



Appendix D. Probe Calibration Data

Miniature Isotropic RF Probe

M/N: ALS-E-020

S/N: 264

2450MHz Head Calibration page 2~11

2450MHz Body Calibration page 12~21

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-634

Client: QUIETEK

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.

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 264

HEAD Calibration


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

Project No: QUIB-Probe-Cal-5210

Calibrated: 21st March 2006

Released on: 21st March 2006

This Calibration Certificate is incomplete unless accompanied with the Calibration Results Summary

Released By: 

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA, K2R 1E8

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

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

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained

NCL Calibration Laboratories

Division of APREL Laboratories.

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-020 264.

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 264 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

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.



Stuart Nicol

Yi Pan

Page 2 of 10

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Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	264
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 $\mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	1.2 $\mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	1.2 $\mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV

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Sensitivity in Head Tissue

Frequency: 2450 MHz

Epsilon: 39.2 (+/-5%)

Sigma: 1.80 S/m (+/-5%)

ConvF

Channel X: 5.0

Channel Y: 5.0

Channel Z: 5.0

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

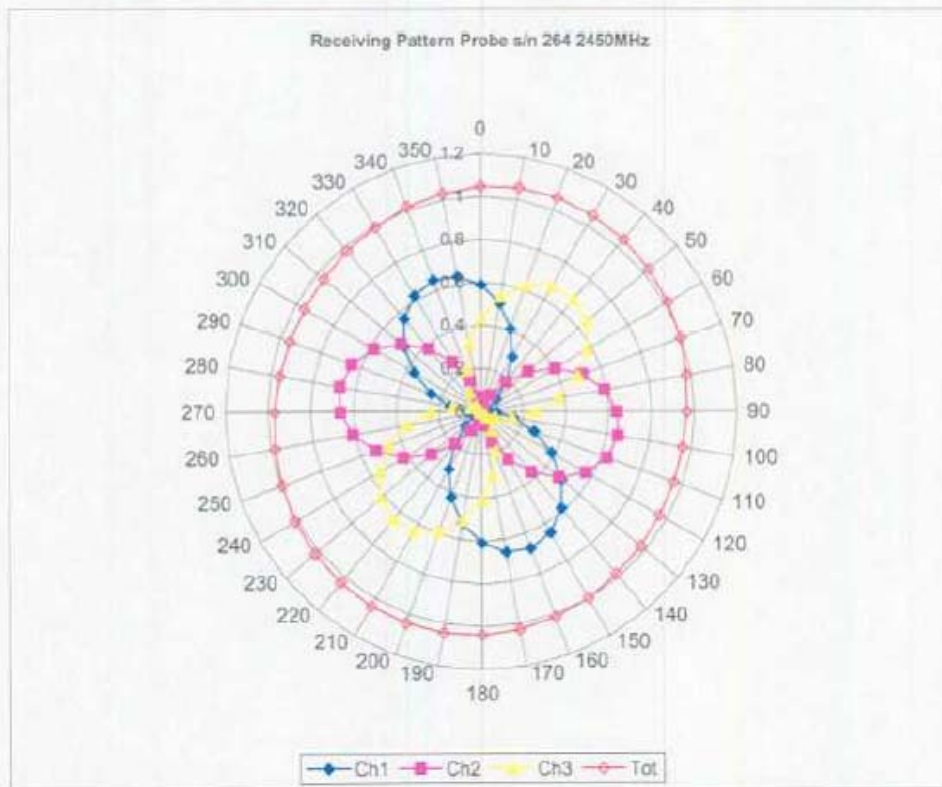
Boundary Effect:

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 2.44mm.

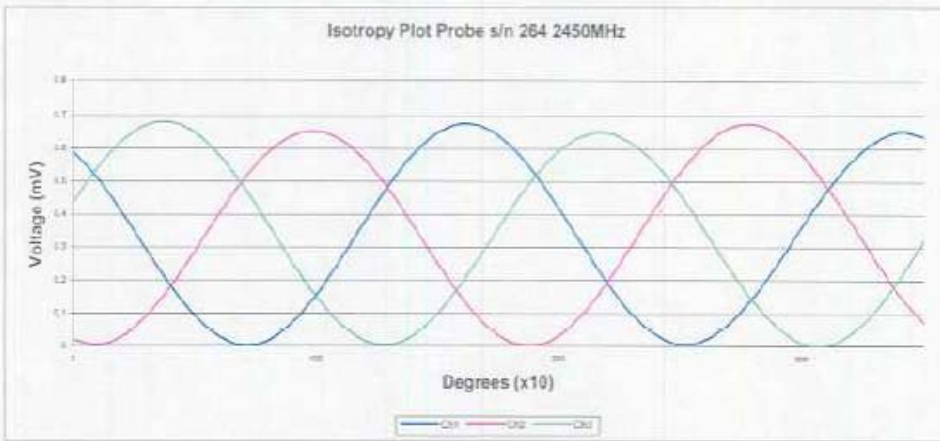
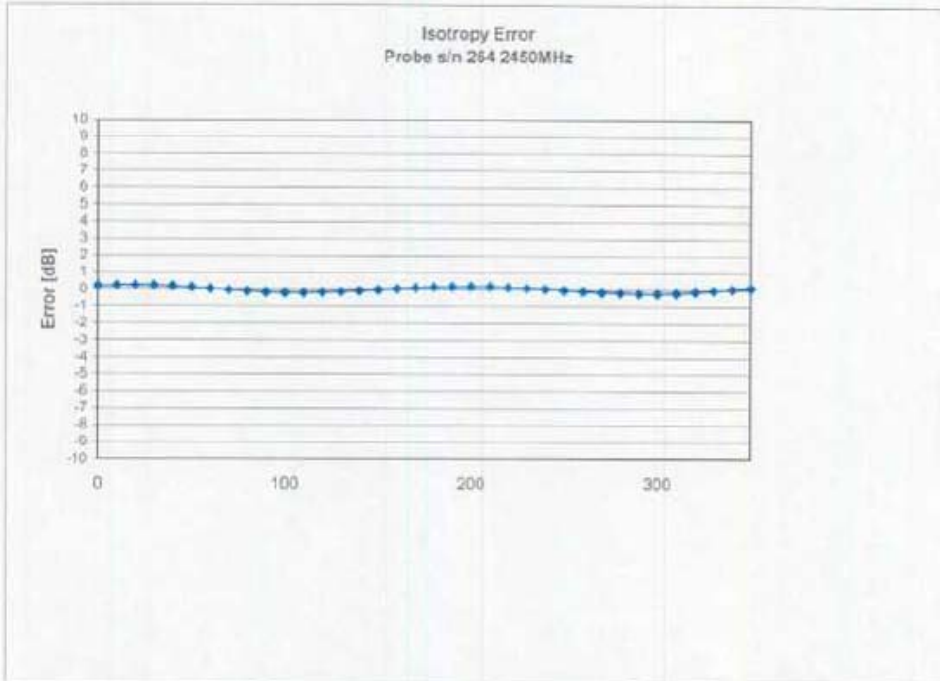
Spatial Resolution:

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)



Isotropicity in Tissue:

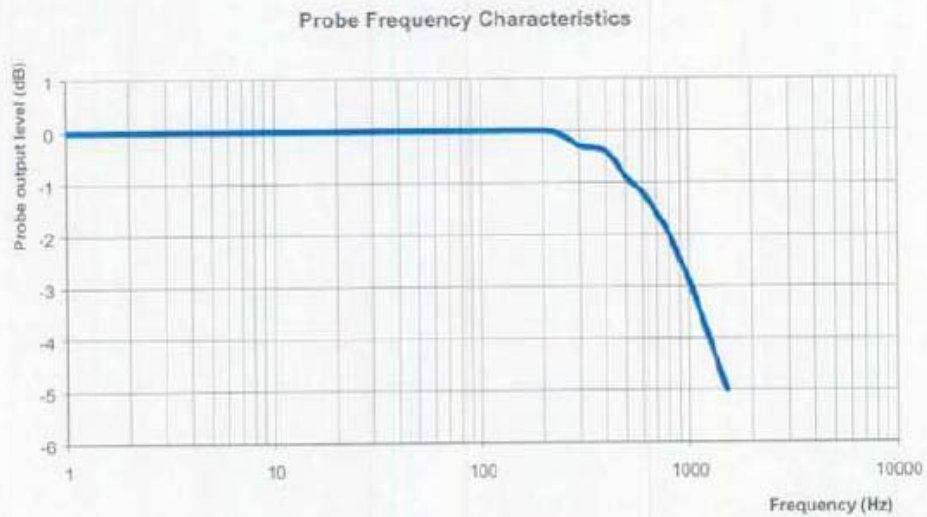
0.10 dB

Dynamic Range



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Video Bandwidth



Video Bandwidth at 500 Hz	1 dB
Video Bandwidth at 1000 Hz	3 dB

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Conversion Factor Uncertainty Assessment

Frequency:		2450MHz	
Epsilon:	39.2 (+/-5%)	Sigma:	1.80 S/m (+/-5%)
ConvF			
Channel X:	5.0	7%(K=2)	
Channel Y:	5.0	7%(K=2)	
Channel Z:	5.0	7%(K=2)	

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

Boundary Effect:

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

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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.

Page 10 of 10

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NCL CALIBRATION LABORATORIES

Calibration File No.: CP-641

Client: QUIETEK

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.

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories

Model No.: ALS-E-020

Serial No.: 264

BODY Calibration

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

Project No: QUIB-Probe-Cal-5210

Calibrated: 21st March 2006

Released on: 21st March 2006

This Calibration Certificate is incomplete unless accompanied with the Calibration Results Summary

Released By: _____

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51 SPECTRUM WAY
NEPEAN, ONTARIO
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Introduction

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Conditions

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Yi Pan

Page 2 of 10

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Calibration Results Summary

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Sensor Length:	2.5 mm
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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:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV

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Sensitivity in Body Tissue

Frequency: 2450 MHz

Epsilon: 52.7 (+/-5%)

Sigma: 1.95 S/m (+/-5%)

ConvF

Channel X: 5.2

Channel Y: 5.2

Channel Z: 5.2

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

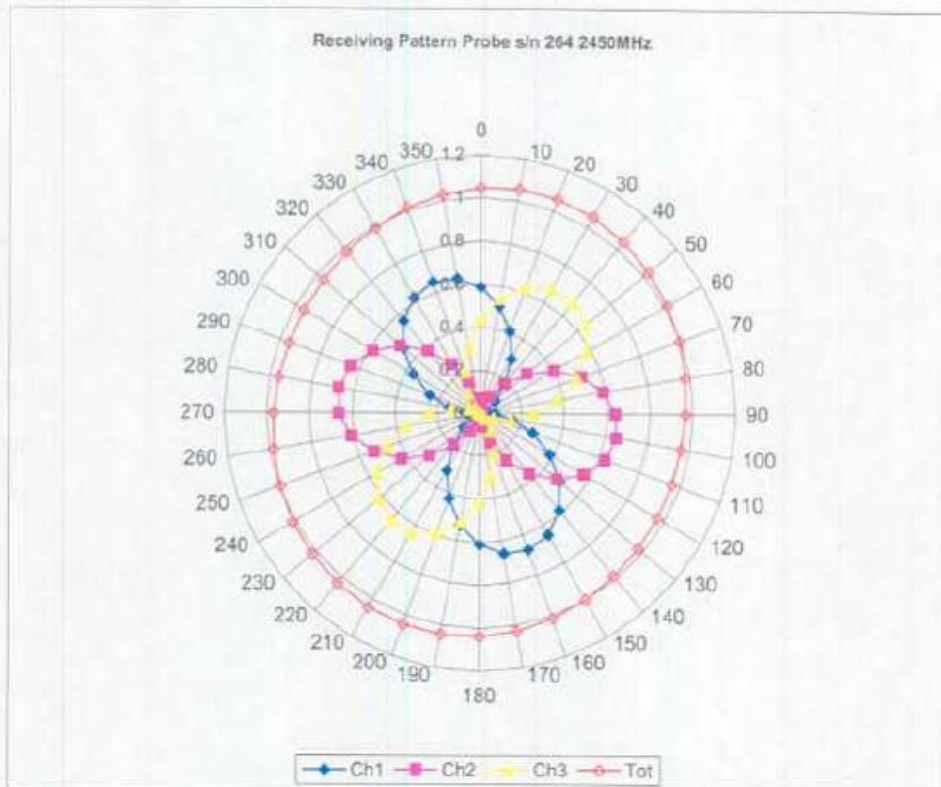
Boundary Effect:

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 2.44mm.

Spatial Resolution:

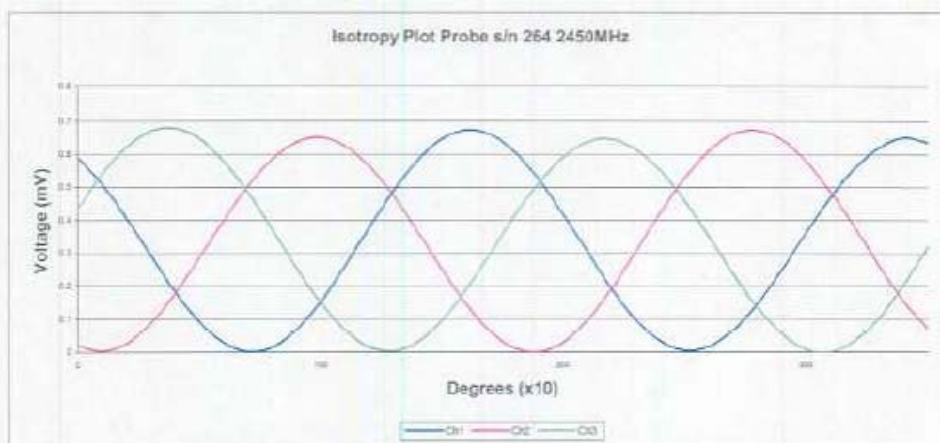
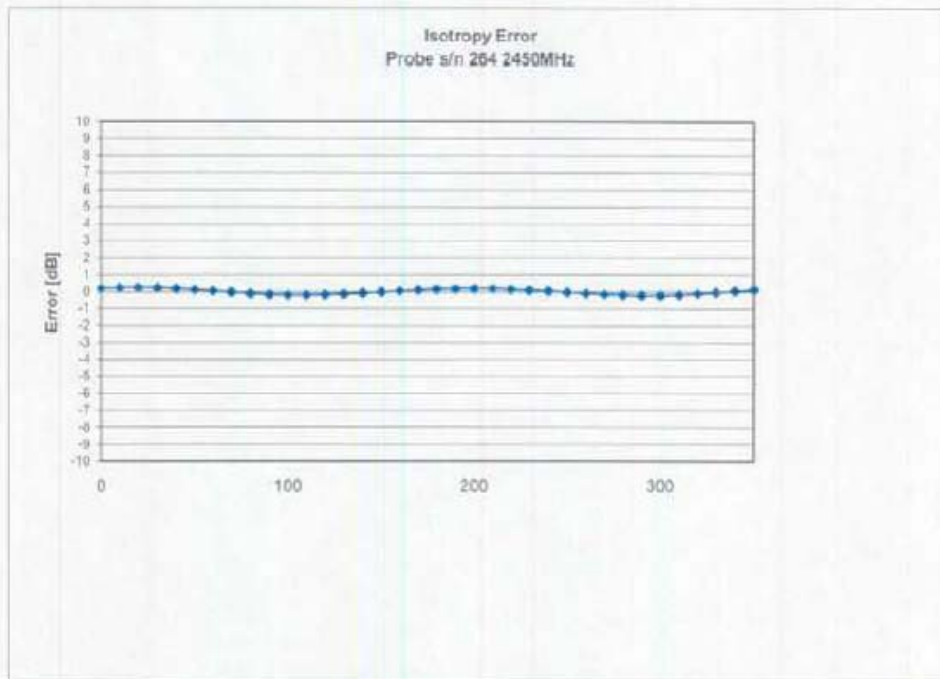
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 2450 MHz (Air)



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Isotropy Error 2450 MHz (Air)



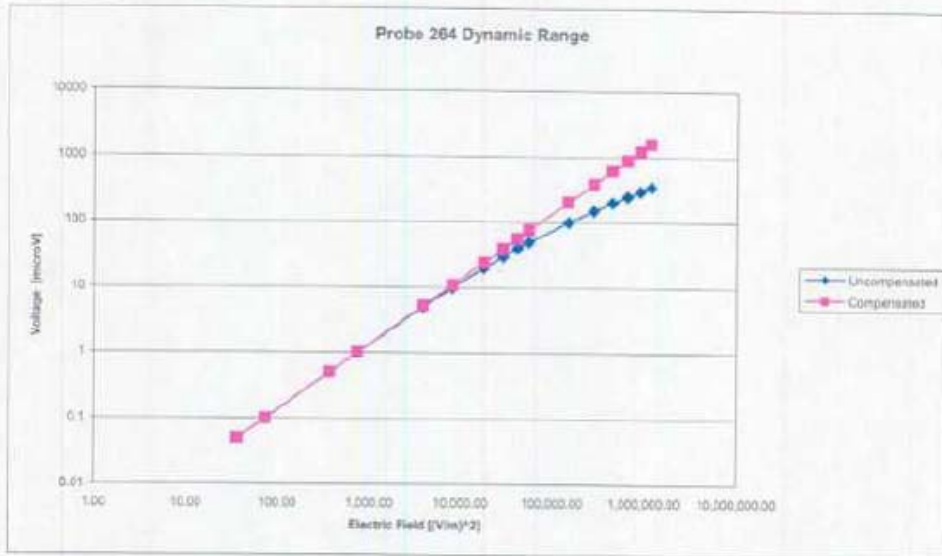
Isotropy in Tissue:

0.10 dB

Page 6 of 10

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Dynamic Range

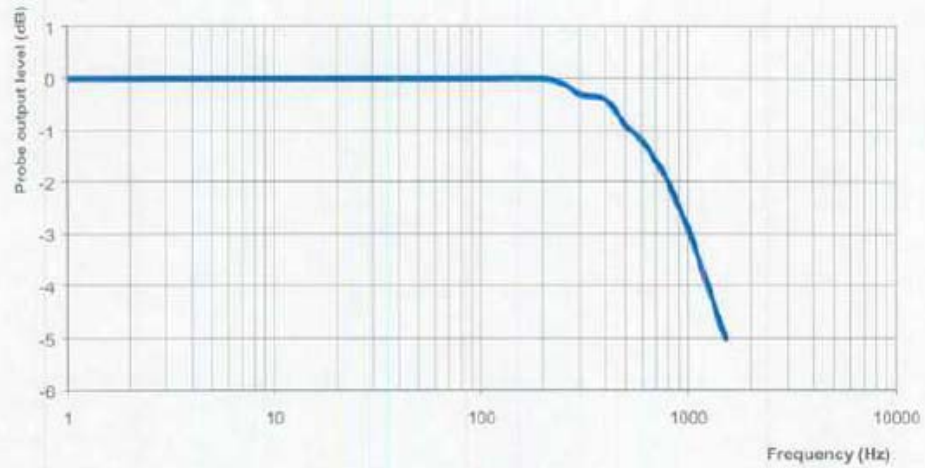


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Video Bandwidth

Probe Frequency Characteristics



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1000 Hz 3 dB