: 70.0 mm  
Height: 39.5 mm

#### Electrical Specification

SWR: 1.1 U  
Return Loss: -25.7 dB  
Impedance: 46.8  $\Omega$

#### System Validation Results

Frequency	1 Gram	10 Gram	Peak
1.9 GHz	36.0	20.78	67.7



## **NCL Calibration Laboratories**

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### **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 QTK-318. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the IEEE/APREL 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 QTK 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 QTK-318 was received for calibration.

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

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

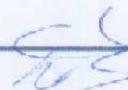
## Dipole Calibration Results

### Mechanical Verification

IEEE Length	IEEE Height	Measured Length	Measured Height
68.0 mm	39.5 mm	70.0 mm	39.5 mm

### Tissue Validation

Head Tissue 1900 MHz	Measured
Dielectric constant, $\epsilon_r$	39.9
Conductivity, $\sigma$ [S/m]	1.42



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**Electrical Calibration**

Test	Result
S11 R/L	-25.7 dB
SWR	1.1 U
Impedance	46.8 $\Omega$

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

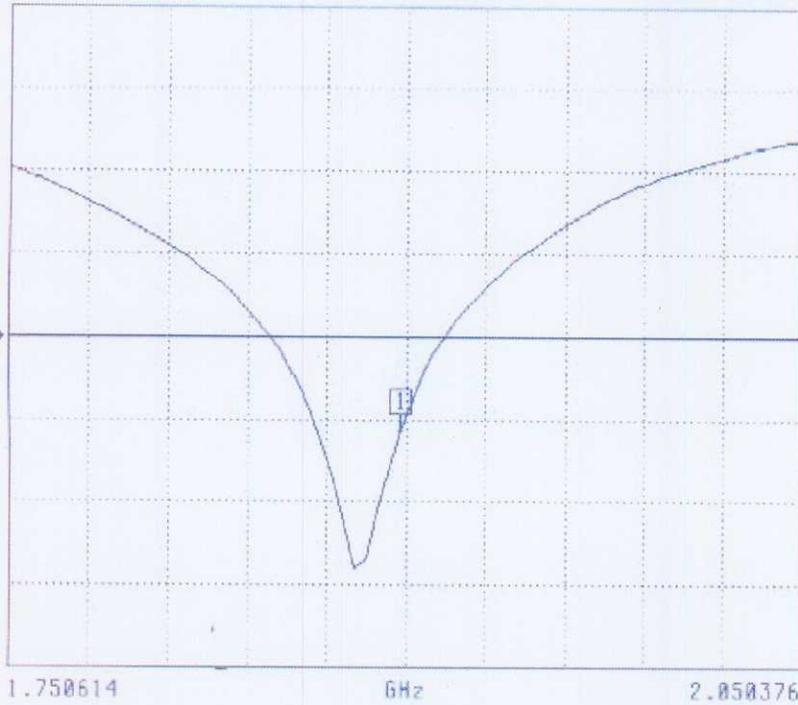
**S11 Parameter Return Loss**

S22 REVERSE REFLECTION

LOG MAGNITUDE

REF = -20.000 dB

5.000 dB/DIV



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
1.898384 GHz  
-25.740 dB

MARKER TO MAX  
MARKER TO MIN

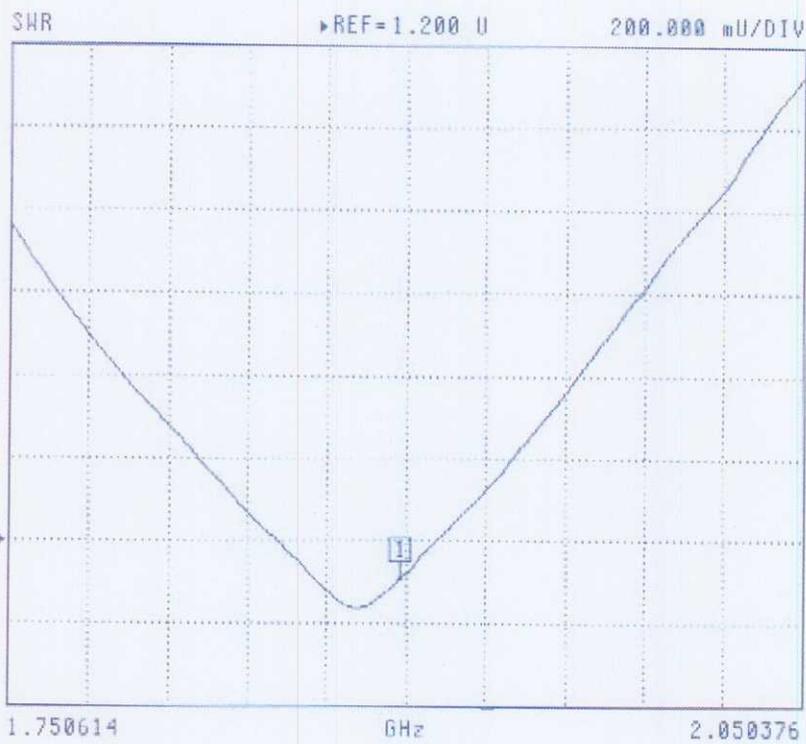
MARKER READOUT  
FUNCTIONS

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**SWR**

S22 REVERSE REFLECTION



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

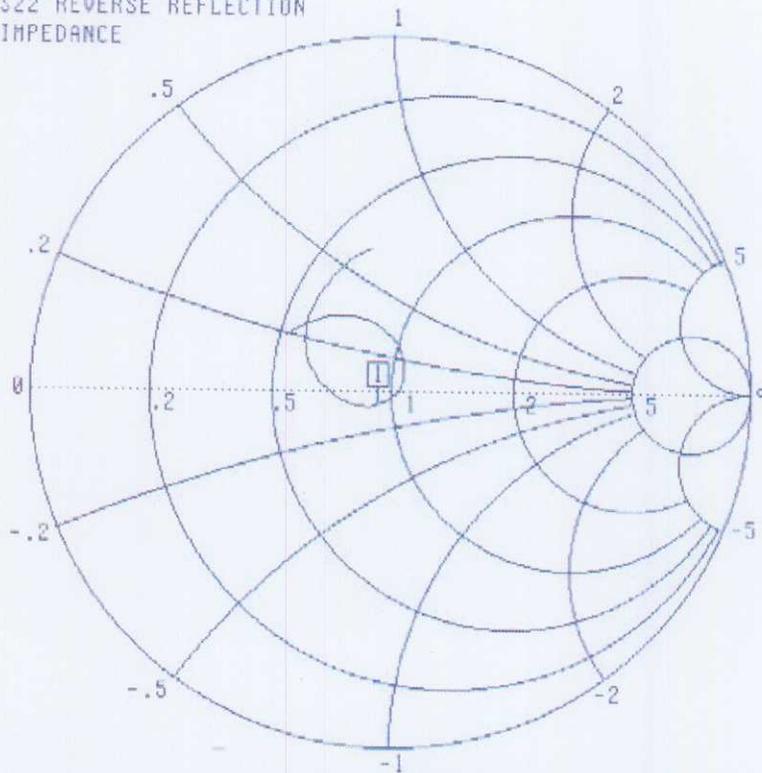
▶ MARKER 1  
1.898384 GHz  
1.106 U

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  
1.898384 GHz  
46.767 Ω  
-3.770 jΩ

MARKER TO MAX  
MARKER TO MIN

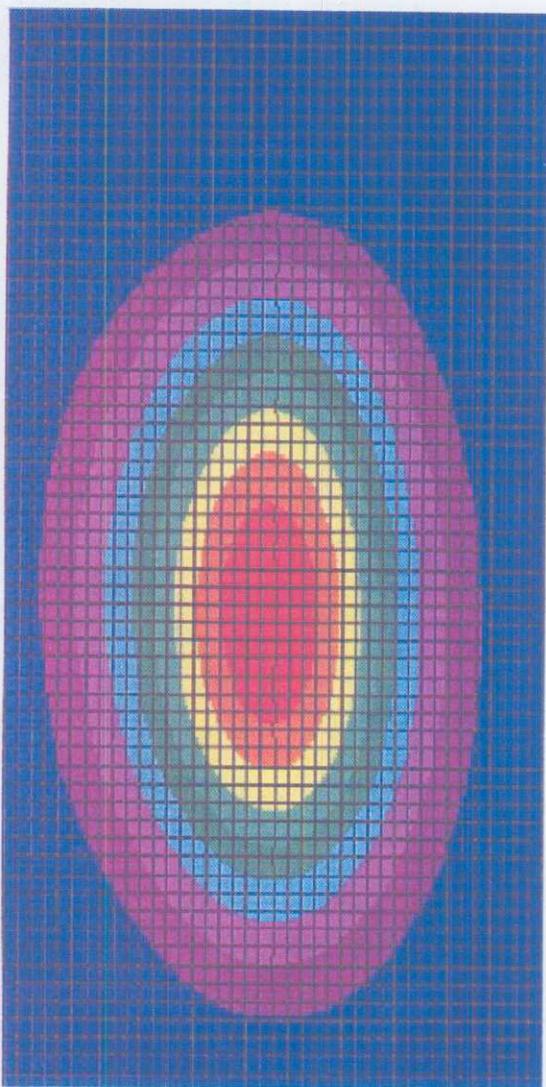
MARKER READOUT  
FUNCTIONS

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**System Validation Results Using the Electrically Calibrated Dipole**

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



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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

