



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

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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

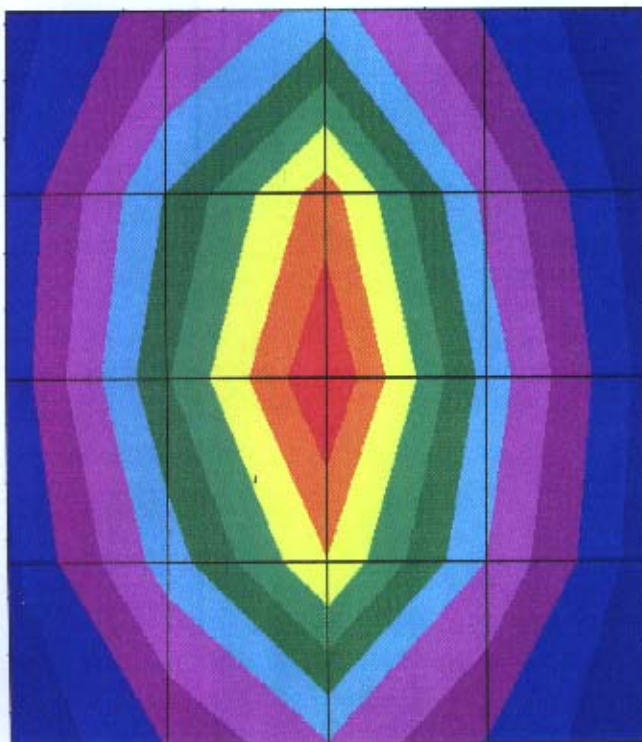
Length: 53.5 mm
Height: 30.4 mm

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



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



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



NCL Calibration Laboratories

Division of APREL Laboratories.

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



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
2.451466 GHz
-20.669 dB

MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

ES

ES

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

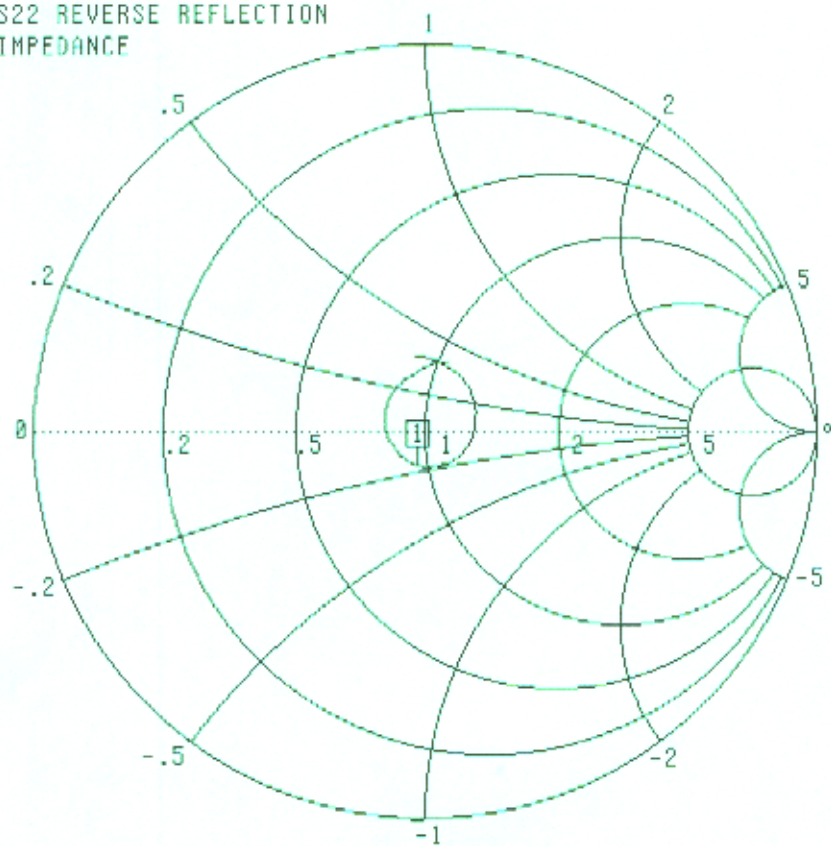
MARKER READOUT
FUNCTIONS

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Smith Chart Dipole Impedance

S22 REVERSE REFLECTION
IMPEDANCE



2.299474 - 2.599236 GHz

CH 4 - S22
REFERENCE PLANE
0.0000 mm

▶ MARKER 1
2.451466 GHz
47.685 Ω
-8.889 j Ω

MARKER TO MAX
MARKER TO MIN

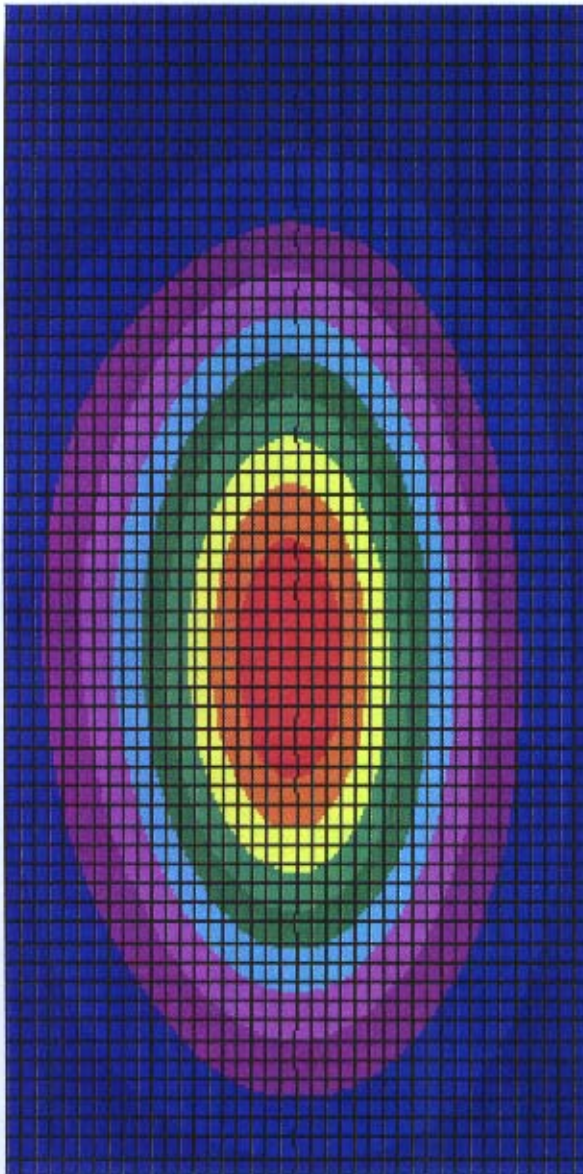
MARKER READOUT
FUNCTIONS

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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



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 5200MHz

P/N: ALS-D-5200-S-2

S/N: QTK-320

NCL CALIBRATION LABORATORIES

Calibration File No: DC-410-1
Project Number: QTKB-Dipole Cal-5229

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-5200-S-2

Frequency: 5.2 GHz

Serial No: QTK-320

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

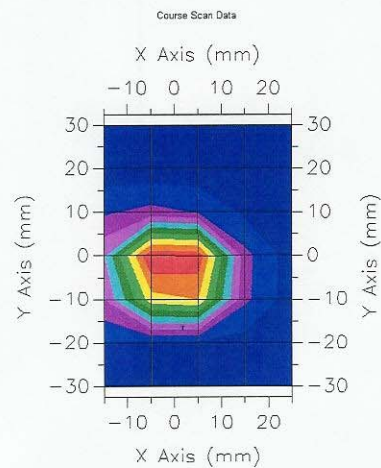
Length: 23.6 mm
Height: 14.0 mm

Electrical Specification

SWR: 1.57 U
Return Loss: -13.15 dB
Impedance: 78.2 Ω

System Validation Results

Frequency	1 Gram
5200 GHz	58.8



Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018. The results contained within this report are for Validation Dipole QTK-320 at 5.2 GHz. 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 mechanical specification. 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 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-320 was received for calibration.

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

Temperature of the Tissue: 21 °C +/- 0.5°C



Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
23.6 mm	14.0 mm	23.1 mm	14.2 mm

Tissue Validation

Head Tissue 5200 MHz	Measured
Dielectric constant, ϵ_r	39.94
Conductivity, σ [S/m]	5.24



Electrical Calibration

Test	Result
S11 R/L	-13.15 dB
SWR	1.57 U
Impedance	78.2 Ω

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

S22 REVERSE REFLECTION

LOG MAGNITUDE REF = -15.000 dB 1.000 dB/DIV



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
5.19988 GHz
-13.147 dB

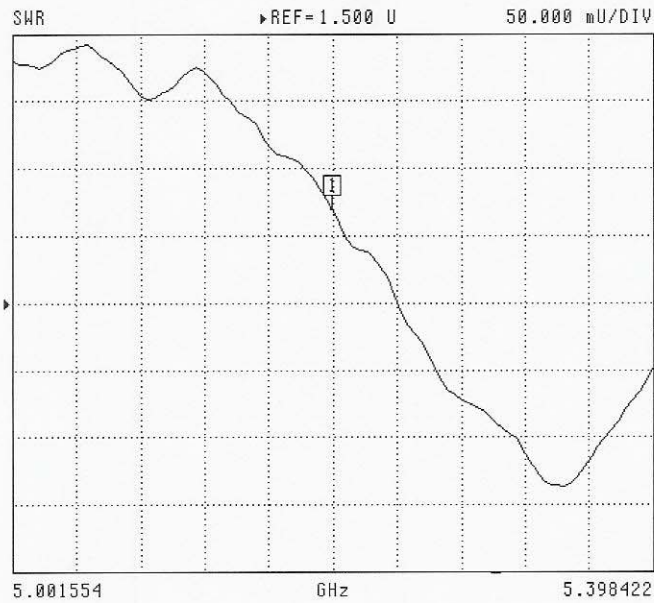
MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

S11 Parameter Return Loss

SWR

S22 REVERSE REFLECTION



CH 4 - S22
REFERENCE PLANE
0.0000 mm

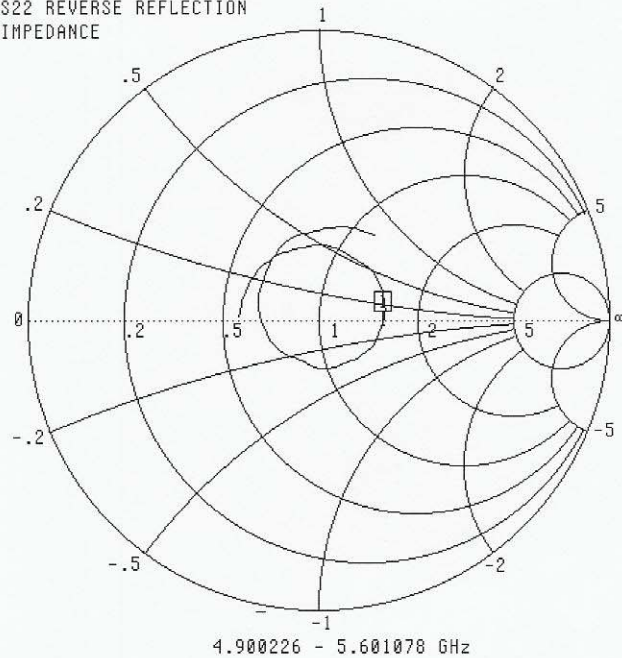
MARKER 1
5.199988 GHz
1.570 U

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

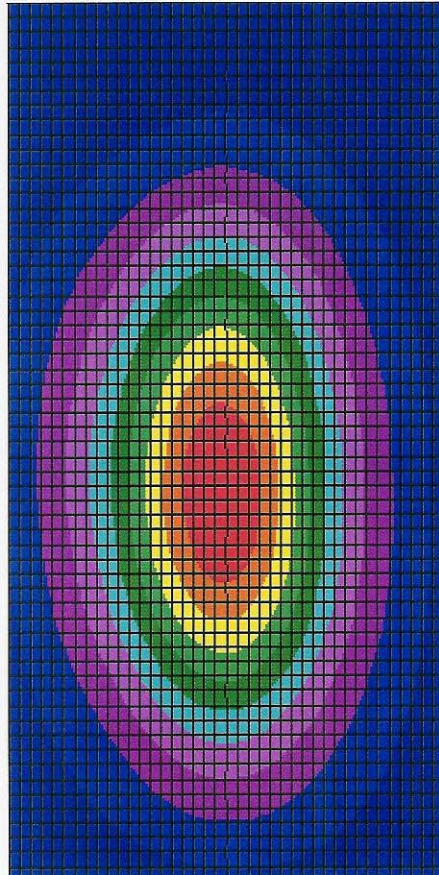
▶ MARKER 1
5.199988 GHz
78.201 Ω
-3.155 $j\Omega$

MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

System Validation Results Using a Complex Dipole Model (FDTD calculations)

Frequency	1 Gram
5.2 GHz	58.8



Test Equipment

NCL Calibration Laboratories

Division of APREL Laboratories.

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



NCL CALIBRATION LABORATORIES

Calibration File No: DC-411-1
Project Number: QTKB-Dipole Cal-5225

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-5800-S-2

Frequency: 5.8 GHz

Serial No: QTK-321

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

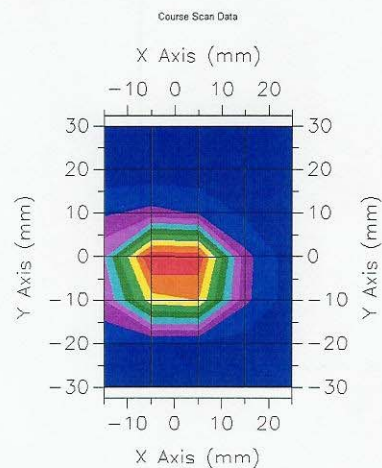
Length: 21.6 mm
Height: 12.6 mm

Electrical Specification

SWR: 1.78 U
Return Loss: -11.0 dB
Impedance: 74.8 Ω

System Validation Results

Frequency	1 Gram
5800 GHz	57.9



Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018. The results contained within this report are for Validation Dipole QTK-321 at 5.8 GHz. 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 mechanical specification. 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 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-321 was received for calibration.

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

Temperature of the Tissue: 21 °C +/- 0.5°C

Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
21.6 mm	12.6 mm	21.2 mm	13.1 mm

Tissue Validation

Head Tissue 5800 MHz	Measured
Dielectric constant, ϵ_r	35.15
Conductivity, σ [S/m]	6.4

NCL Calibration Laboratories

Division of APREL Laboratories.

Electrical Calibration

Test	Result
S11 R/L	-11.0 dB
SWR	1.78 U
Impedance	74.8 Ω

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

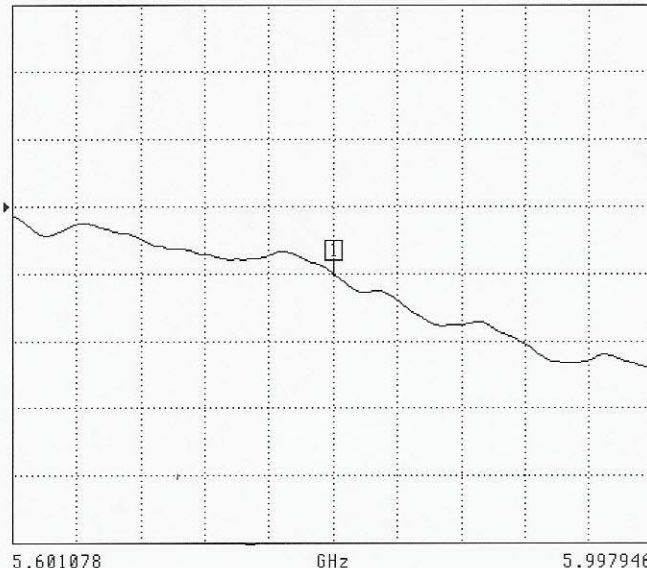
S11 Parameter Return Loss

S22 REVERSE REFLECTION

LOG MAGNITUDE

REF = -10.000 dB

1.000 dB/DIV



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SWR

S22 REVERSE REFLECTION



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
5.799512 GHz
1.776 U

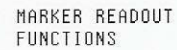
MARKER TO MAX
MARKER TO MIN

MARKER READOUT
FUNCTIONS

[Signature]

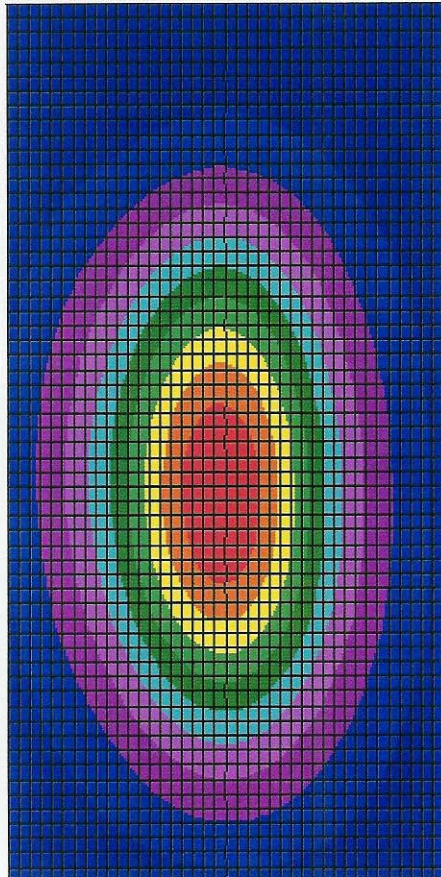
[Signature]

Smith Chart Dipole Impedance



System Validation Results Using a Complex Dipole Model (FDTD calculations)

Frequency	1 Gram
5.8 GHz	57.9



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

