CERTIFICATE OF COMPLIANCE

November 14, 2001 File No.: PAN-005-SAR

Panasonic Canada Inc.
5770 Ambler Drive
Mississauga, ON
CANADA L4W 2T3

NOT TRANSFERABLE

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

GRANTEE'S NAME:	**Panasonic Canada Inc.**
PRODUCT UNDER TEST:	**2.4GHz FHSS Cordless Telephone**
MODEL NO.:	**KX-TD7690**
FCC ID:	
OPERATING FREQUENCY RANGE:	**2401.0 ~ 2479.6 MHz**
NOMINAL RF OUTPUT POWER:	**329 mW EIRP**
PEAK SPATIAL-AVERAGE SAR:	**0.441 W/Kg (7% Duty Cycle, 0mm separation)**
APPLICABLE STANDARDS:	**SAR (Specific Absorption Rate) requirements using guidelines established in IEEE C95.1-1991, FCC OET Bulletin 65 (Supplement C), Industry Canada RSS-102(Issue 1) and ACA Radiocommunications (Electromagnetic Radiation – Human Exposure) Amendment Standard 2000 (No. 1)**

- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Approved by: Tri M. Luu, P.Eng.
V.P. – Engineering

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 829-1570
Facsimile (905) 829-8050
Website: www.ultratech-labs.com
Email: vhk.ultratech@sympatico.ca

ENGINEERING TEST REPORT

2.4GHz FHSS Cordless Telephone
Model No.: KX-TD7690

Tested For

Panasonic Canada Inc.
5770 Ambler Drive
Mississauga, ON
CANADA L4W 2T3

In Accordance With

SAR (Specific Absorption Rate) Requirements
Using Guidelines Established in IEEE C95.1-1991,
FCC OET Bulletin 65 (Supplement C),
Industry Canada RSS-102(Issue 1) and
ACA Radiocommunications (Electromagnetic Radiation – Human Exposure)
Amendment Standard 2000 (No. 1)

UltraTech's File No.: PAN-005-SAR

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: November 14, 2001	
Report Prepared by: JaeWook Choi Issued Date: November 14, 2001	Tested by: JaeWook Choi Test Dates: November 2, 2001

The results in this Test Report apply only to the sample(s) tested, which has been randomly selected.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	SAR (Specific Absorption Rate) Requirements IEEE C95.1-1991, FCC OET Bulletin 65 (Supplement C) Industry Canada RSS-102 (Issue 1). ACA Radiocommunications (Electromagnetic Radiation – Human Exposure), Amendment Standard 2000 (No. 1)
Title:	Safety Levels with respect to human exposure to Radio Frequency Electromagnetic Fields Guideline for Evaluating the Environmental Effects of Radio Frequency Radiation
Purpose of Test:	To verify compliance with Federal regulated SAR requirements in Canada and the US.
Method of Measurements:	IEEE C95.1-1991, FCC OET Bulletin 65 (Supplement C) and Industry Canada RSS-102 (Issue 1)
Exposure Category:	**[X] General population, uncontrolled exposure** [ ] Occupational, controlled exposure

1.2. REFERENCES

The methods and procedures used for the measurements contained in this report are details in the following reference standards:

Publications	Year	Title
IEEE Std. 1528-2001 Draft	2001	Draft Recommended practice for determining the Peak Spatial-Average Specific Absorption rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.
Industry Canada RSS102	1999	"Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields"
ACA	2000	ACA Radiocommunications (Electromagnetic Radiation – Human Exposure) Amendment Standard 2000 (No. 1)
NCRP Report No.86	1986	"Biological Effects and Exposure Criteria for radio Frequency Electromagnetic Fields"
FCC OET Bulletin 65	1997	"Evaluating Compliance with FCC Guidelines for Human Exposure to radio Frequency Fields"
ANSI/IEEE C95.3	1992	"Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave"
ANSI/IEEE C95.1	1992	"Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz"
AS/NZS 2722.1	1998	Interim Australian/New Zealand Standard. "Radiofrequency fields, Part 1:Maximum exposure levels – 3kHz to 300GHz "

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT AND MANUFACTURER INFORMATION

APPLICANT	
Name:	Panasonic Canada Inc.
Address:	5770 Ambler Drive Mississauga, ON CANADA L4W 2T3
Contact Person:	Mr. Edmond Leung Phone #: +1-905-238-2225 FAX #: +1-905-238-2226 Email Address: eleung@panasonic.ca

MANUFACTURER	
Name:	Kyushuu Matsushita Electric Co.Ltd.
Address:	1080, Takano, Kukusui-machi, Tamana-gun, Kumamoto, 865-0193, Japan
Contact Person:	Mr. Tadashi Yoshinaga Phone # : +81-92-477-1101 FAX # : +81-92-477-1450 Email Address : yoshinaga@stc.kme.mei.co.jp

2.2. DEVICE UNDER TEST (EUT) DESCRIPTION

The following is the information provided by the applicant.

Trade Name:	Panasonic
Type/Model Number:	KX-TD7690
Serial Number:	N/A
Type of Equipment:	2.4GHz FHSS Cordless Telephone
Frequency of Operation:	2401.0 – 2479.6 MHz
Rated RF Power:	329 mW EIRP
Modulation Employed:	Frequency Hopping Spread Spectrum
Antenna Type:	Monopole
External Power Supply:	Rechargeable Li-Ion Battery Pack (3.7V, 480mAh)
Primary User Functions of EUT:	Wireless network communication

2.3. LIST OF EUT'S ACCESSORIES

- Headset (M/N: KX-TCA88)
- Battery Charger
- Power Adapter (M/N: KX-TCA1)

2.4. SPECIAL CHANGES ON THE EUT'S HARDWARE/SOFTWARE FOR TESTING PURPOSES

None

2.5. ANCILLARY EQUIPMENT

None

2.6. GENERAL TEST CONFIGURATIONS

2.6.1. Equipment Configuration

Power and signal distribution, grounding, interconnecting cabling and physical placement of equipment of a test system shall simulate the typical application and usage in so far as is practicable, and shall be in accordance with the relevant product specifications of the manufacturer.

The configuration that tends to maximize the EUT's emission or minimize its immunity is not usually intuitively obvious and in most instances selection will involve some trial and error testing. For example, interface cables may be moved or equipment re-orientated during initial stages of testing and the effects on the results observed.

Only configurations within the range of positions likely to occur in normal use need to be considered.

The configuration selected shall be fully detailed and documented in the test report, together with the justification for selecting that particular configuration.

2.6.2. Exercising Equipment

The exercising equipment and other auxiliary equipment shall be sufficiently decoupled from the EUT so that the performance of such equipment does not significantly influence the test results.

2.7. SPECIFIC OPERATING CONDITIONS

Not specified.

2.8. BLOCK DIAGRAM OF TEST SETUP

The EUT was configured as normal intended use. The following block diagram shows a representative equipment arrangement during tests:

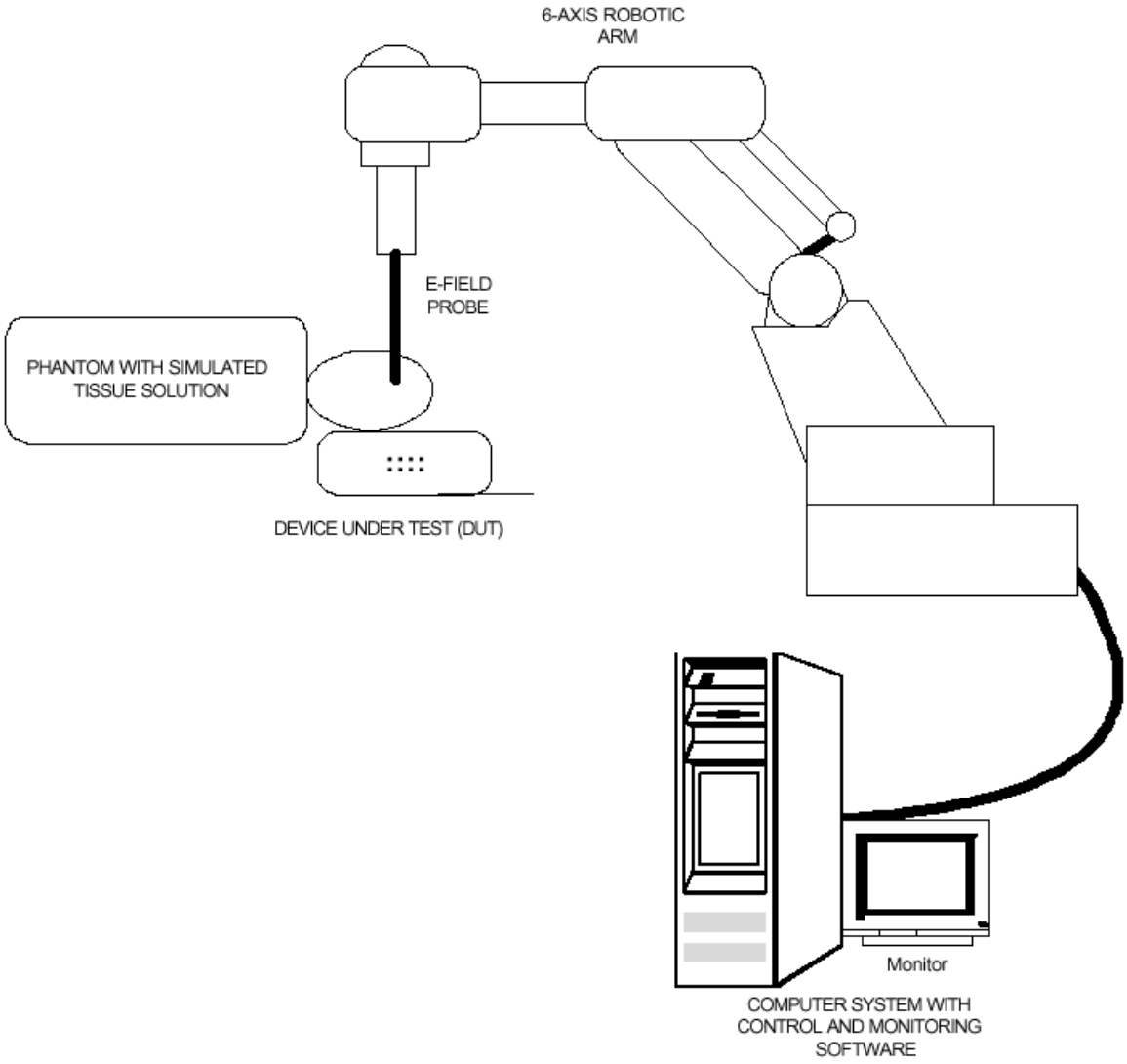


EXHIBIT 3. SUMMARY OF TEST RESULTS

3.1. LOCATION OF TESTS

All of the measurements described in this report were performed at UltraTech Group of Labs located at:

3000 Bristol Circle, in the city of Oakville, Province of Ontario, Canada.

All measurements were performed in UltraTech's shielded chamber, 24' x 16' x 8'.

3.2. APPLICABILITY & SUMMARY OF SAR RESULTS

The peak spatial - average SAR measured was found to be **0.441** W/Kg **(7% Duty Cycle, 0mm separation)**

SAR Limits	Test Requirements	Compliance (Yes/No)
General population/Uncontrolled exposure 0.08W/kg whole body average and spatial peak SAR of 1.6W/kg, averaged over 1gram of tissue Hands, wrist, feet and ankles have a peak SAR not to exceed 4 W/kg, averaged over 10 grams of tissue.	Requirements using guidelines established in IEEE C95.1-1991 FCC OET Bulletin 65 (Supplement C) Industry Canada RSS-102 (Issue 1). ACA Radiocommunications (Electromagnetic Radiation – Human Exposure) Amendment Standard 2000 (No. 1)	Yes
Occupational/Controlled Exposure 0.4W/kg whole body average and spatial peak SAR of 8W/kg, averaged over 1gram of tissue Hands, wrist, feet and ankles have a peak SAR not to exceed 20 W/kg, averaged over 10 grams of tissue.	Requirements using guidelines established in IEEE C95.1-1991 FCC OET Bulletin 65 (Supplement C), Industry Canada RSS-102 (Issue 1) ACA Radiocommunications (Electromagnetic Radiation – Human Exposure) Amendment Standard 2000 (No. 1)	N/A

EXHIBIT 4. MEASUREMENTS, EXAMINATIONS & TEST DATA

4.1. TEST SETUP

EUT Information		Condition	
Radio Type	2.4GHz FHSS Cordless Telephone	Robot Type	6 Axis
Model Number	KX-TD7690	Scan Type	SAR
Serial Number	N/A	Measured Field	E
Frequency Band (MHz)	2401.0 – 2479.6	Phantom Type	Right Head Phantom, Left Head Phantom, Flat Phantom
Frequency Tested (MHz)	2441.0	Phantom Position	Right Head, Left Head, Body-Worn
EIRP (W)	0.329	Room Temperature	23 ± 1 °C
Antenna Type	Retractable Monopole	Room Humidity	35%
Signal Type	FHSS	Tissue Temperature	23°C
Duty Cycle	7 %		

Type of Tissue	Muscle	Brain
Target Frequency (MHz)	2450	2450
Target Dielectric Constant	52.70	39.20
Target Conductivity (S/m)	1.95	1.80
Composition (by weight)	DI Water - 48,310.0g (72.42%) Alcohol - 17,600.0g (26.38%) Salt - 800.0g (1.20%)	DI Water – 31,980.0g (53.30%) Alcohol – 28,020.0g (46.70%)
Measured Dielectric Constant	52.64	38.70
Measured Conductivity (S/m)	1.98	2.01
Probe Name	UT-ETR-0200-1	UT-ETR-0200-1
Probe Orientation	Isotropic	Isotropic
Probe Offset (mm)	2.25	2.25
Sensor Factor	10.8	10.8
Conversion Factor	3.467	4.482
Calibration Date (MM/DD/YY)	06/29/2001	10/24/2001

4.2. PHOTOGRAPH OF EUT WITH ALL ACCESORIES

< Front view with headset(M/N:KX-TD7690) >

<Front View>

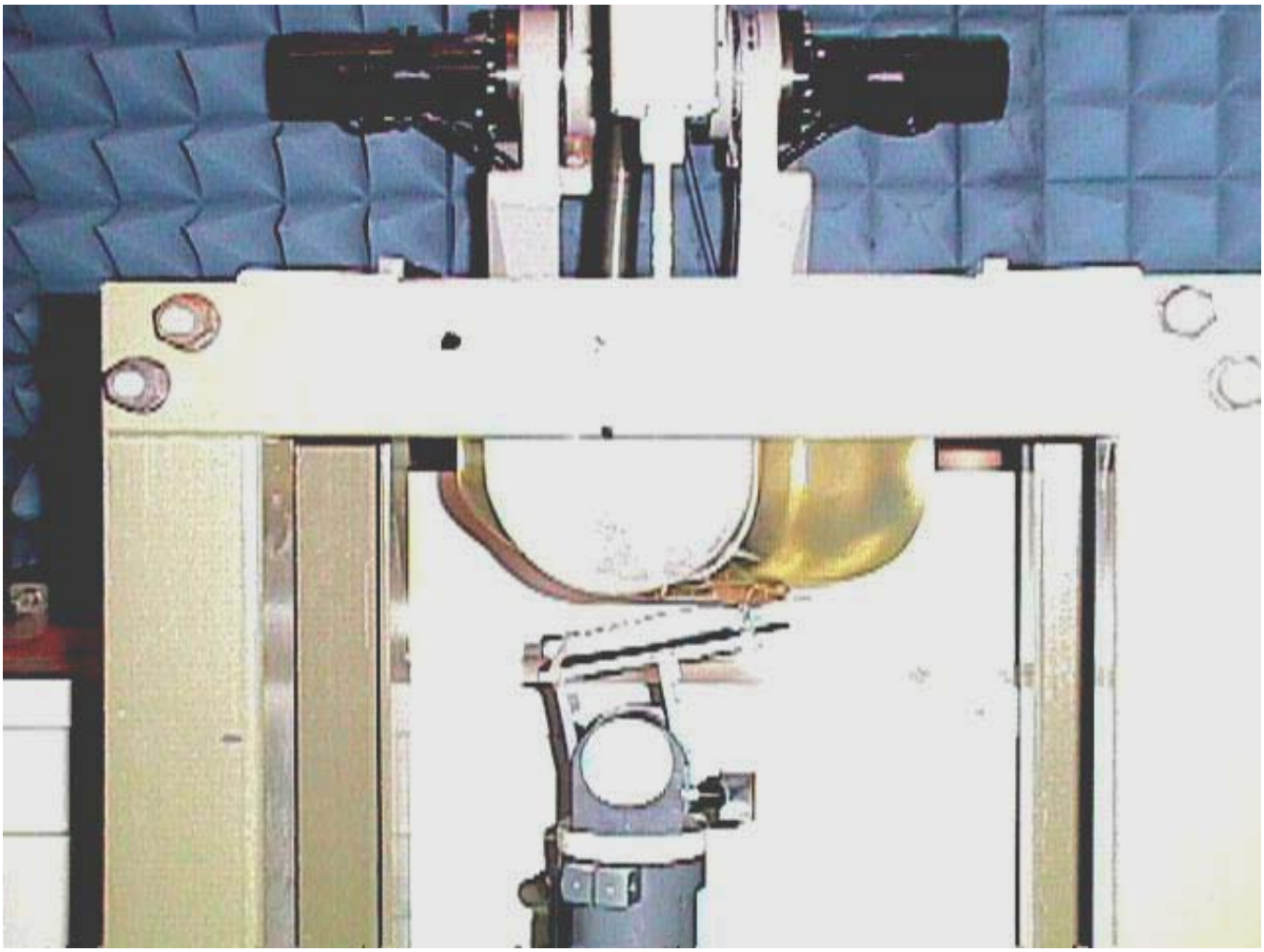
<Back View>

< Headset (M/N: KX-TD7690) >

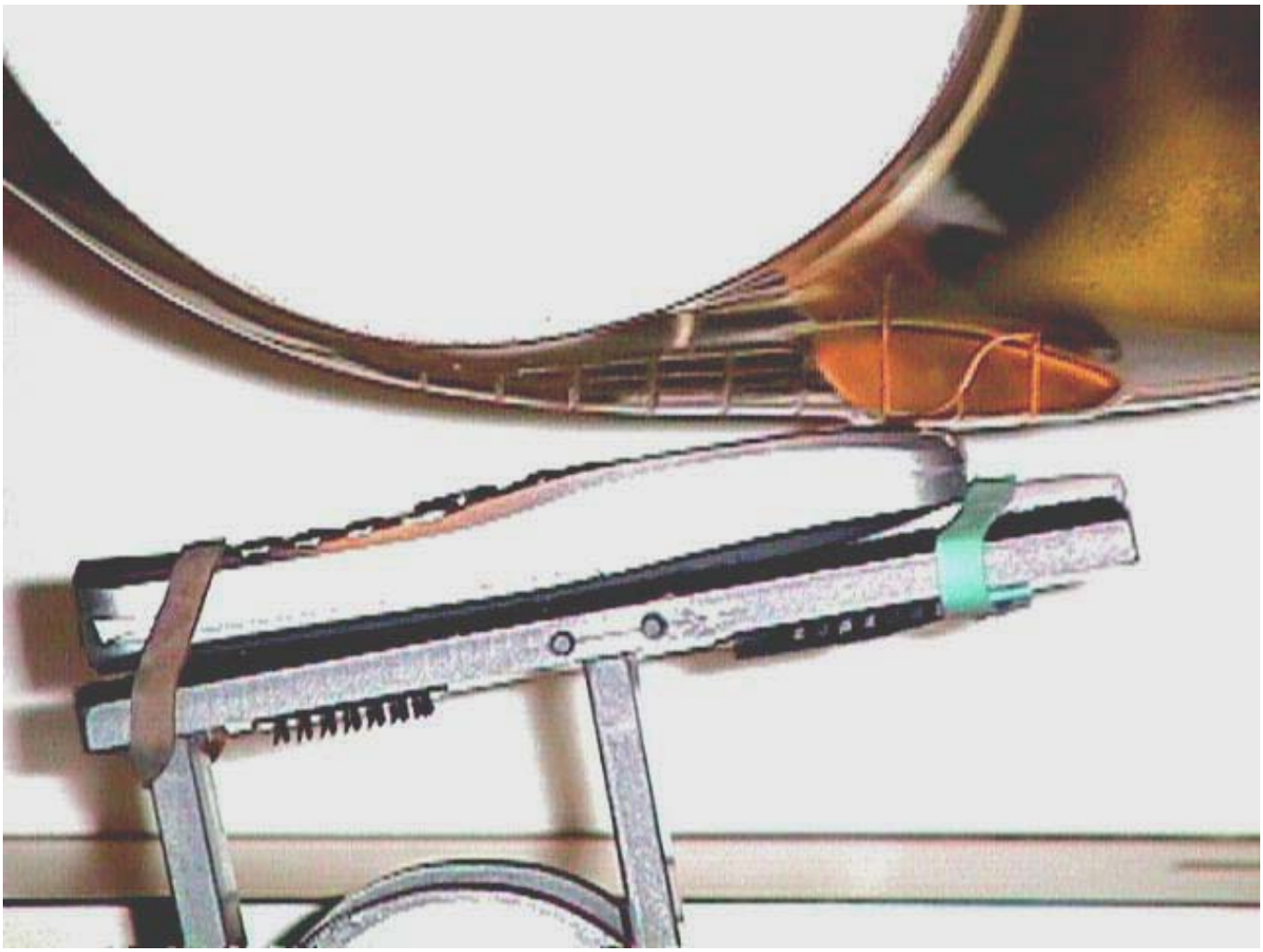
< Rechargeable Li-Ion Battery Pack >

< Battery Charger and Power Adapter(M/N: KX-TCA1) >

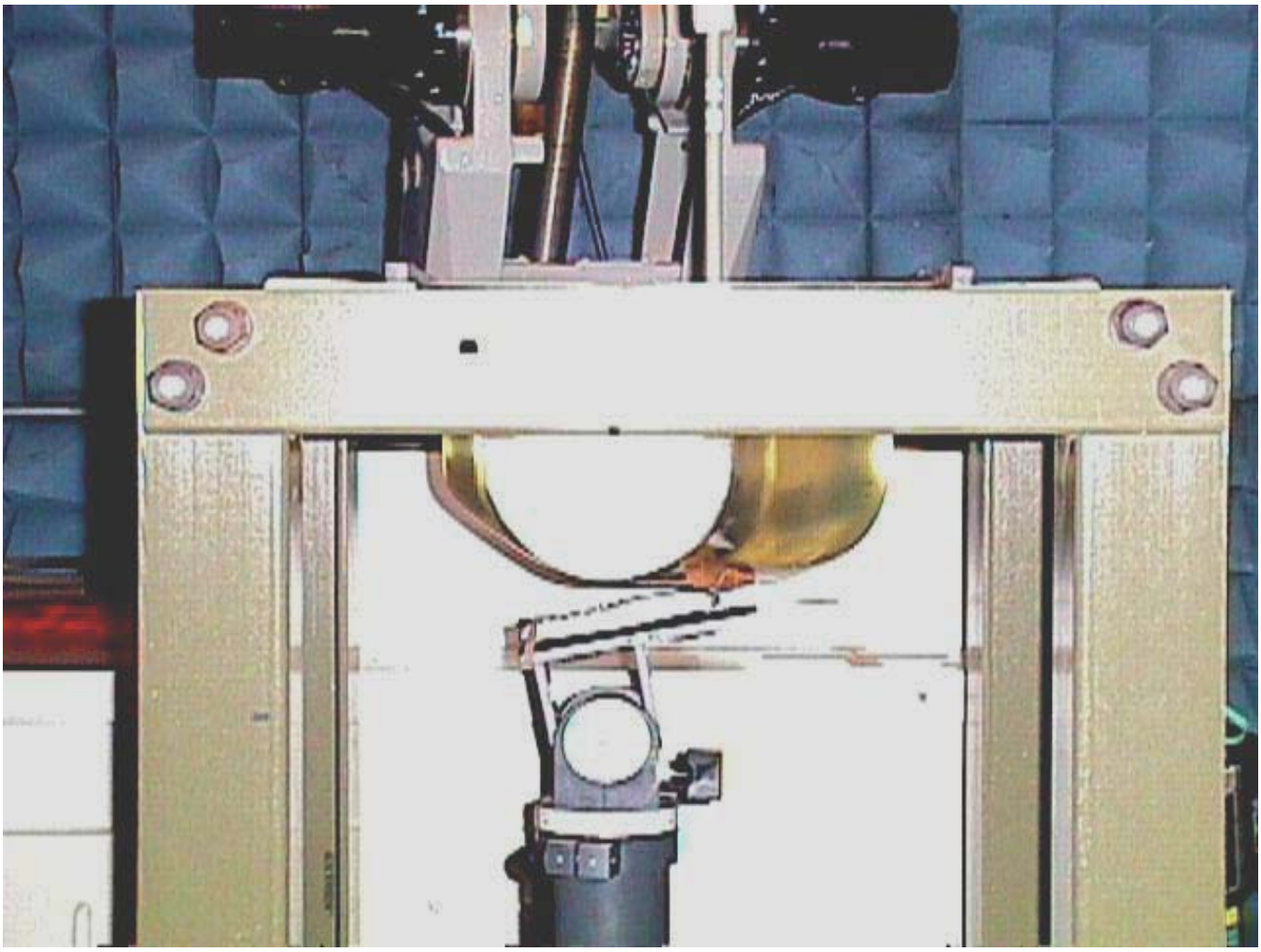
4.3. PHOTOGRAPHS OF EUT POSITION (HEAD)



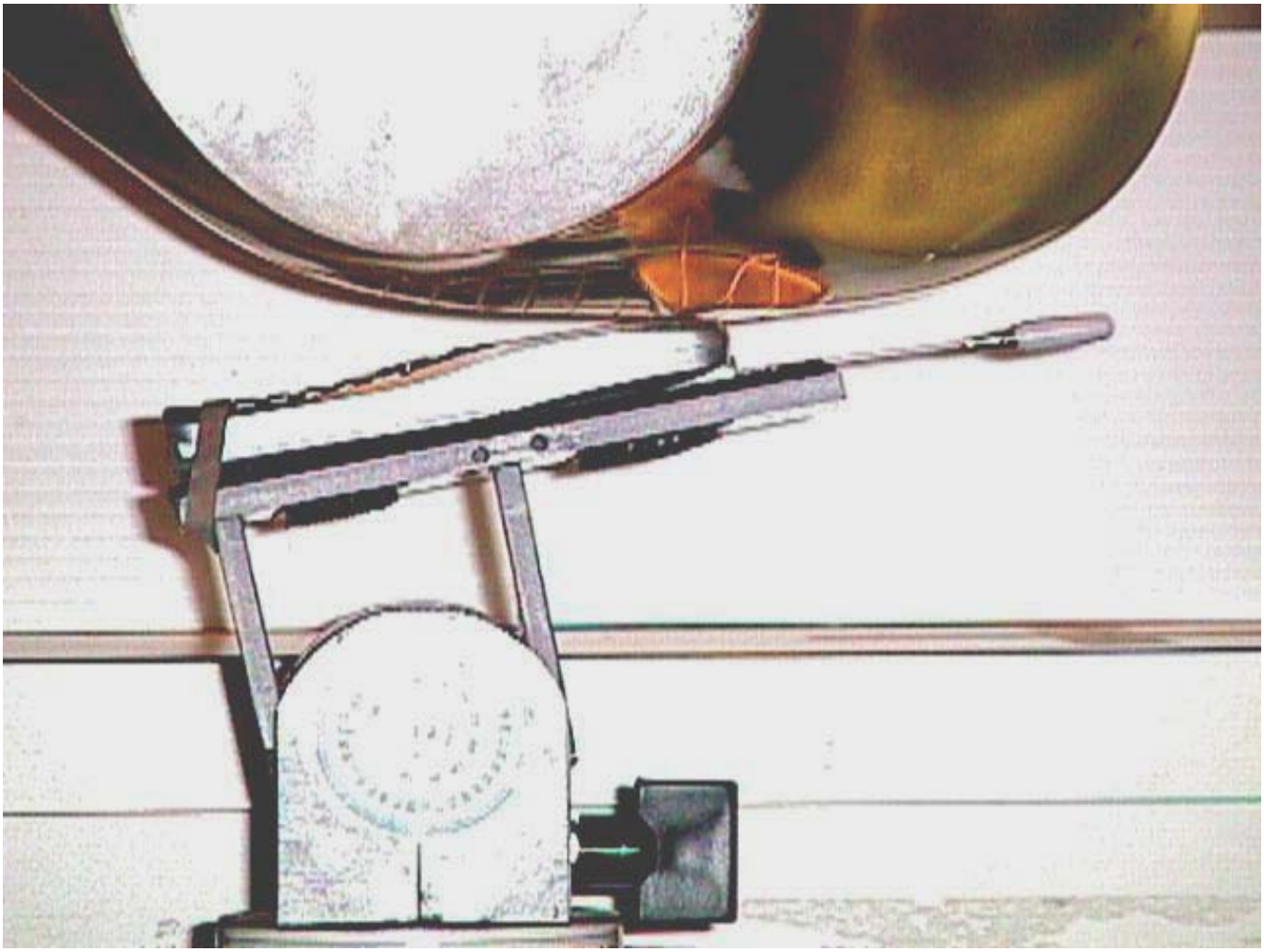
< Right Head, Tilt Position with the antenna retracted – Overview >



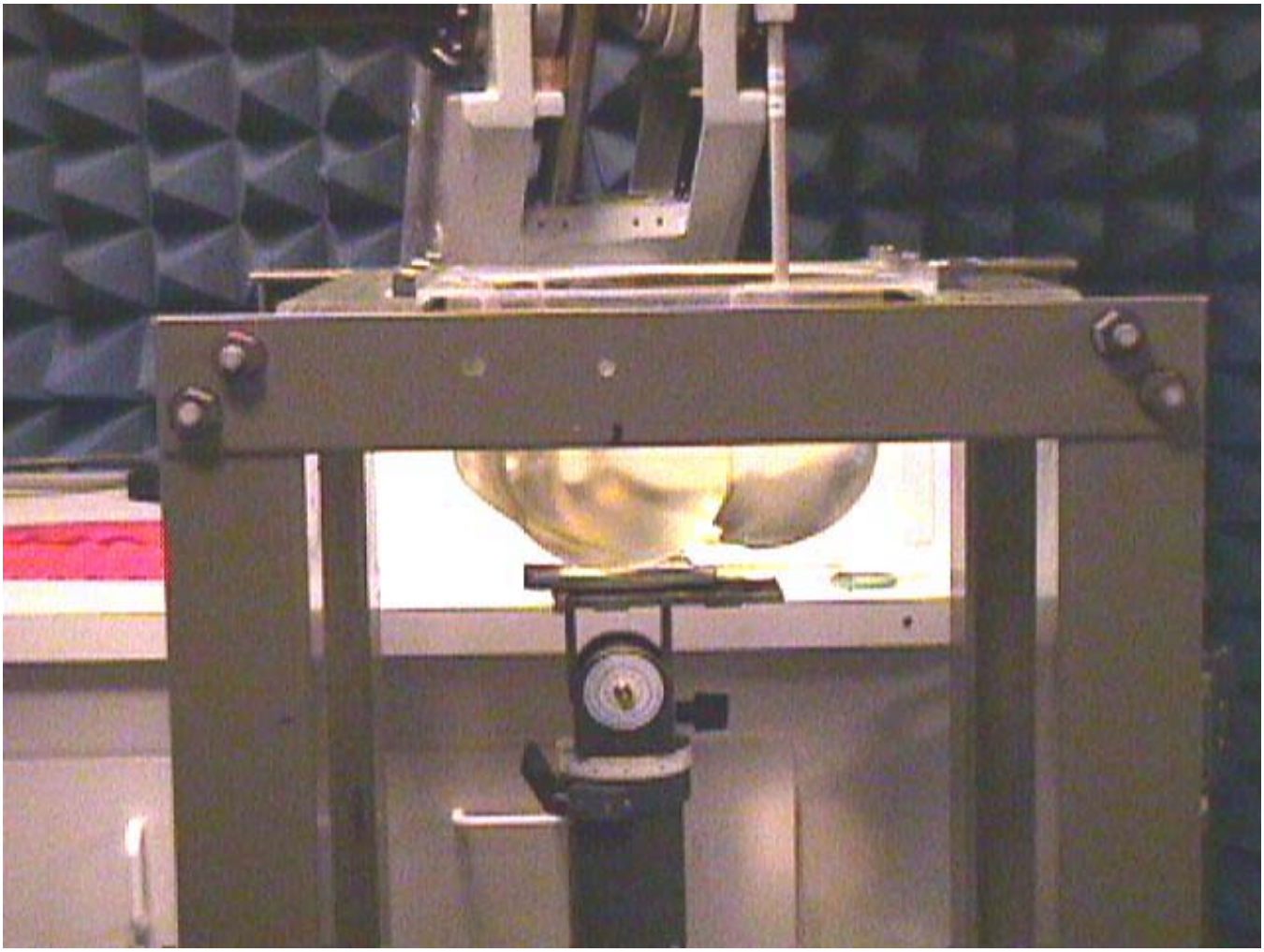
< Right Head, Tilt Position with the antenna retracted – Closeup-View >



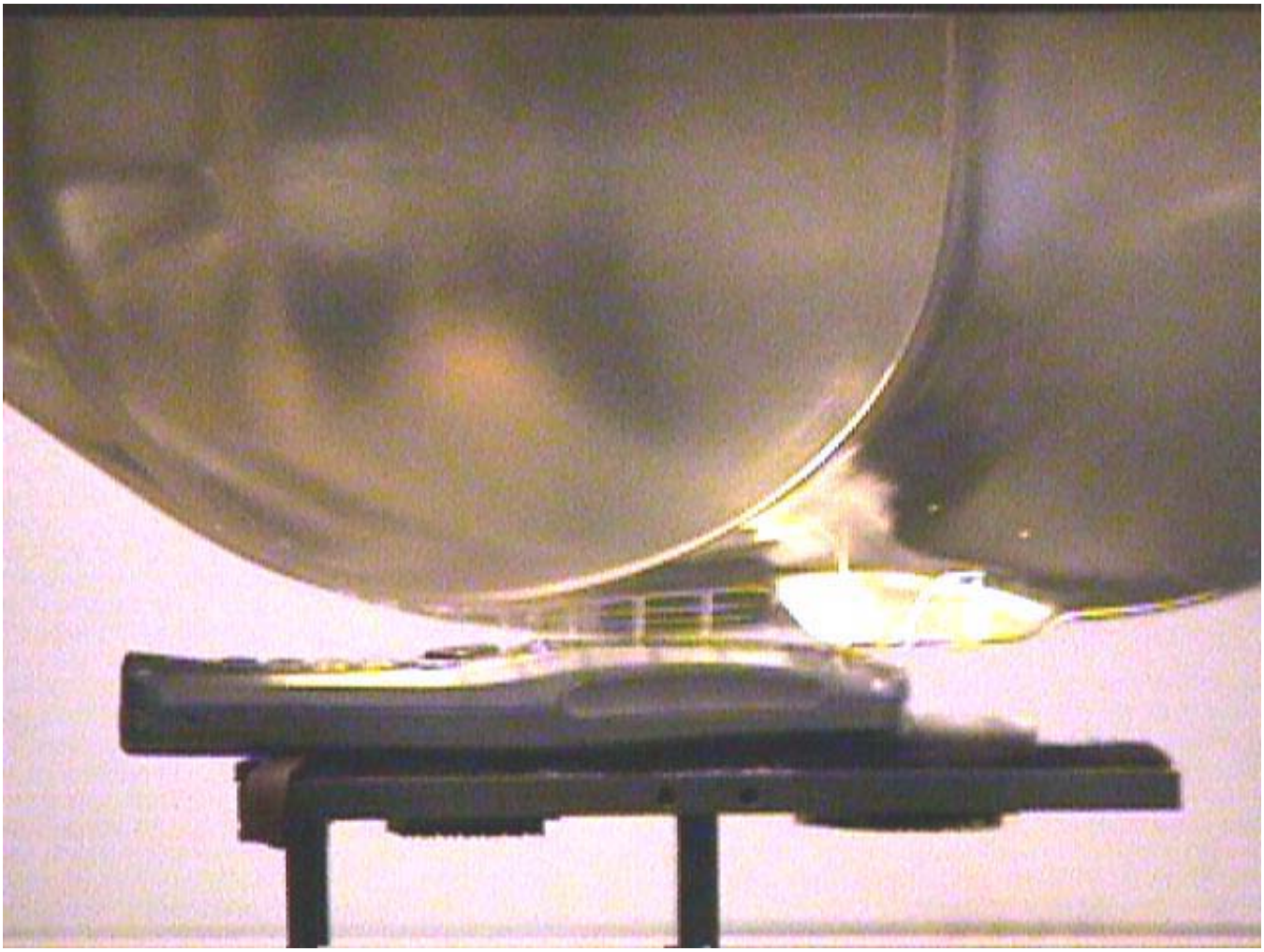
< Right Head, Tilt Position with the antenna fully extended – Overview >



< Right Head, Tilt Position with the antenna fully extended – Closeup-View >

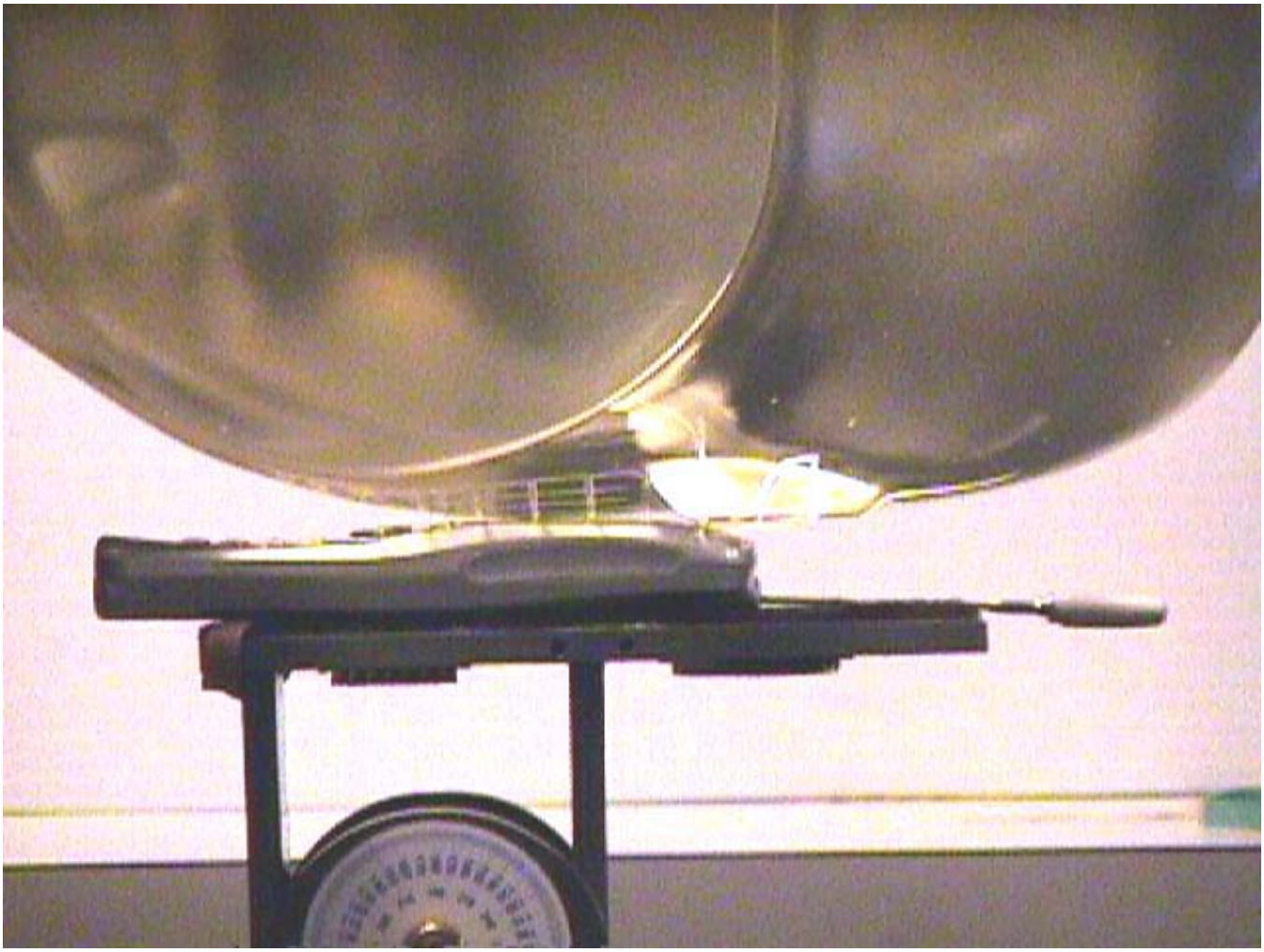


< Right Head, Cheek Position with the antenna retracted – Overview >

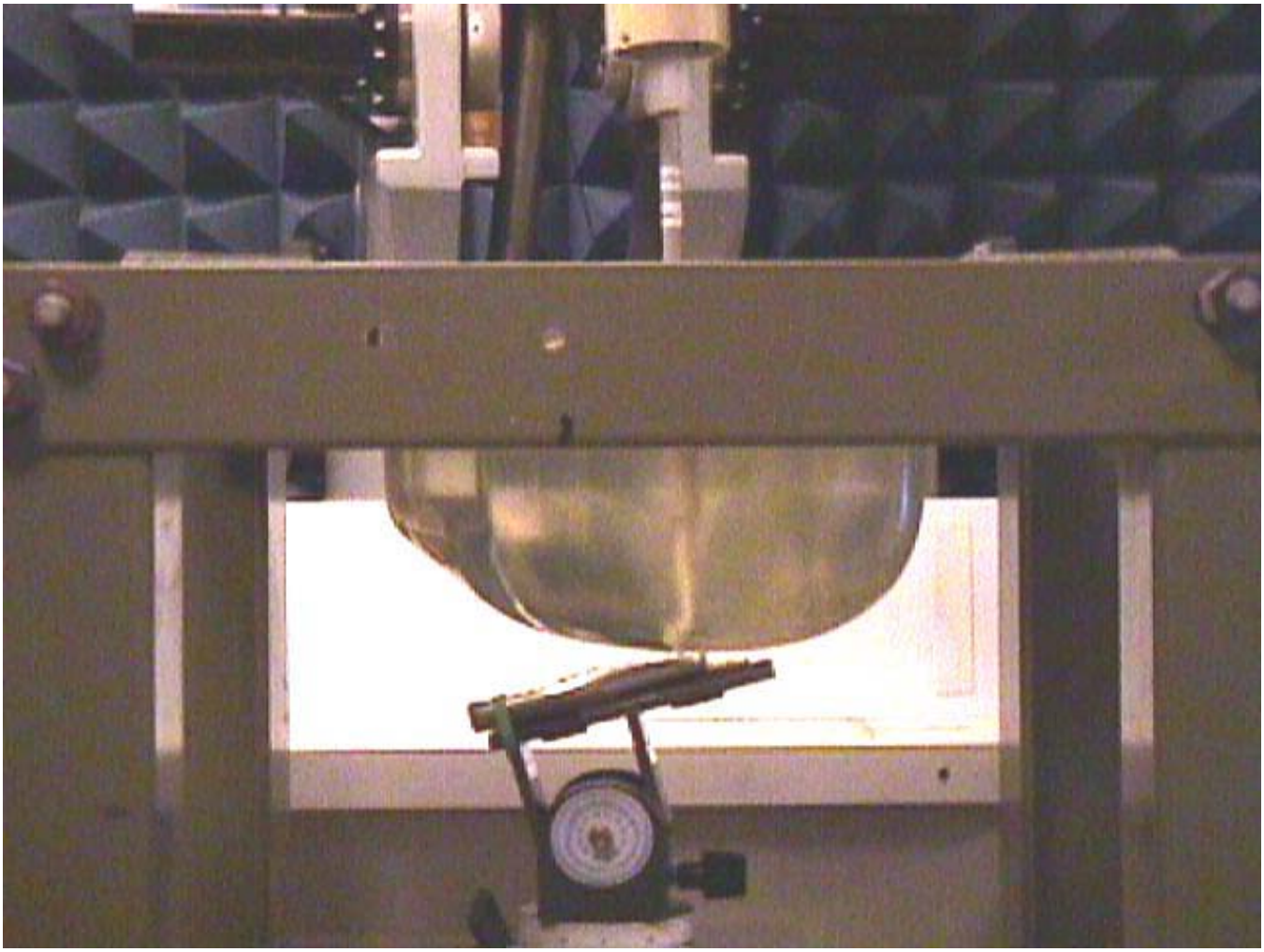


< Right Head, Cheek Position with the antenna retracted – Closeup-View >

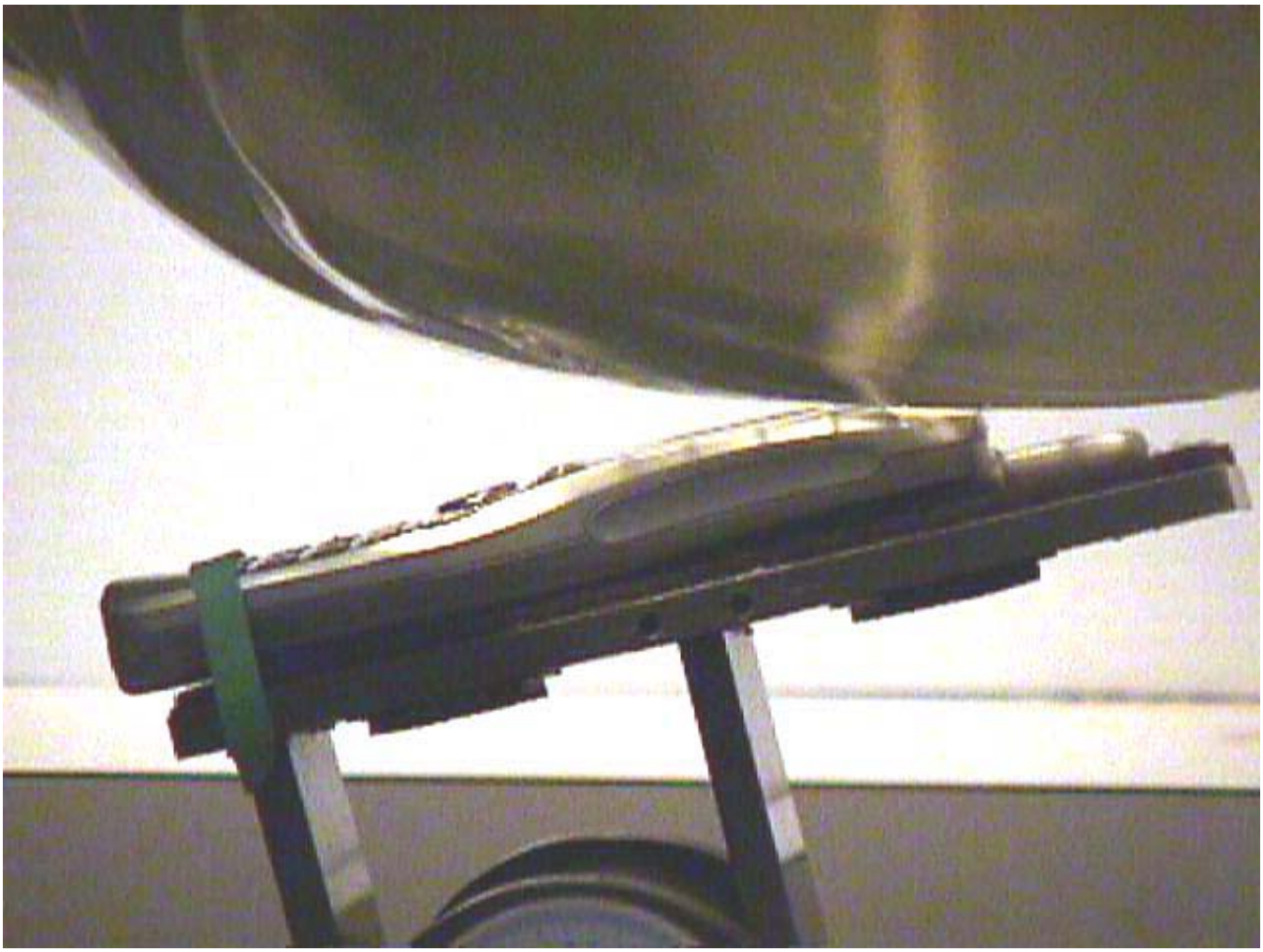
< Right Head, Cheek Position with the antenna fully extended – Overview >



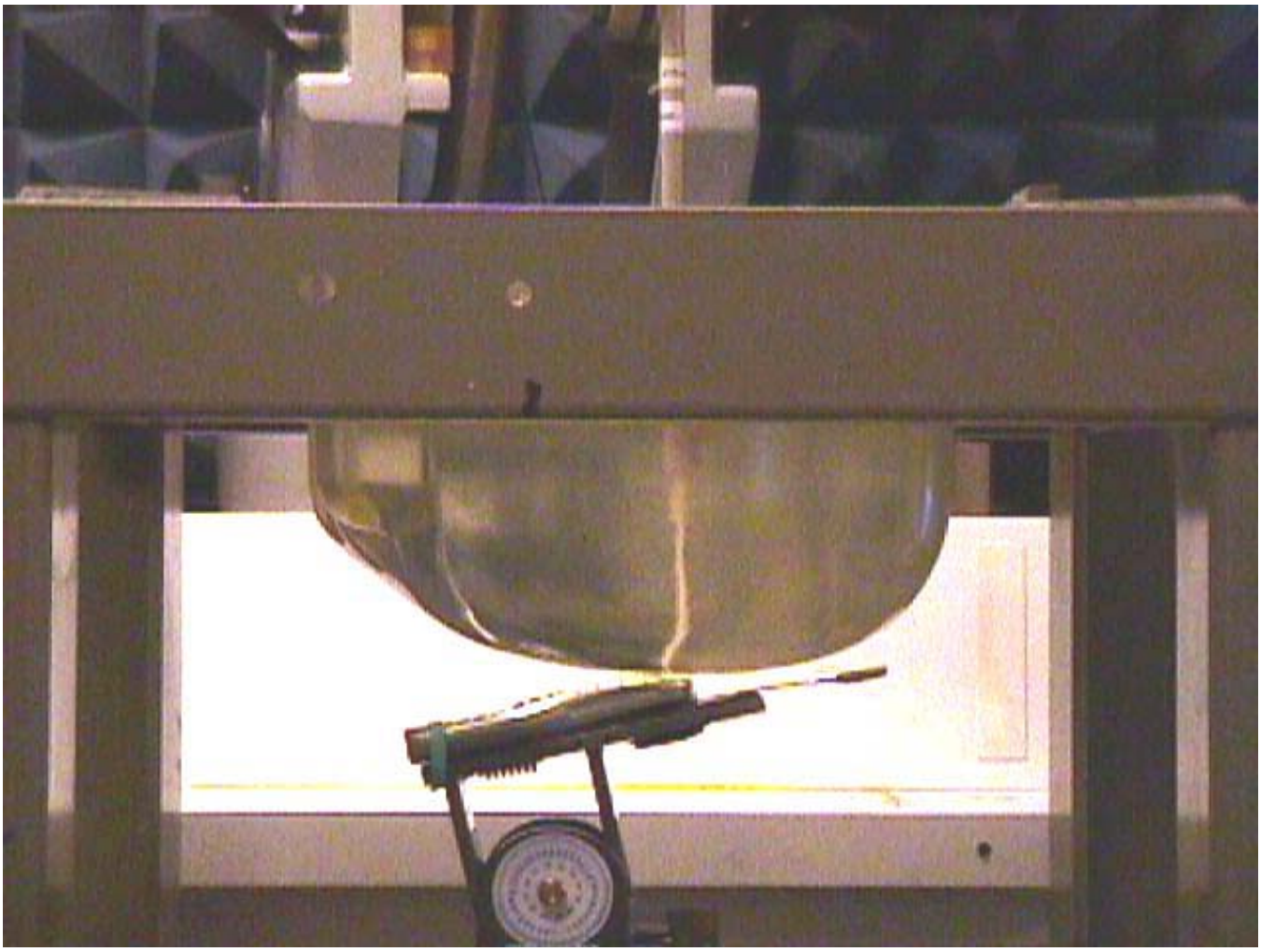
< Right Head, Cheek Position with the antenna fully extended – Closeup-View >



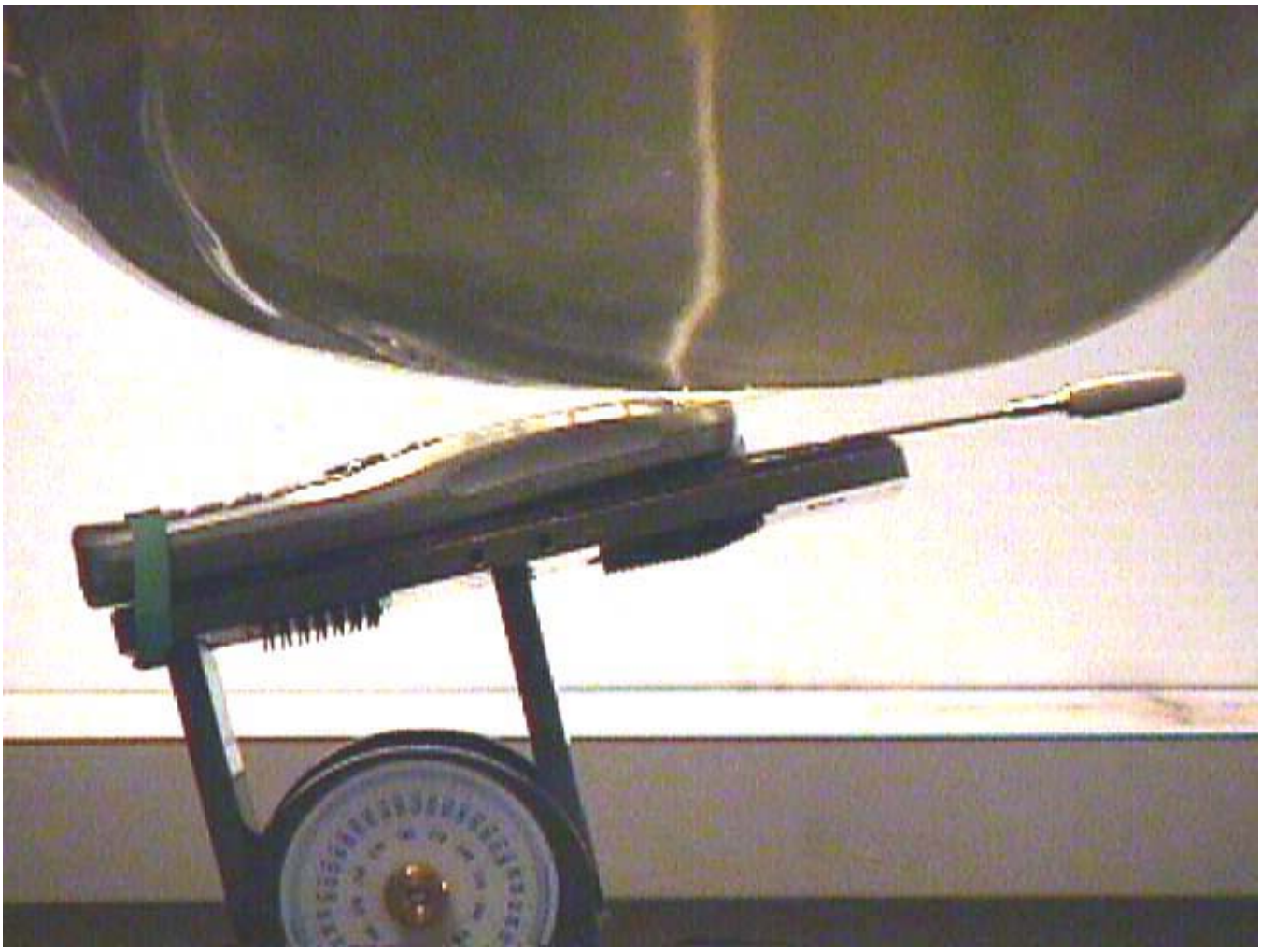
< Left Head, Tilt Position with the antenna retracted – Overview >



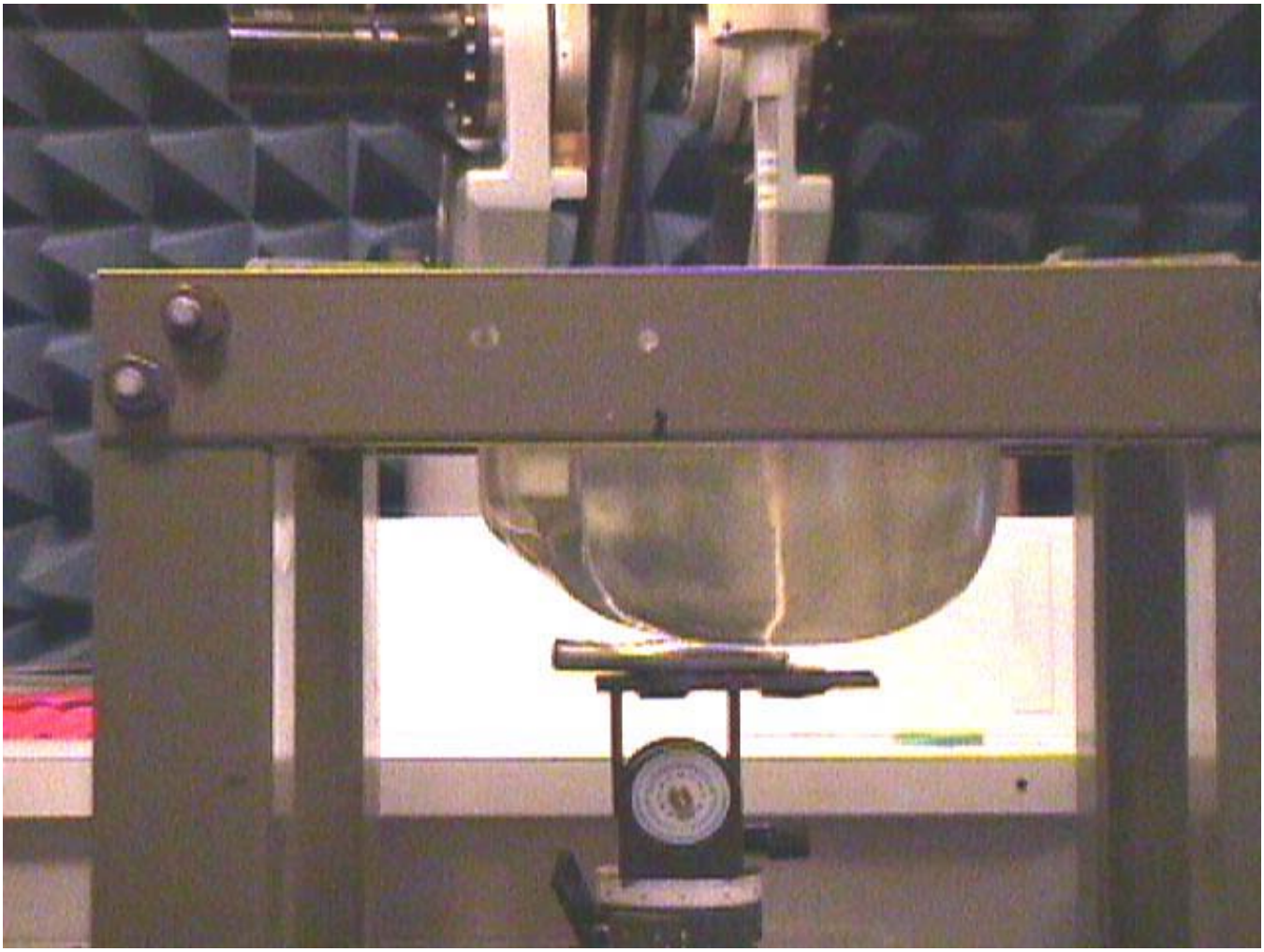
< Left Head, Tilt Position with the antenna retracted – Closeup-View >



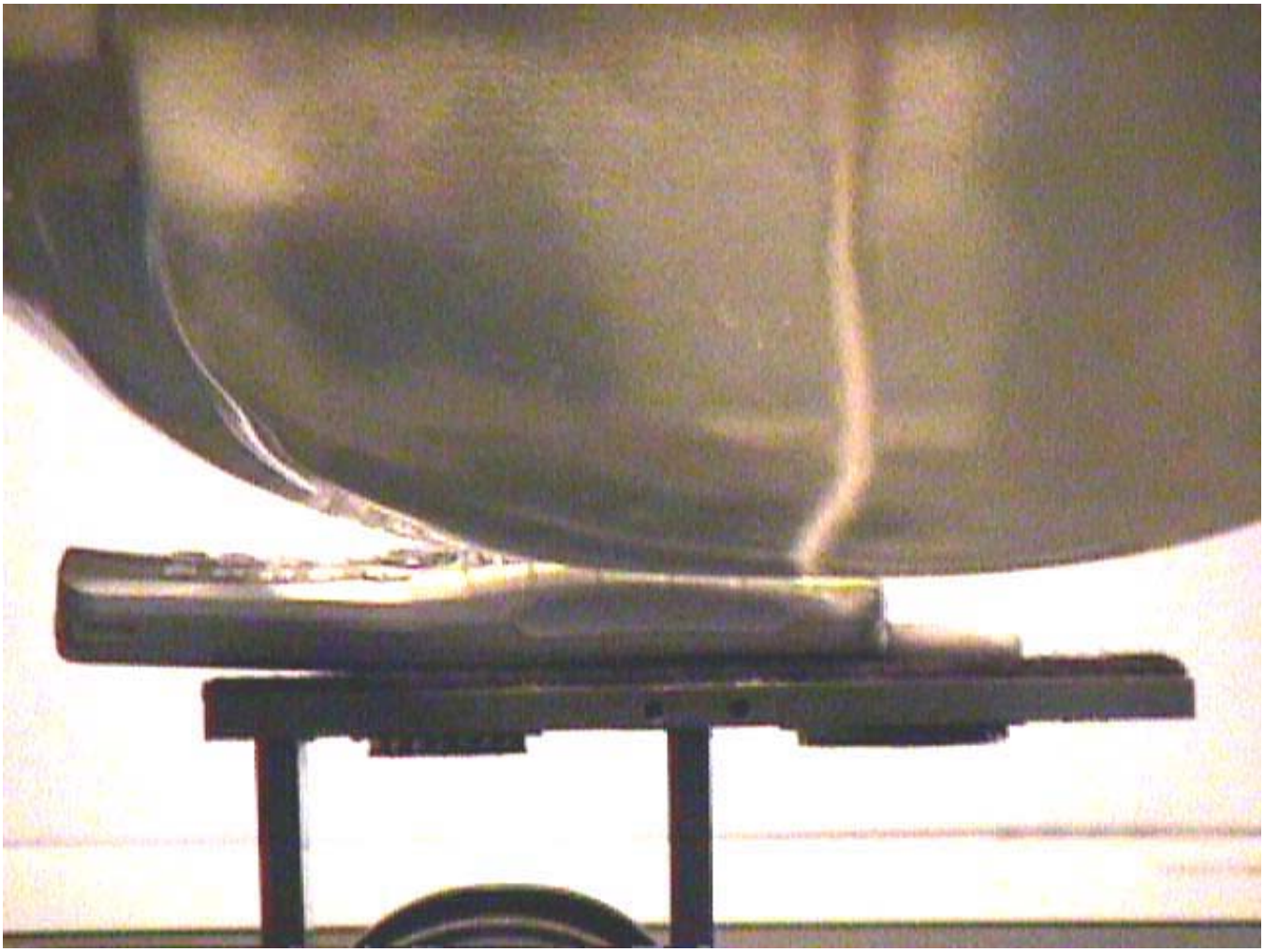
< Left Head, Tilt Position with the antenna fully extended – Overview >



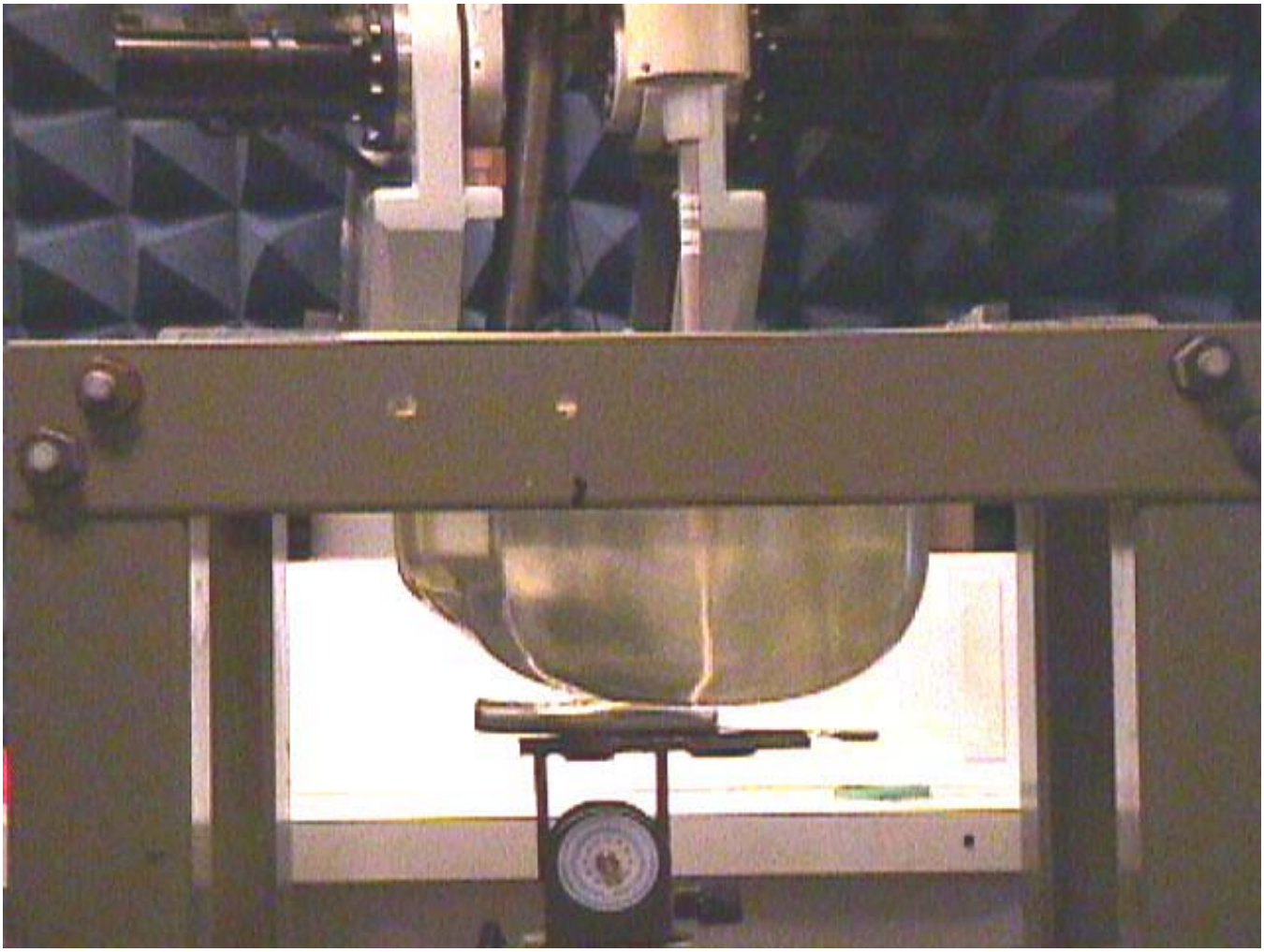
< Left Head, Tilt Position with the antenna fully extended – Closeup-View >



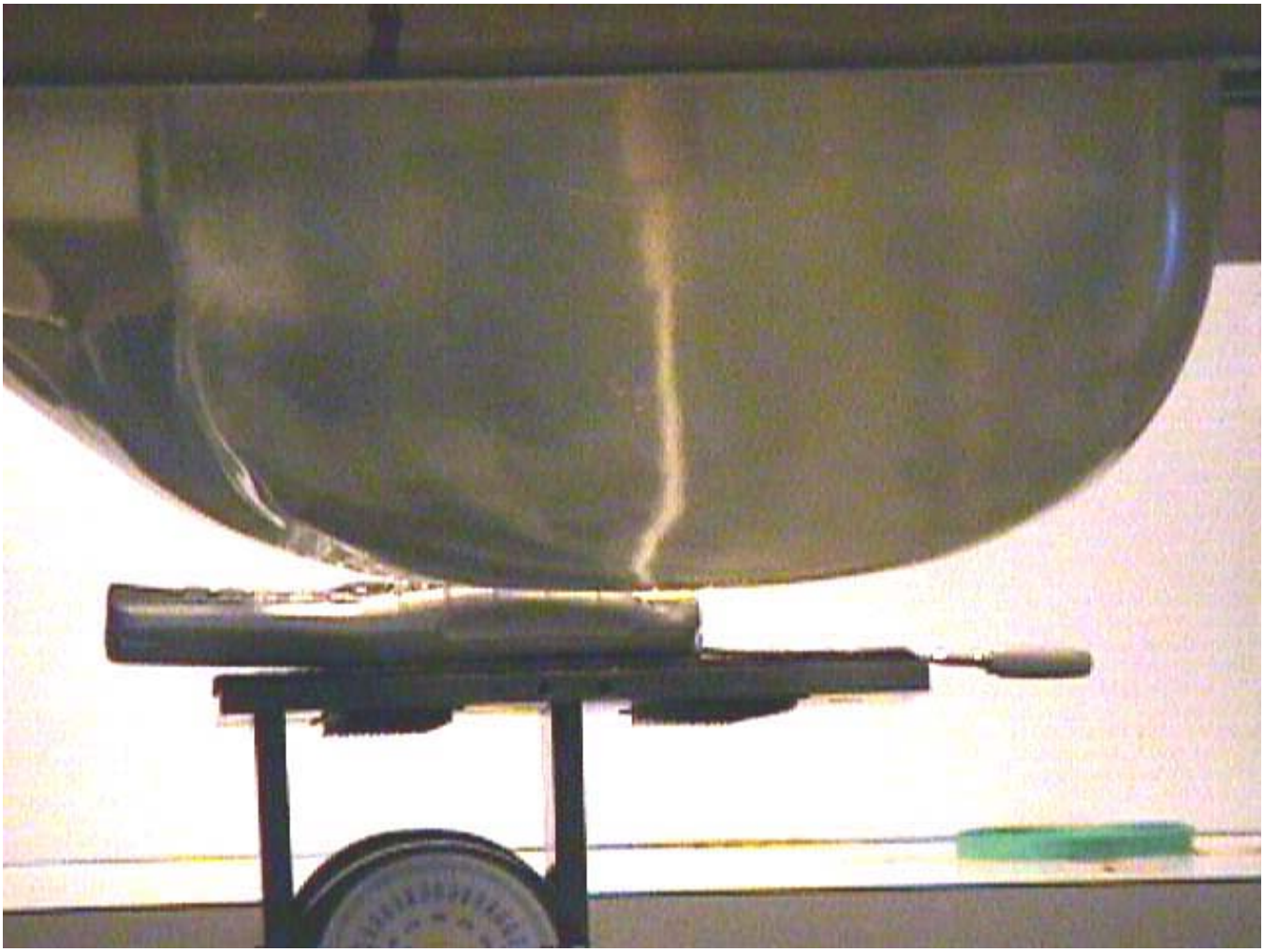
< Left Head, Cheek Position with the antenna retracted – Overview >



< Left Head, Cheek Position with the antenna retracted – Closeup-View >



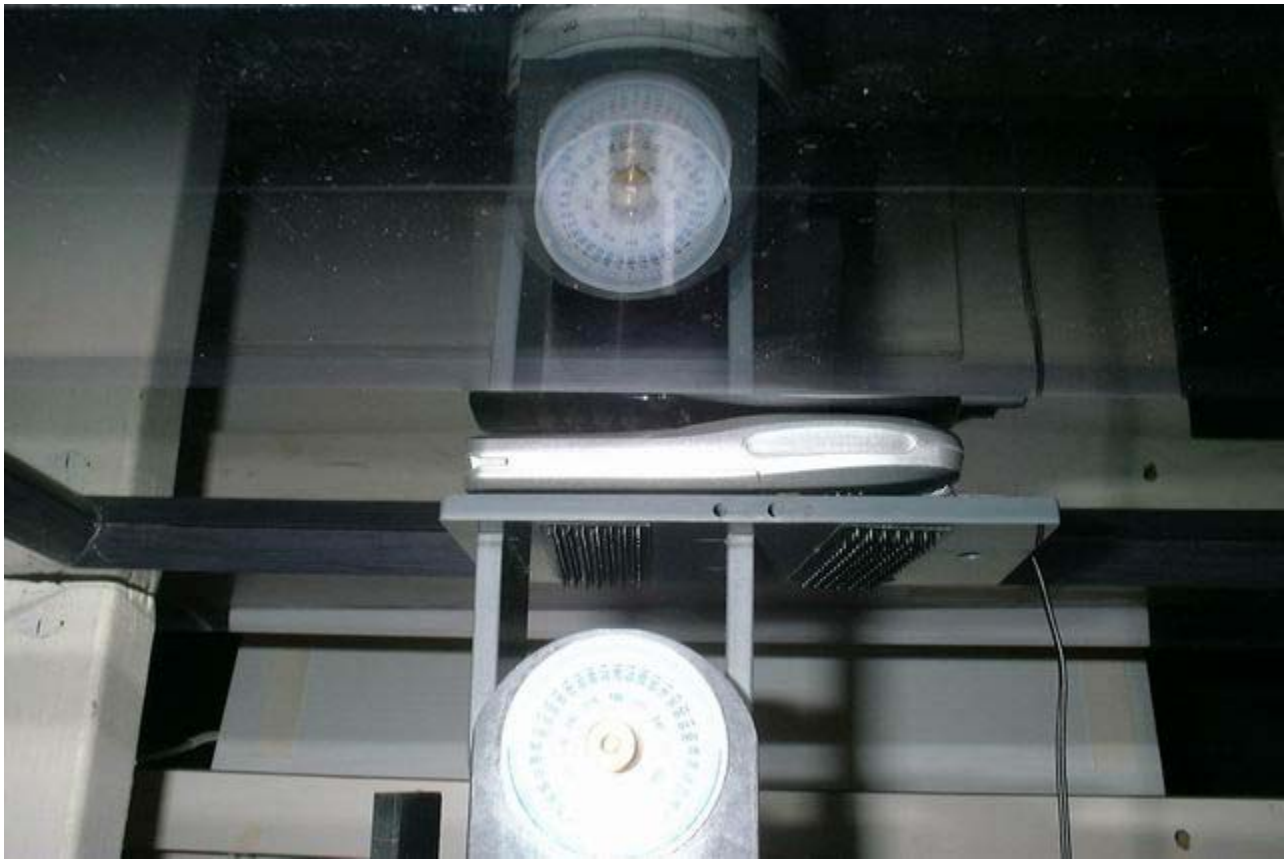
< Left Head, Cheek Position with the antenna fully extended – Overview >



< Left Head, Cheek Position with the antenna fully extended – Closeup-View >

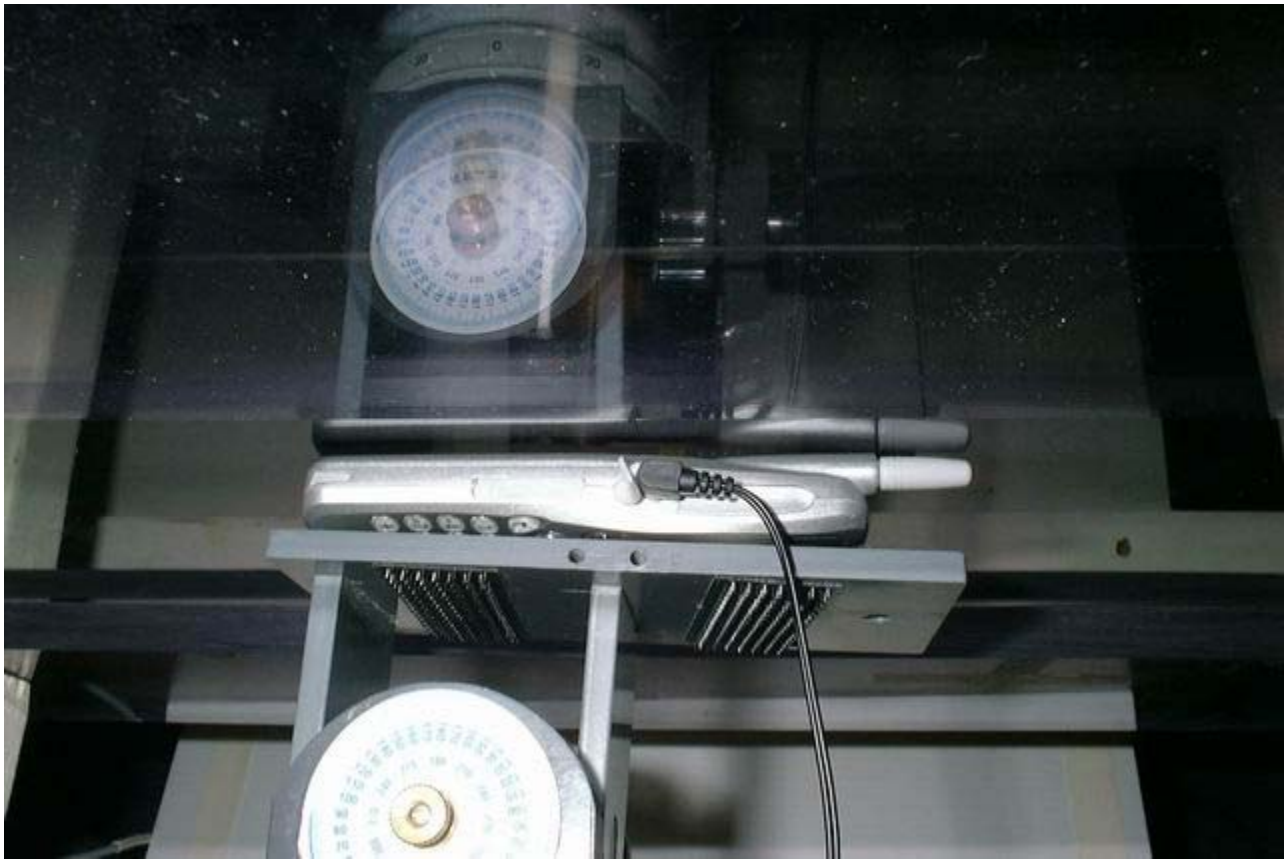
4.4. PHOTOGRAPHS OF EUT POSITION (BODY-WORN)

< Display faced inward to the phantom with headset(M/N:KX-TCA88) – Overview >

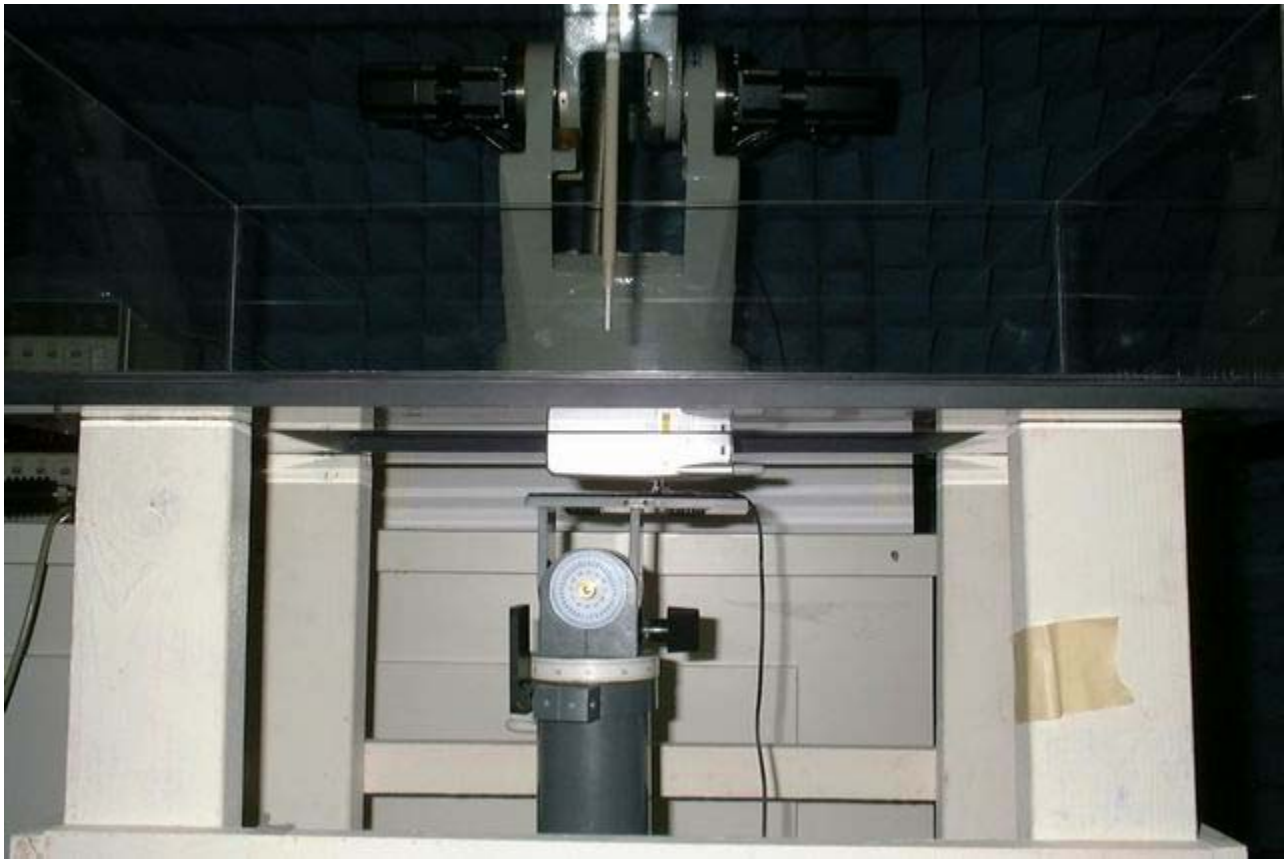


< Display faced inward to the phantom with headset(M/N:KX-TCA88) – Close-up View >

< Display faced outward from the phantom with headset(M/N:KX-TCA88) – Overview >



< Display faced inward to the phantom with headset(M/N:KX-TCA88) – Closeup-View >

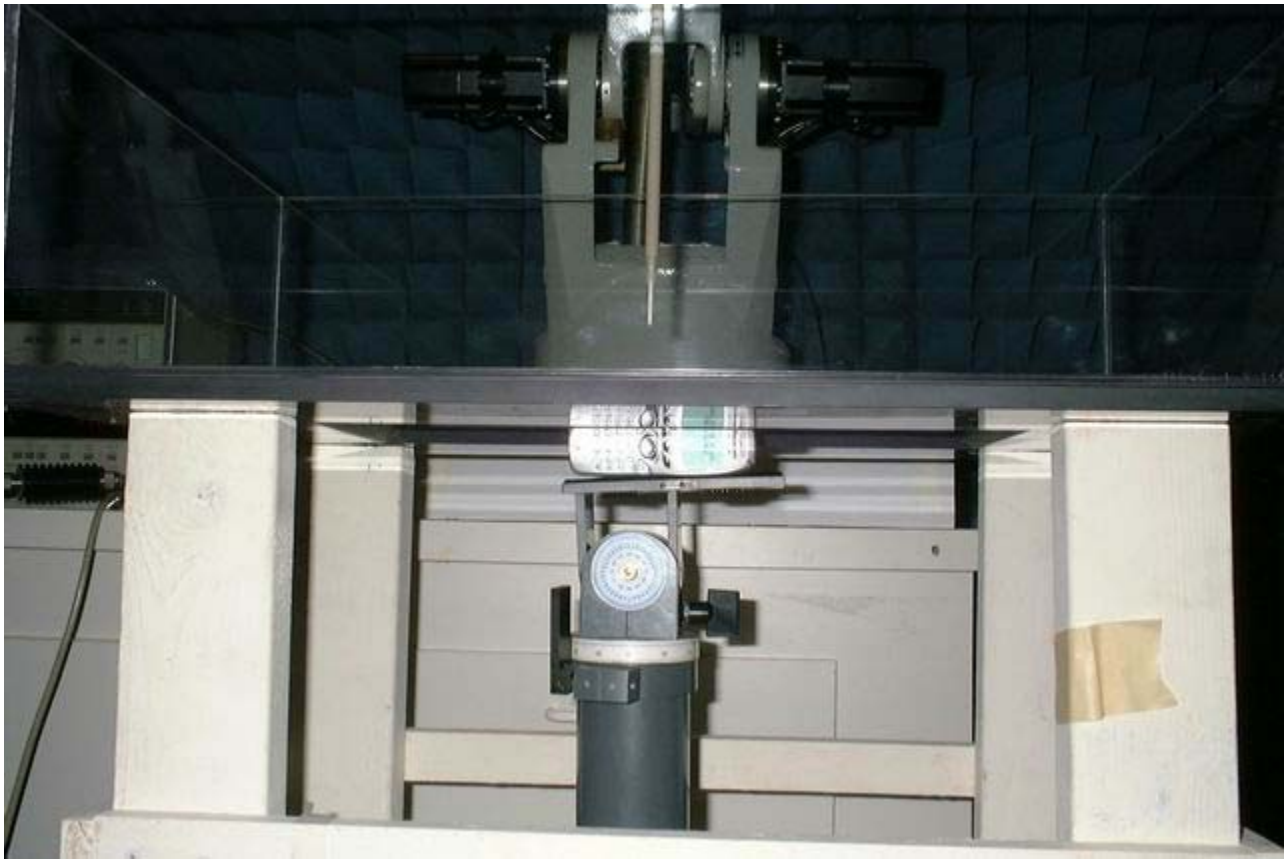


< Left side with headset(M/N:KX-TCA88) – Overview >

< Left side with headset(M/N:KX-TCA88) – Closeup-View >

< Right side with headset(M/N:KX-TCA88) – Overview >

< Right side with headset(M/N:KX-TCA88) – Closeup-View >



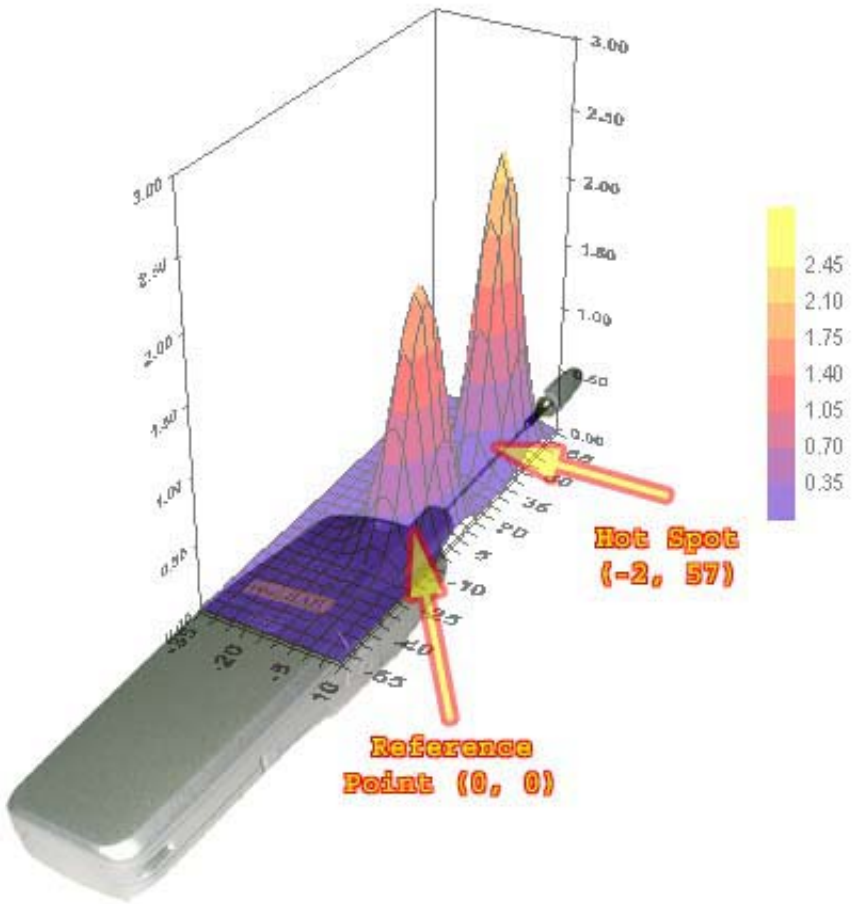
< Right side without headset – Overview >

< Right side without headset – Closeup-View >

4.5. MAXIMUM FIELD LOCATION

The maximum field was found to be located at (-2, 57) with the test configuration as described below:

- ♦ Body-worn position with the flat phantom
- ♦ Back of EUT in contact with the phantom
- ♦ Antenna fully extracted



Complete area Pre-scans at 2441.0 MHz with all possible test configurations were conducted to determine the location of the highest SAR.

4.6. PEAK SPATIAL-AVERAGE SAR MEASURED

Phantom Configurations	Device Test Positions	Antenna Position	SAR (W/kg) @ 2441.0 MHz
Body-worn	Back of EUT in contact with the phantom	Extended	0.441

4.7. SAR MEASUREMENT DATA

4.7.1. Prescan Test Results of body-worn configuration at 2441.0MHz with EUT Face in contact with phantom surface

Test Configuration * EUT Face scanned	Antenna Position	SAR (W/Kg)	Location of hot spot (mm) * Base of antenna as reference point (0, 0)
Front	Retracted	0.127	(0, 2)
	Extended	0.087	(-3, 55)
Back	Retracted	0.237	(-3, 2)
	Extended	**0.441**	(-2, 57)
Left	Retracted	0.085	(-8, -17)
	Extended	0.073	(-10, -27)
Right	Retracted	0.274	(2, 3)
	Extended	0.390	(0, 52)

4.7.2. Prescan Test Results of head configuration at 2441.0MHz

Test Configuration	Antenna Position	SAR (W/Kg)	Location of hot spot (mm) * Center of ear piece as reference point (0, 0)
Right Head Tilt Position	Retracted	0.138	(-13, 5)
	Extended	0.057	(-12, 51)
Right Head Cheek Position	Retracted	0.085	(-12, 3)
	Extended	0.000	(0, 0)
Left Head Tilt Position	Retracted	0.059	(-7, 8)
	Extended	0.026	(-5, 55)
Left Head Cheek Position	Retracted	0.019	(-10, 8)
	Extended	0.000	N/A

EXHIBIT 5. SAR SYSTEM CONFIGURATION & TEST METHODOLOGY

5.1. MEASUREMENT SYSTEM SPECIFICATIONS

Positioning Equipment	Probe
Type : 3D Near Field Scanner Location Repeatability : 0.1mm Speed 180 ^{o}/sec AC motors	Sensor : E-Field Spatial Resolution : 0.1 cm^3 Isotropic Response : ± 0.25 dB Dynamic Range : 2 W/g to 100 mW/g
Computer	**Phantom**
Type : Pentium III 500MHz CPU Memory : 256 Meg. RAM Operating System : Windows 2000 Professional Monitor : 17”	Tissue : Simulated Tissue with electrical characteristics similar to those of the human at normal body temperature. Shell : Fiberglass human shell shaped (1.5 mm thick)

5.2. TEST PROCEDURES

In the SAR measurement, the positioning of the probes must be performed with sufficient accuracy to obtain repeatable measurements in the presence of rapid spatial attenuation phenomena. The accurate positioning of the E-field probe is accomplished by using a high precision robot. The robot can be taught to position the probe sensor following a specific pattern of points. In a first sweep, the sensor is positioned as close as possible to the interface, with the sensor enclosure touching the inside of the fiberglass shell. The SAR is measured on a grid of points, which covers the curved surface of the phantom in an area larger than the size of the EUT. After the initial scan, a high-resolution grid is used to locate the absolute maximum measured energy point. At this location, attenuation versus depth scan will be accomplished by the measurement system to calculate the SAR value.

5.3. PHANTOM

The phantom used in the evaluation of the RF exposure of the user of the wireless device is a clear fiberglass enclosure 1.5 mm thick, shaped like a human head or body and filled with a mixture simulating the dielectric characteristics of the brain, muscle or other types of human tissue. The maximum width of the cranial model is 17 cm, the cephalic index is 0.7 and the crown circumference of the cranial model is 61 cm. The ear is 6 mm above the outer surface of the shell.

5.4. SIMULATED TISSUE

Simulated Tissue: Suggested in a paper by George Hartsgrove and colleagues in University of Ottawa Ref.: Bioelectromagnetics 8:29-36 (1987)

Ingredient	Quantity
Water	40.4 %
Sugar	56.0 %
Salt	2.5 %
HEC	1.0 %
Bactericide	0.1 %

Table. Example of composition of simulated tissue.

This simulated tissue is mainly composed of water, sugar and salt. At higher frequencies, in order to achieve the proper conductivity, the solution does not contain salt. Also, at these frequencies, D.I. water and alcohol is preferred.

Tissue Density: Approximately 1.25 g/cm^3

5.4.1. Preparation

We determine the volume needs and carefully measure all components. A clean container is used where the ingredients will be mixed. A stirring paddle mounted to a drill press is used to stir the mixture. First we heat the DI water to about 40 ^{o}C to help the ingredients dissolve and then we pour the salt and the bactericide. We stir until all the ingredients are completely dissolved. We continue stirring slowly while adding the sugar. We avoid high RPM from the mixing device to prevent air bubbles in the mixture. Later on, we add the HEC to maintain the solution homogeneous. Mixing time is approximately 30 to 40 min.

5.5. MEASUREMENT OF ELECTRICAL CHARACTERISTICS OF SIMULATED TISSUE

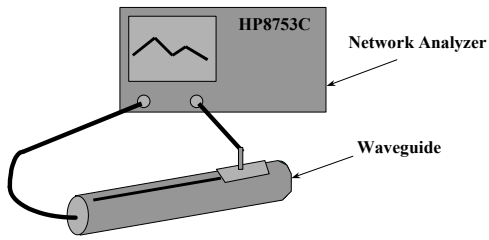
1) Network Analyzer HP8753C or others
2) Slotted Coaxial Waveguide

5.5.1. Description Of The Slotted Coaxial Waveguide

The cylindrical waveguide is constructed with copper tube of about 30 to 40 cm in length, generally 12.5 mm diameter, with connectors at both ends. Inside of this tube, a conductive rod about 6.3 mm is coaxial supported by the two ends connectors (radiator). A slot 3 mm wide start at the beginning of the tube to approximately two thirds of the tube length. The outer edge of the slotted tube is marked in increments of 1 centimeter (10 to 12), and 0.5 centimeter for higher frequencies. A saddle piece containing the sampling probe is inserted in the slot so the tip of the probe is close but not in contact with the inner conductor (radiator).

To measure the electrical characteristics of the liquid simulated tissue, we fill the coaxial waveguide with the mixture, select CW frequency and measure amplitude and phase with the Network Analyzer for every point in the slot (typically 11). An effort is made to keep the resultant dielectric constant and conductivity within 5 % of published data.

Electrical Characteristics Measurement Setup



$$c = 3 \cdot 10^8 \text{ m/s}$$

$$A = \frac{\Delta A}{20} \ln_{10} \frac{1}{m}$$

$$\theta = \frac{\Delta\theta \cdot 2\pi}{360}$$

$$\lambda = \frac{c}{f} \cdot \frac{100}{2.54} \text{ inches}$$

$$\varepsilon_{re} = \frac{(A^2 + \theta^2) \cdot \lambda^2}{4\pi^2}$$

$$\theta' = \left| \frac{|A| \cdot \lambda}{4\pi\sqrt{\varepsilon_{re}}} \right|$$

$$S = \tan(2\theta')$$

$$\varepsilon_r = \frac{\varepsilon_{re}}{\sqrt{(1 + S^2)}}$$

$$\sigma = S \cdot 2\pi \cdot f \cdot 8.854 \cdot 10^{12} \cdot \varepsilon_r \text{ (S/m)}$$

Where: ΔA is the amplitude attenuation in dB
$\Delta\theta$ is the phase change in degrees for 5 cm of wave propagation in the slotted line
f is the frequency of interest in Hz.

5.6. SYSTEM DESCRIPTION

The measurement system consists of an E-field probe, instrumentation amplifiers, RF transparent cable connecting the amplifiers to the computer, the robotics arm with its extension and proximity sensors, a phantom with simulated tissue and a radio holder to support the device under test. The E-field probe is a three channel device used to measure RF electric fields in the near vicinity of the source. The three sensors are mutually orthogonal positioned dipoles, and are constructed over a quartz substrate. Located in the center of the dipole is a Schottky diode. High impedance lines are connecting the sensor to the amplifier and then optically linked to the computer. The probe has an isotropic response and is transparent to the RF fields.

Calibration is performed by two steps:

1) Determination of free space E-field from amplified probe outputs in a test RF field. This calibration is performed in a TEM cell when the frequency is below 1 GHz and in a waveguide or some other methodologies above 1 GHz. For the free space calibration, we place the probe in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. This reading equate to 1mW/cm^2 if that power density is available in the correspondent cavity.

2) Correlation of the measured free space E-field, to temperature rise in a dielectric medium. E-field temperature correlation calibration is performed in a planar phantom filled with the appropriate simulated tissue.

For temperature correlation calibration, a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe. First, the location of the maximum E-field close to the phantom's inner surface is determined as a function of power into the RF source; in this case, a dipole. Then, the E-field probe is moved sideways so that the temperature probe, while affixed to the E-field probe is placed at the previous location of the E-field probe. Finally, temperature changes for 30 seconds exposure at the same RF power levels used for the E-field measurement are recorded. The following equation relates SAR to initial temperature slope:

$$SAR = C\frac{\Delta T}{\Delta t}$$

where: t = exposure time (30 seconds),
C = heat capacity of tissue (brain or muscle),
T = temperature increase due to RF exposure.

The heat capacity used for brain simulated tissue is 2.7 joules/^{0}C/g and 3.0 joules/^{0}C/g for muscle.

SAR is proportional to T / t, the initial rate of tissue heating, before thermal diffusion takes place. Now, it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E-field;

$$SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

where: = Simulated tissue conductivity
= Tissue density (1.25 g/cm^3 for simulated tissue)

5.7. DATA EXTRAPOLATION (CURVE FITTING)

The distance from the center of the sensor (diode) to the end of the protective tube is called the 'probe offset'. To compensate we use an exponential curve fitting method to obtain the peak surface value from the voltages measured at the distance from the inner surface of the phantom. At the point where the highest voltage was recorded, the field is measured as close as possible to the phantom's surface and every 1mm along the ` Z ` axis for a distance of 50 mm. The appropriate exponential curve is obtained from all the points measured and used to define an exponential decay of the energy density versus depth.

$$E(z) = E_0 \cdot e^{-z/\delta} \text{ (mV)}$$

5.8. INTERPOLATION AND GRAM AVERAGING

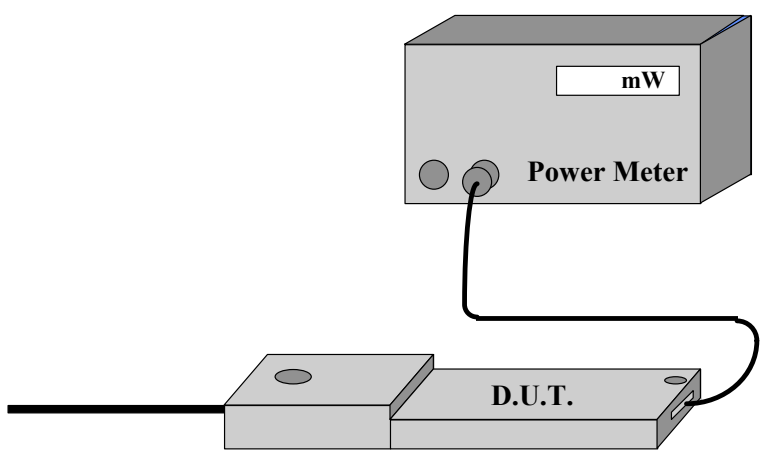
The voltage, (1 cm) above the phantoms surface (E_{tot} 1 cm), is needed to calculate the exposure over one gram of tissue. This SAR value that estimates the average over 1 gram of tissue, is obtained by taking the integral over 1 cm^2 surface of the measured field along the exponential decay curve of the energy density with depth.

$$SAR(mW/g) = \int_{v=1g} SAR(\bullet)dv = \int_{s=1cm^2}\int_0^{1cm} E(z)\cdot\frac{CF}{SensorFactor}dzds$$

5.9. POWER MEASUREMENT

Whenever possible, a conducted power measurement is performed. To accomplish this, we utilize a fully charged battery, a calibrated power meter and a cable adapter provided by the manufacturer. The data of the cable and related circuit losses are also provided by the manufacturer. The power measurement is then performed across the operational band and the channel with the highest output power is recorded.

Power measurement is performed before and after the SAR to verify if the battery was delivering full power at the time of testing. A difference in output power would determine a need for battery replacement and to repeat the SAR test.



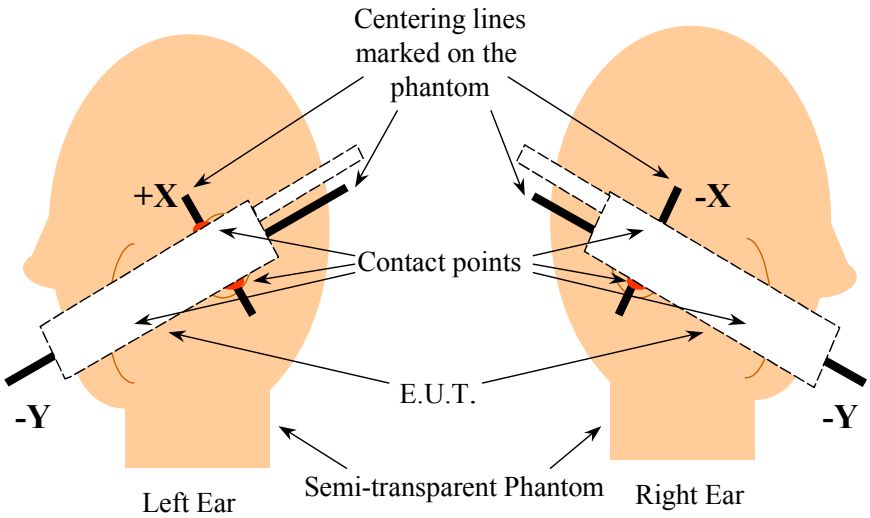
Measured Power + Cable and Switching Mechanism Loss

5.10. POSITIONING OF EUT

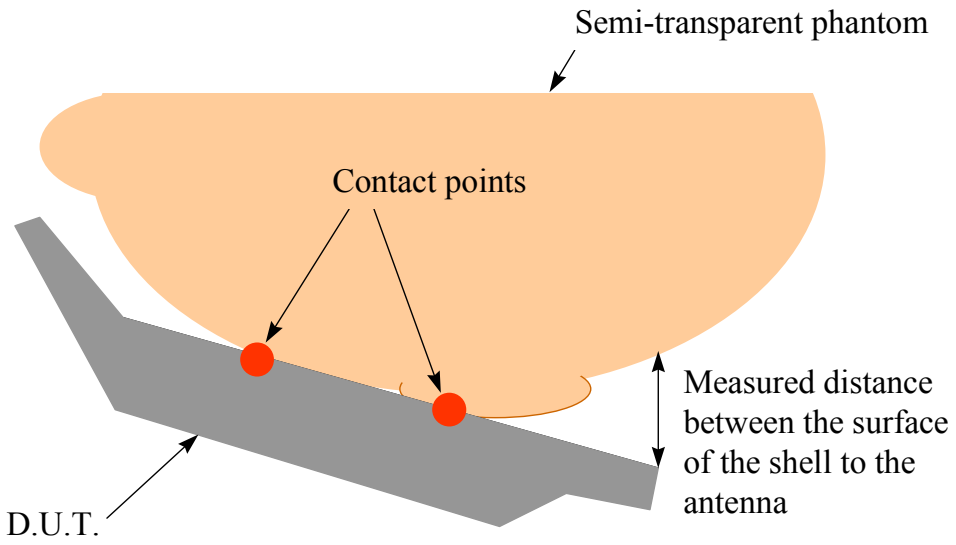
The clear fiberglass phantom shell have been previously marked with a highly visible line, so it can easily be seen through the liquid simulated tissue. In the case of testing a cellular phone, this line is connecting the ear channel with the corner of the lips. The EUT is then placed by centering the speaker with the ear channel and the center of the radio width with the corner of the mouth. At the same time the surface of the EUT is always in contact with the phantoms shell. Three points contact; two in the ear region and one on the chin in addition to the previously describe alignment will assure repeatability of the test.

For HAND HELD devices (push-to-talk), or any other type of wireless transmitters, the EUT will be positioned as suggested by manufacturer operational manuals.

Positioning of theE.U.T.



Side View


Semi-transparent phantom
Contact points
Measured distance between the surface of the shell to the antenna
D.U.T.

5.11. SAR MEASUREMENT UNCERTAINTY

This uncertainty analysis covers the 3D-EMC Laboratory test procedure for Specific Absorption Rate (SAR) associated with wireless telephones and similar devices.

Standards Covered Are:

WGMTE 96/4 - Secretary SC211/B

FCC 96-326, ET Docket No. 93-62

Industry Canada RSS 102

ACA Radiocommunications (Electromagnetic Radiation – Human Exposure) Amendment Standard 2000 (No. 1)

The laboratory test procedure, and this uncertainty analysis, may be used to cover all standards above. It is based on test equipment and procedures specified by 3D-EMC Laboratories, Inc. located in Ft. Lauderdale, Florida.

Measurement Uncertainty:

Table I. Estimated SAR Measurement Uncertainty

Contribution	Error (±dB)	Probability Distribution	Type Evaluation	Standard Uncertainty (±dB)
A. Field Measurement Errors:		Rectangular	Type B	
Isotropy in Phantom BTS Liquid	0.8			0.46
Frequency Response	0.2			0.12
Linearity	0.2			0.12
Probe Calibration Error (rss)	0.7			0.40
Duty Factor Variability	0.2			0.12
B. Spatial Peak SAR Errors:		Normal	Type A	
Extrapolation & Interpolation, and Position	0.2			0.20
Integration & Search Routine	0.1			0.10
Cube Shape	0.2			0.20
C. Additional Errors:		Rectangular	Type B	
Solution Variability (Worst-Case SAR)	0.21			0.12
D. Combined Standard Uncertainty, u_c:		Normal	-	0.52
E. Expanded Uncertainty, U:		Normal (k=2)	-	1.04
		95% Confidence	-	27.14%

EXHIBIT 6. BODY WORN CONFIGURATION INFORMATION

FCC OET 65 Supplement C Requirements

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. The EUT was placed against the phantom and tested in its appropriate holster as would normally be used by the end user. If the SAR measured at the middle channel for each test is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional

When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. **A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances**. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components..

Equipment permutation investigated for each orientation

Even though the manufacturer does not include a body-mounting device for this device, it is intended to be used as a body worn device since the manufacturer provide a headset. An investigation were carried out using the body worn requirements as a guideline. As such, a preliminary scan on all faces of the EUT were carried out to determine the potential hot spot locations. The hottest spots was determined to be at the antenna.

Comments on non-tested configurations

High and low frequency were not investigated as the peak spatial-average SAR(0.441 W/Kg) was found to be at least 2.0dB lower than the SAR limit (1.6 W/Kg). No other configurations considered abnormal use, were investigated.

Recommended Caution Statements to be included in Users Manual

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and caution statements should be included in the manual. The information should allow users to make informed decisions on the type of body-worn accessories and operating configurations that are appropriate for the device. The following are *examples* of typical statements that provide end-users with the necessary information about body-worn accessories:

1. For a product that has the potential to be used in a body worn configuration and has been tested and certified with a specific accessory device(s):

> **"For body worn operation, this device has been tested and meets the FCC RF exposure guidelines when used with the (*manufacturer name*) accessories supplied or designated for this product. Use of other accessories may not ensure compliance with FCC RF exposure guidelines. "**

2. For a product that has the potential to be used in a body worn configuration and has not been certified with a specific accessory device(s):

> "For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with an accessory that contains no metal and that positions the device a minimum of 1.5cm from the body. Use of other accessories may not ensure compliance with FCC RF exposure guidelines."

3. For a product that has the potential to be used in a body worn configuration with future manufacturer designed accessories:

> "For body worn operation, this device has been tested and meets the FCC RF exposure guidelines when used with a (*manufacturer name*) accessory designated for this product or when used with an accessory that contains no metal and that positions the handset a minimum of (specified distance) from the body."

EXHIBIT 7. PRESCAN RESULTS OF BODY-WORN CONFIGURATION AT 2441.0 MHz

Prescan results of Body-worn configuration at 2441.0 MHz are presented in following order:

Test Configuration * EUT Face scanned	**Antenna Position**	**SAR (W/Kg)**	**Location of hot spot (mm)** * Base of antenna as reference point (0, 0)
Front	Retracted	0.127	(0, 2)
	Extended	0.087	(-3, 55)
Back	Retracted	0.237	(-3, 2)
	Extended	**0.441**	(-2, 57)
Left	Retracted	0.085	(-8, -17)
	Extended	0.073	(-10, -27)
Right	Retracted	0.274	(2, 3)
	Extended	0.390	(0, 52)

Test Information

Date : 26/10/2001
Time : 10:50:37 AM

Product	: 2.4GHz FHSS Cordless Telephone	**Test**	: SAR
Manufacturer	: Panasonic Canada Inc.	**Frequency (MHz)**	: 2440
Model Number	: KX-TD7690	**EIRP (W)**	: 0.329
Serial Number	: N/A	**Antenna Type**	: Monopole
FCC ID Number	:	**Signal**	: Spread Spectrum

Phantom	: Waist	**Dielectric Constant**	: 52.64
Simulated Tissue	: Muscle	**Conductivity**	: 1.98

Probe	: UT-ETR-0200-1	**Antenna Position**	: Retracted
Probe Offset (mm)	: 2.250		
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 3.467		
Calibrated Date	: 29/06/2001		

Amplifier Setting :

Channel 1 : 0.0043 Channel 2 : 0.0042 Channel 3 : 0.0052

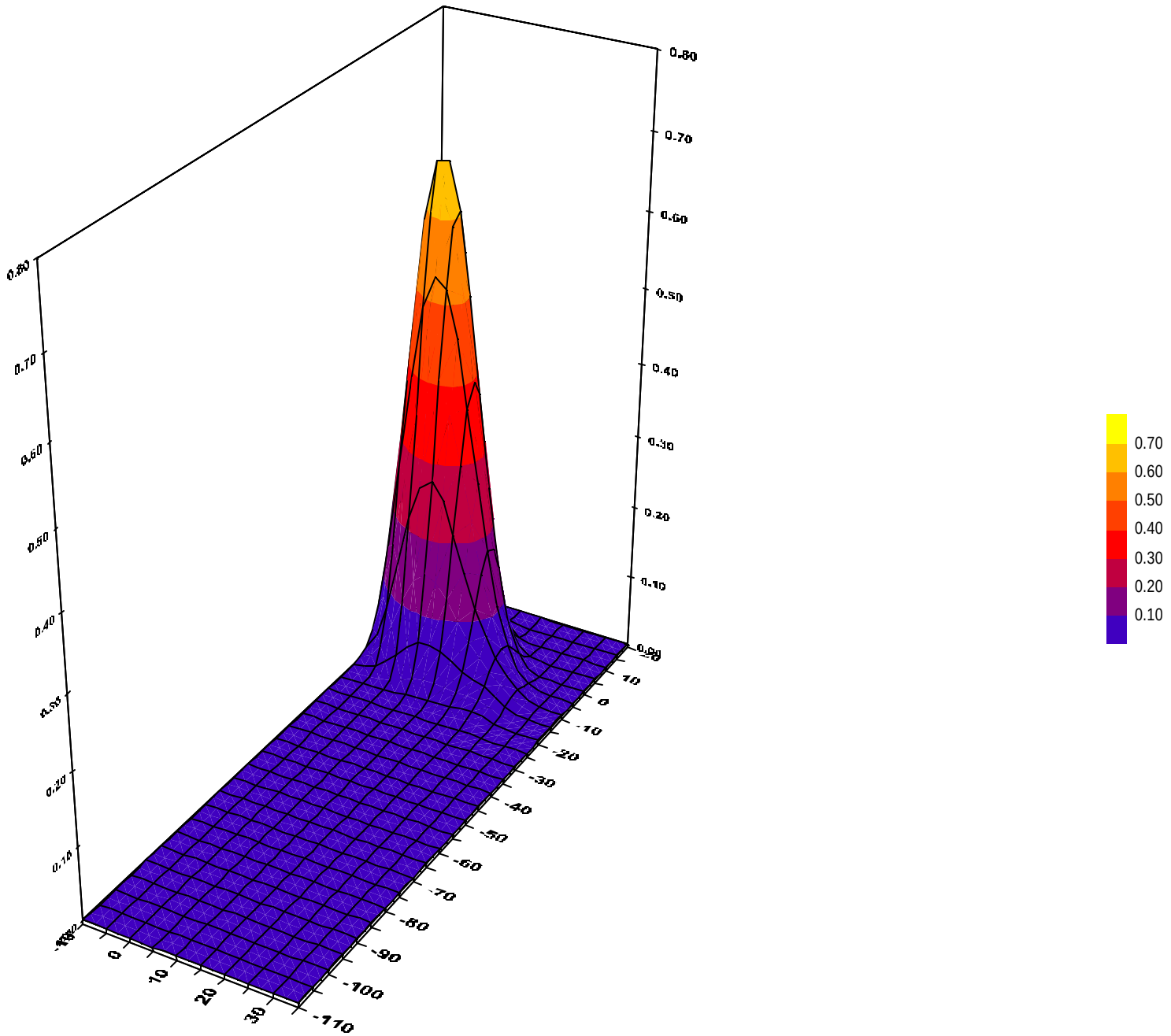
Location of Maximum Field :

X = 0 Y = 2

Measured Values (mV) :

0.749	0.614	0.420	0.264	0.148	0.053
0.009	0.000	0.000	0.000	0.000	

Peak Voltage (mV) : 1.917 **1 Cm Voltage (mV)** : 0.041 **SAR (W/Kg)** : 0.127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0.30
0.20
0.10
0.00
10
0
-10
-20
-30
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-50
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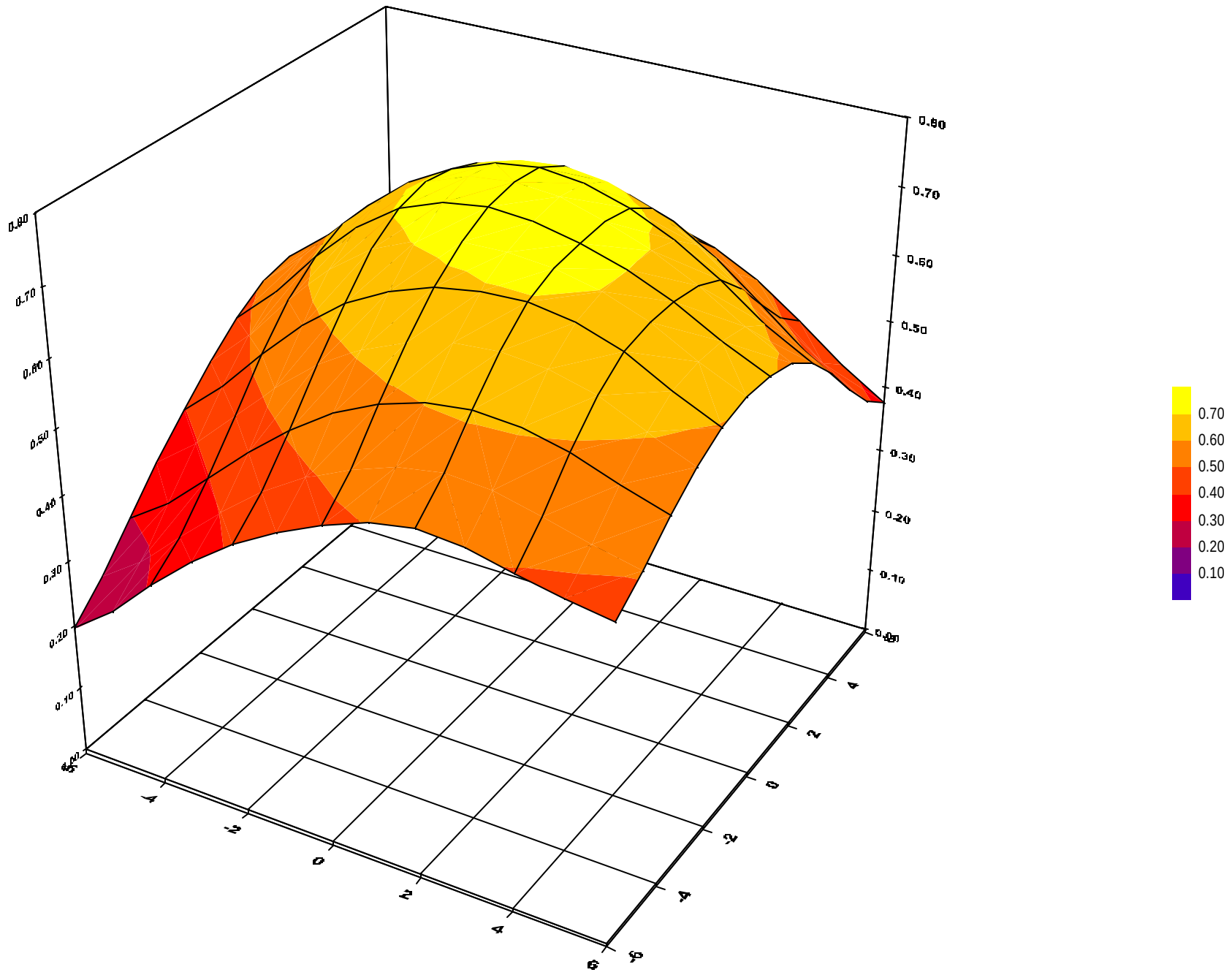
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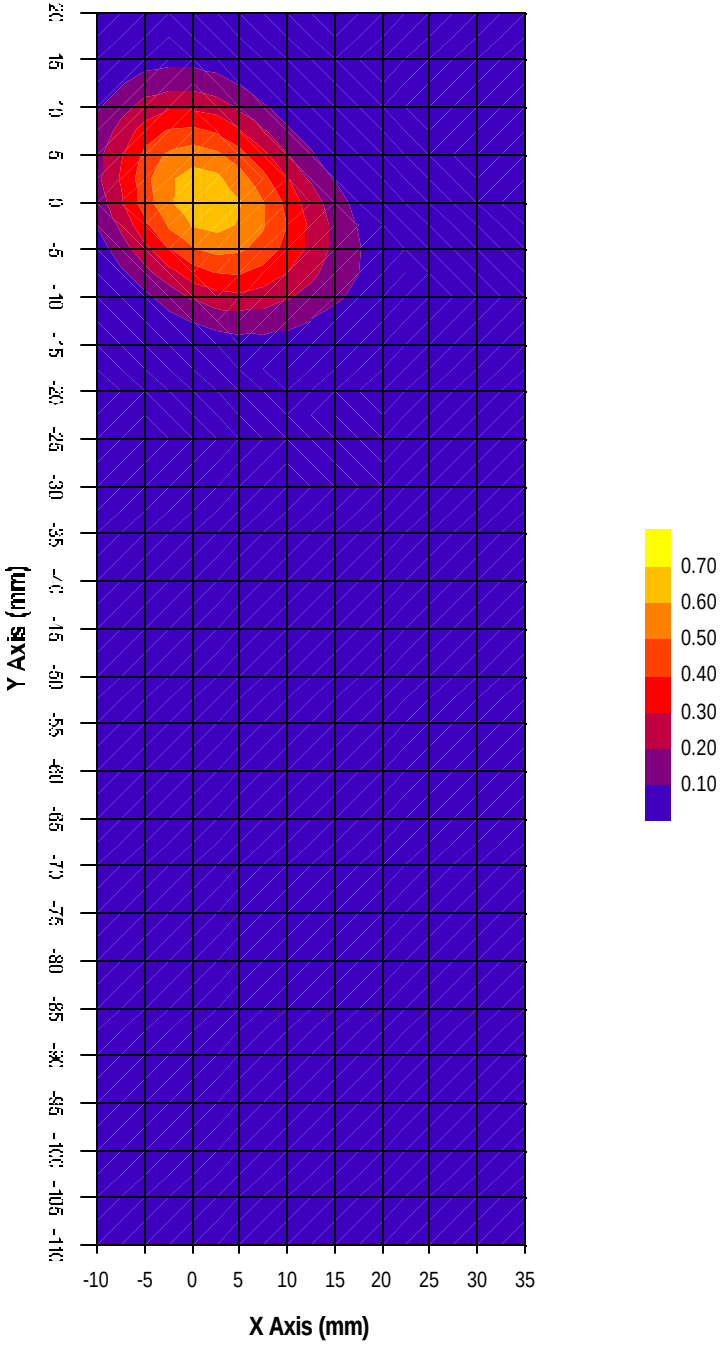
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X Axis (mm)
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-5
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20
25
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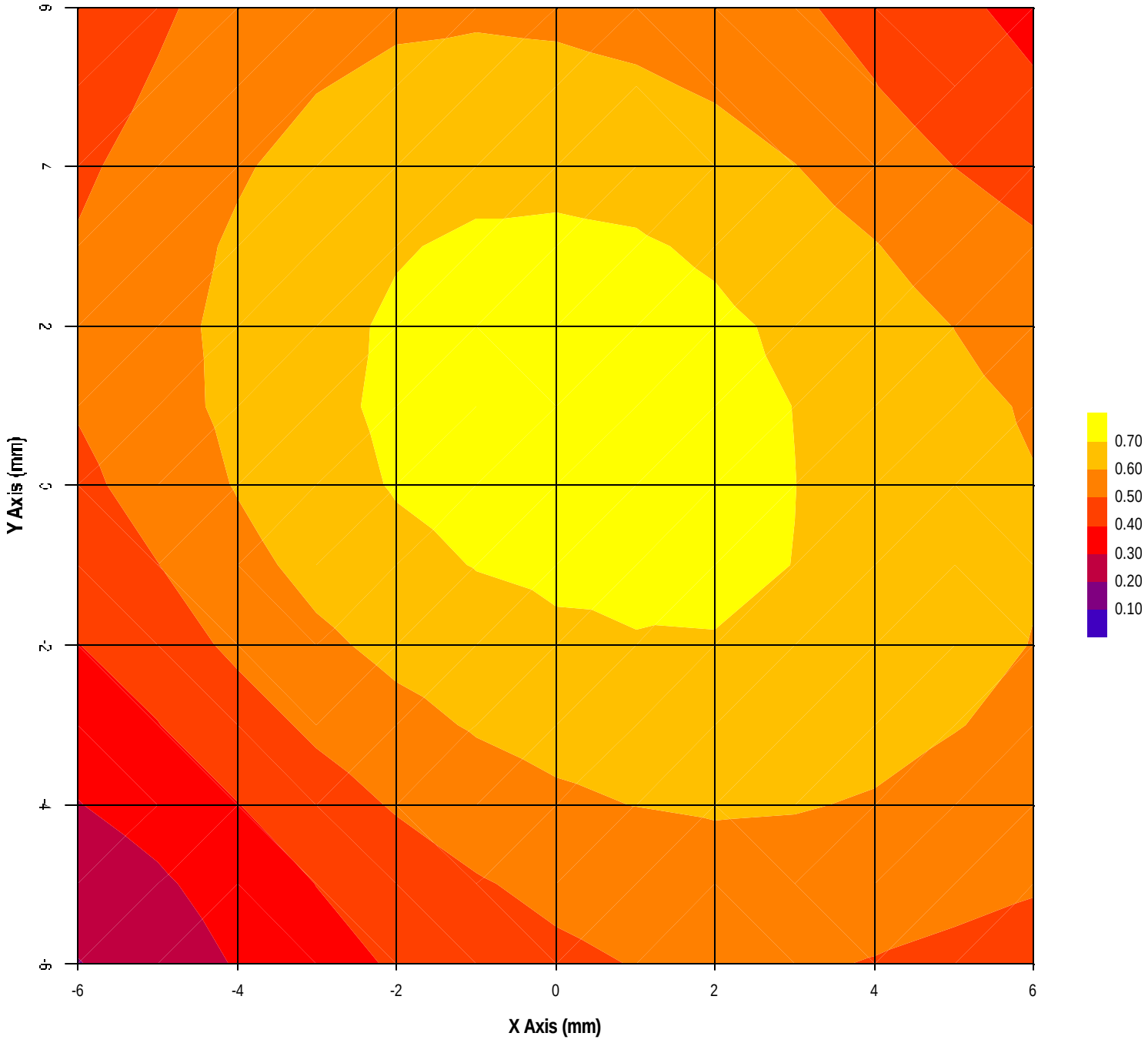
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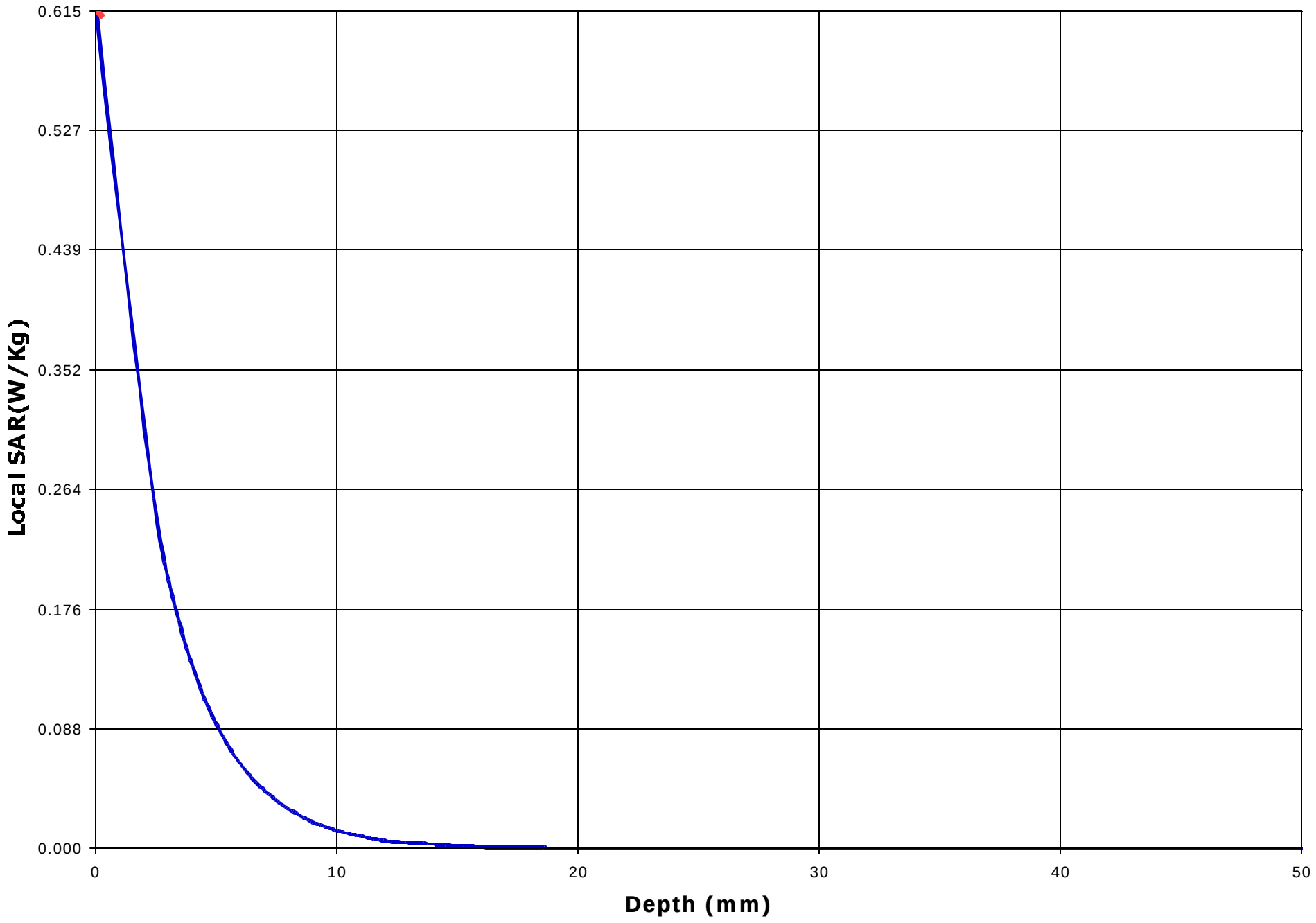
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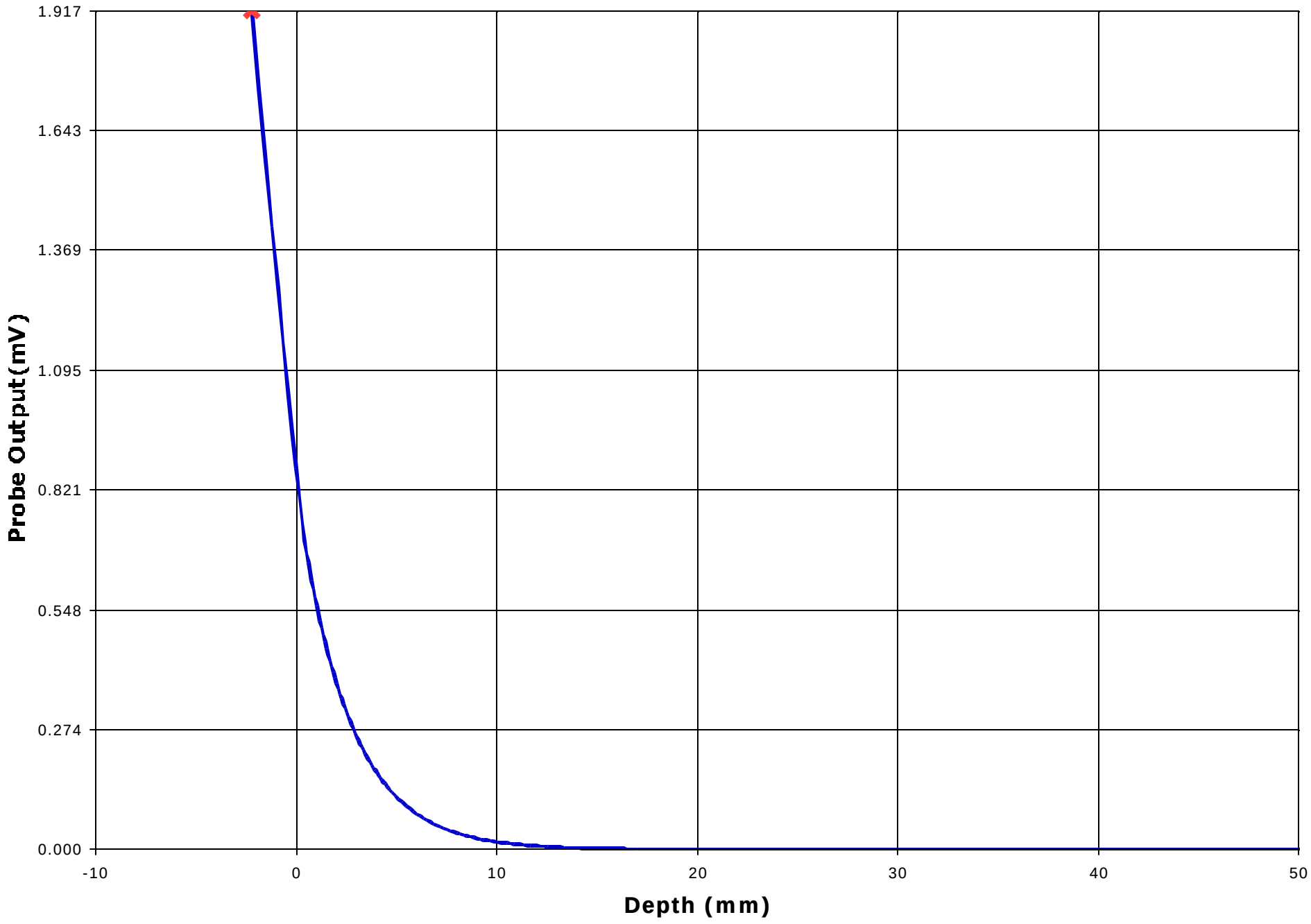
Local SAR(W/Kg)
0
10
20
30
40
50
Depth (mm)


1.917
1.643
1.369
1.095
0.821
0.548
0.274
0.000
Probe Output (mV)
-10
0
10
20
30
40
50
Depth (mm)

Test Information

Date : 26/10/2001
Time : 11:15:16 AM

Product	: 2.4GHz FHSS Cordless Telephone	**Test**	: SAR
Manufacturer	: Panasonic Canada Inc.	**Frequency (MHz)**	: 2440
Model Number	: KX-TD7690	**EIRP (W)**	: 0.329
Serial Number	: N/A	**Antenna Type**	: Monopole
FCC ID Number	:	**Signal**	: Spread Spectrum

Phantom	: Waist	**Dielectric Constant**	: 52.64
Simulated Tissue	: Muscle	**Conductivity**	: 1.98

Probe	: UT-ETR-0200-1	**Antenna Position**	: Extended
Probe Offset (mm)	: 2.250		
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 3.467		
Calibrated Date	: 29/06/2001		

Amplifier Setting :

Channel 1 : 0.0043 Channel 2 : 0.0042 Channel 3 : 0.0052

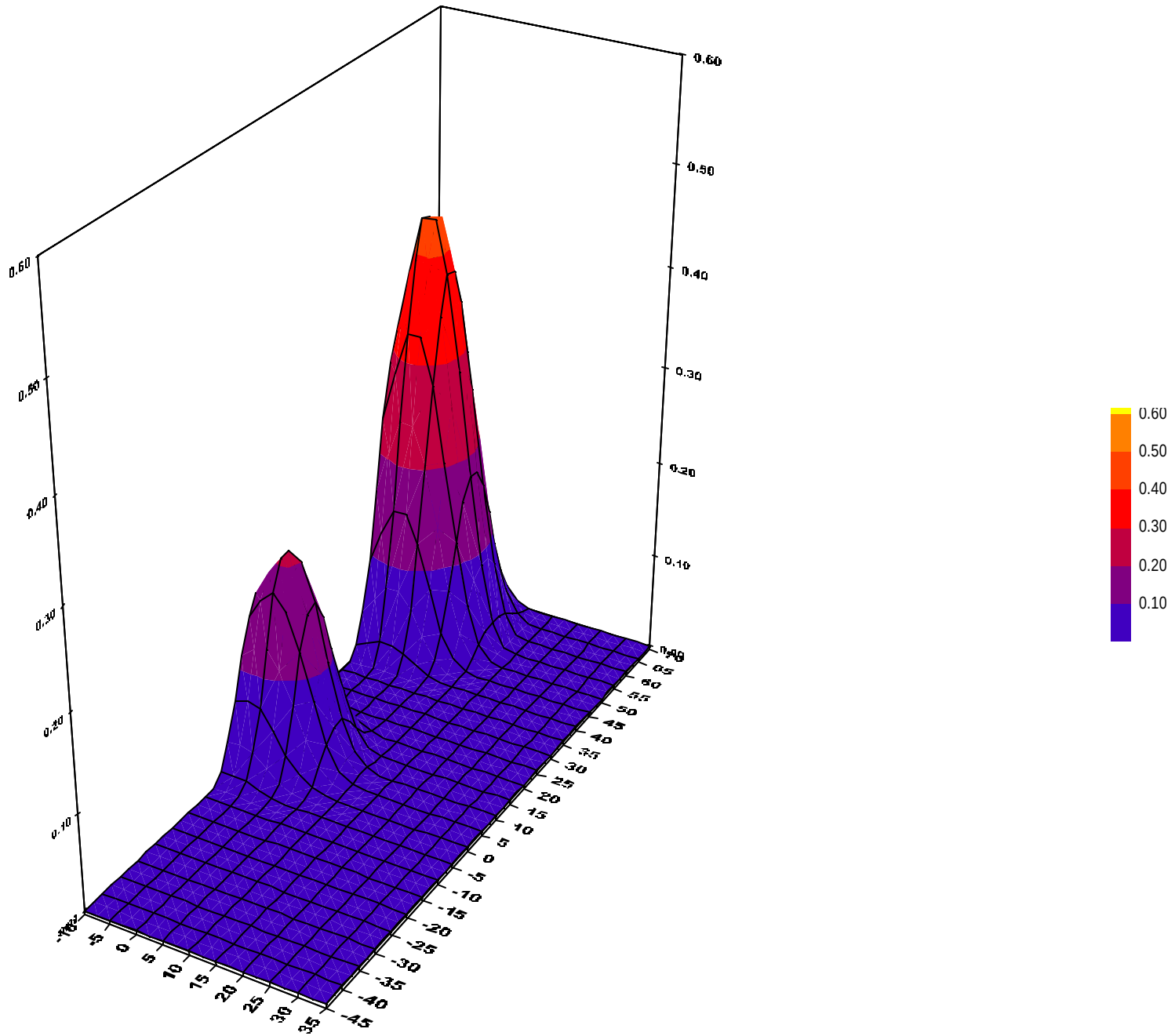
Location of Maximum Field :

X = -3 Y = 55

Measured Values (mV) :

0.485	0.416	0.323	0.229	0.170	0.110
0.042	0.004	0.000	0.000	0.000	

Peak Voltage (mV) : 0.891 **1 Cm Voltage (mV)** : 0.062 **SAR (W/Kg)** : 0.087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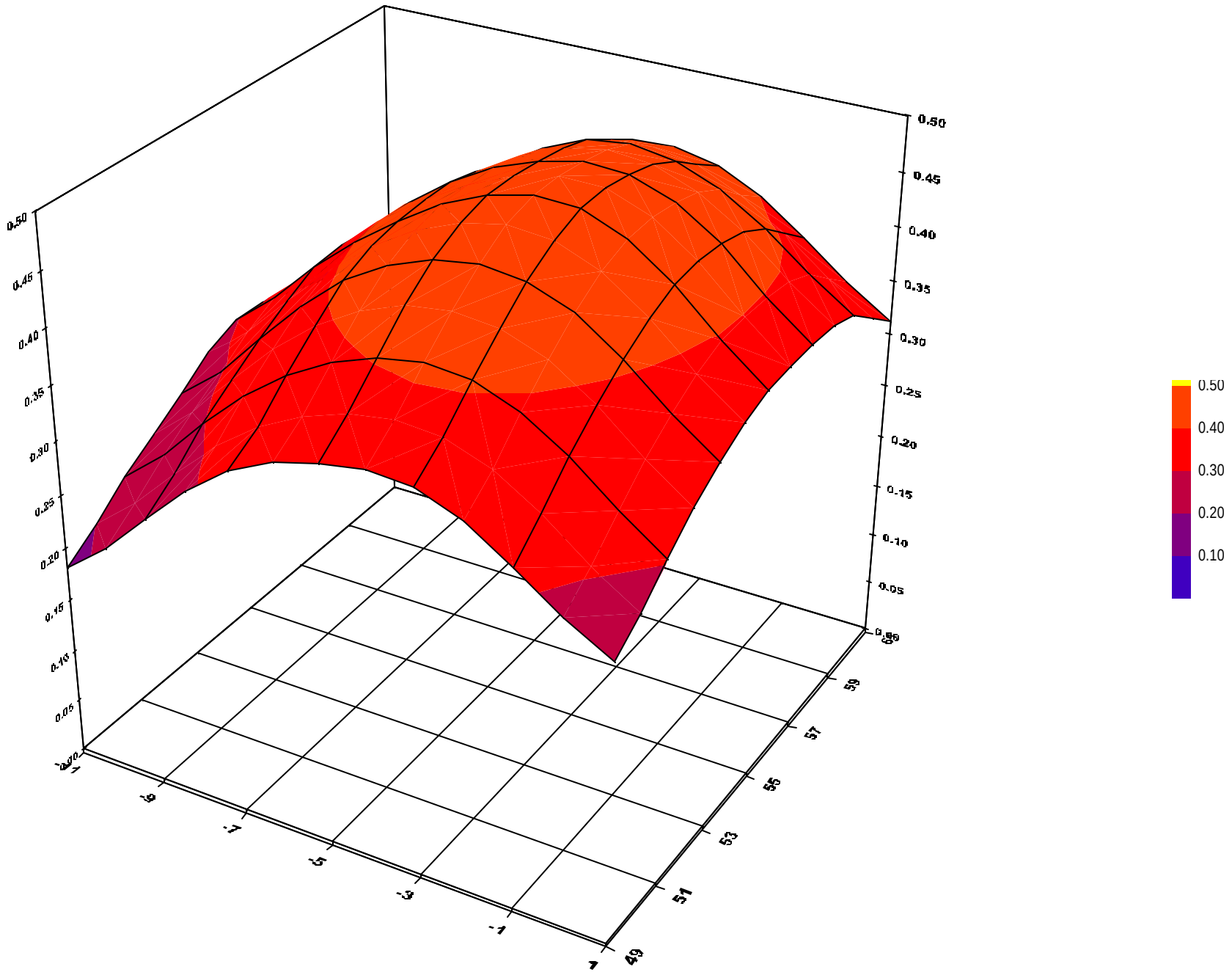
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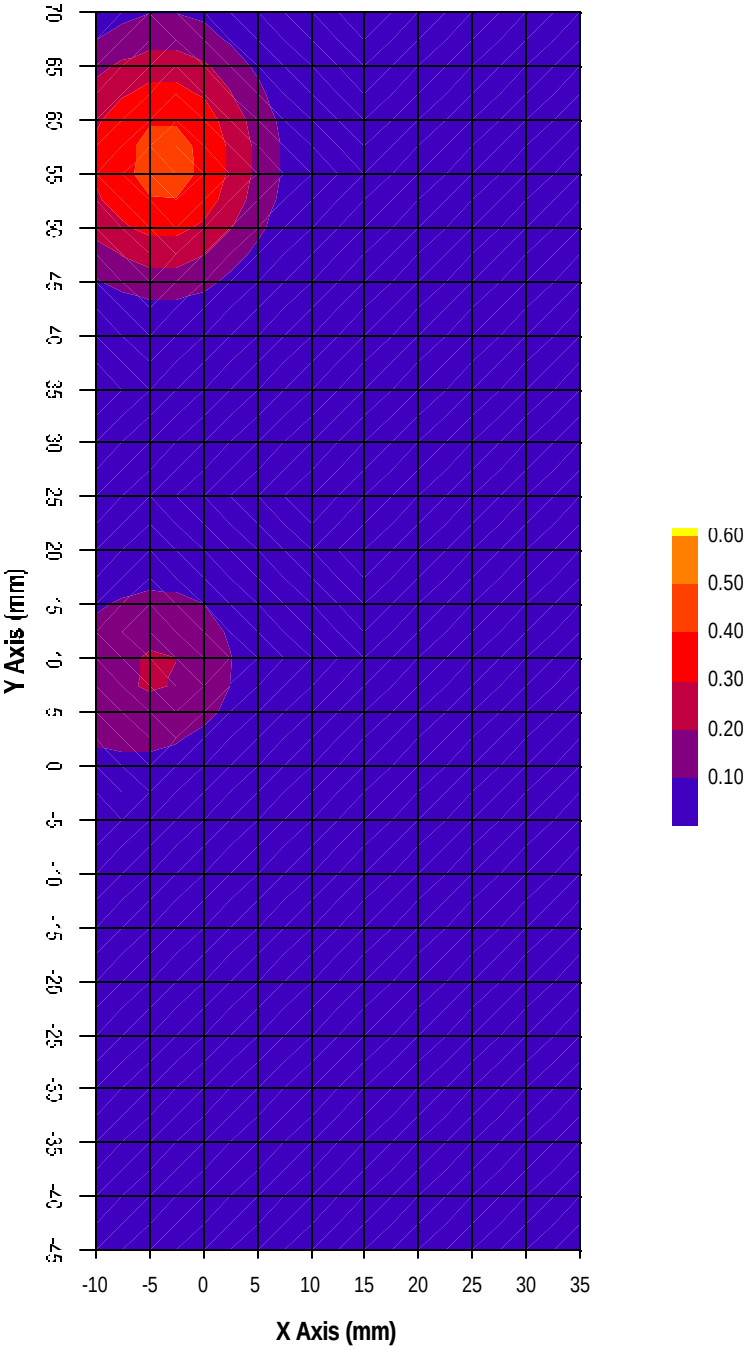
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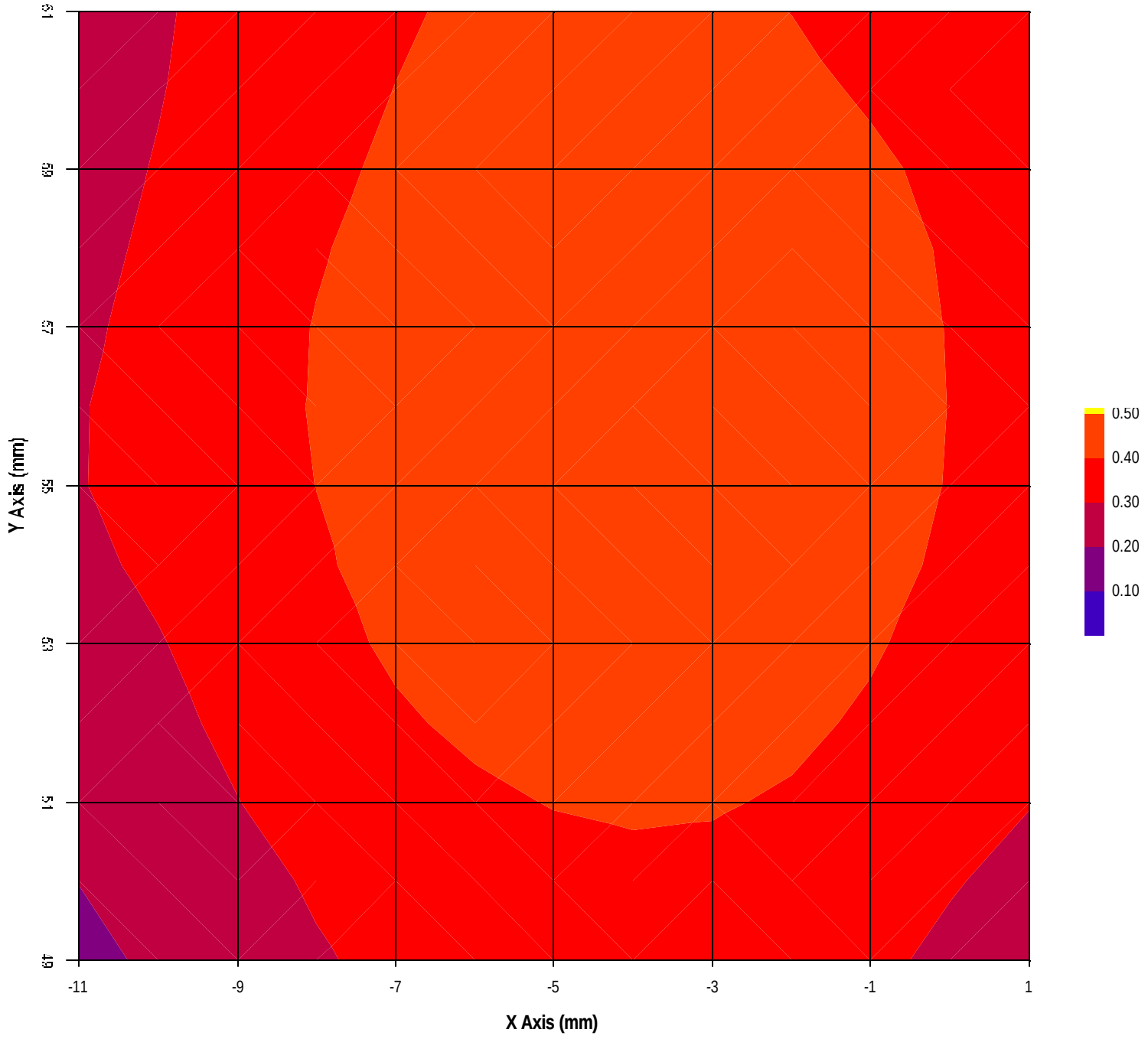
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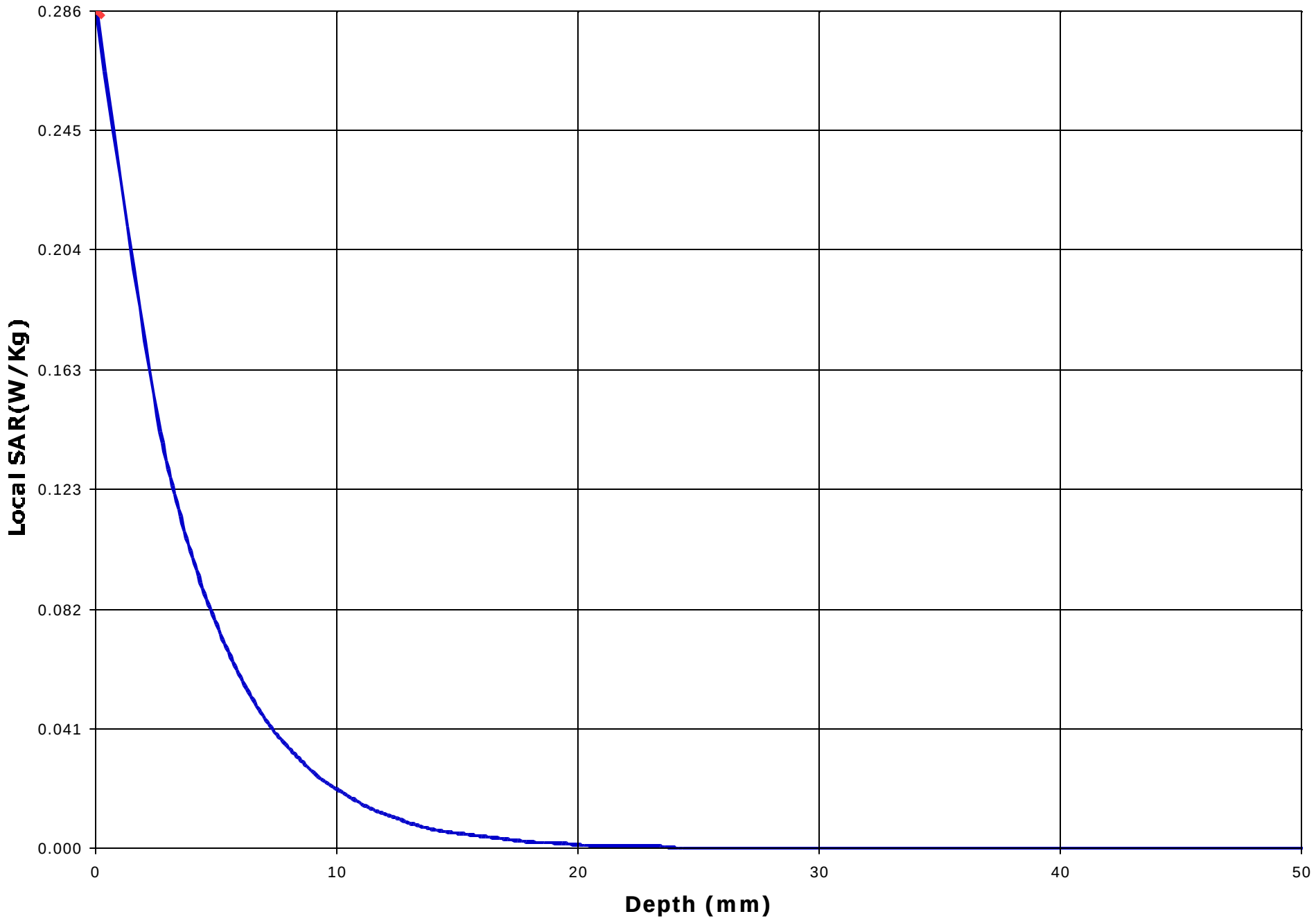
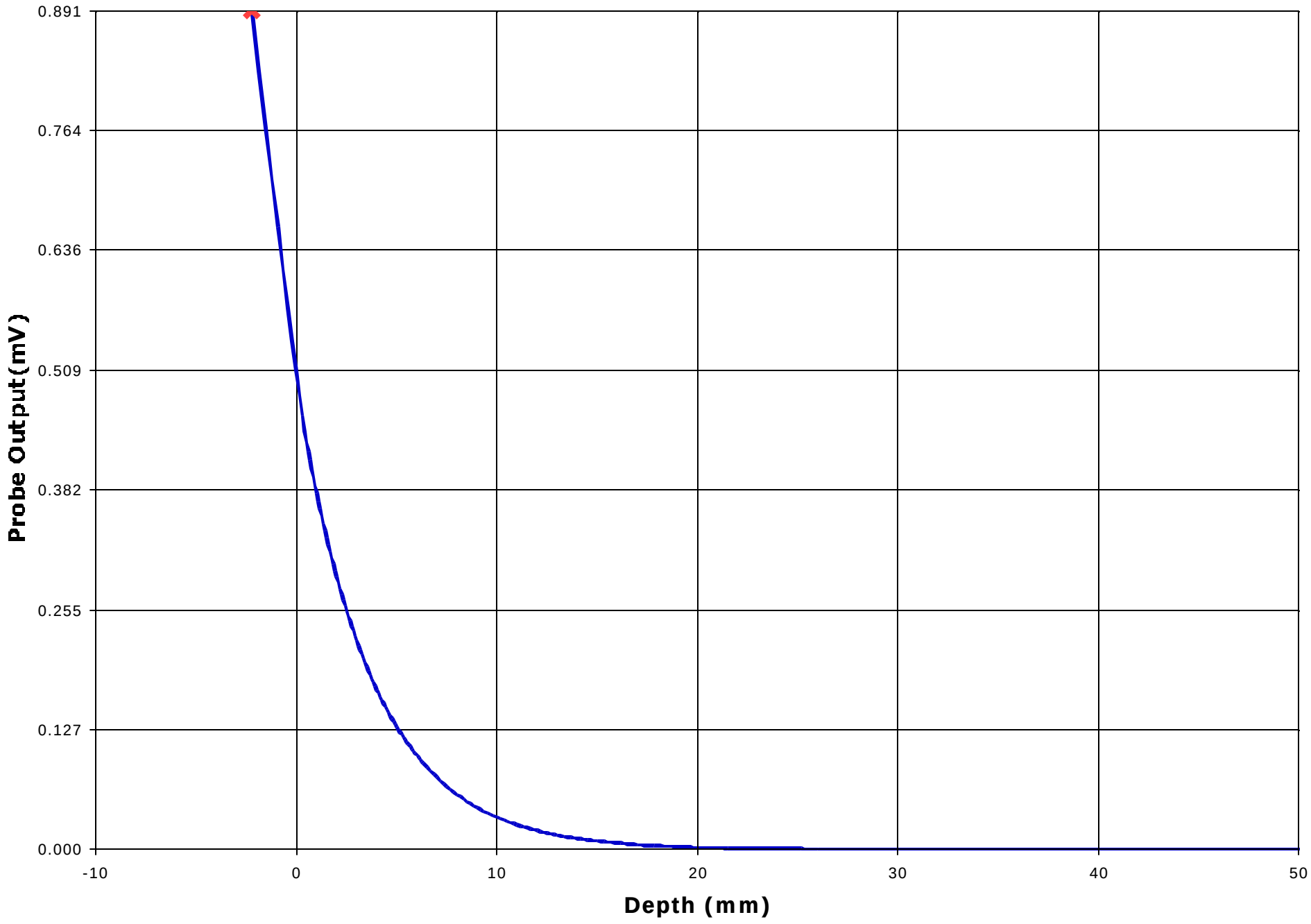
0.20
0.10


0.286
0.245
0.204
0.163
0.123
0.082
0.041
0.000
Local SAR(W/Kg)
0
10
20
30
40
50
Depth (mm)


0.891
0.764
0.636
0.509
0.382
0.255
0.127
0.000
Probe Output (mV)
-10
0
10
20
30
40
50
Depth (mm)

Test Information

Date : 26/10/2001
Time : 11:47:15 AM

Product	: 2.4GHz FHSS Cordless Telephone	**Test**	: SAR
Manufacturer	: Panasonic Canada Inc.	**Frequency (MHz)**	: 2440
Model Number	: KX-TD7690	**EIRP (W)**	: 0.329
Serial Number	: N/A	**Antenna Type**	: Monopole
FCC ID Number	:	**Signal**	: Spread Spectrum

Phantom	: Waist	**Dielectric Constant**	: 52.64
Simulated Tissue	: Muscle	**Conductivity**	: 1.98

Probe	: UT-ETR-0200-1	**Antenna Position**	: Extended
Probe Offset (mm)	: 2.250		
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 3.467		
Calibrated Date	: 29/06/2001		

Amplifier Setting :

Channel 1 : 0.0043 Channel 2 : 0.0042 Channel 3 : 0.0052

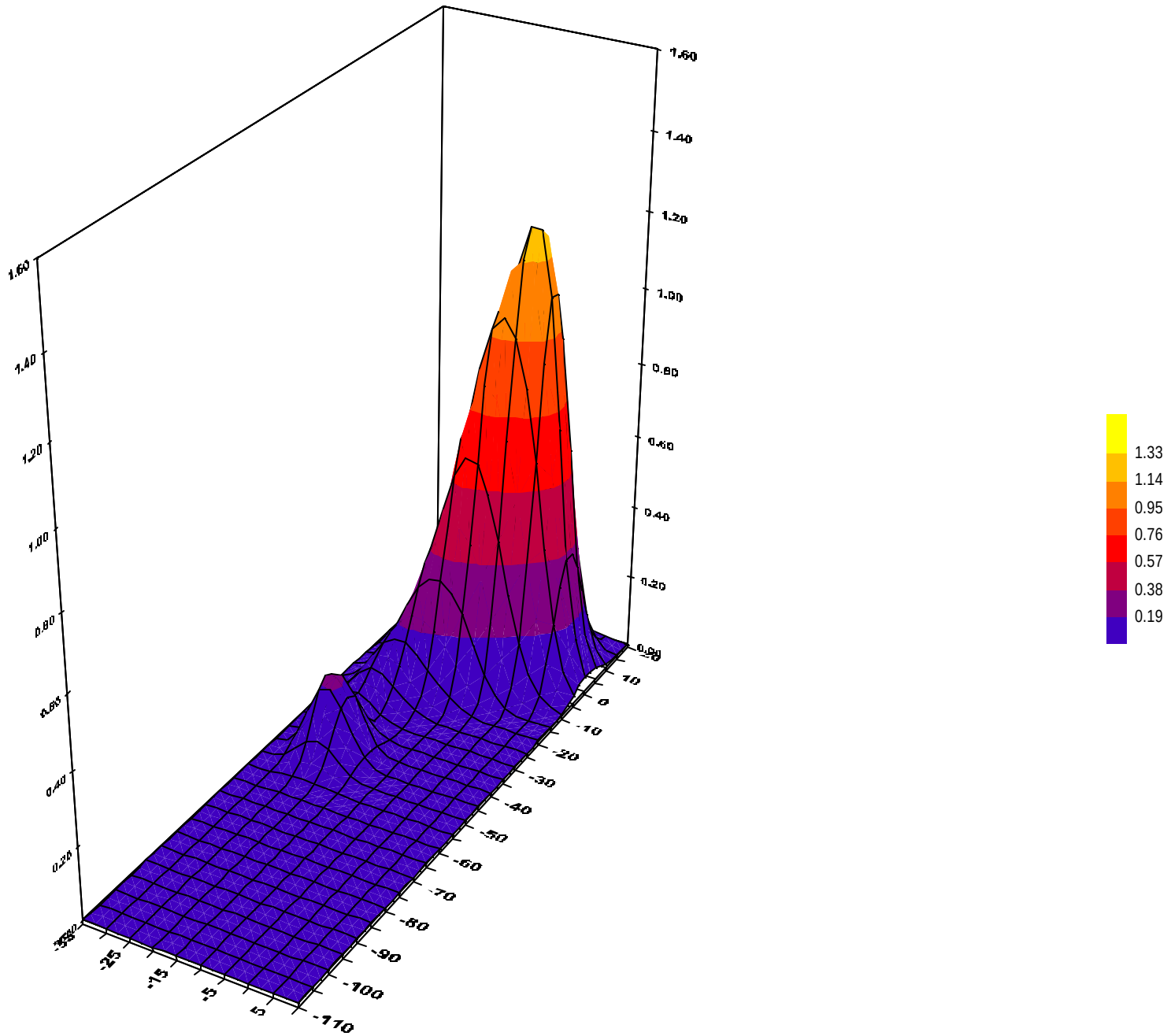
Location of Maximum Field :

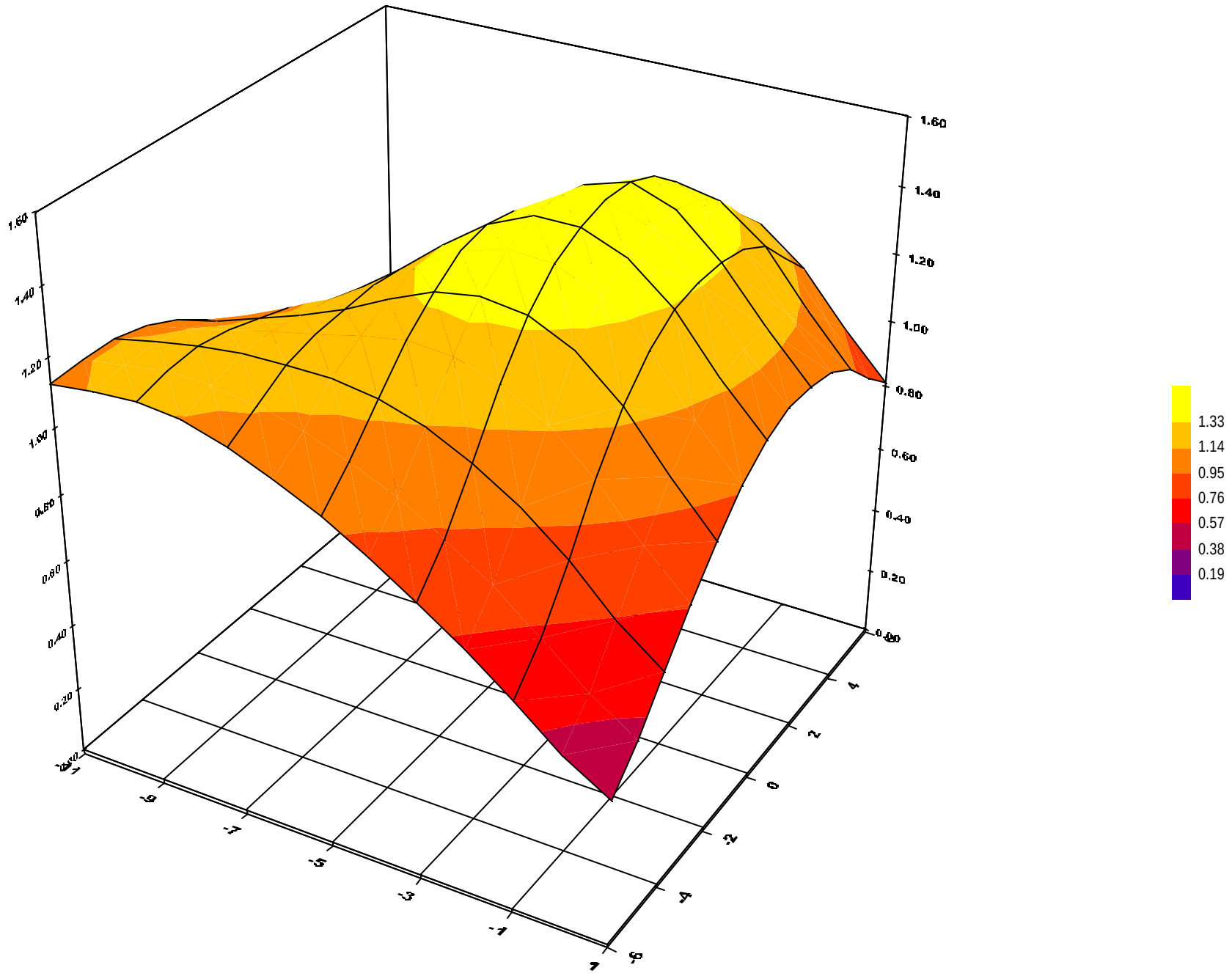
X = -3 Y = 2

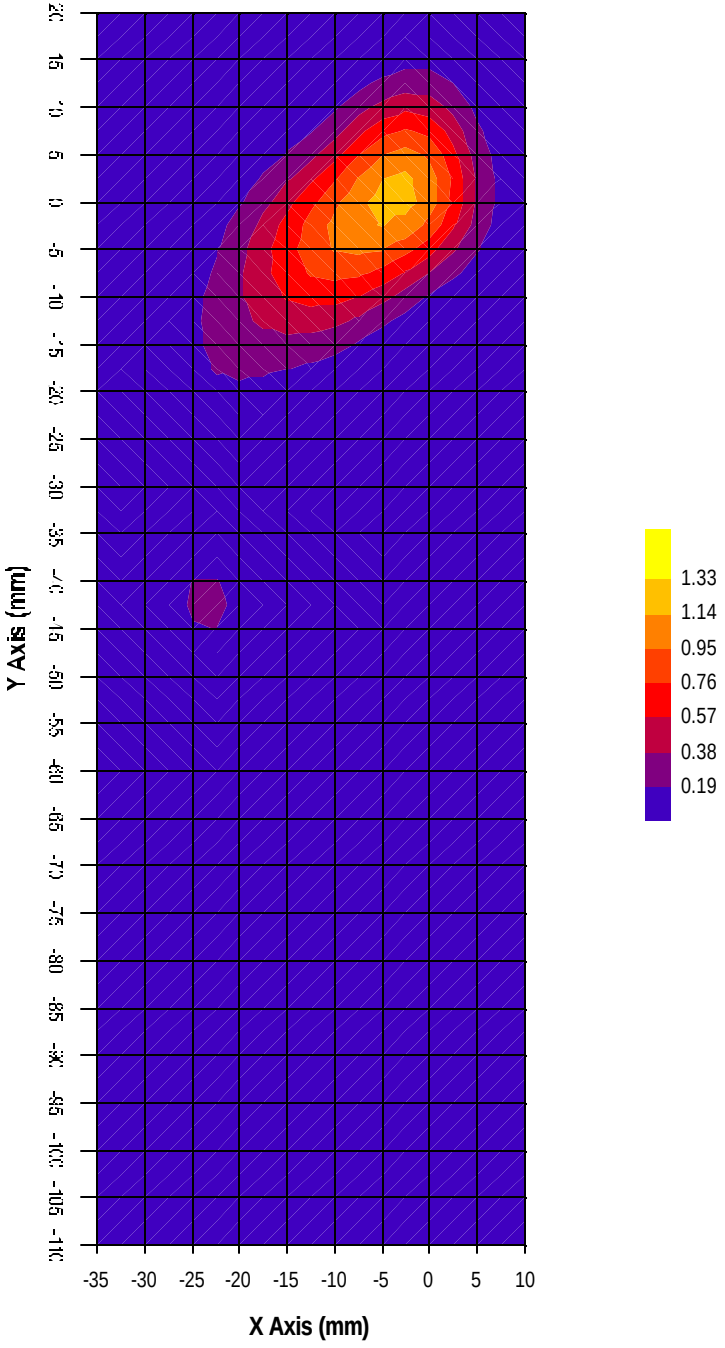
Measured Values (mV) :

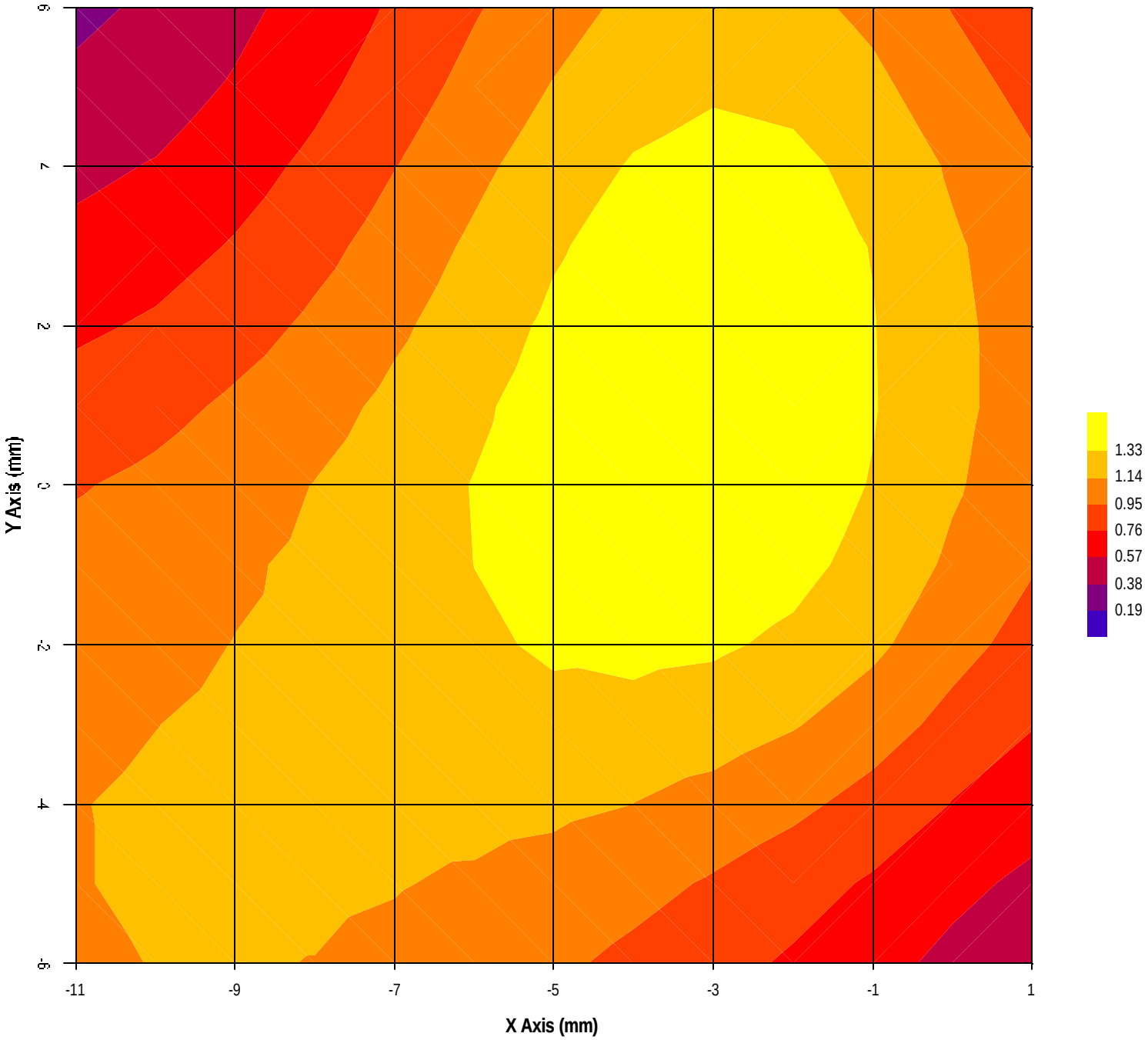
1.565	1.277	0.807	0.545	0.335	0.183
0.029	0.000	0.000	0.000	0.000	

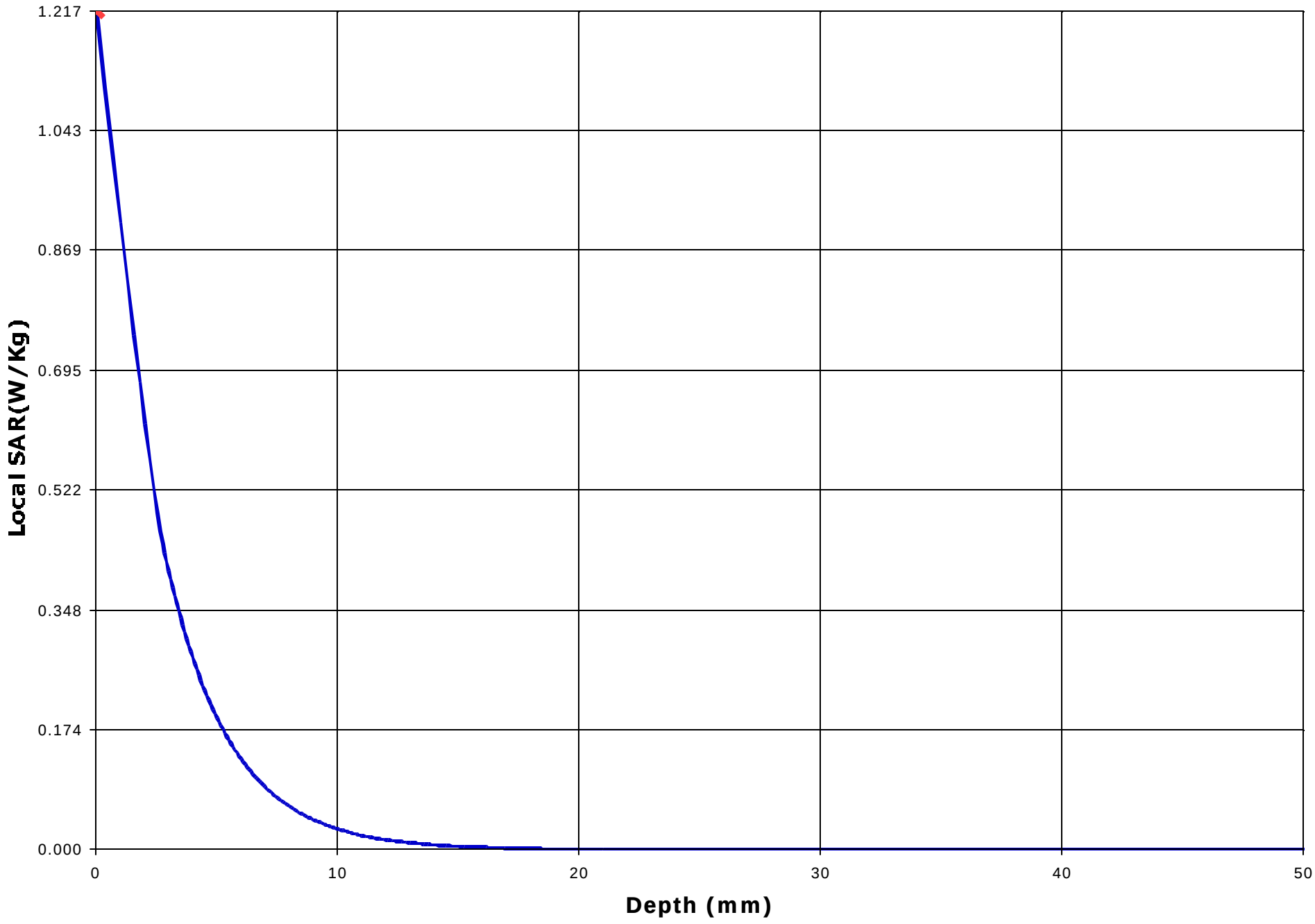
Peak Voltage (mV) : 3.792 **1 Cm Voltage (mV)** : 0.091 **SAR (W/Kg)** : 0.237

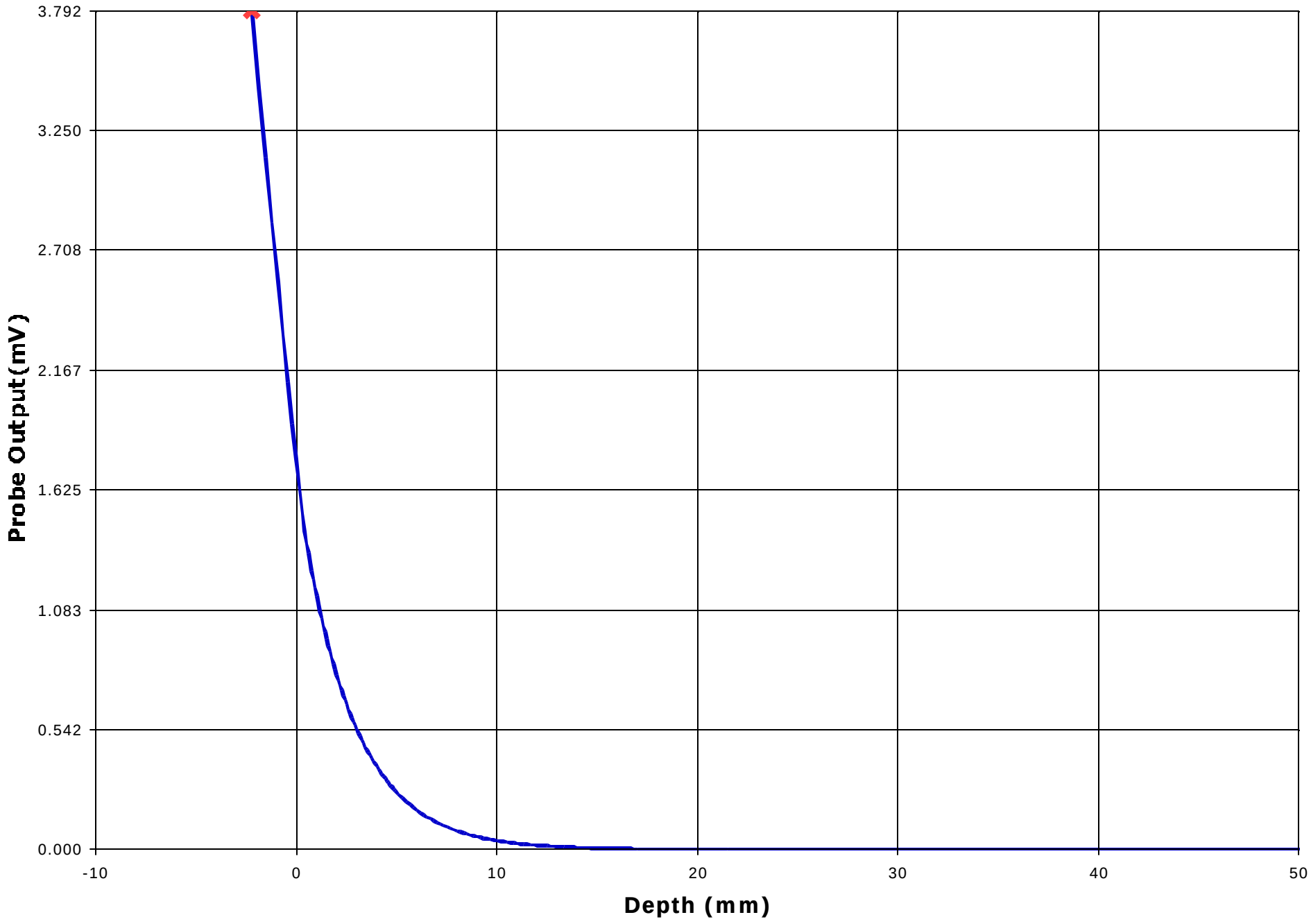

1.33
1.14
0.95
0.76
0.57
0.38
0.19


1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1.33
1.14
0.95
0.76
0.57
0.38
0.19


Y Axis (mm)
X Axis (mm)
-35
-30
-25
-20
-15
-10
-5
0
5
10
1.33
1.14
0.95
0.76
0.57
0.38
0.19


Y Axis (mm)
6
7
2
0
-2
4
-6
-11
-9
-7
-5
-3
-1
1
X Axis (mm)
1.33
1.14
0.95
0.76
0.57
0.38
0.19


1.217
1.043
0.869
0.695
0.522
0.348
0.174
0.000
Local SAR(W/Kg)
0
10
20
30
40
50
Depth (mm)


3.792
3.250
2.708
2.167
1.625
1.083
0.542
0.000
Probe Output (mV)
-10
0
10
20
30
40
50
Depth (mm)

Test Information

Date : 26/10/2001
Time : 12:49:44 PM

Product	: 2.4GHz FHSS Cordless Telephone	**Test**	: SAR
Manufacturer	: Panasonic Canada Inc.	**Frequency (MHz)**	: 2440
Model Number	: KX-TD7690	**EIRP (W)**	: 0.329
Serial Number	: N/A	**Antenna Type**	: Monopole
FCC ID Number	:	**Signal**	: Spread Spectrum

Phantom	: Waist	**Dielectric Constant**	: 52.64
Simulated Tissue	: Muscle	**Conductivity**	: 1.98

Probe	: UT-ETR-0200-1	**Antenna Position**	: Extended
Probe Offset (mm)	: 2.250		
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 3.467		
Calibrated Date	: 29/06/2001		

Amplifier Setting :

Channel 1 : 0.0043 Channel 2 : 0.0042 Channel 3 : 0.0052

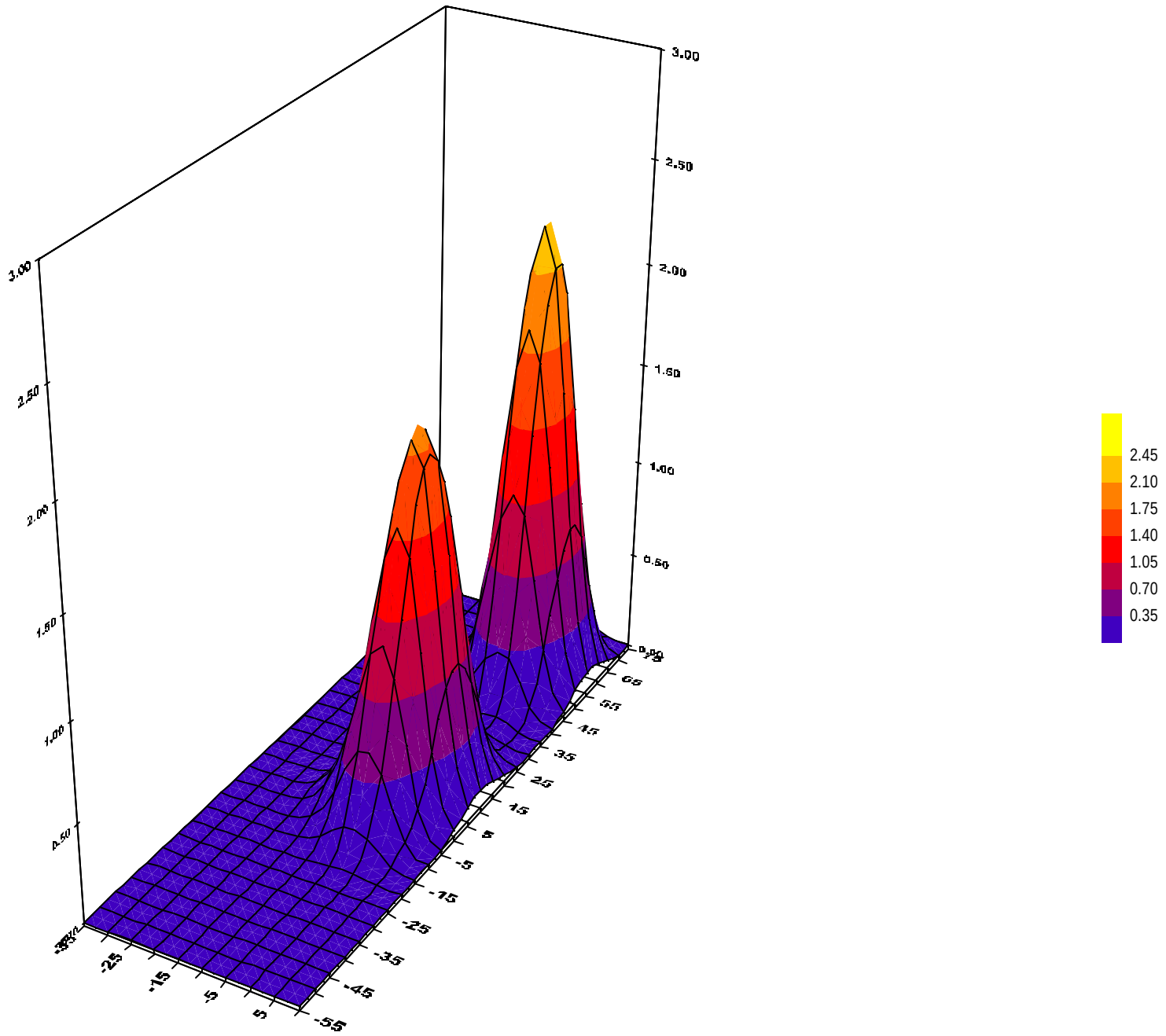
Location of Maximum Field :

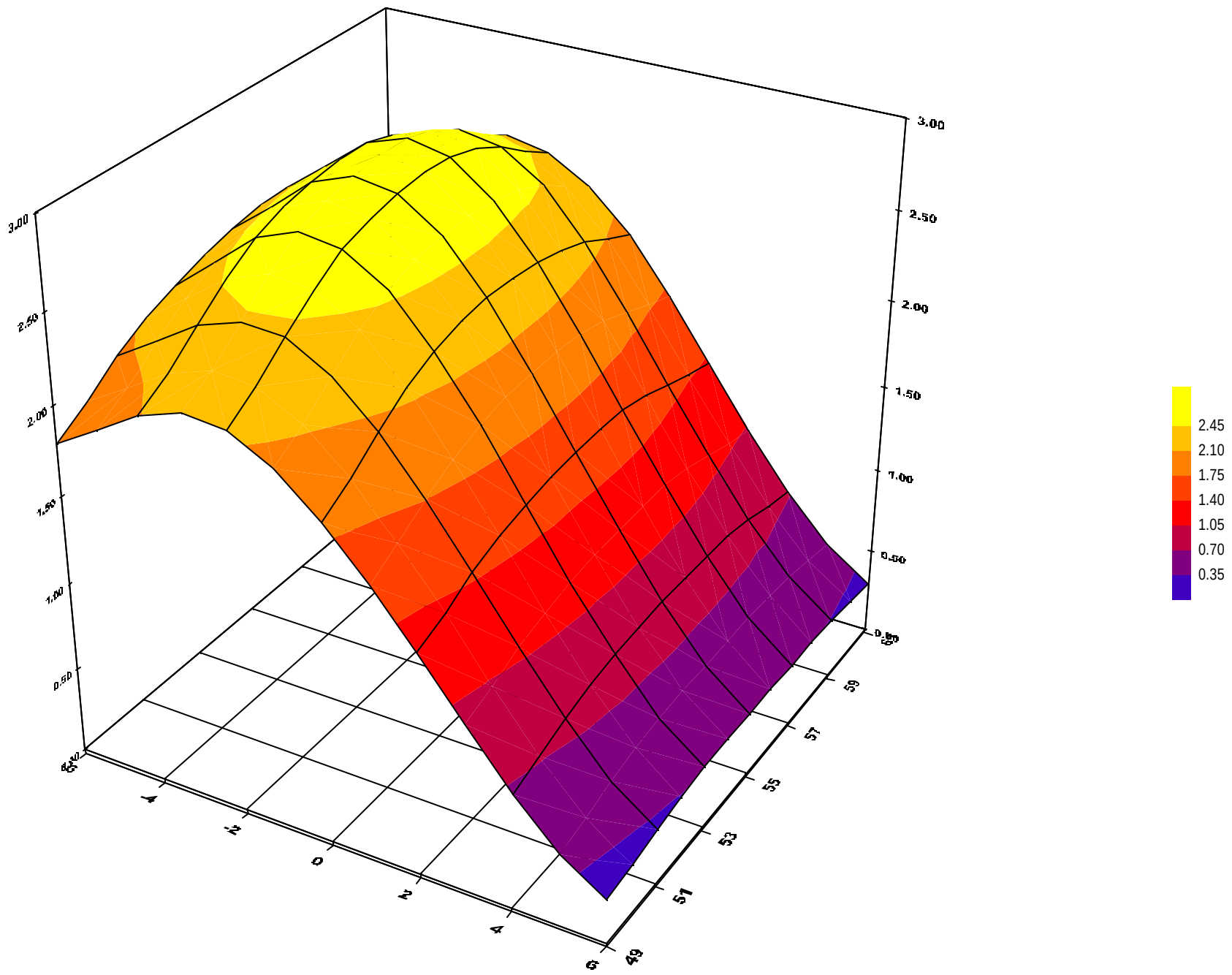
X = -2 Y = 57

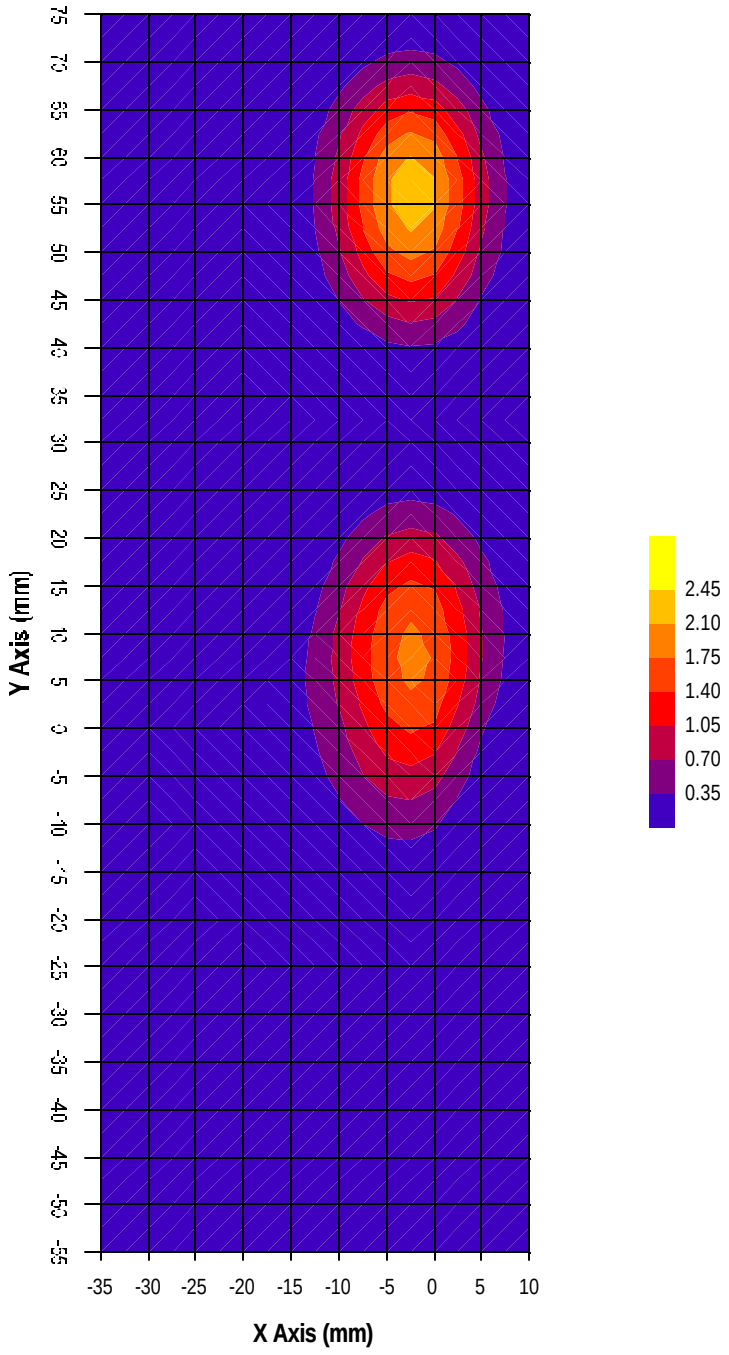
Measured Values (mV) :

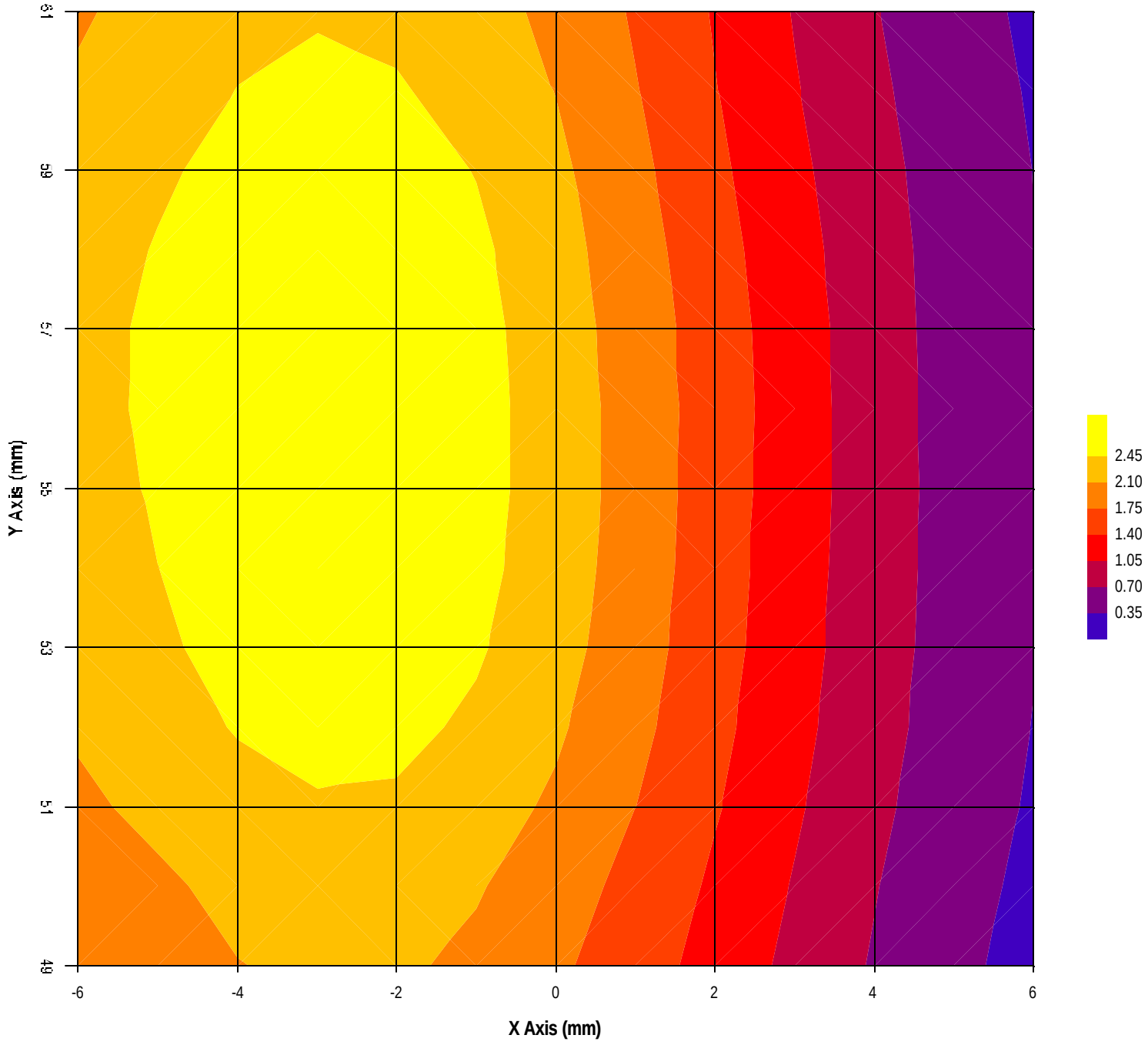
2.716	2.375	1.837	1.368	0.977	0.704
0.518	0.395	0.289	0.212	0.144	

Peak Voltage (mV) : 4.901 **1 Cm Voltage (mV)** : 0.390 **SAR (W/Kg)** : 0.441

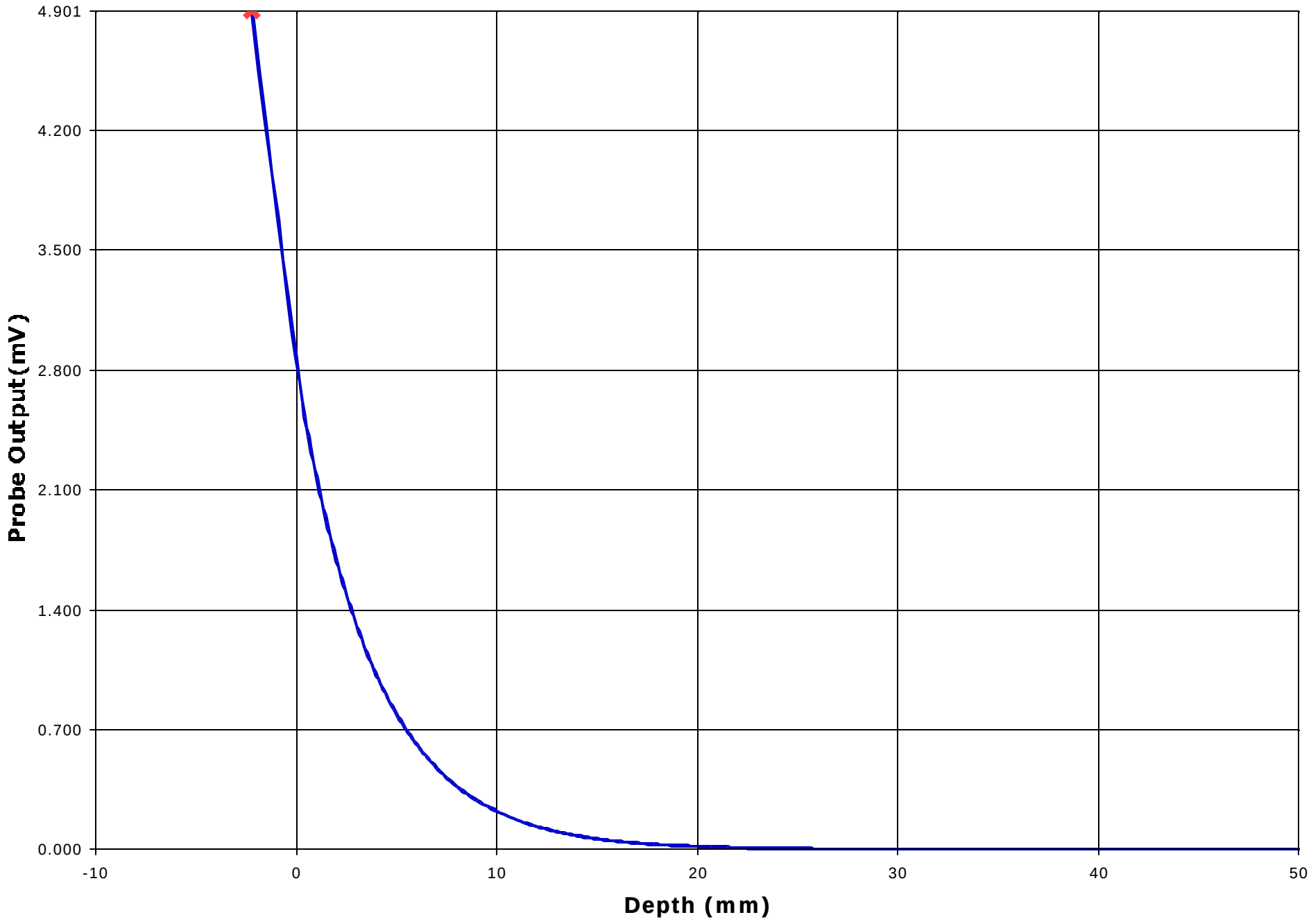

3.00
2.50
2.00
1.50
1.00
0.50
0.00
-25
-15
-5
5
-55
-45
-35
-25
-15
-5
5
15
25
35
45
55
65
75
2.45
2.10
1.75
1.40
1.05
0.70
0.35


3.00
2.50
2.00
1.50
1.00
0.50
0.00
6
4
2
0
2
4
6
49
51
53
55
57
59
61
2.45
2.10
1.75
1.40
1.05
0.70
0.35


Y Axis (mm)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
X Axis (mm)
-35
-30
-25
-20
-15
-10
-5
0
5
10
2.45
2.10
1.75
1.40
1.05
0.70
0.35


Y Axis (mm)
61
59
57
55
53
51
49
-6
-4
-2
0
2
4
6
X Axis (mm)
2.45
2.10
1.75
1.40
1.05
0.70
0.35

1.573
1.348
1.124
0.899
0.674
0.449
0.225
0.000
Local SAR(W/Kg)
0
10
20
30
40
50
Depth (mm)


4.901
4.200
3.500
2.800
2.100
1.400
0.700
0.000
Probe Output (mV)
-10
0
10
20
30
40
50
Depth (mm)

Test Information

Date : 26/10/2001
Time : 2:21:01 PM

Product	: 2.4GHz FHSS Cordless Telephone	**Test**	: SAR
Manufacturer	: Panasonic Canada Inc.	**Frequency (MHz)**	: 2440
Model Number	: KX-TD7690	**EIRP (W)**	: 0.329
Serial Number	: N/A	**Antenna Type**	: Monopole
FCC ID Number	:	**Signal**	: Spread Spectrum

Phantom	: Waist	**Dielectric Constant**	: 52.64
Simulated Tissue	: Muscle	**Conductivity**	: 1.98

Probe	: UT-ETR-0200-1	**Antenna Position**	: Retracted
Probe Offset (mm)	: 2.250		
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 3.467		
Calibrated Date	: 29/06/2001		

Amplifier Setting :

Channel 1 : 0.0043 Channel 2 : 0.0042 Channel 3 : 0.0052

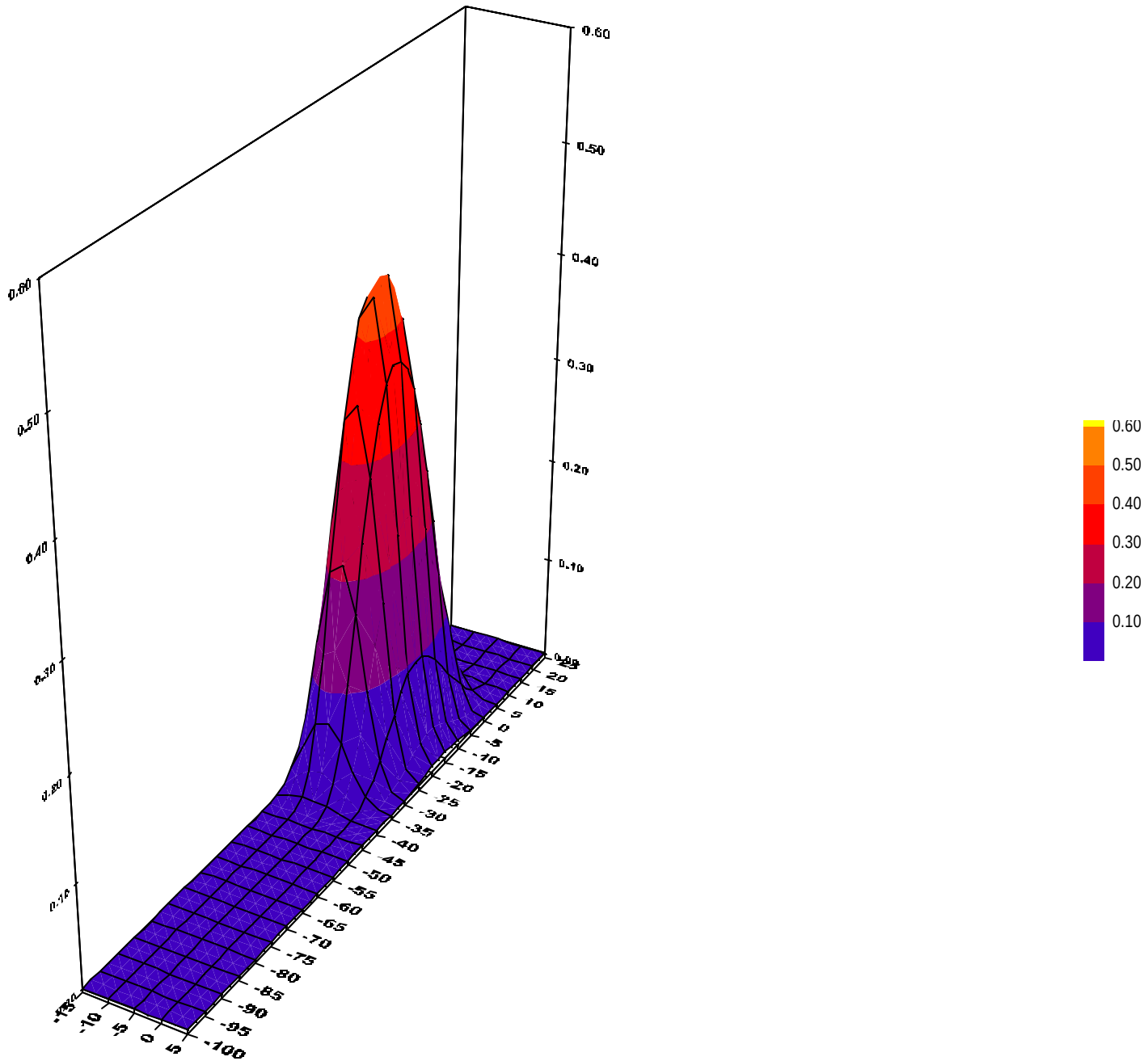
Location of Maximum Field :

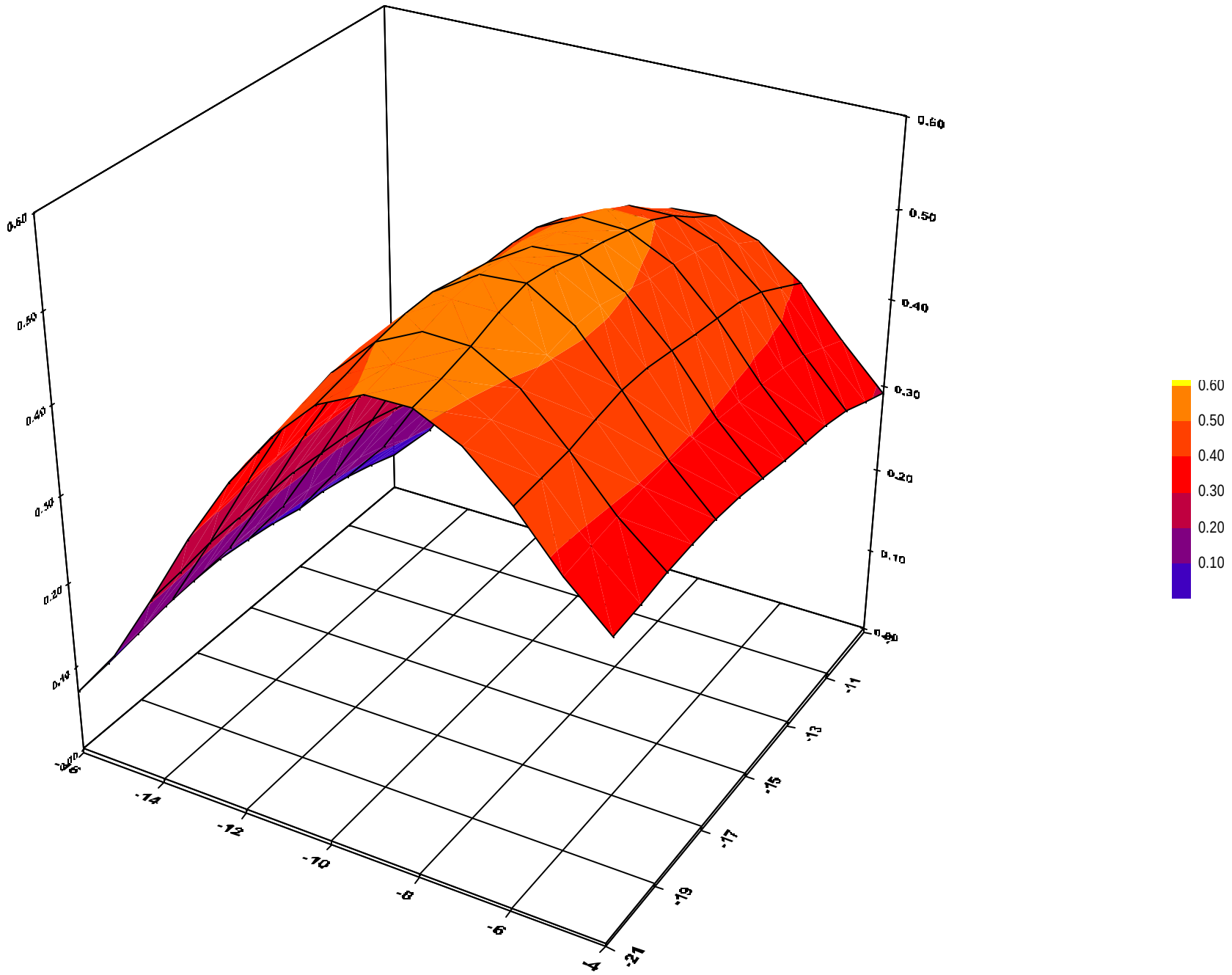
X = -8 Y = -17

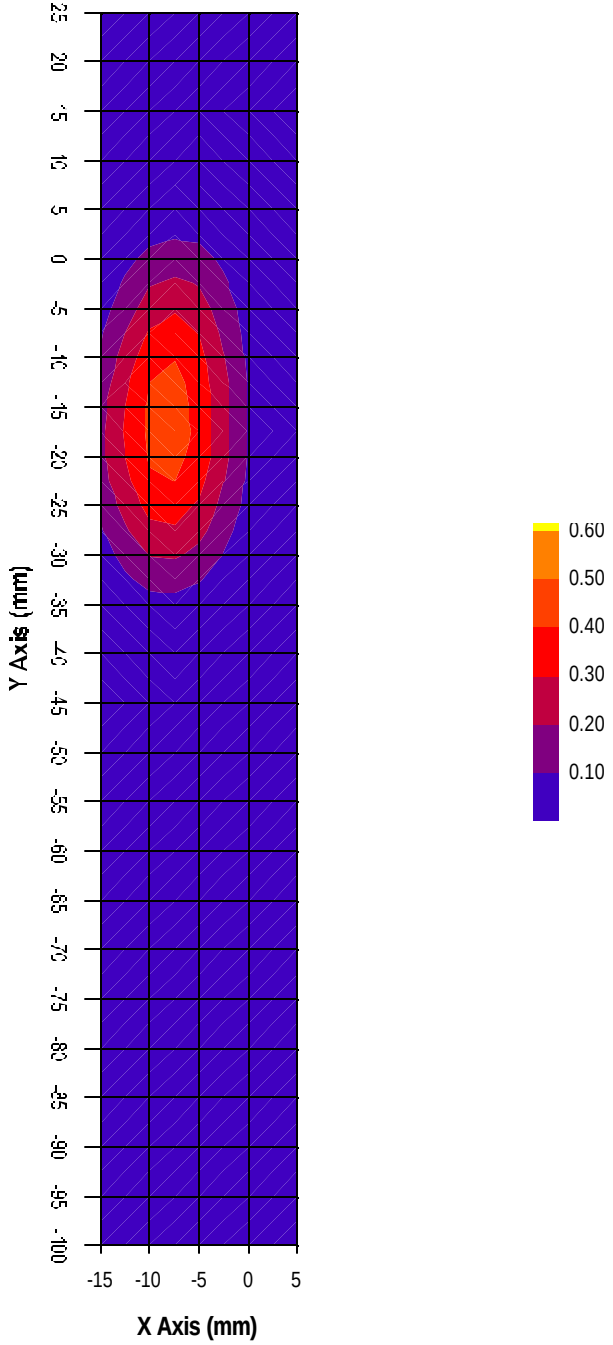
Measured Values (mV) :

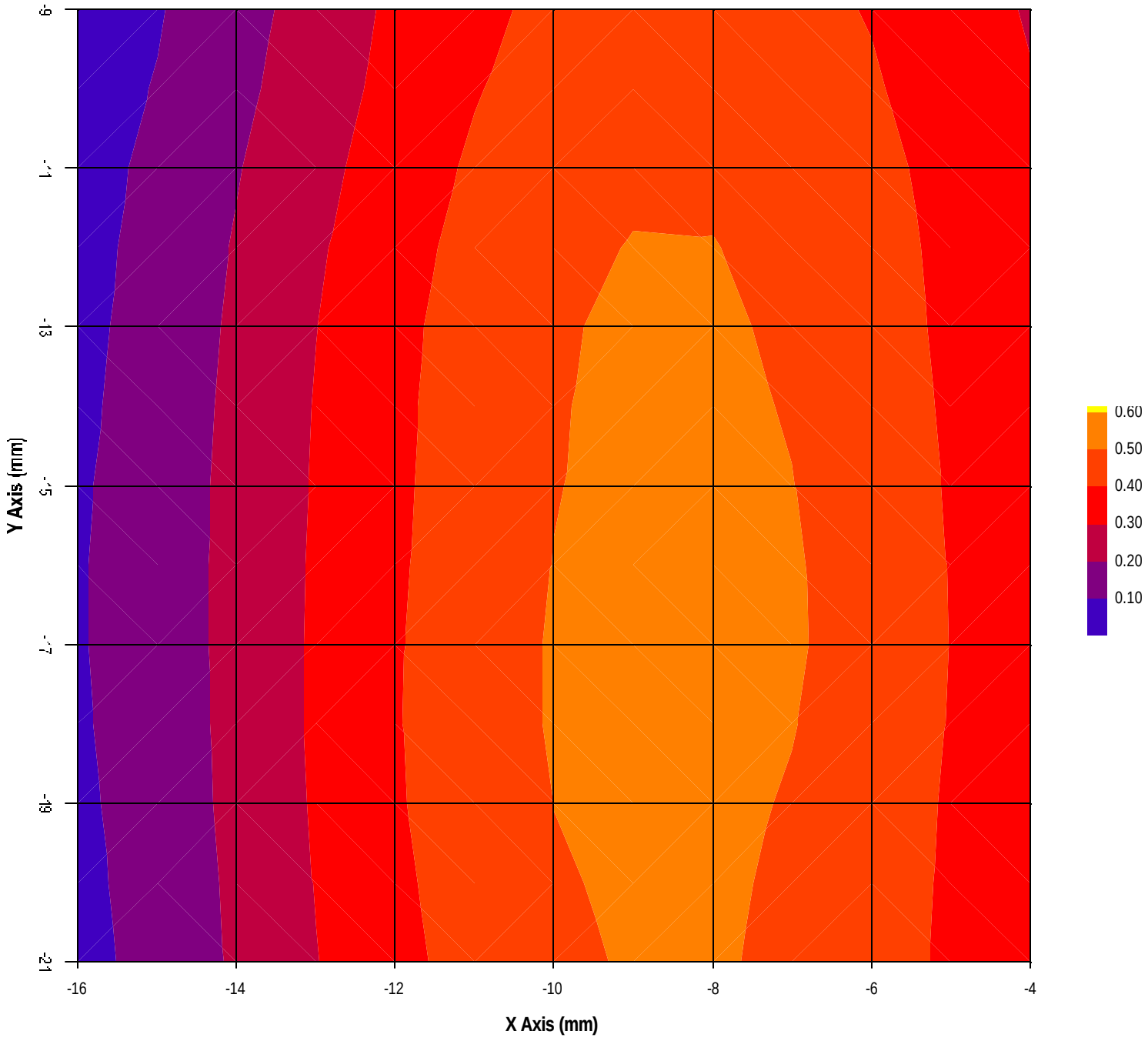
0.552	0.408	0.276	0.187	0.110	0.038
0.000	0.000	0.000	0.000	0.000	

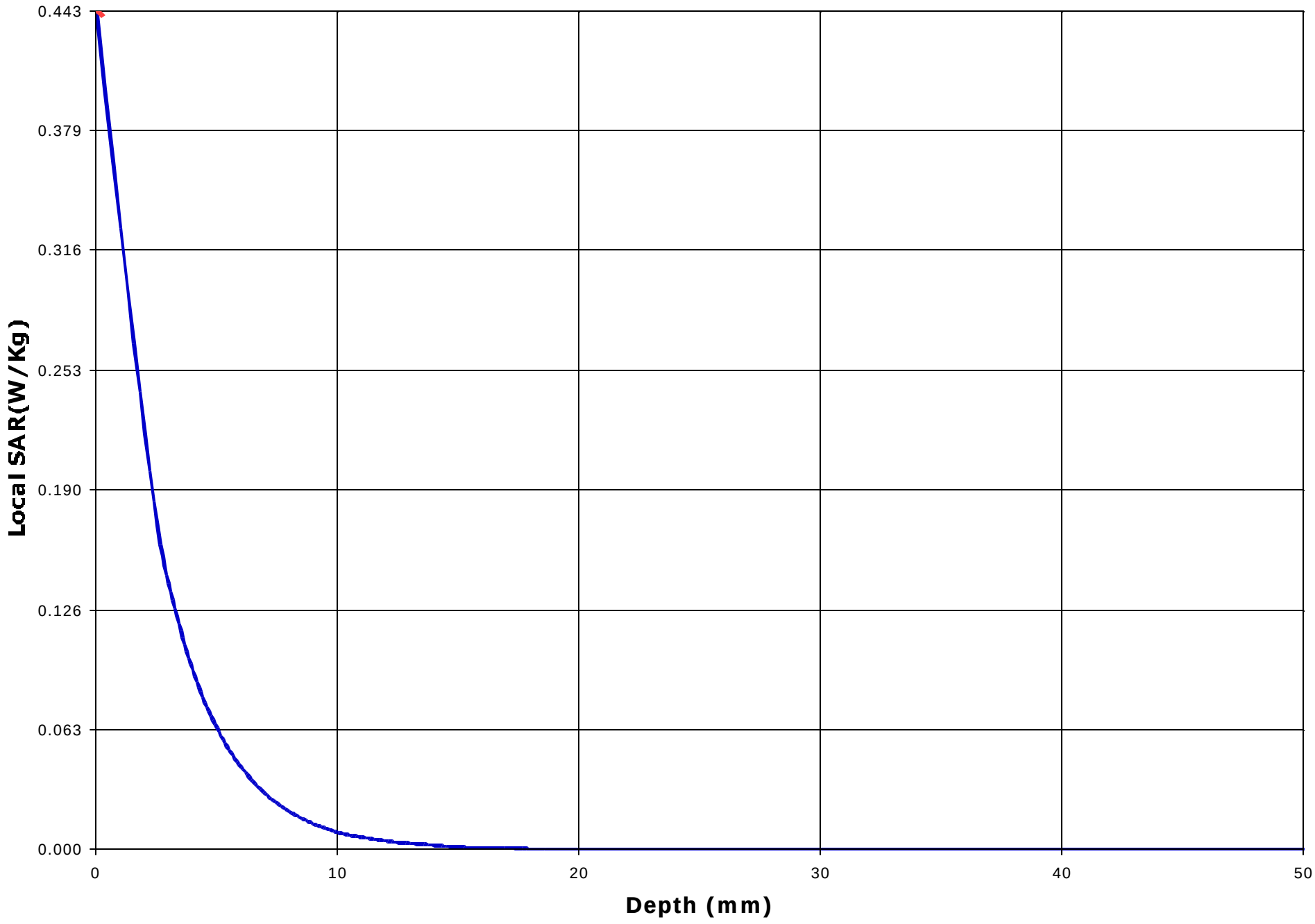
Peak Voltage (mV) : 1.379 **1 Cm Voltage (mV)** : 0.028 **SAR (W/Kg)** : 0.085


0.60
0.50
0.40
0.30
0.20
0.10
0.60
0.50
0.40
0.30
0.20
0.10
0.00
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
-15
-10
-5
0
5
0.60
0.50
0.40
0.30
0.20
0.10


0.60
0.50
0.40
0.30
0.20
0.10
0.00
-14
-12
-10
-8
-6
-11
-13
-15
-17
-19
-21


Y Axis (mm)
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
-15
-10
-5
0
5
X Axis (mm)
0.60
0.50
0.40
0.30
0.20
0.10


Y Axis (mm)
-9
-11
-13
-15
-17
-19
-21
X Axis (mm)
-16
-14
-12
-10
-8
-6
-4
0.60
0.50
0.40
0.30
0.20
0.10


0.443
0.379
0.316
0.253
0.190
0.126
0.063
0.000
Local SAR(W/Kg)
0
10
20
30
40
50
Depth (mm)

Test Information

Date : 26/10/2001
Time : 3:06:07 PM

Product	: 2.4GHz FHSS Cordless Telephone	**Test**	: SAR
Manufacturer	: Panasonic Canada Inc.	**Frequency (MHz)**	: 2440
Model Number	: KX-TD7690	**EIRP (W)**	: 0.329
Serial Number	: N/A	**Antenna Type**	: Monopole
FCC ID Number	:	**Signal**	: Spread Spectrum

Phantom	: Waist	**Dielectric Constant**	: 52.64
Simulated Tissue	: Muscle	**Conductivity**	: 1.98

Probe	: UT-ETR-0200-1	**Antenna Position**	: Extended
Probe Offset (mm)	: 2.250		
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 3.467		
Calibrated Date	: 29/06/2001		

Amplifier Setting :

Channel 1 : 0.0043 Channel 2 : 0.0042 Channel 3 : 0.0052

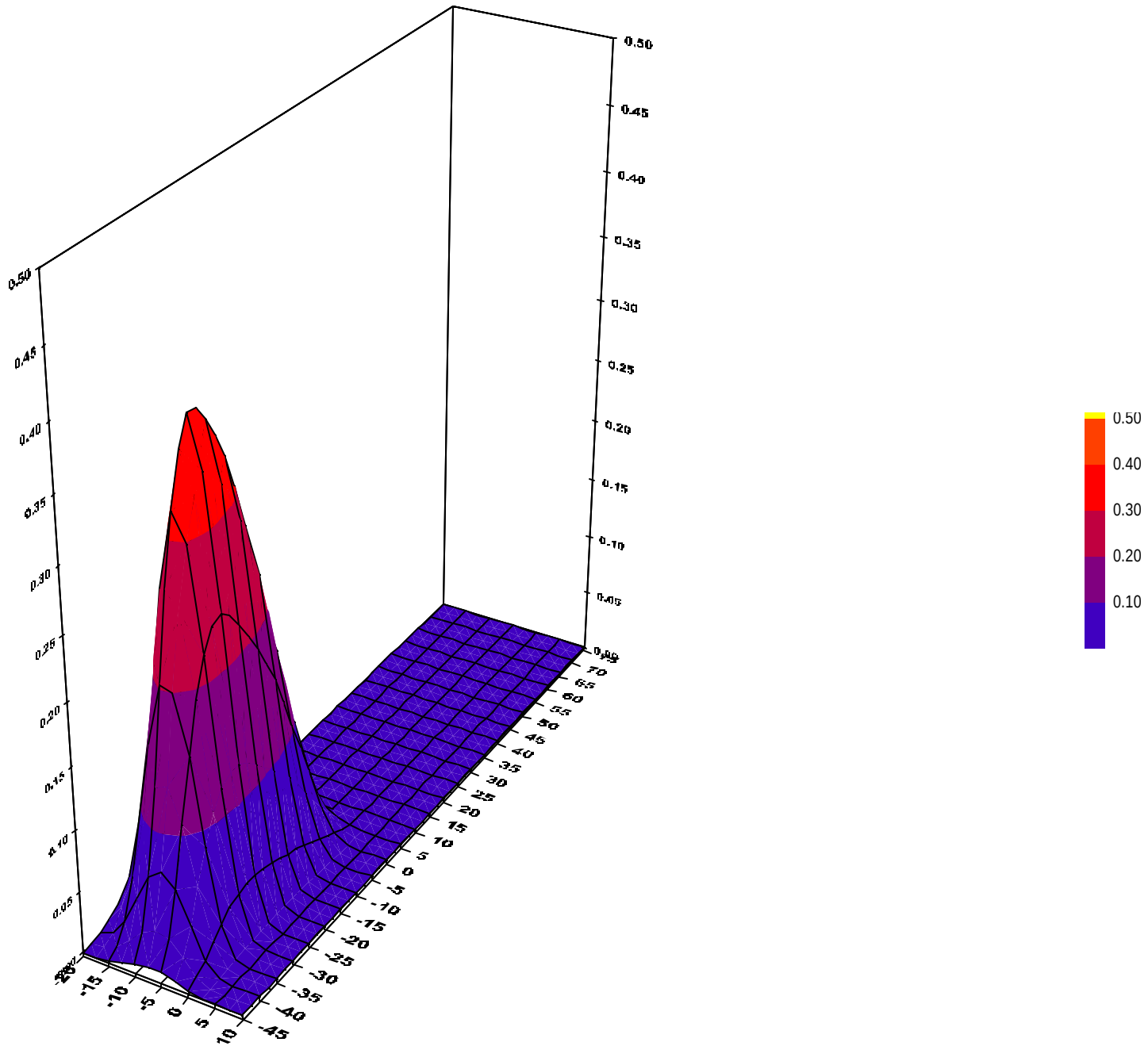
Location of Maximum Field :

X = -10 Y = -27

Measured Values (mV) :

0.467	0.353	0.238	0.140	0.068	0.008
0.000	0.000	0.000	0.000	0.000	

Peak Voltage (mV) : 1.433 **1 Cm Voltage (mV)** : 0.015 **SAR (W/Kg)** : 0.073


0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-20
-15
-10
-5
0
5
10
0.50
0.40
0.30
0.20
0.10