ENGINEERING TEST REPORT

GMRS UHF Transceiver
Model No.: GR-2000

Tested For

Genex Electronic Co, LTD.
3243 Ha Ahn Industrial Zone
201 Ha Ahn 3-Dong Kwang Myung-City
Korea, 423-754

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.: RLI-001-SAR

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: April 5, 2002	
Report Prepared by: JaeWook Choi Issued Date: April 4, 2002	Tested by: JaeWook Choi Test Dates: March 25, 2002

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

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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	[ ] General population, uncontrolled exposure **[X] 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:	Genex Electronics Co, LTD.
Address:	3243 Ha Ahn Industrial Zone 201 Ha Ahn 3-Dong Kwang Myung-City Korea, 432-754
Contact Person:	Clark Cheon (Manager) Phone #: +82 2 803 9022 FAX #: +82 2 803 9105 Email : clark@genexelec.co.kr

MANUFACTURER:	
Name:	Genex Electronics Co, LTD.
Address:	3243 Ha Ahn Industrial Zone 201 Ha Ahn 3-Dong Kwang Myung-City Korea, 432-754
Contact Person:	Clark Cheon (Manager) Phone #: +82 2 803 9022 FAX #: +82 2 803 9105 Email : clark@genexelec.co.kr

2.2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The following is the information provided by the applicant.

Type/Model Number	GR-2000
Serial Number	ENG-01
Type of Equipment	GMRS UHF Transceiver
Frequency of Operation	462.550 – 462.725 MHz
Rated RF Power	2 W (conducted)
Emissions Designation	6K0F3E
Antenna Type	Monopole
External Power Supply	AC Adaptor (M/N: DPX351317, Output: 7.5 VDC, 200 mA)
Primary User Functions of EUT:	Wireless voice communication through air

2.3. LIST OF ACCESSORIES AND BATTERY PACKS OF EUT

PTT Headset (M/N: HS-100), AC Adaptor (M/N: DPX351317, Output: 7.5 VDC, 200 mA), Rechargeable NI-MH Battery pack (4.8VDC 1200mAh), 4 × AA size alkaline batteries(1.5 VDC each)

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

N/A

2.5. ANCILLARY EQUIPMENT

N/A

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

N/A

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:

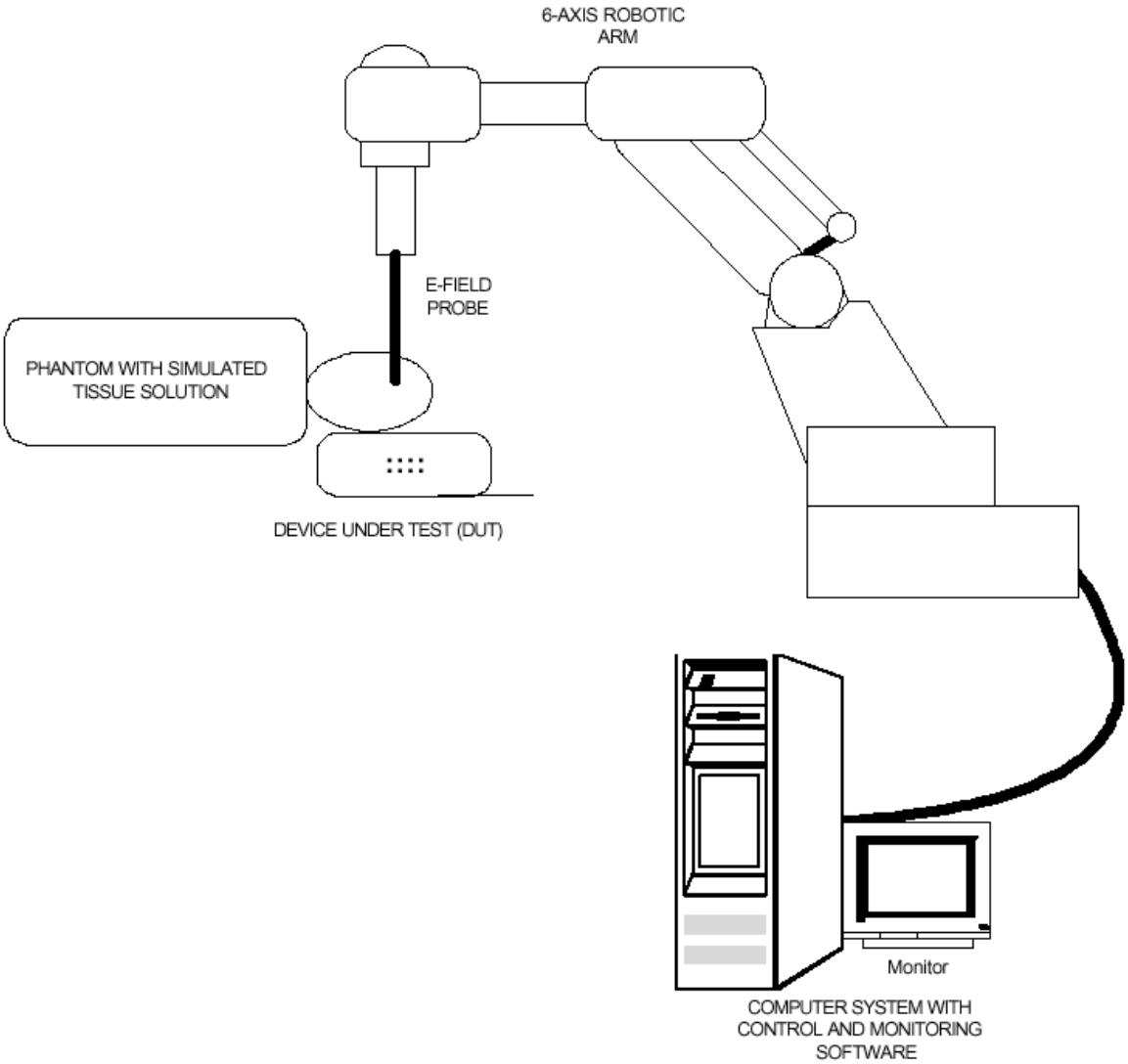


EXHIBIT 3. SUMMARY OF TEST RESULTS

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 maximum peak spatial-average SAR measured was found to be **2.005(4.010) W/Kg** with **50 % duty cycle**

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)	N/A
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)	**Yes**

EXHIBIT 4. MEASUREMENTS, EXAMINATIONS & TEST DATA

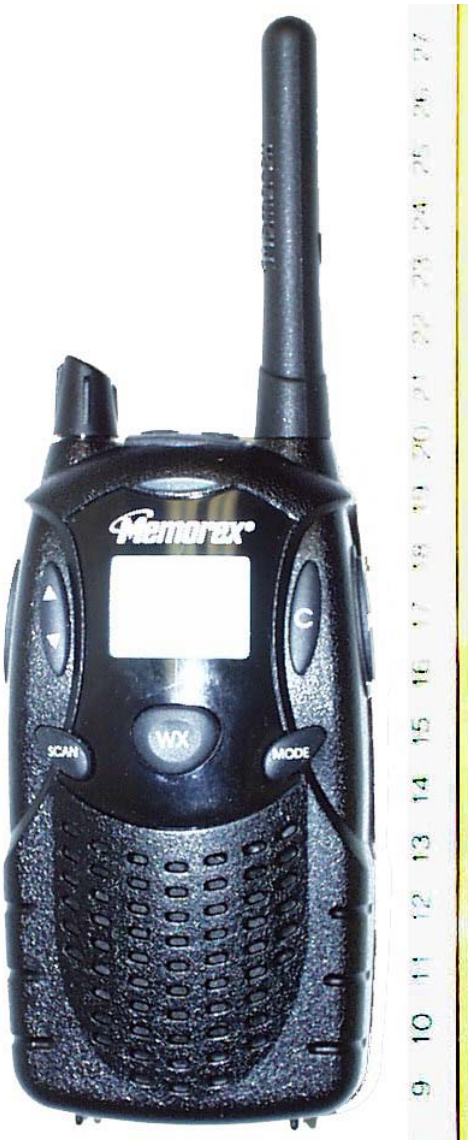
4.1. TEST SETUP

EUT Information		**Condition**	
Radio Type	GMRS UHF Transceiver	Robot Type	6 Axis
Model Number	GR-2000	Scan Type	SAR - Area/Zoom
Serial Number	ENG-01	Measured Field	E
Frequency Band [MHz]	462.550 – 462.725	Phantom Type	2mm base Flat Phantom
Frequency Tested [MHz]	462.633	Phantom Position	Body-worn, Head front
Nominal Output Power [W]	2 W Conducted	Room Temperature	21 °C ± 1 °C
Antenna Type	Monopole	Room Humidity	35 % ± 10 %
Signal Type	CW	Tissue Temperature	21 °C ± 1 °C
Duty Cycle	50 %*		

Type of Tissue	Brain	Muscle
Target Frequency [MHz]	450	450
Target Dielectric Constant	43.5 ± 5%	46.7 ± 5%
Target Conductivity [S/m]	0.87 ± 5%	0.94 ± 5%
Composition (by weight)	DI Water (38.94 %) Sugar (56.88 %) Salt (3.99 %) HEC (0.09 %) Bactericide (0.09 %)	DI Water (51.76 %) Sugar (46.05 %) Salt (1.90 %) HEC (0.21 %) Bactericide (0.07 %)
Measured Dielectric Constant	44.13	58.79
Measured Conductivity [S/m]	0.88	0.94
Probe Name	UT-ETR-0200-1	UT-ETR-0200-1
Probe Orientation	Isotropic	Isotropic
Probe Offset [mm]	2.25	2.25
Sensor Factor [$^{mV}/_{(mW/cm^2)}$]	10.8	10.8
Conversion Factor [$^{W/Kg}/_{(mW/cm^2)}$]	0.8898	0.7391
Calibration Date [MM/DD/YYYY]	03/22/2002	03/19/2002

* EUT is transmitting with 100% duty cycle but **50% duty factor** can only be applied for truly PTT device, that is using a mechanical switch and the device is designed for PTT that does not have feasibility to be connected to wired lines through an operator.

4.2. PHOTOGRAPHS OF EUT AND ACCESSORIES



<Front View>

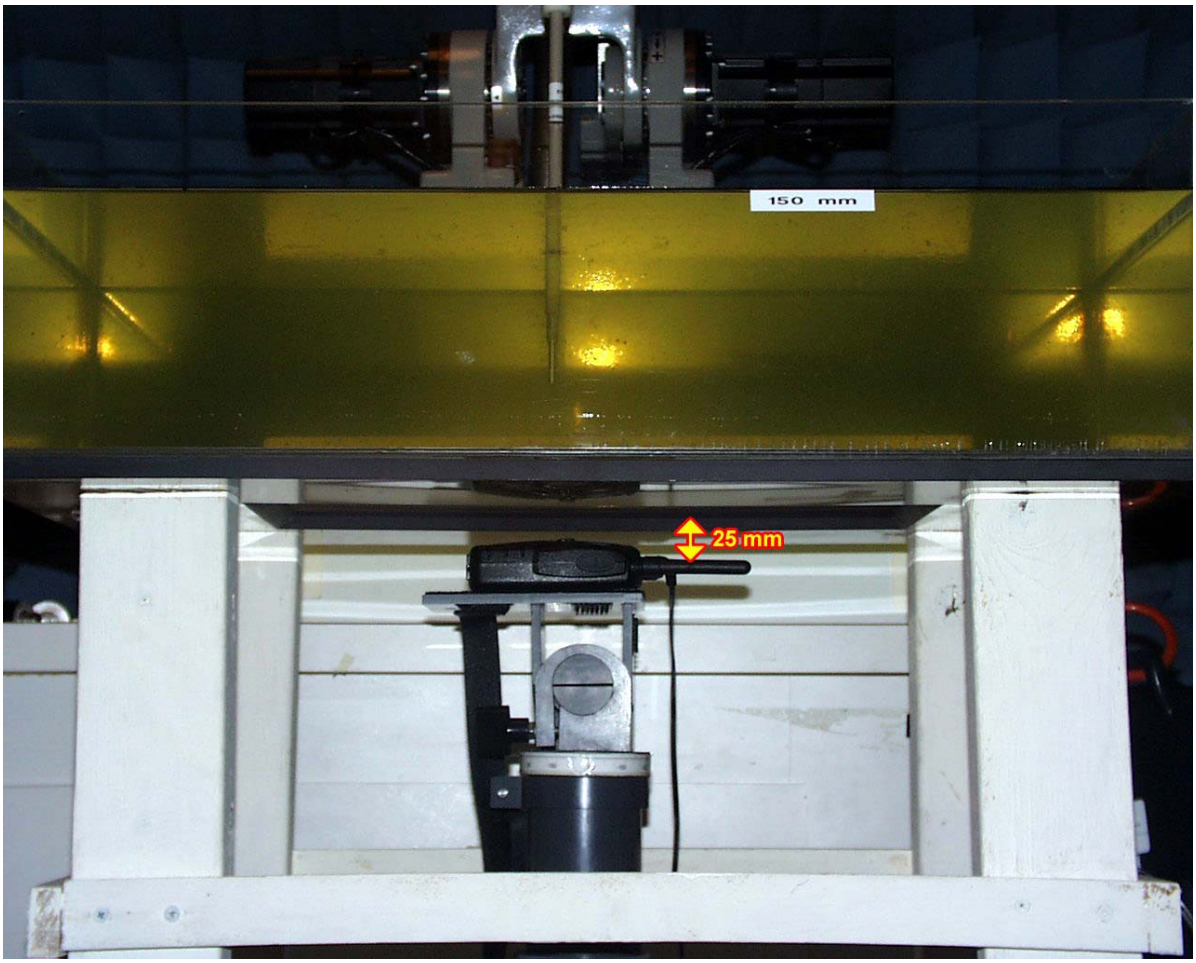
<Back View>

< Power AC Adaptor (M/N: DPX351317, Output: 7.5 VDC 200 mA) >

< Rechargeable Ni-MH battery pack (4.8V 1,200 mAh) >

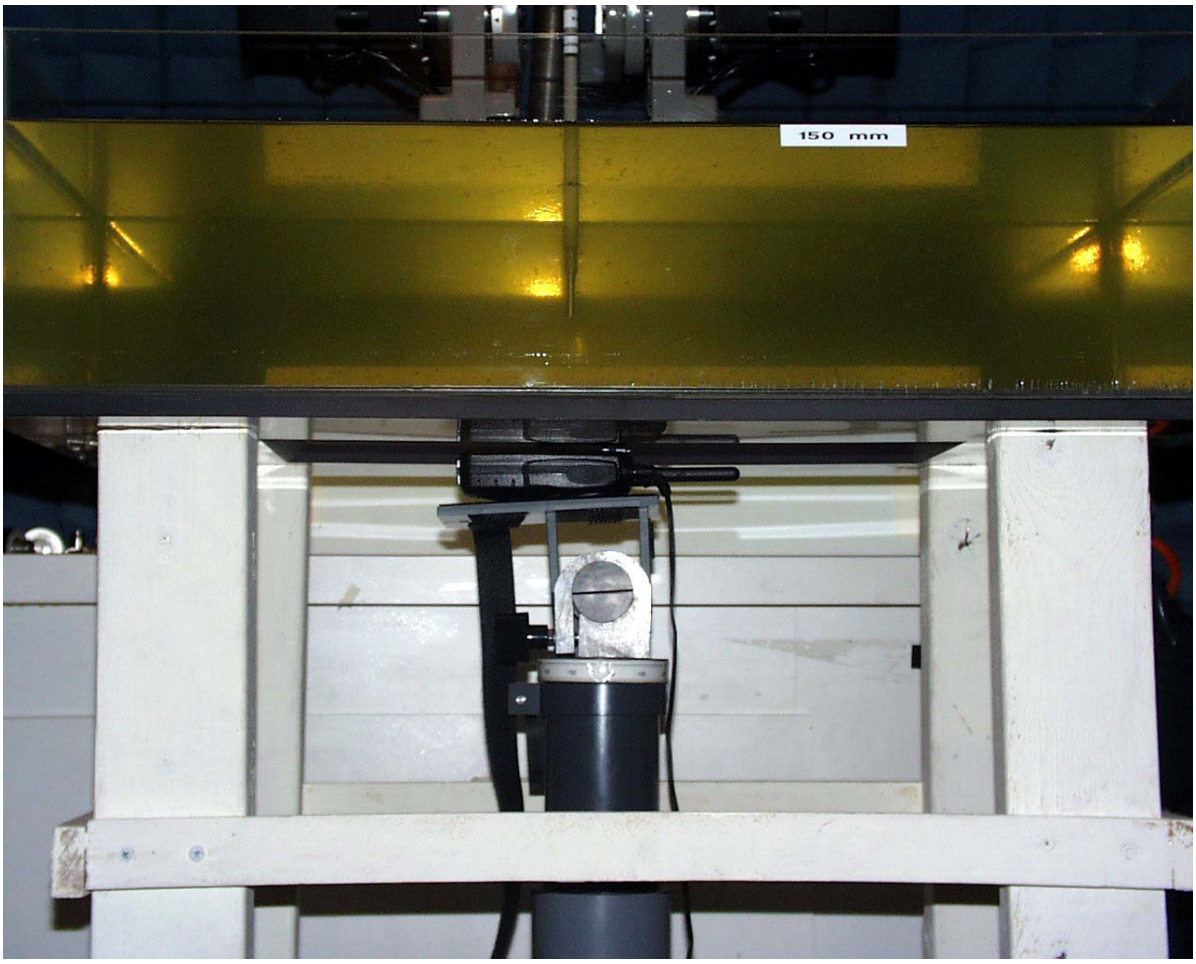
< PTT Headset (M/N: HS-100) >

4.3. PHOTOGRAPHS OF HEAD FRONT CONFIGURATIONS

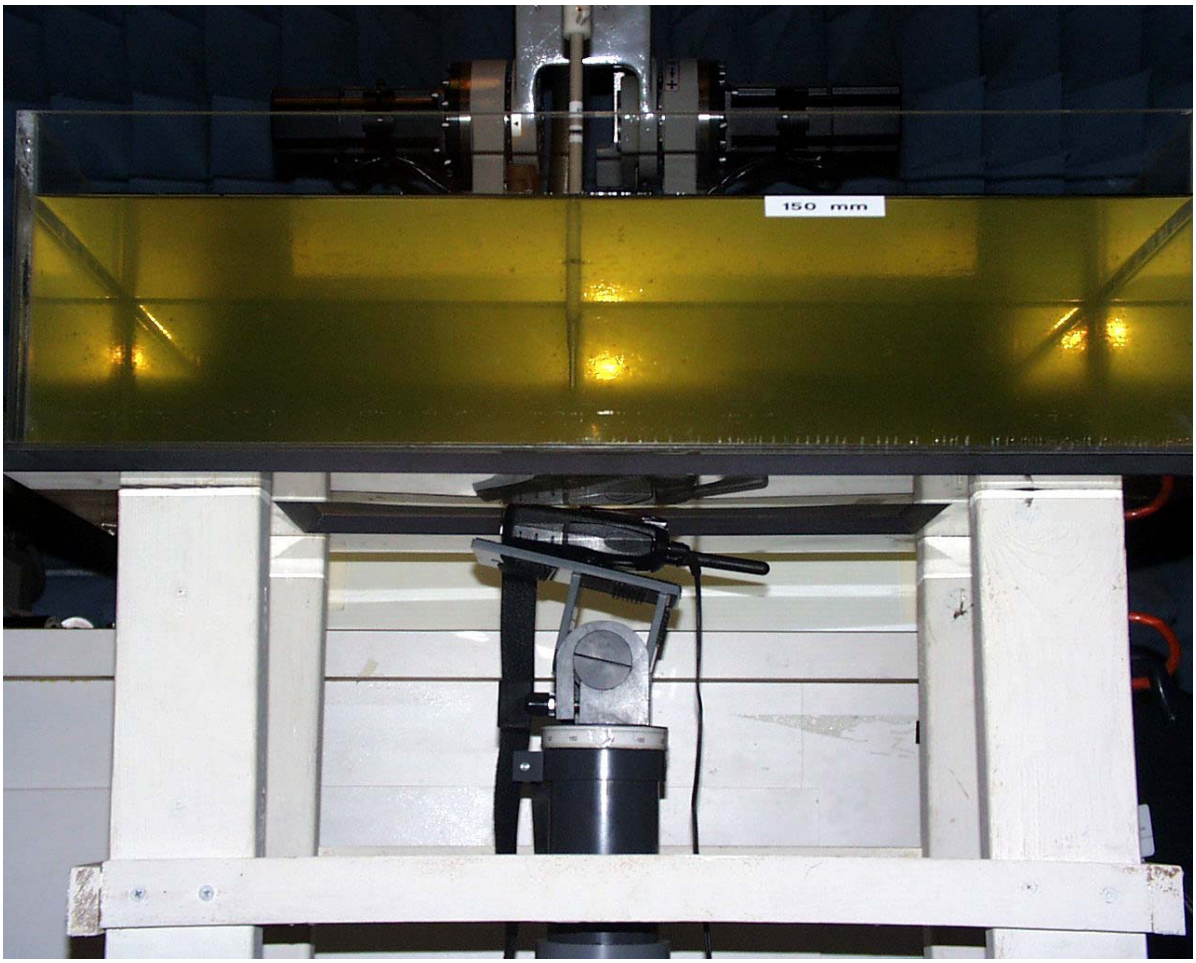


< Display of EUT was faced inward to the phantom at 25 mm separation >

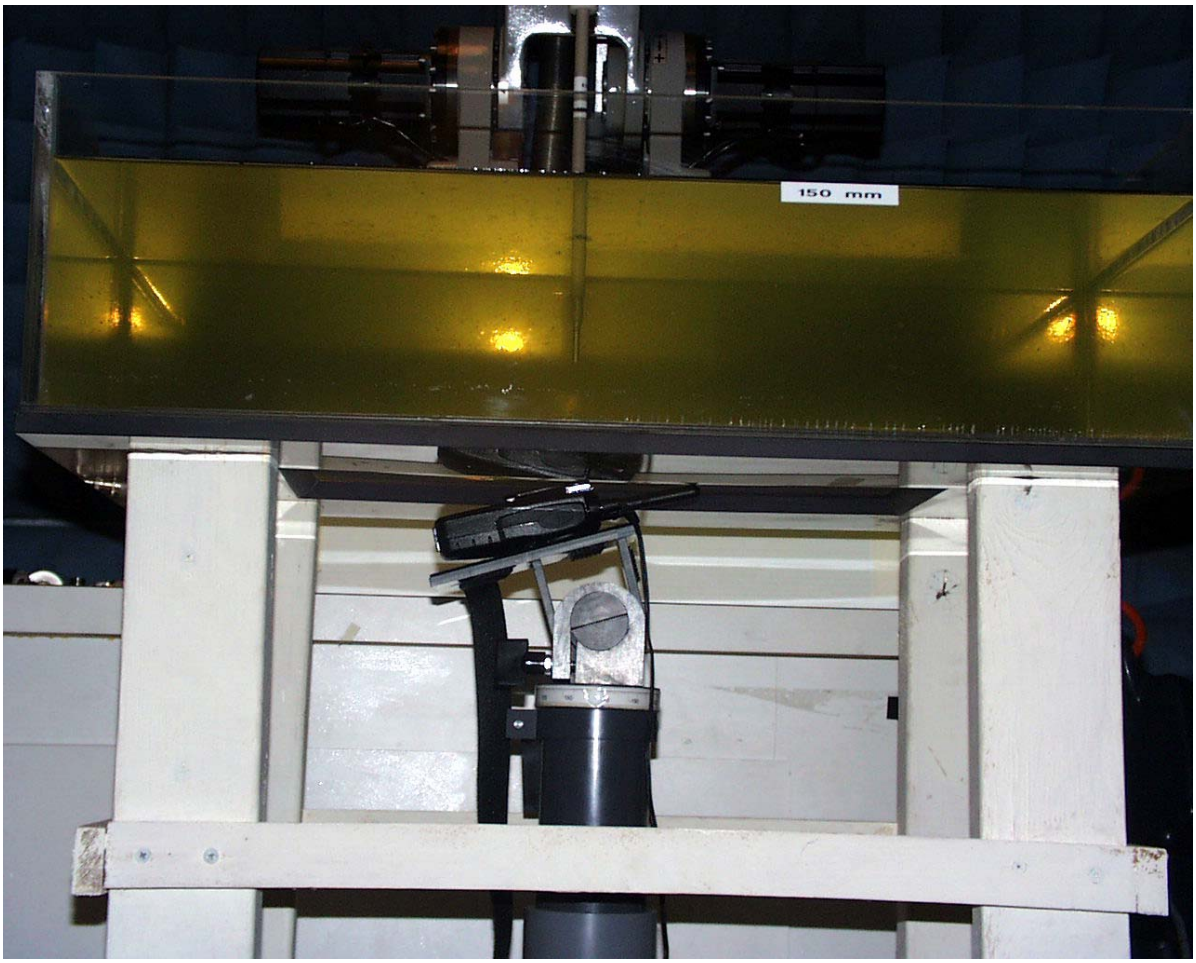
4.4. PHOTOGRAPHS OF BODY-WORN CONFIGURATIONS



< EUT was parallel to the phantom with the belt clip in contact and PTT headset was connected >



< Bottom of EUT and the belt clip was made to contact with the phantom and PTT headset was connected >

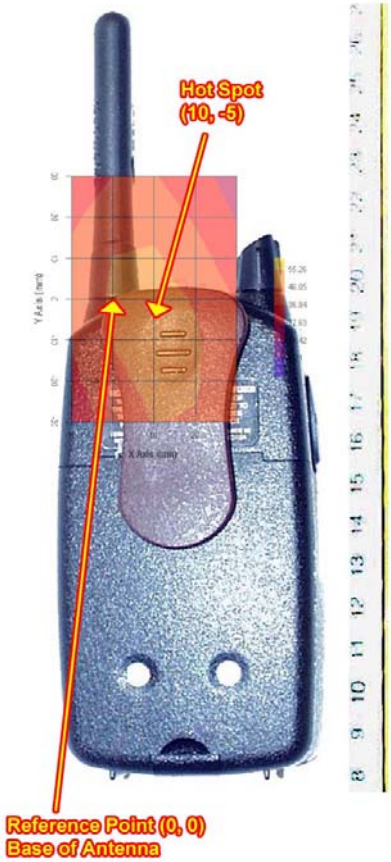


< Tip of antenna and belt clip in contact with the phantom and PTT headset was connected >

4.5. MAXIMUM FIELD LOCATION

The maximum field was found to be located at (10, -5) with the test configuration as described below:

- Body-worn configuration
- EUT parallel to the phantom with the belt clip in contact and PTT headset(M/N: HS-100) connected
- 462.633 MHz



Complete area Pre-scans on all faces of the EUT were conducted to determine the location of the highest SAR and the device was repositioned to allow the identified hot-spots to be orientated with as large an area around the hot-spots to come into contact with the phantom surface. This procedure ensured that the maximum SAR readings would be obtained from the hot-spot areas identified.

Unless otherwise specified, the reference point (0, 0) in the plots was set to the point at the base of antenna in the projected image of EUT to the phantom surface.

4.6. MAXIMUM PEAK SPATIAL-AVERAGE SAR MEASURED

Phantom & EUT Configurations	Battery Type	Antenna Position	SAR (W/kg) Device Test Frequency
			462.633 MHz
Body-worn configuration, EUT parallel to the phantom with the belt clip in contact and PTT headset connected	4 × AA alkaline batteries	Fixed	2.005 (4.010)

4.7. SAR MEASUREMENT DATA

4.7.1. Head front configuration results* **

EUT Configurations	Battery Type	Antenna Position	SAR (W/kg) Device Test Frequency
			462.633 MHz
Display of EUT was faced inward to the phantom at 25 mm separation	Ni-MH battery pack	Fixed	1.453 (2.906)
	4 × AA alkaline batteries	Fixed	1.780 (3.560)

* Since the rapid power drop was observed through the power drift measurement (refer to 4.7.3, pg. 19) , the each measurement was paused before commencing the zoom scan in order to replace the batteries with fully charged or new batteries. It took approximately 5 minutes to complete the measurement once it resumed.

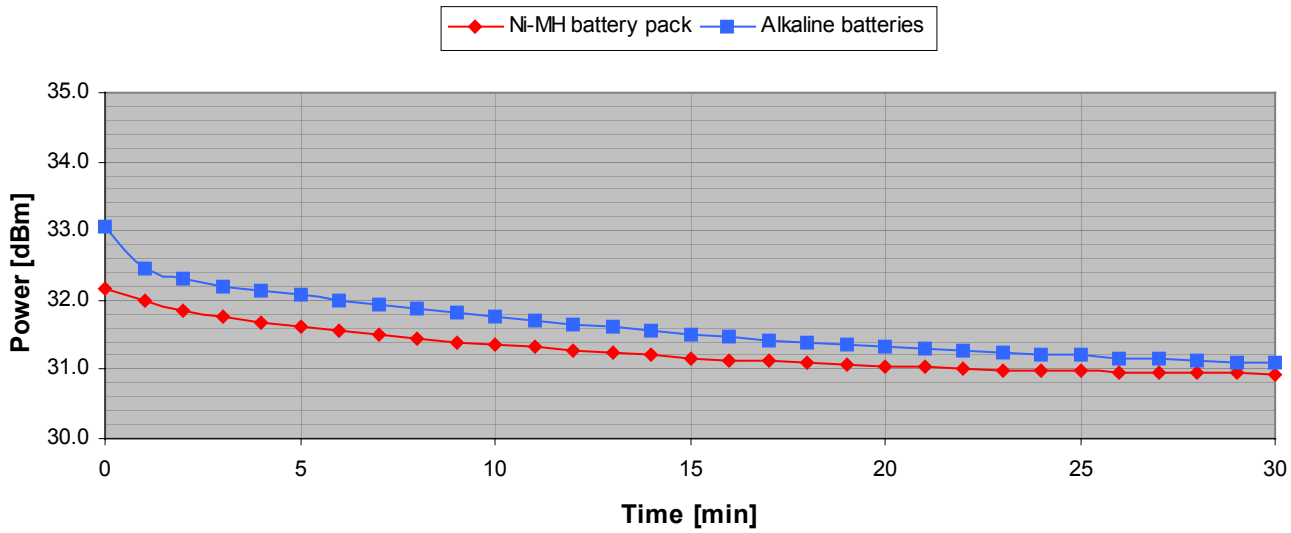
** The SAR Measurement inside the parenthesis indicates the reading before 50 % duty factor is applied for the half-duplex type PTT

4.7.2. Body-worn configuration results* **

EUT Configurations	Battery Type	Antenna Position	SAR (W/kg) Device Test Frequency
			462.633 MHz
EUT parallel to the phantom with the belt clip in contact and PTT headset connected	Ni-MH battery pack	Fixed	1.388 (2.776)
	4 × AA alkaline batteries	**Fixed**	**2.005 (4.010)**
Bottom of EUT and the belt clip was made to contact with the phantom and PTT headset was connected	Ni-MH battery pack	Fixed	1.064 (2.127)
Tip of antenna and belt clip in contact with the phantom and PTT headset was connected	Ni-MH battery pack	Fixed	0.523 (1.046)

4.7.3. Power drift measurement

The conducted power was measured, using HP 436A power meter, at the antenna feeding point during the period of 30 minute for both fully charged Ni-MH battery pack and new alkaline batteries.



* Since the rapid power drop was observed through the power drift measurement (refer to 4.7.3, pg. 19) , the each measurement was paused before commencing the zoom scan in order to replace the batteries with fully charged or new batteries. It took approximately 5 minutes to complete the measurement once it resumed.

** The SAR Measurement inside the parenthesis indicates the reading before 50 % duty factor is applied for the half-duplex type PTT

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 μW/g to 100 mW/g
Computer	**Phantom**
Type : Pentium III 500MHz Memory : 256 MB RAM Operating System : Windows 2000 Pro Monitor : 19" SVGA	Tissue : Simulated Tissue with electrical characteristics similar to those of the human at normal body temperature. Left/Right Head: IEEE P1528 Compliant SAM manufactured by Aprel Body/Frontal Head: IEEE Flat Phantom 2mm Base

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

For Head mounted devices placed next to the ear, the phantom used in the evaluation of the RF exposure of the user of the wireless device is a IEEE P1528 compliant SAM phantom, shaped like a human head and filled with a mixture simulating the dielectric characteristics of the brain. A left sided head and a right sided head are evaluated to determine the worst case orientation for SAR. For body mounted and frontal held push-to-talk devices, a flat phantom of dimensions 70x42x20cm with a base plate thickness of 2mm is used.

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.

Target Frequency	Head		Body	
(MHz)	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^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

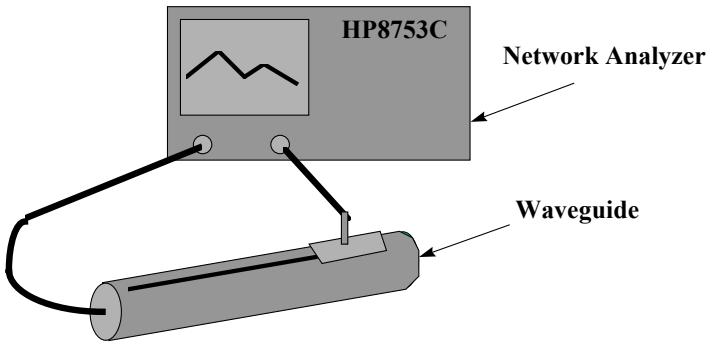
2) Slotted Coaxial Waveguide

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:
Δt = exposure time (30 seconds),
C = heat capacity of tissue,
ΔT = temperature increase due to RF exposure.

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:
σ = Simulated tissue conductivity,
ρ = Mass density of solution

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

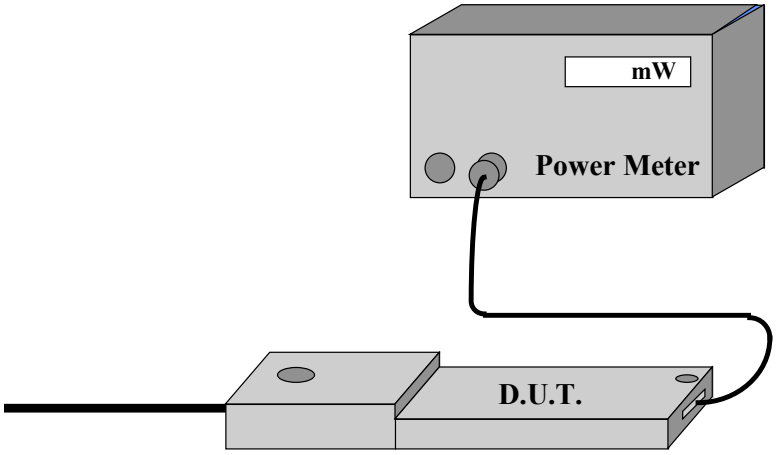
The voltage, (1 cm) above the phantoms surface (E_{tot} 1 cm), is needed to calculate the exposure over one gram of tissue. This SAR value that estimates the average over 1 gram of tissue, is obtained by taking the integral over 1 cm^2 surface of the measured field along the exponential decay curve of 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 SAM phantom shell have been previously marked with a highly visible grid with a defined centre 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.

For HAND HELD devices (push-to-talk), or any other type of wireless transmitters postioned in front of the face, the EUT will be positioned 2.5cm distance from a flat phantom to simulate the frontal facial position in use. All body-worn operating configurations are tested using a flat phantom. The length and width of the phantom is at least twice the corresponding dimensions of the test device, including its antenna.

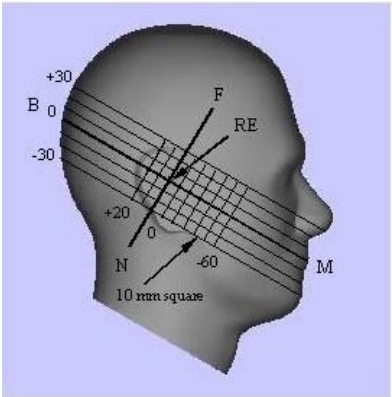


Figure 5.1 – Side view of the phantom showing relevant marking

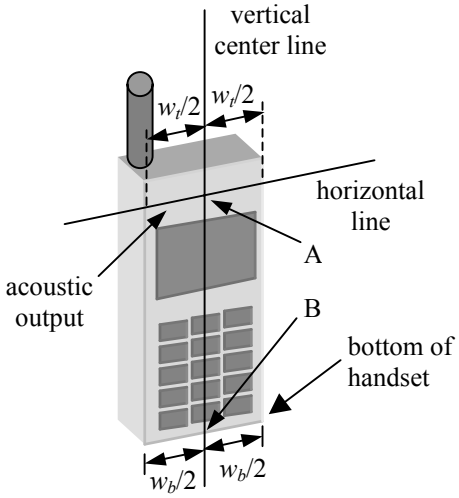


Figure 5.2a – Handset vertical and horizontal reference lines – fixed case

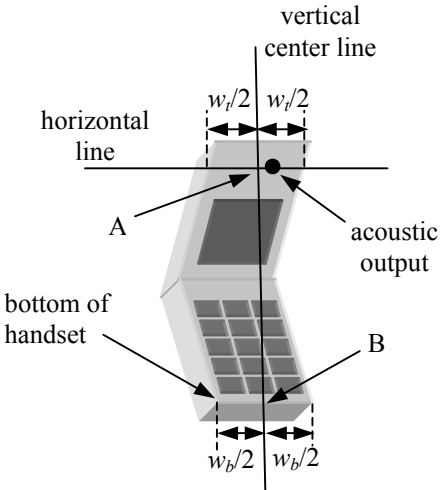


Figure 5.2b – Handset vertical and horizontal reference lines – "clam-shell"

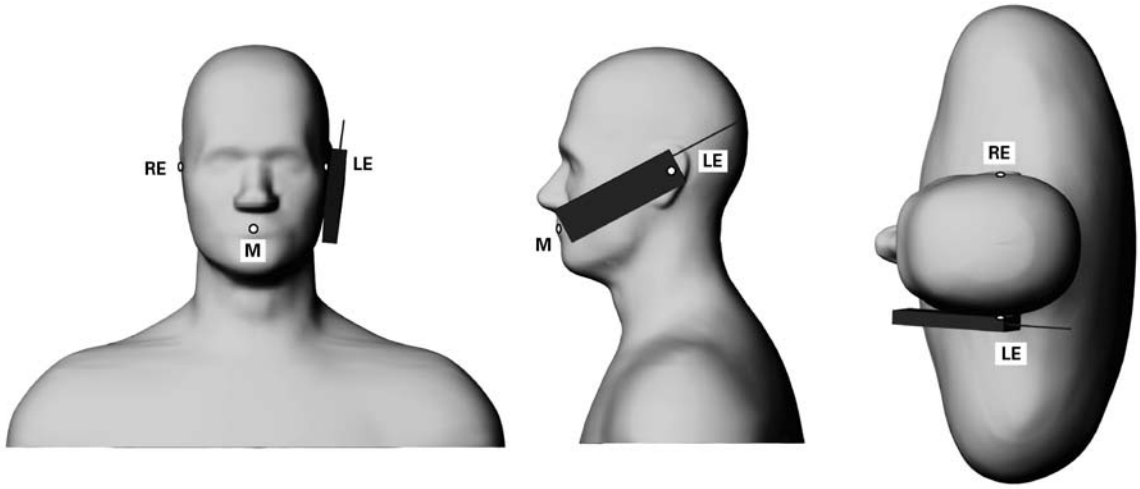


Figure 5.3 – Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only (also see Section 4).

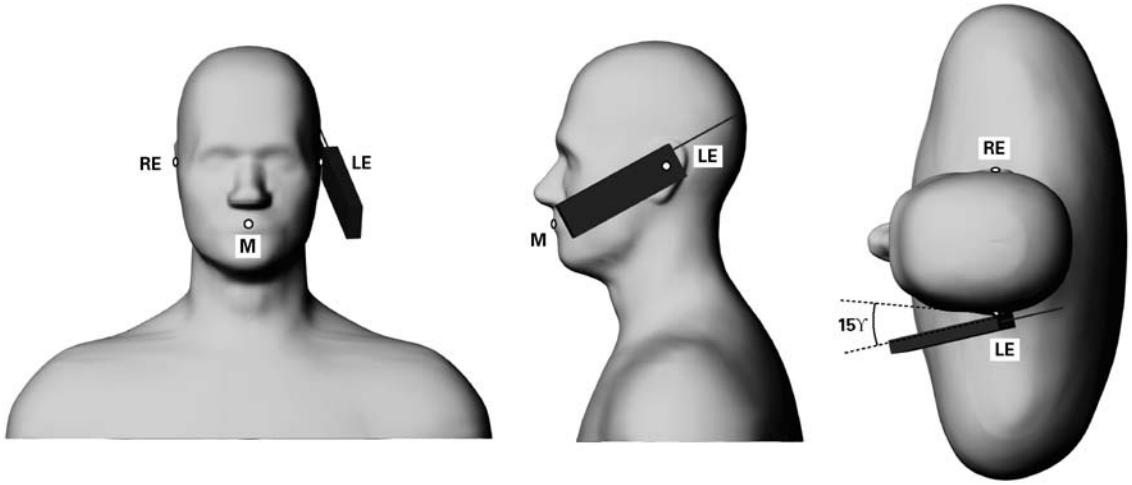


Figure 5.4 – Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only (also see Section 4).

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. SAR PRESCANS

6.1. BODY WORN POSITION

Test configurations used

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

The normal holster mounting position was the only permutation tested for determining peak-spatial average SAR analysis.

Comments on non-tested configurations

No other configurations considered abnormal use, were investigated.

6.2. 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 phone 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 phone has been tested and meets FCC RF exposure guidelines when used with an accessory that contains no metal and that positions the handset a minimum of (specified distance) 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 phone 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. HEAD FRONT CONFIGURATION SAR MEASUREMENTS* ** ***

EUT Configurations	Battery Type	Antenna Position	SAR (W/kg) Device Test Frequency
			462.633 MHz
Display of EUT was faced inward to the phantom at 25 mm separation	Ni-MH battery pack	Fixed	1.453 (2.906)
	4 × AA alkaline batteries	Fixed	1.780 (3.560)

* Unless otherwise specified, the reference point (0, 0) in the plots was set to the point at the base of antenna in the projected image of EUT to the phantom surface.

** Since the rapid power drop was observed through the power drift measurement (refer to 4.7.3, pg. 19) , the each measurement was paused before commencing the zoom scan in order to replace the batteries with fully charged or new batteries. It took approximately 5 minutes to complete the measurement once it resumed.

*** The SAR Measurement inside the parenthesis indicates the reading before 50 % duty factor is applied for the half-duplex type PTT.

Test Information

Date : 25/03/2002
Time : 2:15:04 PM

Product	: GMRS UHF TRANSCIEVER	**Test**	: SAR
Manufacturer	: GENEX ELECTRONICS	**Frequency (MHz)**	: 462.633
Model Number	: GR-2000	**Nominal Output Power (W)**	: 2.0
Serial Number	: ENG-01	**Antenna Type**	: Monopole
FCC ID Number	: PM3GR2000	**Signal**	: CW

Phantom	: Flat	**Dielectric Constant**	: 44.13
Simulated Tissue	: Brain	**Conductivity**	: 0.88

Probe	: UT-ETR-0200-1	**Antenna Position**	: Fixed
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 1.64
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.890		
Calibrated Date	: 19/03/2002		

Amplifier Setting :

Channel 1 : 0.0053 Channel 2 : 0.0049 Channel 3 : 0.0061

Location of Maximum Field :

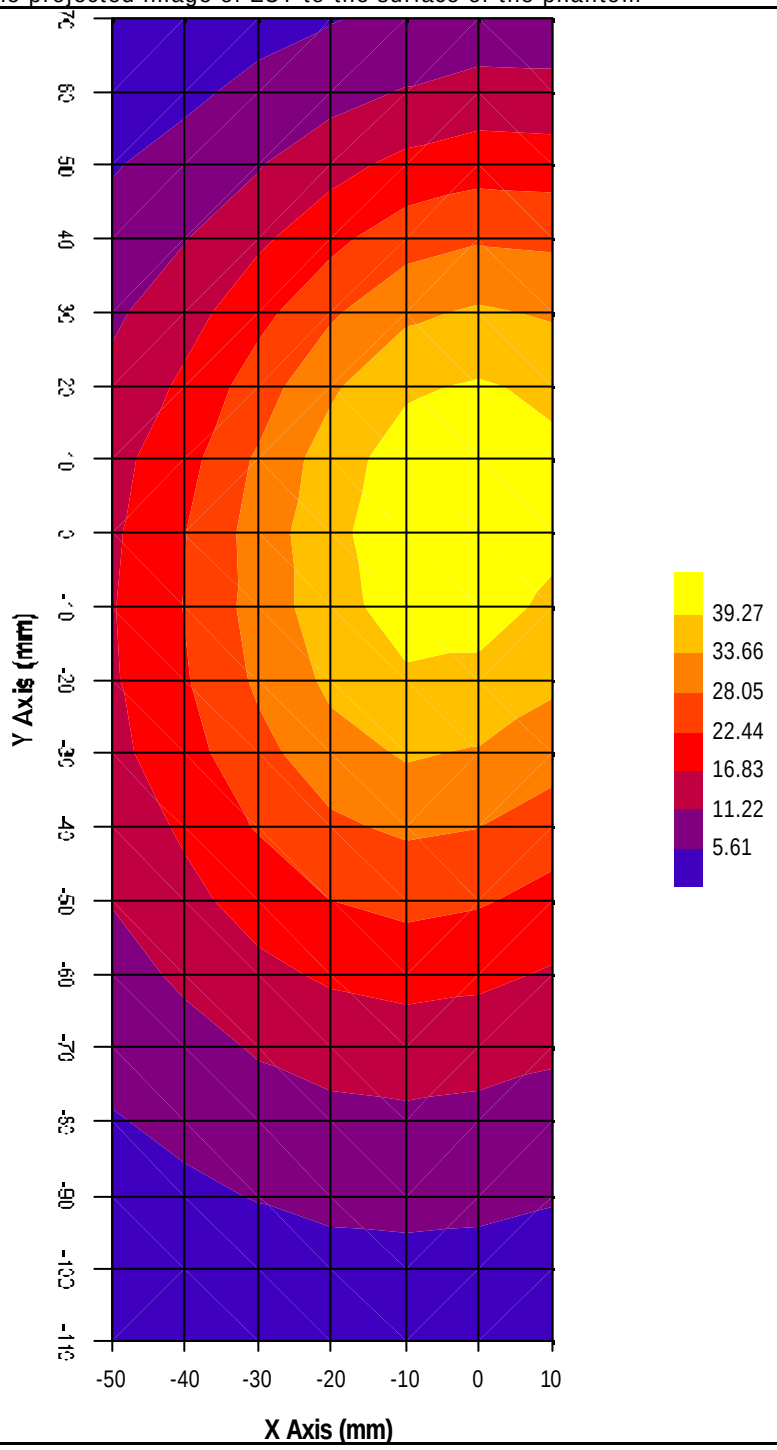
X = -5 Y = 0

Measured Values (mV) :

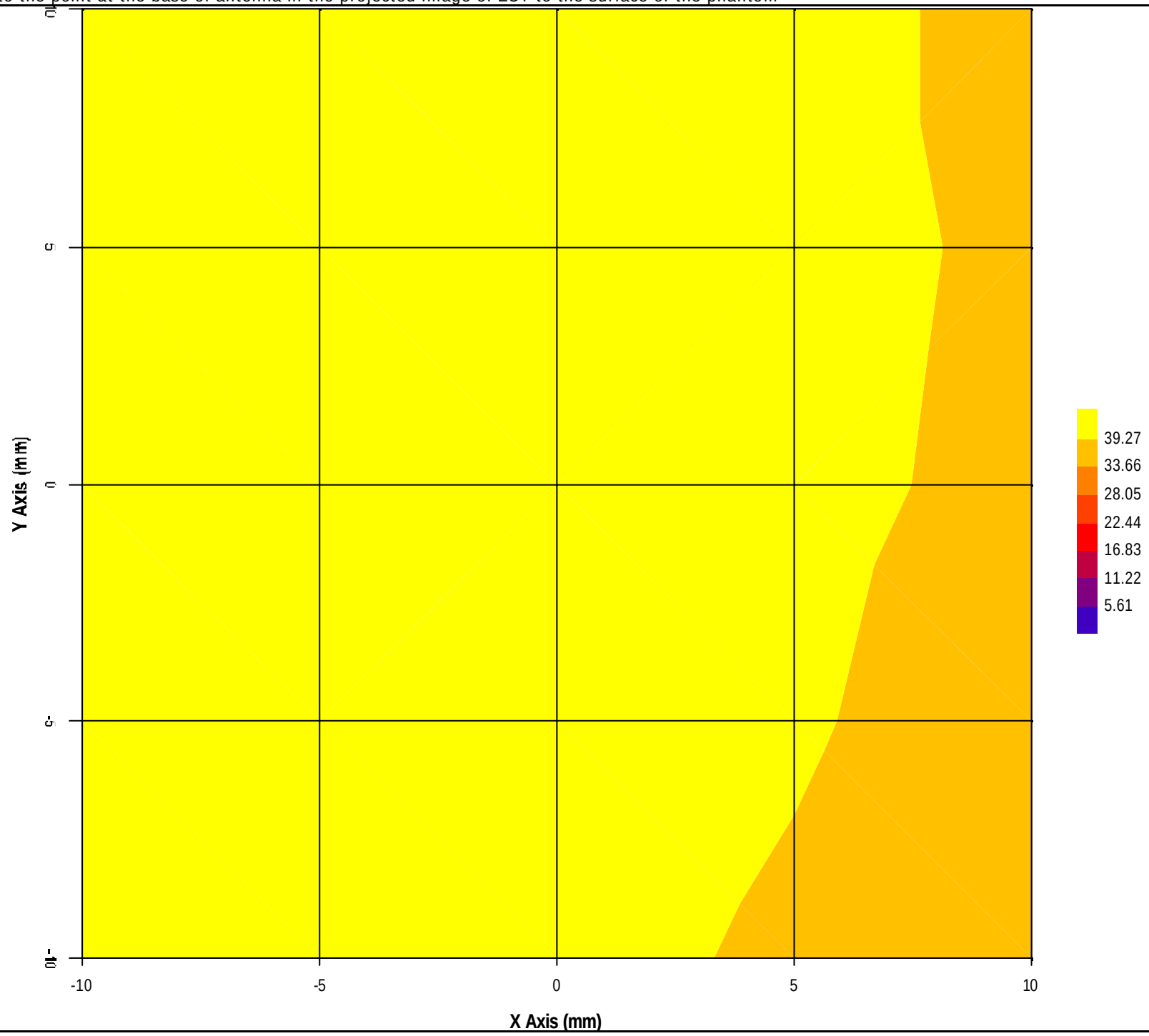
42.786	36.766	33.695	31.488	29.569	27.876
26.272	24.885	23.483	22.189	20.988	

Peak Voltage (mV) : 47.988 **1 Cm Voltage (mV)** : 25.932 **SAR (W/Kg)** : 2.906

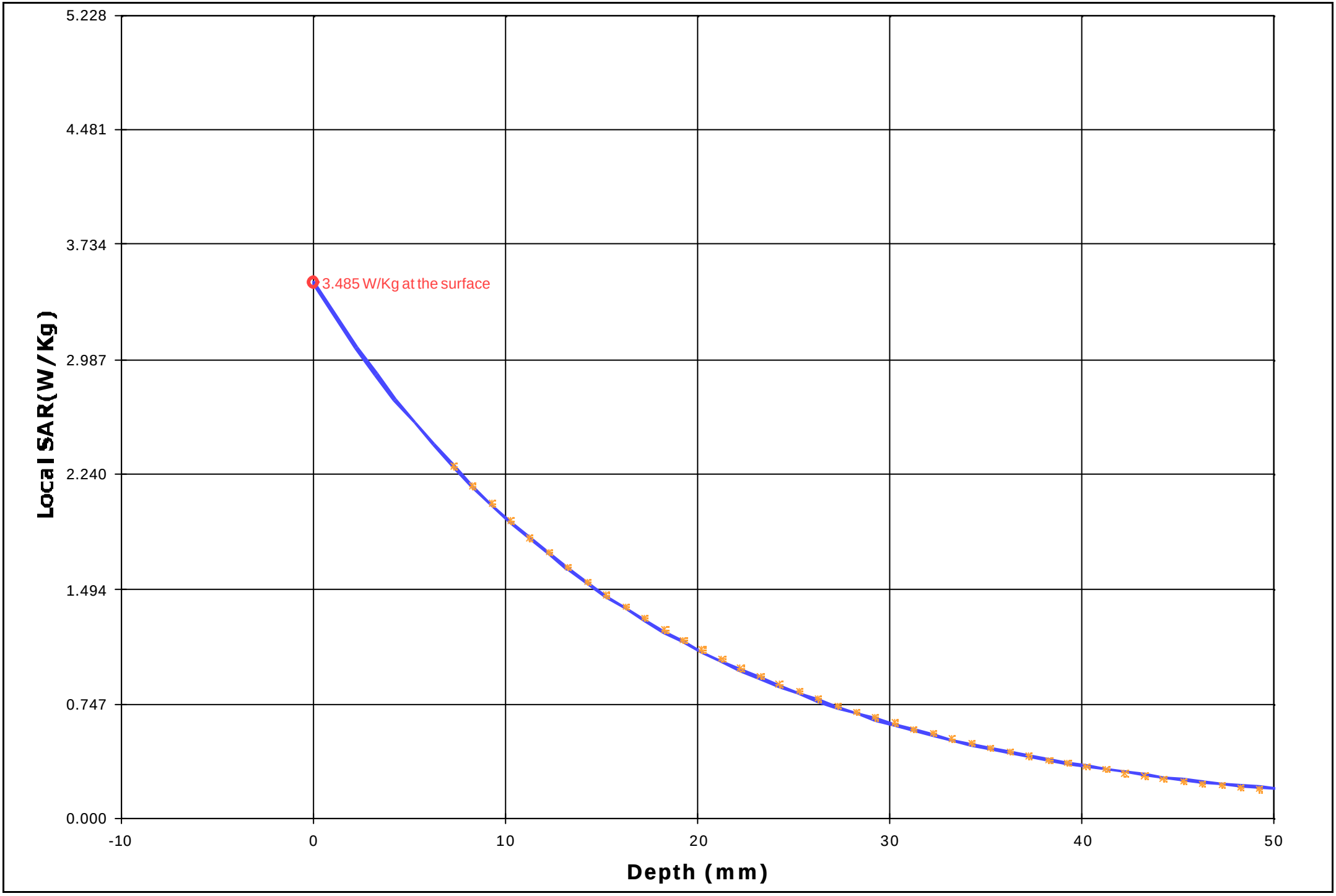
Head front, Ni-MH battery pack, Display of EUT faced inward to the phantom at 25 mm separation, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Head front, Ni-MH battery pack, Display of EUT faced inward to the phantom at 25 mm separation, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Head front, Ni-MH battery pack, Display of EUT faced inward to the phantom at 25 mm separation, 462.633 MHz



Test Information

Date : 25/03/2002
Time : 2:37:36 PM

Product	: GMRS UHF TRANSCIEVER	**Test**	: SAR
Manufacturer	: GENEX ELECTRONICS	**Frequency (MHz)**	: 462.633
Model Number	: GR-2000	**Nominal Output Power (W)**	: 2
Serial Number	: ENG-01	**Antenna Type**	: Monopole
FCC ID Number	: PM3GR2000	**Signal**	: CW

Phantom	: Flat	**Dielectric Constant**	: 44.13
Simulated Tissue	: Brain	**Conductivity**	: 0.88

Probe	: UT-ETR-0200-1	**Antenna Position**	: Fixed
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 2.03
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.890		
Calibrated Date	: 19/03/2002		

Amplifier Setting :

Channel 1 : 0.0053 Channel 2 : 0.0049 Channel 3 : 0.0061

Location of Maximum Field :

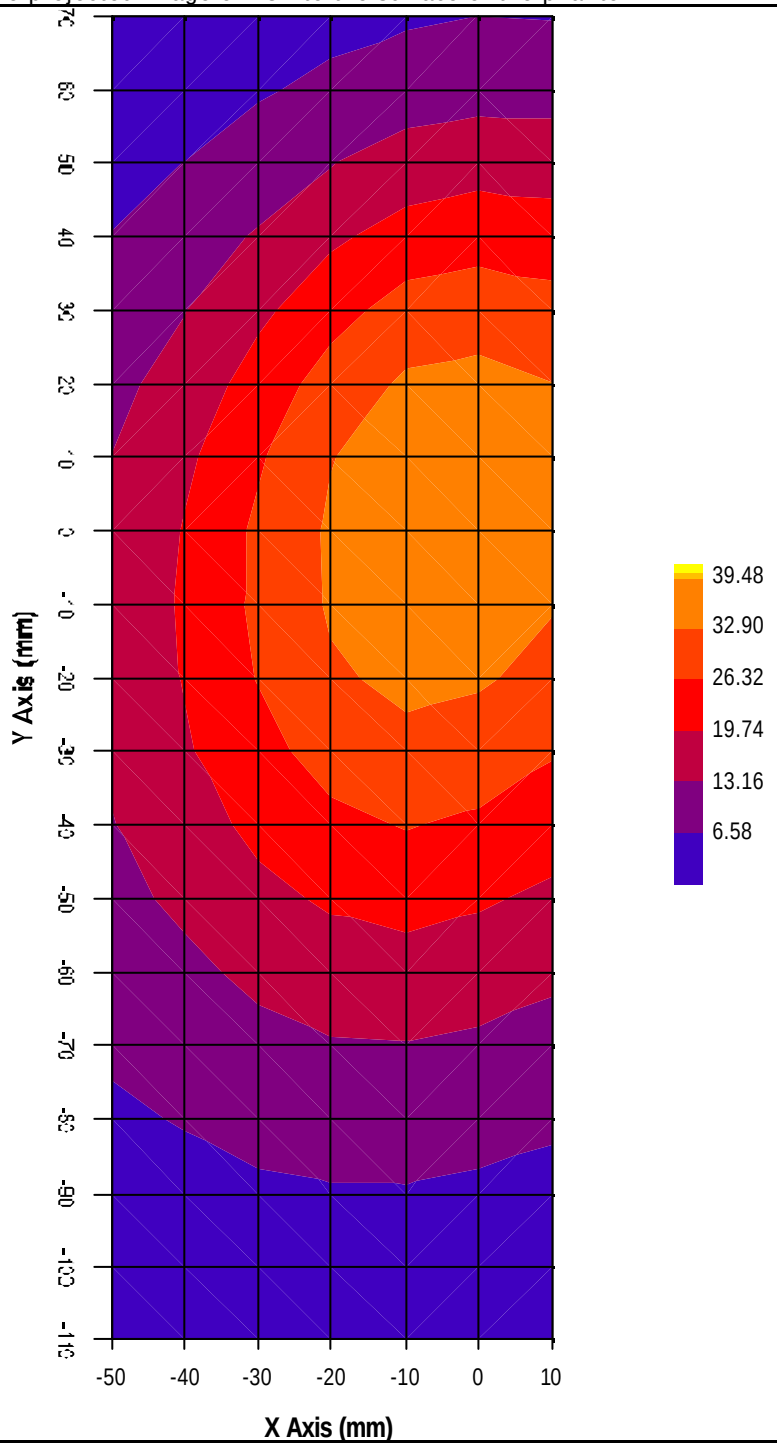
X = -10 Y = -10

Measured Values (mV) :

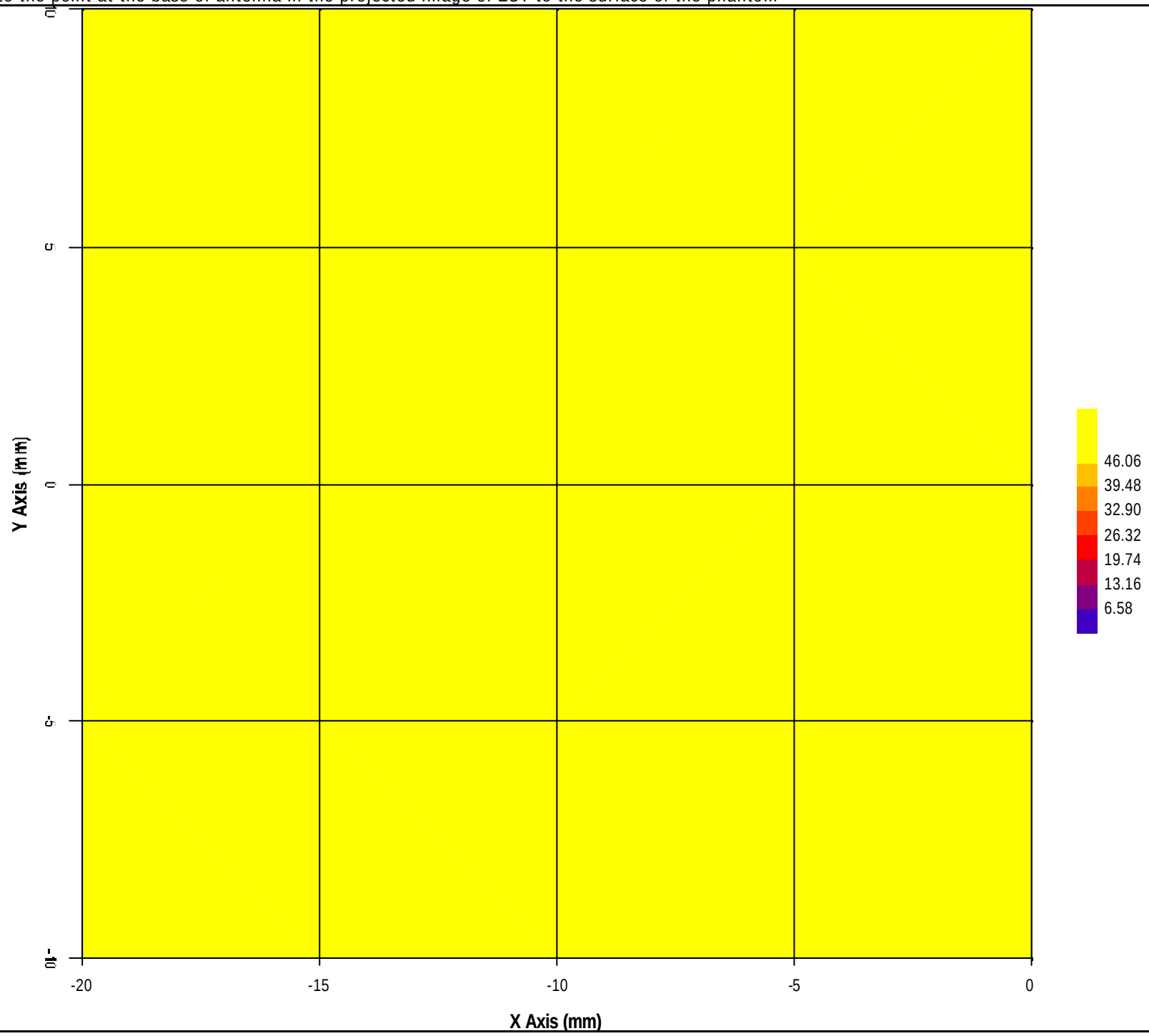
48.604	41.654	38.265	35.778	33.672	31.763
30.008	28.363	26.815	25.361	23.984	

Peak Voltage (mV) : 54.296 **1 Cm Voltage (mV)** : 29.620 **SAR (W/Kg)** : 3.560

Head front, Alkaline batteries, Display of EUT faced inward to the phantom at 25 mm separation, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Head front, Alkaline batteries, Display of EUT faced inward to the phantom at 25 mm separation, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Head front, Alkaline batteries, Display of EUT faced inward to the phantom at 25 mm separation, 462.633 MHz

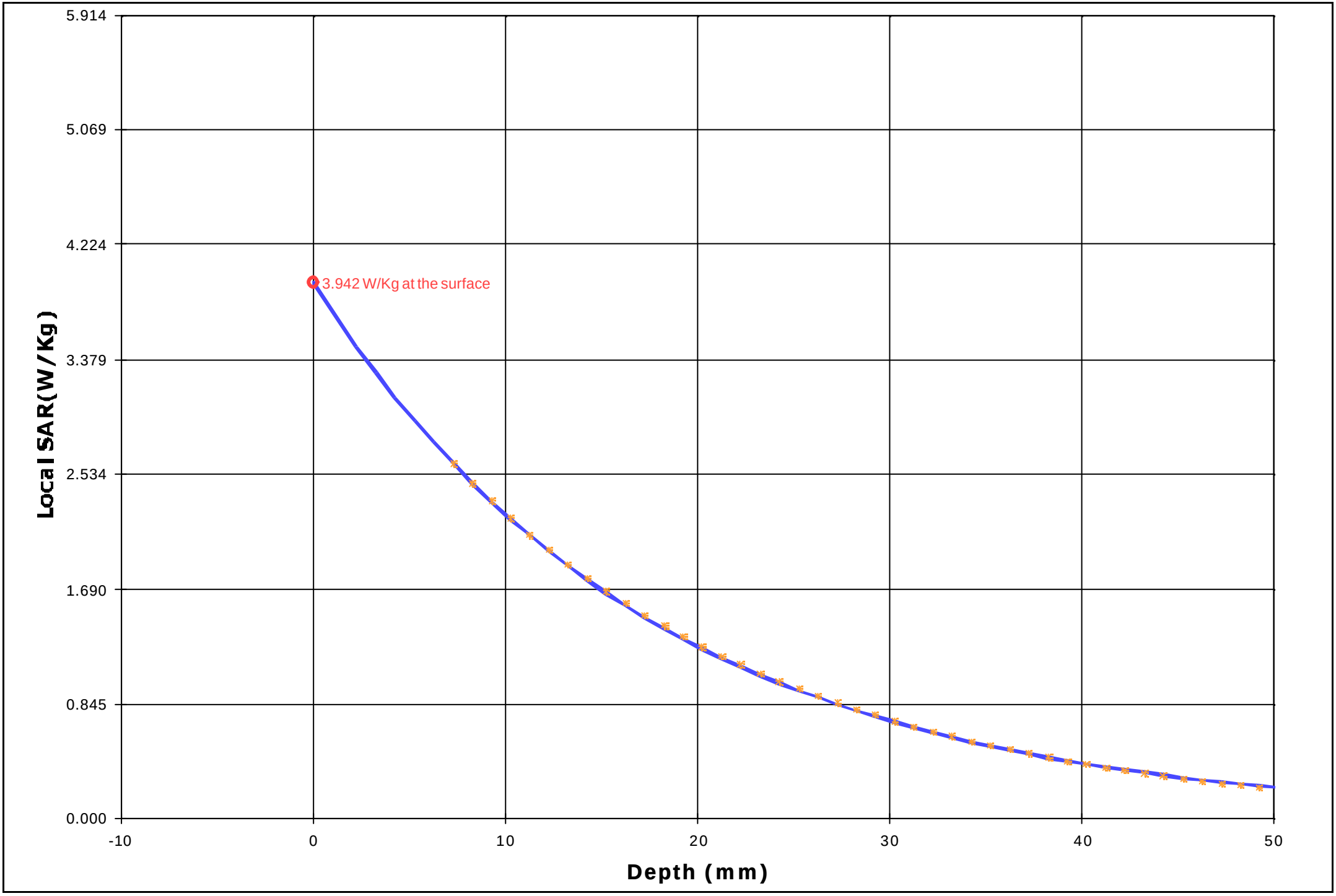


EXHIBIT 8. BODY-WORN CONFIGURATION SAR MEASUREMENTS* ** ***

EUT Configurations	Battery Type	Antenna Position	SAR (W/kg) Device Test Frequency
			462.633 MHz
EUT parallel to the phantom with the belt clip in contact and PTT headset connected	Ni-MH battery pack	Fixed	1.388 (2.776)
	4 × AA alkaline batteries	**Fixed**	**2.005 (4.010)**
Bottom of EUT and the belt clip was made to contact with the phantom and PTT headset was connected	Ni-MH battery pack	Fixed	1.064 (2.127)
Tip of antenna and belt clip in contact with the phantom and PTT headset was connected	Ni-MH battery pack	Fixed	0.523 (1.046)

* Unless otherwise specified, the reference point (0, 0) in the plots was set to the point at the base of antenna in the projected image of EUT to the phantom surface.

** Since the rapid power drop was observed through the power drift measurement (refer to 4.7.3, pg. 19) , the each measurement was paused before commencing the zoom scan in order to replace the batteries with fully charged or new batteries. It took approximately 5 minutes to complete the measurement once it resumed.

*** The SAR Measurement inside the parenthesis indicates the reading before 50 % duty factor is applied for the half-duplex type PTT.

Test Information

Date : 19/03/2002
Time : 2:34:04 PM

Product	: GMRS UHF TRANSCIEVER	**Test**	: SAR
Manufacturer	: GENEX ELECTRONICS CO LTD.	**Frequency (MHz)**	: 462.633
Model Number	: GR-2000	**Nominal Output Power (W)**	: 2.0
Serial Number	: ENG-01	**Antenna Type**	: Monopole
FCC ID Number	: PM3GR2000	**Signal**	: CW

Phantom	: Flat	**Dielectric Constant**	: 58.79
Simulated Tissue	: Muscle	**Conductivity**	: 0.94

Probe	: UT-ETR-0200-1	**Antenna Position**	: Fixed
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 1.64
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.739		
Calibrated Date	: 19/03/2002		

Amplifier Setting :

Channel 1 : 0.0053 Channel 2 : 0.0049 Channel 3 : 0.0061

Location of Maximum Field :

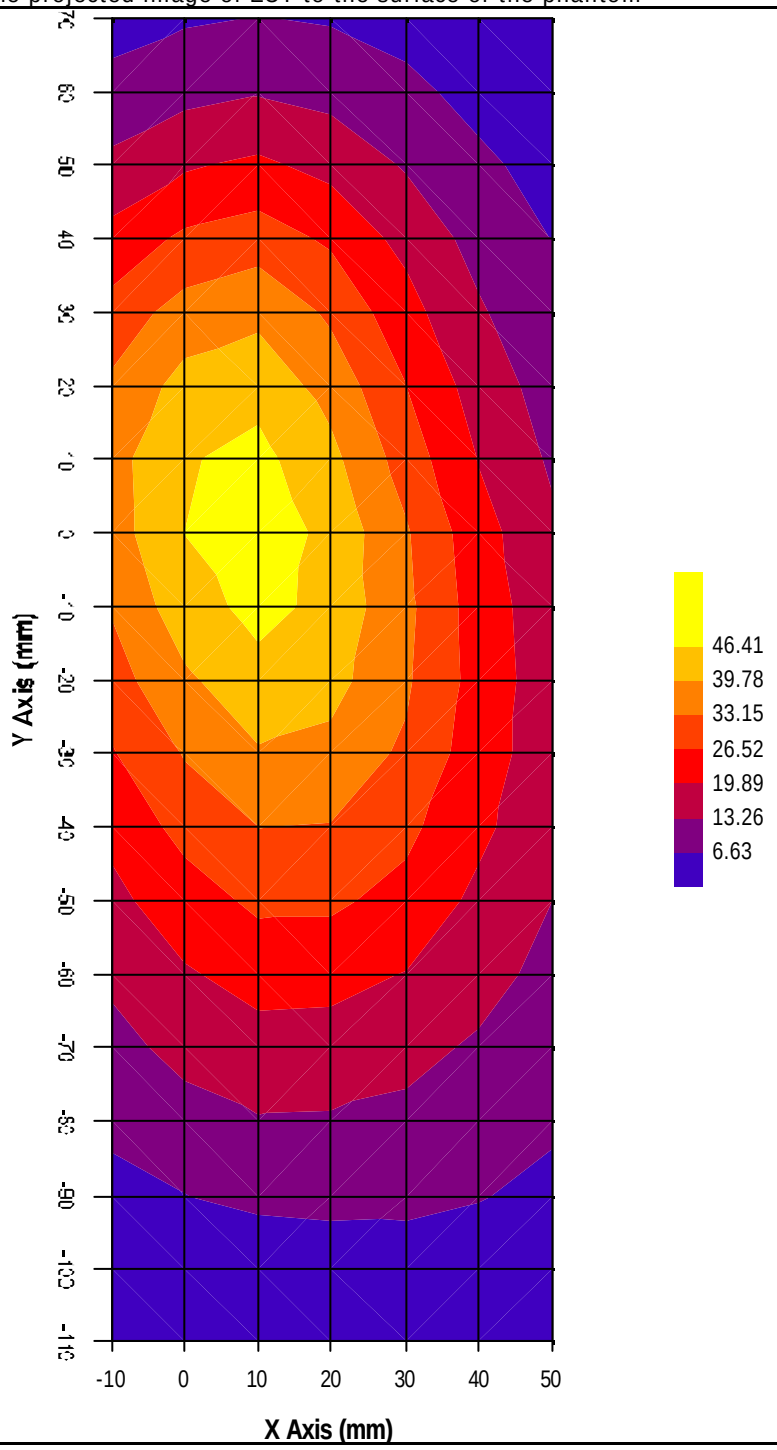
X = 10 Y = 0

Measured Values (mV) :

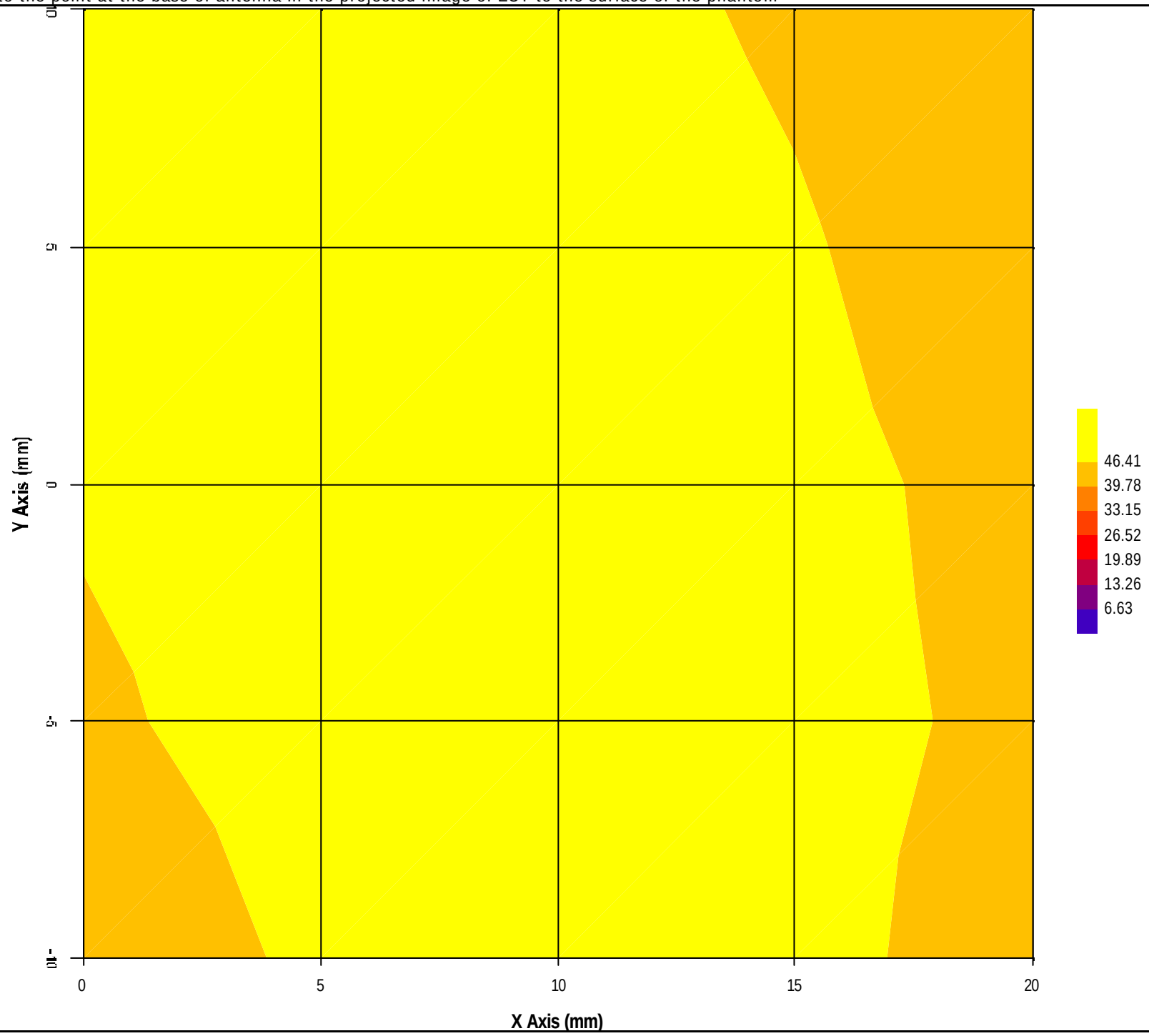
51.067	43.238	39.320	36.355	33.888	31.677
29.658	27.799	26.091	24.473	22.963	

Peak Voltage (mV) : 57.348 **1 Cm Voltage (mV)** : 29.180 **SAR (W/Kg)** : 2.776

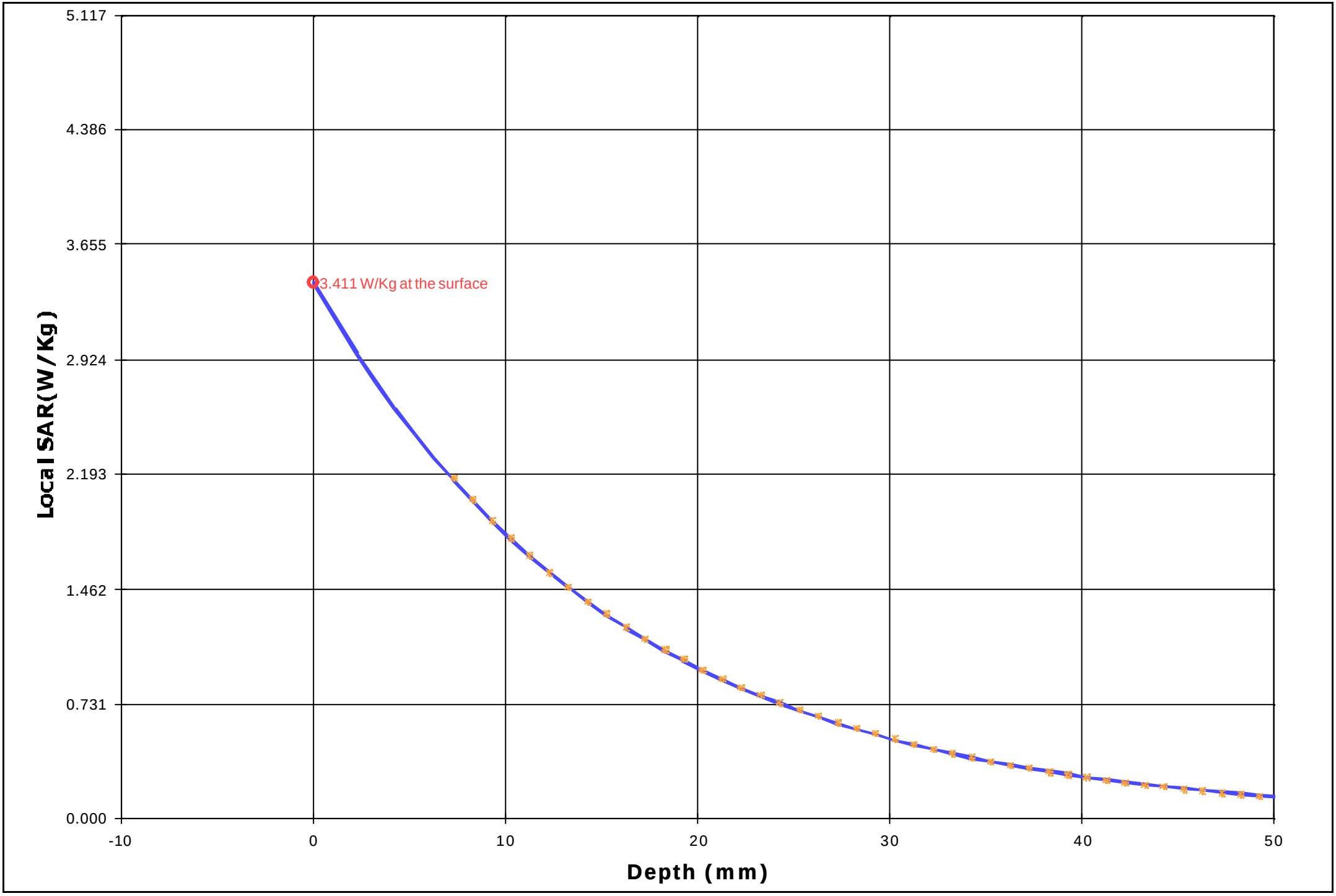
Body-worn, Ni-MH battery pack, EUT parallel to the phantom with belt-clip in contact, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Ni-MH battery pack, EUT parallel to the phantom with belt-clip in contact, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Ni-MH battery pack, EUT parallel to the phantom with belt-clip in contact, 462.633 MHz



Test Information

Date : 20/03/2002
Time : 2:35:19 PM

Product	: GMRS UHF TRANSCIEVER	**Test**	: SAR
Manufacturer	: GENEX ELECTRONICS CO LTD.	**Frequency (MHz)**	: 462.633
Model Number	: GR-2000	**Nominal Output Power (W)**	: 2.0
Serial Number	: ENG-01	**Antenna Type**	: Monopole
FCC ID Number	: PM3GR2000	**Signal**	: CW

Phantom	: Flat	**Dielectric Constant**	: 58.79
Simulated Tissue	: Muscle	**Conductivity**	: 0.94

Probe	: UT-ETR-0200-1	**Antenna Position**	: Fixed
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 2.03
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.739		
Calibrated Date	: 19/03/2002		

Amplifier Setting :

Channel 1 : 0.0053 Channel 2 : 0.0049 Channel 3 : 0.0061

Location of Maximum Field :

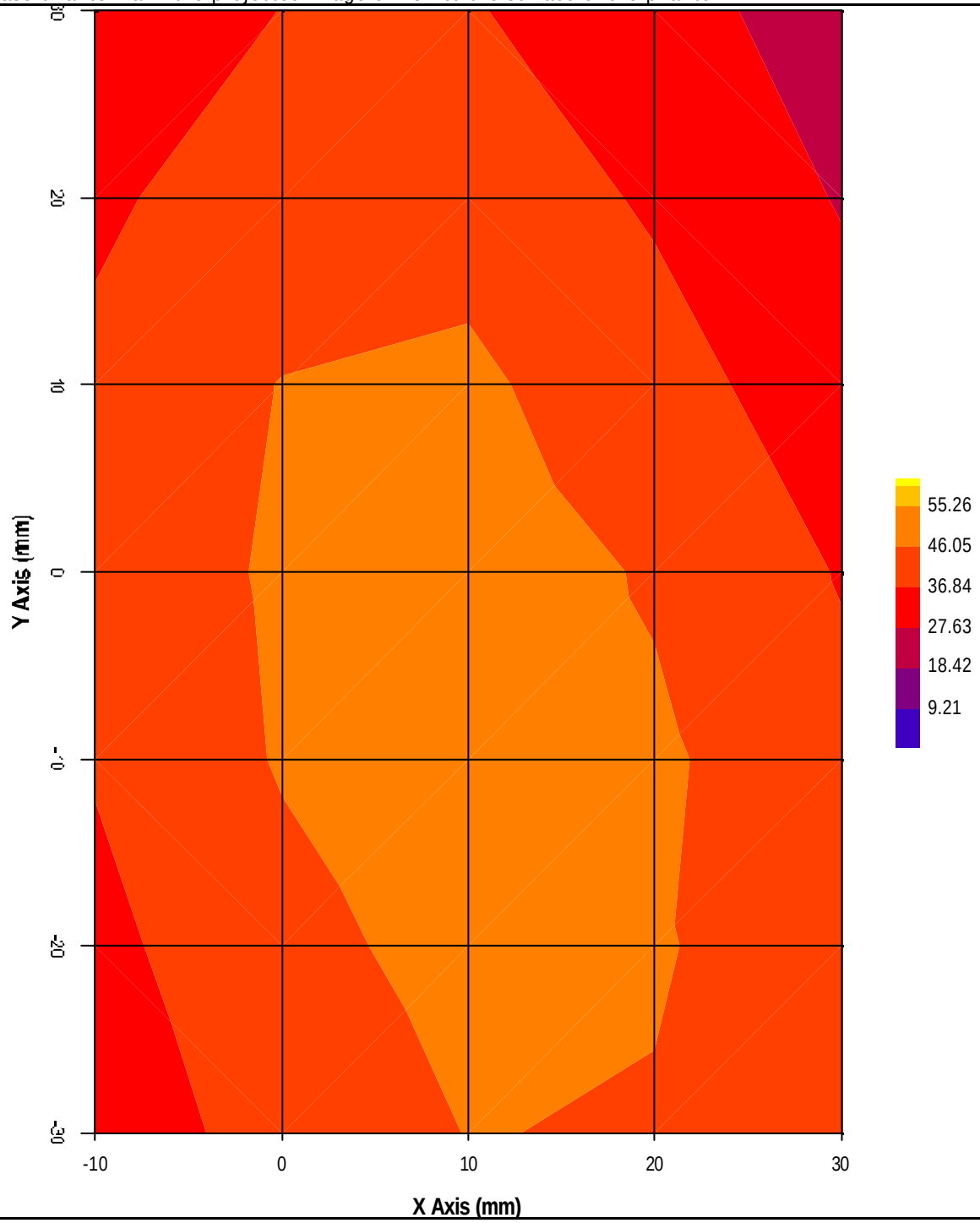
X = 10 Y = -5

Measured Values (mV) :

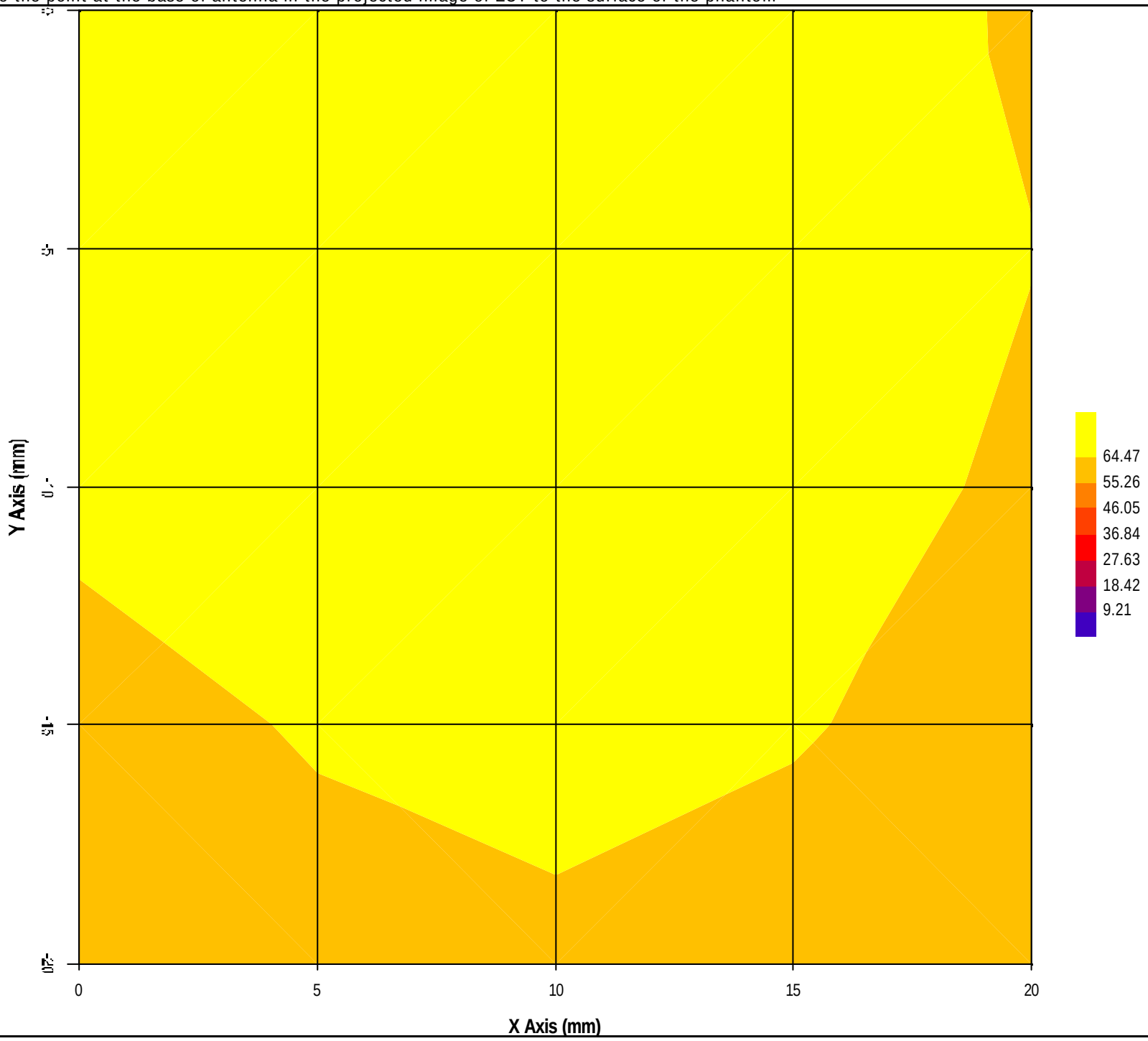
71.116	59.925	54.639	50.736	47.322	44.272
41.510	38.957	36.606	34.385	32.299	

Peak Voltage (mV) : 80.136 **1 Cm Voltage (mV)** : 40.947 **SAR (W/Kg)** : 4.010

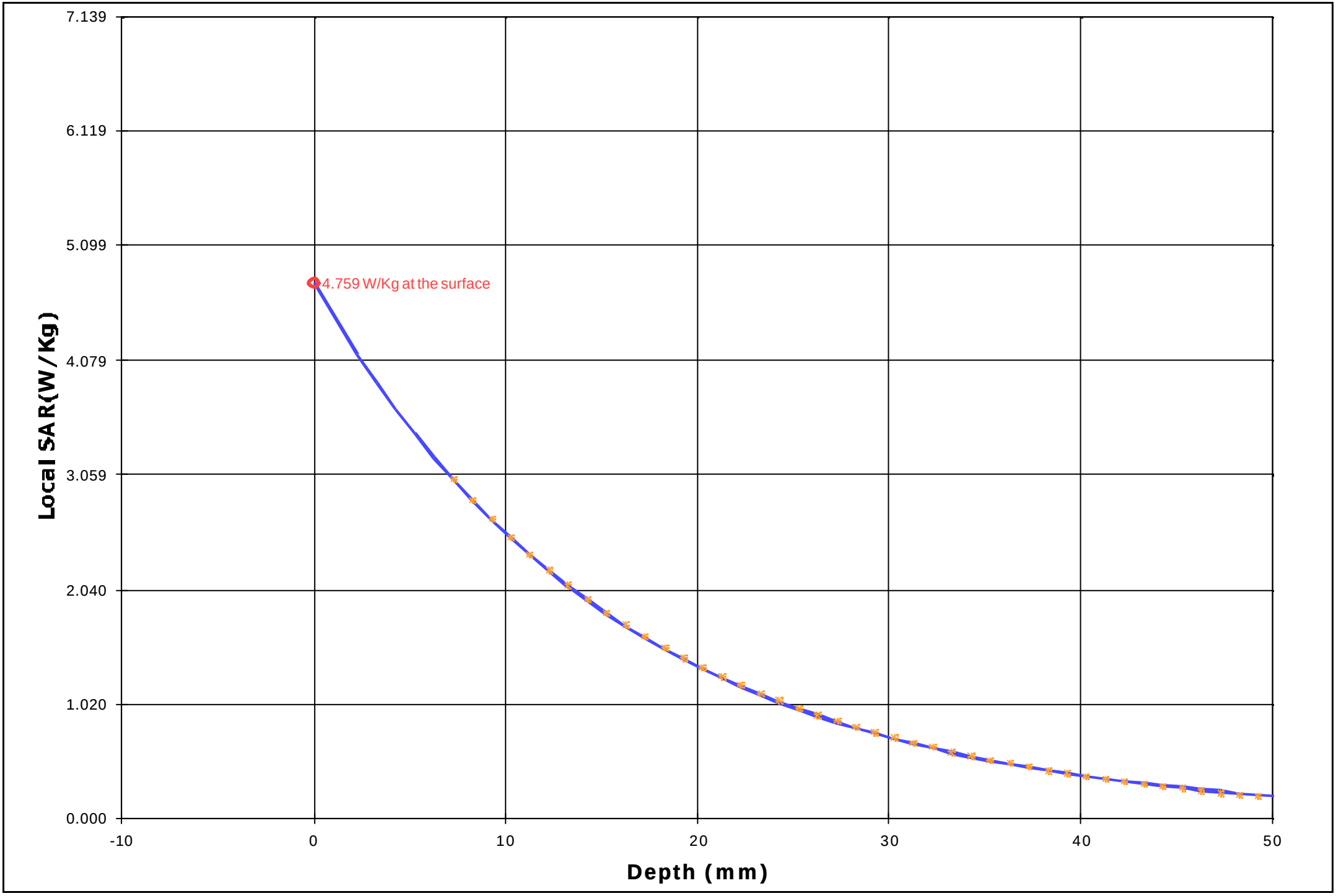
Body-worn, Alkaline batteries, EUT parallel to the phantom with belt-clip in contact, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Alkaline batteries, EUT parallel to the phantom with belt-clip in contact, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Alkaline batteries, EUT parallel to the phantom with belt-clip in contact, 462.633 MHz



Test Information

Date : 19/03/2002
Time : 4:29:34 PM

Product	: GMRS UHF TRANSCIEVER	**Test**	: SAR
Manufacturer	: GENEX ELECTRONICS CO LTD.	**Frequency (MHz)**	: 462.633
Model Number	: GR-2000	**Nominal Output Power (W)**	: 2.0
Serial Number	: ENG-01	**Antenna Type**	: Monopole
FCC ID Number	: PM3GR2000	**Signal**	: CW

Phantom	: Flat	**Dielectric Constant**	: 58.79
Simulated Tissue	: Muscle	**Conductivity**	: 0.94

Probe	: UT-ETR-0200-1	**Antenna Position**	: Fixed
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 1.64
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.739		
Calibrated Date	: 19/03/2002		

Amplifier Setting :

Channel 1 : 0.0053 Channel 2 : 0.0049 Channel 3 : 0.0061

Location of Maximum Field :

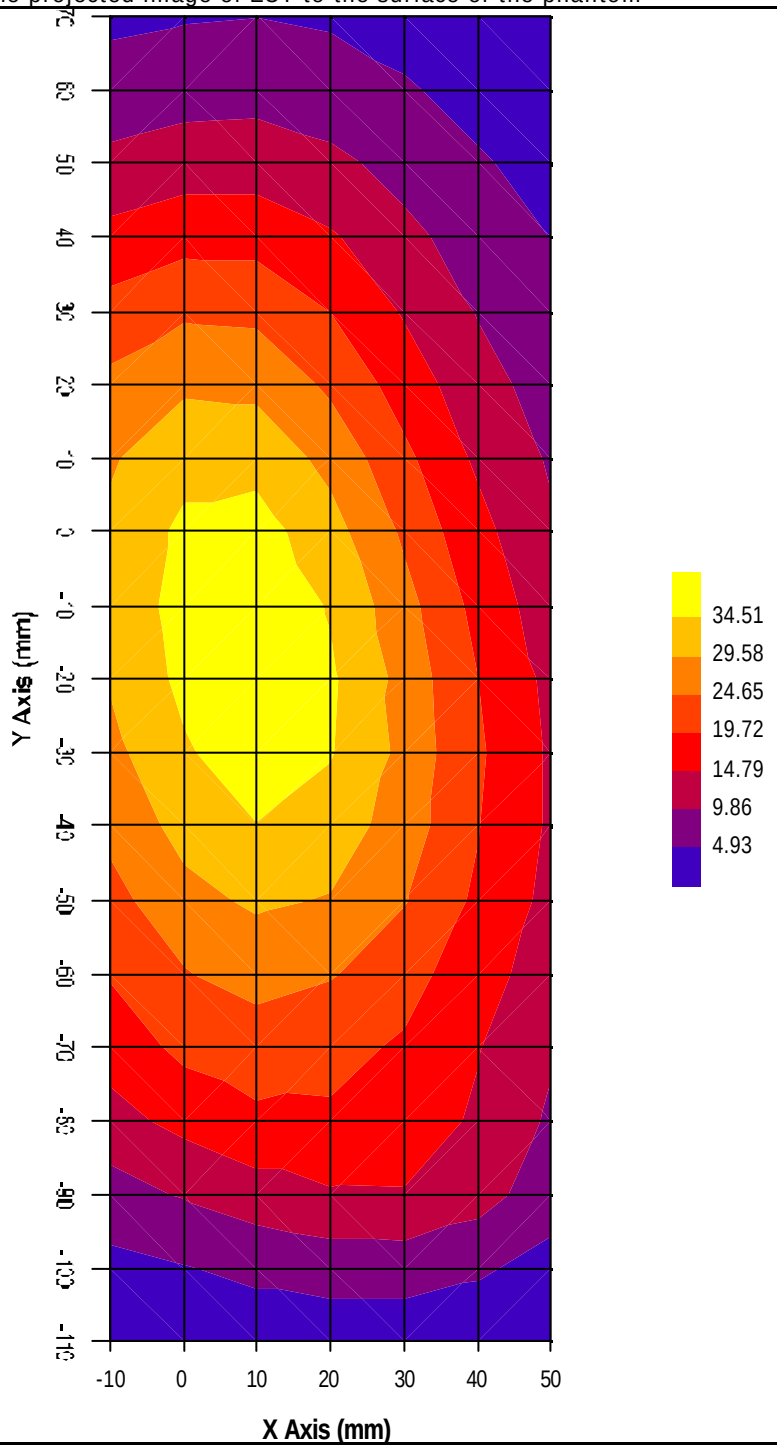
X = 10 Y = -15

Measured Values (mV) :

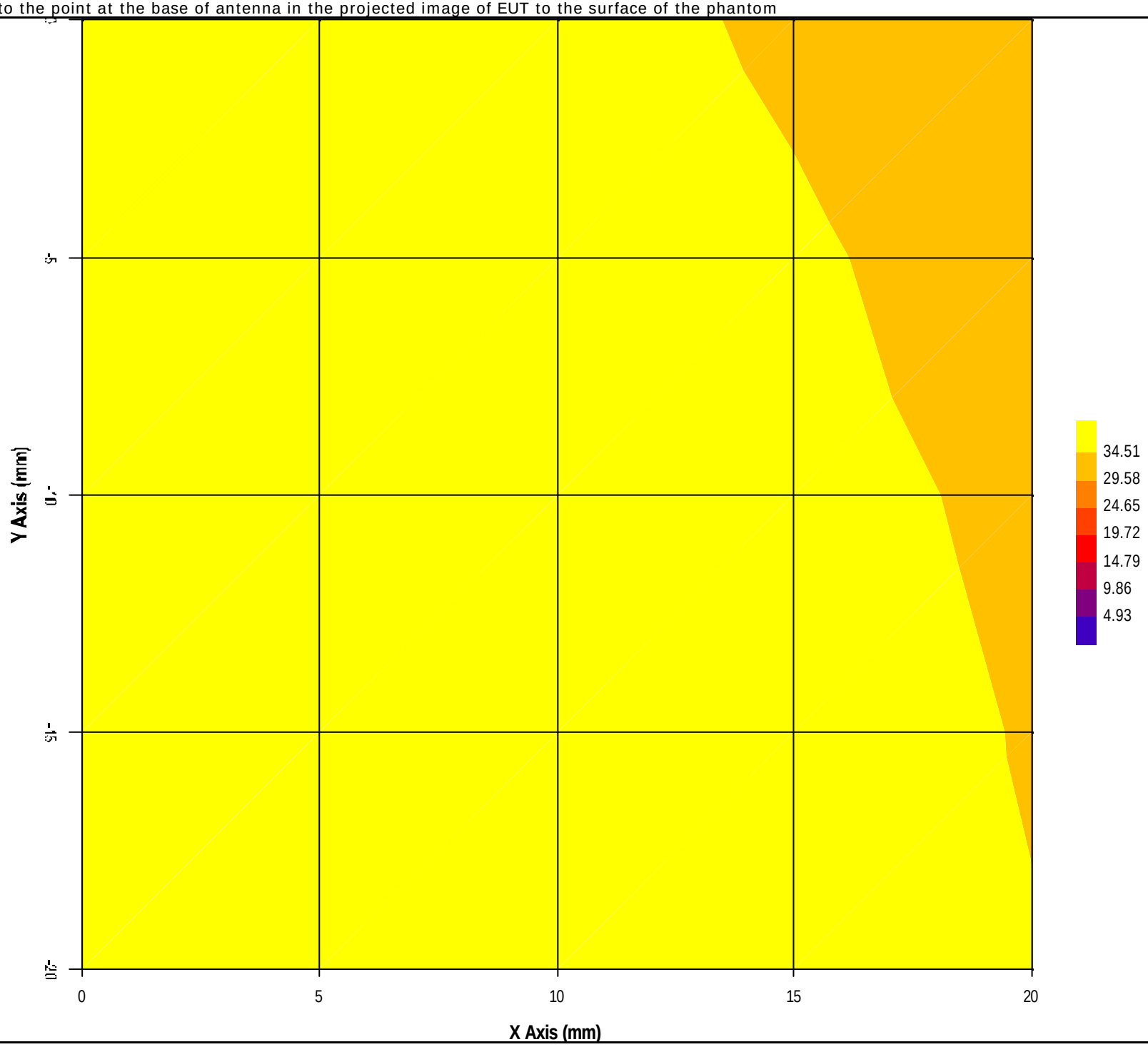
37.933	32.440	29.758	27.716	25.976	24.411
22.996	21.672	20.434	19.260	18.171	

Peak Voltage (mV) : 42.702 **1 Cm Voltage (mV)** : 22.500 **SAR (W/Kg)** : 2.127

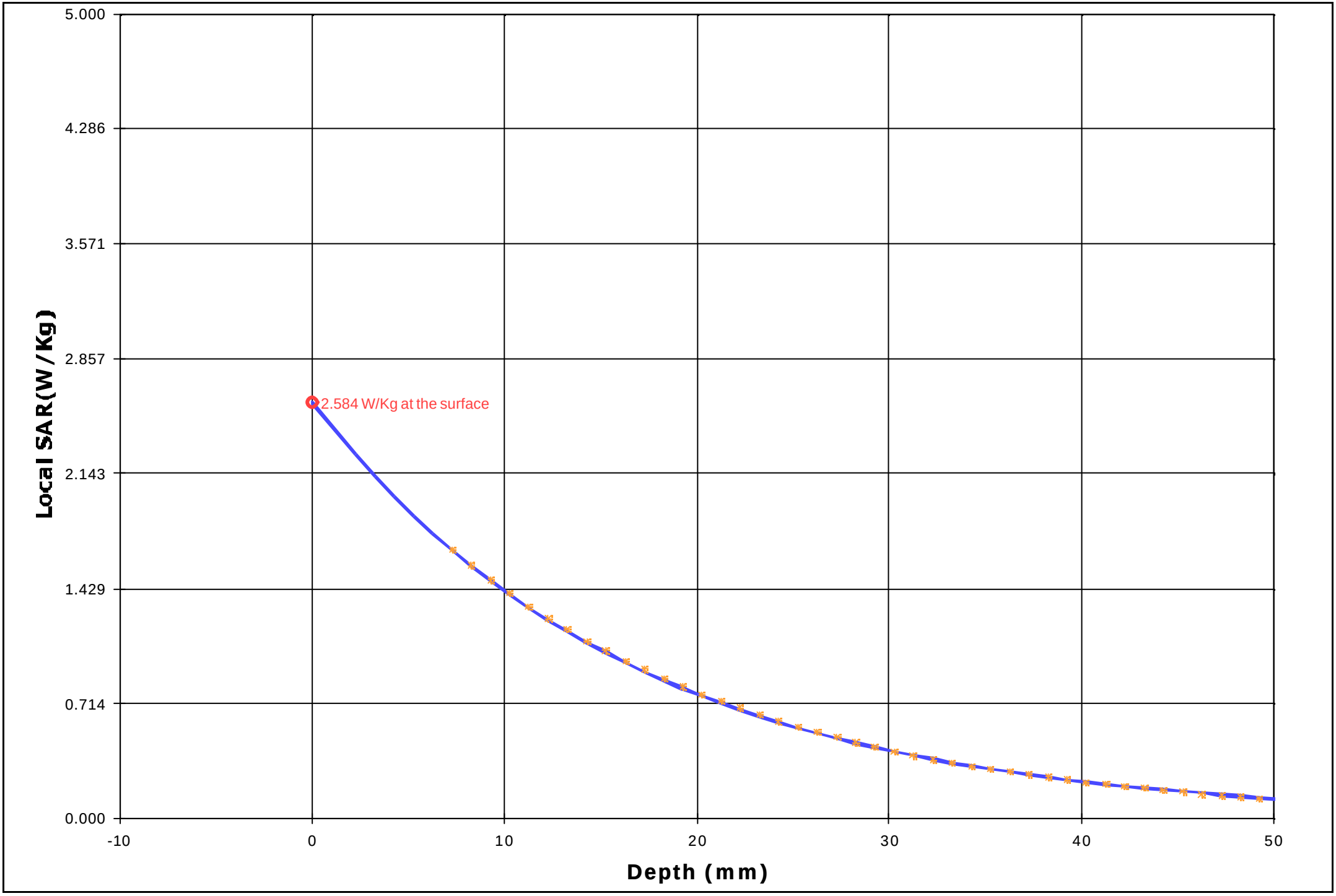
Body-worn, Ni-MH battery pack, Bottom of EUT and belt-clip in contact with the phantom, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Ni-MH battery pack, Bottom of EUT and belt-clip in contact with the phantom, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Ni-MH battery pack, Bottom of EUT and belt-clip in contact with the phantom, 462.633 MHz



Test Information

Date : 20/03/2002
Time : 10:07:32 AM

Product	: GMRS UHF TRANSCIEVER	**Test**	: SAR
Manufacturer	: GENEX ELECTRONICS CO LTD.	**Frequency (MHz)**	: 462.633
Model Number	: GR-2000	**Nominal Output Power (W)**	: 2.0
Serial Number	: ENG-01	**Antenna Type**	: Monopole
FCC ID Number	: PM3GR2000	**Signal**	: CW

Phantom	: Flat	**Dielectric Constant**	: 58.79
Simulated Tissue	: Muscle	**Conductivity**	: 0.94

Probe	: UT-ETR-0200-1	**Antenna Position**	: Fixed
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 1.64
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.739		
Calibrated Date	: 19/03/2002		

Amplifier Setting :

Channel 1 : 0.0053 Channel 2 : 0.0049 Channel 3 : 0.0061

Location of Maximum Field :

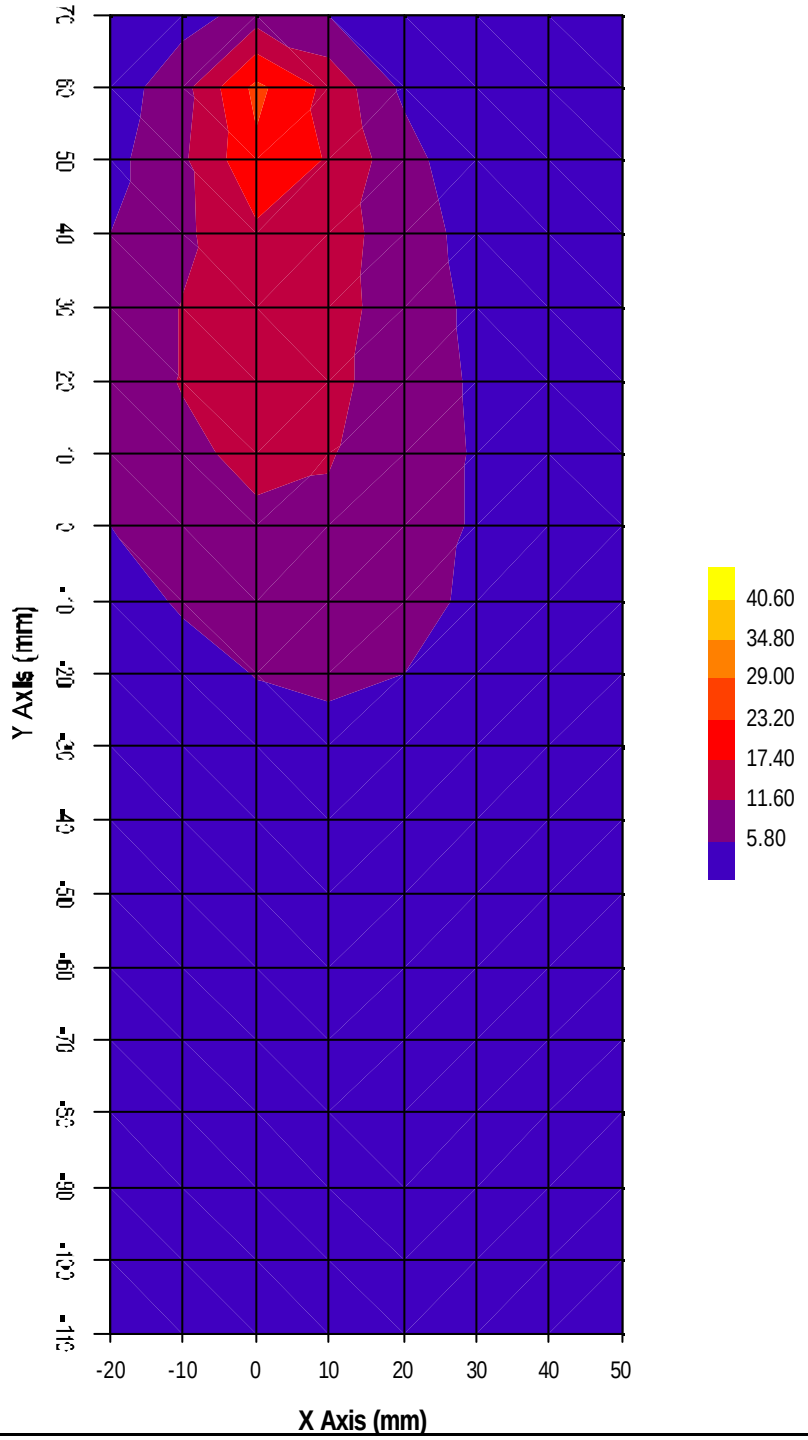
X = 0 Y = 60

Measured Values (mV) :

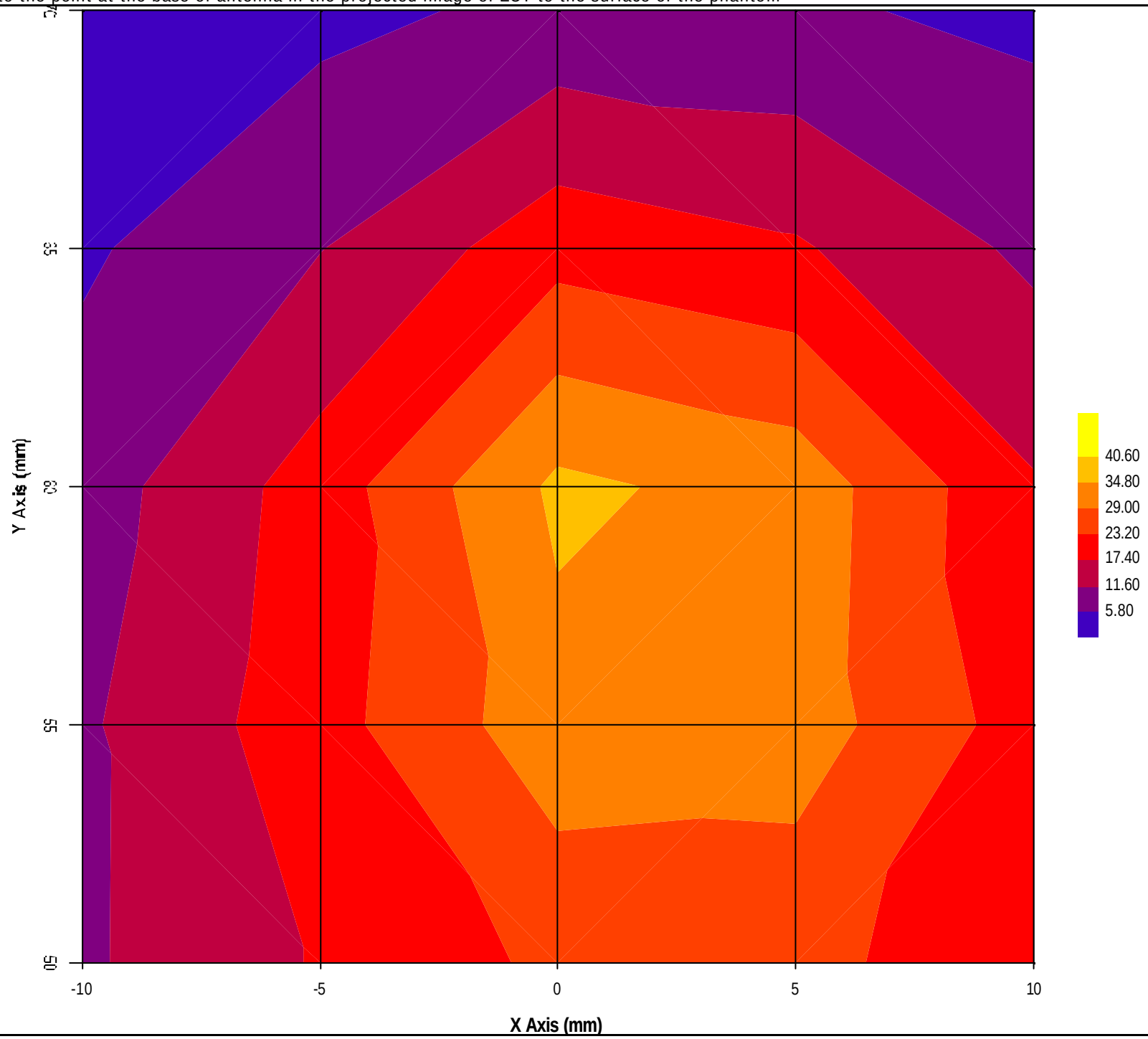
43.902	21.683	14.699	10.859	8.366	6.577
5.198	4.244	3.459	2.839	2.344	

Peak Voltage (mV) : 114.337 **1 Cm Voltage (mV)** : 1.291 **SAR (W/Kg)** : 1.046

Body-worn, Ni-MH battery pack, Tip of antenna and belt-clip in contact with the phantom, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Ni-MH battery pack, Tip of antenna and belt-clip in contact with the phantom, 462.633 MHz
The reference point (0, 0) was set to the point at the base of antenna in the projected image of EUT to the surface of the phantom



Body-worn, Ni-MH battery pack, Tip of antenna and belt-clip in contact with the phantom, 462.633 MHz

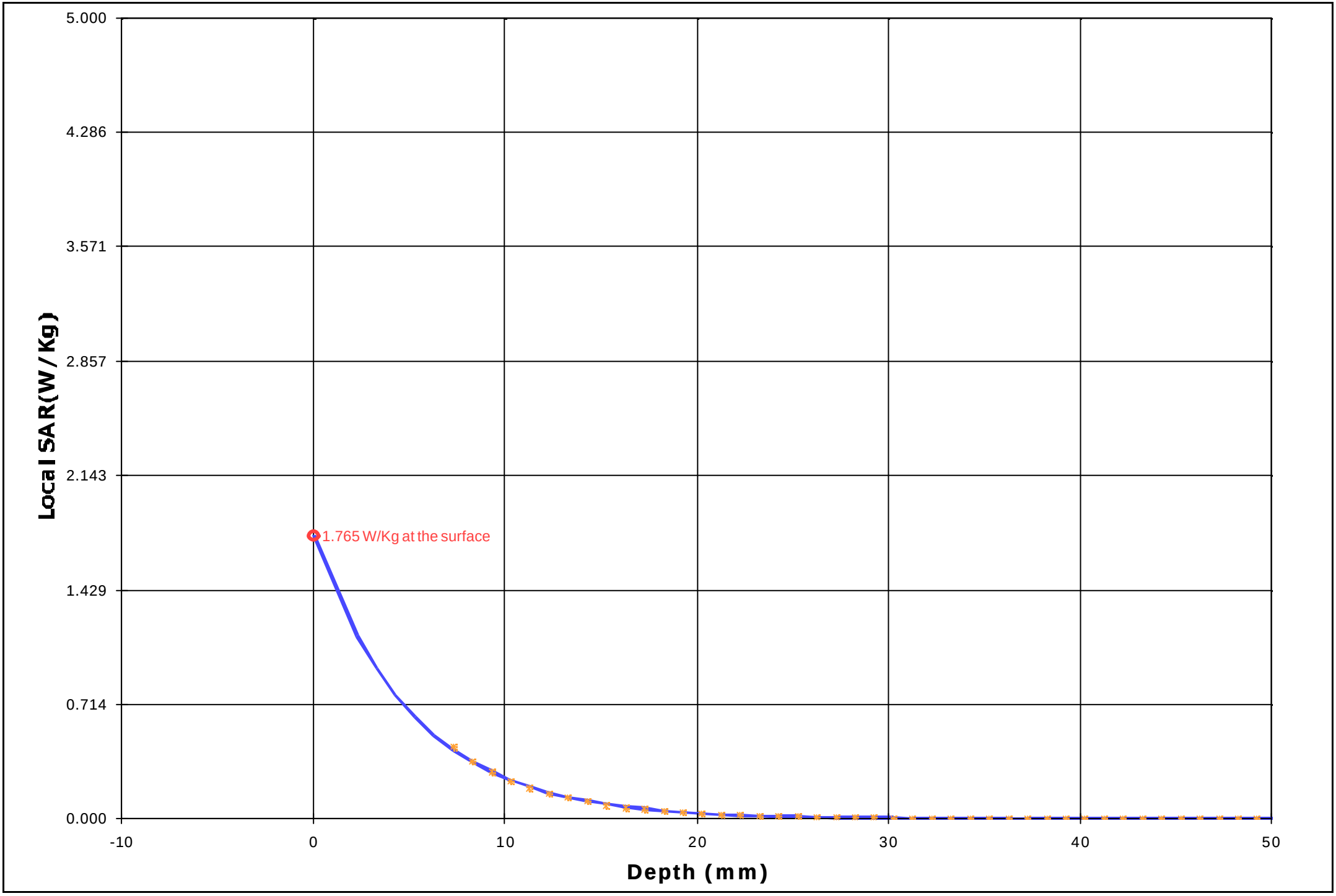


EXHIBIT 9. TISSUE CALIBRATION

The tissue conductivity was calibrated in accordance with IEEE Std 1528-200X, Draft 6.1 November 14, 2000, Sponsor IEEE SCC 34

The solution was initially calibrated using the slotted coaxial waveguide on 03/22/2002 for brain tissue and 11/01/2001 for muscle tissue.

The dielectric parameters of the solutions were verified again using HP 85070C dielectric probe kit as shown below.

Calibration Kit	Tissue Type	Calibrated Date	f [MHz]	Tissue Temp. [°C]	ε′	ε″	σ [S/m]
HP 85070C Dielectric Probe Kit	Brain	03/25/2002	450	22.0 ± 1	**44.13**	35.04	**0.88**
	Muscle	03/19/2002	450	22.0 ± 1	**58.79**	37.51	**0.94**

Ultratech Group of Labs.
3000 Bristol Circle Road
Oakville, Ontario
Canada L6H 6G4

Phone (905) 829-1570
FAX (905) 829-8050
Email vhk.ultratech@sympatico.ca

Name: Jay

Date: 03/22/2002

Frequency: 450 MHz

Mixture: Brain

Room Temp.: 22.5 ±1°C

# of Points: 11

Point Dist: 1.0 cm

Point	Amplitude	Phase
1	-25.67	27.09
2	-27.79	-19.58
3	-29.94	-60.89
4	-31.98	-98.19
5	-34.01	-135.35
6	-35.96	-172.24
7	-38.00	149.86
8	-40.05	112.38
9	-41.98	73.58
10	-43.90	35.97
11	-45.84	1.63

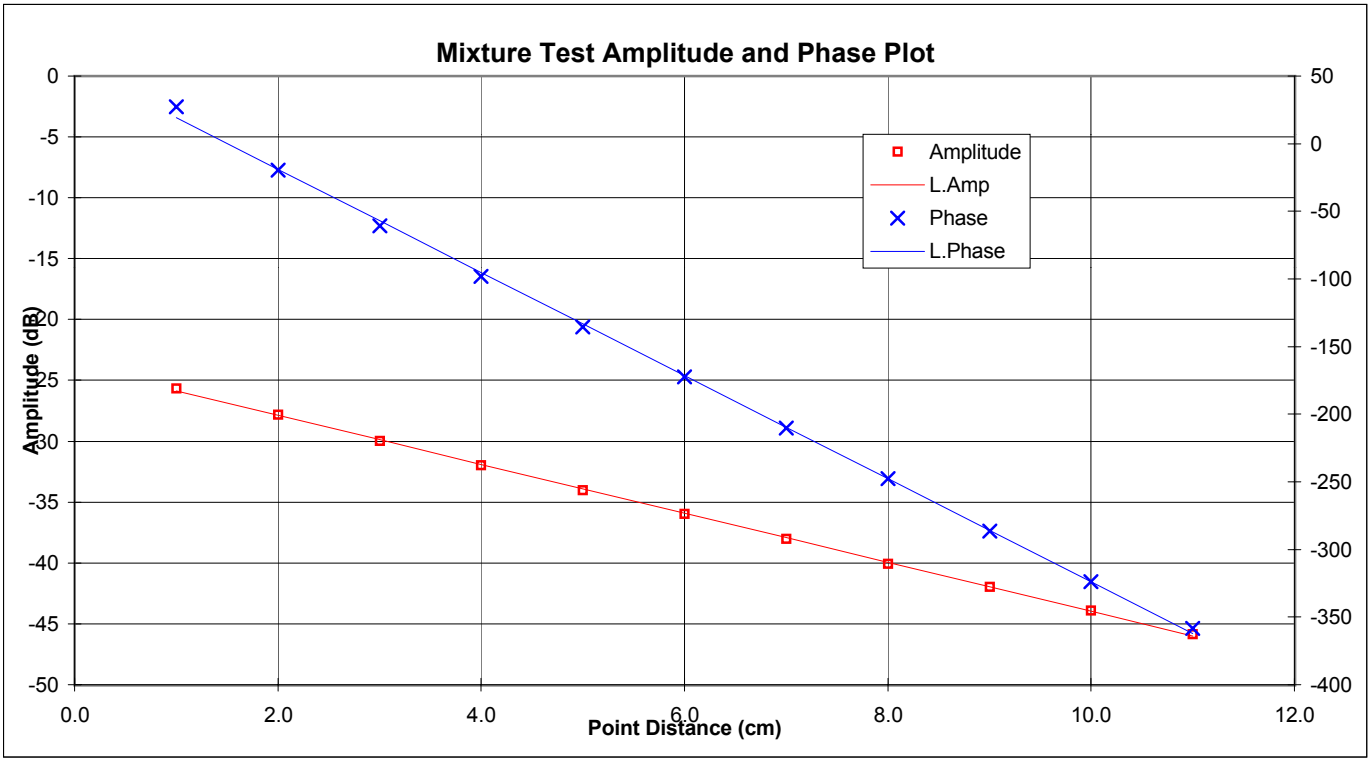
Composition

		weight	% by weight
	DI Water	25,449.6 g	38.94 %
Sucrose (98 %) ←	Sugar	37,171.2 g	56.88 %
2-(2-ButoxyEthoxy) Ethanol ←	Alcohol	0.0 g	0.00 %
Sodium Chloride (99+ %) ←	Salt	2,607.0 g	3.99 %
Hydroxyethyl Cellulose ←	HEC	60.0 g	0.09 %
	Bactericide	60.0 g	0.09 %
	1,2-propanediol	0.0 g	0.00 %
		0.0 g	0.00 %
		0.0 g	0.00 %
	Total	65,347.8 g	100.00 %

Heat Cap. 2.7979

ω(rad/sec)	2.827E+09
ε_0(F/m)	8.854E-12
μ(H/m)	1.257E-06
α_{avg}(Np/cm)	-0.23182
β_{avg}(rad/cm)	-0.66566

Results:		Target	Low Limit	High Limit	% Off Target
D. Const:	43.78	43.50	41.325	45.675	0.64
Conductivity:	0.87	0.87	0.827	0.914	-0.15



Ultratech Group of Labs.
3000 Bristol Circle Road
Oakville, Ontario
Canada L6H 6G4

Phone (905) 829-1570
FAX (905) 829-8050
Email vhk.ultratech@sympatico.ca

Name: Jay

Date: 11/01/01

Frequency: 450 MHz

Mixture: Muscle

Room Temp.: 23.0 ±1°C

# of Points: 11

Point Dist: 1.0 cm

Point	Amplitude	Phase
1	-27.87	78.50
2	-29.86	33.67
3	-31.74	-9.87
4	-33.50	-53.35
5	-35.66	-98.66
6	-37.52	-139.81
7	-39.18	-179.99
8	-41.21	136.81
9	-43.24	93.33
10	-45.08	52.67
11	-47.09	11.34

Composition

		weight	% by weight
	DI Water	36,365.0 g	51.76 %
Sucrose (98 %) ←	Sugar	32,353.3 g	46.05 %
2-(2-ButoxyEthoxy) Ethanol ←	Alcohol	0.0 g	0.00 %
Sodium Chloride (99+ %) ←	Salt	1,338.1 g	1.90 %
Hydroxyethyl Cellulose ←	HEC	150.0 g	0.21 %
	Bactericide	50.0 g	0.07 %
	1,2-propanediol	0.0 g	0.00 %
		0.0 g	0.00 %
		0.0 g	0.00 %
	Total	70,256.4 g	100.00 %

Heat Cap. 3.0070

ω(rad/sec)	2.827E+09
ε_0(F/m)	8.854E-12
μ(H/m)	1.257E-06
α_{avg}(Np/cm)	-0.22023
β_{avg}(rad/cm)	-0.74434

Results:		Target	Low Limit	High Limit	% Off Target
D. Const:	56.84	56.70	53.865	59.535	0.24
Conductivity:	0.92	0.94	0.893	0.987	-1.83

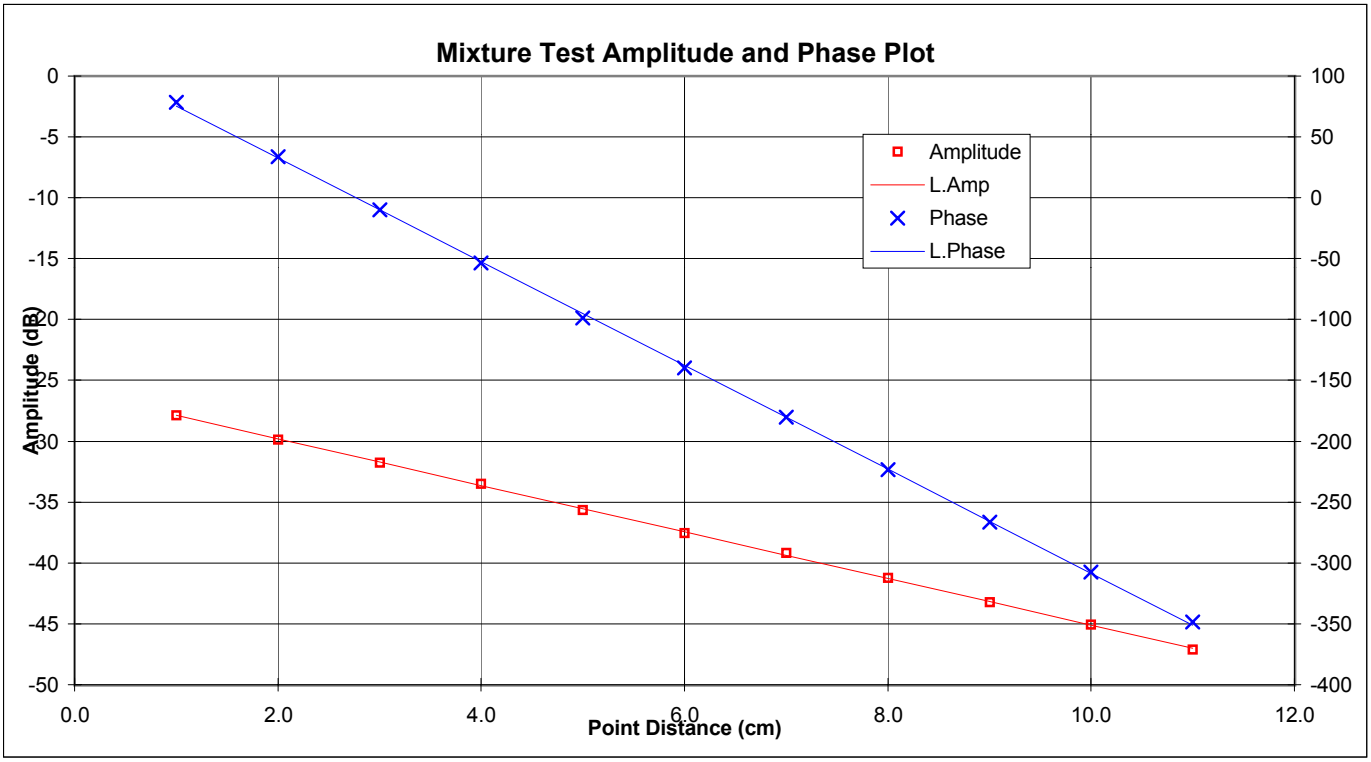
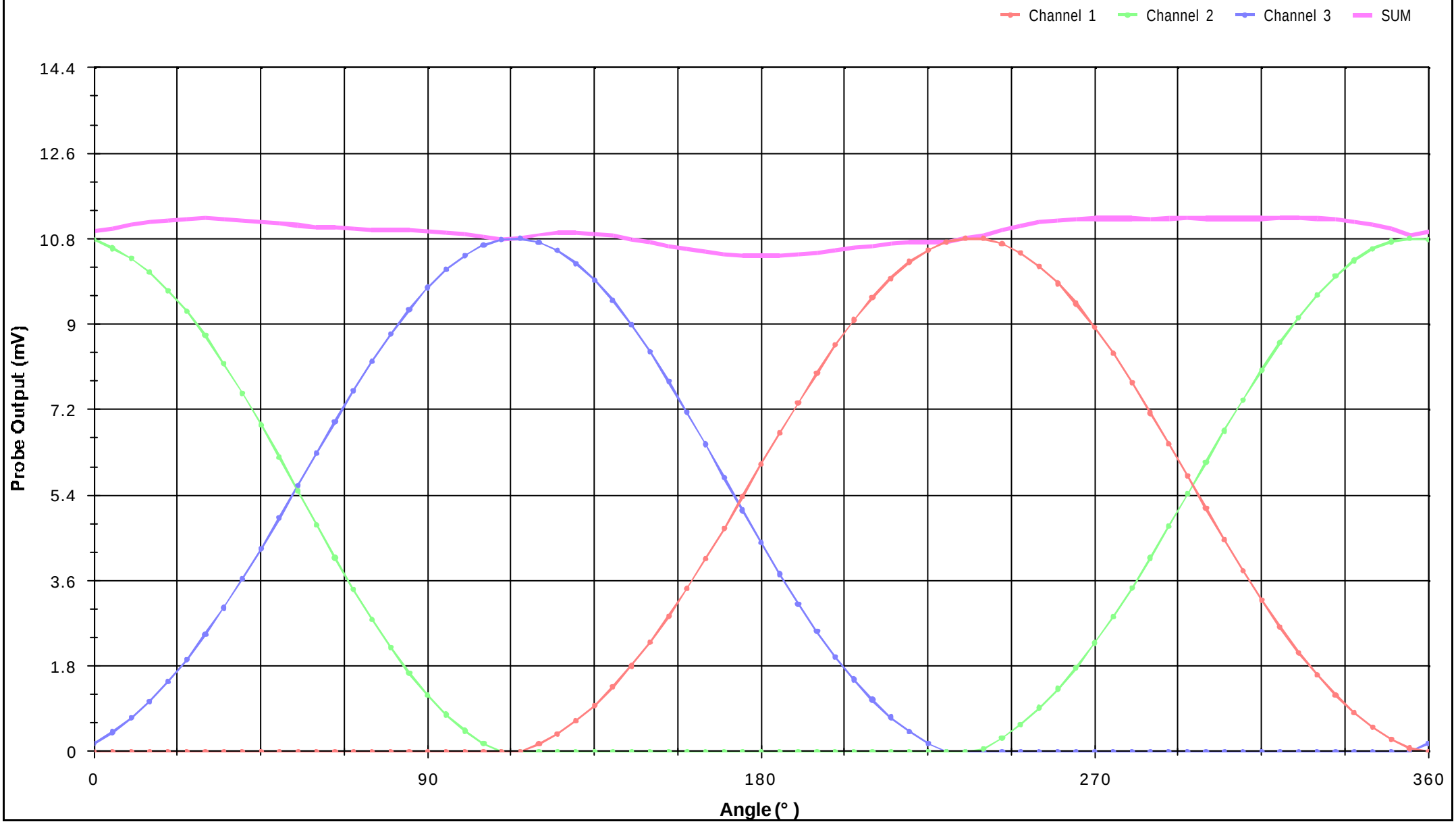


EXHIBIT 10. PROBE CALIBRATION FREE SPACE

Probe Type	E-Field Triangle
Model Number	UT-ETR
Serial Number	0200-01
Manufacturer	3D-EMC Laboratory Inc.
Manufactured Date	February 2000
Length	270 [mm]
Internal sensor offset	2.25 [mm]
Tip diameter	4.0 [mm]
Sensor Factor	10.8 [mV/(mW/cm^2)] or 2.864 [uV/(V/m)^2]

Free space calibration at 463MHz - Amplifier Settings and Isotropy

Probe Name : UT-ETR-0200-1
Type : E-field (Triangular beam), Offset(mm) : 2.25
Frequency(MHz) : 463
Amplifier Setting : 0.00539550, 0.00499076, 0.00613636
Calibrated Date : 18/03/2002 10:56:46 AM



Free space calibration at 463MHz - Amplifier Settings and Isotropy

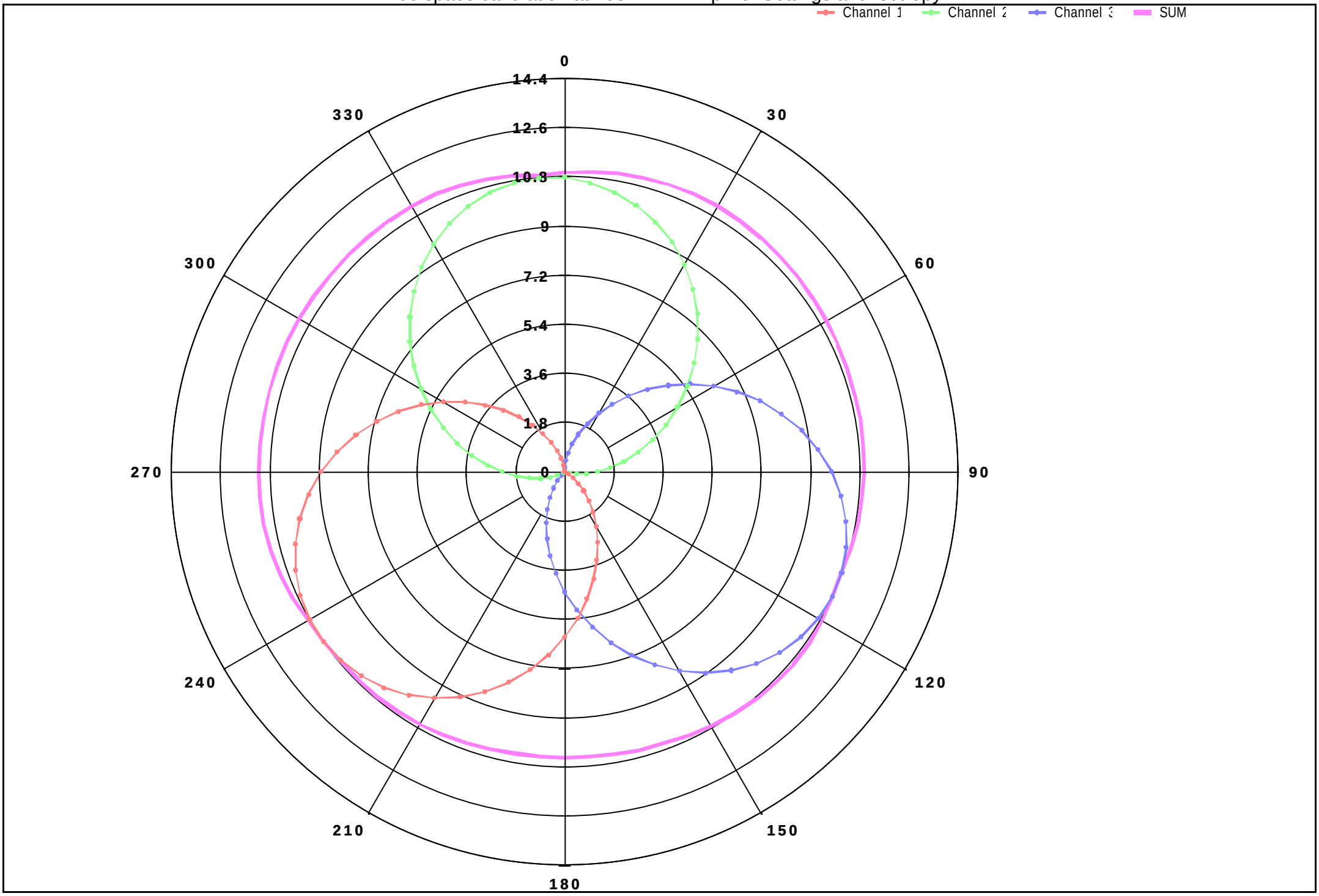
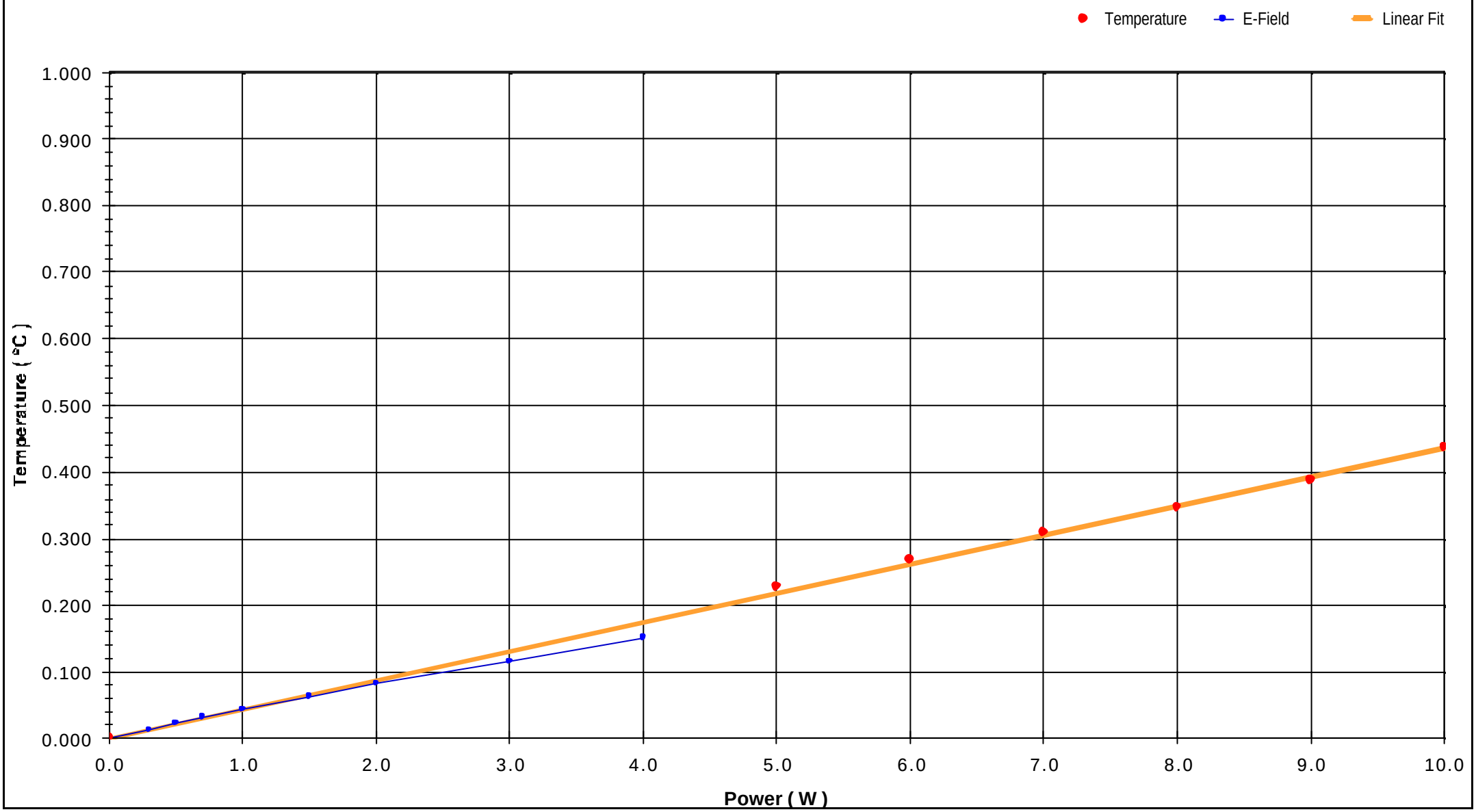


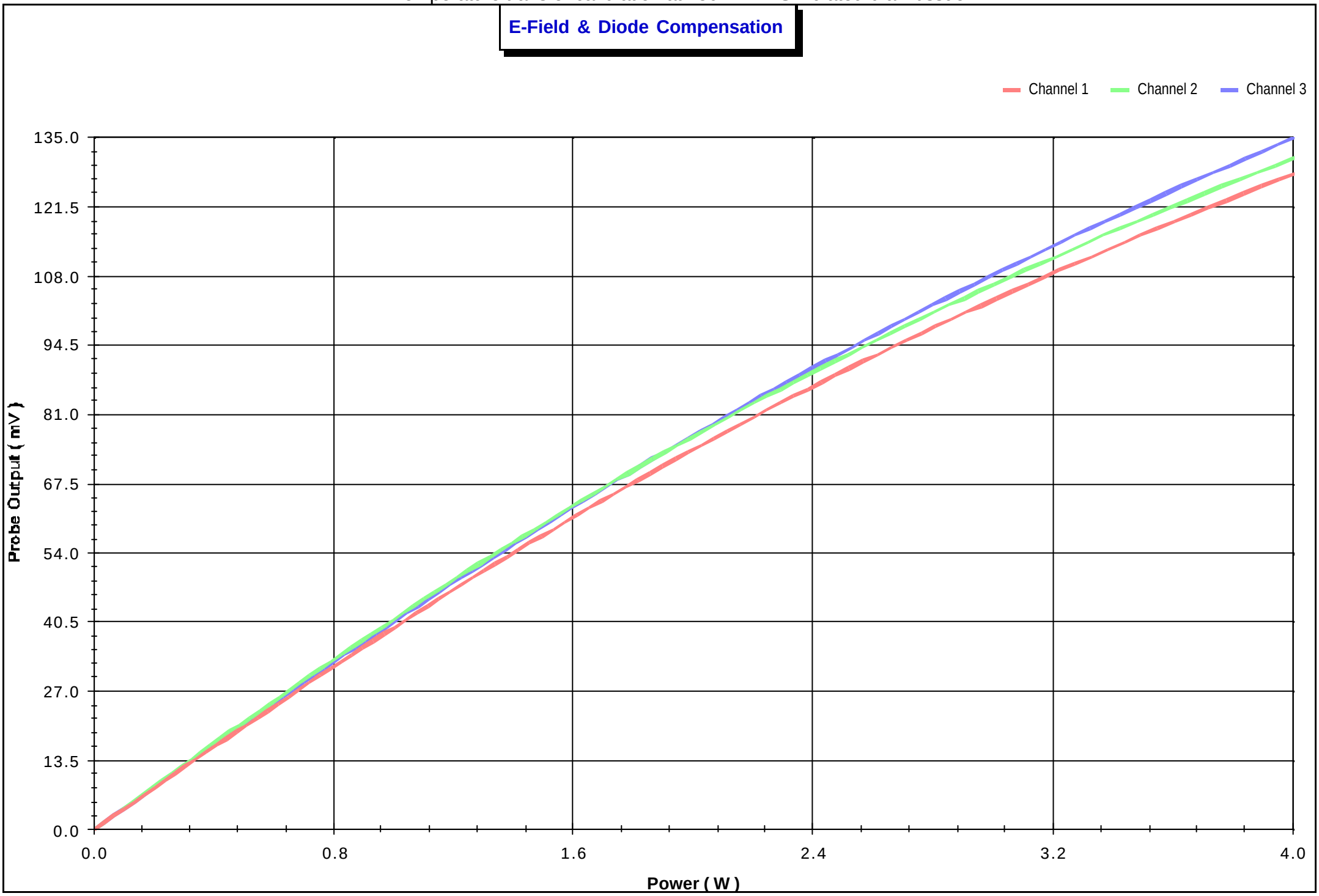
EXHIBIT 11. PROBE TEMPERATURE TRANSFER CALIBRATION

Temperature transfer calibration at 450 MHz - Simulated brain tissue

Probe Name : UT-ETR-0200-1
Type : E-field (Triangular beam), Offset(mm) : 2.25
Frequency(MHz) : 450, Conversion Factor : 0.8898
Simulated Tissue Type : Brain
Dielectrical Const. : 44.126, Conductivity : 0.877
Temperature - Simulated Tissue : 22.6° C, Room : 22.6° C
Calibrated Date : 22/03/2002 2:17:51 PM

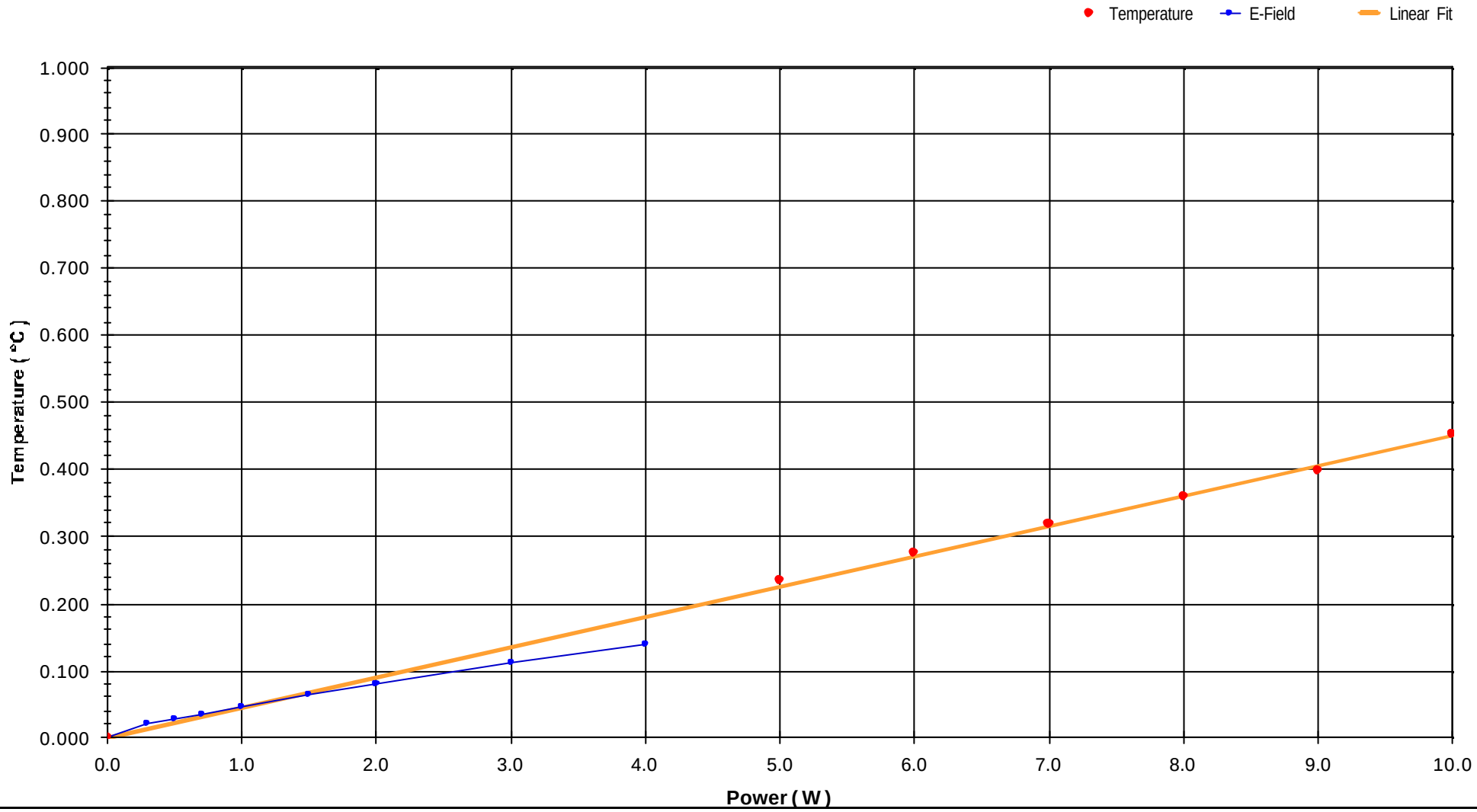


Temperature transfer calibration at 450 MHz - Simulated brain tissue



Temperature transfer calibration at 450 MHz - Simulated muscle tissue

ProbeName:UT-ETR-0200-1
Type:E-field(Triangularbeam),Offset(mm):2.25
Frequency(MHz):450,ConversionFactor:0.7391
SimulatedTissueType:Muscle
DielectricalConst.:58.7857,Conductivity:0.939
Temperature-SimulatedTissue:21.3°C,Room:22°C
CalibratedDate:19/03/200211:04:37AM



Temperature transfer calibration at 450 MHz - Simulated muscle tissue

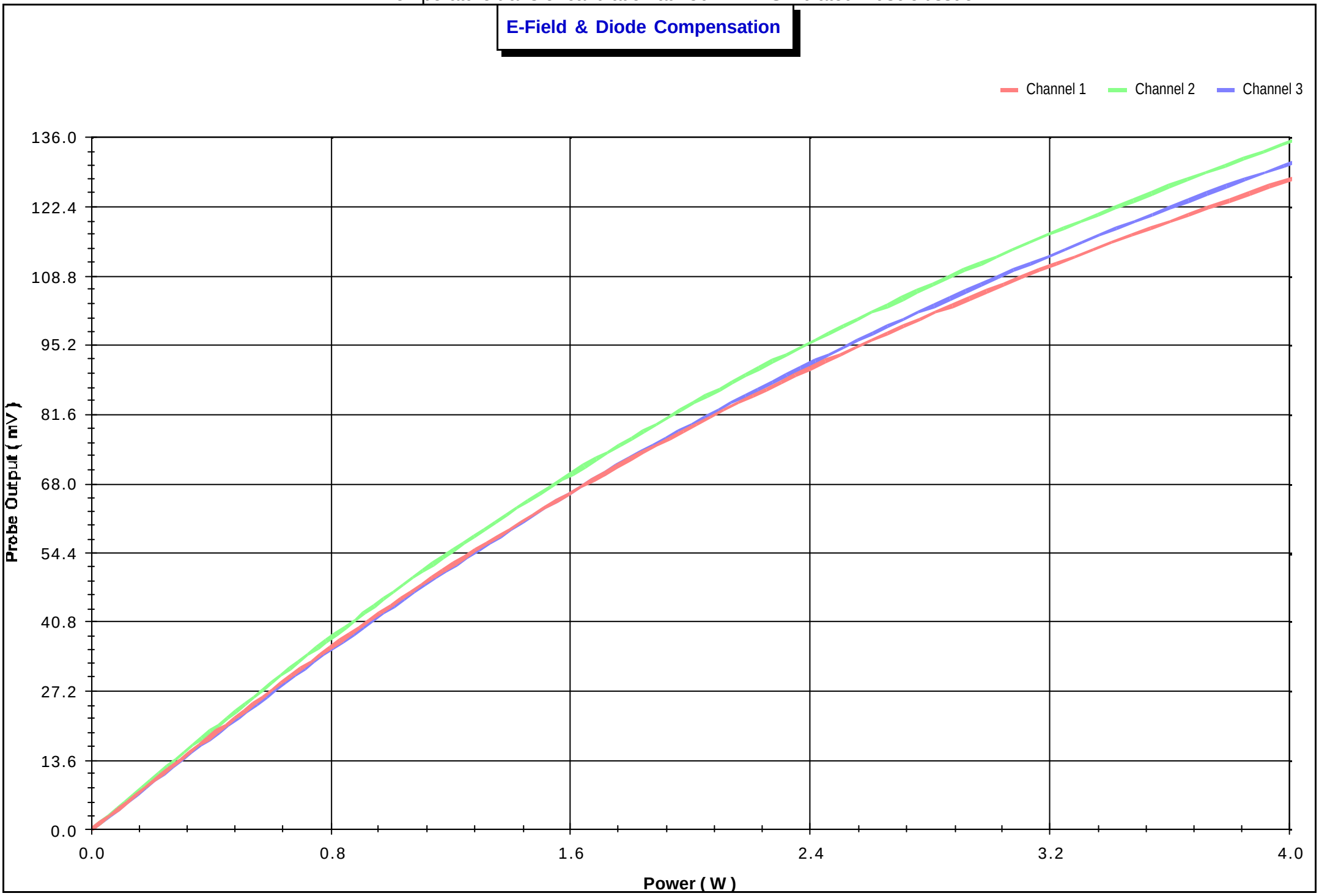
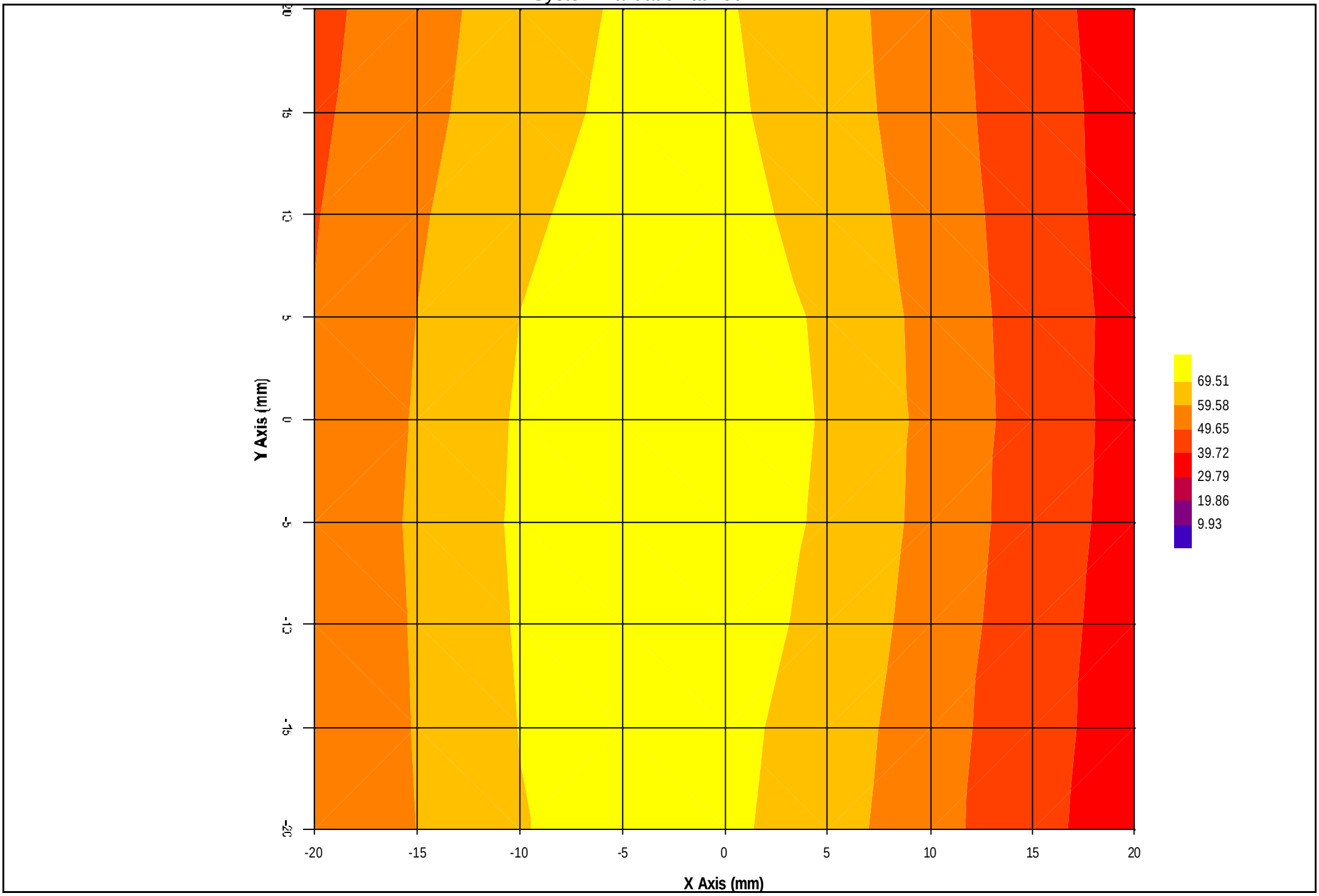
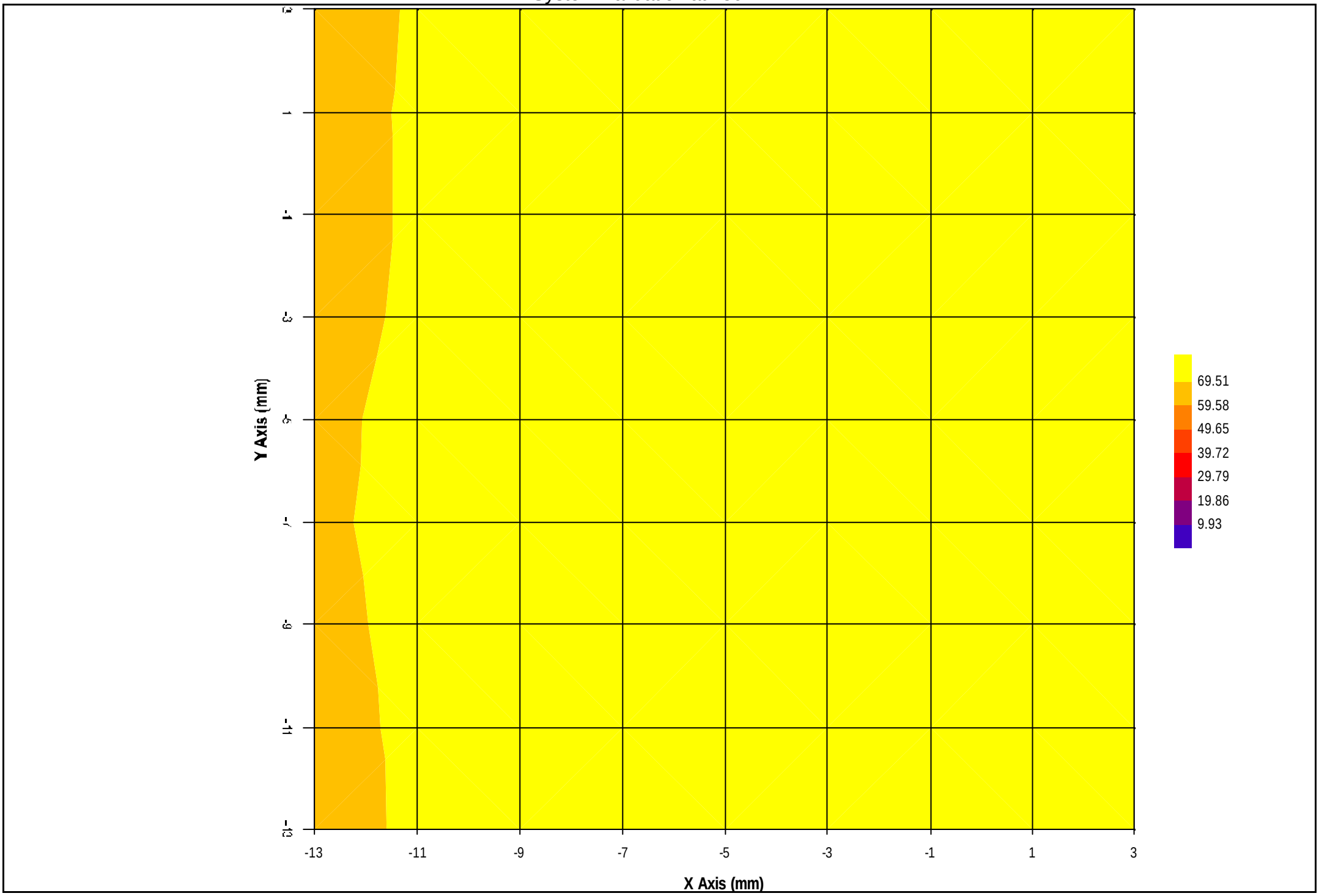


EXHIBIT 12. SYSTEM VALIDATION

The system was verified in the flat phantom (2.0mm ± 0.2mm base thickness) using 450MHz dipole validation kit (M/N: CD450 S/N: 1001) manufactured by 3D-EMC Lab. A forward power of 1.0 W was fed to the dipole and the distance between the dipole axis and the liquid were 15mm as specified in IEEE Standards 1528.

Validation Kit	Target SAR (W/Kg) over 1g volume	SAR (W/Kg) over 1g volume
3D-EMC M/N: CD450	4.9	5.106

System Validation at 450 MHz



System Validation at 450 MHz