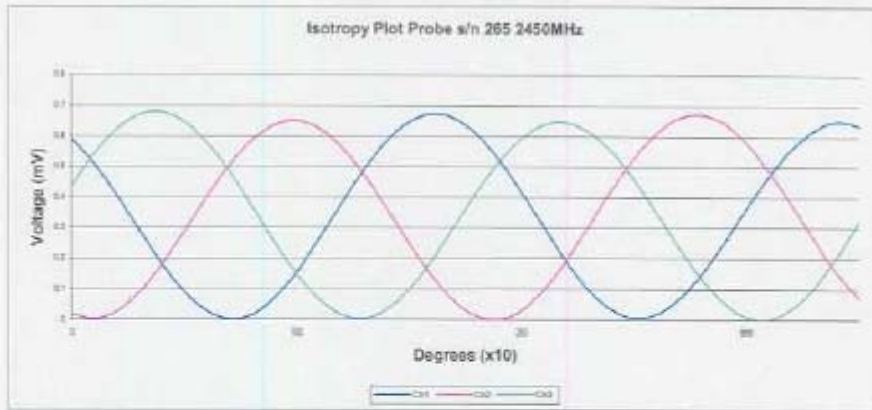
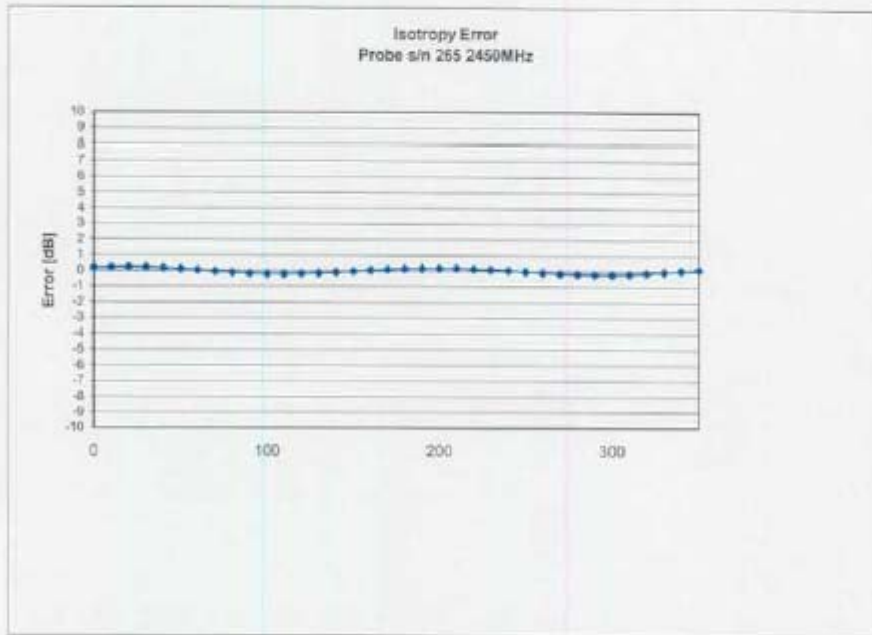


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Isotropy Error 2450 MHz (Air)

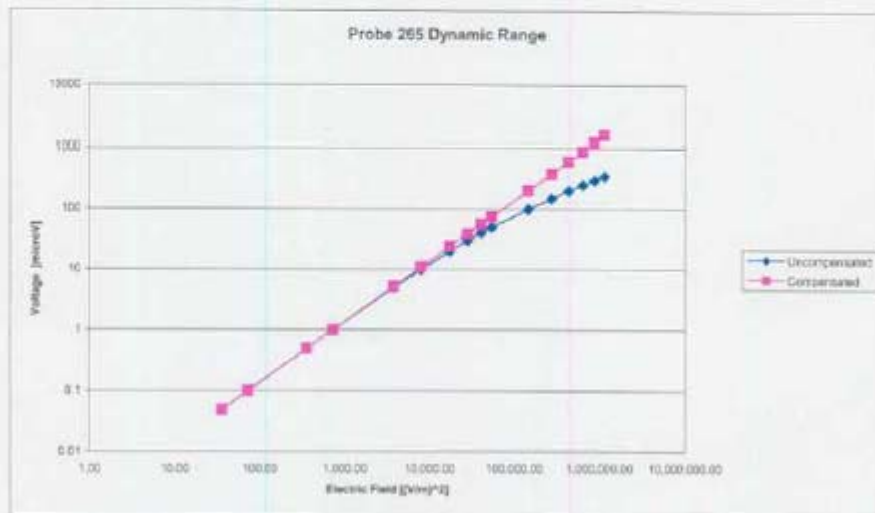


Isotropicity in Tissue: 0.10 dB

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

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Dynamic Range

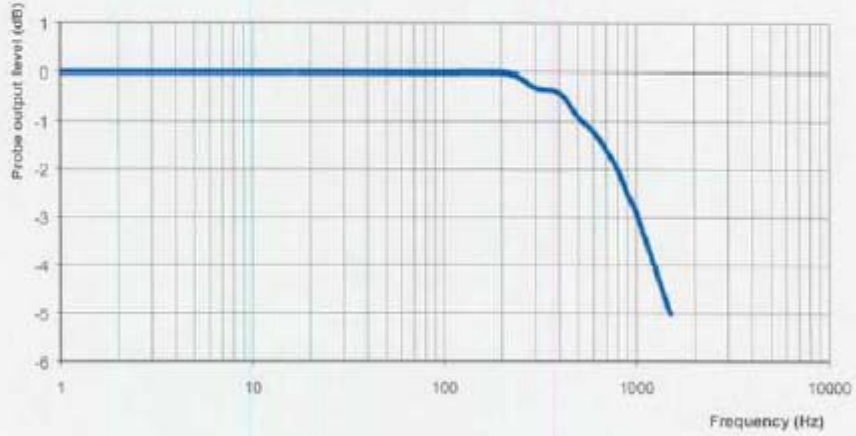


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Video Bandwidth

Probe Frequency Characteristics



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1000 Hz 3 dB

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Conversion Factor Uncertainty Assessment

Frequency: 2450MHz
 Epsilon: 52.7 (+/-5%) Sigma: 1.95 S/m (+/-5%)

ConvF

Channel X: 4.7 7%(K=2)
 Channel Y: 4.7 7%(K=2)
 Channel Z: 4.7 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%.

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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 May 2004.

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Dipole Calibration

NCL CALIBRATION LABORATORIES

Calibration File No: DC-409
Project Number: QTKB-ALSAS-10U-5050

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

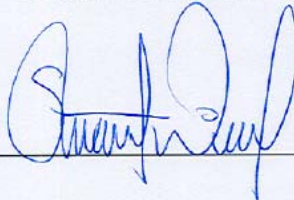
Frequency: 2.45 GHz

Serial No: QTK-319

Customer: Quietek

Calibrated: 23 June 2004
Released on: 23 June 2004

Released By: _____



NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4181

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Calibration Results Summary

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

Mechanical Dimensions

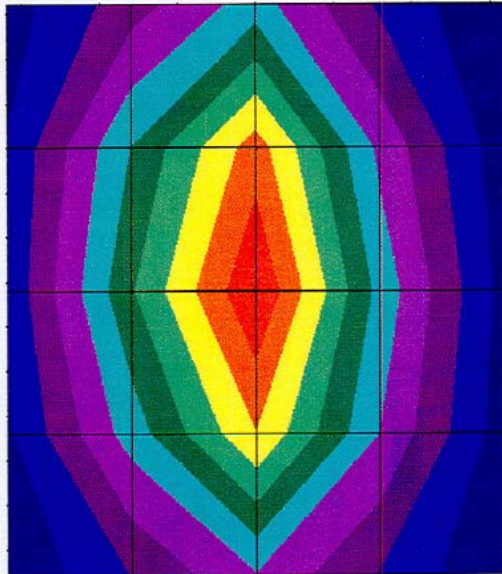
Length: 53.5 mm
Height: 30.4 mm

Electrical Specification

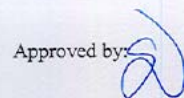
SWR: 1.19 U
Return Loss: -20.8 dB
Impedance: 49.4 Ω

System Validation Results

Frequency	1 Gram	10 Gram	Peak
2.45 GHz	48.07	25.65	95.6



Calibrated by 

Approved by 

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-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 new taken from stock.

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

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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, ϵ_r	52.5
Conductivity, σ [S/m]	1.78

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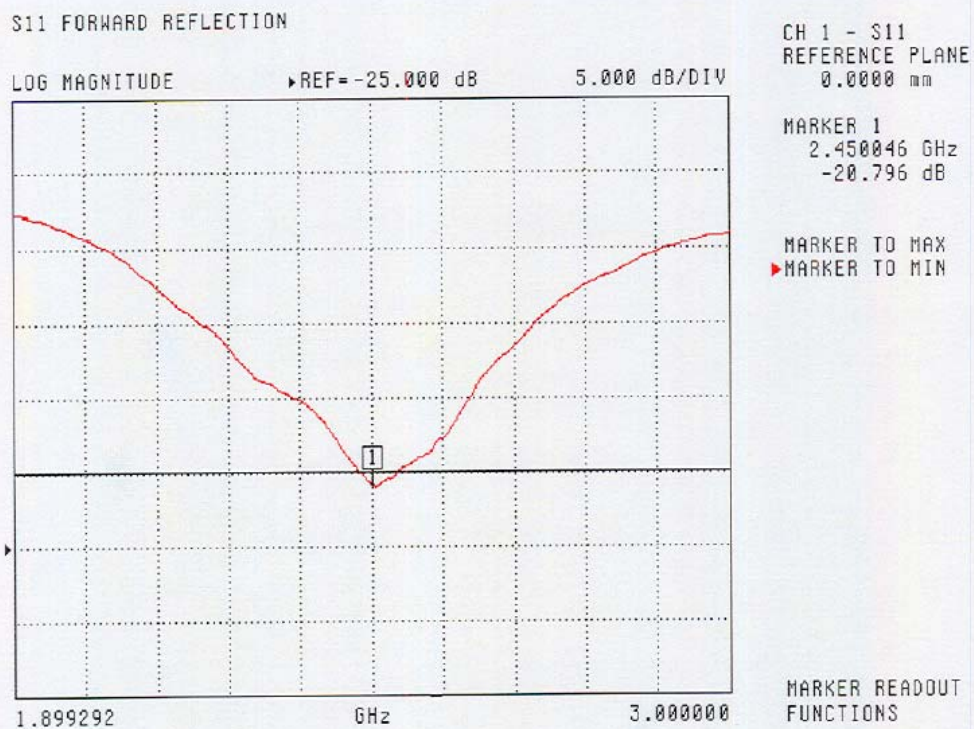
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Electrical Calibration

Test	Result
S11 R/L	-20.8 dB
SWR	1.2 U
Impedance	49.4 Ω

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

S11 Parameter Return Loss



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SWR

S11 FORWARD REFLECTION

SWR REF=500.000 mU 1.000 U/DIV



CH 1 - S11
REFERENCE PLANE
0.0000 mm

MARKER 1
2.45046 GHz
1.199 U

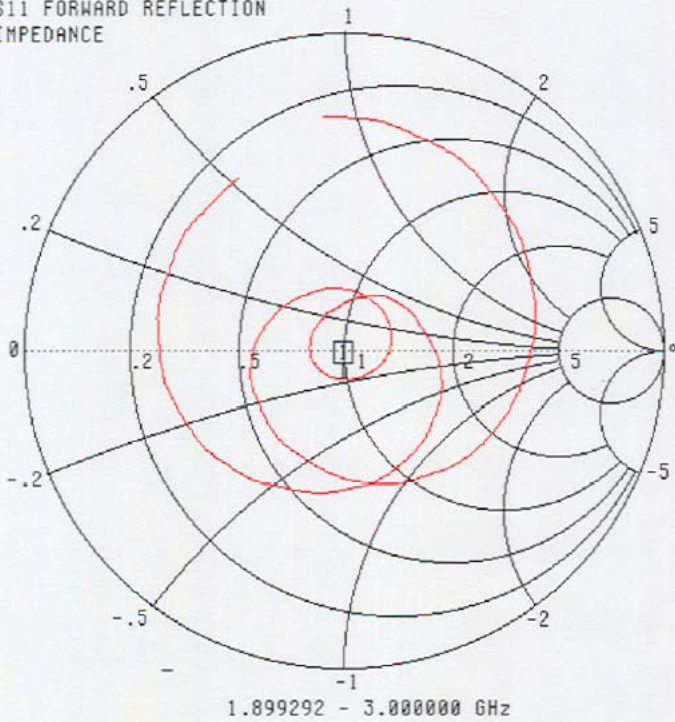
MARKER TO MAX
▶ MARKER TO MIN

MARKER READOUT
FUNCTIONS

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Smith Chart Dipole Impedance

S11 FORWARD REFLECTION
IMPEDANCE



CH 1 - S11
REFERENCE PLANE
0.0000 mm

MARKER 1
2.450046 GHz
49.365 Ω
-9.232 $j\Omega$

MARKER TO MAX
▶ MARKER TO MIN

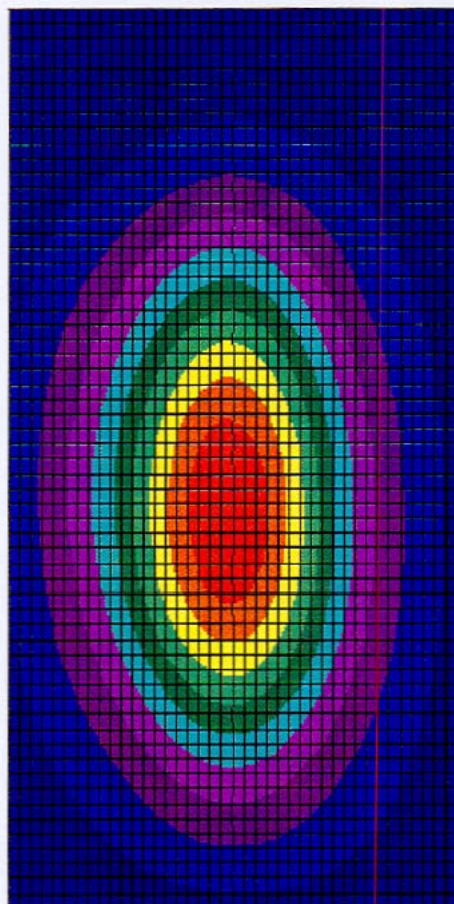
MARKER READOUT
FUNCTIONS

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System Validation Results Using the Electrically Calibrated Dipole

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



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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 May 2003