

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-961  
Project Number: ISLB-D-2450S2-5416

## 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.

WISB Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-2450-S-2

Frequency: 2450 MHz

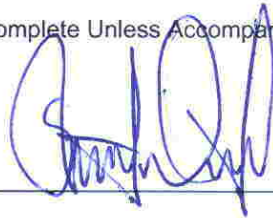
Serial No: 2450-220-00753

Customer: WISB

Calibrated: 3<sup>rd</sup> February 2009  
Released on: 5<sup>th</sup> February 2009

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

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



### **NCL** CALIBRATION LABORATORIES

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NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4162

## NCL Calibration Laboratories

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Division of APREL Laboratories.

### Conditions

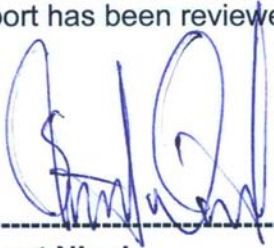
Dipole 2450-220-00753 was a re-calibration.

**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.**

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

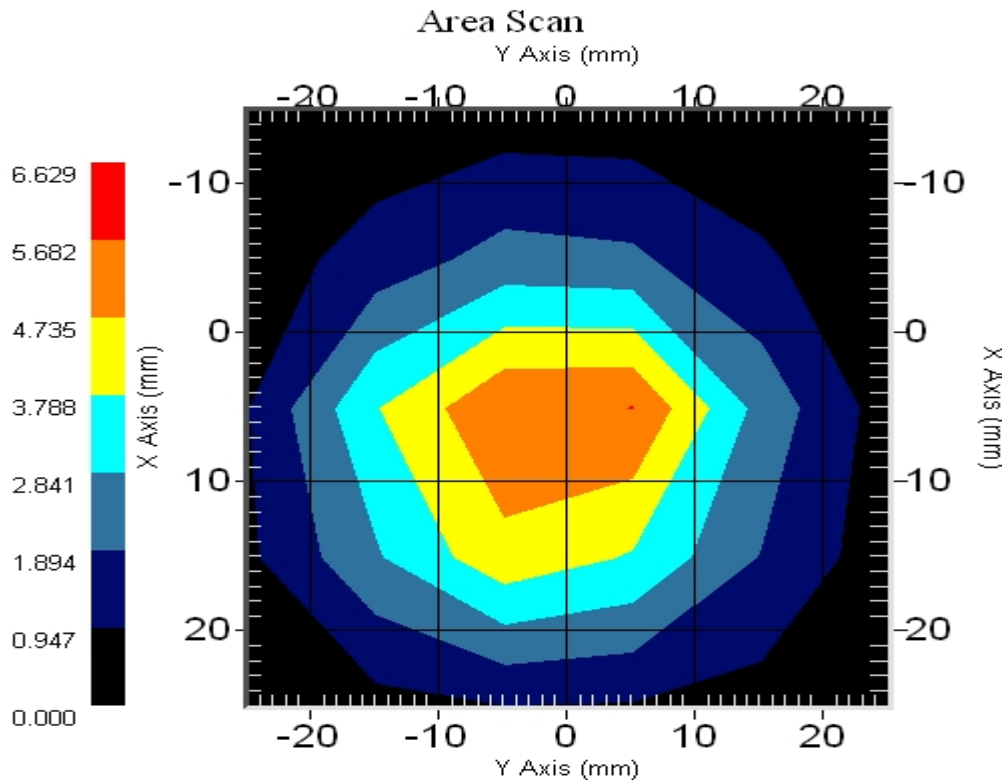
**Length:** 51.5 mm  
**Height:** 30.4 mm

### Electrical Specification

**SWR:** 1.01 U  
**Return Loss:** -45.3 dB  
**Impedance:** 50.6  $\Omega$

### System Validation Results

Frequency	1 Gram	10 Gram	Peak
2450 MHz	5.31	2.44	10.18



## **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 2450-220-00753. 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 2450-220-00753 was a re-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

<b>APREL Length</b>	<b>APREL Height</b>	<b>Measured Length</b>	<b>Measured Height</b>
51.5 mm	30.4 mm	52.1 mm	31.0 mm

### Tissue Validation

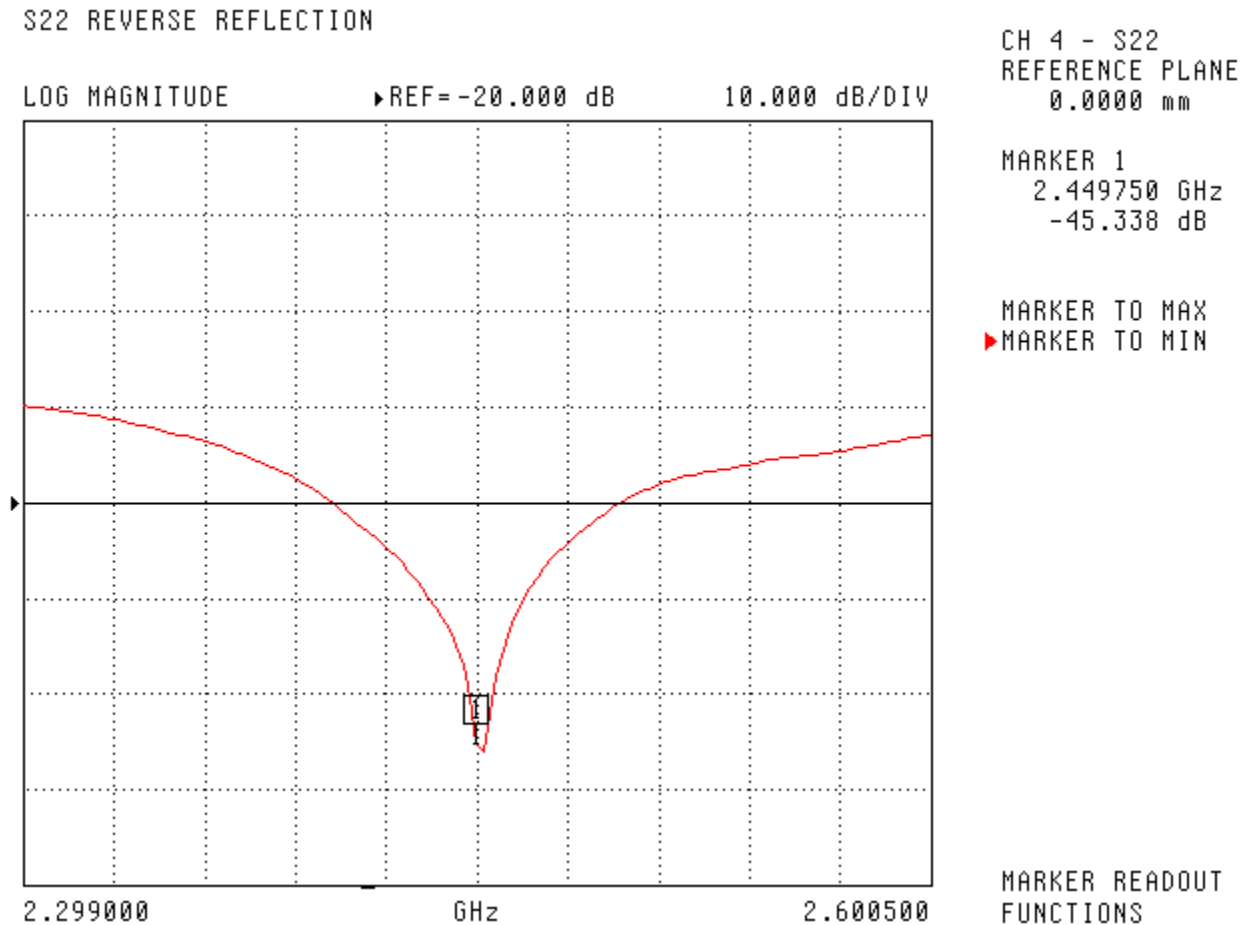
<b>Head Tissue 2450 MHz</b>	<b>Measured</b>
<b>Dielectric constant, <math>\epsilon_r</math></b>	39.8
<b>Conductivity, <math>\sigma</math> [S/m]</b>	1.88

**Electrical Calibration**

Test	Result
S11 R/L	-45.3 dB
SWR	1.01 U
Impedance	50.6 $\Omega$

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

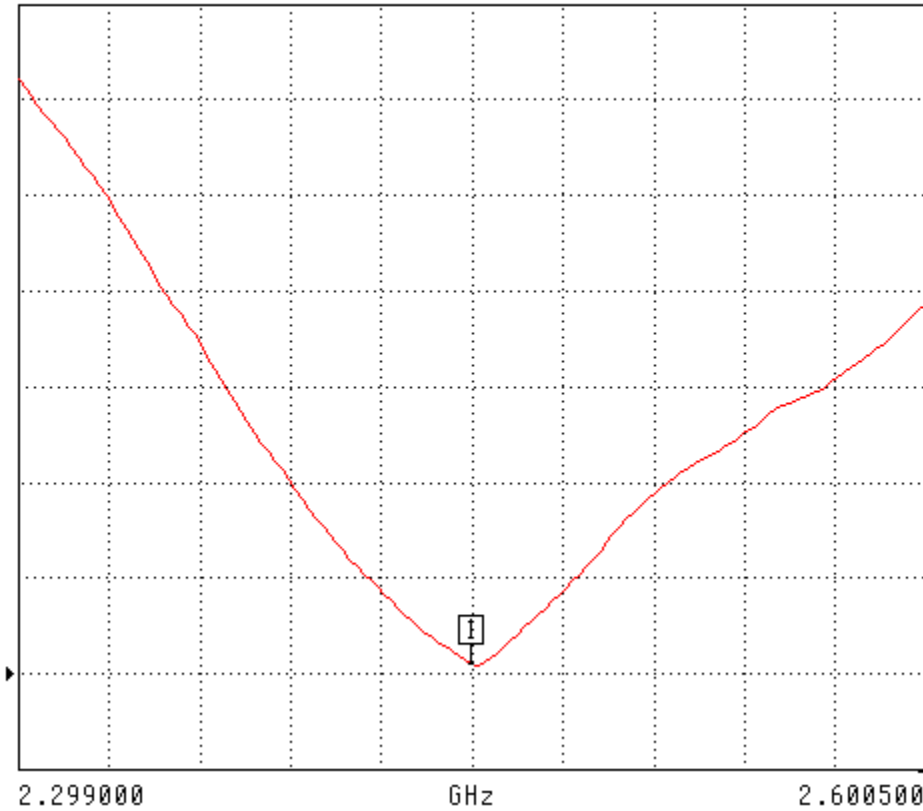
**S11 Parameter Return Loss**



SWR

S22 REVERSE REFLECTION

SWR                      ▶ REF= 1.000 U                      150.000 mU/DIV



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

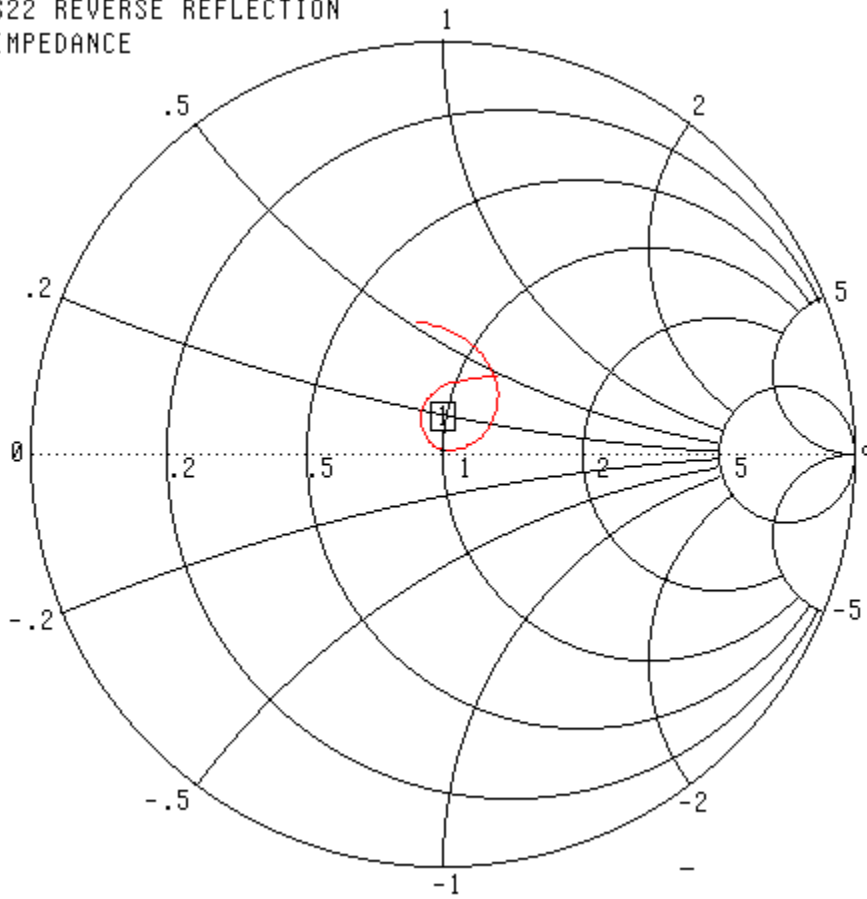
MARKER 1  
2.449750 GHz  
1.014 U

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  
2.449750 GHz  
50.609  $\Omega$   
602.944  $j\Omega$

MARKER TO MAX  
▶ MARKER TO MIN

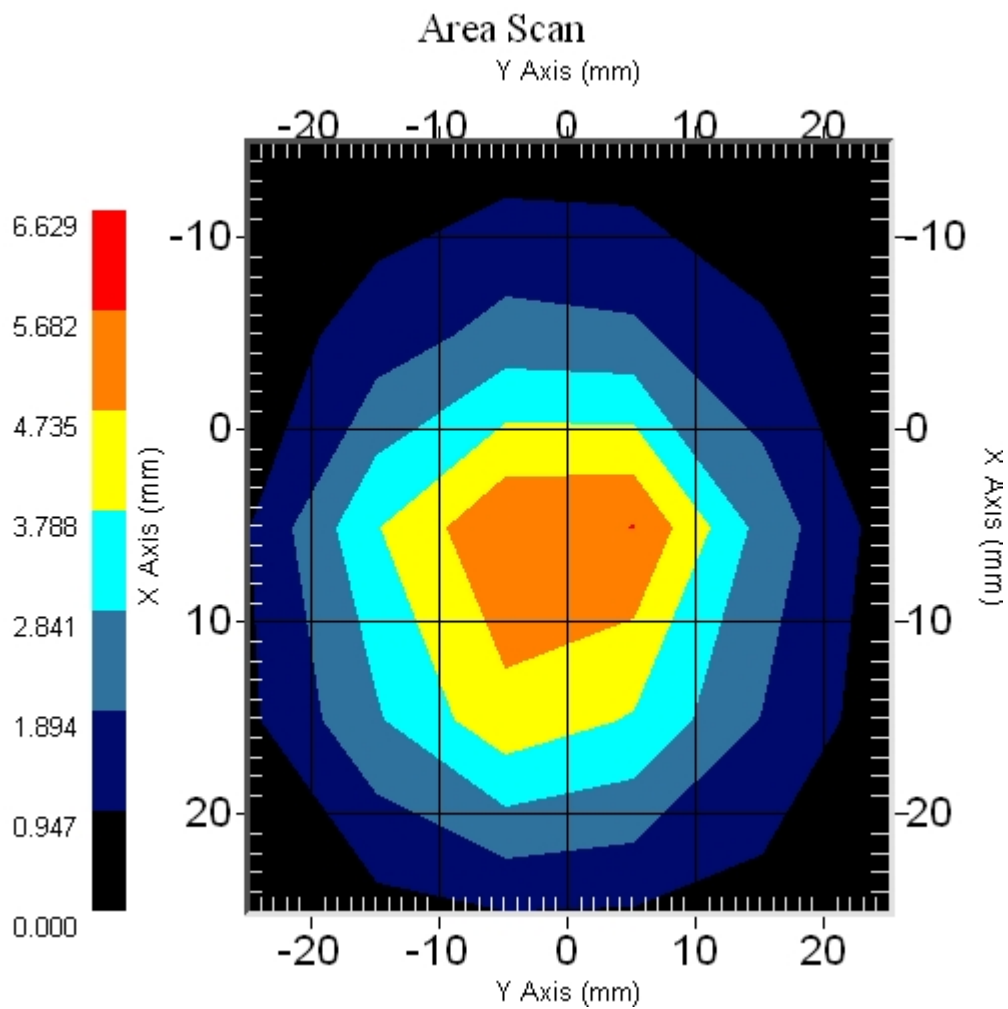
MARKER READOUT  
FUNCTIONS

2.299000 - 2.600500 GHz



System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
2450 MHz	5.31	2.44	10.18



## **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 2008.

**MEMO:** 13<sup>th</sup> May 2010  
**From:** Stuart Nicol  
**Title:** FCC Calibration KDB Notice 50824  
**To:** APREL Asia/SGL for ISL

To whom it may concern,

This memo is issued in support of the calibration performed by APREL Laboratories on behalf of ISL for the 2450MHz dipole serial number 2450-220-00753.

We have been asked to clarify the data included in calibration file number DC-961 project number ISLB-D-2450S2-5416 and provide further information in support of the data presented.

It has been stated that the calibration report as issued is not in line with the direction of the FCC document number 50824 Dipole SAR Validation Verification.

Having reviewed the claim that the certificate issued by APREL did not follow the direction of the FCC we would like to clarify the following.

- 1) The FCC released document number 50824 on 13<sup>th</sup> of November 2009, where the request has been made that the power being fed to the dipole must be included in the certificate and document issued.
- 2) The dipole was calibrated on the 3<sup>rd</sup> of February 2009 and at this time the FCC document had not been released.
- 3) The actual power feed to the dipole was 100mW which when scaled by the appropriate value of 10 would equate to the target values as described in IEEE-1528.

In line with FCC requirements all future dipole calibration certificates and documents will include the actual power being feed to the dipole.

In conclusion due to the issue date of the calibration certificate and the pursuant issue of the FCC document the certificate is valid and upon recalibration the expected data and format will be included in the applicable calibration documentation in line with FCC guidance.

APREL continue to monitor all FCC KDB's and guidance as and when they are announced including standards etc but we must state that it is the responsibility of the user to maintain compliance of their equipment to the requirements of any certification, government or regulatory body.

Thanks,



Stuart Nicol  
**APREL Laboratories**  
**Vice President**