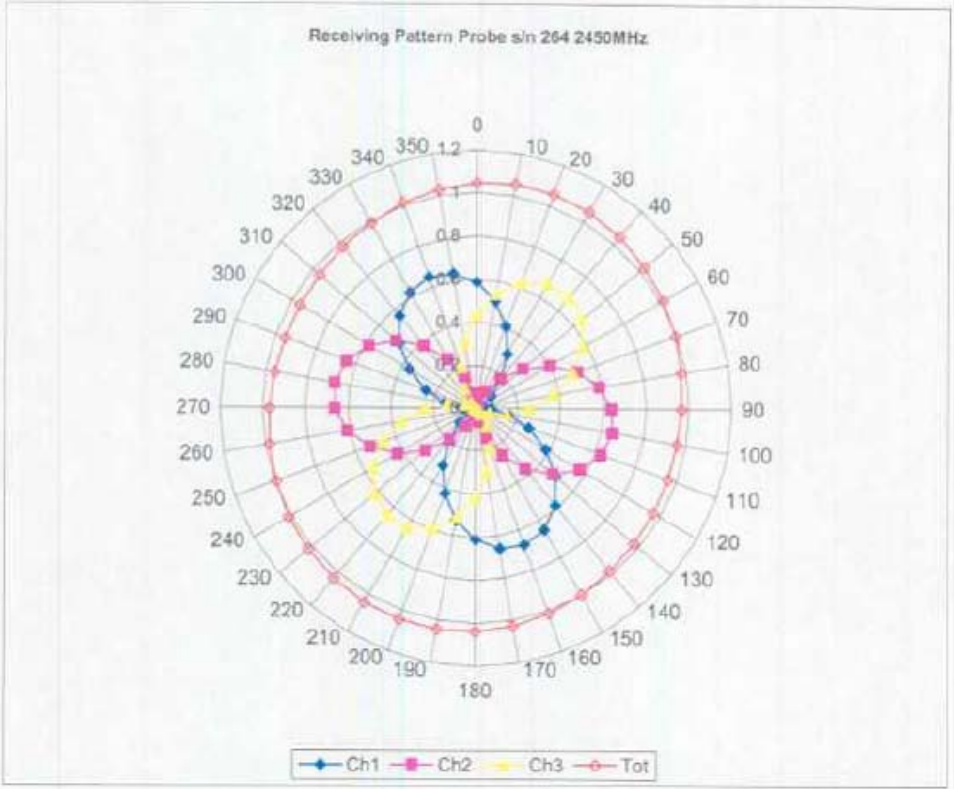
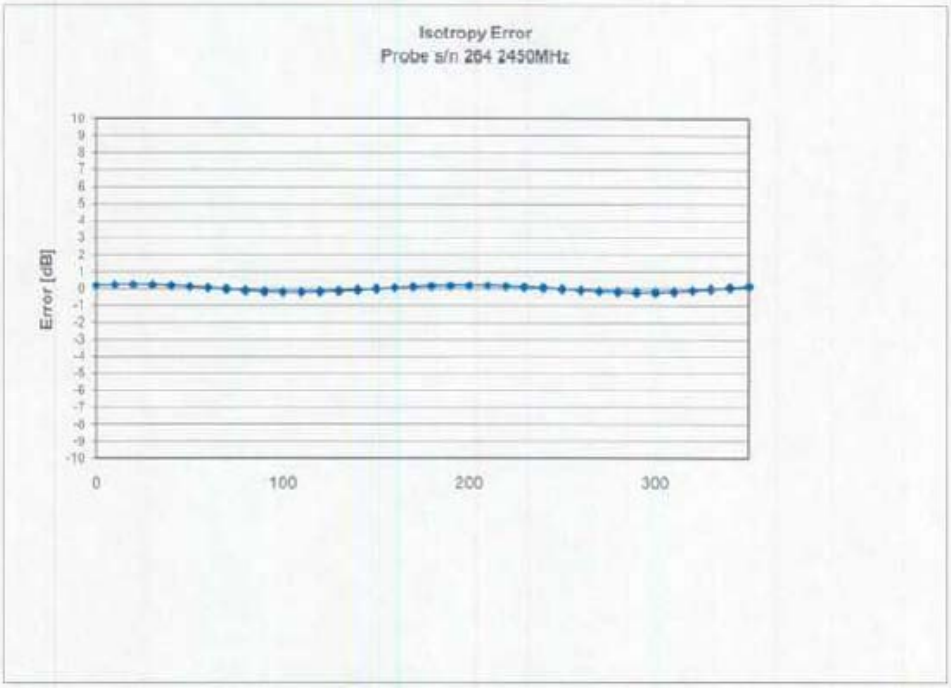
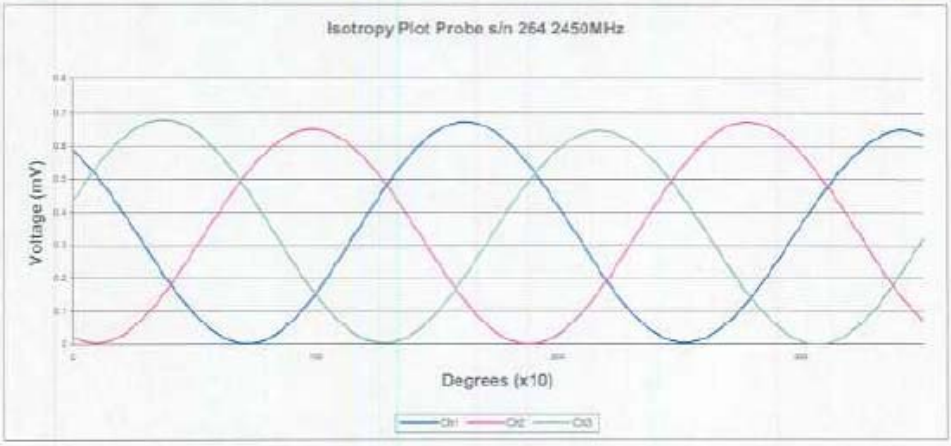
## Receiving Pattern 2450 MHz (Air)



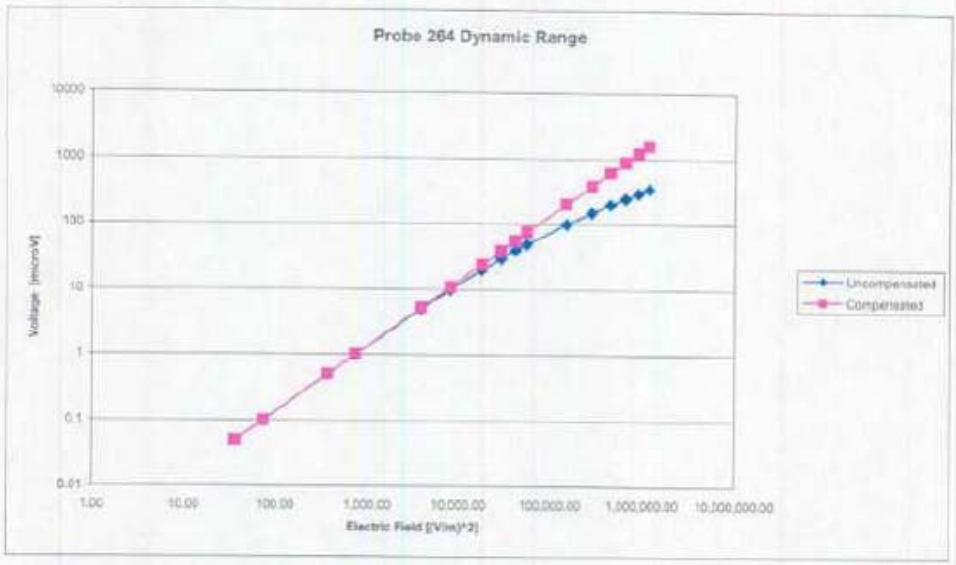
## Isotropy Error 2450 MHz (Air)




**Isotropicity in Tissue:** 0.10 dB

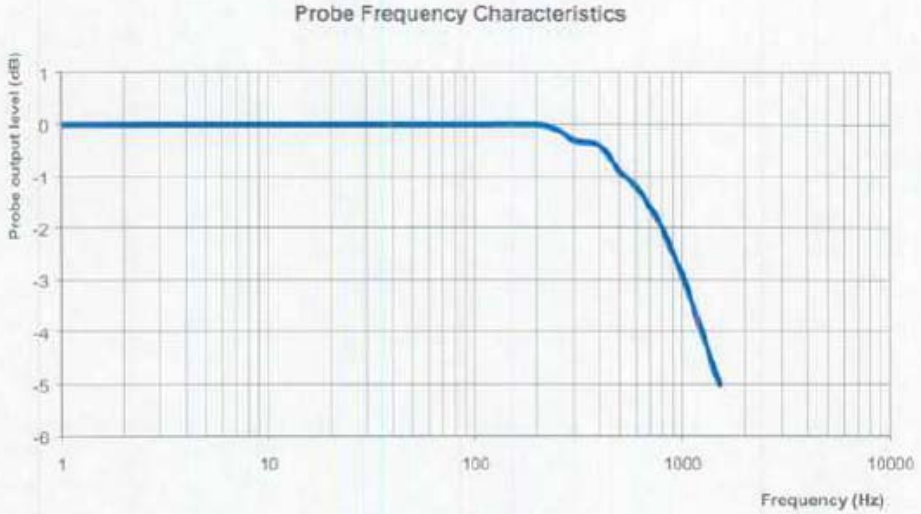
## Dynamic Range





This page has been reviewed for content and attested to on Page 2 of this document.

## Video Bandwidth




| | |
|---|---|
| **Video Bandwidth at 500 Hz** | 1 dB |
| **Video Bandwidth at 1000 Hz** | 3 dB |

## Conversion Factor Uncertainty Assessment

| | | | |
|---|---|---|---|
| **Frequency:** | | 2450MHz | |
| **Epsilon:** | 52.7 (+/-5%) | **Sigma:** | 1.95 S/m (+/-5%) |
| **ConvF** | | | |
| **Channel X:** | 5.2 | 7%(K=2) | |
| **Channel Y:** | 5.2 | 7%(K=2) | |
| **Channel Z:** | 5.2 | 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 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## 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.

QuieTek

# Appendix - Dipole Calibration

## Validation Dipole 2450MHz
## P/N: ALS-D-2450-S-2
## S/N: QTK-319

## NCL CALIBRATION LABORATORIES

Calibration File No: DC-409-1
Project Number: QTKB-Dipole Cal-5228

# 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-2450-S-2
Frequency: 2.45 GHz
Serial No: QTK-319

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
FAX: (613) 820-4161

## Calibration Results Summary

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

### Mechanical Dimensions

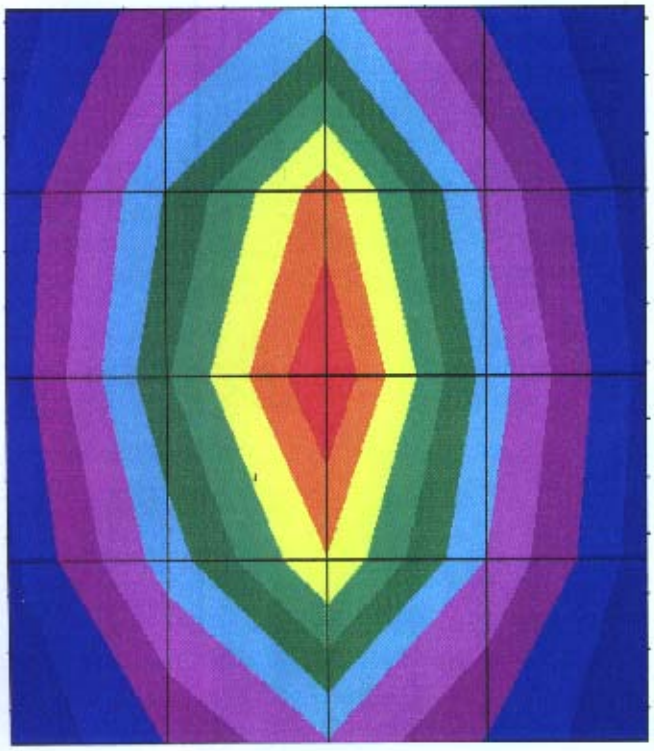
**Length:** 53.5 mm
**Height:** 30.4 mm

### Electrical Specification

**SWR:** 1.21 U
**Return Loss:** -20.7 dB
**Impedance:** 47.7 Ω

### System Validation Results

| Frequency | 1 Gram | 10 Gram | Peak |
|---|---|---|---|
| 2.45 GHz | 48.07 | 25.65 | 95.6 |





Calibrated by

Approved by:

## 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-319. 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-319 was received for calibration.

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


Calibrated by 
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# Dipole Calibration Results

## Mechanical Verification

| IEEE Length | IEEE Height | Measured Length | Measured Height |
|---|---|---|---|
| 51.5 mm | 30.4 mm | 53.5 mm | 30.4 mm |

## Tissue Validation

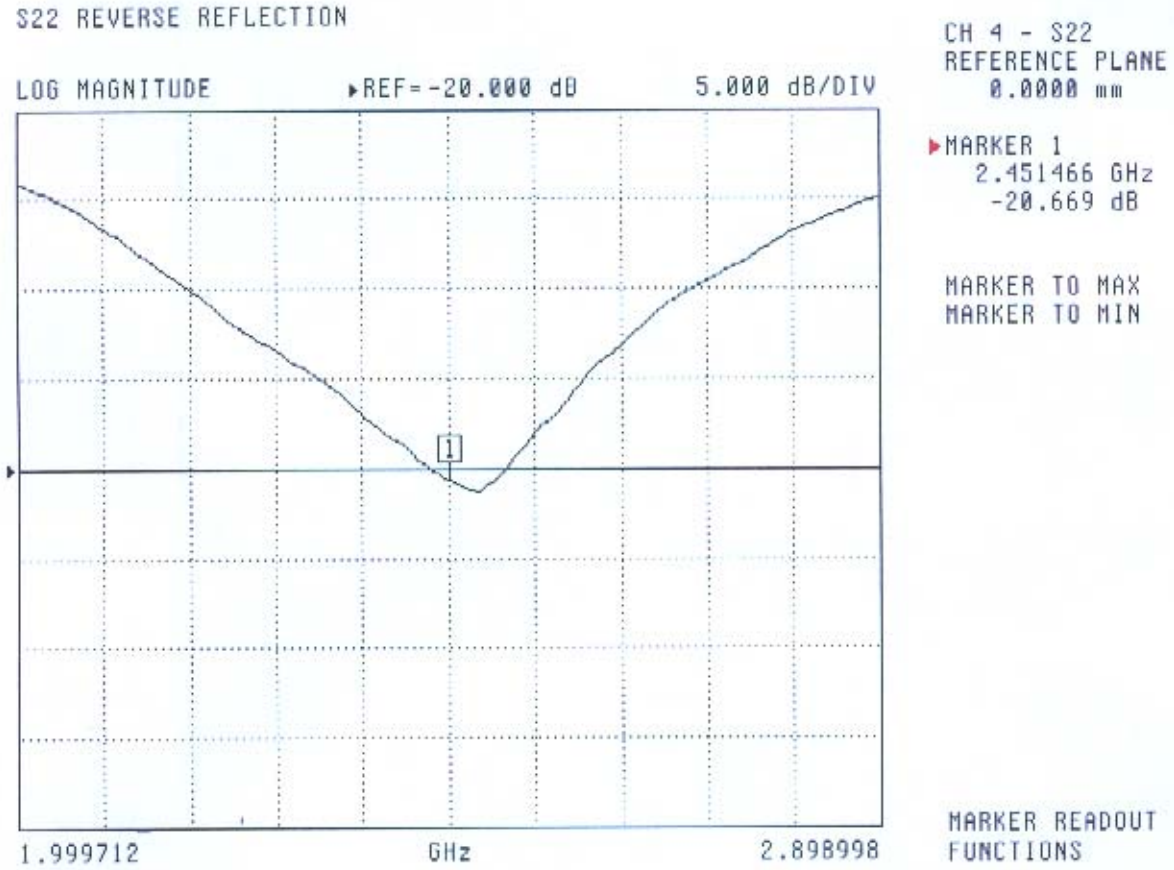
| Body Tissue 2450 MHz | Measured |
|---|---|
| Dielectric constant, $\varepsilon_r$ | 52.5 |
| Conductivity, $\sigma$ [S/m] | 1.78 |

## Electrical Calibration

| Test | Result |
|---|---|
| S11 R/L | -20.7 dB |
| SWR | 1.21 U |
| Impedance | 47.7 Ω |

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

### S11 Parameter Return Loss





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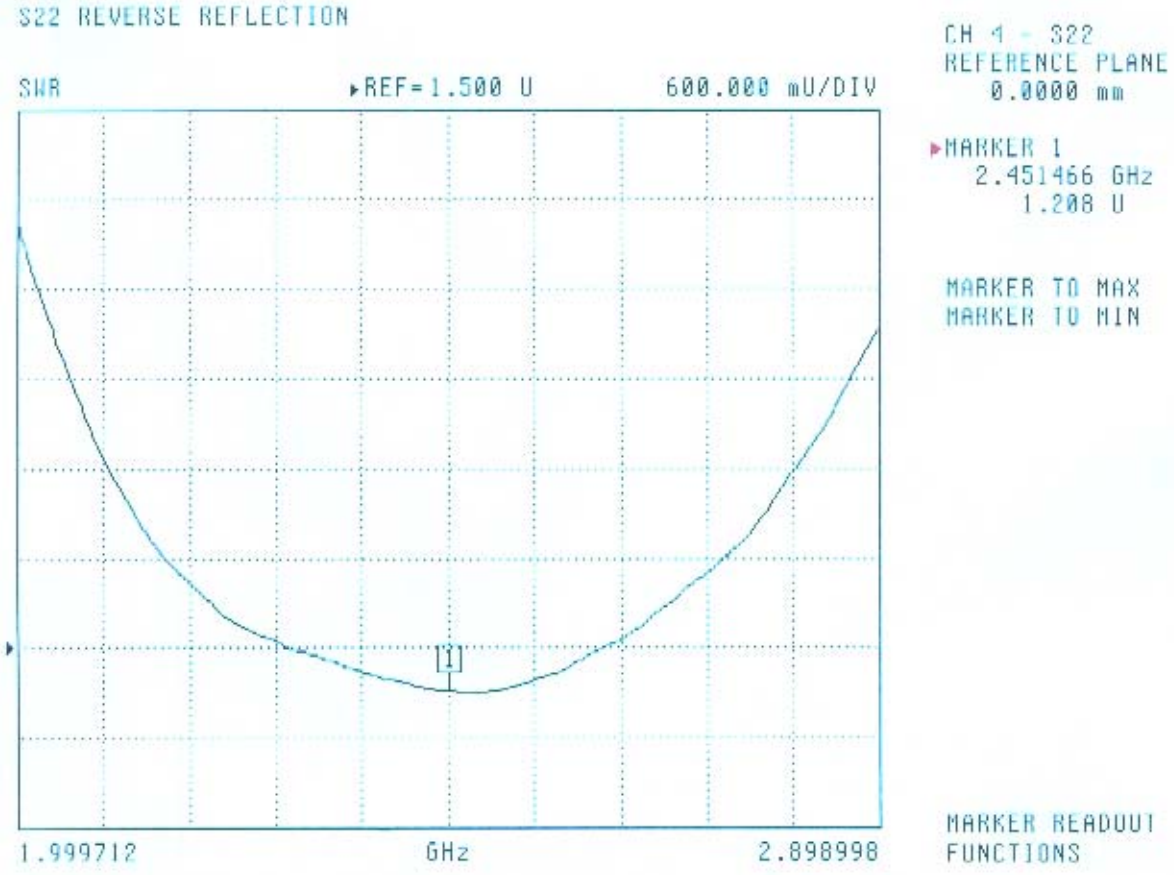
## SWR



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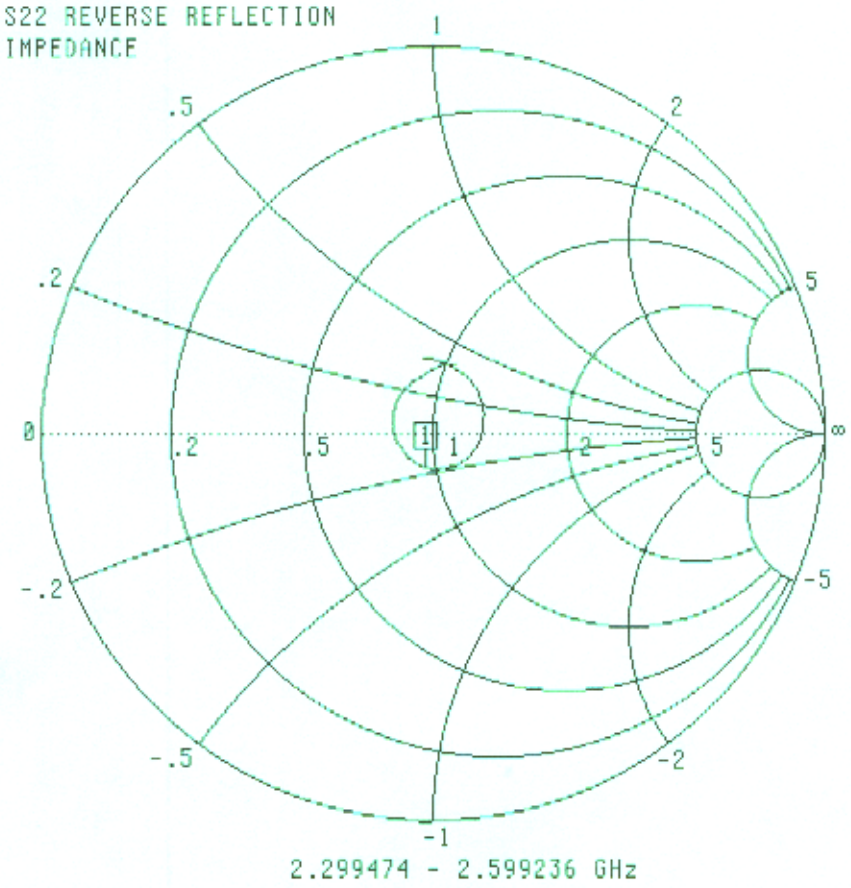
Approved by:

## Smith Chart Dipole Impedance




CH 4 - S22
REFERENCE PLANE
0.0000 mm

▸MARKER 1
2.451466 GHz
47.685 Ω
-8.809 jΩ

MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

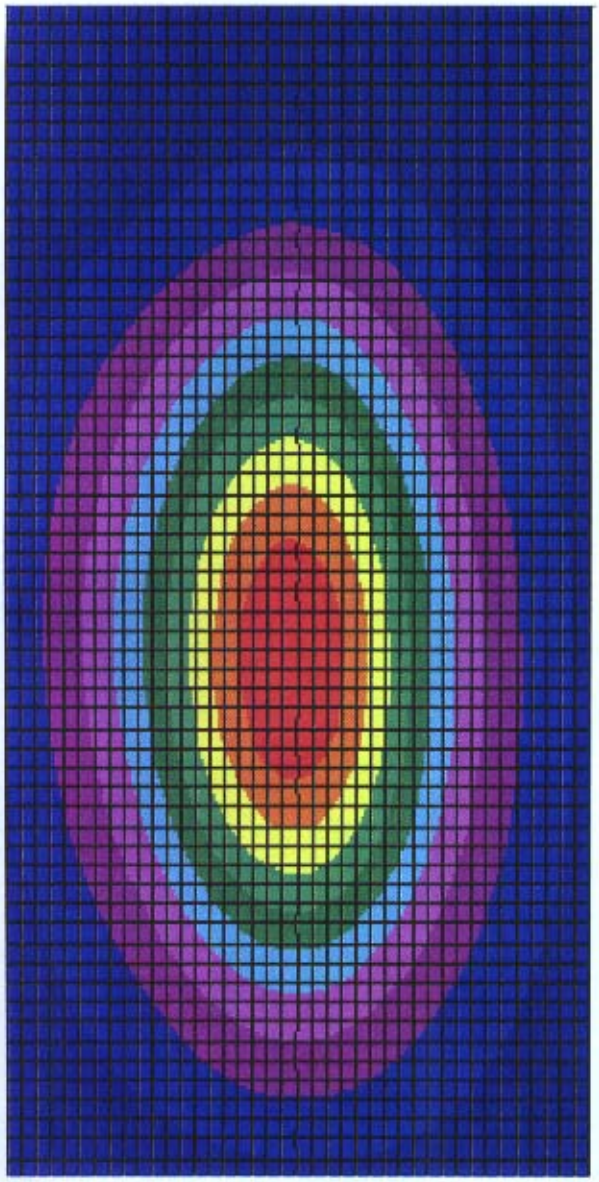


Calibrated by

Approved by:

## System Validation Results Using the Electrically Calibrated Dipole

| Frequency | 1 Gram | 10 Gram | Peak Above Feed Point |
|---|---|---|---|
| 2.45 GHz | 48.07 | 25.65 | 95.6 |





Calibrated by

Approved by:

## 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