

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1198
Project Number: SPTB-ALSAS-5566

C E R T I F I C A T E O F C A L I B R A T I O N

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
835MHz Head & Body

Manufacturer: APREL Laboratories

Part number: ALS-D-835-S-2

Frequency: 835MHz

Serial No: 180-00565

Customer: SPORTON

Calibrated: 18th February 2011
Released on: 25^h February 2011

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

Released By: _____

NCL CALIBRATION LABORATORIES

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NCL Calibration Laboratories

Division of APREL Inc.

Conditions

Dipole 180-00565 was a new dipole taken from stock.

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	90025437	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: 161.0 mm
Height: 89.8 mm

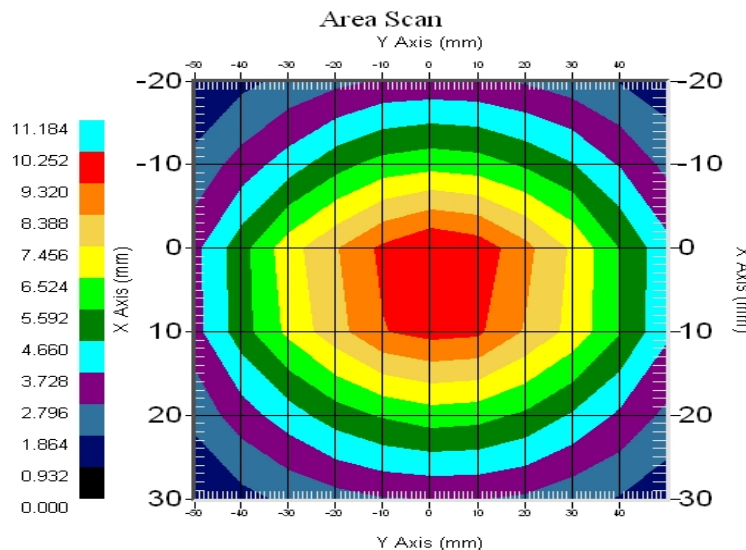
Electrical Specification 835MHz

Tissue Type	Return Loss:	Impedance:	SWR:
Head	-28.527	50.316	1.087U
Body	-23.340	56.867	1.157U

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	835 MHz	9.590	6.003	15.013
Body	835 MHz	9.981	6.006	15.013

835MHz



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 180-00565. 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

- o 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
- o 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
- o 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)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 180-00565 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

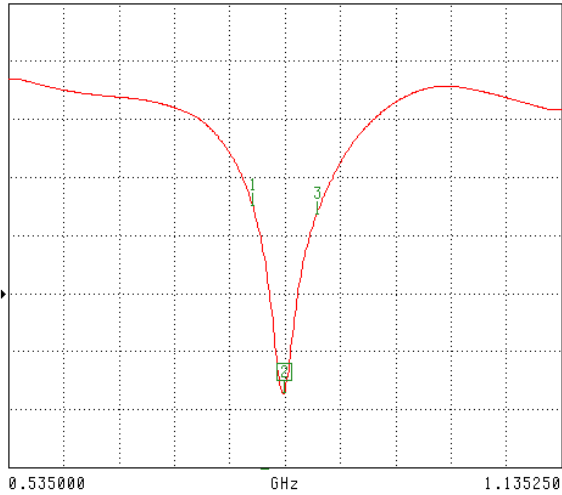
Electrical Specification 835MHz

Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Head Tissue

S11 FORWARD REFLECTION

LOG MAGNITUDE REF=-20.000 dB 5.000 dB/DIV



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

MARKER 2
0.835000 GHz
-28.527 dB

MARKER TO MAX
MARKER TO MIN

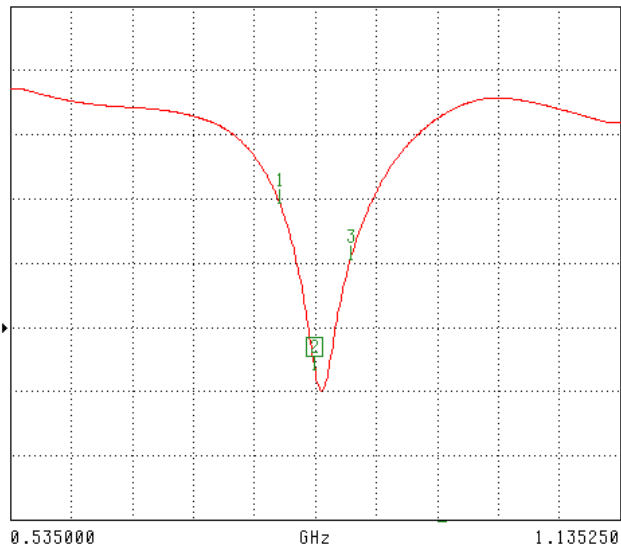
- 1 0.800000 GHz
-12.425 dB
- 3 0.870000 GHz
-13.175 dB

MARKER READOUT
FUNCTIONS

Body Tissue

S11 FORWARD REFLECTION

LOG MAGNITUDE REF=-20.000 dB 5.000 dB/DIV



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

MARKER 2
0.835000 GHz
-23.340 dB

MARKER TO MAX
MARKER TO MIN

- 1 0.800000 GHz
-10.292 dB
- 3 0.870000 GHz
-14.772 dB

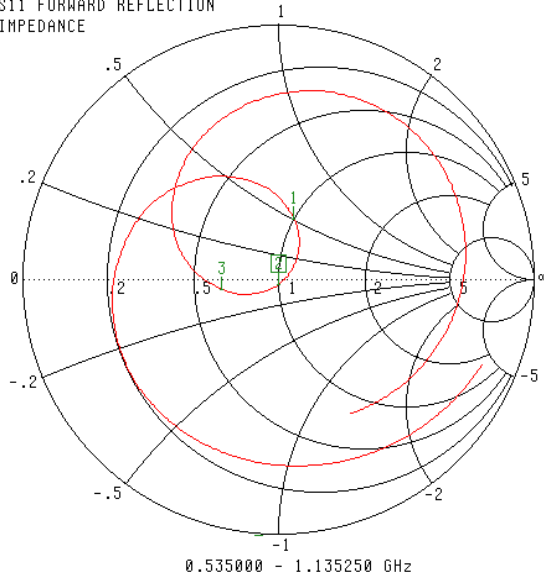
MARKER READOUT
FUNCTIONS

**Electrical Specification 835MHz
Impedance**

Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Head Tissue

S11 FORWARD REFLECTION
IMPEDANCE



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

▶ MARKER 2
0.835000 GHz
50.316 Ω
-2.405 jΩ

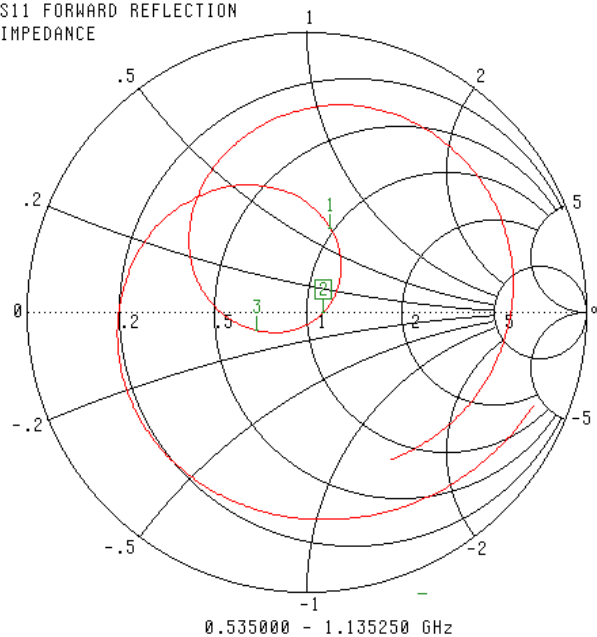
MARKER TO MAX
MARKER TO MIN

1 0.800000 GHz
50.561 Ω
25.190 jΩ
3 0.870000 GHz
32.007 Ω
-2.820 jΩ

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
0.835000 GHz
56.867 Ω
-649.560 jΩ

MARKER TO MAX
MARKER TO MIN

1 0.800000 GHz
49.189 Ω
32.267 jΩ
3 0.870000 GHz
35.011 Ω
-5.022 jΩ

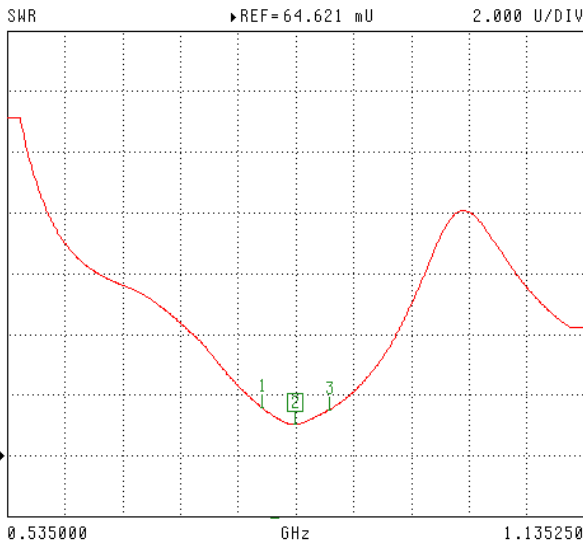
MARKER READOUT
FUNCTIONS

**Electrical Specification 835MHz
Standing Wave Ratio**

Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Head Tissue

S11 FORWARD REFLECTION



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

▶MARKER 2
0.835000 GHz
1.087 U

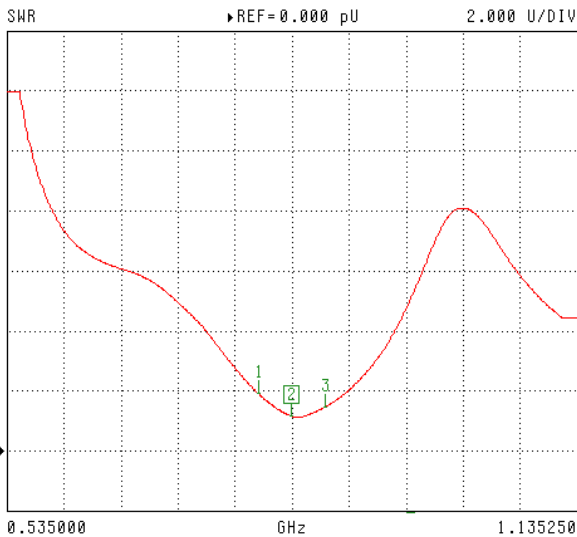
MARKER TO MAX
MARKER TO MIN

- 1 0.800000 GHz
1.648 U
- 3 0.870000 GHz
1.573 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
0.835000 GHz
1.157 U

MARKER TO MAX
MARKER TO MIN

- 1 0.800000 GHz
1.902 U
- 3 0.870000 GHz
1.460 U

MARKER READOUT
FUNCTIONS

NCL Calibration Laboratories

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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 2010.