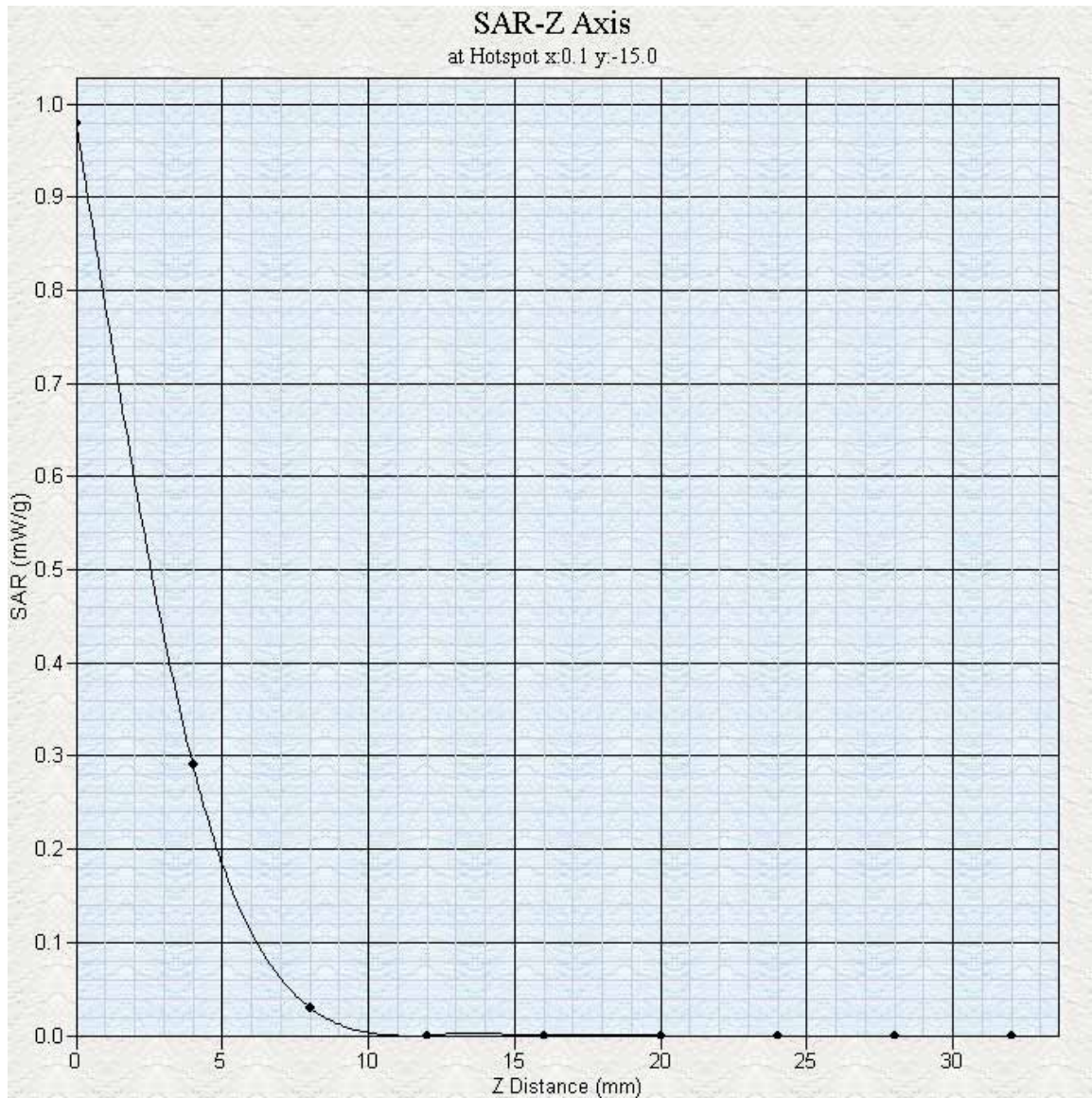


Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g)	Standard Uncertainty (10-g)
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	•3	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	•3	•cp	•cp	4.4	4.4
Boundary Effect	1.0	rectangular	•3	1	1	0.6	0.6
Linearity	4.7	rectangular	•3	1	1	2.7	2.7
Detection Limit	1.0	rectangular	•3	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	•3	1	1	0.5	0.5
Integration Time	1.7	rectangular	•3	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	•3	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	•3	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	•3	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	•3	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.0	rectangular	•3	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	•3	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	•3	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	0.6	rectangular	•3	0.7	0.5	0.2	0.2
Liquid Permittivity(target)	2.0	rectangular	•3	0.6	0.5	0.7	0.6
Liquid Permittivity(meas.)	2.6	rectangular	•3	0.6	0.5	0.9	0.8
Combined Uncertainty		RSS				9.1	9.0
Combined Uncertainty (coverage factor=2)		Normal (k=2)				18.3	18.0





Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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SAR Test Report

Operator : Roman
 Validation Date : 23-Sep-2004
 Measurement Date : 23-Sep-2004
 Starting Time : 23-Sep-2004 06:20:12 PM
 End Time : 23-Sep-2004 06:36:23 PM
 Scanning Time : 971 secs

Product Data
 Device Name : Dell-Pebble
 Serial No. : #5064
 Type : Other
 Model : D400
 Frequency : 5800.00 MHz
 Max. Transmit Pwr : 0.25 W
 Drift Time : 0 min(s)
 Length : 143
 Width : 34
 Depth : 0
 Antenna Type : Internal
 Power Drift-Start : 0.00
 Power Drift-Finish : 0.00
 Power Drift : 0.00

Phantom Data
 Name : APREL-Uni
 Type : Uni-Phantom
 Size : 280 x 280 x 200
 Serial No. : User Define
 Location : Center
 Description : Uni

Tissue Data
 Type : Body
 Serial No. : 5800
 Frequency : 5800 MHz
 Calibration Date : 23-Sep-2004
 Temperature : 23 °C
 Ambient Temp. : 23 °C
 Humidity : 50 RH%
 Epsilon : 41.0 F/m
 Sigma : 6.5 S/m
 Density : 1000 kg/cu. m

Probe Data
 Name : APREL Probe 212
 Model : E020
 Type : E-Field Triangle
 Serial No. : 212
 Calibration Date : 04-Jun-2004
 Frequency : 5800 MHz
 Duty Cycle Factor : 1
 Conversion Factor : 7.1
 Probe Sensitivity : 0.61 0.61 0.61 $\mu\text{V}/(\text{V}/\text{sq. m})$
 Compression Point : 95
 Offset : 1.56

Measurement Data
 Crest Factor : 1
 Scan Type : Complete
 Set-up Date : 23-Sep-2004
 Set-up Time : 2:11:46 PM

Project number: ITLB-Dell-5064
 FCC ID: ID:E2K5HCKT

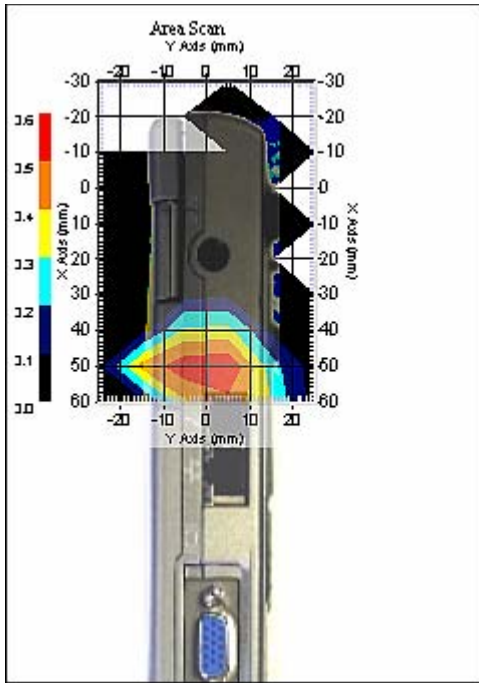
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Other Data
 DUT Position : Separated
 Separation : 5 mm
 Channel : Low - 5745 MHz



1 gram SAR value : 0.55 W/kg
 Zoom Scan Peak SAR : 1.89

Project number: ITLB-Dell-5064
 FCC ID: ID:E2K5HCKT

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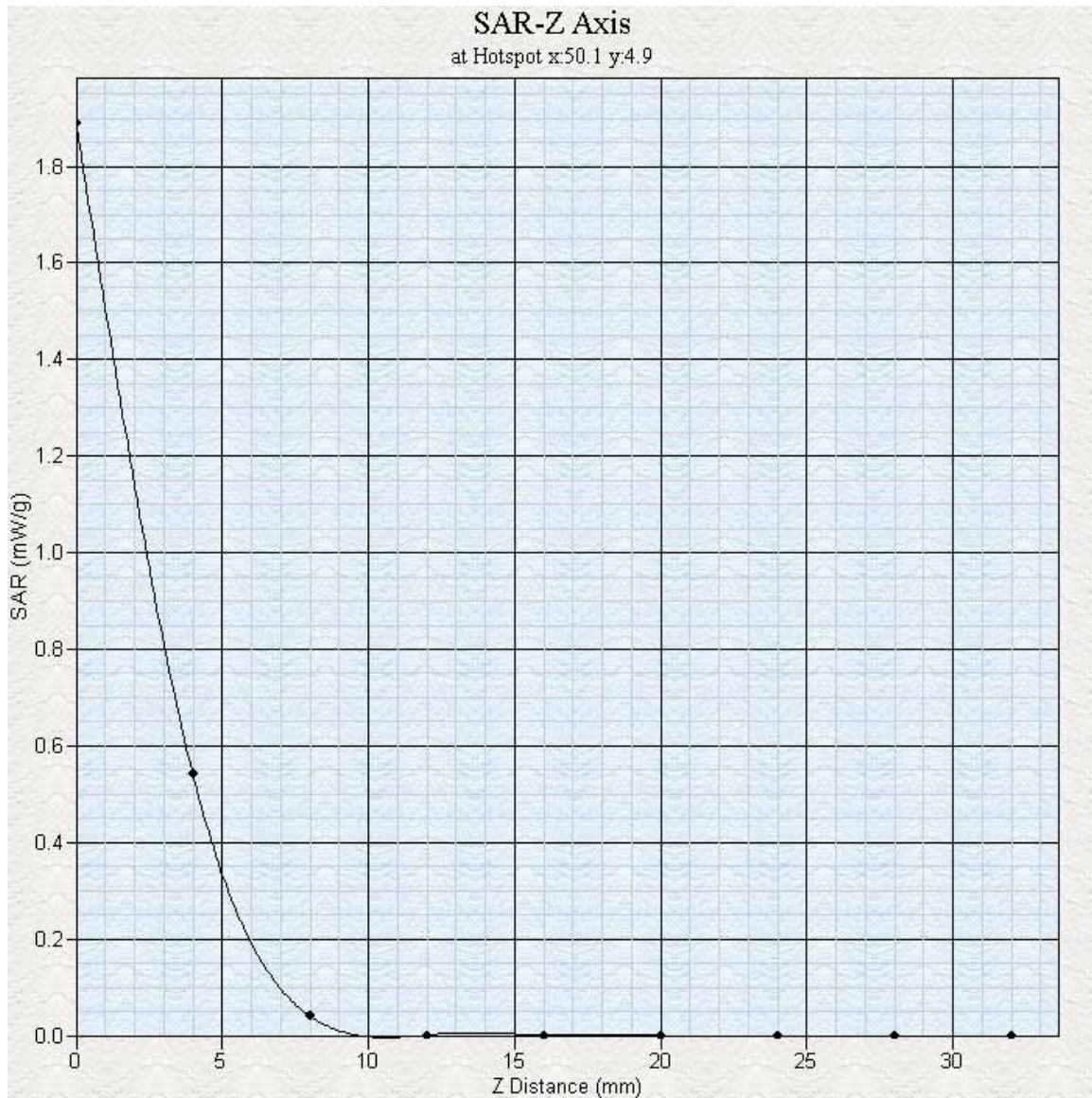
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Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g)	Standard Uncertainty (10-g)
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	•3	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	•3	•cp	•cp	4.4	4.4
Boundary Effect	1.0	rectangular	•3	1	1	0.6	0.6
Linearity	4.7	rectangular	•3	1	1	2.7	2.7
Detection Limit	1.0	rectangular	•3	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	•3	1	1	0.5	0.5
Integration Time	1.7	rectangular	•3	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	•3	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	•3	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	•3	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	•3	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.0	rectangular	•3	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	•3	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	•3	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	0.7	rectangular	•3	0.7	0.5	0.3	0.2
Liquid Permittivity(target)	2.0	rectangular	•3	0.6	0.5	0.7	0.6
Liquid Permittivity(meas.)	3.1	rectangular	•3	0.6	0.5	1.1	0.9
Combined Uncertainty		RSS				9.2	9.0
Combined Uncertainty (coverage factor=2)		Normal (k=2)				18.3	18.1



Project number: ITLB-Dell-5064
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AL-065

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SAR Test Report

Operator : Roman
 Validation Date : 24-Sep-2004
 Measurement Date : 24-Sep-2004
 Starting Time : 24-Sep-2004 10:15:29 AM
 End Time : 24-Sep-2004 10:31:44 AM
 Scanning Time : 975 secs

Product Data
 Device Name : Dell-Pebble
 Serial No. : #5064
 Type : Other
 Model : D400
 Frequency : 5800.00 MHz
 Max. Transmit Pwr : 0.25 W
 Drift Time : 0 min(s)
 Length : 162
 Width : 140
 Depth : 0
 Antenna Type : Internal
 Power Drift-Start : 0.00
 Power Drift-Finish : 0.00
 Power Drift : 0.00

Phantom Data
 Name : APREL-Uni
 Type : Uni-Phantom
 Size : 280 x 280 x 200
 Serial No. : User Define
 Location : Center
 Description : Uni

Tissue Data
 Type : Body
 Serial No. : 5800
 Frequency : 5800 MHz
 Calibration Date : 24-Sep-2004
 Temperature : 23 °C
 Ambient Temp. : 23 °C
 Humidity : 50 RH%
 Epsilon : 41.0 F/m
 Sigma : 6.5 S/m
 Density : 1000 kg/cu. m

Probe Data
 Name : APREL Probe 212
 Model : E020
 Type : E-Field Triangle
 Serial No. : 212
 Calibration Date : 04-Jun-2004
 Frequency : 5800 MHz
 Duty Cycle Factor : 1
 Conversion Factor : 7.1
 Probe Sensitivity : 0.61 0.61 0.61 $\mu\text{V}/(\text{V}/\text{sq. m})$
 Compression Point : 95
 Offset : 1.56

Measurement Data
 Crest Factor : 1
 Scan Type : Complete
 Set-up Date : 24-Sep-2004
 Set-up Time : 2:11:46 PM

Project number: ITLB-Dell-5064
 FCC ID: ID:E2K5HCKT

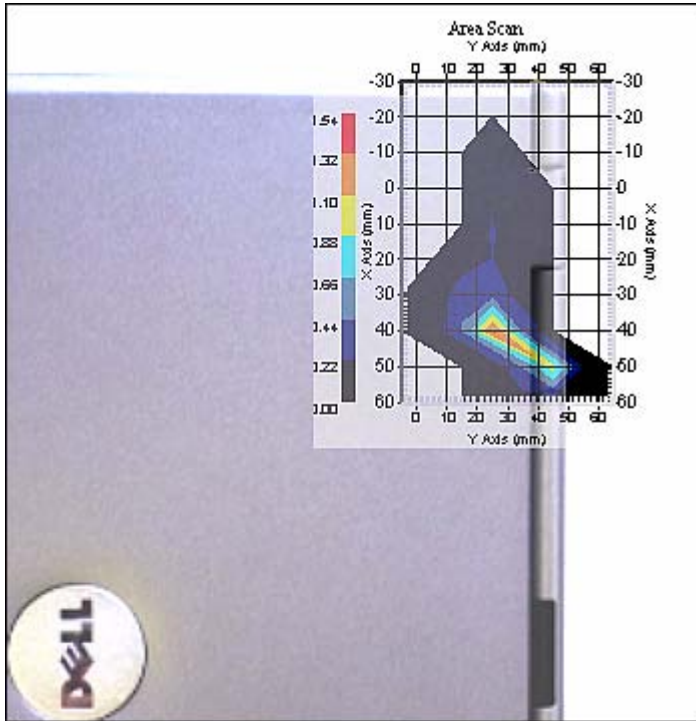
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Other Data
 DUT Position : Touch
 Separation : 0
 Channel : Low - 5745 MHz



1 gram SAR value : 1.03 W/kg
 Zoom Scan Peak SAR : 4.45

Project number: ITLB-Dell-5064
 FCC ID: ID:E2K5HCKT

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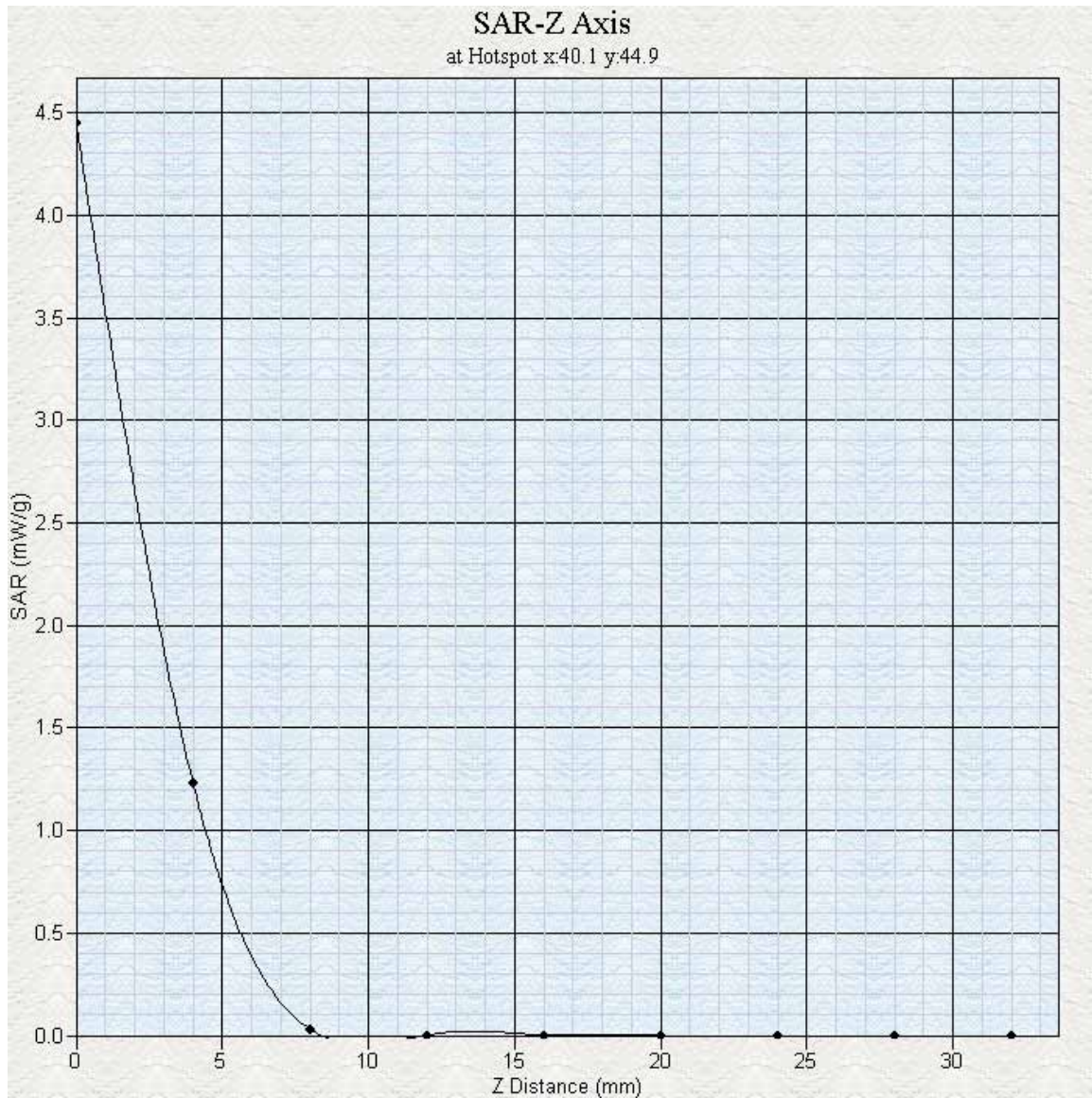


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Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g)	Standard Uncertainty (10-g)
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	•3	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	•3	•cp	•cp	4.4	4.4
Boundary Effect	1.0	rectangular	•3	1	1	0.6	0.6
Linearity	4.7	rectangular	•3	1	1	2.7	2.7
Detection Limit	1.0	rectangular	•3	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	•3	1	1	0.5	0.5
Integration Time	1.7	rectangular	•3	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	•3	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	•3	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	•3	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	•3	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.0	rectangular	•3	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	•3	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	•3	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	0.7	rectangular	•3	0.7	0.5	0.3	0.2
Liquid Permittivity(target)	2.0	rectangular	•3	0.6	0.5	0.7	0.6
Liquid Permittivity(meas.)	3.1	rectangular	•3	0.6	0.5	1.1	0.9
Combined Uncertainty		RSS				9.2	9.0
Combined Uncertainty (coverage factor=2)		Normal (k=2)				18.3	18.1





Project number: ITLB-Dell-5064
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SAR Test Report

Operator : Roman
 Validation Date : 24-Sep-2004
 Measurement Date : 24-Sep-2004
 Starting Time : 24-Sep-2004 11:26:38 AM
 End Time : 24-Sep-2004 11:44:29 AM
 Scanning Time : 1071 secs

Product Data
 Device Name : Dell-Pebble
 Serial No. : #5064
 Type : Other
 Model : D400
 Frequency : 5800.00 MHz
 Max. Transmit Pwr : 0.25 W
 Drift Time : 0 min(s)
 Length : 115
 Width : 157
 Depth : 0
 Antenna Type : Internal
 Power Drift-Start : 0.81
 Power Drift-Finish : 0.85
 Power Drift : 0.04

Phantom Data
 Name : APREL-Uni
 Type : Uni-Phantom
 Size : 280 x 280 x 200
 Serial No. : User Define
 Location : Center
 Description : Uni

Tissue Data
 Type : Body
 Serial No. : 5800
 Frequency : 5800 MHz
 Calibration Date : 24-Sep-2004
 Temperature : 23 °C
 Ambient Temp. : 23 °C
 Humidity : 50 RH%
 Epsilon : 41.0 F/m
 Sigma : 6.5 S/m
 Density : 1000 kg/cu. m

Probe Data
 Name : APREL Probe 212
 Model : E020
 Type : E-Field Triangle
 Serial No. : 212
 Calibration Date : 04-Jun-2004
 Frequency : 5800 MHz
 Duty Cycle Factor : 1
 Conversion Factor : 5.1
 Probe Sensitivity : 0.61 0.61 0.61 $\mu\text{V}/(\text{V}/\text{sq. m})$
 Compression Point : 95
 Offset : 1.56

Measurement Data
 Crest Factor : 1
 Scan Type : Complete
 Set-up Date : 24-Sep-2004
 Set-up Time : 2:11:46 PM

Project number: ITLB-Dell-5064
 FCC ID: ID:E2K5HCKT

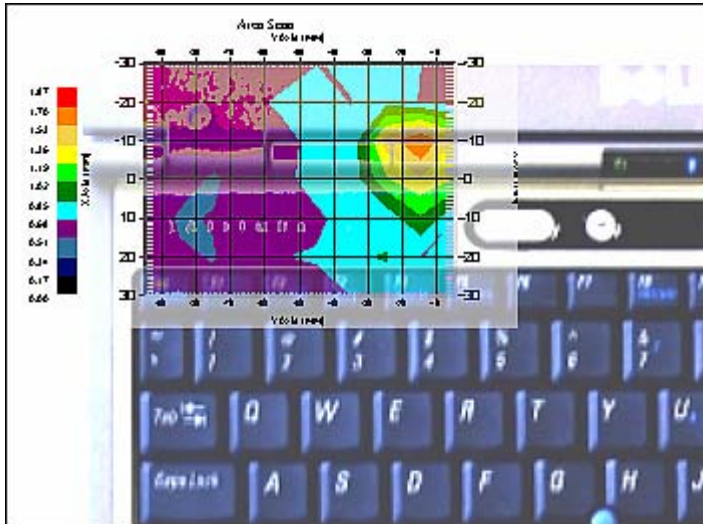
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Other Data
 DUT Position : Touch
 Separation : 0
 Channel : Low - 5745 MHz



1 gram SAR value : 1.32 W/kg
 Zoom Scan Peak SAR : 3.32

Project number: ITLB-Dell-5064
 FCC ID: ID:E2K5HCKT

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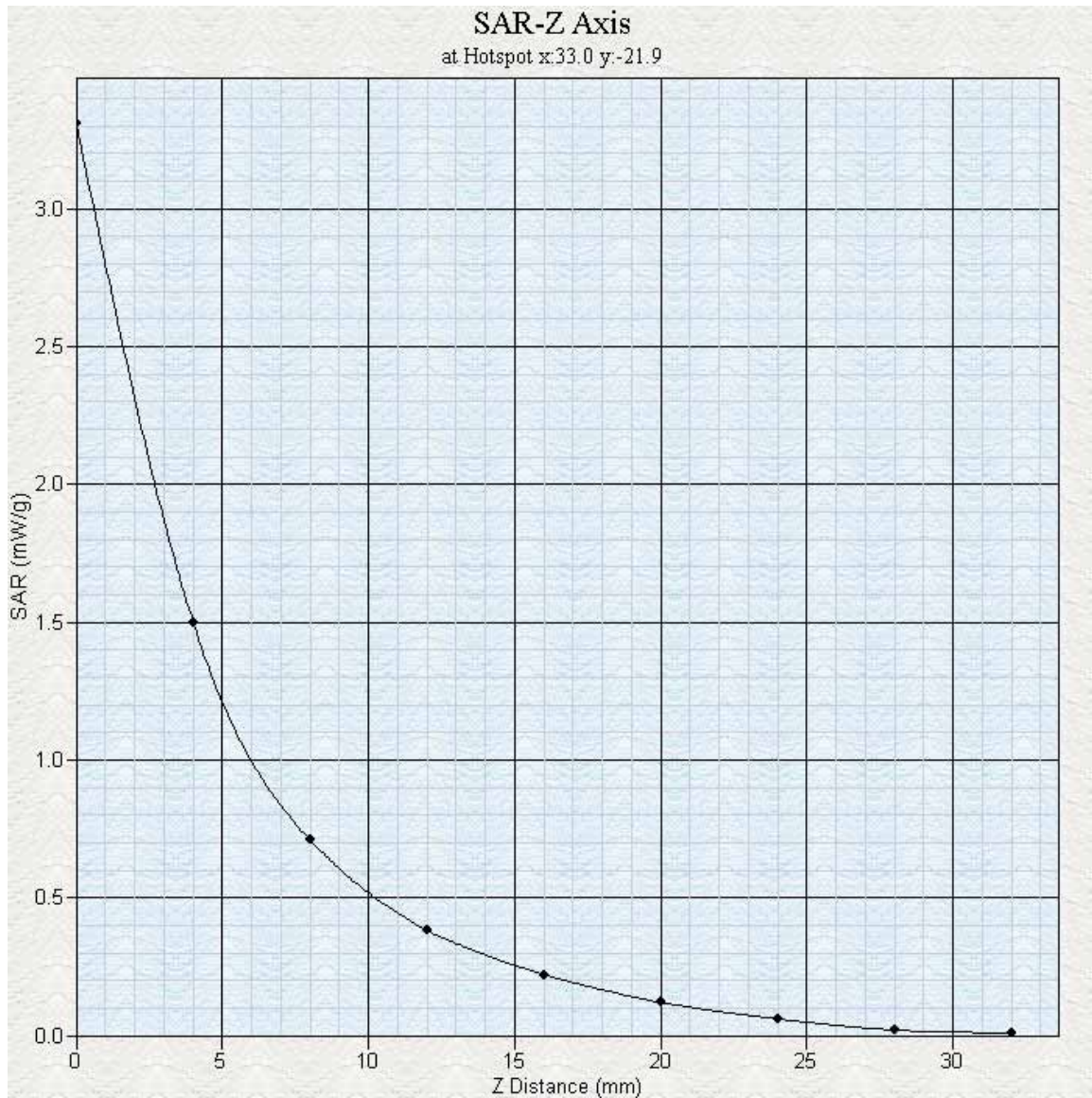
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Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g)	Standard Uncertainty (10-g)
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	•3	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	•3	•cp	•cp	4.4	4.4
Boundary Effect	1.0	rectangular	•3	1	1	0.6	0.6
Linearity	4.7	rectangular	•3	1	1	2.7	2.7
Detection Limit	1.0	rectangular	•3	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	•3	1	1	0.5	0.5
Integration Time	1.7	rectangular	•3	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	•3	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	•3	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	•3	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	•3	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.0	rectangular	•3	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	•3	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	•3	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	0.7	rectangular	•3	0.7	0.5	0.3	0.2
Liquid Permittivity(target)	2.0	rectangular	•3	0.6	0.5	0.7	0.6
Liquid Permittivity(meas.)	3.1	rectangular	•3	0.6	0.5	1.1	0.9
Combined Uncertainty		RSS				9.2	9.0
Combined Uncertainty (coverage factor=2)		Normal (k=2)				18.3	18.1



Appendix B
Probe Calibration Certificate

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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NCL CALIBRATION LABORATORIES

Calibration File No.: CP-339

Client.: APREL

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.

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 212

BODY Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: Internal

Calibrated: 4th June 2004

Released on: 4th June 2004

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

Released By: _____

NCL CALIBRATION LABORATORIES

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NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161



Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 212.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe 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"
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 212 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C



Calibration Results Summary

Probe Type: E-Field Probe E-020
Serial Number: 212
Frequency: 2450 MHz
Sensor Offset: 1.56 mm
Sensor Length: 2.5 mm
Tip Enclosure: Ertalyte*
Tip Diameter: 5 mm
Tip Length: 60 mm
Total Length: 290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X: $1.2 \mu\text{V}/(\text{V/m})^2$
Channel Y: $1.2 \mu\text{V}/(\text{V/m})^2$
Channel Z: $1.2 \mu\text{V}/(\text{V/m})^2$
Diode Compression Point: 95 mV



Sensitivity in Body Tissue

Frequency: 2450 MHz

Epsilon: 50.6 (+/-5%) **Sigma:** 1.98 S/m (+/-10%)

ConvF

Channel X: 3.3

Channel Y: 3.3

Channel Z: 3.3

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

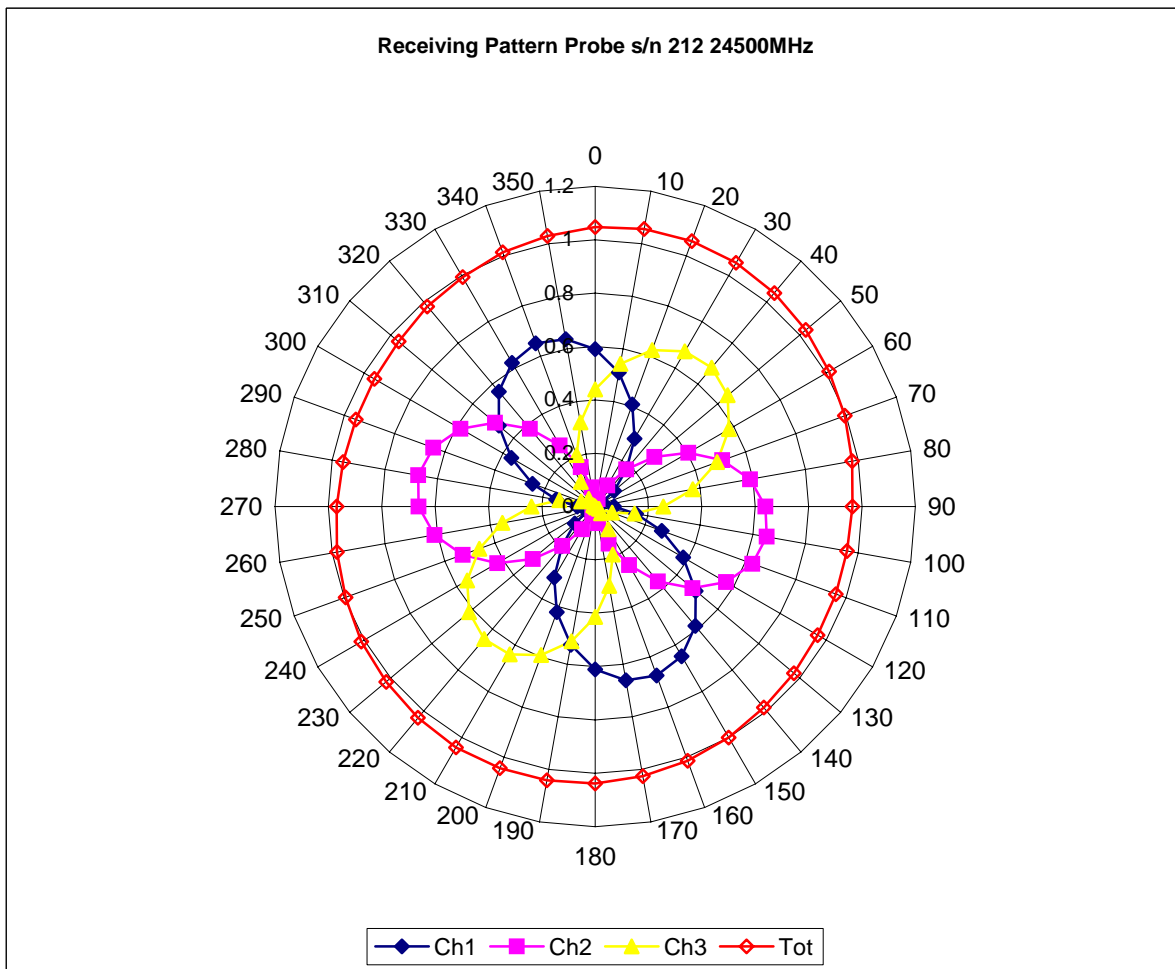
Boundary Effect:

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.4mm.

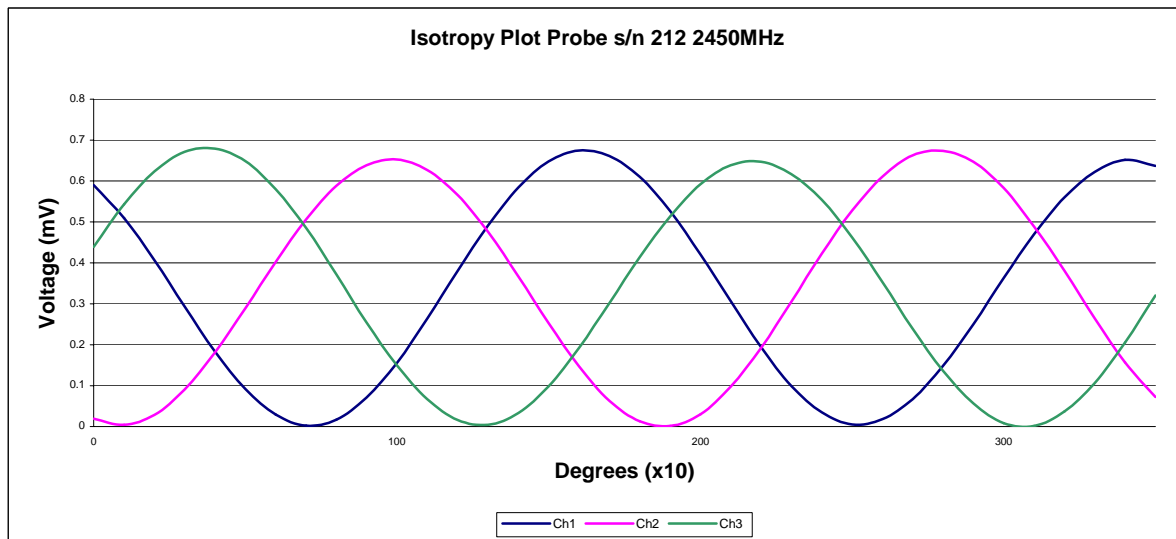
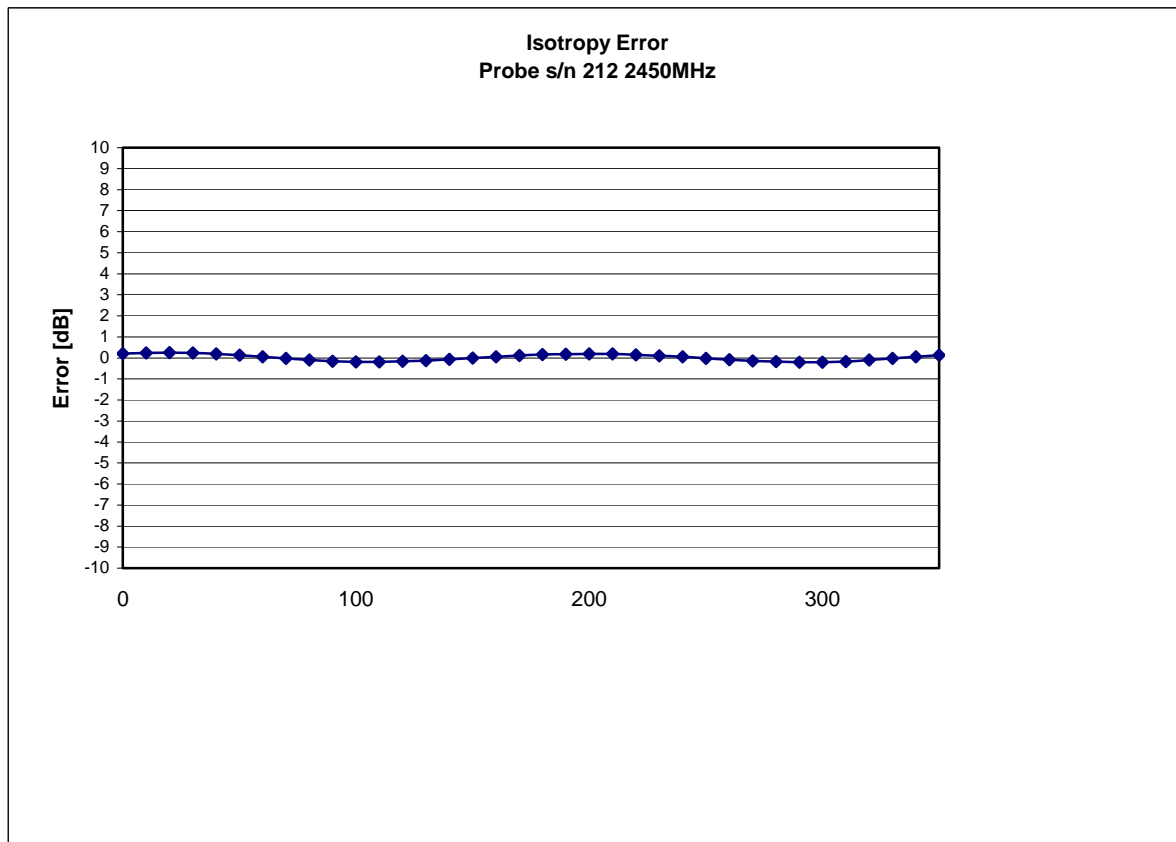
Spatial Resolution:

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 2450 MHz (Air)



Isotropy Error 2450 MHz (Air)



Isotropy:

0.10 dB

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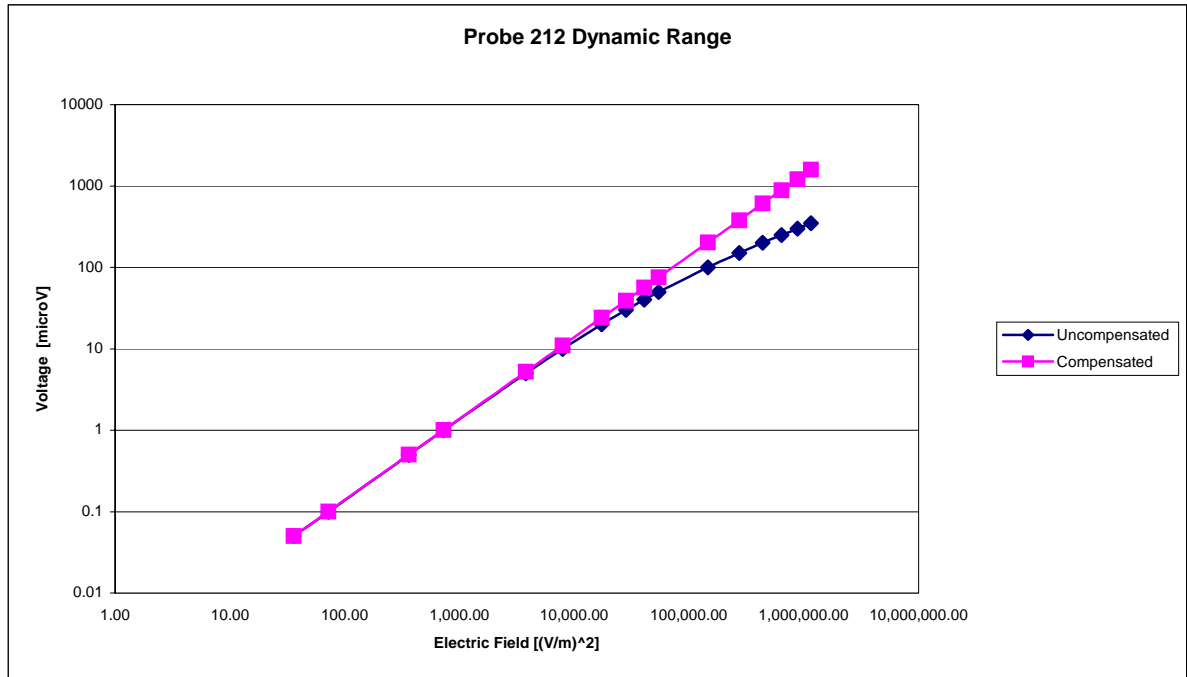
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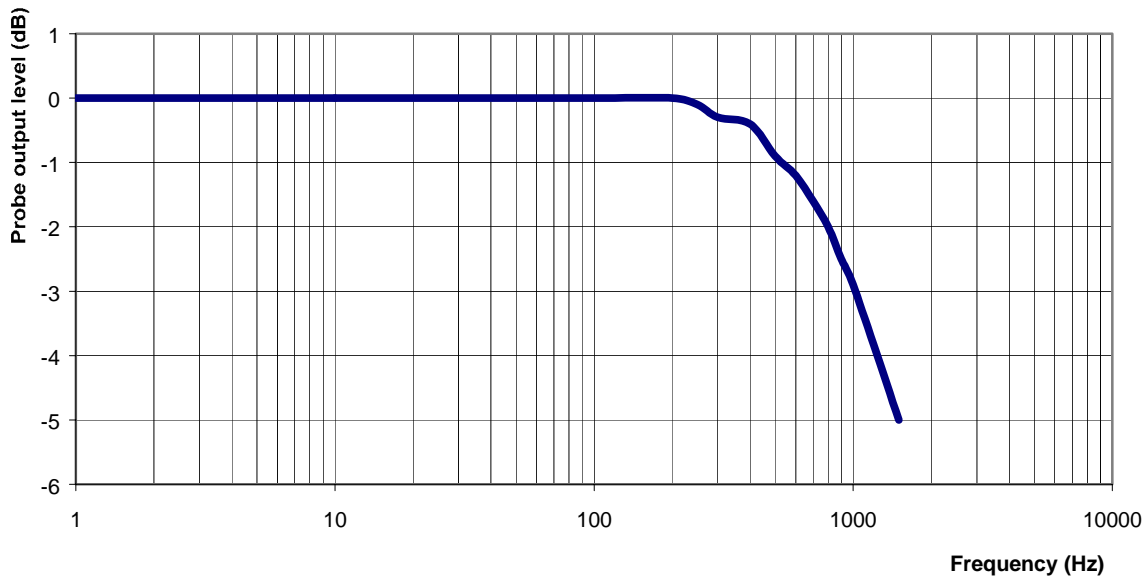
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Dynamic Range



Video Bandwidth

Probe Frequency Characteristics



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment**Frequency:** 2450MHz**Epsilon:** 50.6 (+/-5%)**Sigma:** 1.98 S/m (+/-10%)**ConvF****Channel X:** 3.3 7%(K=2)**Channel Y:** 3.3 7%(K=2)**Channel Z:** 3.3 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.



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 2004.

Project number: ITLB-Dell-5064
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Calibration File No.: CP-420

Client.: APREL

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.

Equipment: Miniature Isotropic RF Probe 5200 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 212

BODY Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: Internal

Calibrated: 2nd March 2004

Released on: 2nd March 2004

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

Released By: _____

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161



Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 212.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe 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"
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 212 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C



Calibration Results Summary

Probe Type: E-Field Probe E-020
Serial Number: 212
Frequency: 5200 MHz
Sensor Offset: 1.56 mm
Sensor Length: 2.5 mm
Tip Enclosure: Ertalyte*
Tip Diameter: 5 mm
Tip Length: 60 mm
Total Length: 290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X: $0.61 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y: $0.61 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z: $0.61 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point: 95 mV



Sensitivity in Body Tissue**Frequency:** 5200 MHz**Epsilon:** 36.0 (+/-5%) **Sigma:** 4.7 S/m (+/-10%)**ConvF****Channel X:** 7.8**Channel Y:** 7.8**Channel Z:** 7.8

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

Boundary Effect:

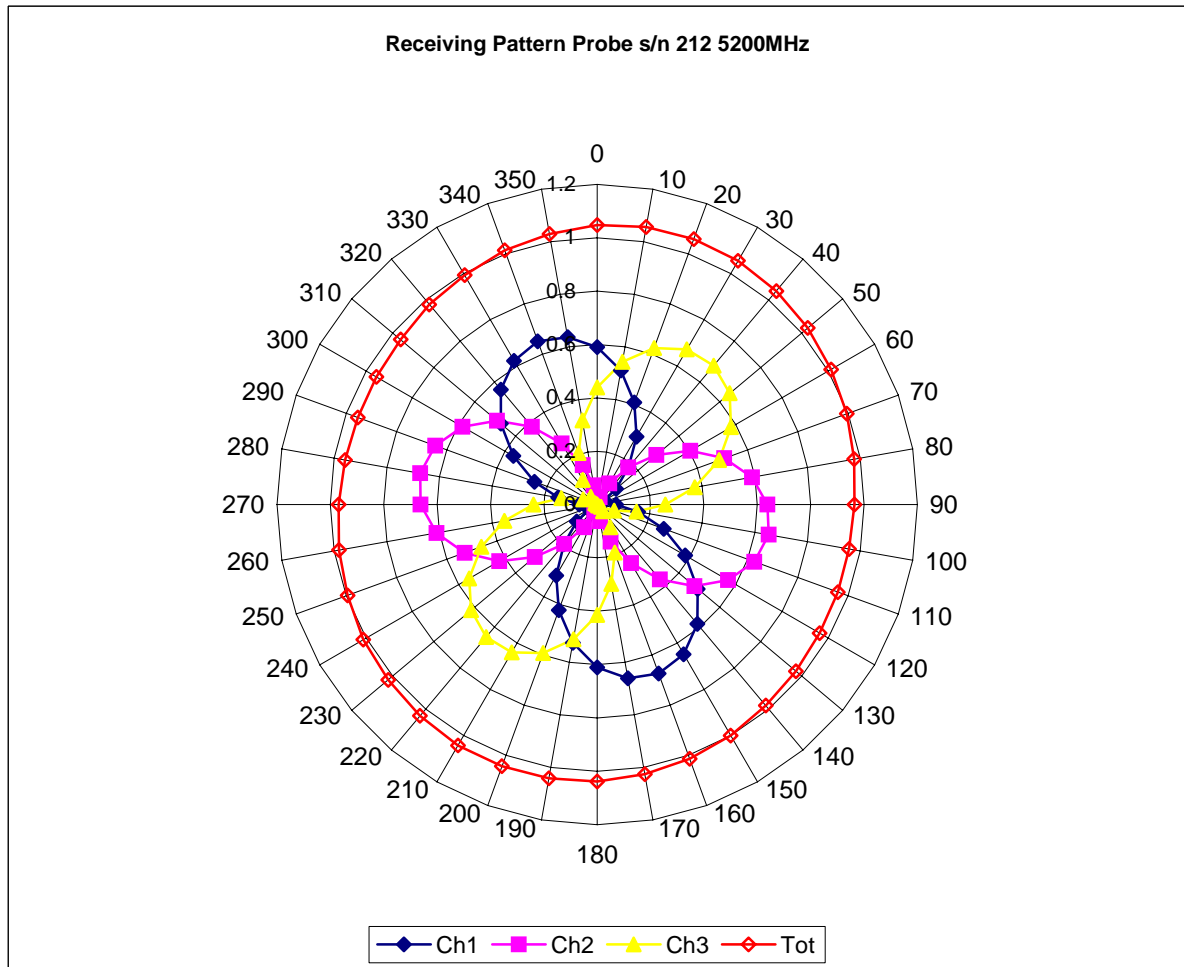
Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.4mm.

Spatial Resolution:

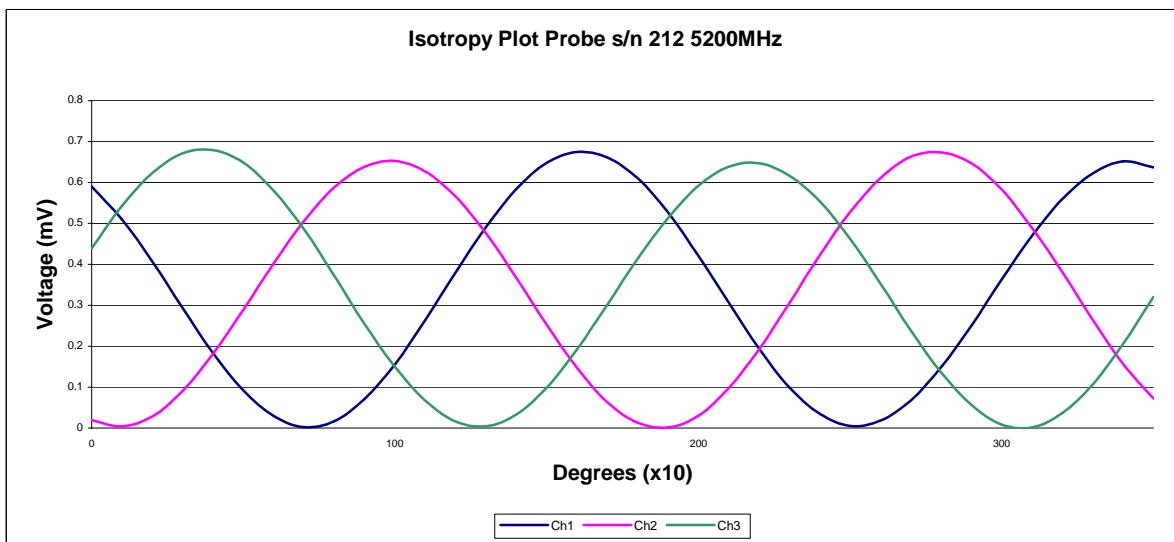
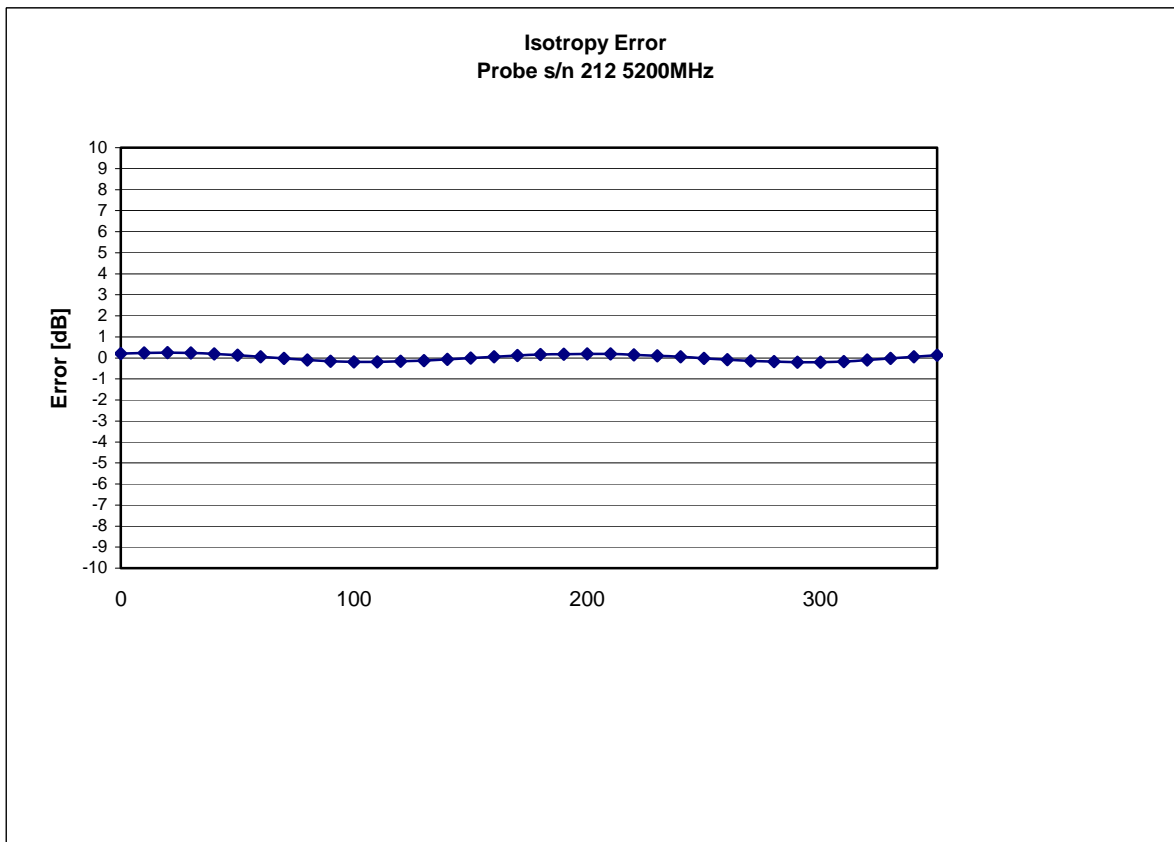
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.



Receiving Pattern 5200 MHz (Air)



Isotropy Error 5200 MHz (Air)



Isotropy:

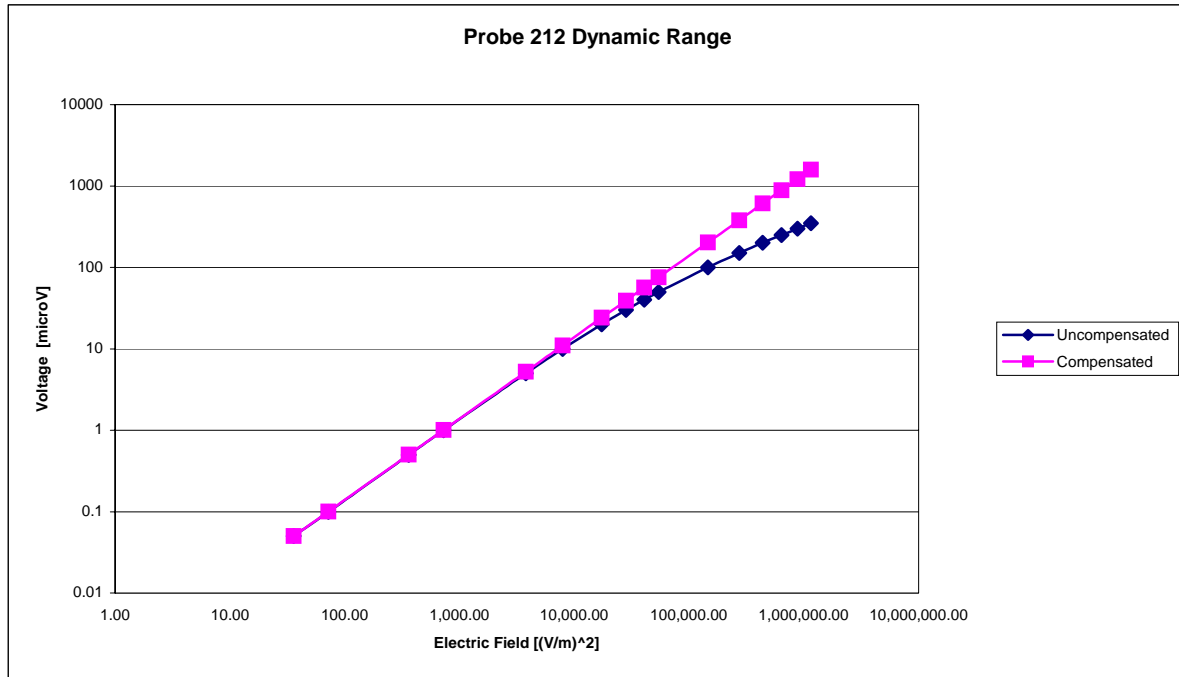
Project number: TLB-Dell-5064
FCC ID: ID:E2K5HCKT

0.10 dB

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Dynamic Range



Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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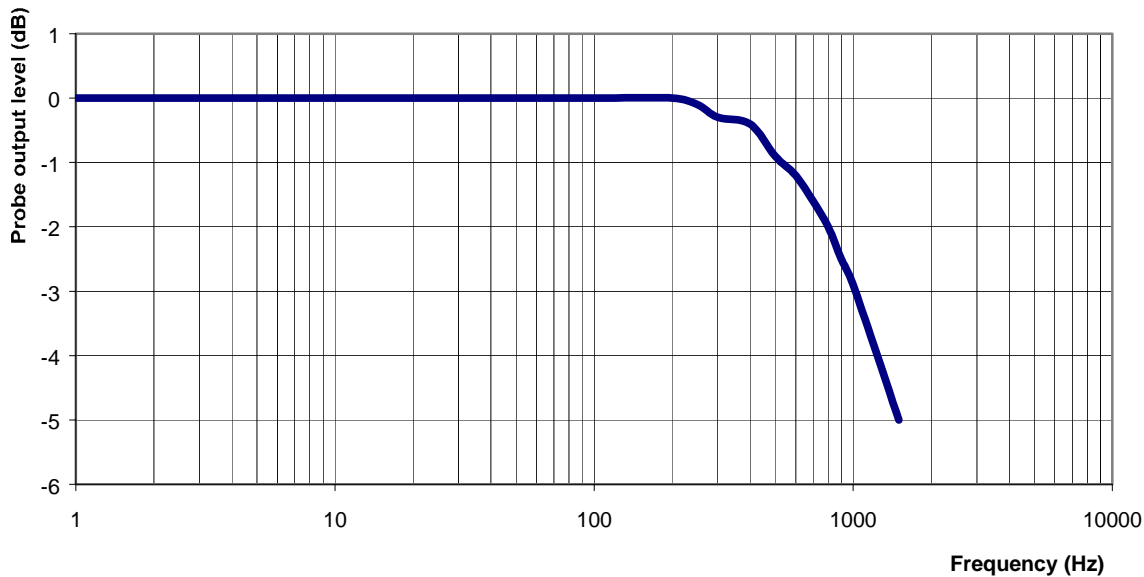
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Video Bandwidth

Probe Frequency Characteristics



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment

Frequency: 5200MHz

Epsilon: 36.0 (+/-5%)

Sigma: 4.7 S/m (+/-10%)

ConvF

Channel X: 7.8 7%(K=2)

Channel Y: 7.8 7%(K=2)

Channel Z: 7.8 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

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 2004.

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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NCL CALIBRATION LABORATORIES

Calibration File No.: CP-421

Client.: APREL

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.

Equipment: Miniature Isotropic RF Probe 5800 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 212

BODY Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: Internal

Calibrated: 2nd March 2004

Released on: 2nd March 2004

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

Released By: _____

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161



Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 212.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe 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"
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 212 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C



Calibration Results Summary

Probe Type: E-Field Probe E-020
Serial Number: 212
Frequency: 5800 MHz
Sensor Offset: 1.56 mm
Sensor Length: 2.5 mm
Tip Enclosure: Ertalyte*
Tip Diameter: 5 mm
Tip Length: 60 mm
Total Length: 290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X: $0.61 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y: $0.61 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z: $0.61 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point: 95 mV

Sensitivity in Body Tissue**Frequency:** 5800 MHz**Epsilon:** 35.15 (+/-5%) **Sigma:** 6.4 S/m (+/-10%)**ConvF****Channel X:** 7.1**Channel Y:** 7.1**Channel Z:** 7.1

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

Boundary Effect:

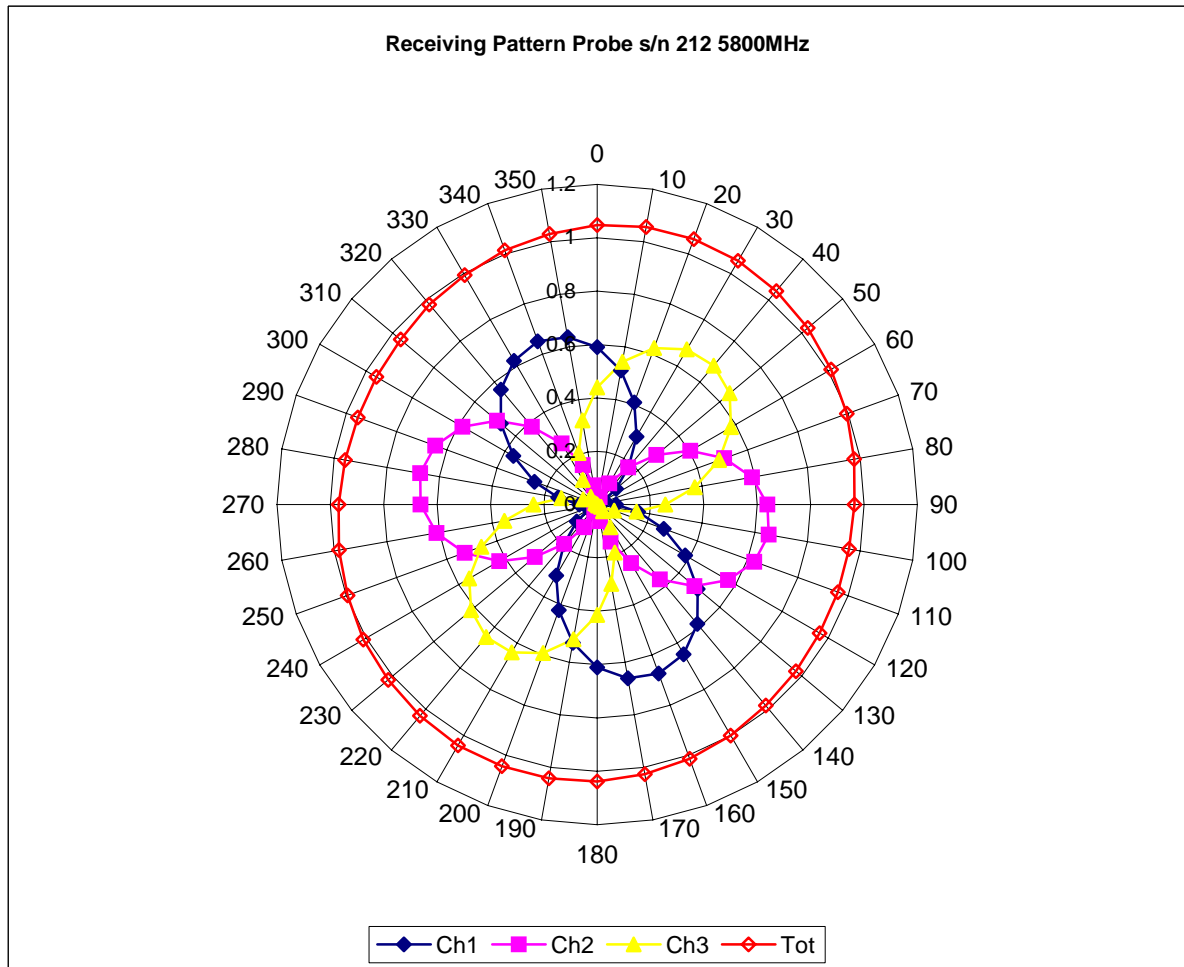
Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.4mm.

Spatial Resolution:

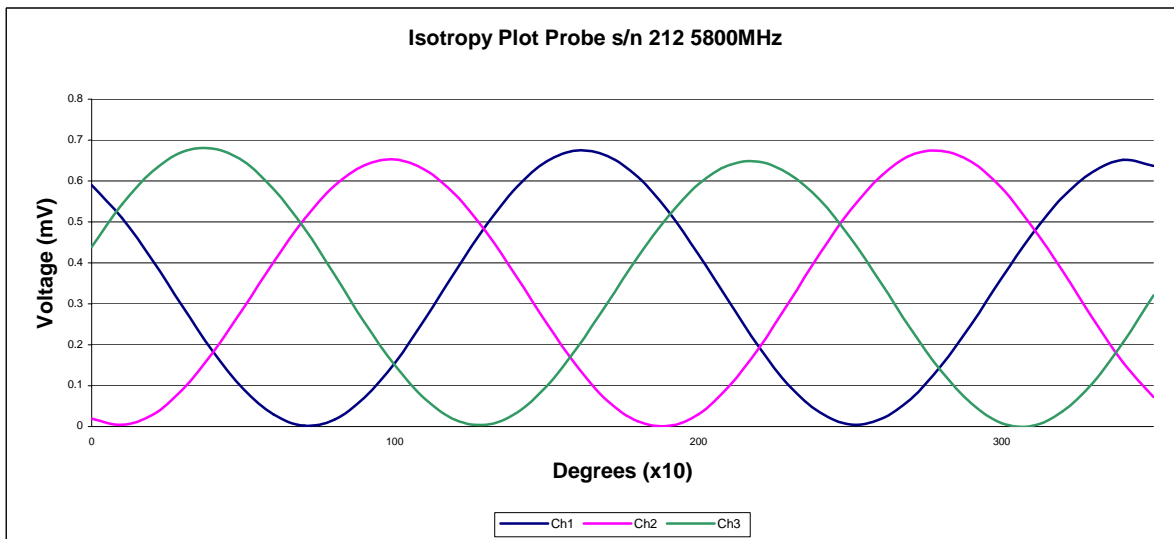
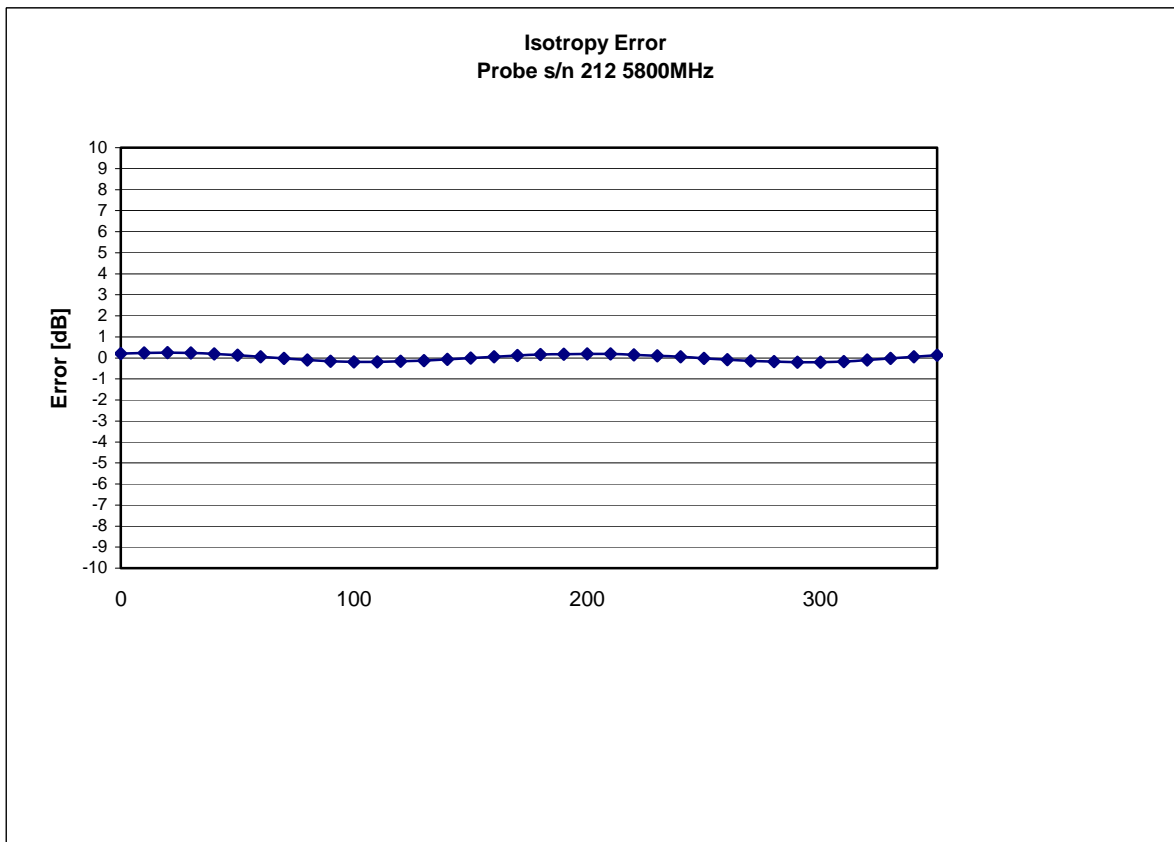
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.



Receiving Pattern 5800 MHz (Air)



Isotropy Error 5800 MHz (Air)



Isotropy:

0.10 dB

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

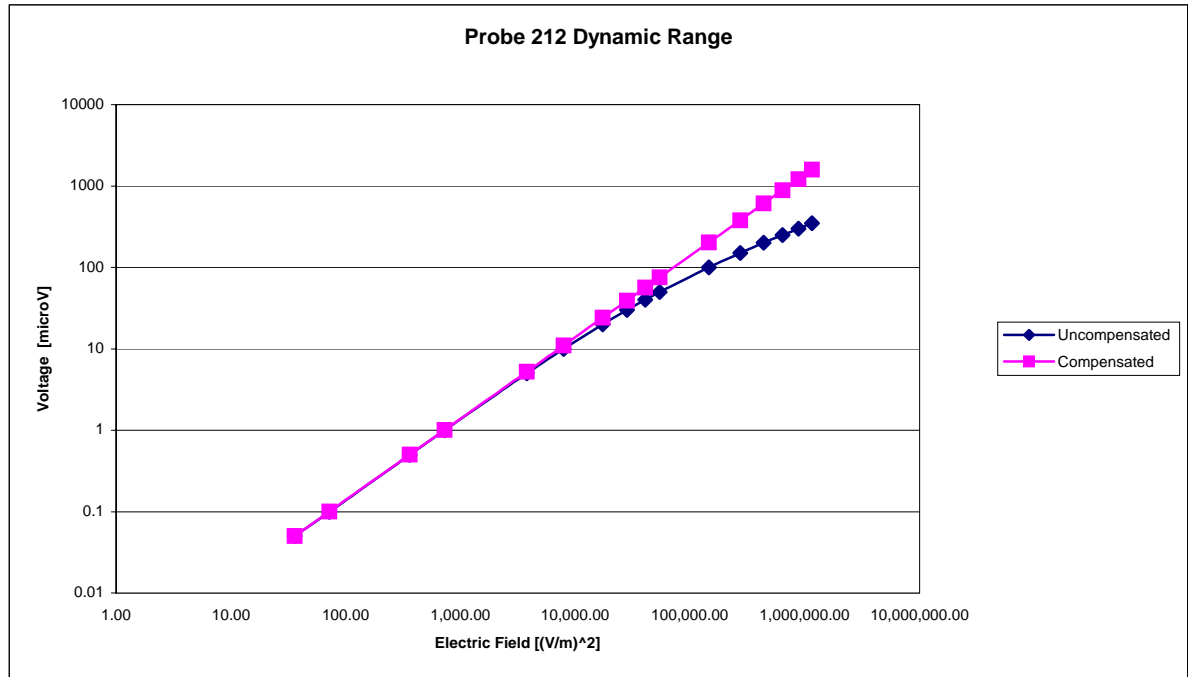
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Dynamic Range



Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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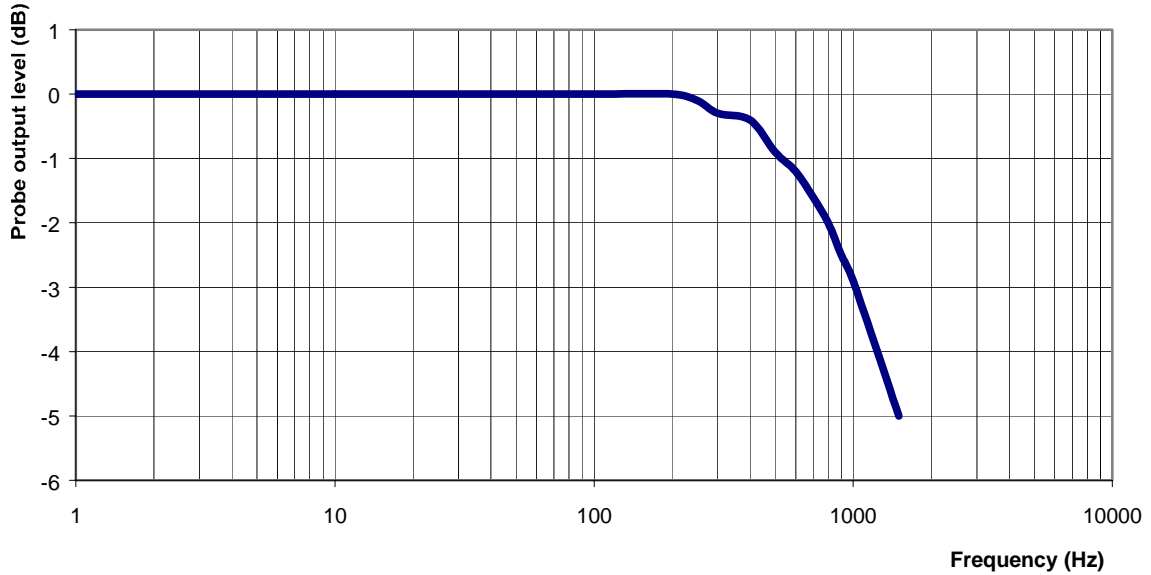
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Video Bandwidth

Probe Frequency Characteristics



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment**Frequency:** 5800MHz**Epsilon:** 35.15 (+/-5%)**Sigma:** 6.4 S/m (+/-10%)**ConvF****Channel X:** 7.1 7%(K=2)**Channel Y:** 7.1 7%(K=2)**Channel Z:** 7.1 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.



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 2004.

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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Appendix C
Dipole Calibration Certificate

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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NCL CALIBRATION LABORATORIES

Calibration File No: DC-0265

Project Number: Internal

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.

APREL Validation Dipole

Manufacturer: APREL Laboratories

Part number: D-2450-S-1

Frequency: 2.45 GHz

Serial No: ALCD-10

Customer: APREL

Calibrated: 14 November 2003

Released on: 15 November 2003

Released By: _____

NCL CALIBRATION LABORATORIES

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NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161



Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Mechanical Dimensions

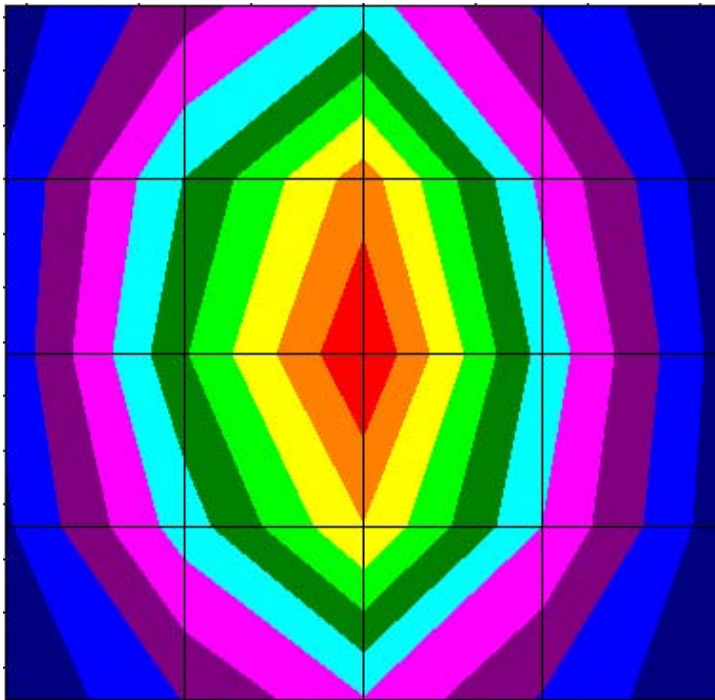
Length: 51.7 mm
Height: 30.8 mm

Electrical Specification

SWR: 1.181U
Return Loss: -21.4 dB
Impedance: 46.175

System Validation Results

Frequency	1 Gram	10 Gram	Peak
2.45 GHz	52.45	22.91	102.91



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 ALCD-10 at 2.45 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 ALIDX-500, along with the APREL Reference E-010 130 MHz to 26 GHz E-Field Probe Serial Number 163.

References

SSI-TP-018 Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

IEEE 1528 *DRAFT* "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 ALCD-10 was a new Dipole taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 24 °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	51.7 mm	30.8 mm

Tissue Validation

Head Tissue 2450 MHz	Measured
Dielectric constant, ϵ_r	39.2
Conductivity, σ [S/m]	1.82
Tissue Conversion Factor,	4.61



Electrical Calibration

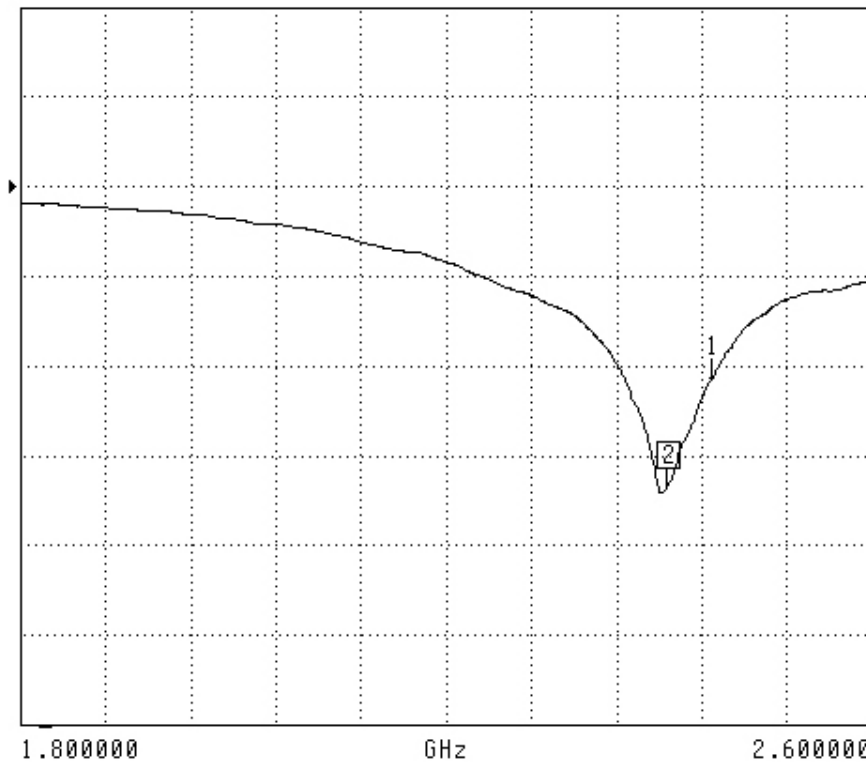
Test	Result	IEEE Value
S11 R/L	-21.4	-21 dB
SWR	1.181U	-
Impedance	46.175 Ω	

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

S11 Parameter Return Loss

S11 FORWARD REFLECTION

LOG MAGNITUDE REF=0.000 dB 10.000 dB/DIV



CH 1 - S11
REFERENCE PLANE
5.1160 mm

MARKER 2
2.408000 GHz
-33.566 dB

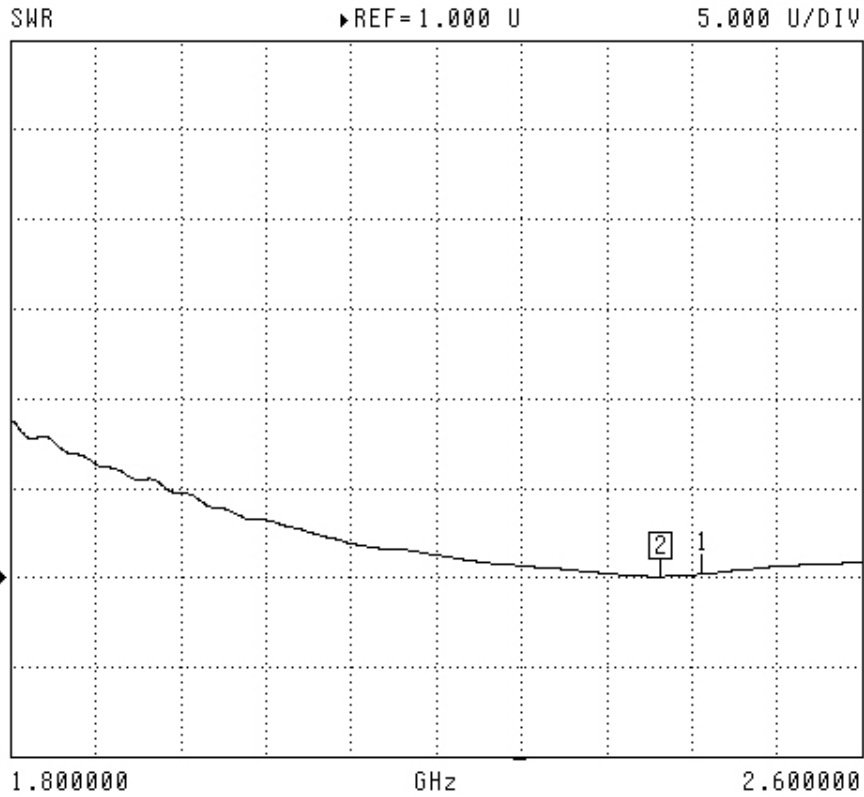
MARKER TO MAX
▶ MARKER TO MIN

1 2.450000 GHz
-21.377 dB

MARKER READOUT
FUNCTIONS

SWR

S11 FORWARD REFLECTION



CH 1 - S11
REFERENCE PLANE
5.1160 mm

MARKER 2
2.411000 GHz
1.049 U

MARKER TO MAX
▶ MARKER TO MIN

1 2.450000 GHz
1.181 U

MARKER READOUT
FUNCTIONS

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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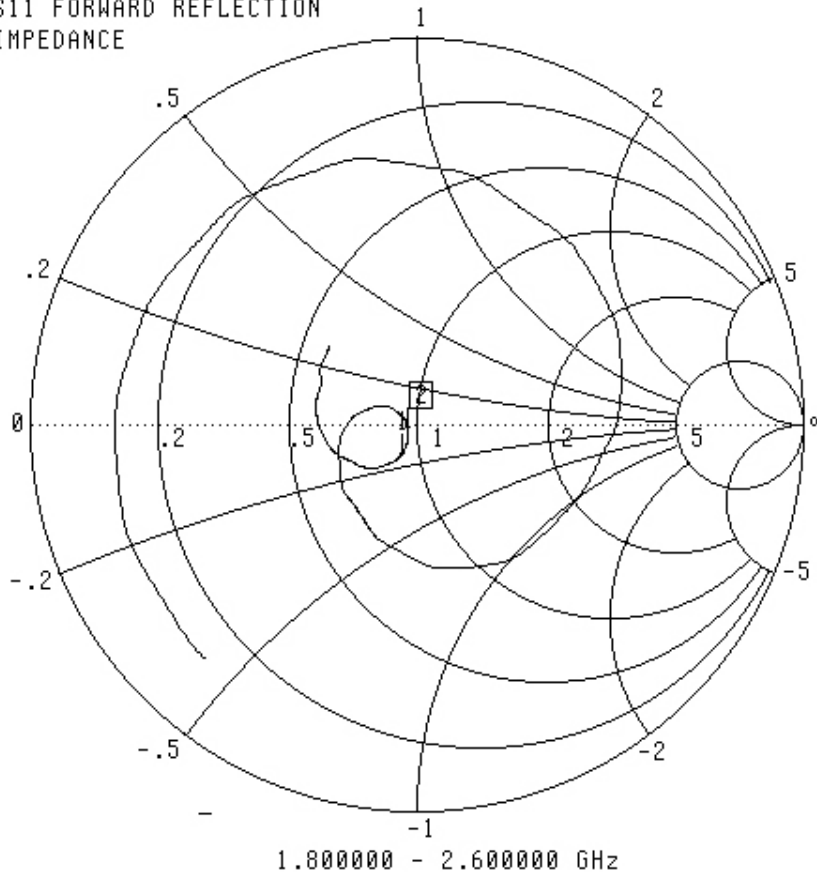
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Smith Chart Dipole Impedance

S11 FORWARD REFLECTION
IMPEDANCE



CH 1 - S11
REFERENCE PLANE
5.1160 mm

MARKER 2
2.411000 GHz
48.080 Ω
-1.171 j Ω

MARKER TO MAX
▶ MARKER TO MIN

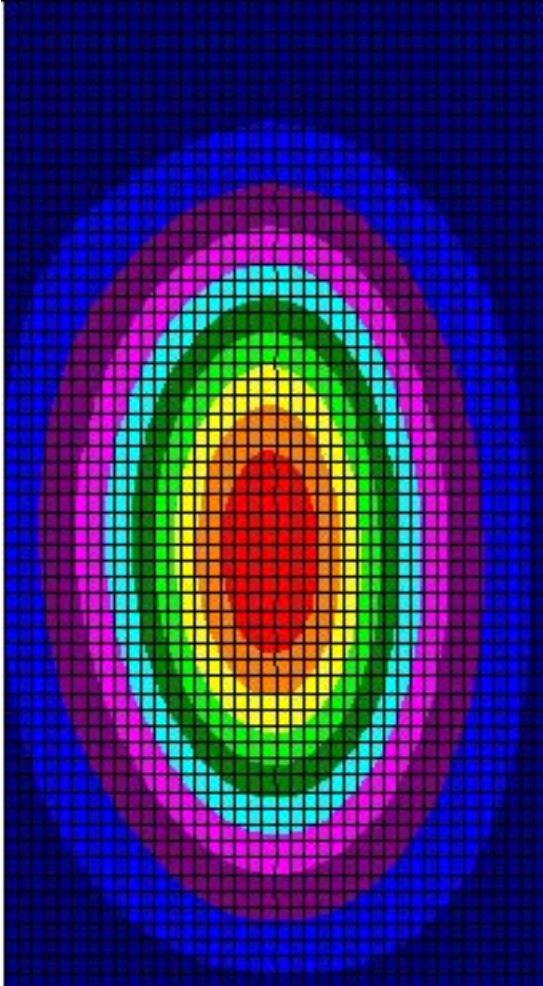
1 2.450000 GHz
46.175 Ω
-7.199 j Ω

MARKER READOUT
FUNCTIONS

System Validation Results Using the Electrically Calibrated Dipole

Frequency	1 Gram	10 Gram	Peak Above Feed Point
2.45 GHz	52.45	22.91	102.91

The following Graphic Plot is the splined measurement result for the course scan.



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 2004.



NCL CALIBRATION LABORATORIES

Calibration File No: DC-0254

Project Number: Internal

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.

APREL Validation Dipole

Manufacturer: APREL Laboratories

Part number: D-5240-S-2

Frequency: 5.24 GHz

Serial No: 301460

Customer: APREL

Calibrated: 1 March 2004
Released on: 1 March 2004

Released By: _____

NCL CALIBRATION LABORATORIES

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NEPEAN, ONTARIO
CANADA K2R 1E6

Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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Calibration Results Summary

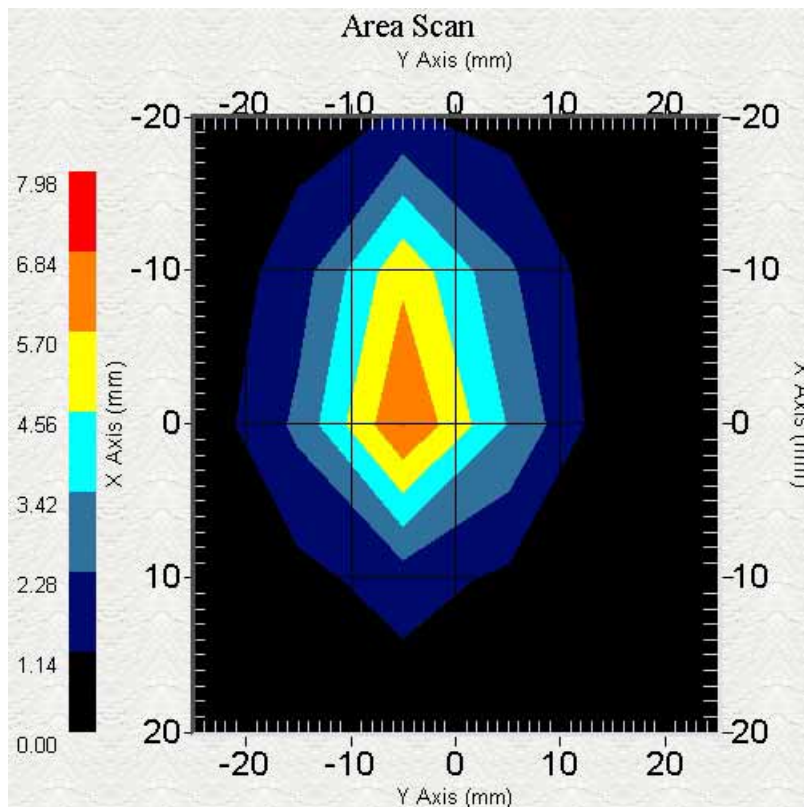
The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Electrical Specification

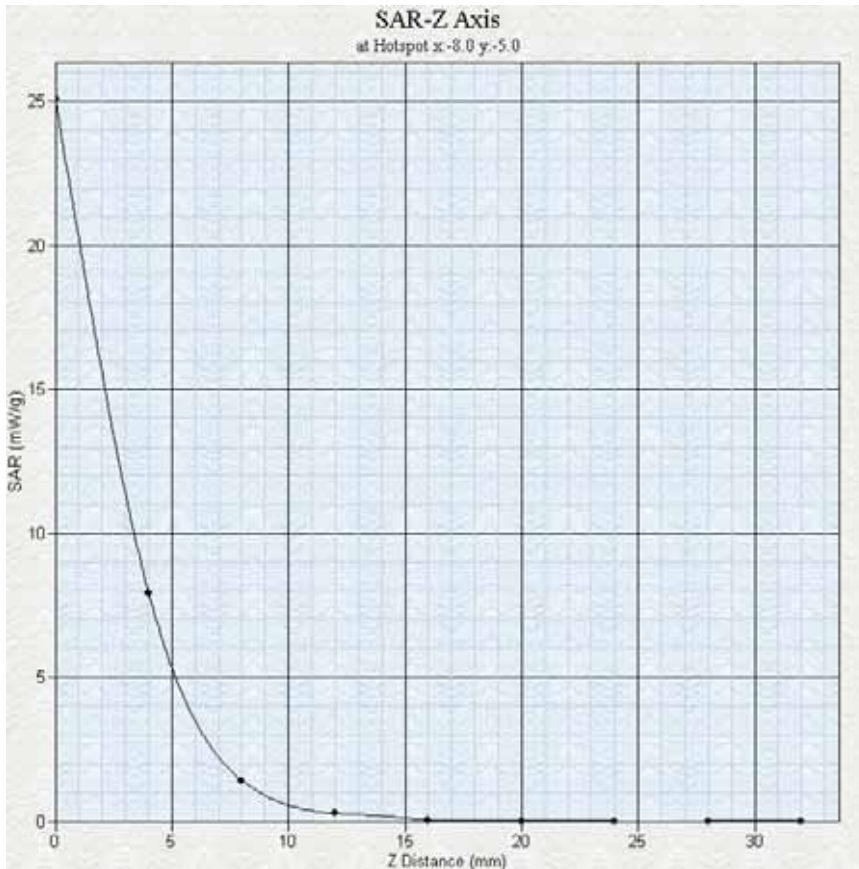
SWR: 1.21U
Return Loss: -17.9 dB
Impedance: 45.175

System Validation Results

Frequency	1 Gram
5240 GHz	61.8



Z-Axis Results



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 301532 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 ALIDX-500, along with the APREL Reference E-010 130 MHz to 26 GHz E-Field Probe Serial Number 163.

References

SSI-TP-018 Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

IEEE P-1528 *DRAFT* "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 301532 was a new Dipole taken from stock prior to calibration.

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

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



NCL CALIBRATION LABORATORIES

Calibration File No: Not Applicable
Project Number: Internal

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.

APREL Validation Dipole

Manufacturer: APREL Laboratories

Part number: D-5800-S-2

Frequency: 5.80 GHz

Serial No: PT-015-a

Customer: APREL

Calibrated: 1 March 2004
Released on: 1 March 2004

Released By: _____

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Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

Project number: ITLB-Dell-5064
FCC ID: ID:E2K5HCKT

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Calibration Results Summary

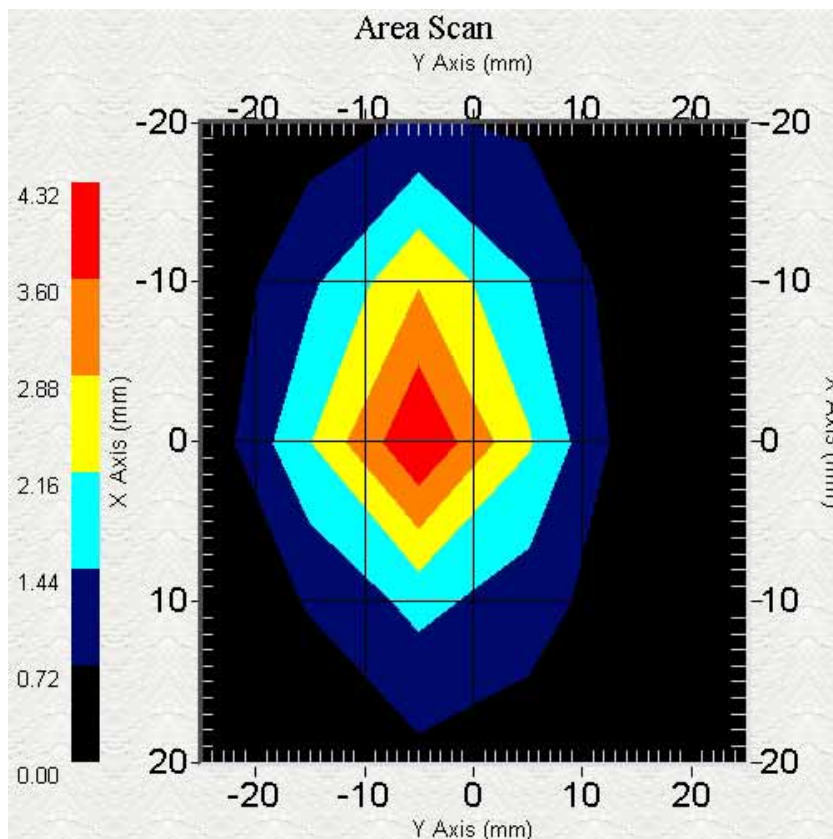
The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Electrical Specification

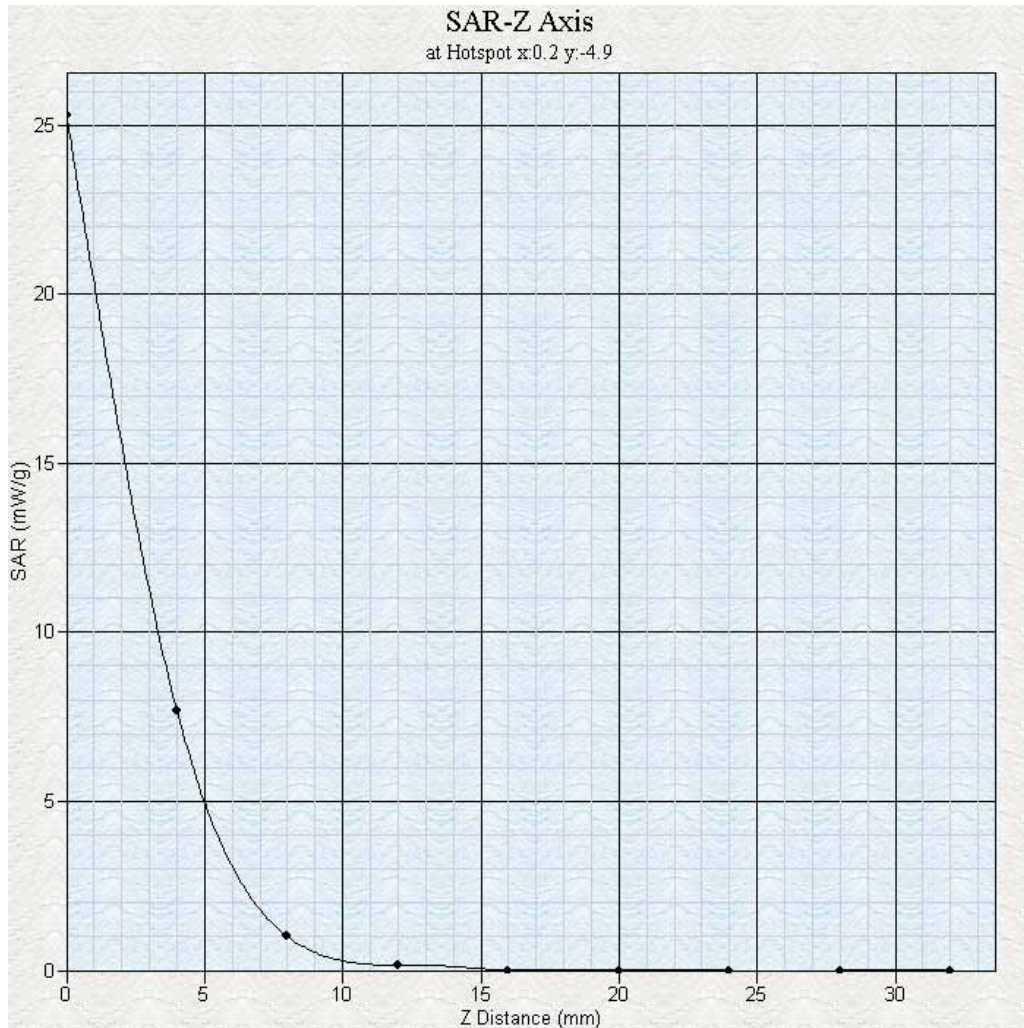
SWR: 1.26U
Return Loss: -16.3 dB
Impedance: 44.175

System Validation Results

Frequency	1 Gram
5800 GHz	57.9



Z-Axis Results



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 301532 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 ALIDX-500, along with the APREL Reference E-010 130 MHz to 26 GHz E-Field Probe Serial Number 163.

References

SSI-TP-018 Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

IEEE P-1528 *DRAFT* "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 PT-015-a was a new Dipole taken from stock prior to calibration.

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

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

