ENGINEERING TEST REPORT

Point of Sale Device
Model No.: NURIT 8000

Tested For

Lipman USA, Inc.
50 Gordon Dr.
Syosset, NY
USA, 11791

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.: LIP-013-SAR

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: March 21, 2002	
Report Prepared by: JaeWook Choi Issued Date: March 21, 2002	Tested by: JaeWook Choi Test Dates: March 8, 2002

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

UltraTech

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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:	Lipman USA, Inc.
Address:	50 Gorgon Dr. Syosset, NY USA, 11791
Contact Person:	Mr. John Carpino Phone #: +1 516 484 9898

MANUFACTURER:	
Name:	Lipman Electronic Engineering, Ltd.
Address:	11 Haamal St Park Afek Rosh Haayin 48092 Israel
Contact Person:	Amit Chhabra Phone #: +1 800 454 7626 ext. 2300 +1 516 484 9898 ext. 2300

2.2. DEVICE UNDER TEST (DUT) DESCRIPTION

The following is the information provided by the applicant.

Trade Name	Point of Sale Device
Type/Model Number	NURIT 8000
Serial Number	Test Sample
Type of Equipment	Licensed Non-Broadcast Station Transmitter
Frequency of Operation	806 – 821 MHz
Rated RF Power	2 W (conducted)
Modulation Employed	FM data
Emissions Designation	20K0F1D
Antenna Type	Patch
External Power Supply	Lipman USA inc., Power Supply/Charger Model No.: TRF00050
Primary User Functions of DUT:	Wireless hand held POS/EDC terminal for credit, debit and ERT transactions

2.3. LIST OF DUT'S ACCESSORIES:

Lipman USA Inc., Power Supply/Charger, Model No.: TRF00050

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

N/A

2.5. ANCILLARY EQUIPMENT

IBM Laptop, Type 2625-DEF, Serial No. 78-WWM48 96/05

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 DUT'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

1. EUT will not transmit without connecting the RS232C cable at the back of EUT by its nature at the moment. Therefore the evaluation was performed with RS232C cable connected and the other end of cable connected to the laptop for control.
2. EUT was configured to transmit the signal with **25% duty cycle** since it can transmit only a few seconds with 100% duty cycle then automatically shut down, and also it is limited on the network the radio modem is designed to be used in. (Refer to EXHIBIT 12. Duty Cycle Information)

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:

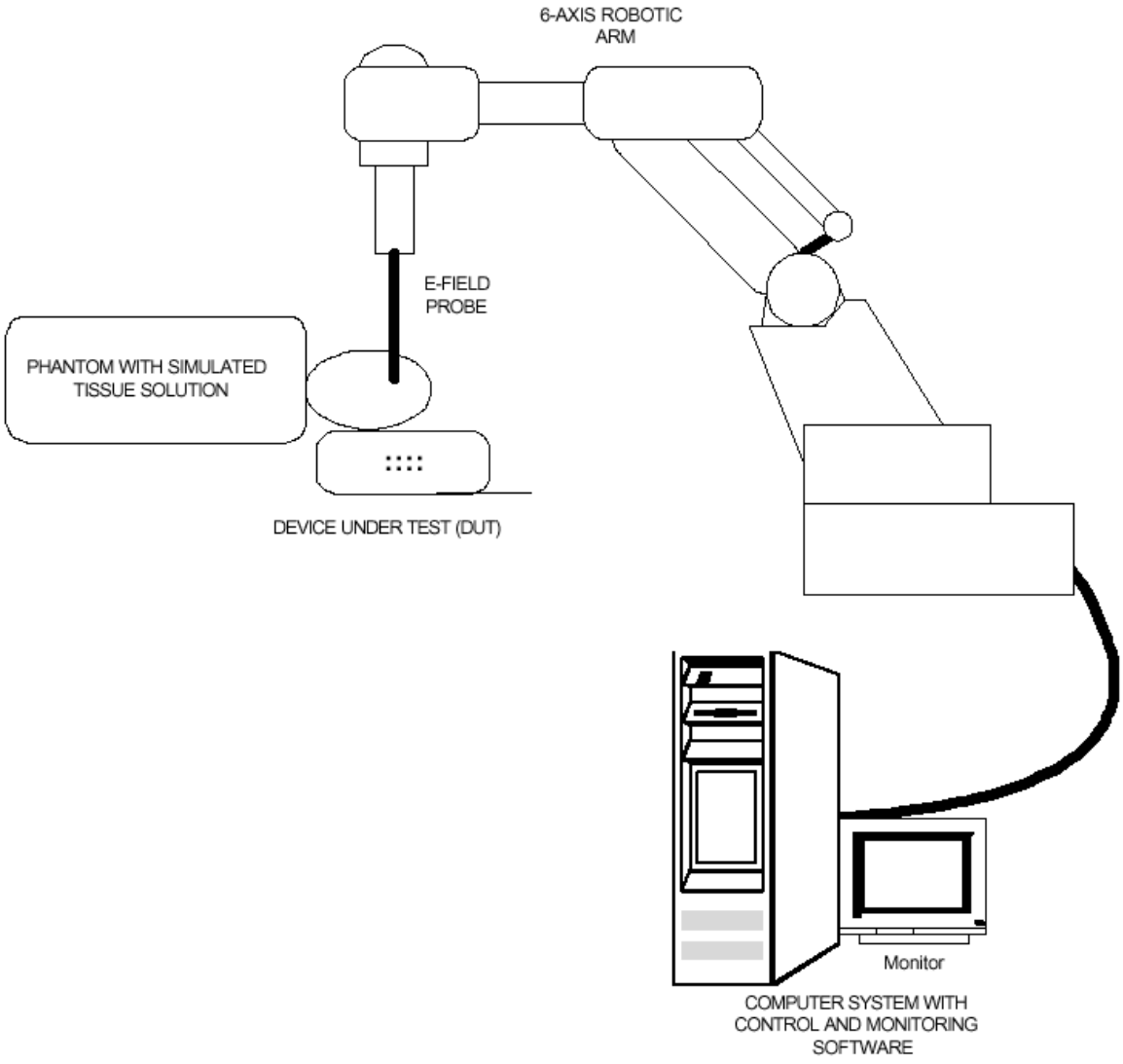


EXHIBIT 3. SUMMARY OF TEST RESULTS

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 **1.300 W/Kg** at **20 mm separation** with **25 % duty cycle** (40 ms : 120 ms)

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	Point of Sale Device	Robot Type	6 Axis
Model Number	NURIT 8000	Scan Type	SAR - Area/Zoom
Serial Number	Test Sample	Measured Field	E
Frequency Band (MHz)	806 – 821	Phantom Type	2mm base Flat Phantom
Frequency Tested (MHz)	806.0, 813.5, 821.0	Phantom Position	Waist
Nominal Output Power (W)	2 W Conducted	Room Temperature	21 °C ± 1 °C
Antenna Type	Integrated PCB mount	Room Humidity	35 % ± 10 %
Signal Type	FM	Tissue Temperature	21 °C ± 1 °C
Duty Cycle	25% (40 ms : 120 ms)		

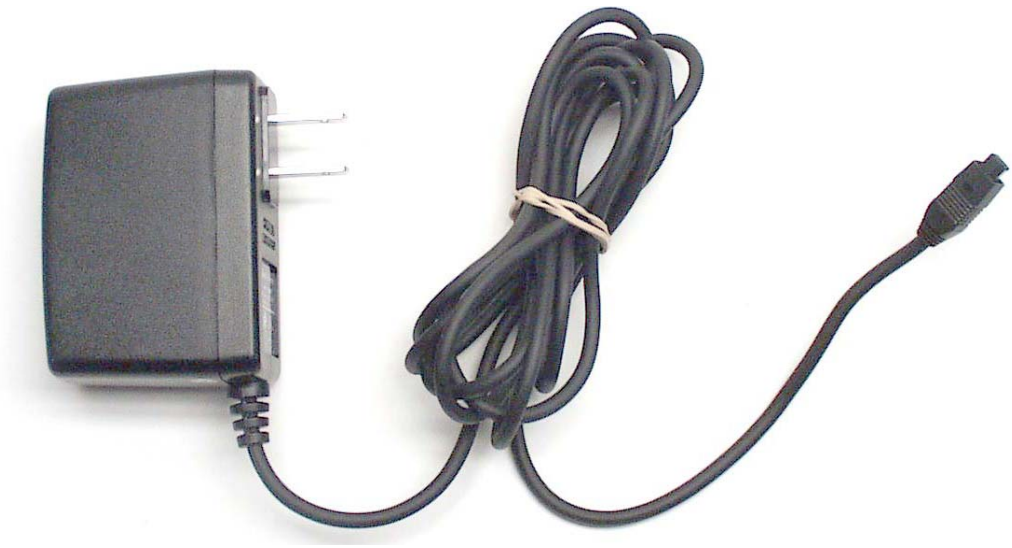
Type of Tissue	Muscle
Target Frequency (MHz)	835
Target Dielectric Constant	55.2 ± 5%
Target Conductivity (S/m)	0.97 ± 5%
Composition (by weight)	DI Water (53.13 %) Sugar (45.62 %) Salt (0.93%) HEC (0.23 %) Bactericide (0.10%)
Measured Dielectric Constant	53.53
Measured Conductivity (S/m)	0.965
Probe Name	UT-ETR-0200-1
Probe Orientation	Isotropic
Probe Offset (mm)	2.25
Sensor Factor	10.8
Conversion Factor	0.9664
Calibration Date (MM/DD/YY)	01/31/2002

4.2. PHOTOGRAPH OF EUT WITH ALL ACCESORIES

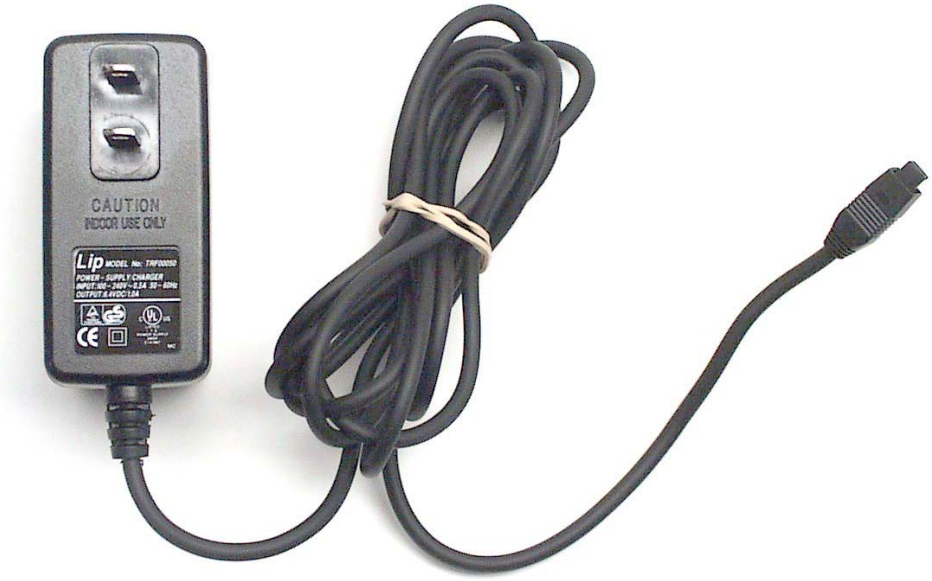
<Front View>


Lip
NURIT 8000
LIPMAN ELECTRONIC ENGINEERING LTD
COMPLIES WITH FCC RULES PARTS 15
INPUT VOLTAGE: 9 V/1A MAX
USE RECOMMENDED LIPMAN CHARGER ONLY
MADE IN ISRAEL

<Back View>



<Side View - Lipman USA Inc., Power Supply/Charger, Model No.: TRF00050>



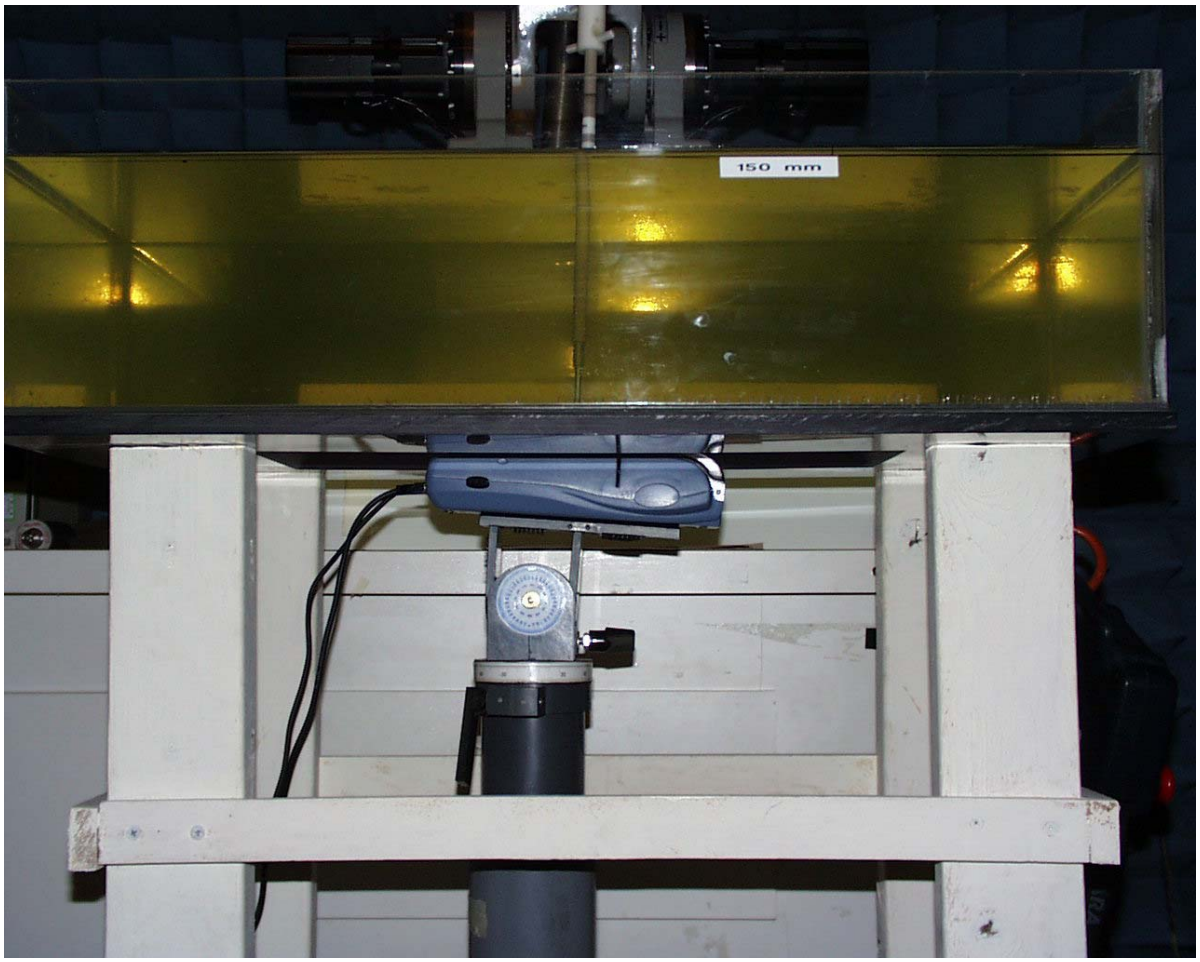
<Rear View - Lipman USA Inc., Power Supply/Charger, Model No.: TRF00050>

<Front View – Lipman USA, Inc. Li-ion Battery Pack, Model BAT00021, 7.2V, 1450mAh>

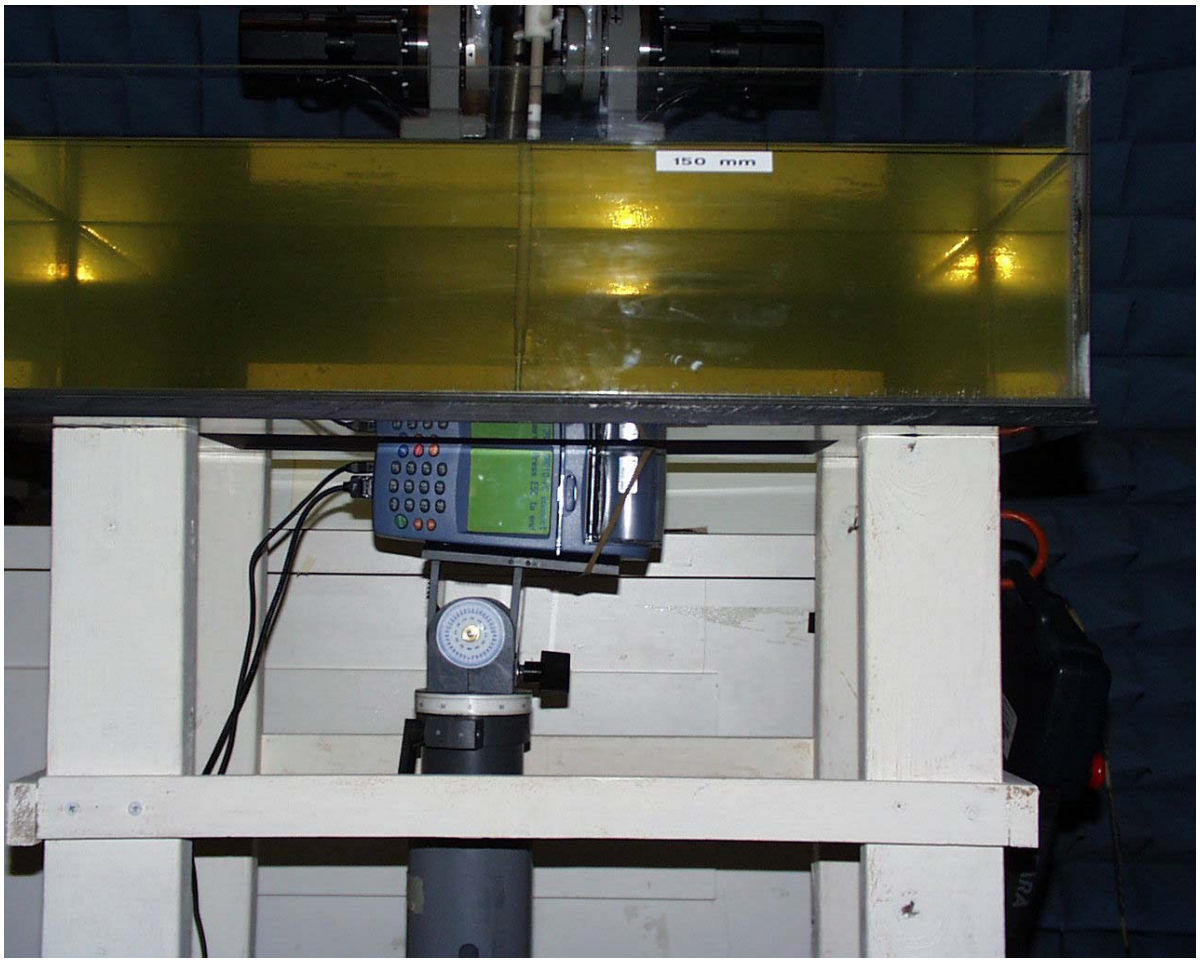
<Rear View – Lipman USA, Inc. Li-ion Battery Pack, Model BAT00021, 7.2V, 1450mAh>

4.3. PHOTOGRAPHS OF EUT POSITION (BODY WORN POSITION)

< Left face in contact with the phantom >

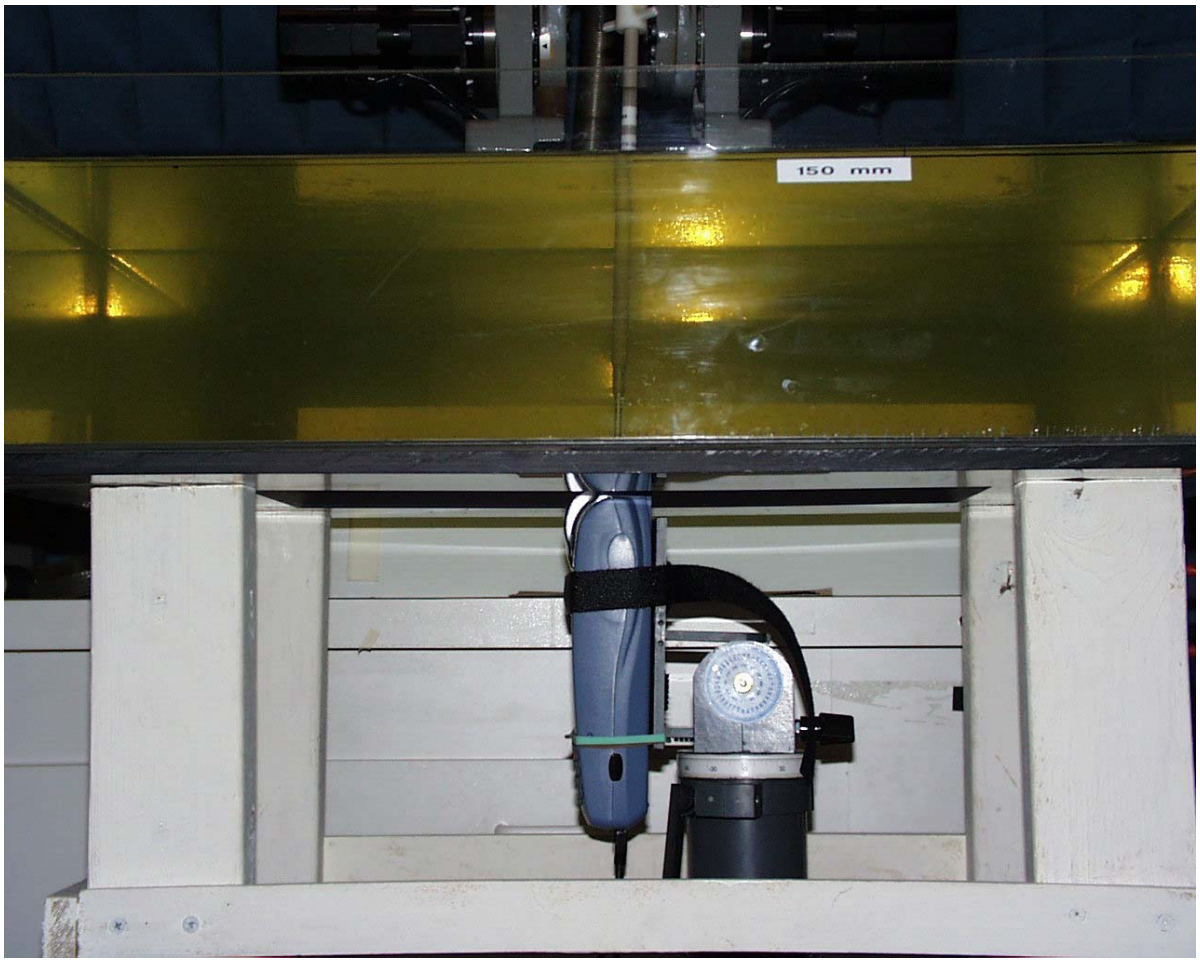


< Front face in contact with the phantom >

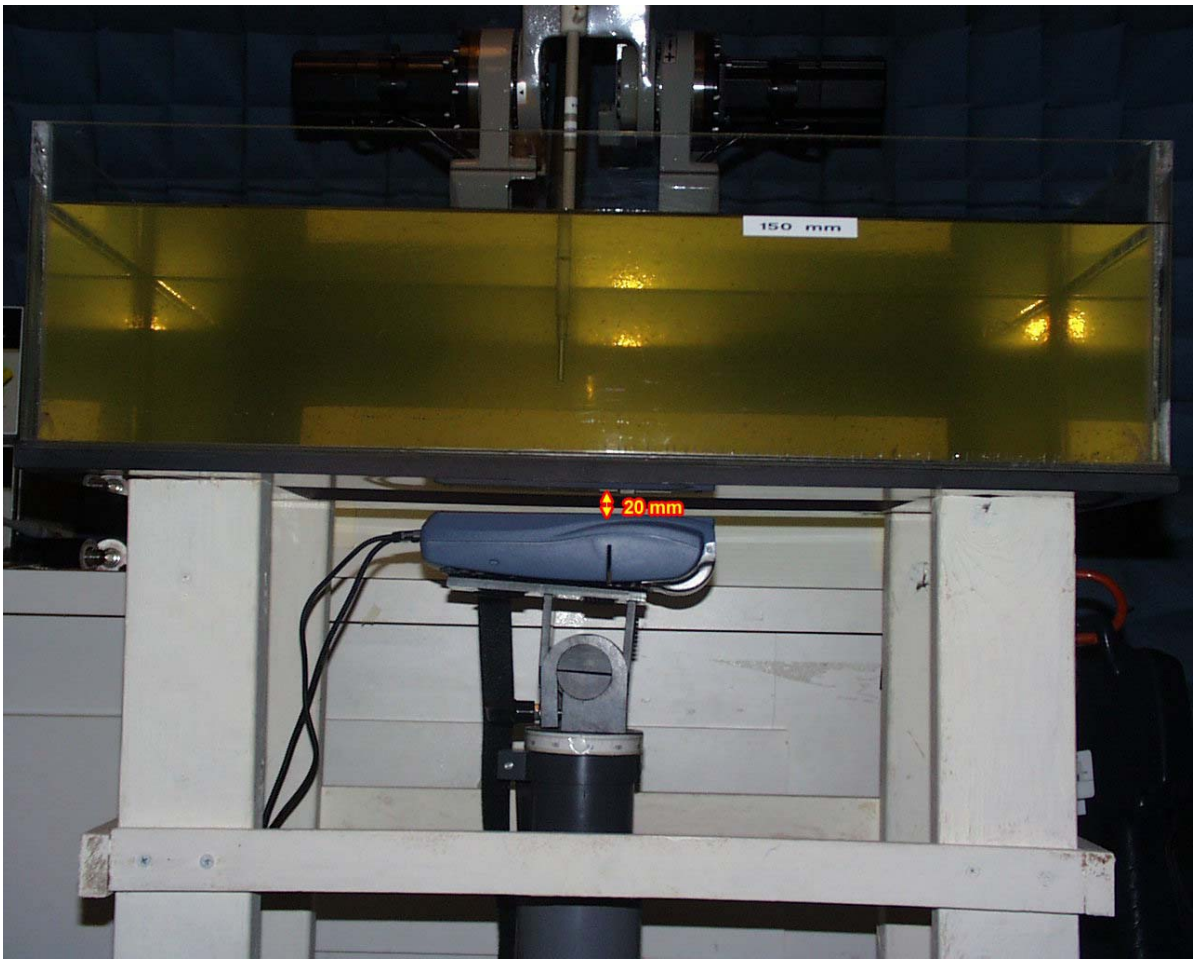


< Right face in contact with phantom >

< Back face toward phantom >



< Top face toward phantom >

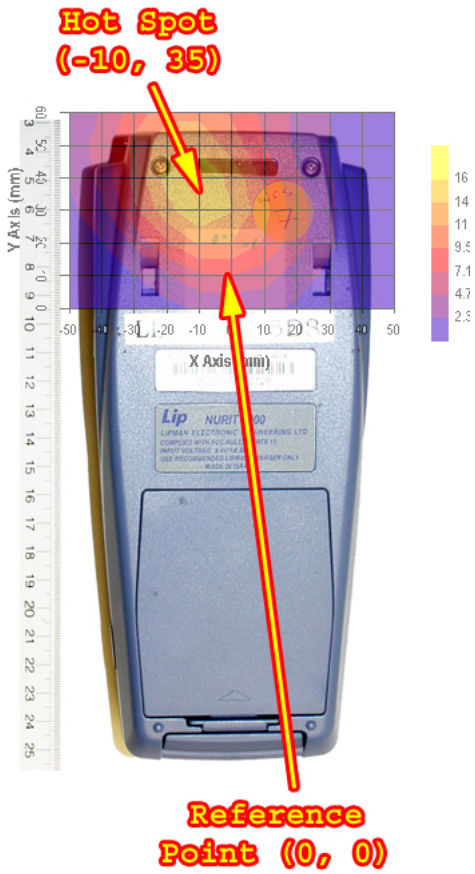


< Back face toward phantom with 20 mm separation >

4.4. MAXIMUM FIELD LOCATION (BODY)

The maximum field was found to be located at (-10, 35) with the test configuration as described below:

- Body-worn position
- The Back of EUT in contact with the phantom
- 821.0 MHz
- 20 mm separation
- 25 % duty cycle



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.

The reference point (0, 0) in the plots was set to a mid-point in the projected image of EUT to the phantom surface as shown above since EUT doesn't have an explicit point for the reference such as the base of antenna, the center of ear pieced, and so on.

4.5. PEAK SPATIAL-AVERAGE SAR MEASURED

Phantom Configurations	Device Test Positions	Antenna Position	SAR (W/kg) Device Test Frequency		
			896.0 MHz	813.5	821.0 MHz
Body-worn (Waist)	Back face toward the phantom, 20 mm separation, 25 % duty cycle	Internal	0.884	1.134	**1.300**

4.6. SAR MEASUREMENT DATA

4.6.1. Body-worn configuration Results

EUT Configurations	Separation distance (mm)	Antenna Position	SAR (W/kg) Device Test Frequency		
			806.0 MHz	813.5 MHz	821.0 MHz
Back face toward the phantom, 25% duty cycle	0	Internal		8.786	
	15	Internal		1.935	
	20	Internal	0.884	1.134	**1.300**

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 °/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 DUT. 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

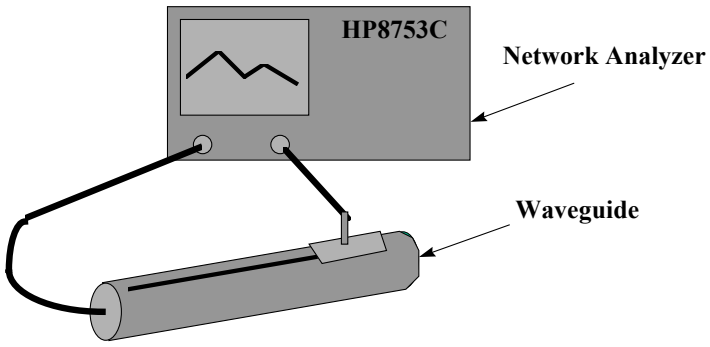
2) Slotted Coaxial Waveguide

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

Δθ 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

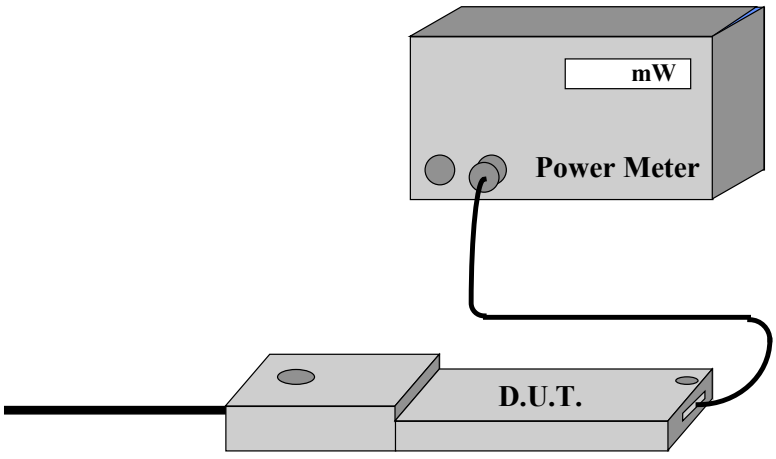
The voltage, (1 cm) above the phantoms surface (E_{tot} 1 cm), is needed to calculate the exposure over one gram of tissue. This SAR value that estimates the average over 1 gram of tissue, is obtained by taking the integral over 1 cm^2 surface of the measured field along the exponential decay curve of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

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 D.U.T. 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 D.U.T. 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.

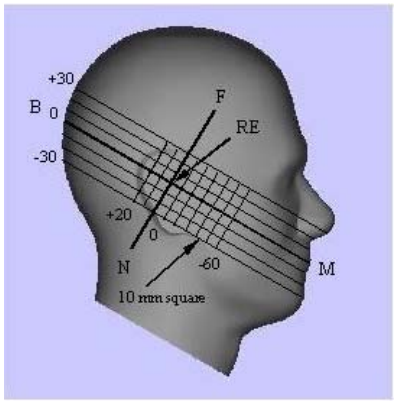


Figure 5.1 – Side view of the phantom showing relevant marking

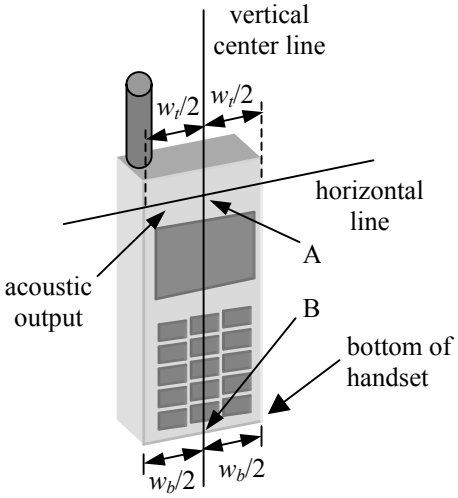


Figure 5.2a – Handset vertical and horizontal reference lines – fixed case

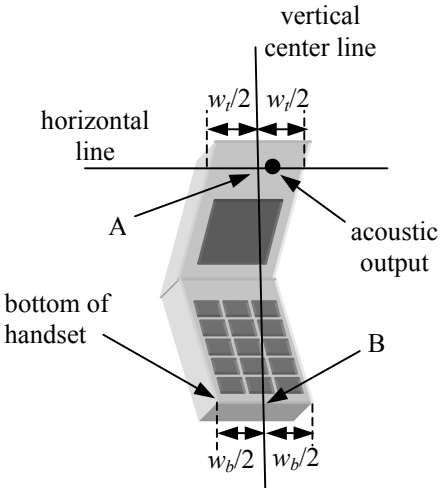


Figure 5.2b – Handset vertical and horizontal reference lines – "clam-shell"

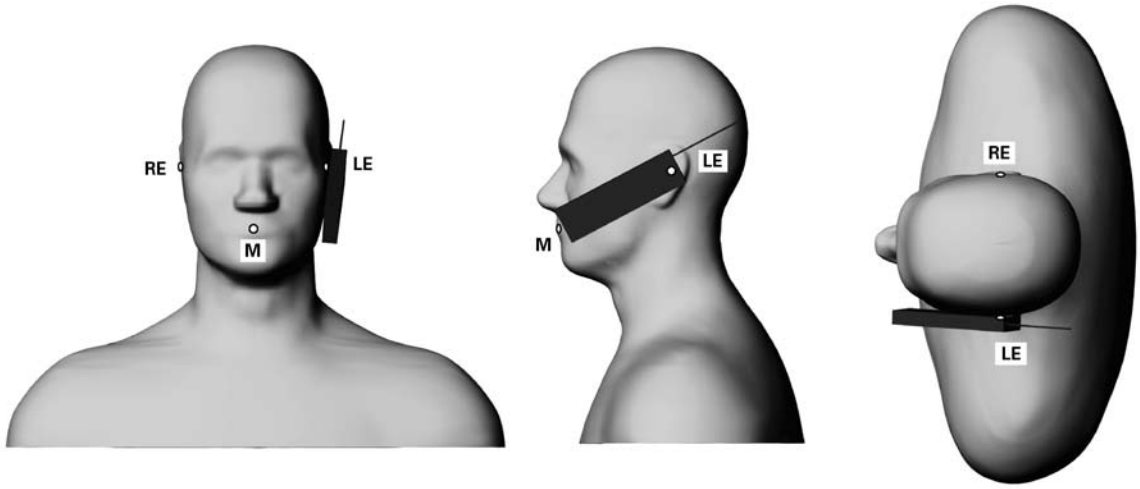


Figure 5.3 – Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only (also see Section 4).

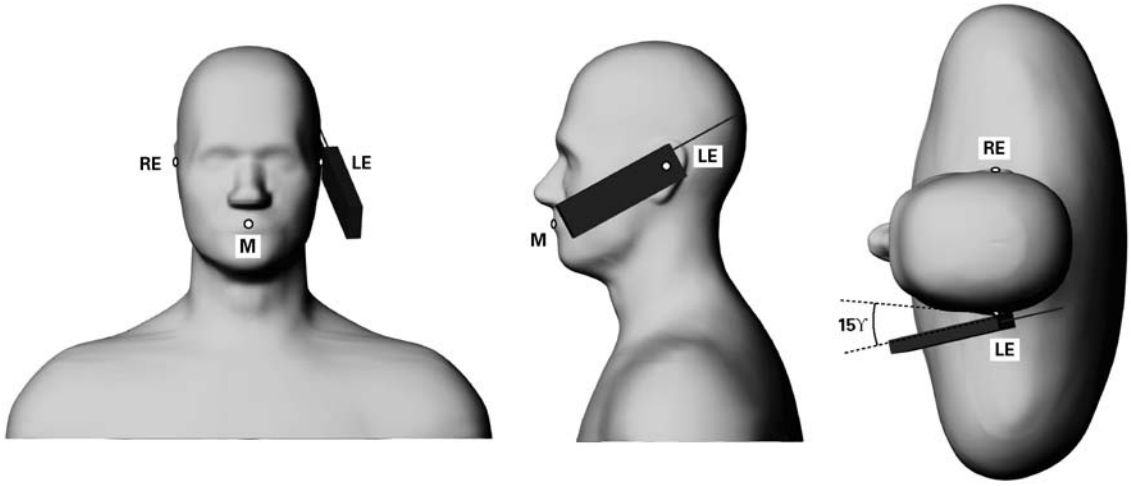


Figure 5.4 – Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only (also see Section 4).

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."

6.3. PRESCAN DATA FOR WORST CONFIGURATION OF RF EXPOSURE

6.3.1. Body-worn configurations

EUT Configurations	Antenna Position	SAR (W/kg) Device Test Frequency
		813.5 MHz
Back face in contact with phantom, 25% duty cycle	Internal	**8.786**
Front face in contact with phantom, 25% duty cycle	Internal	1.007
Left face in contact with phantom, 25% duty cycle	Internal	0.895
Right face in contact with phantom, 25% duty cycle	Internal	0.736
Top face in contact with phantom, 25% duty cycle	Internal	2.767

Prescans for the feasible configurations had been performed in order to determine the worst case under the specific configurations as described in the table. Through these prescans, the hot spot was found to be located at the vicinity of the base of the antenna. The test configurations in which a failure was found, were re-evaluated by increasing the separation distance until it was compliant with FCC limit.

EXHIBIT 7. BODY-WORN CONFIGURATION SAR MEASUREMENTS

7.1. BACK FACE TOWARD THE PHANTOM

EUT Configurations	Separation distance (mm)	Antenna Position	SAR (W/kg) Device Test Frequency		
			806.0 MHz	813.5 MHz	821.0 MHz
Back face toward the phantom, 25% duty cycle	0	Internal		8.786	
	15	Internal		1.935	
	20	Internal	0.884	1.134	**1.300**

The reference point (0, 0) in the plots was set to a mid-point in the projected image of EUT to the phantom surface as shown at the picture in **4.4. maximum field location (body) (pg. 19)** since EUT doesn't have an explicit point for the reference such as the base of antenna, the center of ear pieced, and so on.

Back of EUT in contact with the phantom, 813.5 MHz

Test Information

Date : 08/03/2002
Time : 2:23:28 PM

Product	: Lipman Point of Sales	**Test**	: SAR
Manufacturer	: LIPMAN USA	**Frequency (MHz)**	: 813.5
Model Number	: NURIT 8000	**Nominal Output Power (W)**	: 2.0
Serial Number	:	**Antenna Type**	: Patch
FCC ID Number	: O2SNURIT8000AI	**Signal**	: 25%(40ms:120ms)

Phantom	: Flat	**Dielectric Constant**	: 53.53
Simulated Tissue	: Muscle	**Conductivity**	: 0.965

Probe	: UT-ETR-0200-1	**Antenna Position**	: Internal
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 2.0
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.966	**Pre Field Measurement (mV)**	: 7.9
Calibrated Date	: 31/01/2002	**Post Field Measurement (mV)**	: 7.8(-1.5%)

Amplifier Setting :

Channel 1 : 0.0047 Channel 2 : 0.0044 Channel 3 : 0.0055

Location of Maximum Field :

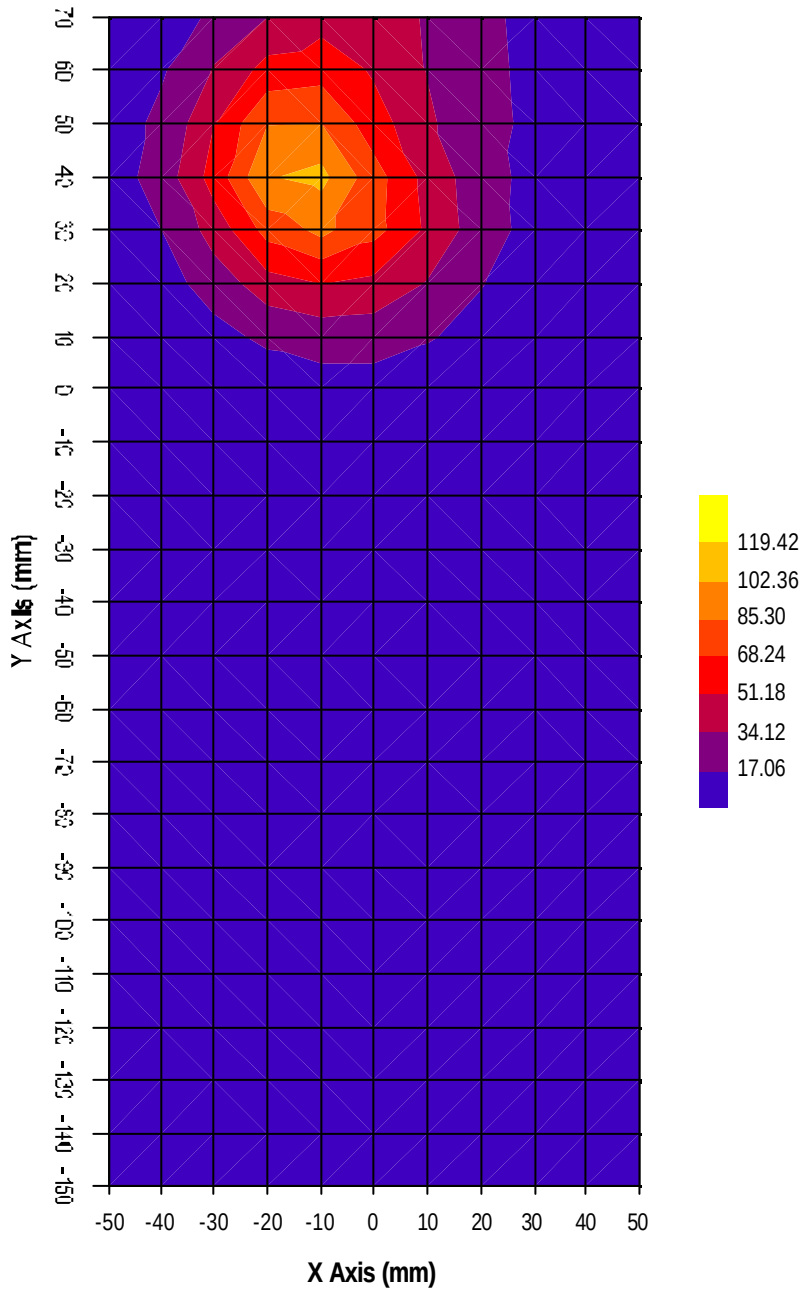
X = -15 Y = 40

Measured Values (mV) :

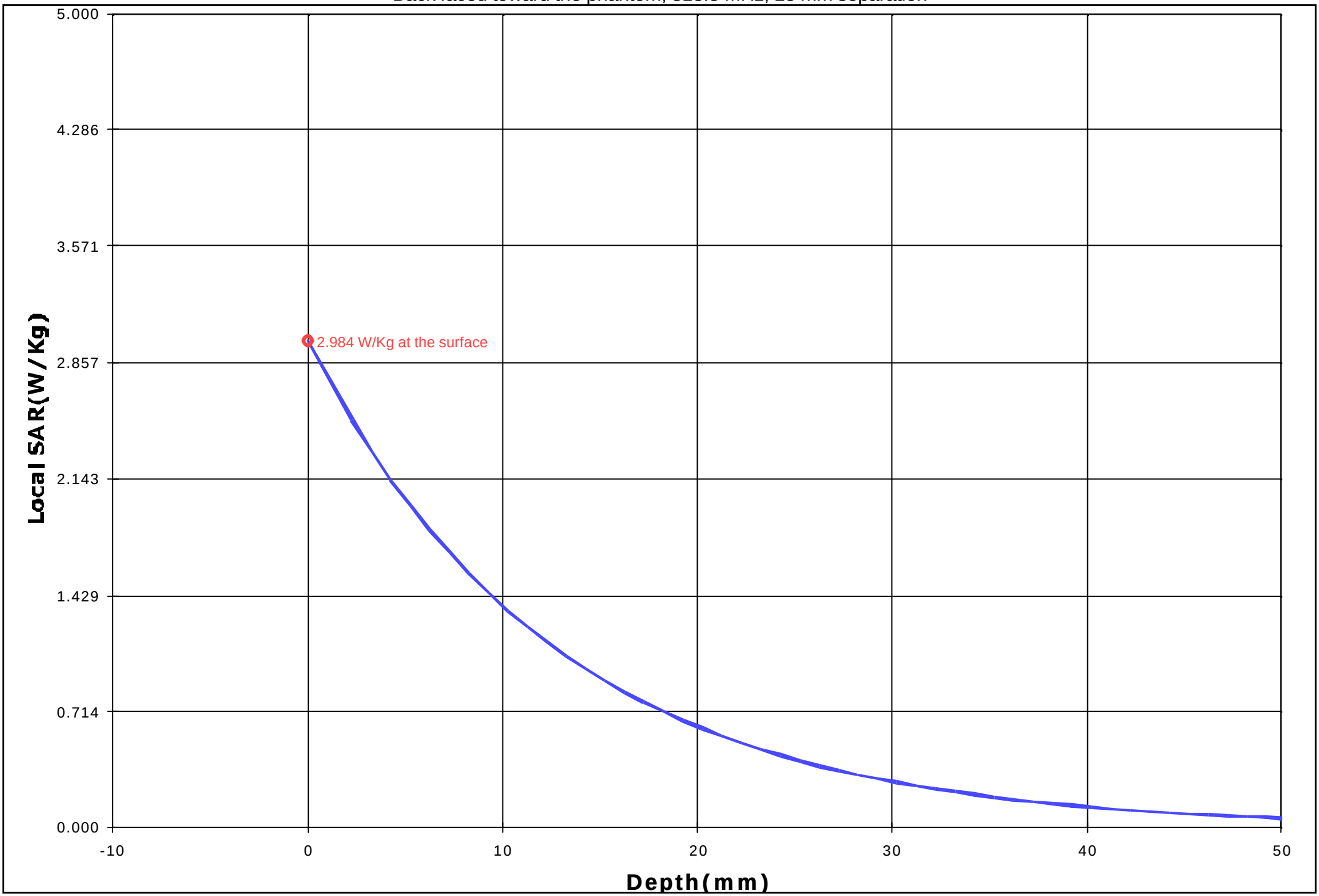
119.281	120.980	111.758	91.768	84.914	73.800
66.069	63.593	57.122	49.711	46.361	

Peak Voltage (mV) : 146.822 **1 Cm Voltage (mV)** : 60.137 **SAR (W/Kg)** : 8.786

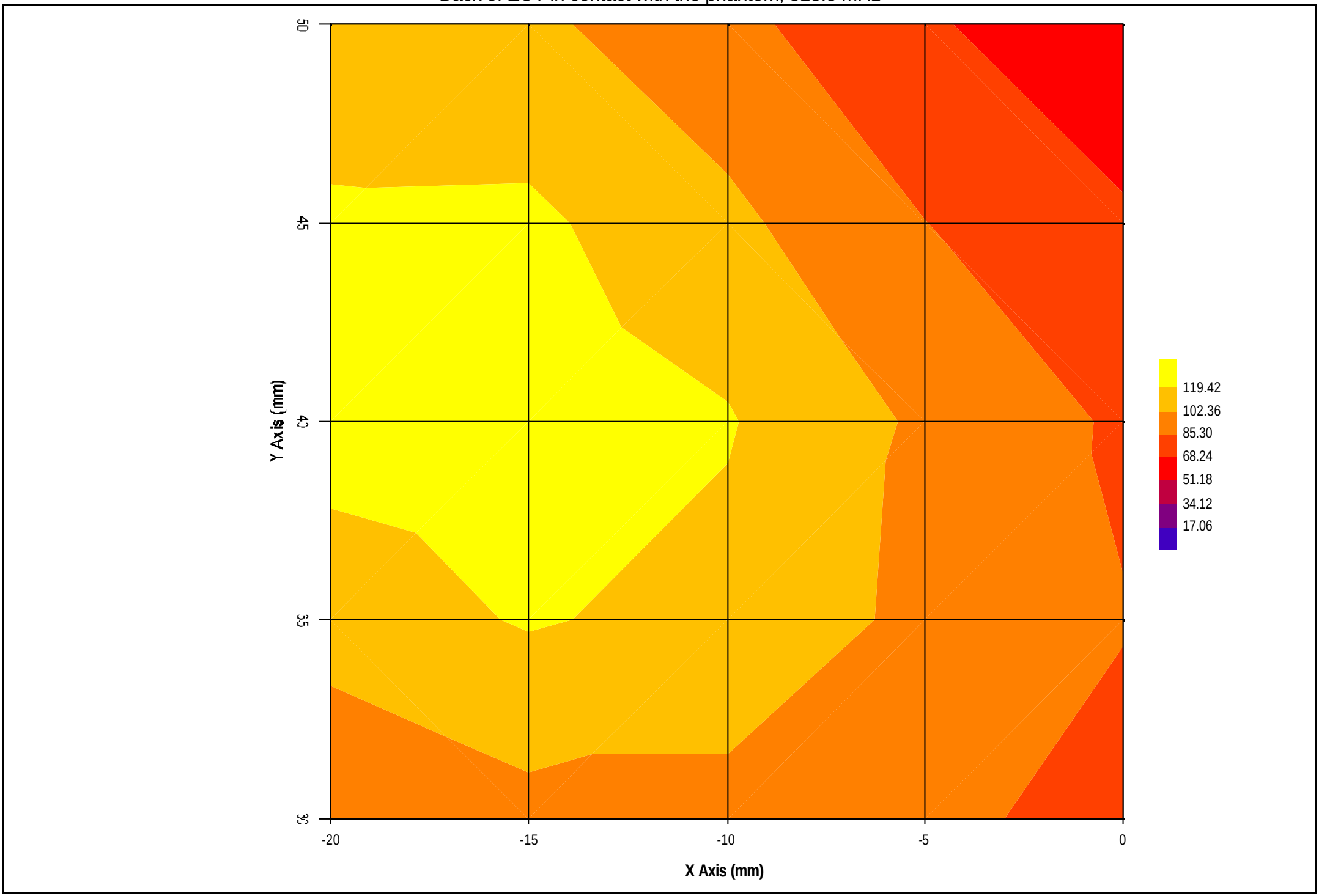
Back of EUT in contact with the phantom, 813.5 MHz



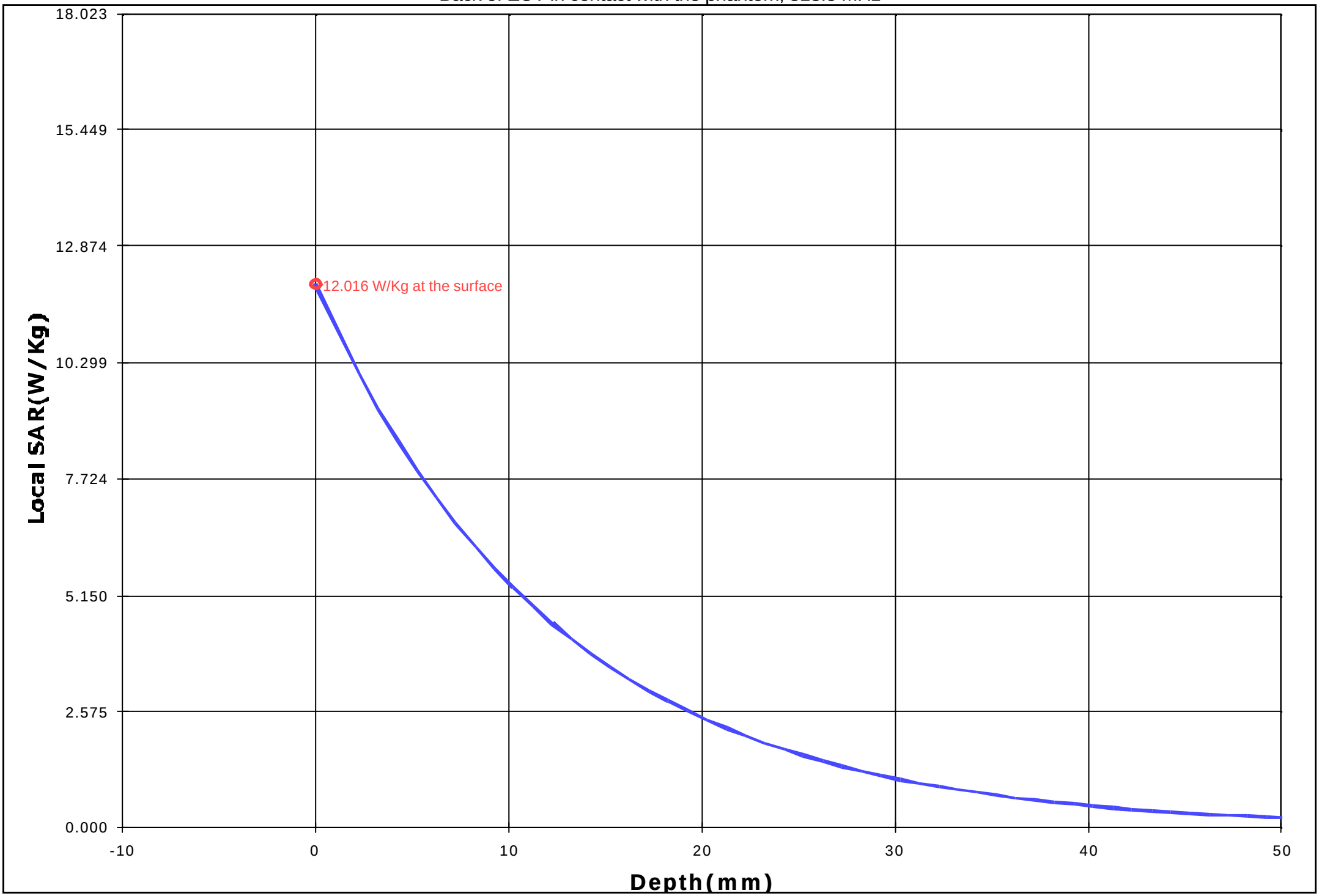
Back faced toward the phantom, 813.5 MHz, 15 mm separation



Back of EUT in contact with the phantom, 813.5 MHz



Back of EUT in contact with the phantom, 813.5 MHz



Back faced toward the phantom, 813.5 MHz, 15 mm separation

Test Information

Date : 08/03/2002
Time : 4:44:44 PM

Product	: Lipman Point of Sales	**Test**	: SAR
Manufacturer	: LIPMAN USA	**Frequency (MHz)**	: 813.5
Model Number	: NURIT 8000	**Nominal Output Power (W)**	: 2.0
Serial Number	:	**Antenna Type**	: Patch
FCC ID Number	: O2SNURIT8000AI	**Signal**	: 25%(40ms:120ms)

Phantom	: Flat	**Dielectric Constant**	: 53.53
Simulated Tissue	: Muscle	**Conductivity**	: 0.965

Probe	: UT-ETR-0200-1	**Antenna Position**	: Internal
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 2.0
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.966	**Pre Field Measurement (mV)**	: 6.1
Calibrated Date	: 31/01/2002	**Post Field Measurement (mV)**	: 6.0(-1.5%)

Amplifier Setting :

Channel 1 : 0.0047 Channel 2 : 0.0044 Channel 3 : 0.0055

Location of Maximum Field :

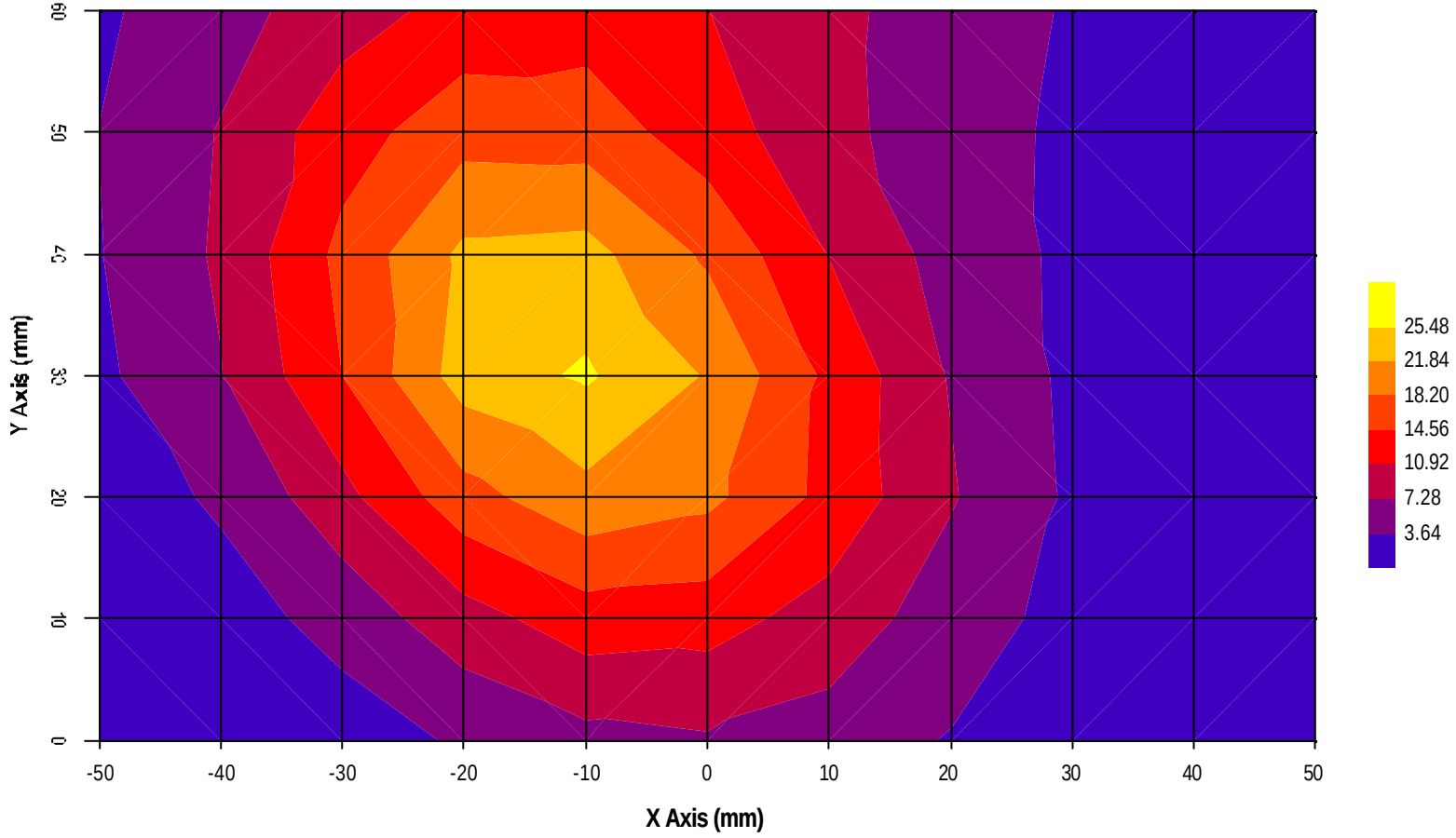
X = -15 Y = 30

Measured Values (mV) :

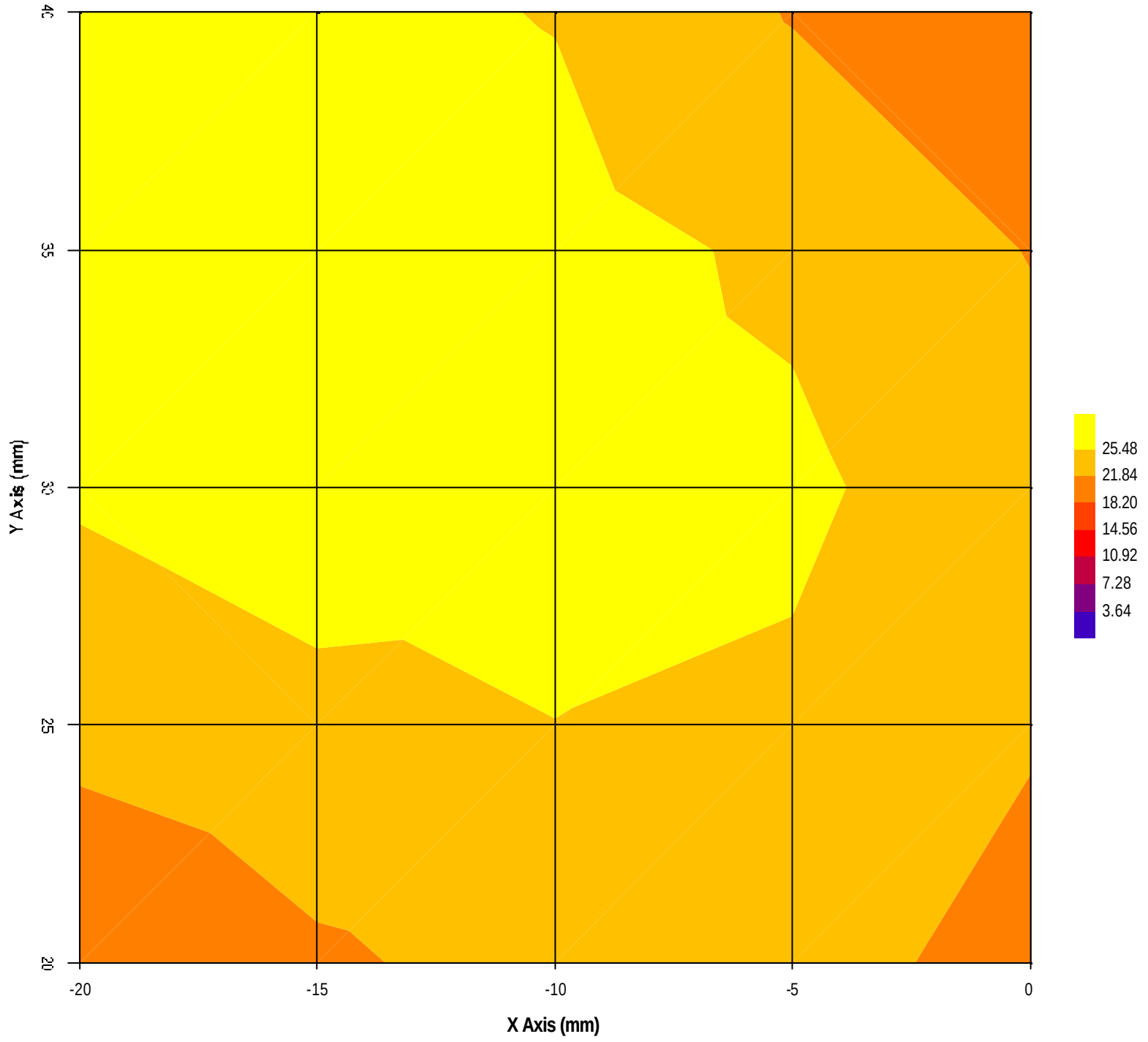
23.580	25.269	22.433	20.081	19.786	17.440
16.629	15.439	14.810	12.740	12.453	

Peak Voltage (mV) : 30.629 **1 Cm Voltage (mV)** : 13.838 **SAR (W/Kg)** : 1.935

Back faced toward the phantom, 813.5 MHz, 15 mm separation



Back faced toward the phantom, 813.5 MHz, 15 mm separation



Test Information

Date : 11/03/2002
Time : 9:44:54 AM

Product	: Lipman Point of Sales	**Test**	: SAR
Manufacturer	: LIPMAN USA	**Frequency (MHz)**	: 806.0
Model Number	: NURIT 8000	**Nominal Output Power (W)**	: 2.0
Serial Number	:	**Antenna Type**	: Patch
FCC ID Number	: O2SNURIT8000AI	**Signal**	: 25%(40ms:120ms)

Phantom	: Flat	**Dielectric Constant**	: 53.53
Simulated Tissue	: Muscle	**Conductivity**	: 0.965

Probe	: UT-ETR-0200-1	**Antenna Position**	: Internal
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 2.0
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.966	**Pre Field Measurement (mV)**	: 1.7
Calibrated Date	: 31/01/2002	**Post Field Measurement (mV)**	: 1.7(-1.3%)

Amplifier Setting :

Channel 1 : 0.0047 Channel 2 : 0.0044 Channel 3 : 0.0055

Location of Maximum Field :

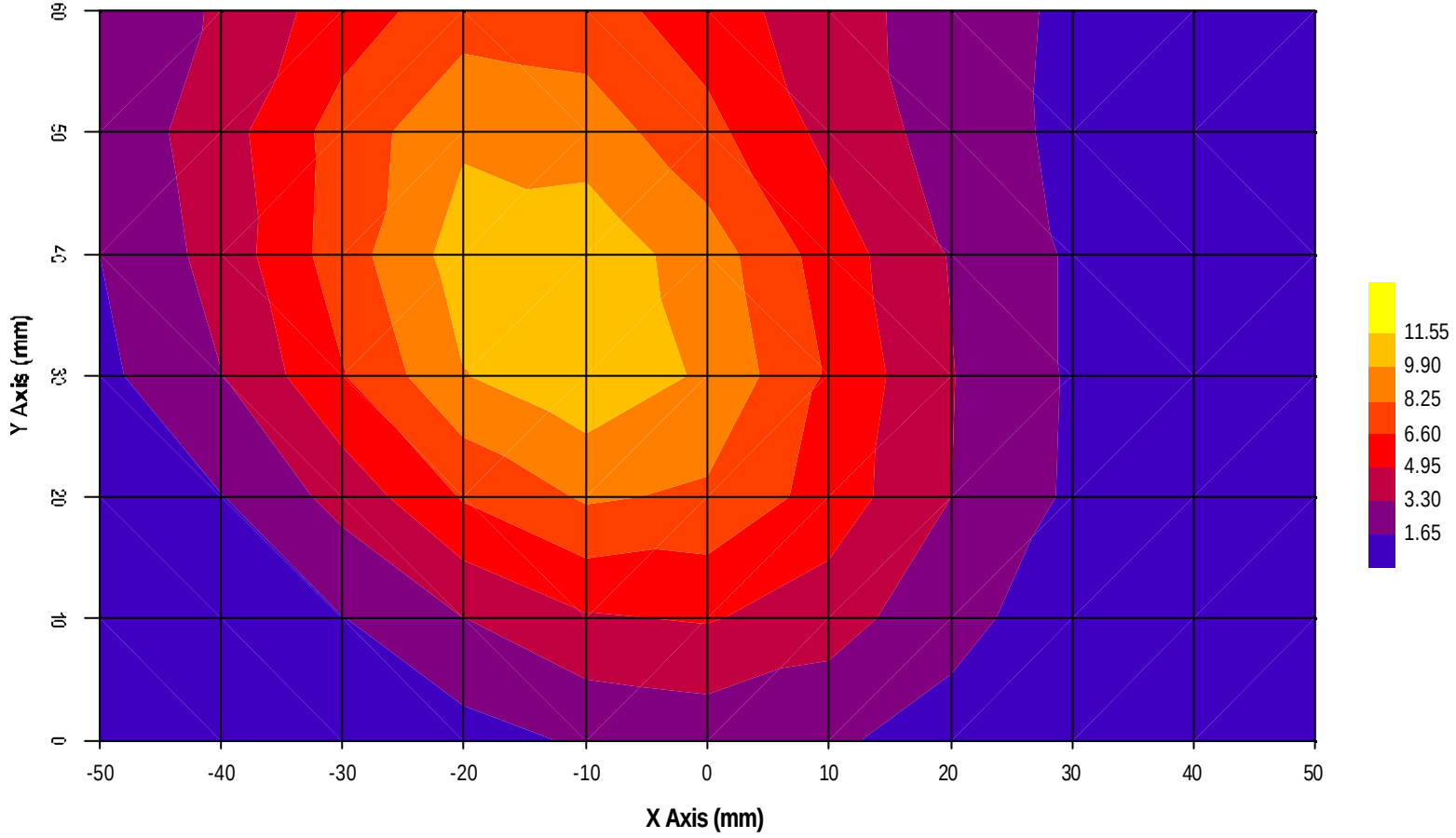
X = -10 Y = 35

Measured Values (mV) :

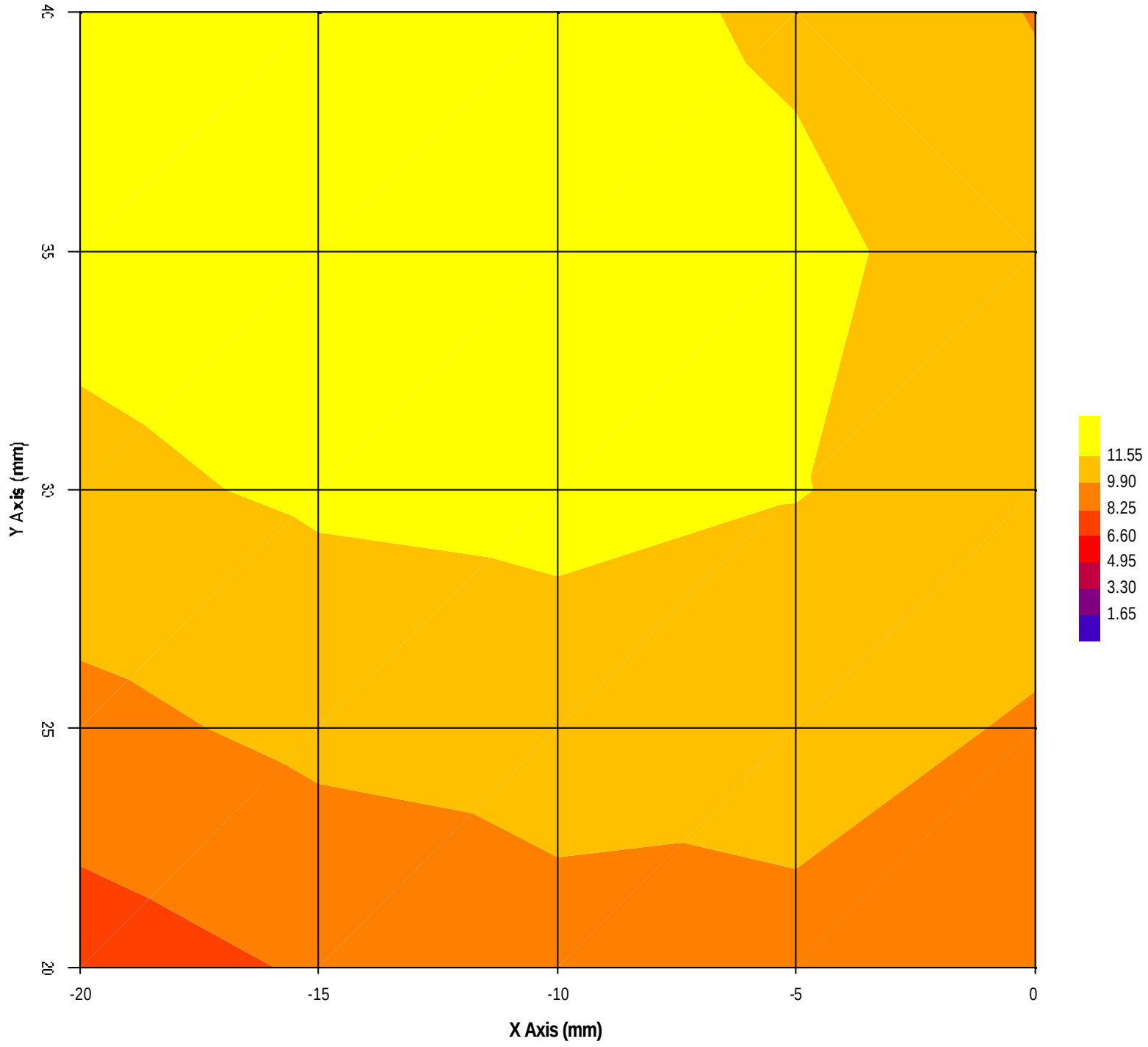
11.728	11.788	10.845	9.276	9.095	8.038
7.649	7.201	6.354	6.242	5.339	

Peak Voltage (mV) : 14.060 **1 Cm Voltage (mV)** : 6.618 **SAR (W/Kg)** : 0.884

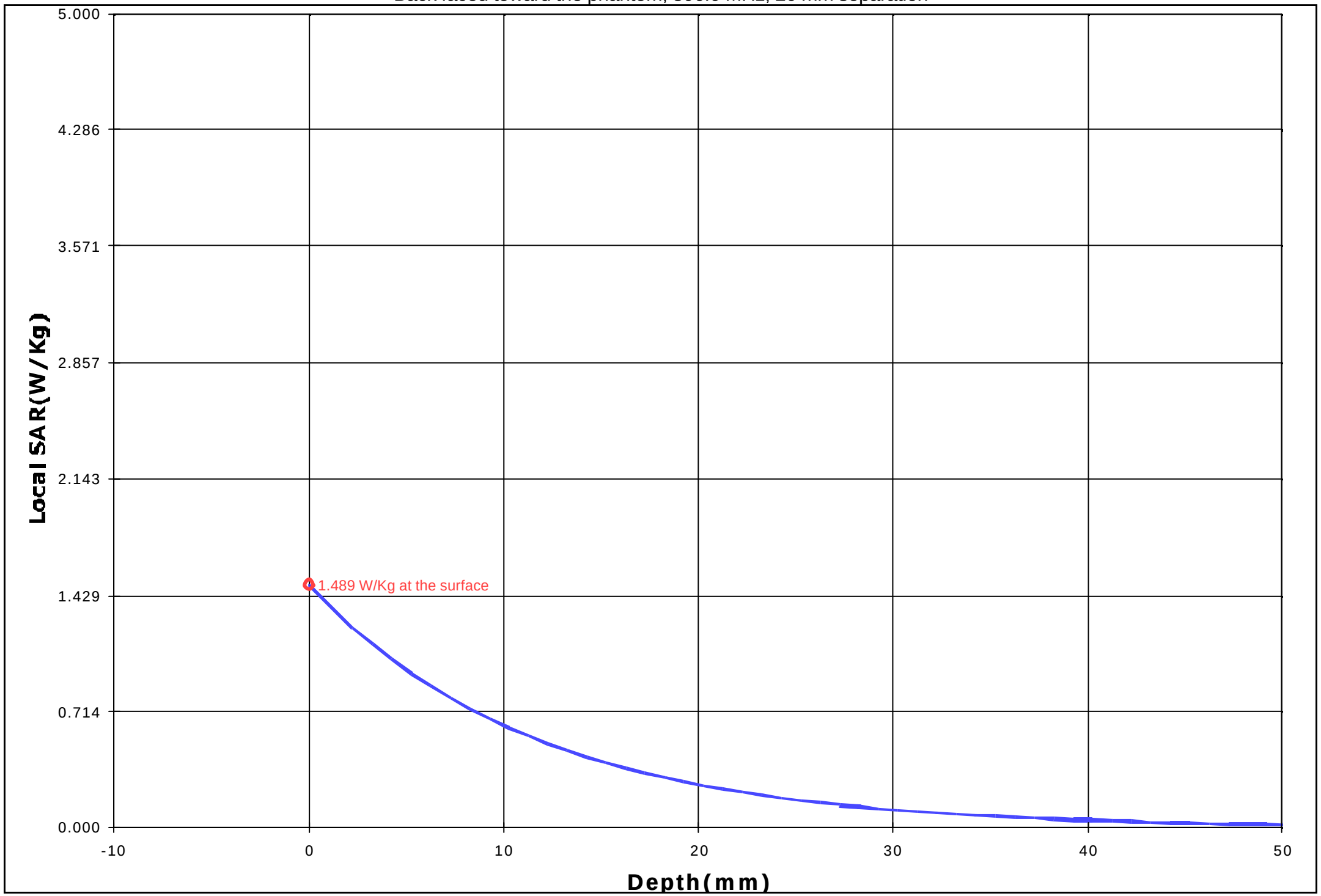
Back faced toward the phantom, 806.0 MHz, 20 mm separation



Back faced toward the phantom, 806.0 MHz, 20 mm separation



Back faced toward the phantom, 806.0 MHz, 20 mm separation



Test Information

Date : 08/03/2002
Time : 4:28:11 PM

Product	: Lipman Point of Sales	**Test**	: SAR
Manufacturer	: LIPMAN USA	**Frequency (MHz)**	: 813.5
Model Number	: NURIT 8000	**Nominal Output Power (W)**	: 2.0
Serial Number	:	**Antenna Type**	: Patch
FCC ID Number	: O2SNURIT8000AI	**Signal**	: 25%(40ms:120ms)

Phantom	: Flat	**Dielectric Constant**	: 53.53
Simulated Tissue	: Muscle	**Conductivity**	: 0.965

Probe	: UT-ETR-0200-1	**Antenna Position**	: Internal
Probe Offset (mm)	: 2.250	**Measured Power (W) (conducted)**	: 2.0
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.966	**Pre Field Measurement (mV)**	: 3.7
Calibrated Date	: 31/01/2002	**Post Field Measurement (mV)**	: 3.6(-0.17%)

Amplifier Setting :

Channel 1 : 0.0047 Channel 2 : 0.0044 Channel 3 : 0.0055

Location of Maximum Field :

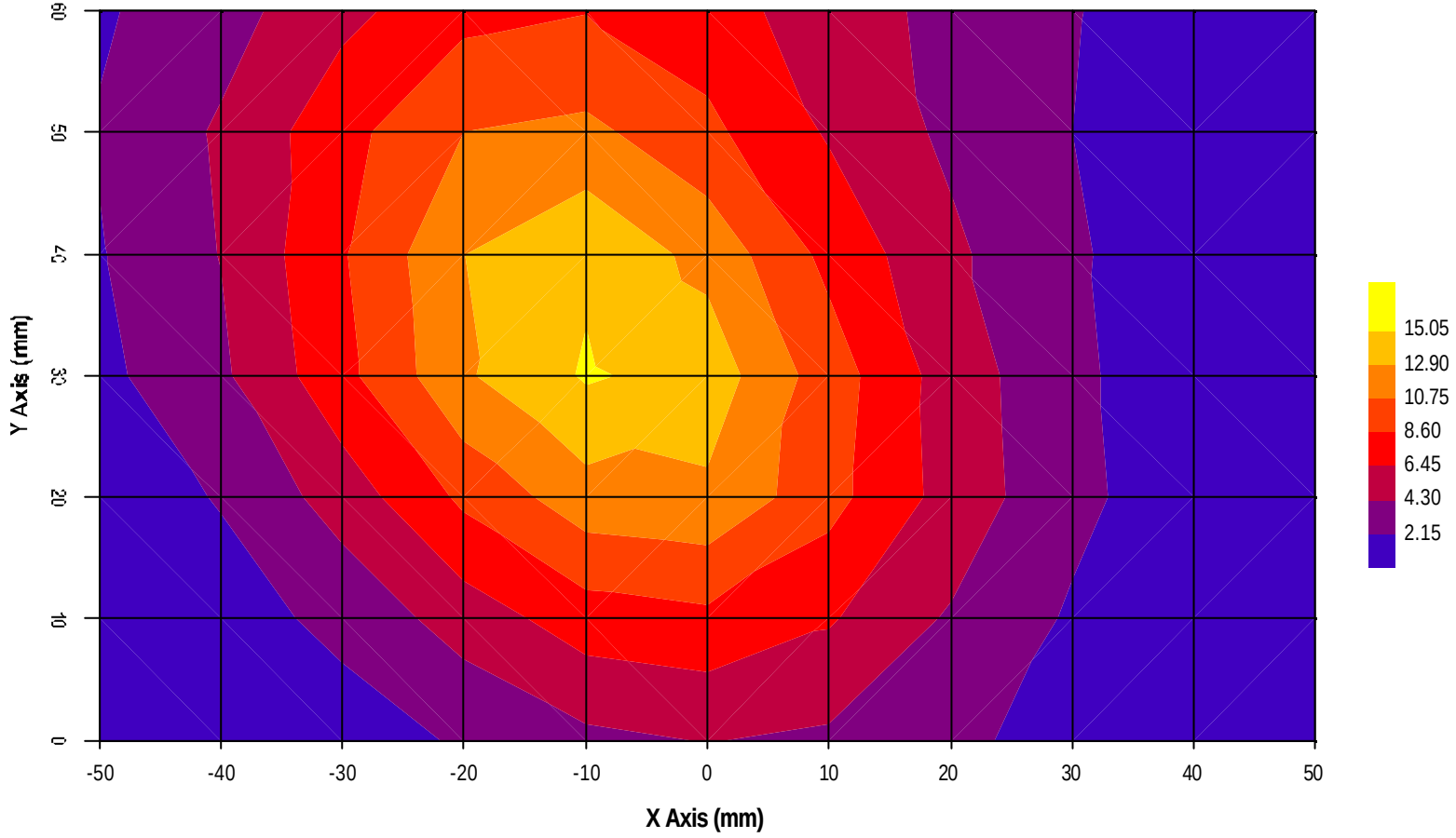
X = -10 Y = 30

Measured Values (mV) :

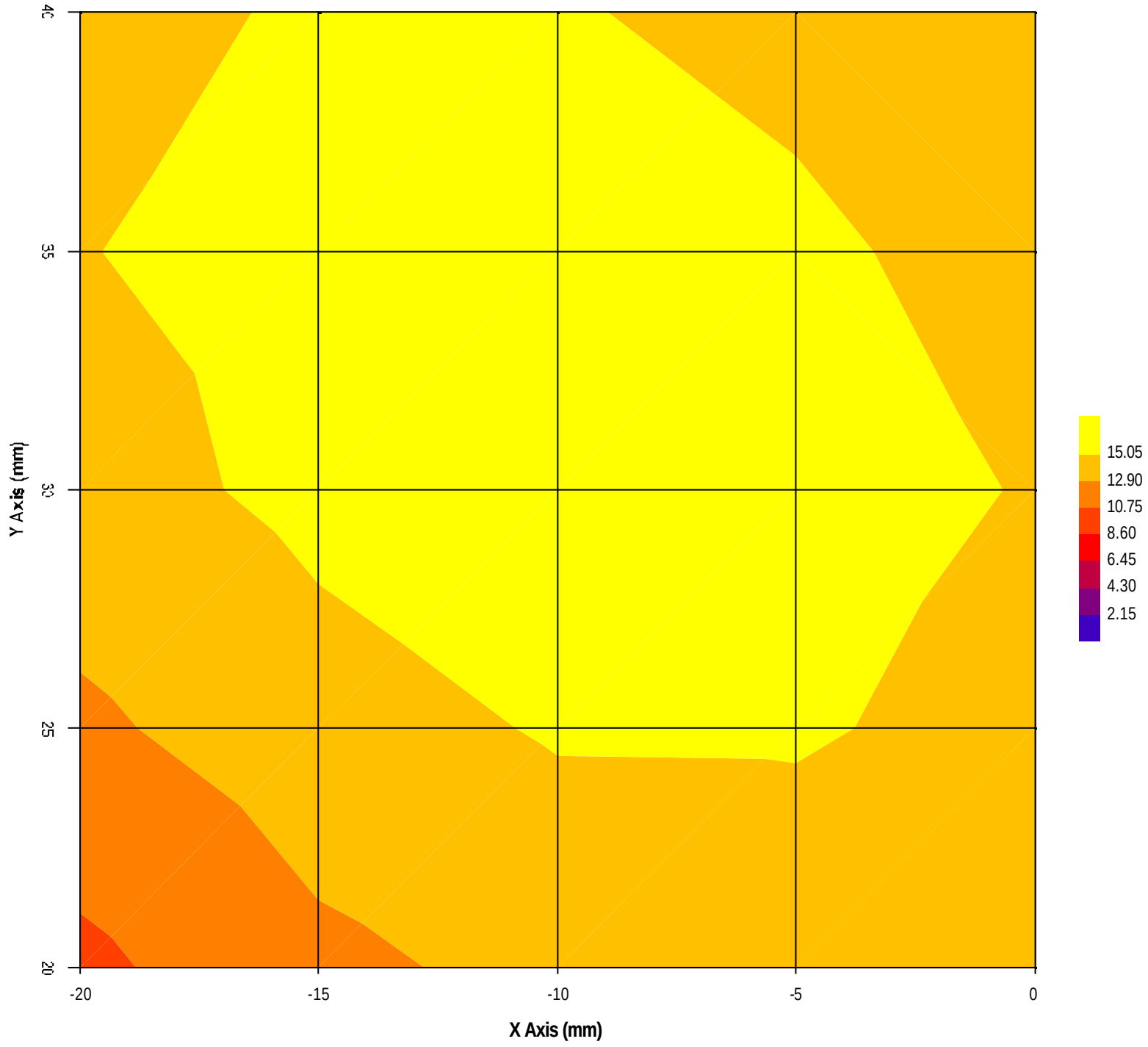
15.075	15.931	13.125	12.093	11.472	10.553
9.797	8.684	8.774	7.716	7.458	

Peak Voltage (mV) : 18.474 **1 Cm Voltage (mV)** : 8.578 **SAR (W/Kg)** : 1.134

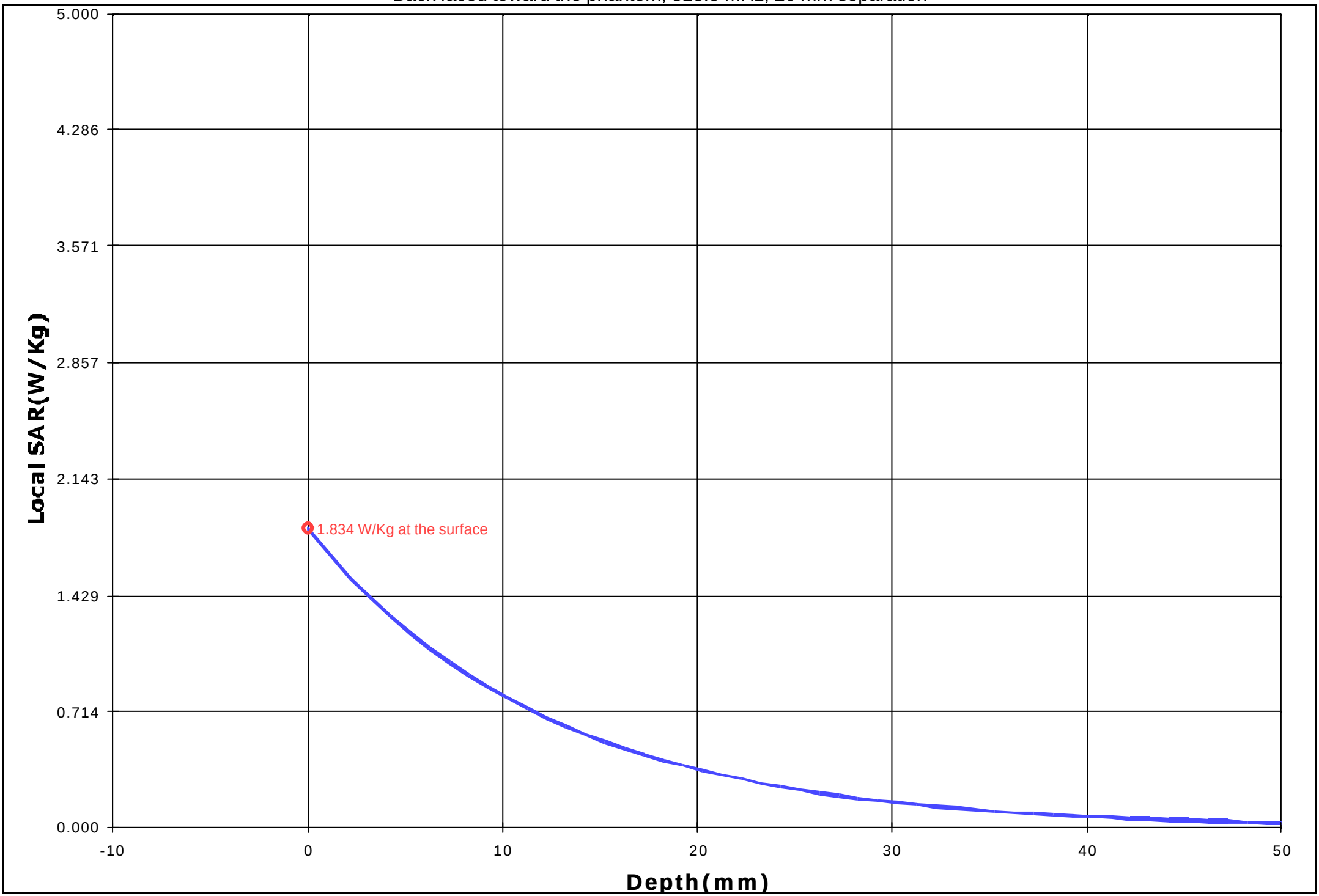
Back faced toward the phantom, 813.5 MHz, 20 mm separation



Back faced toward the phantom, 813.5 MHz, 20 mm separation



Back faced toward the phantom, 813.5 MHz, 20 mm separation



Test Information

Date : 11/03/2002
Time : 10:00:14 AM

Product	: Lipman Point of Sales	**Test**	: SAR
Manufacturer	: LIPMAN USA	**Frequency (MHz)**	: 821.0
Model Number	: NURIT 8000	**Nominal Output Power (W)**	: 2.0
Serial Number	:	**Antenna Type**	: Patch
FCC ID Number	: O2SNURIT8000AI	**Signal**	: 25%(40ms:120ms)

Phantom	: Flat	**Dielectric Constant**	: 53.53
Simulated Tissue	: Muscle	**Conductivity**	: 0.965

Probe	: UT-ETR-0200-1	**Antenna Position**	: Internal
Probe Offset (mm)	: 2.250	**Measured Power (W) (Conducted)**	: 2.0
Sensor Factor (mV)	: 10.8		
Conversion Factor	: 0.966	**Pre Field Measurement (mV)**	: 2.6
Calibrated Date	: 31/01/2002	**Post Field Measurement (mV)**	: 2.5(-1.8%)

Amplifier Setting :

Channel 1 : 0.0047 Channel 2 : 0.0044 Channel 3 : 0.0055

Location of Maximum Field :

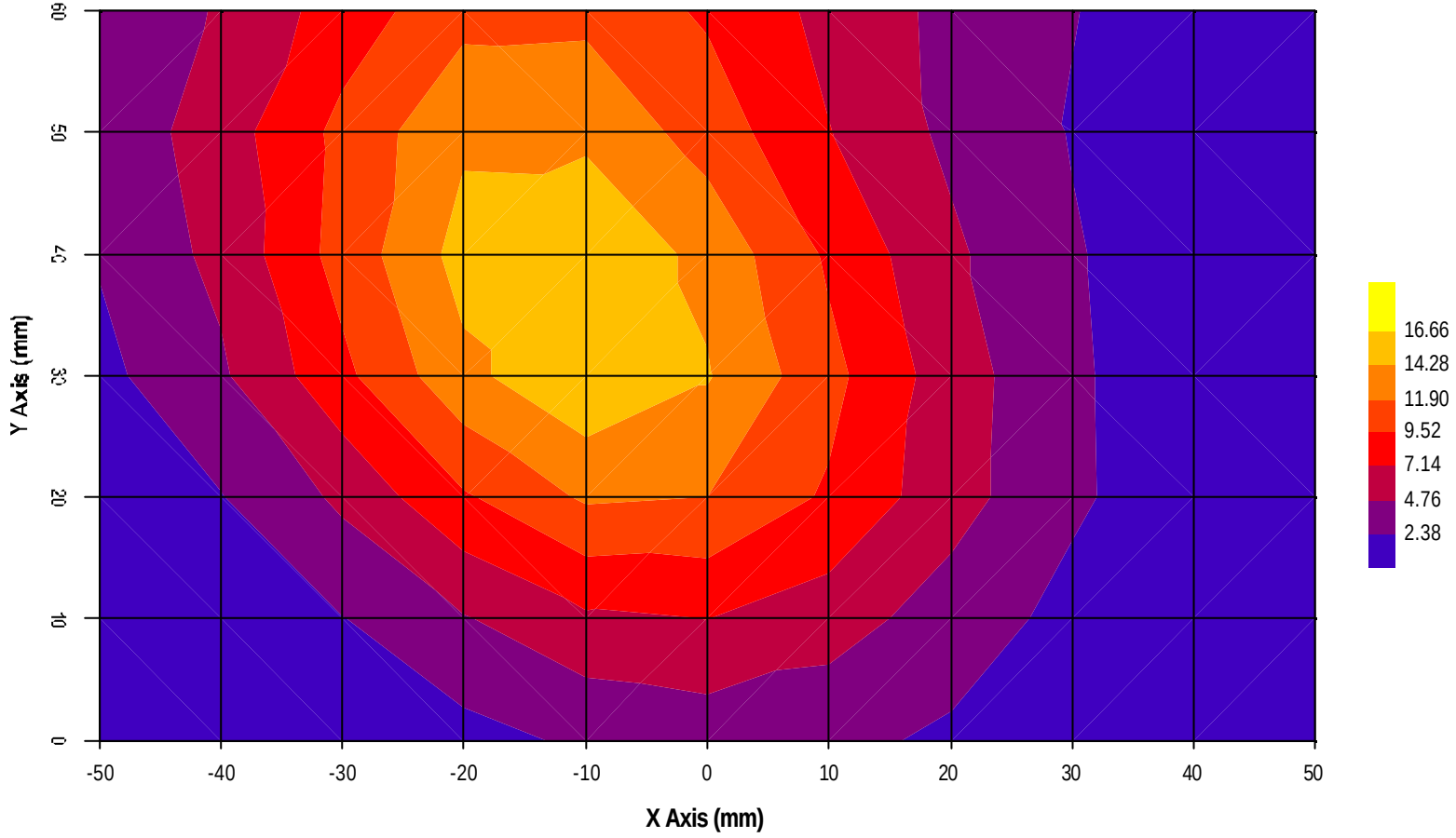
X = -10 Y = 35

Measured Values (mV) :

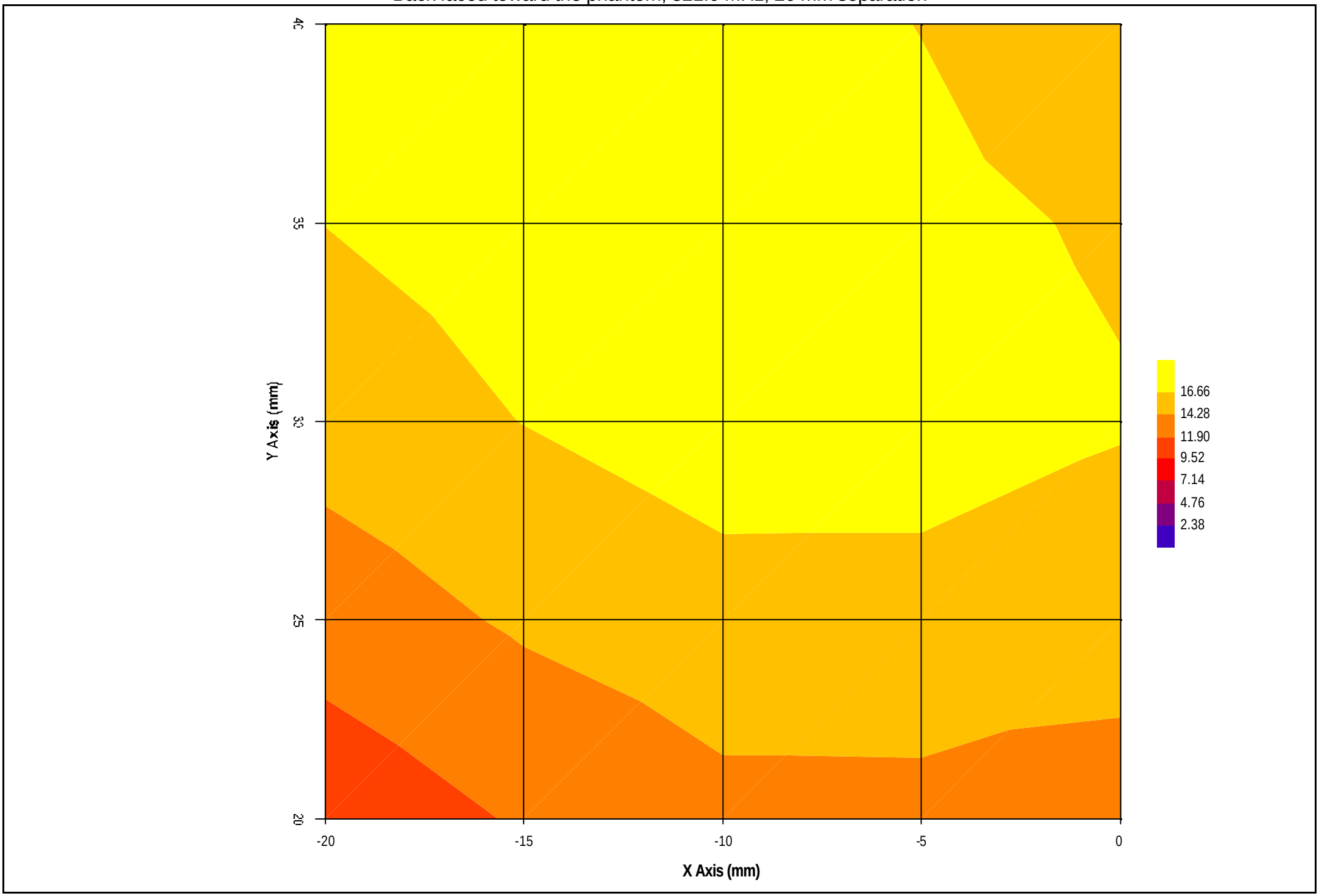
16.962	17.289	15.127	13.896	12.636	12.017
11.568	10.615	9.562	9.019	8.589	

Peak Voltage (mV) : 20.540 **1 Cm Voltage (mV)** : 9.826 **SAR (W/Kg)** : 1.300

Back faced toward the phantom, 821.0 MHz, 20 mm separation



Back faced toward the phantom, 821.0 MHz, 20 mm separation



Back faced toward the phantom, 821.0 MHz, 20 mm separation

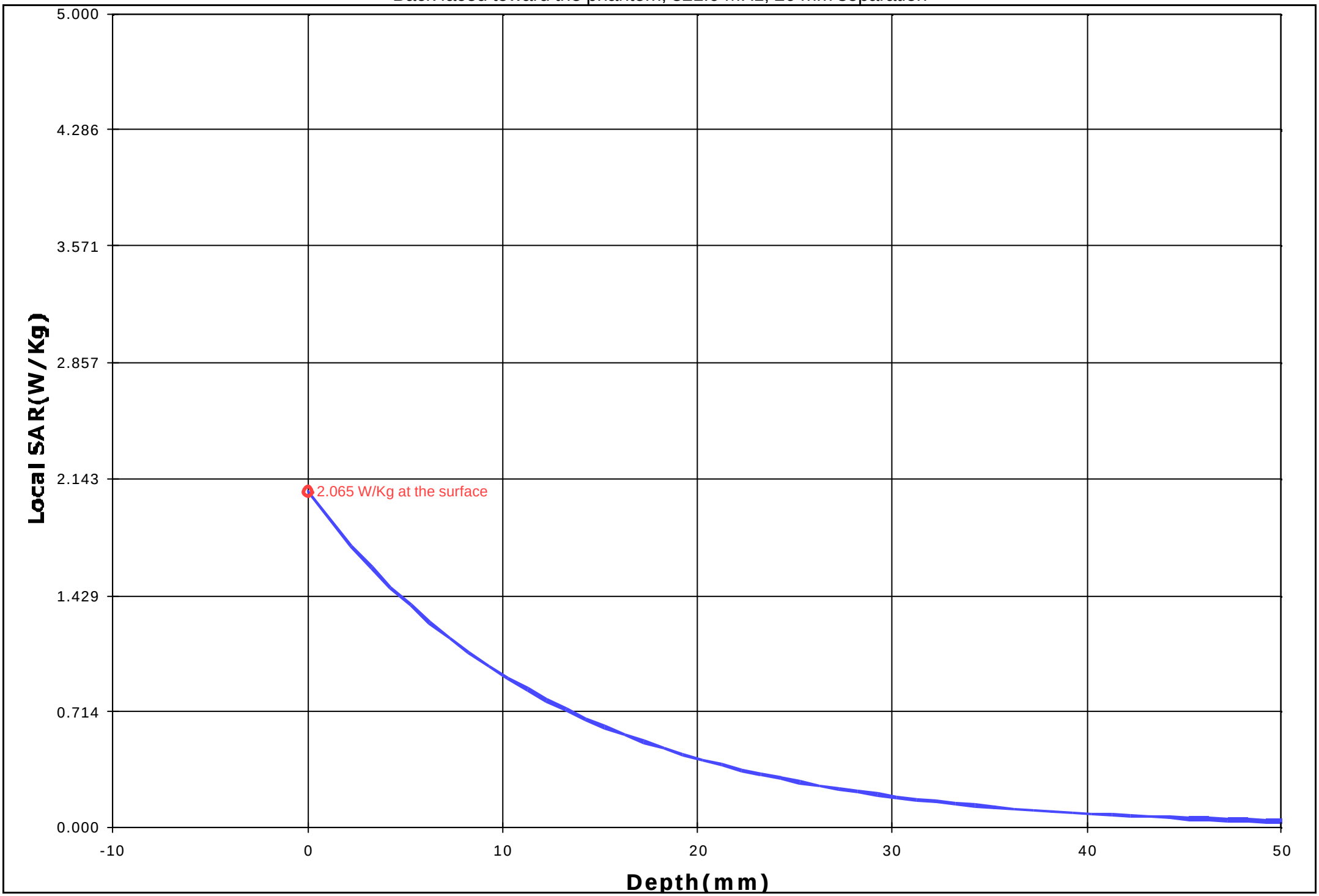


EXHIBIT 8. TISSUE CALIBRATION

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 at 01/09/2002. The dielectric parameters of the solution was verified again using HP 85070C dielectric probe kit as shown below at 03/08/2002.

Calibration Kit	f (MHz)	Tissue Temperature (°C)	ε′	ε″	σ (S/m)
HP 85070C Dielectric Probe Kit	835	21.5	**53.53**	20.773	**0.965**

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:** 01/09/02

Frequency: 835 MHz **Mixture:** Muscle **Room Temp.:** 22.5 ±1°C

# of Points: 11 **Point Dist:** 1.0 cm

Point	Amplitude	Phase
1	-27.28	-21.36
2	-29.25	-98.89
3	-31.19	-170.87
4	-33.36	109.71
5	-35.41	32.02
6	-37.43	-42.98
7	-39.40	-117.31
8	-41.64	168.35
9	-43.92	90.10
10	-46.14	15.05
11	-48.14	-60.91

Composition

	weight	% by weight
DI Water	35,178.0 g	53.13 %
Sucrose (98 %) ← Sugar	30,208.2 g	45.62 %
2-(2-ButoxyEthoxy) Ethanol ← Alcohol	0.0 g	0.00 %
Sodium Chloride (99+ %) ← Salt	613.8 g	0.93 %
Hydroxyethyl Cellulose ← HEC	150.0 g	0.23 %
Bactericide	66.0 g	0.10 %
1,2-propanediol	0.0 g	0.00 %
	0.0 g	0.00 %
	0.0 g	0.00 %
Total	66,216.0 g	100.00 %

Mass Den. 1235.6
Heat Cap. 3.2

ω(rad/sec)	5.246E+09
ε_0(F/m)	8.854E-12
μ(H/m)	1.257E-06
α_{avg}(Np/cm)	-0.24140
β_{avg}(rad/cm)	-1.32504

Results:		Target	Low Limit	High Limit	% Off Target
D. Const:	55.43	55.20	52.440	57.960	0.41
Conductivity:	0.97	0.97	0.922	1.019	0.04

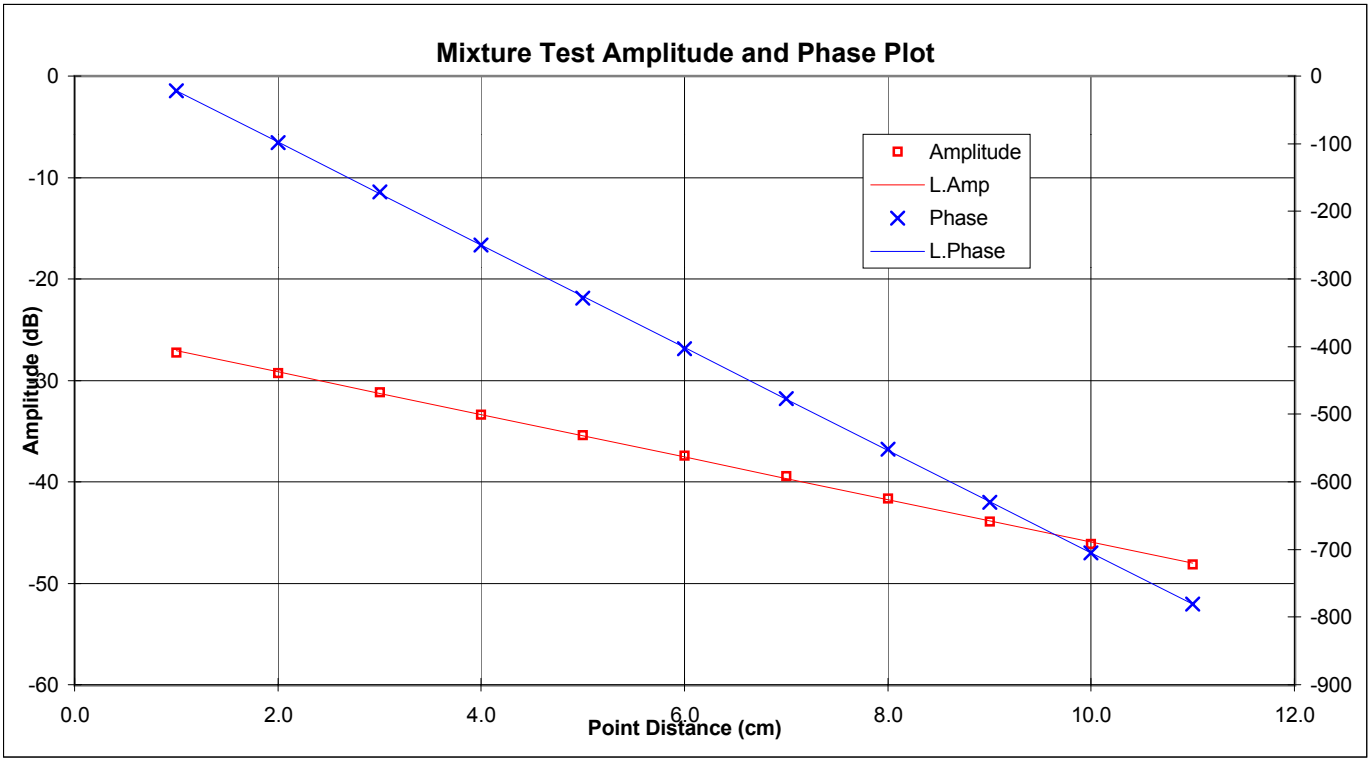
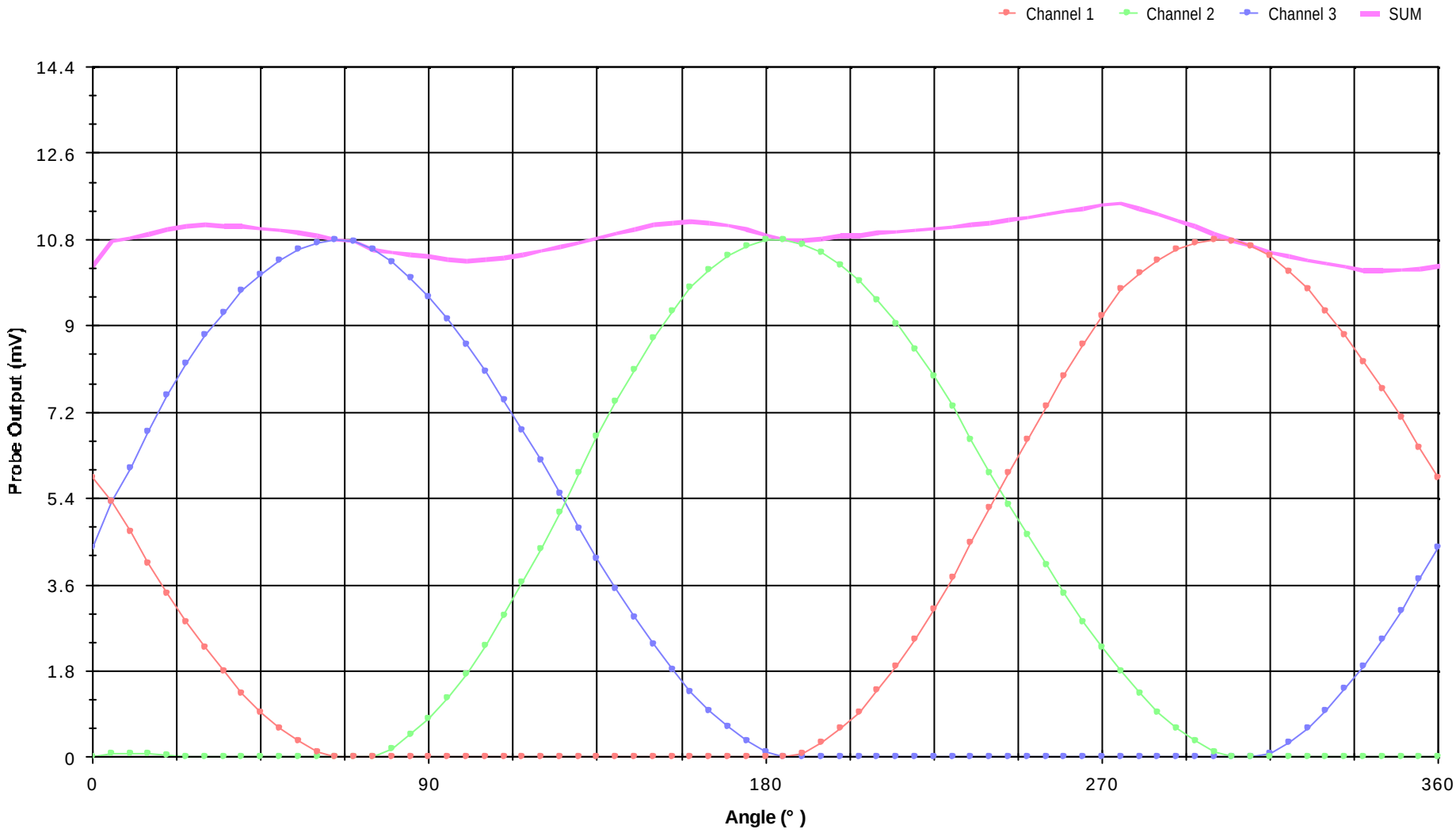


EXHIBIT 9. PROBE CALIBRATION FREE SPACE

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]

Probe Name : UT-ETR-0200-1-C
Type : E-field (Triangular beam), Offset(mm) : 2.25
Frequency(MHz) : 814
Amplifier Setting : 0.00473338, 0.00448195, 0.00551396
Calibrated Date : 08/03/2002 1:13:18 PM



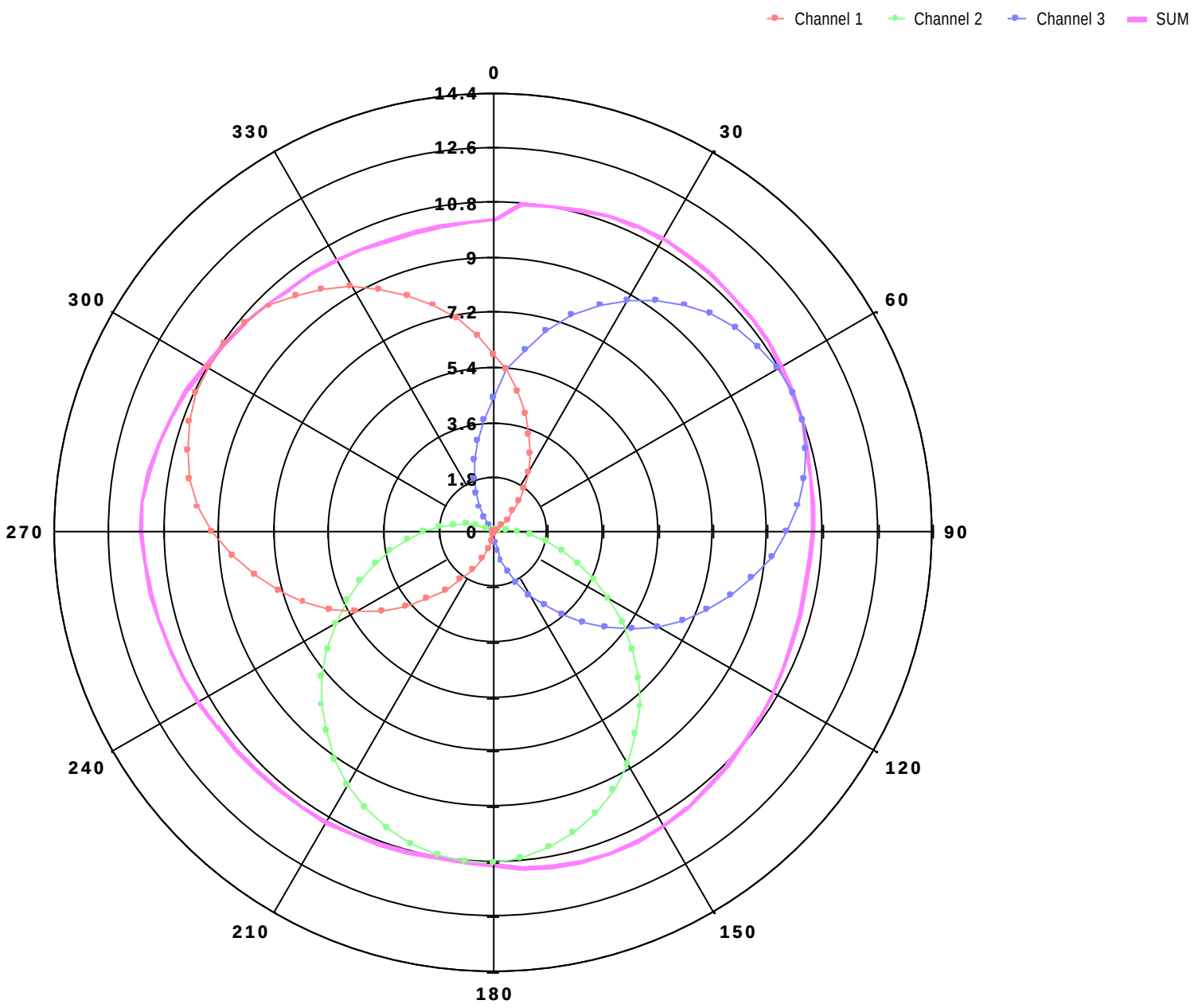
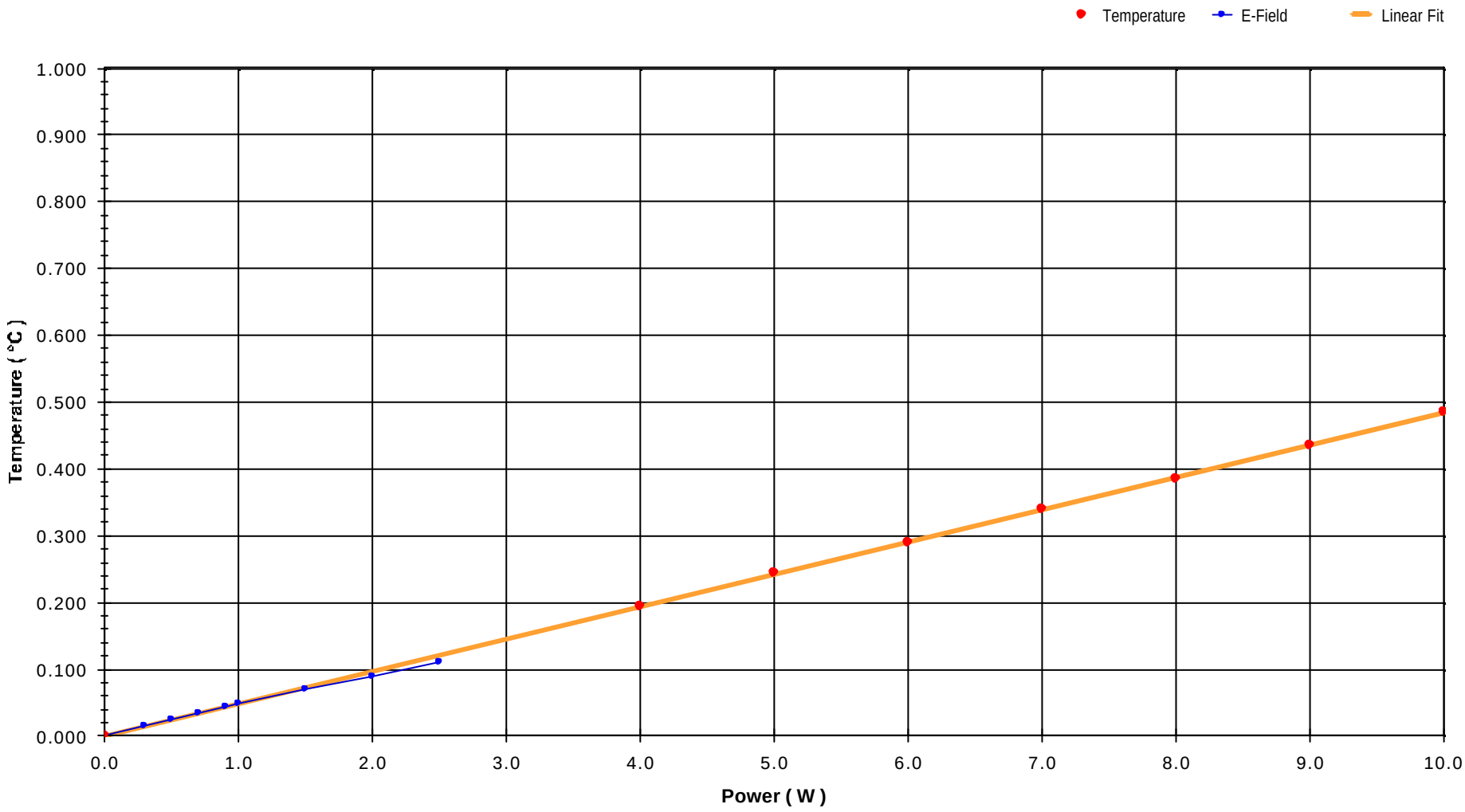

Channel 1
Channel 2
Channel 3
SUM
0
30
60
90
120
150
180
210
240
270
300
330
14.4
12.6
10.8
9
7.2
5.4
3.6
1.8
0

EXHIBIT 10. PROBE TEMPERATURE TRANSFER CALIBRATION

Probe Name : UT-ETR-0200-1
Type : E-field (Triangular beam), Offset(mm) : 2.25
Frequency(MHz) : 835, Conversion Factor : 0.9664
Simulated Tissue Type : Muscle
Dielectrical Const. : 54.9, Conductivity : 0.96
Temperature - Simulated Tissue : 22.5°C, Room : 22.0°C
Calibrated Date : 31/01/2002 2:43:37 PM



E-Field & Diode Compensation

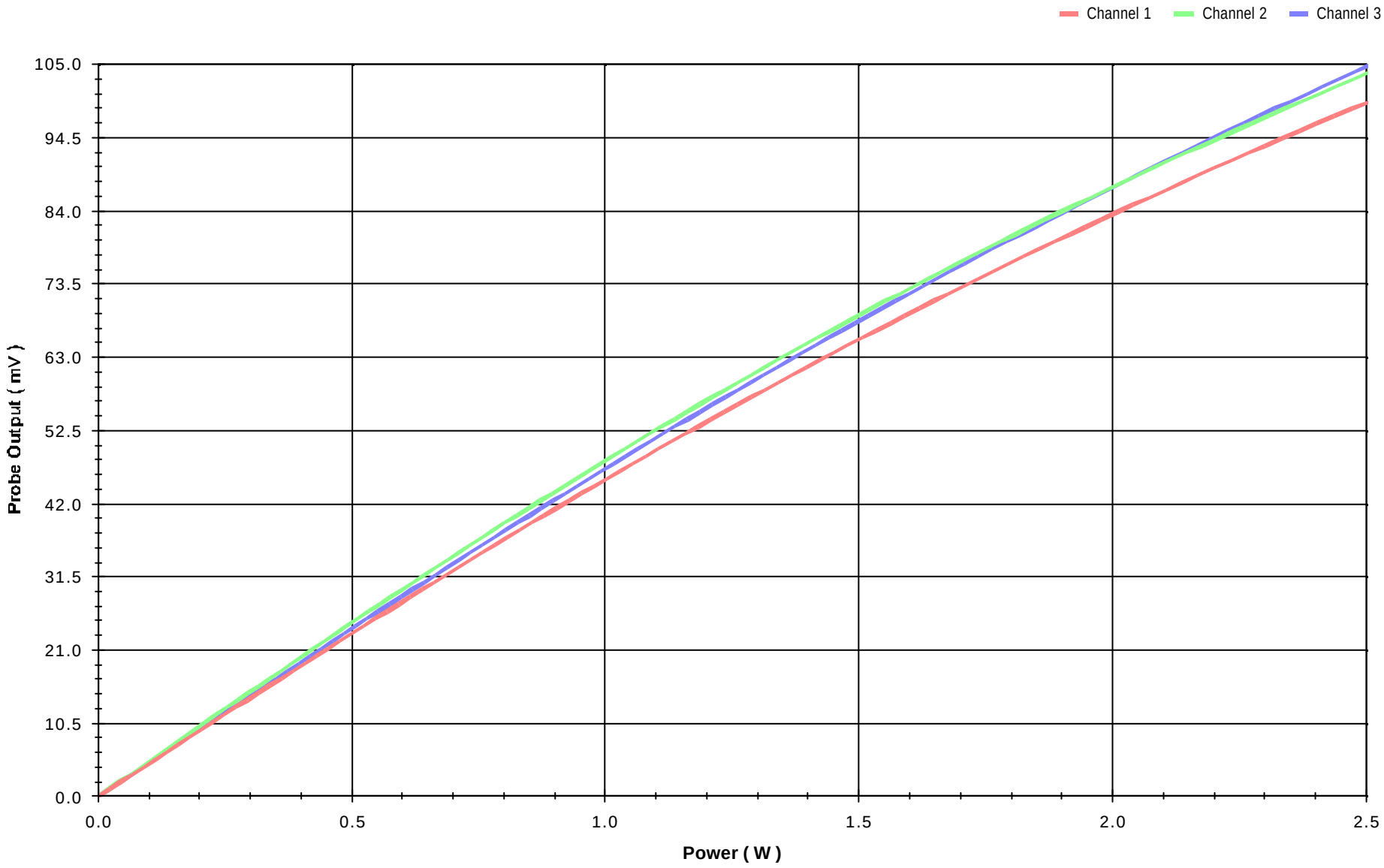
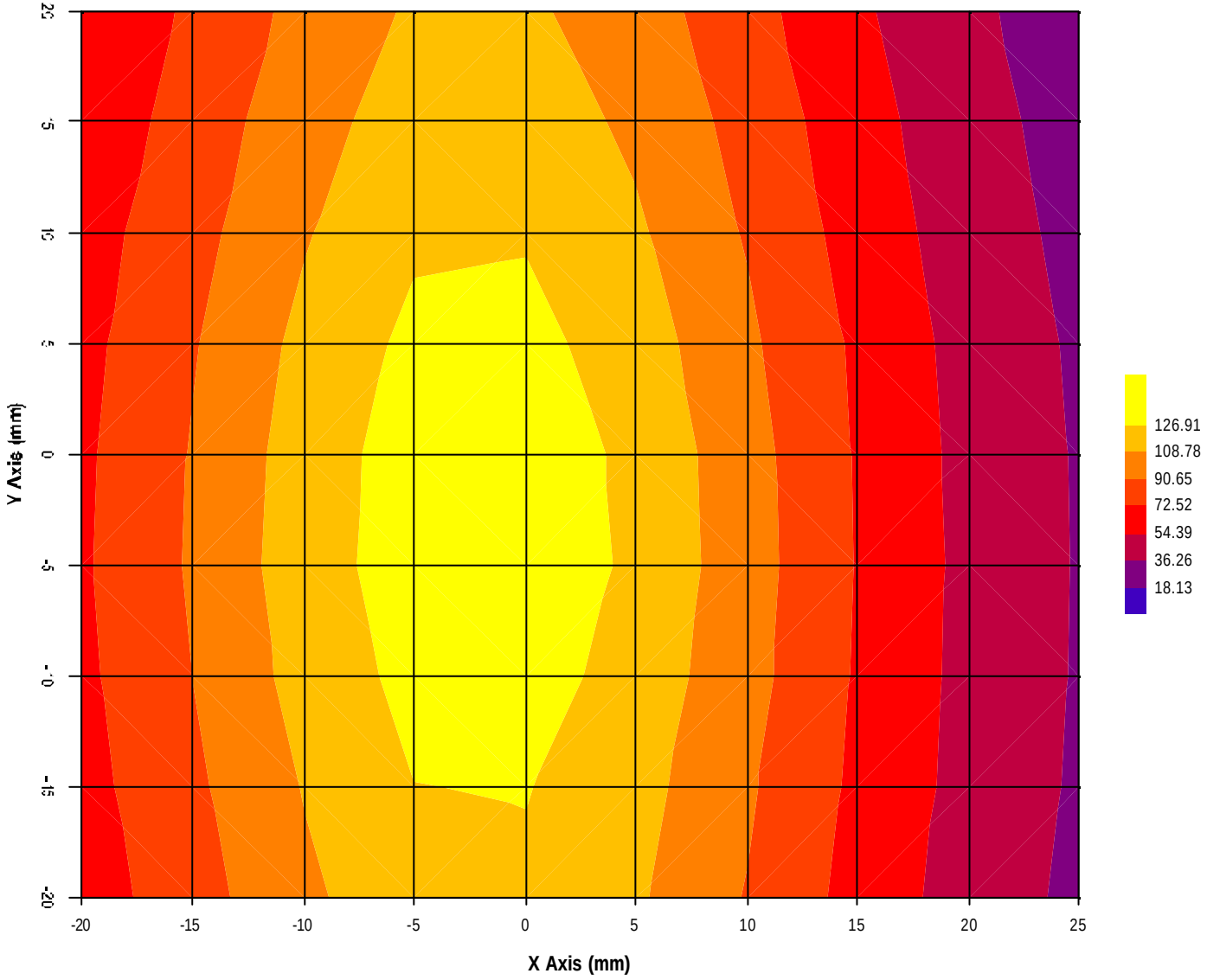


EXHIBIT 11. SYSTEM VALIDATION

The system was verified in the flat phantom (2.0mm ± 0.2mm base thickness) using 835MHz dipole validation kit(M/N: 3125-870 S/N:1008) manufactured by EMCO. 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
EMCO M/N:3125-870	9.5	9.719


Y Axis (mm)
X Axis (mm)
-20
-15
-10
-5
0
5
10
15
20
25
126.91
108.78
90.65
72.52
54.39
36.26
18.13

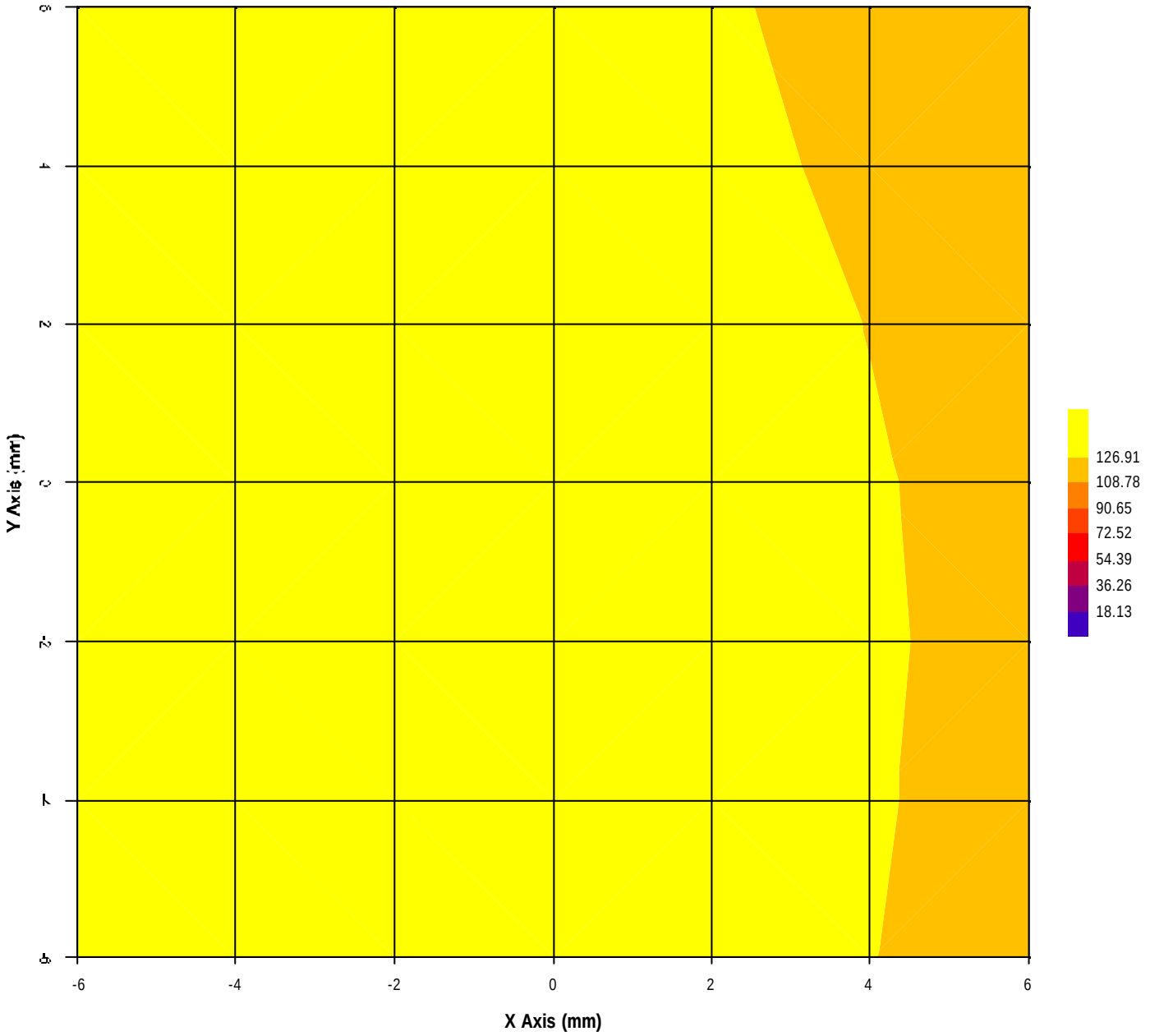
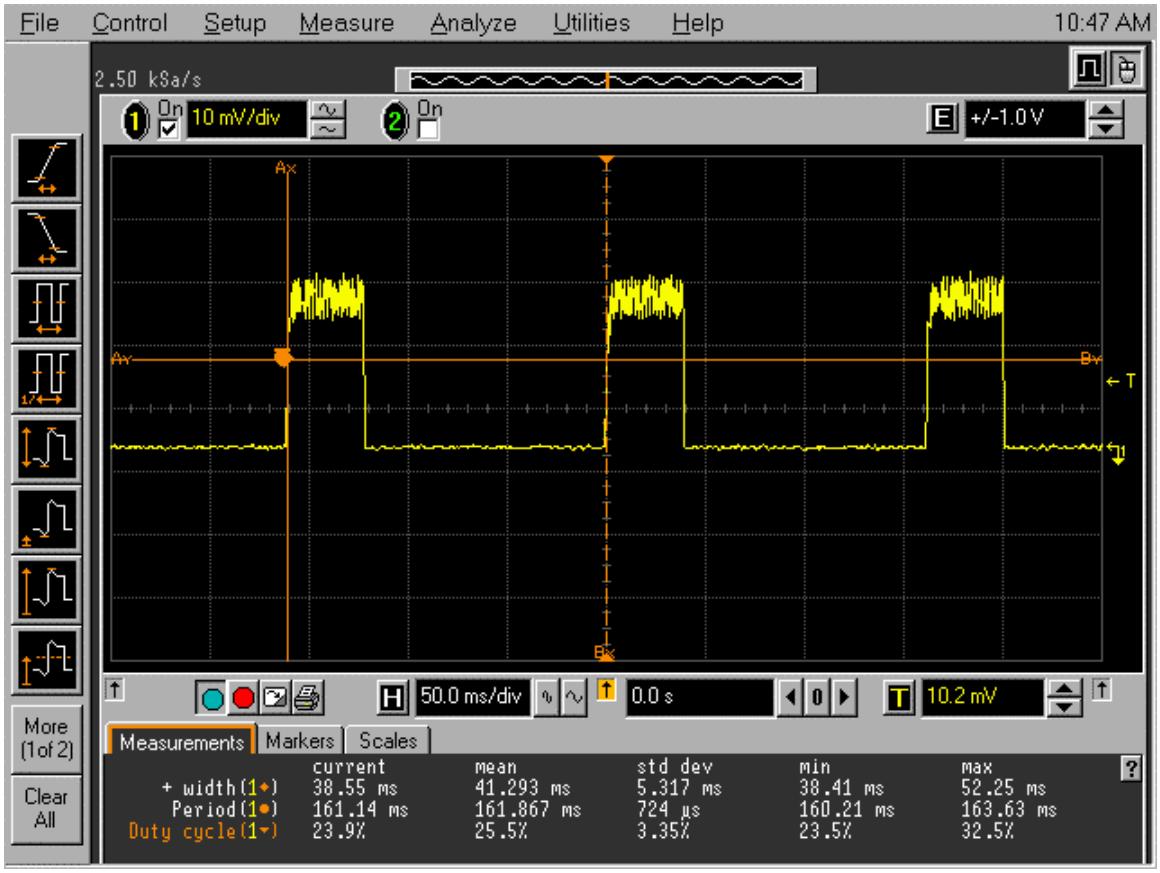

6
4
2
0
-2
-4
-6
Y Axis (mm)
-6
-4
-2
0
2
4
6
X Axis (mm)
126.91
108.78
90.65
72.52
54.39
36.26
18.13

EXHIBIT 12. DUTY CYCLE INFORMATION



Duty Cycle = 40 ms / (120 + 40) ms × 100 ≅ 25%

The Crest Factor is a parameter which describes the SAR systems ability to measure signals that have various peak to RMS ratios while still remaining within the system specifications. The crest factor is not provided for the 3D-EMC system and a verification test was carried out to determine that the SAR system is responding to the duty cycle waveform as an averaging system. A uniform field within a TEM cell is used to compare the output of the SAR system of a CW signal at the frequency of interest, with a pulse modulated carrier using the same pulse width and repetition rate as the Lipman POS previously tested at 25%. An HP 437A Peak power meter is used to set the same peak power in both test conditions. The 3D-EMC system allows for a real-time monitoring of all amplifier channels. The summed output of the three amplifier channels from the probe is directly proportional to the E^2 which is also directly proportional to SAR according to the equation:

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

The measured results from the monitor are:

SAR System Output for CW = 39.094
SAR System Output for 25% = 9.788

The ratio of the CW to Duty Cycle Field = 9.788/39.094*100% = 25.04%

The above test verifies that the SAR system is correctly averaging the pulsed carrier and that the measured SAR values are time based average values.

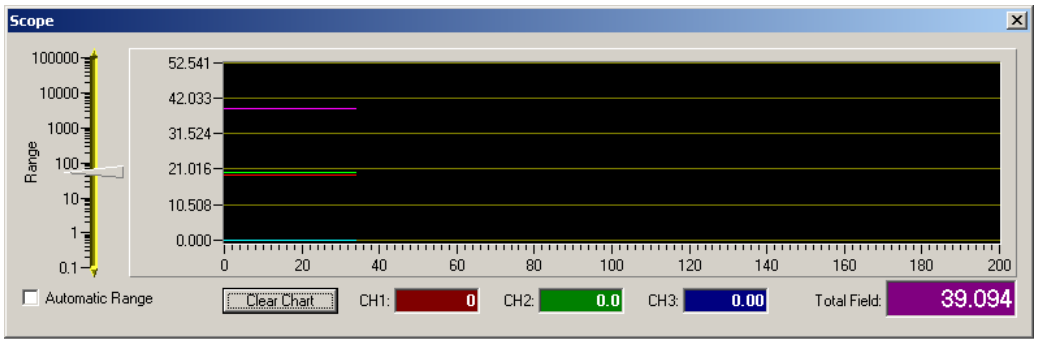


Figure 1. Amplifier channel real-time output monitor of SAR system for a CW signal

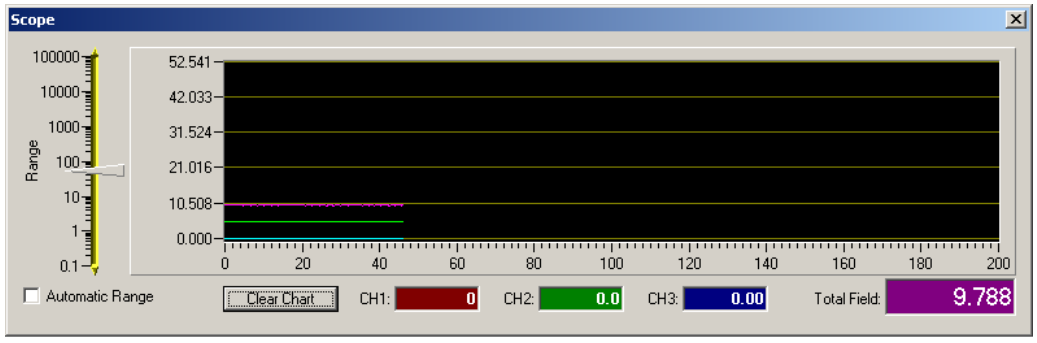


Figure 2. Amplifier channel real-time output monitor of SAR system for a 25% Pulse modulated Signal

RESEARCH IN MOTION

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Ref: 02400-CERT-FCC

July 21, 2000

Federal Communications Commission
Equipment Authorization Division
Application Processing Branch
7435 Oakland Mills Rd.
Columbia, Md. 21046

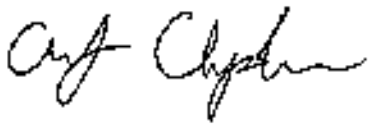
To whom it may concern,

RIM has implemented and tested a duty factor limiting algorithm for the RIM 802D radio modem module (FCC ID L6AR802D-2-O). The algorithm controls the timing of when uplink (transmit) transactions are initiated. When an uplink (transmit) transaction occurs the algorithm accrues the actual transmit time. The algorithm ensures that the idle (transmitter off) time is sufficient to ensure the duty factor is less than the 25% before the next uplink (transmit) transaction is initiated. This ensures that the duty factor is limited to 25% over all times.

This algorithm will be permanently integrated with the radio firmware and installed at the time of manufacture in the production facility. The algorithm cannot be modified or disabled by the user.

Should you have any questions, please do not hesitate to contact our Senior Certification Engineer, Masud Attayi, at (519) 888-7465 x2442 or by email at mattayi@rim.net.

Yours truly,



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