

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-315. 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-315 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 |
|-------------|-------------|-----------------|-----------------|
| 161.0 mm | 89.8 mm | 165.0 mm | 90.0 mm |

Tissue Validation

| Head Tissue 835 MHz | Measured |
|-----------------------------------|----------|
| Dielectric constant, ϵ_r | 42.54 |
| Conductivity, σ [S/m] | 0.91 |

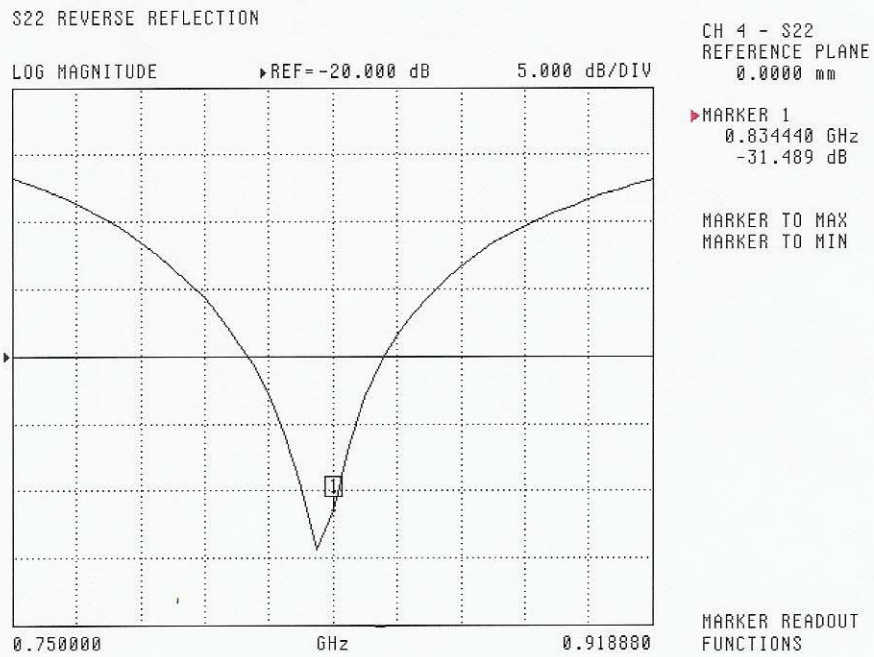


Electrical Calibration

| Test | Result |
|-----------|---------------|
| S11 R/L | -31.5 dB |
| SWR | 1.06 U |
| Impedance | 47.6 Ω |

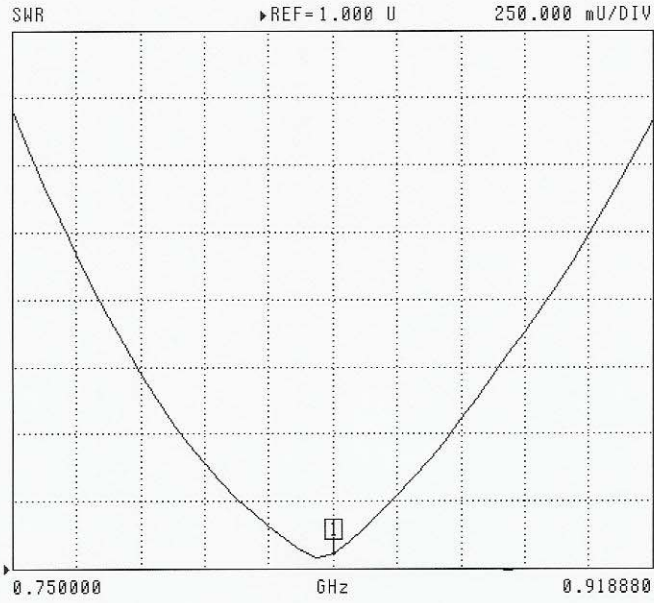
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss



SWR

S22 REVERSE REFLECTION



CH 4 - S22
REFERENCE PLANE
0.0000 mm

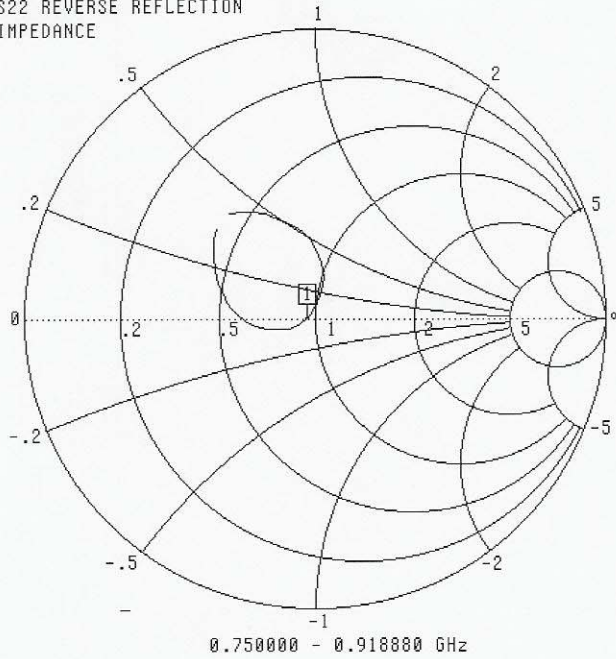
▶ MARKER 1
0.834440 GHz
1.055 U

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

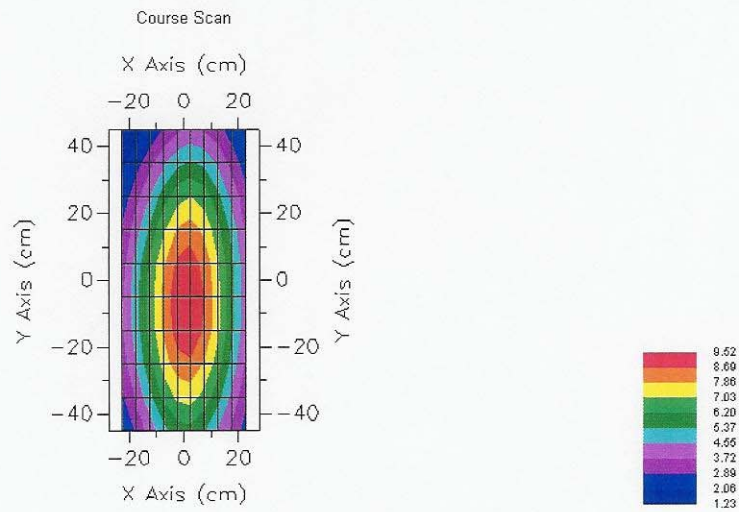
▶ MARKER 1
0.834440 GHz
47.585 Ω
34.845 $j\Omega$

MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

System Validation Results Using the Electrically Calibrated Dipole

| Head Tissue Frequency | 1 Gram | 10 Gram | Peak Above Feed Point |
|-----------------------|--------|---------|-----------------------|
| 835 MHz | 9.33 | 6.42 | 15.0 |



NCL Calibration Laboratories

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





Appendix - Dipole Calibration

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

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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

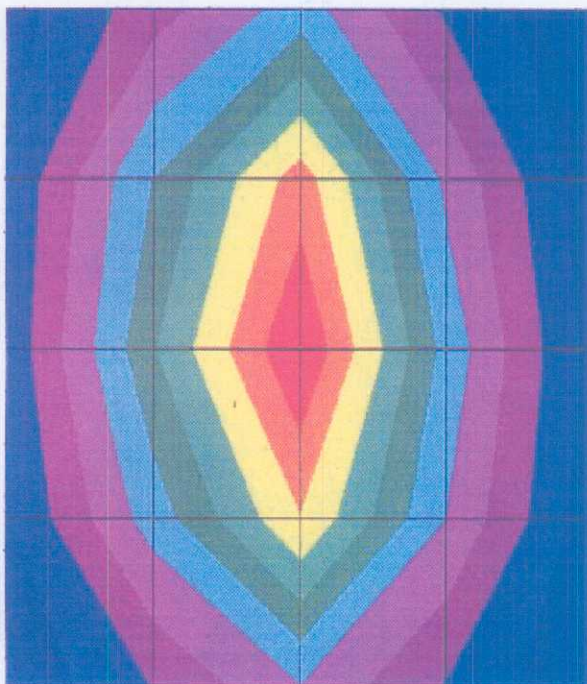
Length: 70.0 mm
Height: 39.5 mm

Electrical Specification

SWR: 1.1 U
Return Loss: -25.7 dB
Impedance: 46.8 Ω

System Validation Results

| Frequency | 1 Gram | 10 Gram | Peak |
|-----------|--------|---------|------|
| 1.9 GHz | 36.0 | 20.78 | 67.7 |



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Introduction

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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, ϵ_r | 39.9 |
| Conductivity, σ [S/m] | 1.42 |

NCL Calibration Laboratories

Division of APREL Laboratories.

Electrical Calibration

| Test | Result |
|-----------|---------------|
| S11 R/L | -25.7 dB |
| SWR | 1.1 U |
| Impedance | 46.8 Ω |

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

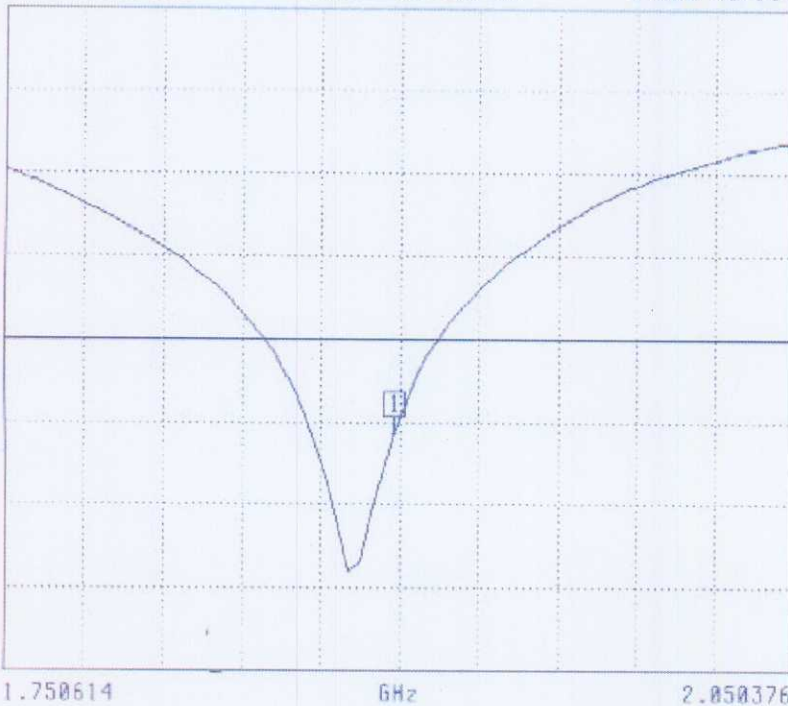
S11 Parameter Return Loss

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

NCL Calibration Laboratories

Division of APREL Laboratories.

SWR

S22 REVERSE REFLECTION



CH 4 - S22
REFERENCE PLANE
0.0000 mm

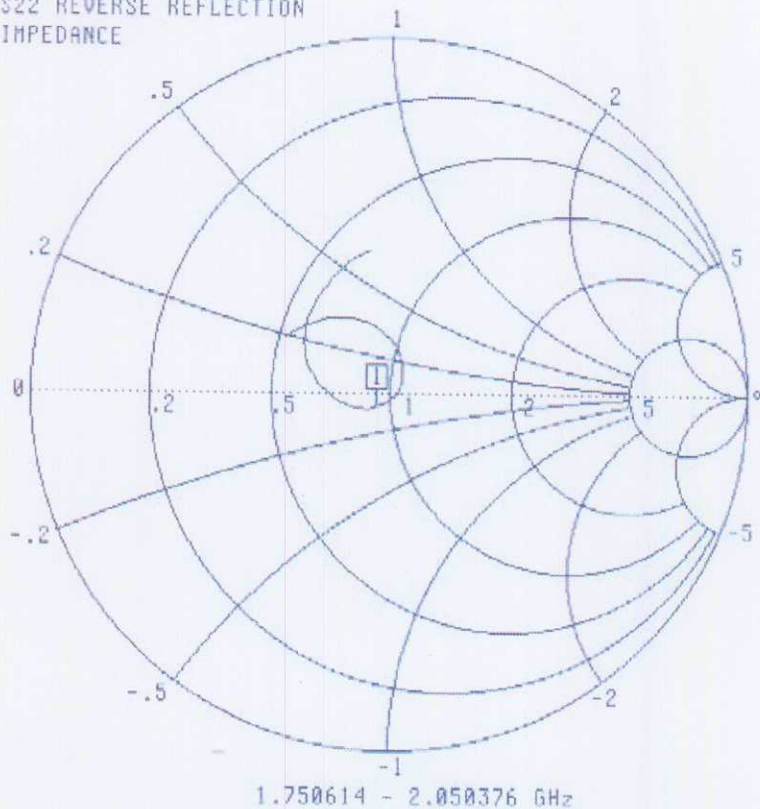
▶MARKER 1
1.898384 GHz
1.106 U

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

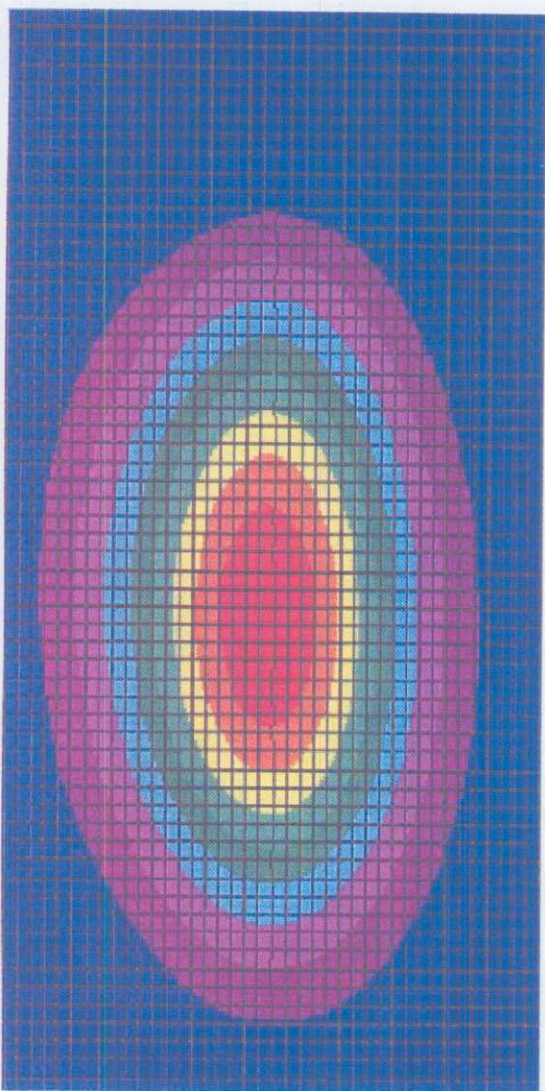
MARKER READOUT
FUNCTIONS

NCL Calibration Laboratories

Division of APREL Laboratories.

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 |



NCL Calibration Laboratories

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





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: _____



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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

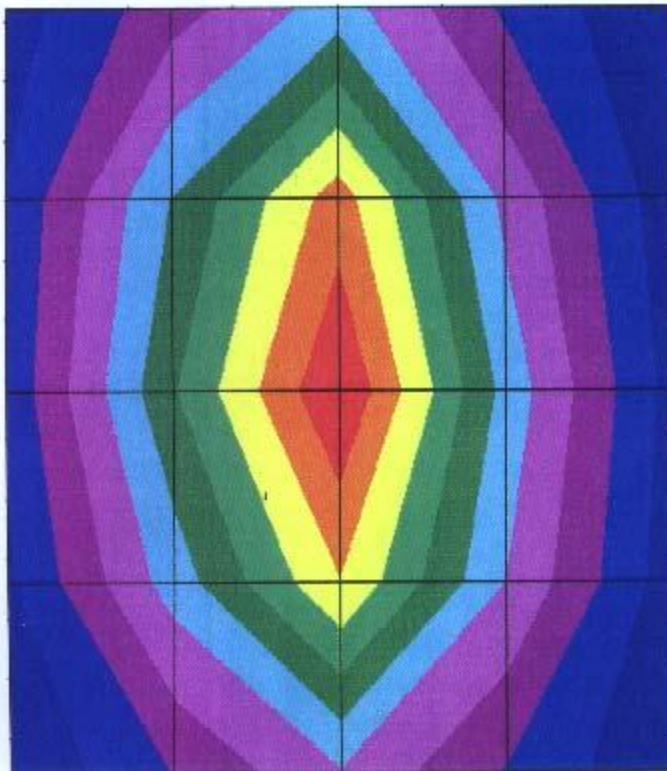
SWR: 1.21 U

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 |



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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 |



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 |



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

S22 REVERSE REFLECTION

LOG MAGNITUDE

REF = -20.000 dB

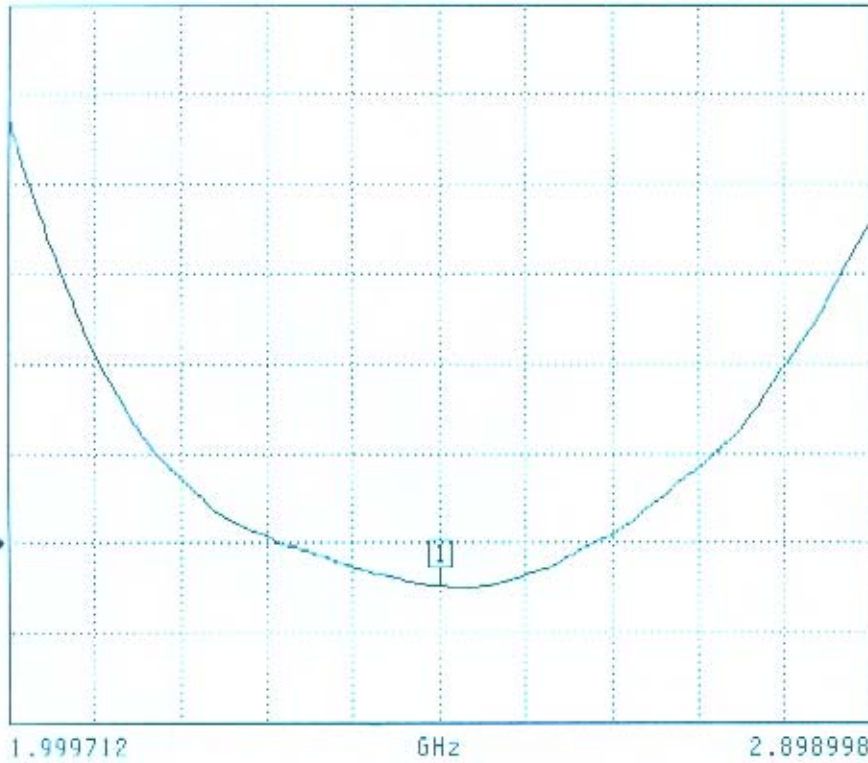
5.000 dB/DIV



SWR

S22 REVERSE REFLECTION

SWR REF=1.500 U 600.000 mU/DIV



CH 1 - S22
REFERENCE PLANE
0.0000 mm

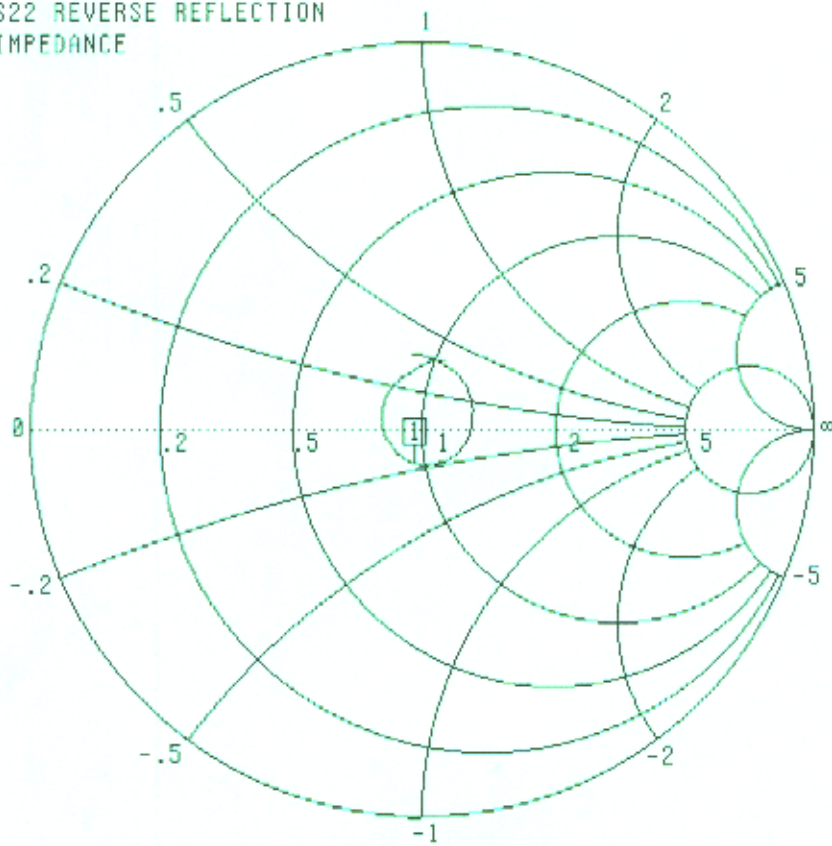
MARKER 1
2.451466 GHz
1.208 U

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
2.451466 GHz
47.685 Ω
-8.889 jΩ

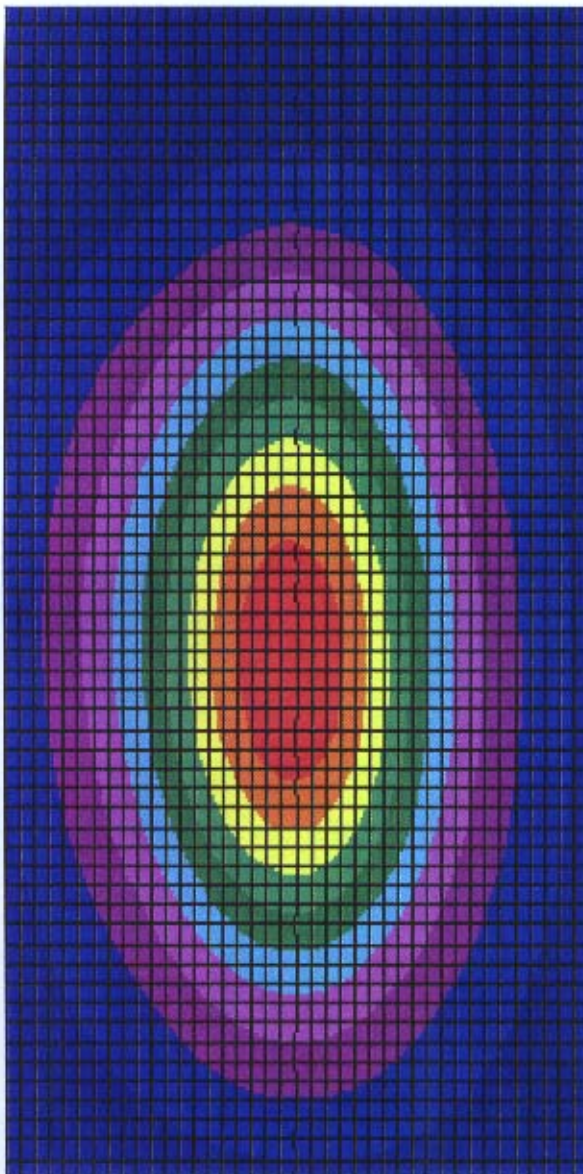
MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

2.299474 - 2.599236 GHz

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 |



Test Equipment

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