

NCL Calibration Laboratories

Division of APREL Laboratories.

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 BCL-141. 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-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 BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

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**

APREL Length	APREL Height	Measured Length	Measured Height
51.5 mm	30.4 mm	51.6 mm	30.5 mm

Tissue Validation

Head Tissue 2450 MHz	Measured
Dielectric constant, ϵ_r	39.2
Conductivity, σ [S/m]	1.80

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Electrical Calibration

Test	Result
S11 R/L	-26.77 dB to -15.52 dB
SWR	1.095 U to 1.397 U
Impedance	47.81 Ω to 63.37 Ω

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

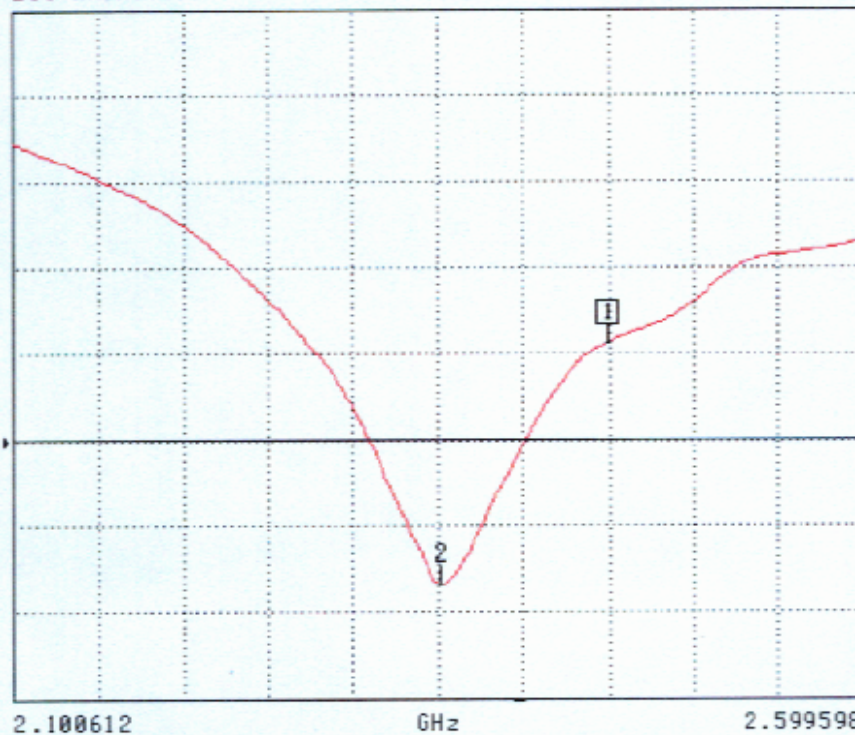
S11 Parameter Return Loss

S22 REVERSE REFLECTION

LOG MAGNITUDE

REF = -20.000 dB

4.000 dB/DIV



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
2.450046 GHz
-15.516 dB

MARKER TO MAX
▶ MARKER TO MIN

2 2.352262 GHz
-26.773 dB

MARKER READOUT
FUNCTIONS

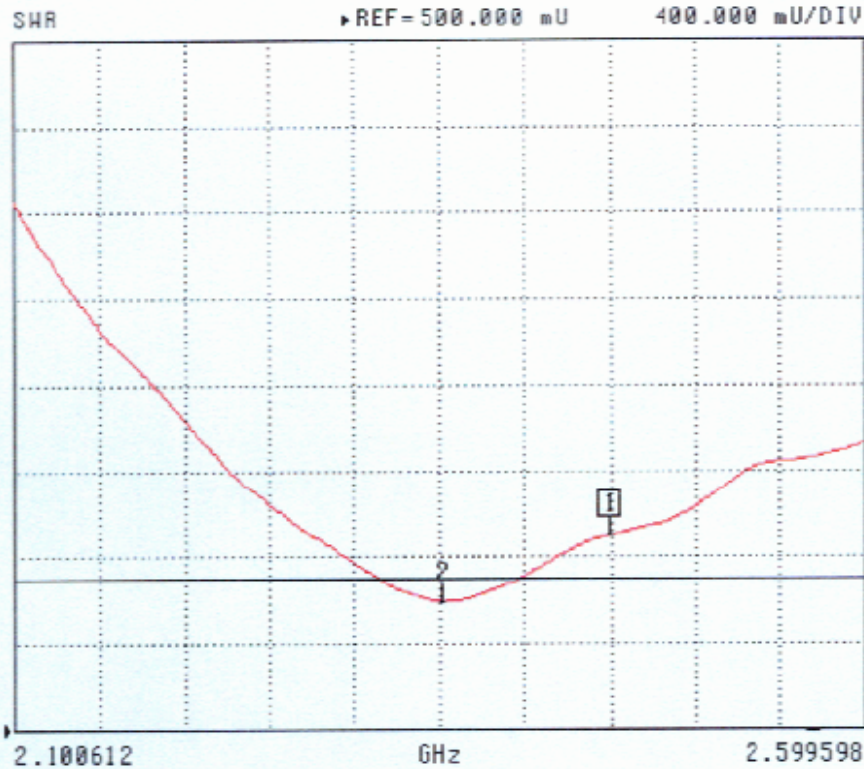
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SWR

S22 REVERSE REFLECTION

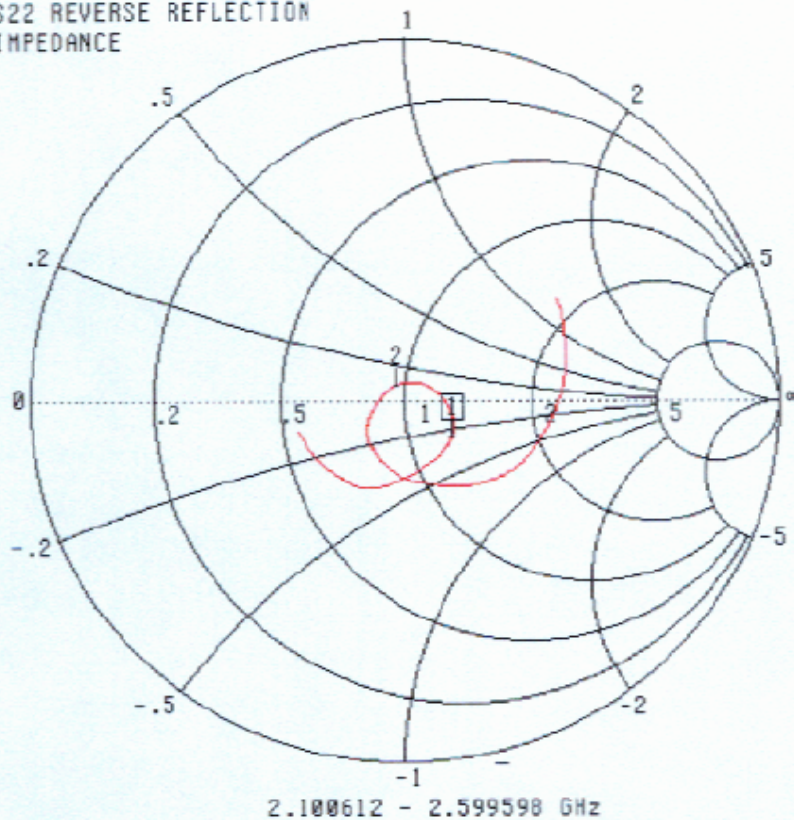
CH 4 - S22
REFERENCE PLANE
0.0000 mmMARKER 1
2.45046 GHz
1.397 UMARKER TO MAX
▶ MARKER TO MIN2 2.352262 GHz
1.095 UMARKER READOUT
FUNCTIONS

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Smith Chart Dipole ImpedanceS22 REVERSE REFLECTION
IMPEDANCECH 4 - S22
REFERENCE PLANE
0.0000 mmMARKER 1
2.450046 GHz
63.373 Ω
-13.350 $j\Omega$ MARKER TO MAX
▶ MARKER TO MIN
2 2.352262 GHz
47.808 Ω
3.861 $j\Omega$ MARKER READOUT
FUNCTIONS

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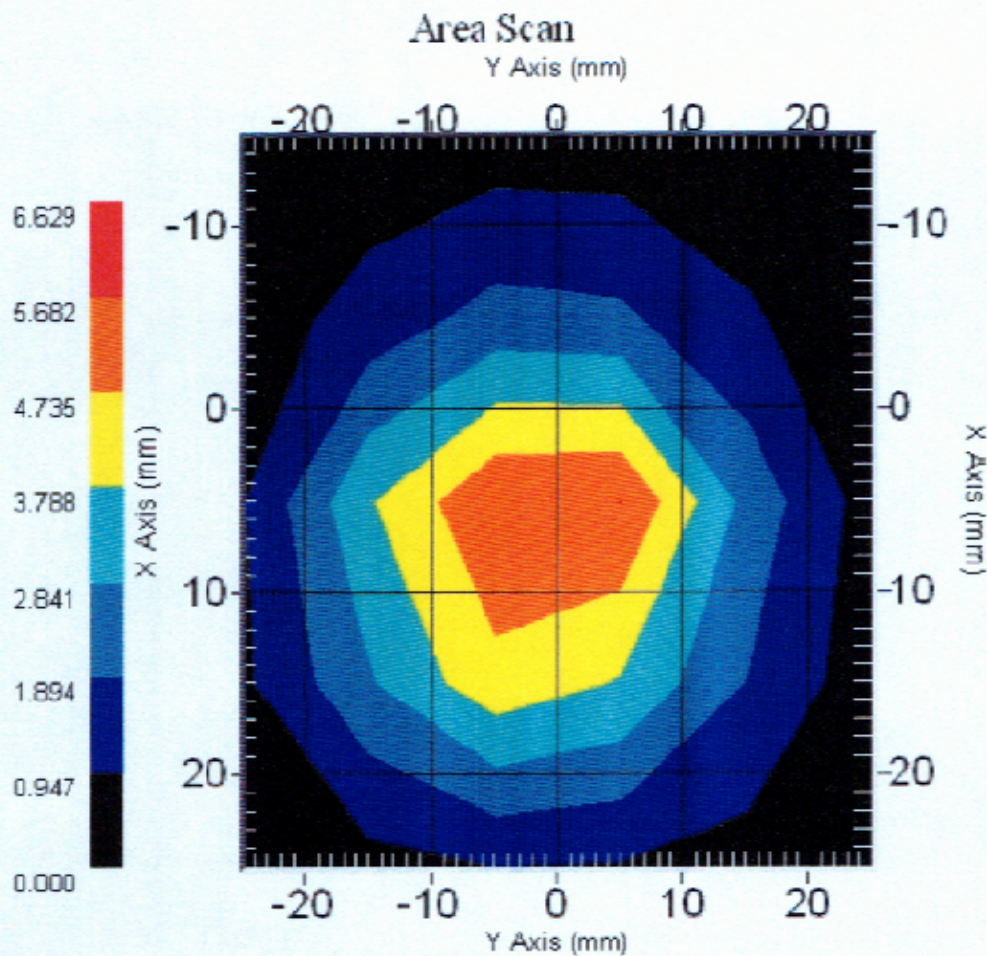
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System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
2450 MHz	5.31	2.44	10.18



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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

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APPENDIX D - TEST SYSTEM VERIFICATIONS SCANS**Liquid Measurement Result**

2006-09-06

Stimulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ_r	22	52.7	52.8	0.19	±5
		σ	22	1.95	1.96	0.51	±5
		1g SAR	22	56.84	57.3	0.81	±10
Head	2450	ϵ_r	22	39.2	38.9	-0.76	±5
		σ	22	1.80	1.79	-0.56	±5
		1g SAR	22	52.4	51.9	-0.95	±10

ϵ_r = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Test Laboratory: Bay Area Compliance Lab Corp.(BACL)**System Validation for Body****DUT: Dipole 2450 MHz; Type: D-2450-S-1; Serial: BCL-141**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.27, 4.27, 4.27); Calibrated: 5/02/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 10/18/2005
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161

d=10mm, Pin=1W /Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 65.7 mW/g

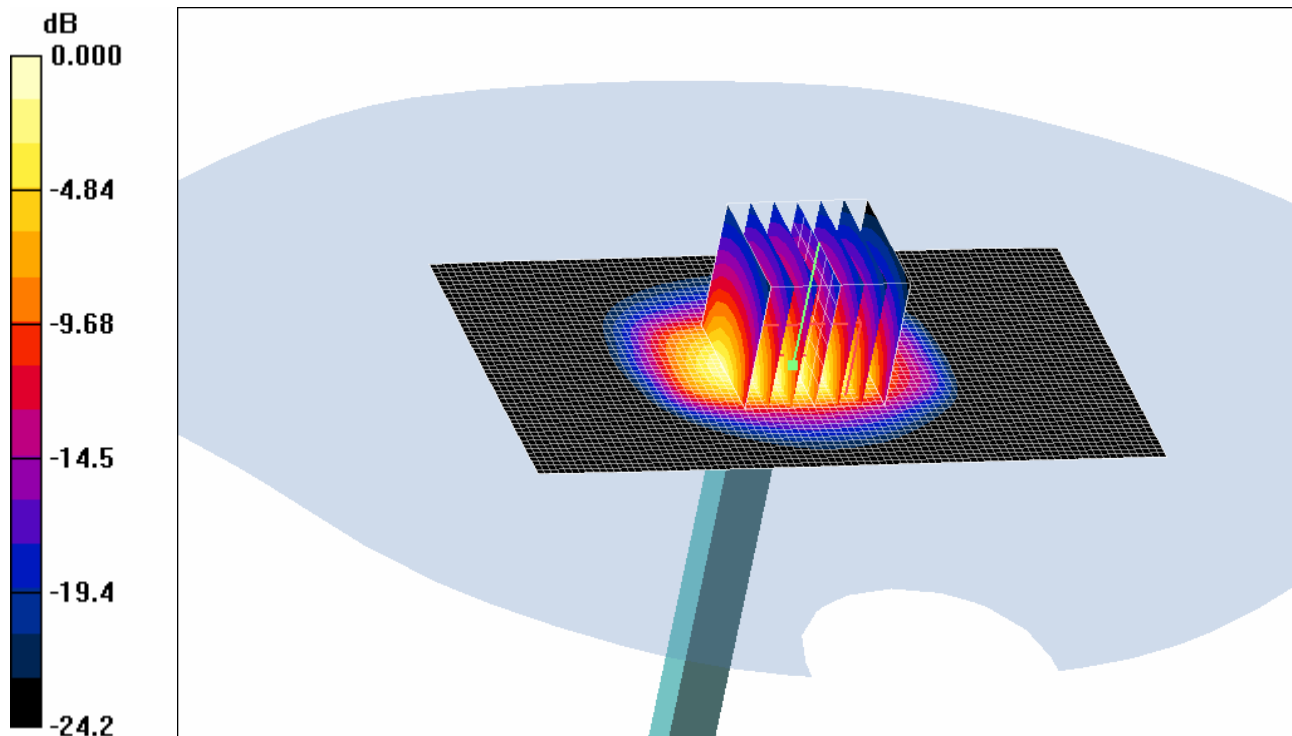
d=10mm, Pin=1W /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 186.5 V/m; Power Drift = 0.015 dB

Peak SAR (extrapolated) = 137.4 W/kg

SAR(1 g) = 57.3 mW/g; SAR(10 g) = 24.4 mW/g

Maximum value of SAR (measured) = 64.9 mW/g



0 dB = 64.9mW/g

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**System Validation for Head****DUT: Dipole 2450 MHz; Type: D-2450-S-1; Serial: BCL-141**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.79$ mho/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.60, 4.60, 4.60); Calibrated: 5/02/2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 10/18/2005
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161

d=10mm, Pin=1W /Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 55.1 mW/g

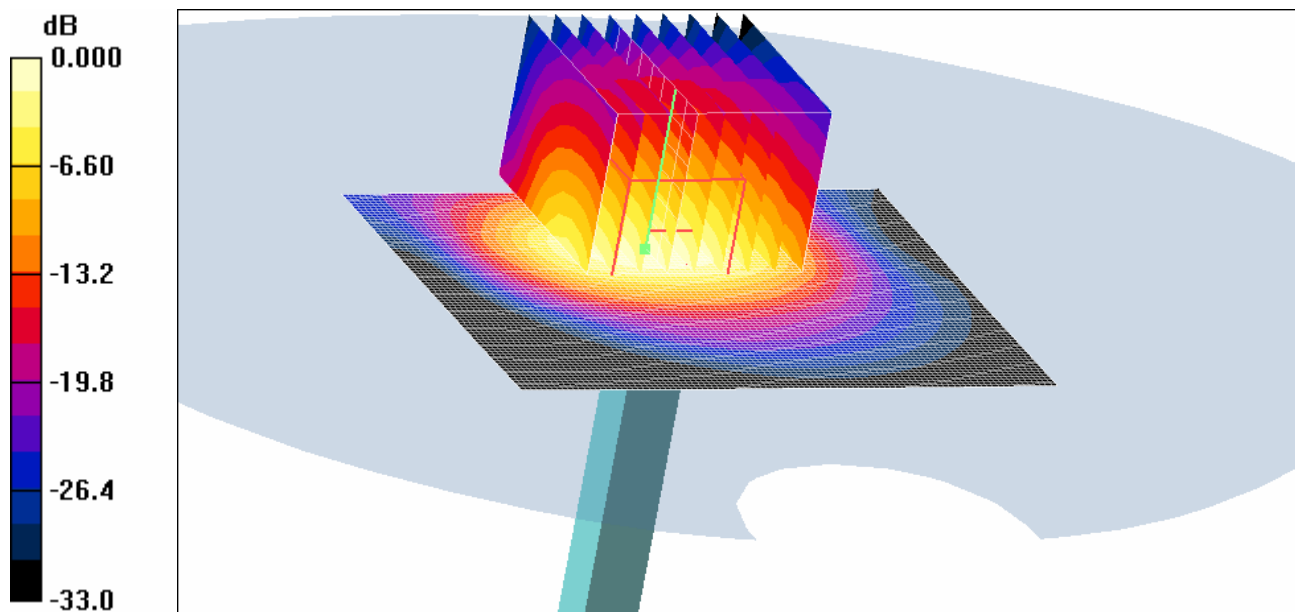
d=10mm, Pin=1W /Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 198.4 V/m; Power Drift = 0.331 dB

Peak SAR (extrapolated) = 125.1 W/kg

SAR(1 g) = 51.9 mW/g; SAR(10 g) = 23.8 mW/g

Maximum value of SAR (measured) = 52.6 mW/g



0 dB = 52.6mW/g