

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1229/30
Project Number: SGL-IAC-DC-5582-93

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.

Validation Dipole
2450MHz Head & Body

Manufacturer: APREL Laboratories

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

Frequency: 2450MHz

Serial No: 220-00755

Customer: IAC

Calibrated: 19th May 2011
Released on: 27th May 2011

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

Released By: _____

NCL CALIBRATION LABORATORIES

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CANADA K2K 3J1

Division of APREL
TEL: (613) 435-8300
FAX: (613) 435-8306

Conditions

Dipole 220-00755 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.



Stuart Nicol



C. Teodorian

Primary Measurement Standards

Instrument	Serial Number	Cal due date
Power meter Anritsu MA2408A	245025437	Nov.4, 2010
Power Sensor Anritsu MA2481D	103555	Nov 4, 2010
Attenuator HP 8495A (70dB)	1944A10711	Sept. 14, 2010
Network Analyzer Anritsu MT8801C	MB11855	Feb. 8, 2011

Secondary Measurement Standards

Signal Generator Agilent E4438C -506	MY55182336	June 7, 2011
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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: 51.5 mm

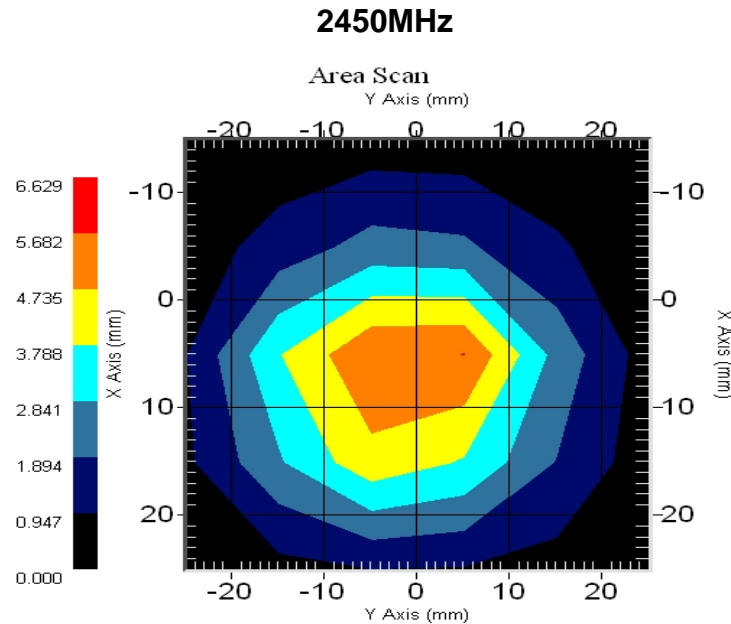
Height: 30.4 mm

Electrical Specification 2450MHz

Tissue Type	Return Loss:	Impedance:	SWR:
Head	-34.847	50.047	1.038U
Body	-32.513	50.190	1.029U

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	2450 MHz	52.456	23.603	108.940
Body	2450 MHz	52.592	24.461	104.910



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 220-00755. 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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

References

- IEEE Standard 1528 (2003) including Amendment 1
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- EN 62209-1 (2006)
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- IEC 62209-2 Ed. 1.0 (2010-03)
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 220-00755 was a new dipole taken from stock.

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

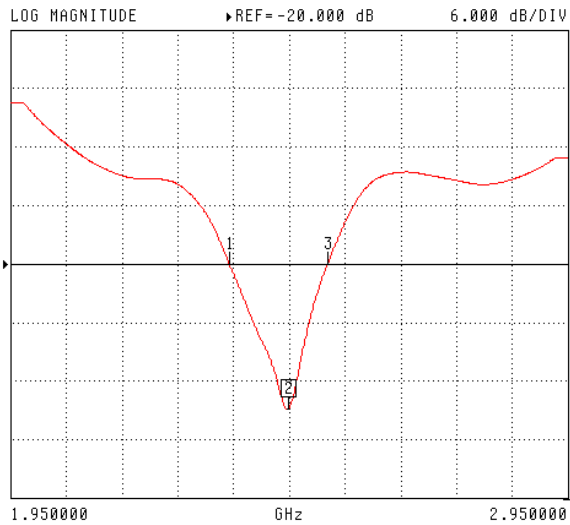
Electrical Calibration

Electrical Specification 2450MHz

Tissue Type	Measured Epsilon	Measured Sigma
Head	37.87	1.82
Body	50.84	1.92

Head Tissue

S11 FORWARD REFLECTION



CH 1 - S11
5.0584 mm REF
0.000 dB OFFSET
0.00° OFFSET

▶ MARKER 2
2.450000 GHz
-34.847 dB

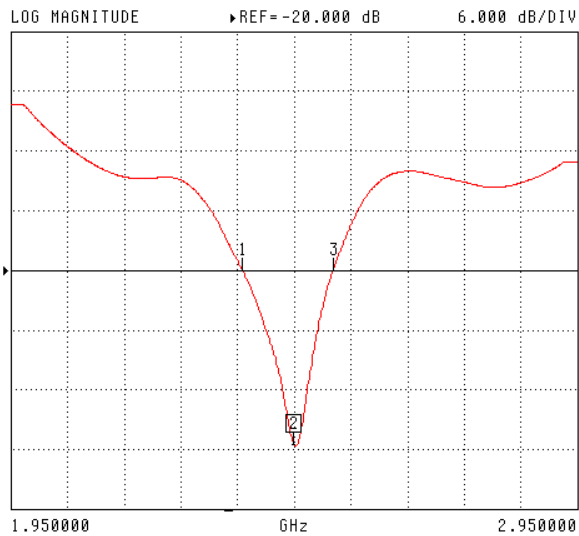
MARKER TO MAX
MARKER TO MIN

1 2.343100 GHz
-20.008 dB
3 2.519500 GHz
-20.005 dB

MARKER READOUT
FUNCTIONS

Body Tissue

S11 FORWARD REFLECTION



CH 1 - S11
5.0584 mm REF
0.000 dB OFFSET
0.00° OFFSET

▶ MARKER 2
2.450000 GHz
-37.513 dB

MARKER TO MAX
MARKER TO MIN

1 2.359300 GHz
-20.004 dB
3 2.519600 GHz
-20.000 dB

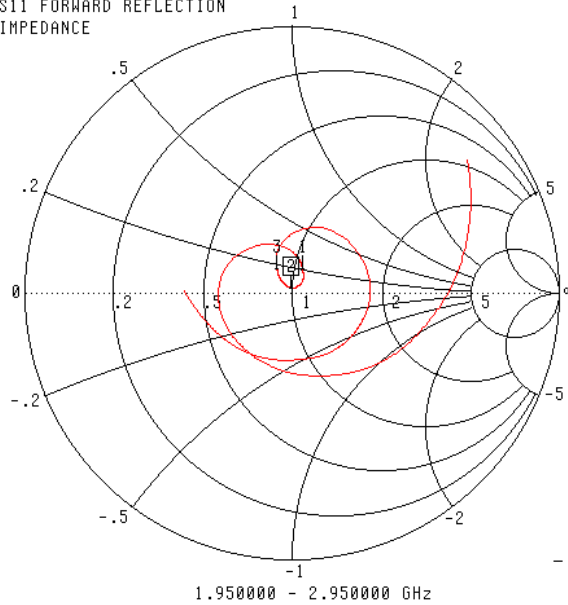
MARKER READOUT
FUNCTIONS

Electrical Specification 2450MHz Impedance

Tissue Type	Measured Epsilon	Measured Sigma
Head	37.87	1.82
Body	50.84	1.92

Head Tissue

S11 FORWARD REFLECTION
IMPEDANCE



CH 1 - S11
5.0584 mm REF
0.000 dB OFFSET
0.00° OFFSET

▶ MARKER 2
2.450000 GHz
50.047 Ω
1.461 $j\Omega$

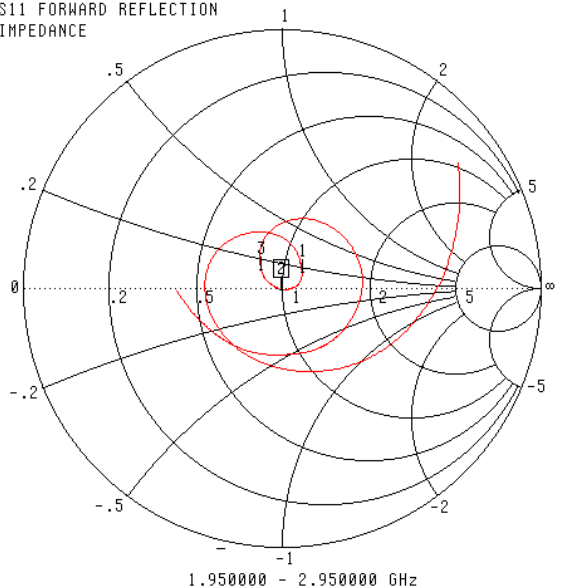
MARKER TO MAX
MARKER TO MIN

1 2.343100 GHz
53.538 Ω
9.647 $j\Omega$
3 2.519500 GHz
44.446 Ω
7.748 $j\Omega$

MARKER READOUT
FUNCTIONS

Body Tissue

S11 FORWARD REFLECTION
IMPEDANCE



CH 1 - S11
5.0584 mm REF
0.000 dB OFFSET
0.00° OFFSET

▶ MARKER 2
2.450000 GHz
50.190 Ω
-999.229 $j\Omega$

MARKER TO MAX
MARKER TO MIN

1 2.359300 GHz
58.351 Ω
6.930 $j\Omega$
3 2.519600 GHz
42.536 Ω
5.740 $j\Omega$

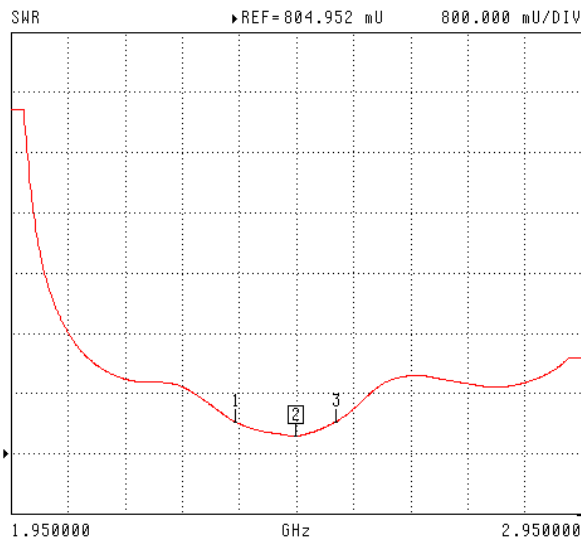
MARKER READOUT
FUNCTIONS

Electrical Specification 2450MHz Standing Wave Ratio

Tissue Type	Measured Epsilon	Measured Sigma
Head	37.87	1.82
Body	50.84	1.92

Head Tissue

S11 FORWARD REFLECTION



CH 1 - S11
5.0584 mm REF
0.000 dB OFFSET
0.00° OFFSET

MARKER 2
2.450000 GHz
1.038 U

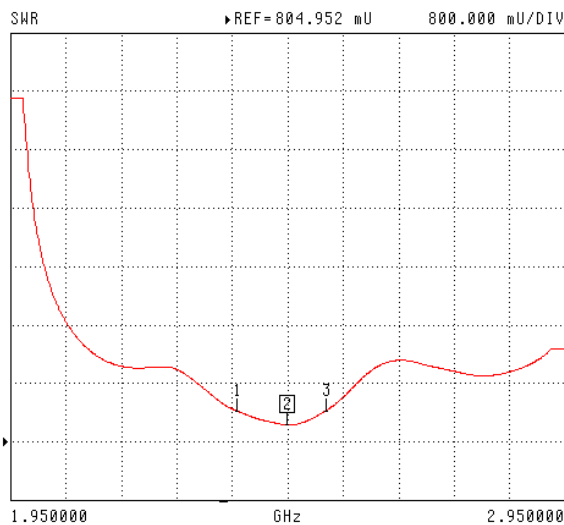
MARKER TO MAX
MARKER TO MIN

1 2.343100 GHz
1.226 U
3 2.519500 GHz
1.226 U

MARKER READOUT
FUNCTIONS

Body Tissue

S11 FORWARD REFLECTION



CH 1 - S11
5.0584 mm REF
0.000 dB OFFSET
0.00° OFFSET

MARKER 2
2.450000 GHz
1.029 U

MARKER TO MAX
MARKER TO MIN

1 2.359300 GHz
1.223 U
3 2.519600 GHz
1.227 U

MARKER READOUT
FUNCTIONS

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 2011.