

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

This page has been reviewed for content and attested to by signature within this document.

4

NCL Calibration Laboratories

Division of APREL Laboratories.

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

This page has been reviewed for content and attested to by signature within this document.

5

NCL Calibration Laboratories

Division of APREL Laboratories.

Electrical Calibration

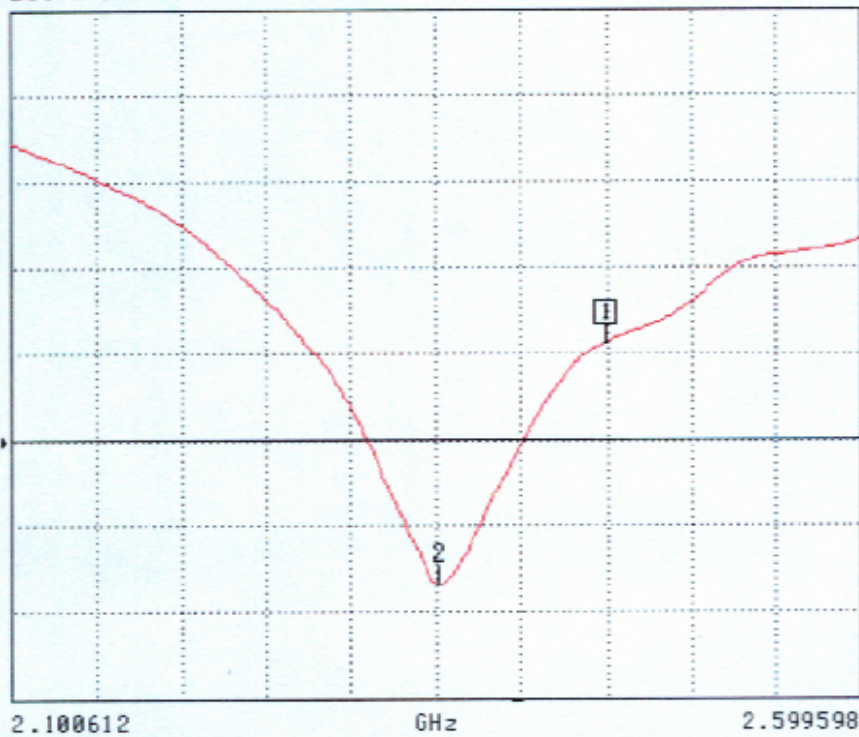
Test	Result
S11 R/L	-26.77 dB to -15.52 dB
SWR	1.095 U to 1.397 U
Impedance	47.81 Ω to 63.37 Ω

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 - 322
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

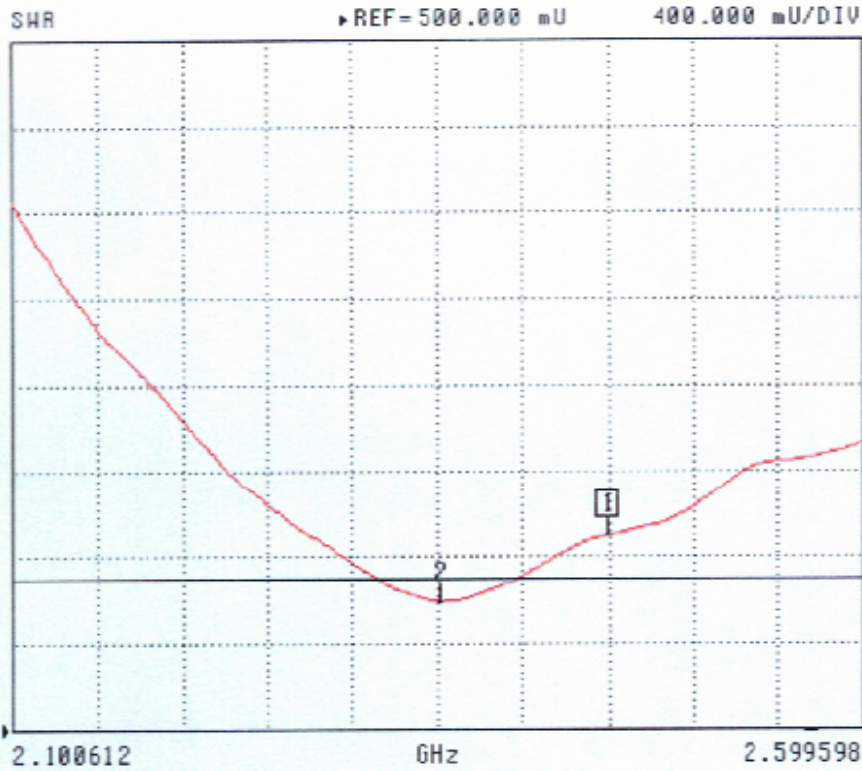
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Laboratories.

SWR

S22 REVERSE REFLECTION



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
2.450046 GHz
1.397 U

MARKER TO MAX
▶ MARKER TO MIN

2 2.352262 GHz
1.095 U

MARKER READOUT
FUNCTIONS

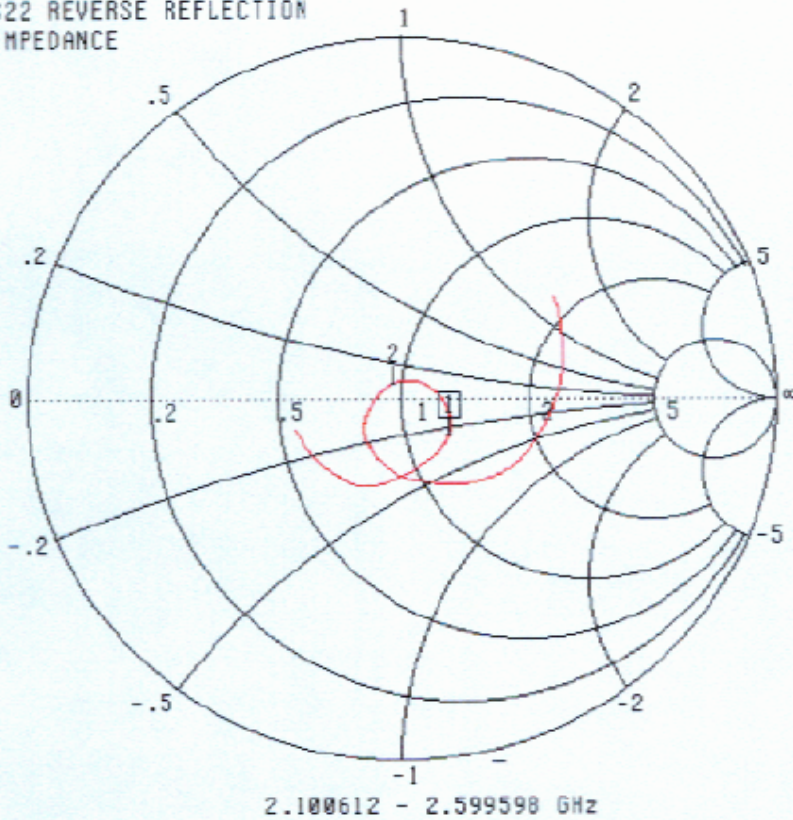
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Laboratories.

Smith Chart Dipole Impedance

S22 REVERSE REFLECTION
IMPEDANCE



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
2.450046 GHz
63.373 Ω
-13.350 jΩ

MARKER TO MAX
▶ MARKER TO MIN
2 2.352262 GHz
17.808 Ω
3.861 jΩ

MARKER READOUT
FUNCTIONS

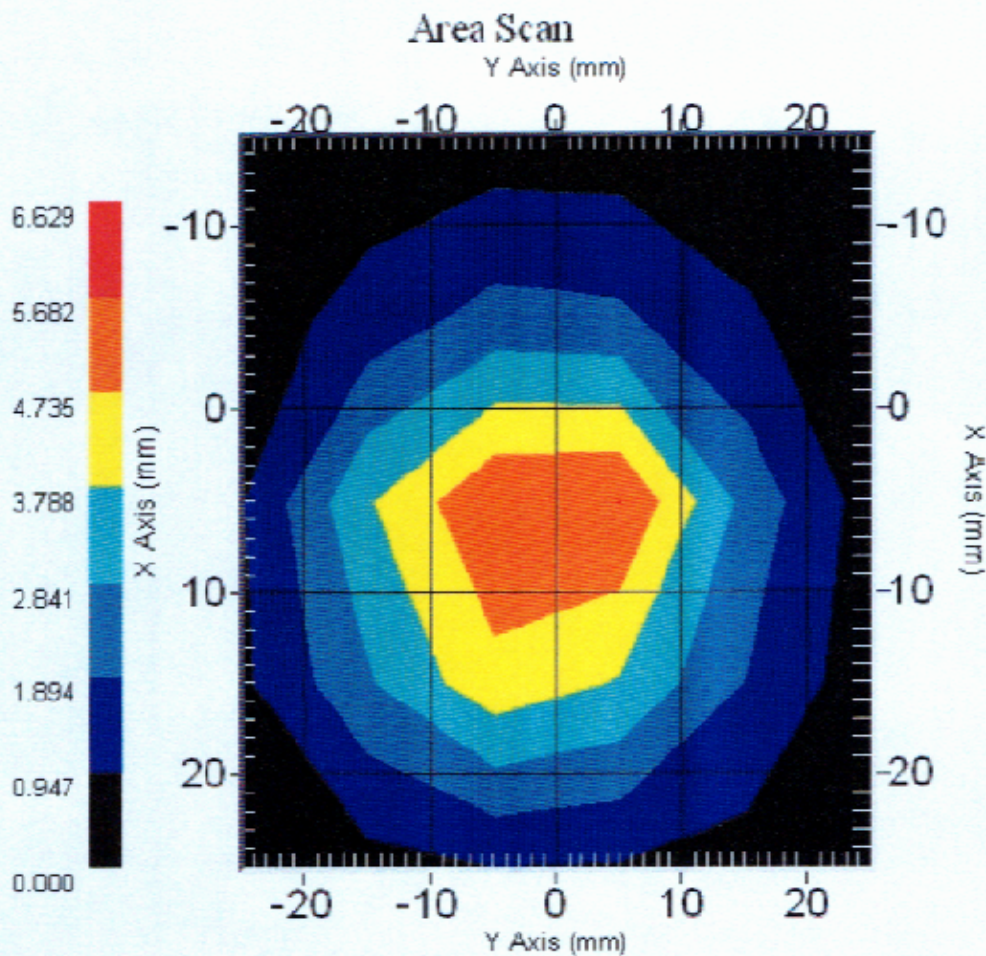
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Laboratories.

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



This page has been reviewed for content and attested to by signature within this document.

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

This page has been reviewed for content and attested to by signature within this document.

APPENDIX D - TEST SYSTEM VERIFICATIONS SCANS

Liquid Measurement and System validation 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
		lg 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
		lg 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**

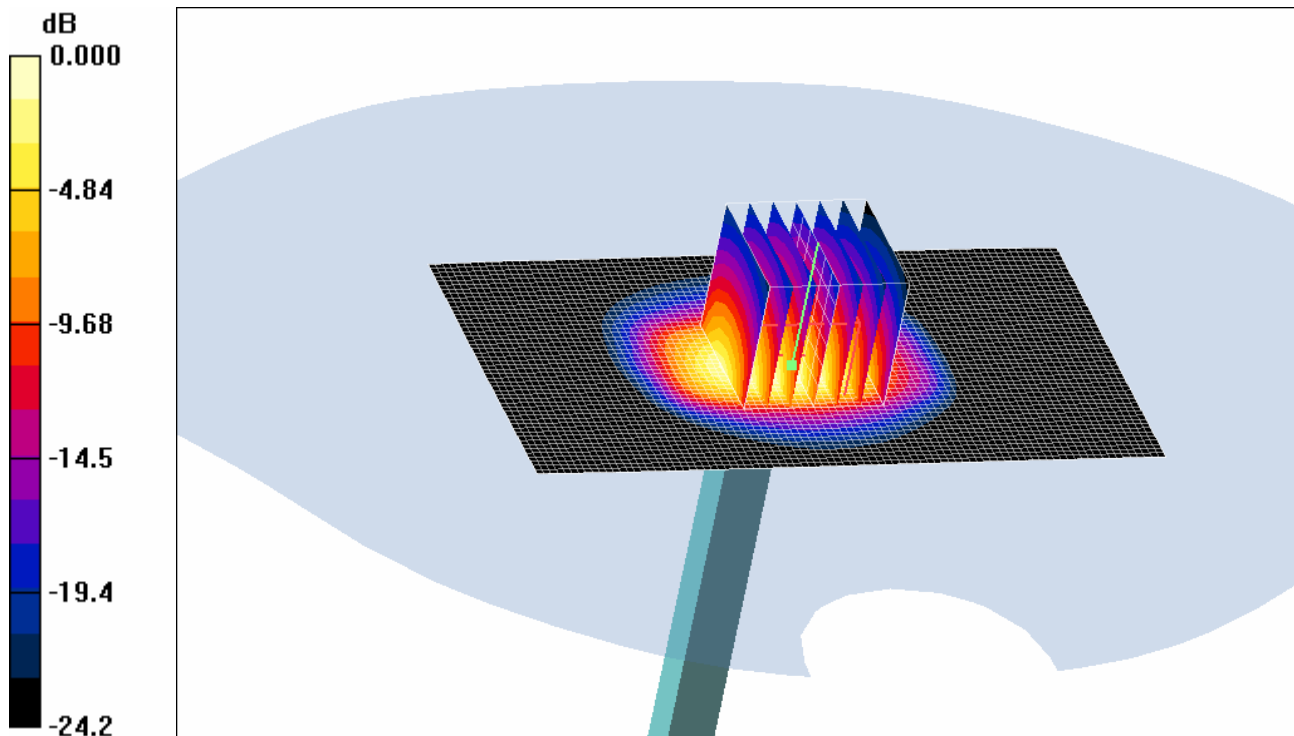
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section

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

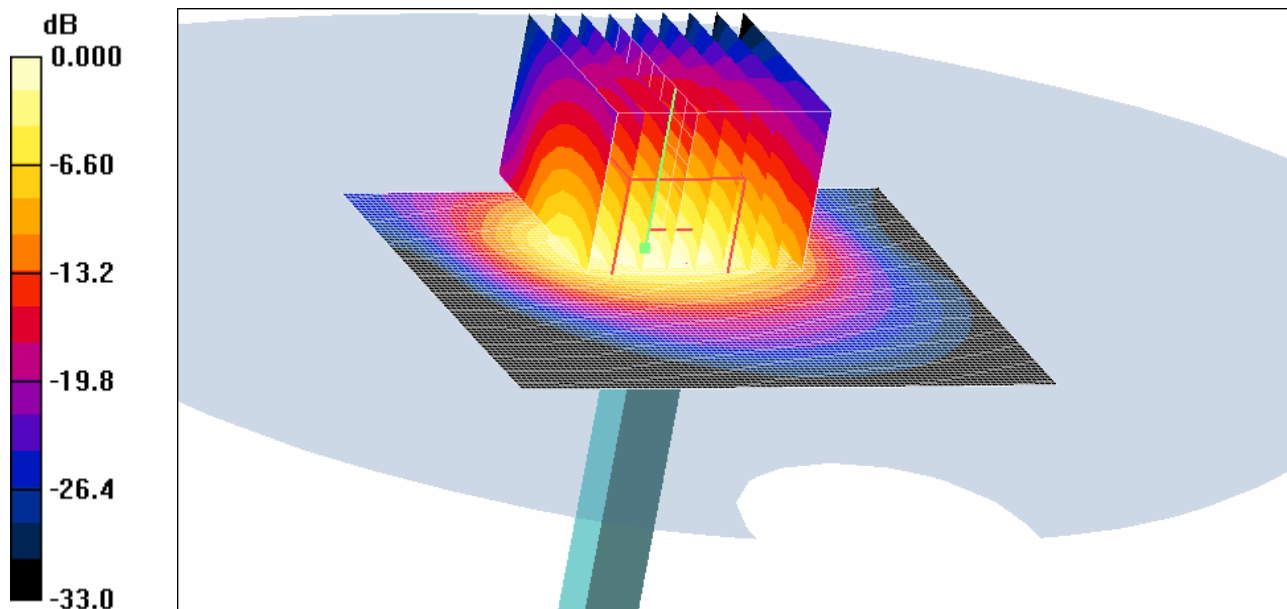
d=10mm, Pin=1W /Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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