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| Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

RF EXPOSURE EVALUATION
SPECIFIC ABSORPTION RATE

SAR TEST REPORT

FOR

VERTEX STANDARD CO., LTD.

PORTABLE VHF PTT MARINE RADIO TRANSCEIVER

MODEL(S): HX500S

FCC ID: K6630183X20

IC ID: 511B-30183X20

Test Report Serial Number

121405K66-F706-S80V

Test Report Issue No.

S706-011206-R0

Test Lab

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| | |
|--|---|
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|-------------------------|---------------------------|--|---|----------------------------|---------------|--------------|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 | |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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DECLARATION OF COMPLIANCE SAR RF EXPOSURE EVALUATION

| | |
|---|---|
| Test Lab CELLTECH LABS INC. Testing and Engineering Services 1955 Moss Court Kelowna, B.C. Canada V1Y 9L3 Phone: 250-448-7047 Fax: 250-448-7046 e-mail: info@celltechlabs.com web site: www.celltechlabs.com | Applicant Information VERTEX STANDARD CO., LTD. 4-8-8 Nakameguro, Meguro-Ku Tokyo 153-8644 Japan |
| FCC IDENTIFIER: IC IDENTIFIER: Model(s): | K6630183X20 511B-30183X20 HX500S |
| SAR Test Requirement(s): SAR Test Procedure(s): FCC Device Classification: Device Description: Modulation Type: | FCC 47 CFR §2.1093; Health Canada Safety Code 6 FCC OET Bulletin 65, Supplement C (Edition 01-01) Industry Canada RSS-102 Issue 2 Part 80 VHF Hand Held Transmitter (GMDSS) - GHH Portable VHF PTT Marine Radio Transceiver FM (VHF) |
| Transmit Frequency Range: Max. RF Output Power Measured: Antenna Type(s) Tested: Battery Type(s) Tested: | 156.0 - 157.425 MHz 4.73 Watts (36.75 dBm) Conducted (156.7 MHz) Detachable Whip (P/N: CAT460) NiMH 7.2 V, 1400 mAh (P/N: FNB-83) Alkaline 1.5 V 2850 mAh (Duracell Procell AA x6) Alkaline Battery Case (P/N: FBA-25A) |
| Body-Worn Accessories Tested: Audio Accessories Tested: | Plastic Belt-Clip with Metal Spring (P/N: BA0102700) Speaker-Microphone (P/N: MH-57A4B) Noise-Canceling Speaker-Microphone (P/N: CMP460) VOX Headset (P/N: VC-24) VOX Earpiece (P/N: VC-27) |
| Max. SAR Level(s) Evaluated: | Face-held: 0.712 W/kg (1g) - 50% Duty Cycle Body-worn: 0.730 W/kg (1g) - 50% Duty Cycle |

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) and Industry Canada RSS-102 Issue 2 for the Occupational / Controlled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

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| | |
|---|---|
| Tested By:  <hr/> Sean Johnston Compliance Technologist Celltech Labs Inc. | Reviewed By:  <hr/> Spencer Watson Senior Compliance Technologist Celltech Labs Inc. |
|---|---|



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|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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1.0 INTRODUCTION

This measurement report demonstrates compliance of the VERTEX STANDARD CO., LTD. Model(s): HX500S Portable VHF PTT Marine Radio Transceiver FCC ID: K6630183X20 with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada Safety Code 6 (see reference [2]) for the Occupational / Controlled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C (Edition 01-01) (see reference [3]) and IC RSS-102 Issue 2 (see reference [4]) were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION OF DEVICE UNDER TEST (DUT)

| | | | | |
|--------------------------------------|---|---------------------|-----------|---------------------|
| SAR Test Requirement(s) | FCC 47 CFR §2.1093 | | | |
| | Health Canada Safety Code 6 | | | |
| SAR Test Procedure(s) | FCC OET Bulletin 65, Supplement C (Edition 01-01) | | | |
| | Industry Canada RSS-102 Issue 2 | | | |
| FCC Device Classification | Part 80 VHF Hand Held Transmitter (GMDSS) - GHH | | | |
| IC Device Classification | RSS-182 - Maritime Radio Transmitter | | | |
| Device Description | Portable VHF PTT Marine Radio Transceiver | | | |
| RF Exposure Category | Occupational / Controlled Exposure Environment | | | |
| FCC IDENTIFIER | K6630183X20 | | | |
| IC IDENTIFIER | 511B-30183X20 | | | |
| Model(s) | HX500S | | | |
| Test Sample Serial No. | 5M000003 | Identical Prototype | | |
| Modulation Type | FM (VHF) | | | |
| Transmit Frequency Range | 156.0 - 157.425 MHz | | | |
| Max. RF Output Power Measured | 4.73 Watts | 36.75 dBm | 156.7 MHz | Conducted |
| Battery Type(s) Tested | NiMH (Pack) | 7.2 V | 1400 mAh | P/N: FNB-83 |
| | Alkaline (6x AA) | 9 V | 2850 mAh | P/N: FBA-25A (Case) |
| Antenna Type(s) Tested | Detachable Whip | Length: 188 mm | | P/N: CAT460 |
| Body-Worn Accessories Tested | Belt-Clip (Plastic with Metal Spring) | 1.3 cm thickness | | P/N: BA0102700 |
| Audio Accessories Tested | Speaker-Microphone | | | P/N: MH-57A4B |
| | Noise-Canceling Speaker-Microphone | | | P/N: CMP460 |
| | VOX Headset | | | P/N: VC-24 |
| | VOX Earpiece | | | P/N: VC-27 |

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3.0 SAR MEASUREMENT SYSTEM


Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.



DASY4 SAR Measurement System with Plexiglas validation phantom



DASY4 SAR Measurement System with Plexiglas side planar phantom

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
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| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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4.0 MEASUREMENT SUMMARY

SAR EVALUATION RESULTS

| Test Type | Freq. (MHz) | Chan. | Test Mode | Antenna Position | Battery Type | Accessories Tested | | Separ. Distance to Planar Phantom (cm) | Cond. Power Before Test (Watts) | Measured SAR 1g (W/kg) | | SAR Drift During Test (dB) | Scaled SAR with droop 1g (W/kg) | | | |
|--|----------------------|-----------|--------------|------------------|---|--------------------|---|--|---|--|--------------|----------------------------|---------------------------------|--------------|---|--|
| | | | | | | Body-worn | Audio | | | Duty Cycle | | | Duty Cycle | | | |
| | | | | | | | | | | 100% | 50% | | 100% | 50% | | |
| Face | 156.7 | 14 | CW | Fixed | NiMH | -- | -- | 2.5 | 4.70 | 1.26 | 0.630 | -0.529 | 1.42 | 0.712 | | |
| Face | 156.7 | 14 | CW | Fixed | Alkaline | -- | -- | 2.5 | 4.73 | 1.21 | 0.605 | -0.643 | 1.40 | 0.702 | | |
| Body | 156.7 | 14 | CW | Fixed | NiMH | Belt-Clip | Speaker-Mic (P/N: MH-57A4B) | 1.3 | 4.72 | P | 1.11 | 0.555 | 0.141 | - | - | |
| | | | | | | | | | | S | 0.940 | 0.470 | 0.109 | - | - | |
| Body | 156.7 | 14 | CW | Fixed | NiMH | Belt-Clip | Noise-Canceling Speaker-Mic (P/N: CMP460) | 1.3 | 4.73 | 0.909 | | 0.455 | 0.169 | - | - | |
| Body | 156.7 | 14 | CW | Fixed | NiMH | Belt-Clip | VOX Headset (P/N: VC-24) | 1.3 | 4.73 | P | 1.06 | 0.530 | 0.206 | - | - | |
| | | | | | | | | | | S | 0.886 | 0.443 | 0.155 | - | - | |
| Body | 156.7 | 14 | CW | Fixed | NiMH | Belt-Clip | VOX Earpiece (P/N: VC-27) | 1.3 | 4.72 | 1.29 | | 0.645 | -0.141 | - | - | |
| Body | 156.7 | 14 | CW | Fixed | Alkaline | Belt-Clip | VOX Earpiece (P/N: VC-27) | 1.3 | 4.71 | 1.46 | | 0.730 | 0.134 | - | - | |
| ANSI / IEEE C95.1 1999 - SAFETY LIMIT | | | | | FACE / BODY: 8.0 W/kg (averaged over 1 gram) | | | | | Spatial Peak - Controlled Exposure / Occupational | | | | | | |
| Test Date | December 23, 2005 | | | | December 23, 2005 | | | | Fluid Type | | Brain | Body | Unit | | | |
| Dielectric Constant ϵ_r | 150 MHz Brain | | | | 150 MHz Body | | | | Relative Humidity | | 30 | 30 | % | | | |
| | IEEE Target | | Meas. | Dev. | IEEE Target | | Meas. | Dev. | Atmospheric Pressure | | 102.4 | 102.6 | kPa | | | |
| | 52.3 | $\pm 5\%$ | 54.9 | +5.0% | 61.9 | $\pm 5\%$ | 62.8 | +1.5% | Ambient Temperature | | 23.6 | 23.0 | °C | | | |
| Conductivity σ (mho/m) | 150 MHz Brain | | | | 150 MHz Body | | | | Fluid Temperature | | 23.0 | 22.8 | °C | | | |
| | IEEE Target | | Meas. | Dev. | IEEE Target | | Meas. | Dev. | Fluid Depth | | ≥ 15 | ≥ 15 | cm | | | |
| | 0.76 | $\pm 5\%$ | 0.795 | +4.6% | 0.80 | $\pm 5\%$ | 0.80 | 0.0% | ρ (Kg/m³) | | 1000 | | | | | |

Note(s):

- The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
- The transmission band of the DUT was < 10 MHz; therefore only the middle channel of the frequency band was evaluated (per FCC OET Bulletin 65, Supplement C, Edition 01-01 - see reference [3]).
- Secondary peak SAR levels measured within 2 dB of the primary were reported (P = Primary, S = Secondary).
- The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down to room temperature and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
- The power droops (> 5% from the start power) measured by the DASY4 system for the duration of the SAR evaluations were added to the measured SAR levels to report scaled SAR results as shown in the above test data table.
- A SAR-versus-Time power drift evaluation was performed in the test configuration that reported the maximum power droop. See Appendix A (SAR Test Plots) for SAR-versus-Time power droop evaluation plot.
- The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
- The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
- The SAR evaluations were performed within 24 hours of the system performance check.

| | | | | | | |
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5.0 DETAILS OF SAR EVALUATION

The VERTEX STANDARD CO., LTD. Model(s): HX500S Portable VHF PTT Marine Radio Transceiver FCC ID: K6630183X20 was compliant for localized Specific Absorption Rate (Occupational / Controlled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix D.

1. The DUT was evaluated in a face-held configuration with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm separation distance was maintained between the front side of the DUT and the outer surface of the planar phantom.
2. The DUT was tested in a body-worn configuration with the back of the radio placed parallel to the outer surface of the planar phantom. The attached belt-clip accessory was touching the planar phantom and provided a 1.3 cm separation distance from the back of the DUT to the outer surface of the planar phantom. The DUT was evaluated for body-worn SAR with speaker-microphone, noise-canceling speaker-microphone, VOX earpiece, and VOX headset audio accessories.
3. The conducted power levels were measured prior to the SAR evaluations using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
4. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down to room temperature and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
5. The power drift of the DUT for the duration of the SAR evaluations was measured by the DASY4 system.
6. The DUT was tested in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.
7. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
8. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
9. The SAR evaluations were performed using a Plexiglas side planar phantom.
10. The SAR evaluations were performed within 24 hours of the system performance check.

6.0 EVALUATION PROCEDURES


- a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.
- b. The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

An area scan was determined as follows:

- c. Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.
- d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

- e. Extrapolation is used to find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix F). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.
- f. Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).
- g. A zoom scan volume of 32 mm x 32 mm x 30 mm (5 x 5 x 7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7 x 7 x 7) to ensure complete capture of the peak spatial-average SAR.

| | | | | | | |
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| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed using a planar phantom and a 300 MHz dipole (see Appendix E for system validation procedures). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of $\pm 10\%$ (see Appendix B for system performance check test plot).

| SYSTEM PERFORMANCE CHECK EVALUATION | | | | | | | | | | | | | | | | |
|-------------------------------------|----------------------|------------------|-------|-------|----------------------------------|-------|-------|-------------------------------|-------|------|-----------------------------|-----------------|------------------|------------------|------------|---------------------|
| Test Date | 300MHz Equiv. Tissue | SAR 1g (W/kg) | | | Dielectric Constant ϵ_r | | | Conductivity σ (mho/m) | | | ρ (Kg/m ³) | Amb. Temp. (°C) | Fluid Temp. (°C) | Fluid Depth (cm) | Humid. (%) | Barom. Press. (kPa) |
| | | IEEE Target | Meas. | Dev. | IEEE Target | Meas. | Dev. | IEEE Target | Meas. | Dev. | | | | | | |
| 12/22/05 | Brain | 0.750 $\pm 10\%$ | 0.803 | +7.1% | 45.3 $\pm 5\%$ | 45.0 | -0.7% | 0.87 $\pm 5\%$ | 0.87 | 0.0% | 1000 | 24.4 | 22.3 | ≥ 15 | 30 | 100.6 |

Note(s):
 1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

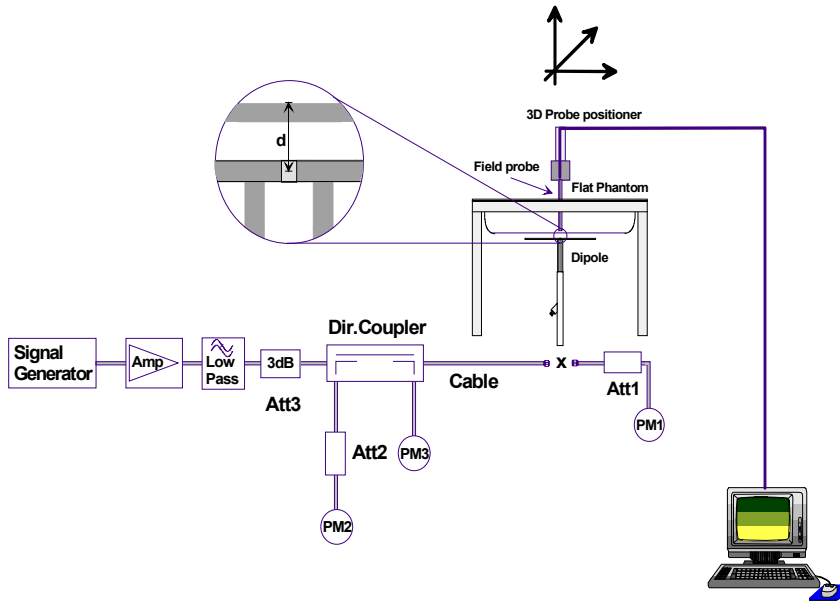


Figure 1. System Performance Check Setup Diagram



300MHz Dipole Setup

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
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8.0 SIMULATED EQUIVALENT TISSUES

The simulated tissue mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).


| SIMULATED TISSUE MIXTURES | | | |
|---------------------------|--------------------------|-------------------|------------------|
| INGREDIENT | 300 MHz Brain (%) | 150 MHz Brain (%) | 150 MHz Body (%) |
| | System Performance Check | DUT Evaluation | DUT Evaluation |
| Water | 37.56 | 38.35 | 46.6 |
| Sugar | 55.32 | 55.5 | 49.7 |
| Salt | 5.95 | 5.15 | 2.6 |
| HEC | 0.98 | 0.9 | 1.0 |
| Bactericide | 0.19 | 0.1 | 0.1 |

9.0 SAR SAFETY LIMITS

| EXPOSURE LIMITS | SAR (W/kg) | |
|--|--|--|
| | (General Population / Uncontrolled Exposure Environment) | (Occupational / Controlled Exposure Environment) |
| Spatial Average (averaged over the whole body) | 0.08 | 0.4 |
| Spatial Peak (averaged over any 1g of tissue) | 1.60 | 8.0 |
| Spatial Peak (hands/wrists/feet/ankles averaged over 10g) | 4.0 | 20.0 |

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

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| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER: Stäubli Unimation Corp. Robot Model: RX60L
Repeatability: 0.02 mm
No. of axis: 6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor: AMD Athlon XP 2400+
Clock Speed: 2.0 GHz
Operating System: Windows XP Professional

Data Converter

Features: Signal Amplifier, multiplexer, A/D converter, and control logic
Software: DASY4 software
Connecting Lines: Optical downlink for data and status info.
 Optical uplink for commands and clock

DASY4 Measurement Server

Function: Real-time data evaluation for field measurements and surface detection
Hardware: PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections: COM1, COM2, DAE, Robot, Ethernet, Service Interface

E-Field Probe

Model: ET3DV6
Serial No.: 1387
Construction: Triangular core fiber optic detection system
Frequency: 10 MHz to 6 GHz
Linearity: ±0.2 dB (30 MHz to 3 GHz)

Phantom(s)

Evaluation Phantom

Type: Side Planar Phantom
Shell Material: Plexiglas
Bottom Thickness: 2.0 mm ± 0.1 mm
Outer Dimensions: 75.0 cm (L) x 22.5 cm (W) x 20.5 cm (H); Back Plane: 25.7 cm (H)

Validation Phantom (≤ 450MHz)

Type: Planar Phantom
Shell Material: Plexiglas
Bottom Thickness: 6.2 mm ± 0.1 mm
Outer Dimensions: 86.0 cm (L) x 39.5 cm (W) x 21.8 cm (H)

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

11.0 PROBE SPECIFICATION (ET3DV6)

| | |
|--------------------|--|
| Construction: | Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycol) |
| Calibration: | In air from 10 MHz to 2.5 GHz In brain simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy $\pm 8\%$) |
| Frequency: | 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz) |
| Directivity: | ± 0.2 dB in brain tissue (rotation around probe axis) ± 0.4 dB in brain tissue (rotation normal to probe axis) |
| Dynamic Range: | 5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB |
| Surface Detection: | ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces |
| Dimensions: | Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm |
| Application: | General dosimetry up to 3 GHz Compliance tests of mobile phone |



**ET3DV6
E-Field Probe**

12.0 SIDE PLANAR PHANTOM

The side planar phantom is constructed of Plexiglas material with a 2.0 mm shell thickness for face-held and body-worn SAR evaluations of handheld and body-worn radio transceivers. The side planar phantom is mounted on the side of the DASY4 compact system table.



Plexiglas Side Planar Phantom

13.0 VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted in the table of the DASY4 compact system.




Validation Planar Phantom

14.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65° . The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.




Device Holder

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

15.0 TEST EQUIPMENT LIST

| USED | TEST EQUIPMENT DESCRIPTION | ASSET NO. | SERIAL NO. | DATE CALIBRATED | | CALIBRATION DUE DATE |
|------|--|-----------|------------|-----------------|---------|----------------------|
| | | | | | | |
| x | Schmid & Partner DASY4 System | - | - | - | - | - |
| x | -DASY4 Measurement Server | 00158 | 1078 | N/A | N/A | N/A |
| x | -Robot | 00046 | 599396-01 | N/A | N/A | N/A |
| x | -DAE4 | 00019 | 353 | 15Jun05 | | 15Jun06 |
| | -DAE3 | 00018 | 370 | 25Jan05 | | 25Jan06 |
| x | -ET3DV6 E-Field Probe | 00016 | 1387 | 18Mar05 | | 18Mar06 |
| | -ET3DV6 E-Field Probe | 00017 | 1590 | 20May05 | | 20May06 |
| | -EX3DV4 E-Field Probe | 00125 | 3547 | 21Jan05 | | 21Jan06 |
| x | -300MHz Validation Dipole | 00023 | 135 | 25Oct05 | | 25Oct06 |
| | -450MHz Validation Dipole | 00024 | 136 | 25Oct05 | | 25Oct06 |
| | -835MHz Validation Dipole | 00022 | 411 | Brain | 30Mar05 | 30Mar06 |
| | | | | Body | 12Apr05 | 12Apr06 |
| | -900MHz Validation Dipole | 00020 | 054 | Brain | 10Jun05 | 10Jun06 |
| | | | | Body | 10Jun05 | 10Jun06 |
| | -1800MHz Validation Dipole | 00021 | 247 | Brain | 14Jun05 | 14Jun06 |
| | | | | Body | 14Jun05 | 14Jun06 |
| | -1900MHz Validation Dipole | 00032 | 151 | Brain | 17Jun05 | 17Jun06 |
| | | | | Body | 22Apr05 | 22Apr06 |
| | -2450MHz Validation Dipole | 00025 | 150 | Brain | 20Sep05 | 20Sep06 |
| | | | | Body | 22Apr05 | 22Apr06 |
| | -5000MHz Validation Dipole | 00126 | 1031 | Brain | 11Jan05 | 11Jan06 |
| | | | | Body | 11Jan05 | 11Jan06 |
| | -SAM Phantom V4.0C | 00154 | 1033 | N/A | | N/A |
| | -Barski Planar Phantom | 00155 | 03-01 | N/A | | N/A |
| x | -Plexiglas Side Planar Phantom | 00156 | 161 | N/A | | N/A |
| x | - Plexiglas Validation Planar Phantom | 00157 | 137 | N/A | | N/A |
| | HP 85070C Dielectric Probe Kit | 00033 | N/A | N/A | | N/A |
| x | ALS-PR-DIEL Dielectric Probe Kit | 00160 | 260-00953 | N/A | | N/A |
| x | Gigatronics 8652A Power Meter | 00110 | 1835801 | 16Apr05 | | 16Apr06 |
| | Gigatronics 8652A Power Meter | 00008 | 1835267 | 29Apr05 | | 29Apr06 |
| x | Gigatronics 80701A Power Sensor | 00012 | 1834350 | 12Sep05 | | 12Sep06 |
| x | Gigatronics 80701A Power Sensor | 00014 | 1833699 | 07Sep05 | | 07Sep06 |
| | Gigatronics 80701A Power Sensor | 00109 | 1834366 | 16Apr05 | | 16Apr06 |
| x | HP 8753ET Network Analyzer | 00134 | US39170292 | 04May05 | | 04May06 |
| x | HP 8648D Signal Generator | 00005 | 3847A00611 | 29Apr05 | | 29Apr06 |
| | Rohde & Schwarz SMR40 Signal Generator | 00006 | 100104 | 12Apr05 | | 12Apr06 |
| x | Amplifier Research 5S1G4 Power Amplifier | 00106 | 26235 | N/A | | N/A |


| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

16.0 MEASUREMENT UNCERTAINTIES

| UNCERTAINTY BUDGET FOR DEVICE EVALUATION | | | | | | |
|--|---------------------------|--------------------------|-------------|-------------|--------------------------------|--------------------|
| Error Description | Uncertainty Value $\pm\%$ | Probability Distribution | Divisor | c_i 1g | Uncertainty Value $\pm\%$ (1g) | V_i or V_{eff} |
| Measurement System | | | | | | |
| Probe calibration | 5.0 | Normal | 1 | 1 | 5.0 | ∞ |
| Axial isotropy of the probe | 4.7 | Rectangular | 1.732050808 | 0.7 | 1.9 | ∞ |
| Spherical isotropy of the probe | 9.6 | Rectangular | 1.732050808 | 0.7 | 3.9 | ∞ |
| Spatial resolution | 0 | Rectangular | 1.732050808 | 1 | 0.0 | ∞ |
| Boundary effects | 1 | Rectangular | 1.732050808 | 1 | 0.6 | ∞ |
| Probe linearity | 4.7 | Rectangular | 1.732050808 | 1 | 2.7 | ∞ |
| Detection limit | 1 | Rectangular | 1.732050808 | 1 | 0.6 | ∞ |
| Readout electronics | 0.3 | Normal | 1 | 1 | 0.3 | ∞ |
| Response time | 0.8 | Rectangular | 1.732050808 | 1 | 0.5 | ∞ |
| Integration time | 2.6 | Rectangular | 1.732050808 | 1 | 1.5 | ∞ |
| RF ambient conditions | 3 | Rectangular | 1.732050808 | 1 | 1.7 | ∞ |
| Mech. constraints of robot | 0.4 | Rectangular | 1.732050808 | 1 | 0.2 | ∞ |
| Probe positioning | 2.9 | Rectangular | 1.732050808 | 1 | 1.7 | ∞ |
| Extrapolation & integration | 1 | Rectangular | 1.732050808 | 1 | 0.6 | ∞ |
| Test Sample Related | | | | | | |
| Device positioning | 2.9 | Normal | 1 | 1 | 2.9 | 12 |
| Device holder uncertainty | 3.6 | Normal | 1 | 1 | 3.6 | 8 |
| Power drift | 5 | Rectangular | 1.732050808 | 1 | 2.9 | ∞ |
| Phantom and Setup | | | | | | |
| Phantom uncertainty | 4 | Rectangular | 1.732050808 | 1 | 2.3 | ∞ |
| Liquid conductivity (target) | 5 | Rectangular | 1.732050808 | 0.64 | 1.8 | ∞ |
| Liquid conductivity (measured) | 2.5 | Normal | 1 | 0.64 | 1.6 | ∞ |
| Liquid permittivity (target) | 5 | Rectangular | 1.732050808 | 0.6 | 1.7 | ∞ |
| Liquid permittivity (measured) | 2.5 | Normal | 1 | 0.6 | 1.5 | ∞ |
| Combined Standard Uncertainty | | | | | 10.33 | |
| Expanded Uncertainty (k=2) | | | | | 20.66 | |

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])


| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

MEASUREMENT UNCERTAINTIES (CONT.)

| UNCERTAINTY BUDGET FOR SYSTEM VALIDATION | | | | | | |
|--|----------------------|--------------------------|-------------|-------|---------------------------|------------------------------------|
| Error Description | Uncertainty Value ±% | Probability Distribution | Divisor | ci 1g | Uncertainty Value ±% (1g) | V _i or V _{off} |
| Measurement System | | | | | | |
| Probe calibration | 4.5 | Normal | 1 | 1 | 4.5 | ∞ |
| Axial isotropy of the probe | 4.7 | Rectangular | 1.732050808 | 1 | 2.7 | ∞ |
| Spherical isotropy of the probe | 0 | Rectangular | 1.732050808 | 1 | 0.0 | ∞ |
| Spatial resolution | 0 | Rectangular | 1.732050808 | 1 | 0.0 | ∞ |
| Boundary effects | 1 | Rectangular | 1.732050808 | 1 | 0.6 | ∞ |
| Probe linearity | 4.7 | Rectangular | 1.732050808 | 1 | 2.7 | ∞ |
| Detection limit | 1 | Rectangular | 1.732050808 | 1 | 0.6 | ∞ |
| Readout electronics | 0.3 | Normal | 1 | 1 | 0.3 | ∞ |
| Response time | 0 | Rectangular | 1.732050808 | 1 | 0.0 | ∞ |
| Integration time | 0 | Rectangular | 1.732050808 | 1 | 0.0 | ∞ |
| RF ambient conditions | 3 | Rectangular | 1.732050808 | 1 | 1.7 | ∞ |
| Mech. constraints of robot | 0.4 | Rectangular | 1.732050808 | 1 | 0.2 | ∞ |
| Probe positioning | 2.9 | Rectangular | 1.732050808 | 1 | 1.7 | ∞ |
| Extrapolation & integration | 1 | Rectangular | 1.732050808 | 1 | 0.6 | ∞ |
| Test Sample Related | | | | | | |
| Dipole Positioning | 2 | Normal | 1.732050808 | 1 | 1.2 | ∞ |
| Power & Power Drift | 4.7 | Normal | 1.732050808 | 1 | 2.7 | ∞ |
| Phantom and Setup | | | | | | |
| Phantom uncertainty | 4 | Rectangular | 1.732050808 | 1 | 2.3 | ∞ |
| Liquid conductivity (target) | 5 | Rectangular | 1.732050808 | 0.64 | 1.8 | ∞ |
| Liquid conductivity (measured) | 2.5 | Normal | 1 | 0.64 | 1.6 | ∞ |
| Liquid permittivity (target) | 5 | Rectangular | 1.732050808 | 0.6 | 1.7 | ∞ |
| Liquid permittivity (measured) | 2.5 | Normal | 1 | 0.6 | 1.5 | ∞ |
| Combined Standard Uncertainty | | | | | 8.20 | |
| Expanded Uncertainty (k=2) | | | | | 16.39 | |


Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])


| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |


17.0 REFERENCES

- [1] Federal Communications Commission, "Radiofrequency radiation exposure evaluation: portable devices", Rule Part 47 CFR §2.1093: 1999.
- [2] Health Canada, "Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz", Safety Code 6: 1999.
- [3] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- [4] Industry Canada, "Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)", Radio Standards Specification RSS-102 Issue 2: November 2005.
- [5] IEEE Standard 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques": December 2003.

| | | | | | | |
|-------------------------|----------------------------------|--|--|----------------------------|----------------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

APPENDIX A - SAR MEASUREMENT DATA

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------|---------------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | | 156.0 - 157.425 MHz | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Face-Held SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Ambient Temp: 23.6 °C; Fluid Temp: 23.0 °C; Barometric Pressure: 102.4 kPa; Humidity: 30%

Communication System: FM VHF (CW)
 RF Output Power: 4.70 Watts (Conducted)
 Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
 7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
 Medium: HSL150 ($\sigma = 0.795 \text{ mho/m}$; $\epsilon_r = 54.9$; $\rho = 1000 \text{ kg/m}^3$)

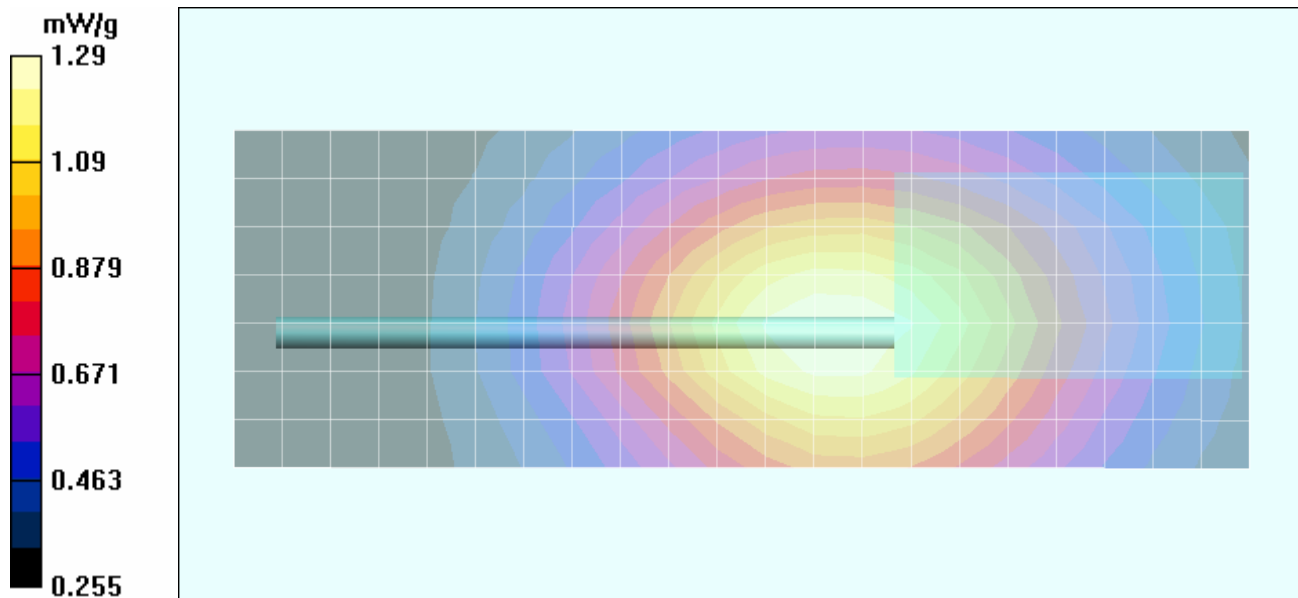
- Probe: ET3DV6 - SN1387; ConvF(8.8, 8.8, 8.8); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159


Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Area Scan (8x22x1):

Measurement grid: dx=15mm, dy=15mm

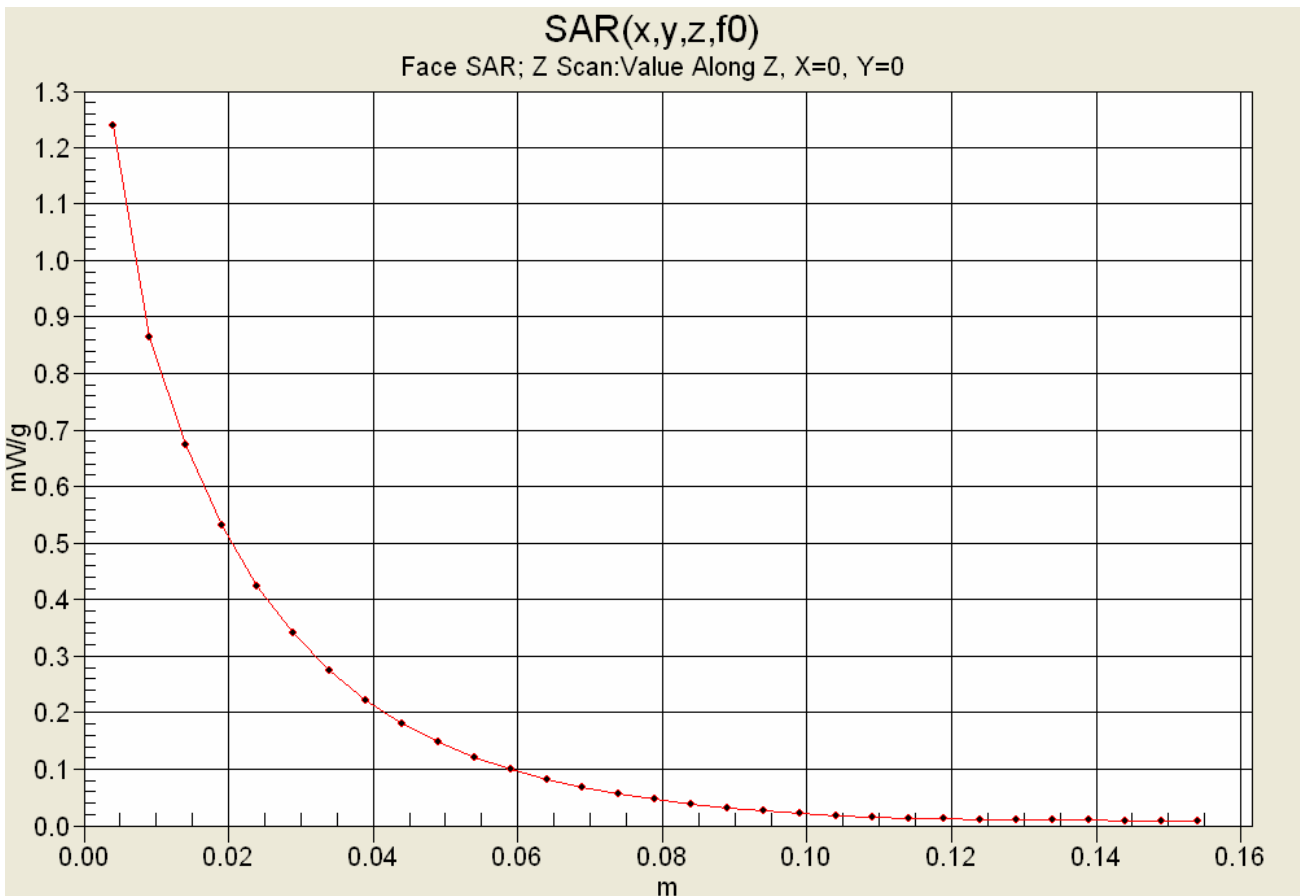
Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 38.4 V/m; Power Drift = -0.529 dB
 Peak SAR (extrapolated) = 2.01 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.921 mW/g



| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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Z-Axis Scan



| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Face-Held SAR - Alkaline Batteries (Duracell Procell) - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Ambient Temp: 23.6 °C; Fluid Temp: 23.0 °C; Barometric Pressure: 102.4 kPa; Humidity: 30%

Communication System: FM VHF (CW)
 RF Output Power: 4.73 Watts (Conducted)
 Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
 9V AA Duracell Procell Alkaline Battery Pack (P/N: FBA-25A)
 Medium: HSL150 ($\sigma = 0.795 \text{ mho/m}$; $\epsilon_r = 54.9$; $\rho = 1000 \text{ kg/m}^3$)

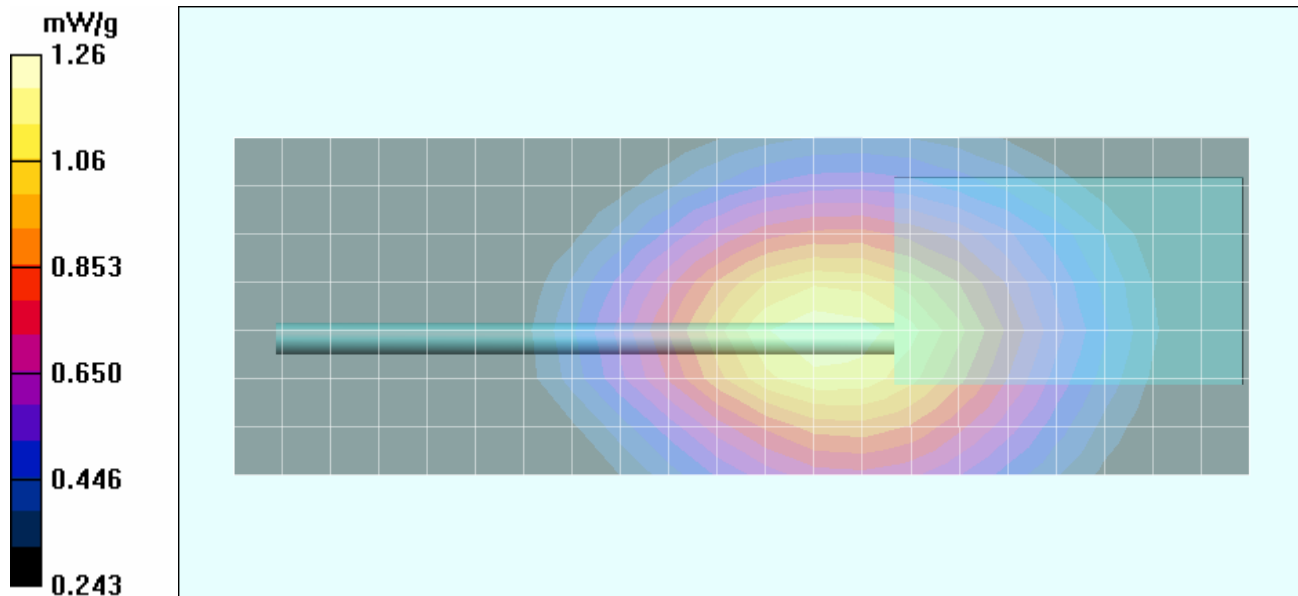
- Probe: ET3DV6 - SN1387; ConvF(8.8, 8.8, 8.8); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DAS4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159


Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Area Scan (8x22x1):

Measurement grid: dx=15mm, dy=15mm

Face-Held SAR - 2.5 cm Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:

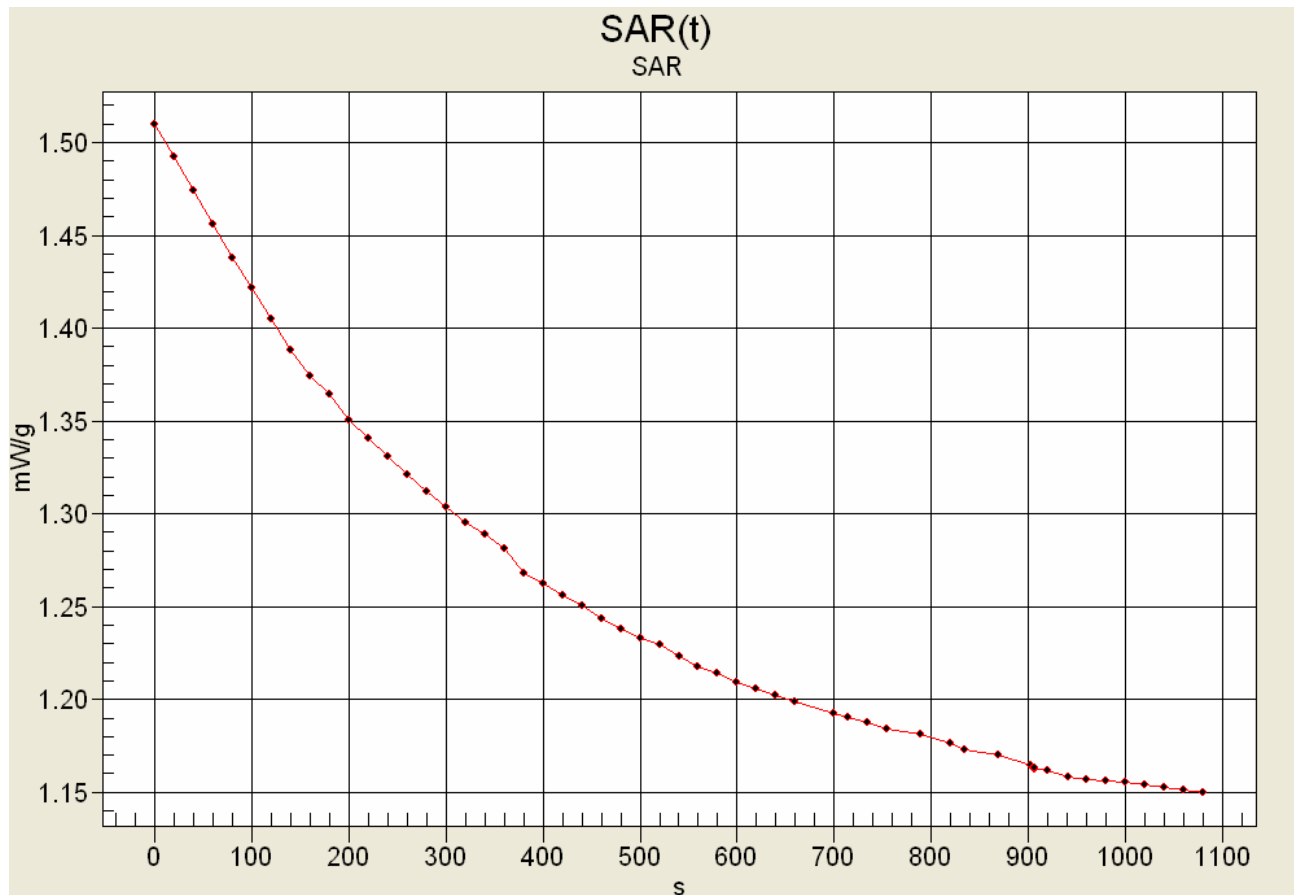
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 38.3 V/m; Power Drift = -0.643 dB
 Peak SAR (extrapolated) = 1.94 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.887 mW/g



| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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SAR-versus-Time Power Drift Evaluation

Face-Held Configuration
 Duracell Procell Alkaline Battery Pack (P/N: FBA-25A)
 Channel 14 - 156.7 MHz



Max SAR: 1.5097 mW/g
 Low SAR: 1.14998 mW/g (-1.1820 dB)
 SAR after 340s: 1.28872 mW/g (-0.6873 dB)
 (340s = Zoom Scan Duration)
 (1080s = Area Scan Duration)

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: Speaker-Microphone (P/N: MH-57A4B)

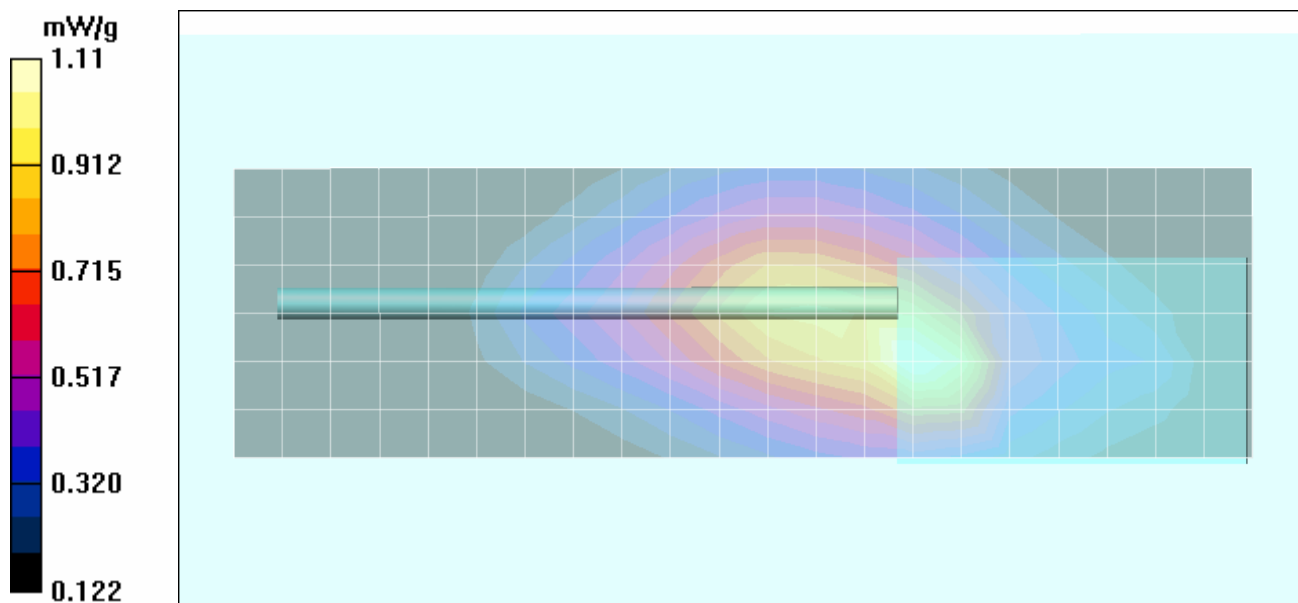
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%


Communication System: FM VHF (CW)
 RF Output Power: 4.72 Watts (Conducted)
 RF Output Power: 4.72 Watts (Conducted) 2nd Maximum
 Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
 7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
 Medium: M150 ($\sigma = 0.80$ mho/m; $\epsilon_r = 62.8$; $\rho = 1000$ kg/m³)
 - Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
 - Sensor-Surface: 4mm (Mechanical Surface Detection)
 - Electronics: DAE4 Sn353; Calibrated: 15/06/2005
 - Phantom: Side Planar; Type: Plexiglas; Serial: 161
 - Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
 Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
 Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 34.6 V/m; Power Drift = 0.141 dB
 Peak SAR (extrapolated) = 2.63 W/kg
SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.684 mW/g

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan 2 (5x5x7)/Cube 0:
 Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 35.3 V/m; Power Drift = 0.109 dB
 Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 0.940 mW/g; SAR(10 g) = 0.667 mW/g



| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: Noise-Canceling Speaker-Microphone (P/N: CMP460)

Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%

Communication System: FM VHF (CW)
 RF Output Power: 4.73 Watts (Conducted)
 Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
 7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
 Medium: M150 ($\sigma = 0.80 \text{ mho/m}$; $\epsilon_r = 62.8$; $\rho = 1000 \text{ kg/m}^3$)

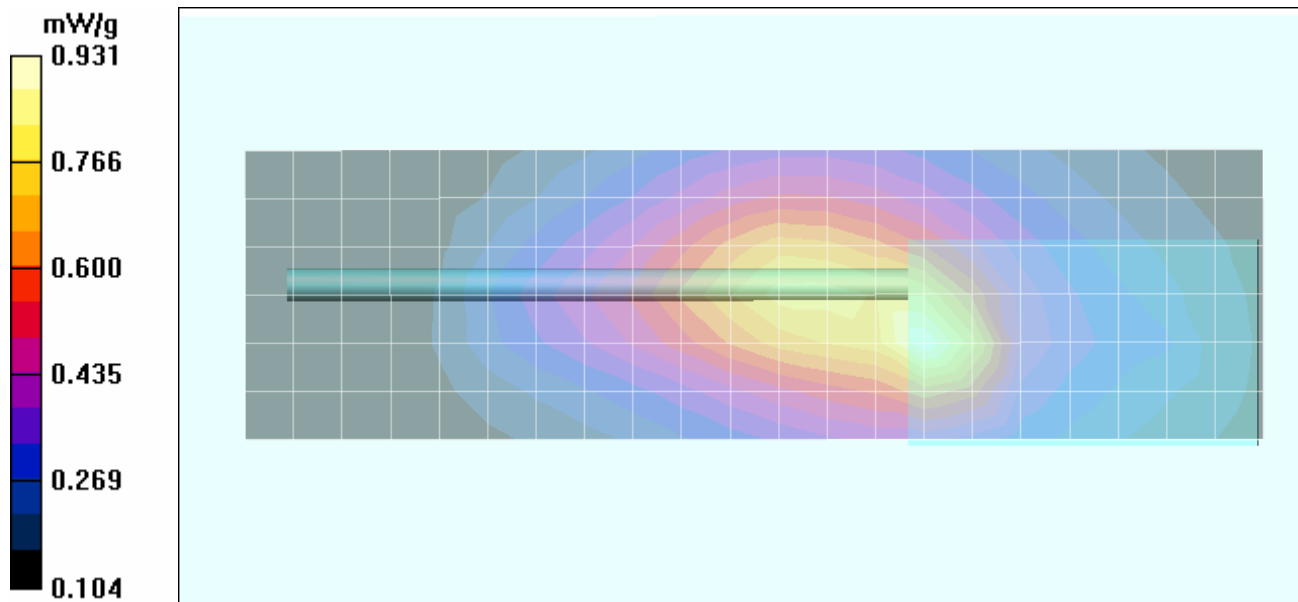
- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159


Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):

Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 31.0 V/m; Power Drift = 0.169 dB
 Peak SAR (extrapolated) = 2.07 W/kg
SAR(1 g) = 0.909 mW/g; SAR(10 g) = 0.567 mW/g



| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: VOX Headset (P/N: VC-24)

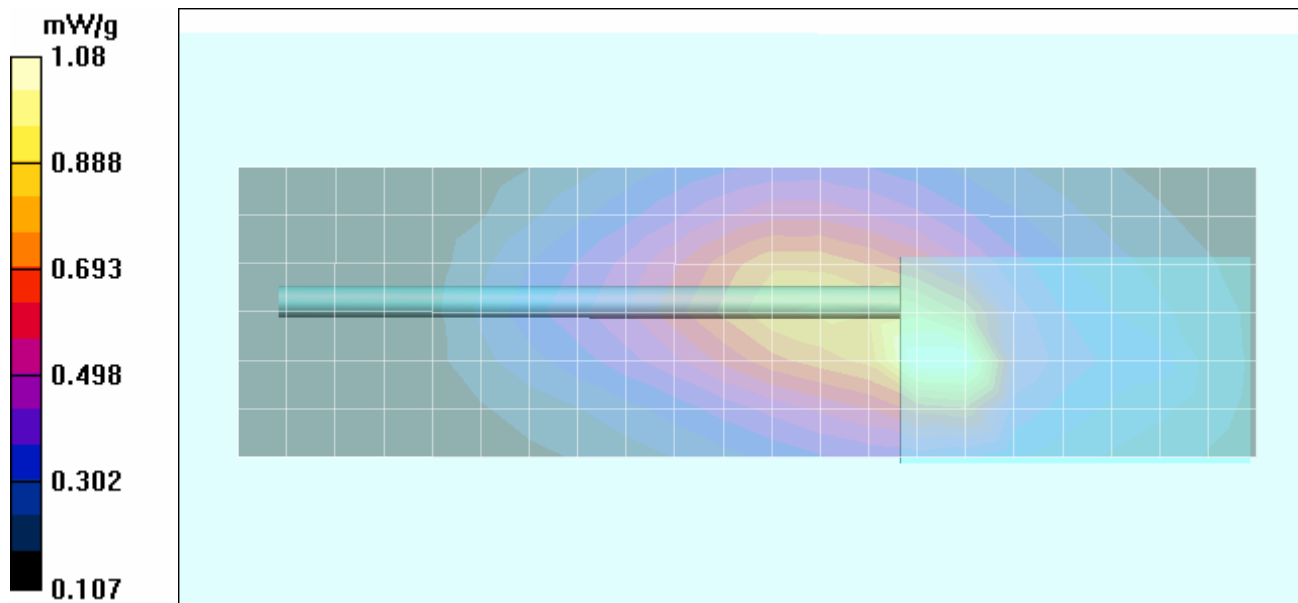
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%


- Communication System: FM VHF (CW)
- RF Output Power: 4.73 Watts (Conducted)
- RF Output Power: 4.72 Watts (Conducted) 2nd Maximum
- Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
- 7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
- Medium: M150 ($\sigma = 0.80$ mho/m; $\epsilon_r = 62.8$; $\rho = 1000$ kg/m³)
- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 33.3 V/m; Power Drift = 0.206 dB
Peak SAR (extrapolated) = 2.44 W/kg
SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.656 mW/g

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan 2 (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 34.1 V/m; Power Drift = 0.155 dB
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.886 mW/g; SAR(10 g) = 0.634 mW/g



| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Body-Worn SAR - NiMH Battery Pack - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: VOX Earpiece (P/N: VC-27)

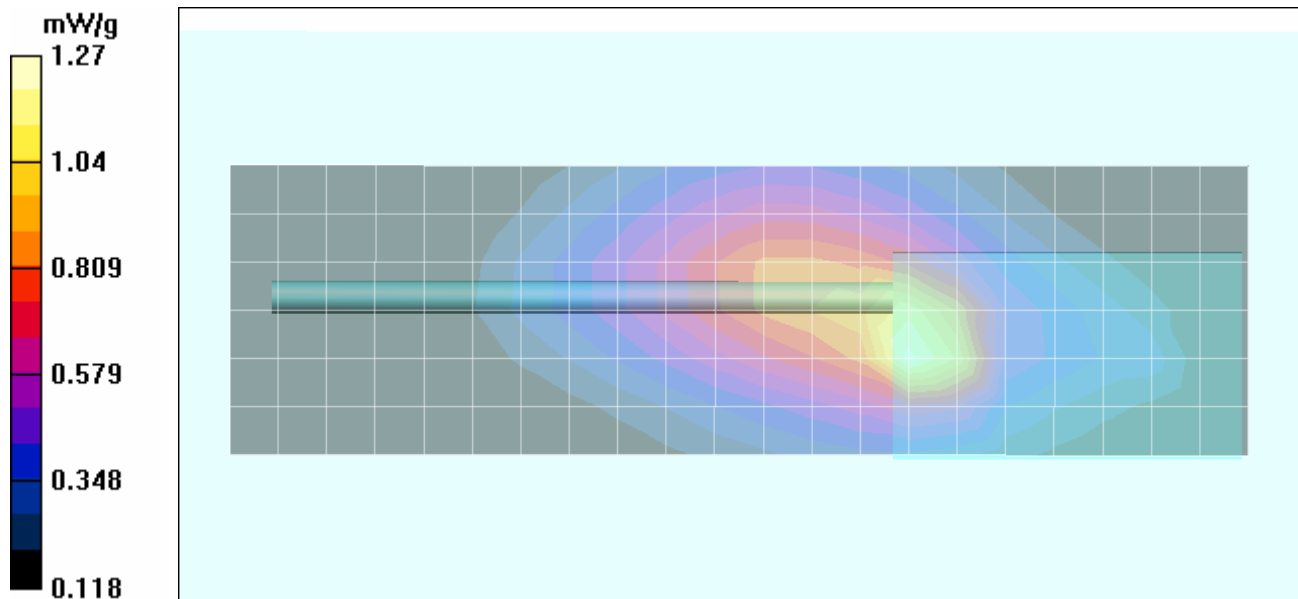
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%


Communication System: FM VHF (CW)
 RF Output Power: 4.72 Watts (Conducted)
 Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
 7.2V 1400mAh NiMH Battery Pack (P/N: FNB-83)
 Medium: M150 ($\sigma = 0.80 \text{ mho/m}$; $\epsilon_r = 62.8$; $\rho = 1000 \text{ kg/m}^3$)


- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
 Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
 Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 36.2 V/m; Power Drift = -0.141 dB
 Peak SAR (extrapolated) = 3.42 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.741 mW/g



| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/23/2005

Body-Worn SAR - Alkaline Batteries (Duracell Procell) - Mid Channel - 156.7 MHz

DUT: Vertex Model: HX500S; Type: Portable VHF PTT Marine Radio Transceiver; Serial: 5M000003

Body-Worn Accessory: Belt-Clip (P/N: BA0102700); Audio Accessory: VOX Earpiece (P/N: VC-27)

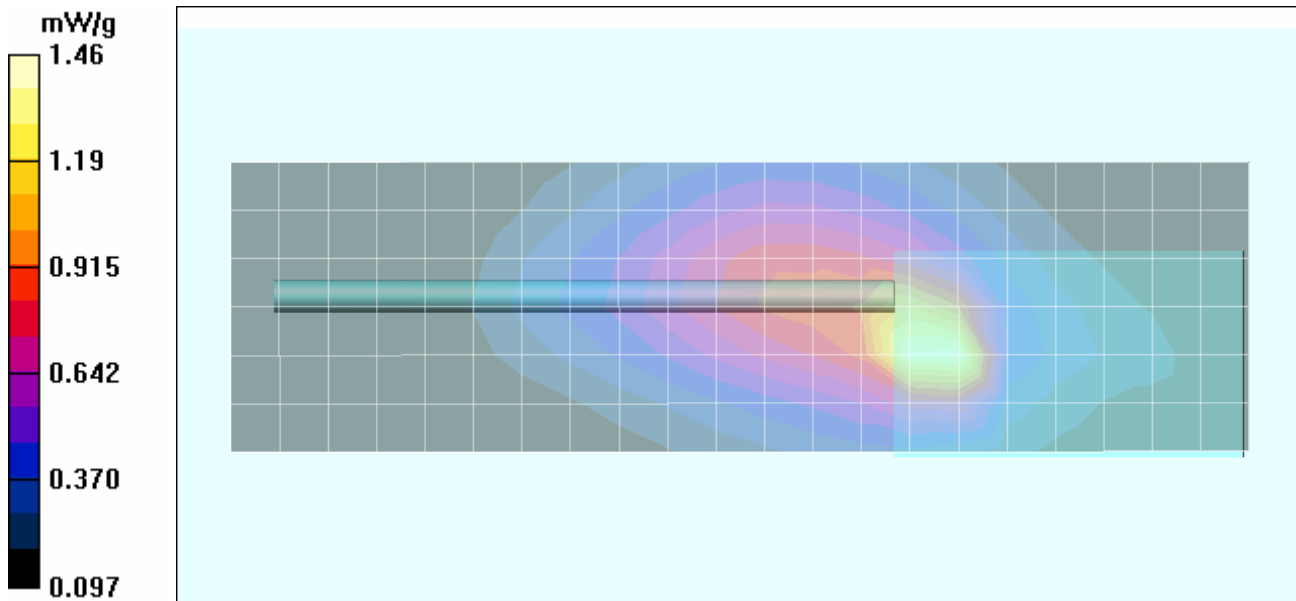
Ambient Temp: 23.0 °C; Fluid Temp: 22.8 °C; Barometric Pressure: 102.6 kPa; Humidity: 30%


Communication System: FM VHF (CW)
 RF Output Power: 4.71 Watts (Conducted)
 Frequency: 156.7 MHz; Channel 14; Duty Cycle: 1:1
 9V AA Duracell Procell Alkaline Battery Pack (P/N: FBA-25A)
 Medium: M150 ($\sigma = 0.80 \text{ mho/m}$; $\epsilon_r = 62.8$; $\rho = 1000 \text{ kg/m}^3$)

- Probe: ET3DV6 - SN1387; ConvF(8.4, 8.4, 8.4); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Side Planar; Type: Plexiglas; Serial: 161
- Measurement SW: DAS4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

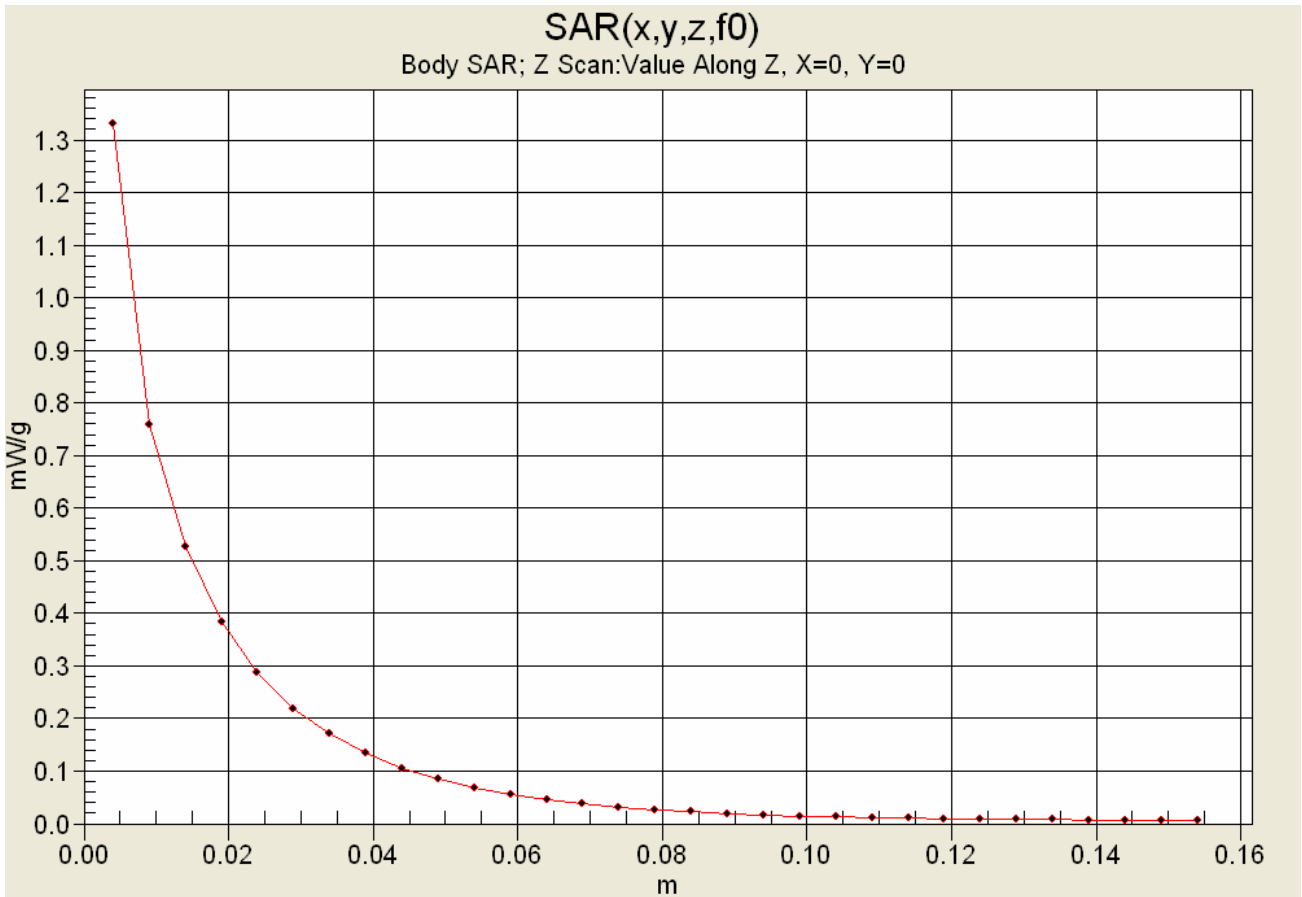
Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Area Scan (7x22x1):
 Measurement grid: dx=15mm, dy=15mm

Body-Worn SAR - 1.3 cm Belt-Clip Separation Distance to Planar Phantom - Mid Channel/Zoom Scan (5x5x7)/Cube 0:
 Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
 Reference Value = 36.0 V/m; Power Drift = 0.134 dB
 Peak SAR (extrapolated) = 4.08 W/kg
SAR(1 g) = 1.46 mW/g; SAR(10 g) = 0.815 mW/g




| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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Z-Axis Scan



| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

| | | | | | | |
|-------------------------|--|----------------|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

Date Tested: 12/22/2005

System Performance Check (Brain) - 300 MHz Dipole

DUT: Dipole 300 MHz; Model: D300V2; Type: System Performance Check; Serial: 135; Calibrated: 10/25/2005

Ambient Temp: 24.4 °C; Fluid Temp: 22.3 °C; Barometric Pressure: 100.6 kPa; Humidity: 30%

Communication System: CW

Forward Conducted Power: 250 mW

Frequency: 300 MHz; Duty Cycle: 1:1

Medium: 300 HSL ($\sigma = 0.87$ mho/m; $\epsilon_r = 45.0$; $\rho = 1000$ kg/m³)

- Probe: ET3DV6 - SN1387; ConvF(7.9, 7.9, 7.9); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DAS4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

300 MHz Dipole - System Performance Check/Area Scan (6x11x1):

Measurement grid: dx=15mm, dy=15mm

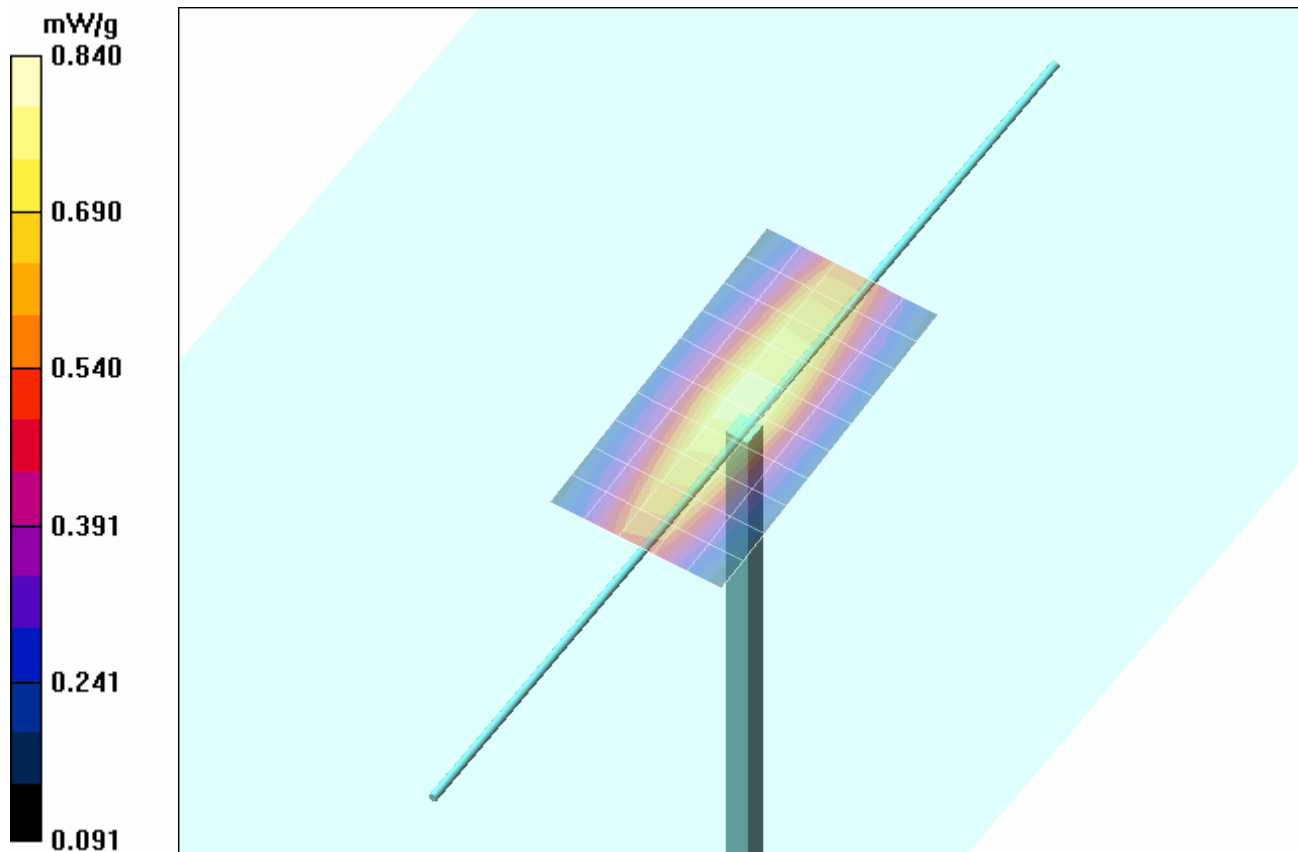
300 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:


Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 31.4 V/m; Power Drift = -0.002 dB

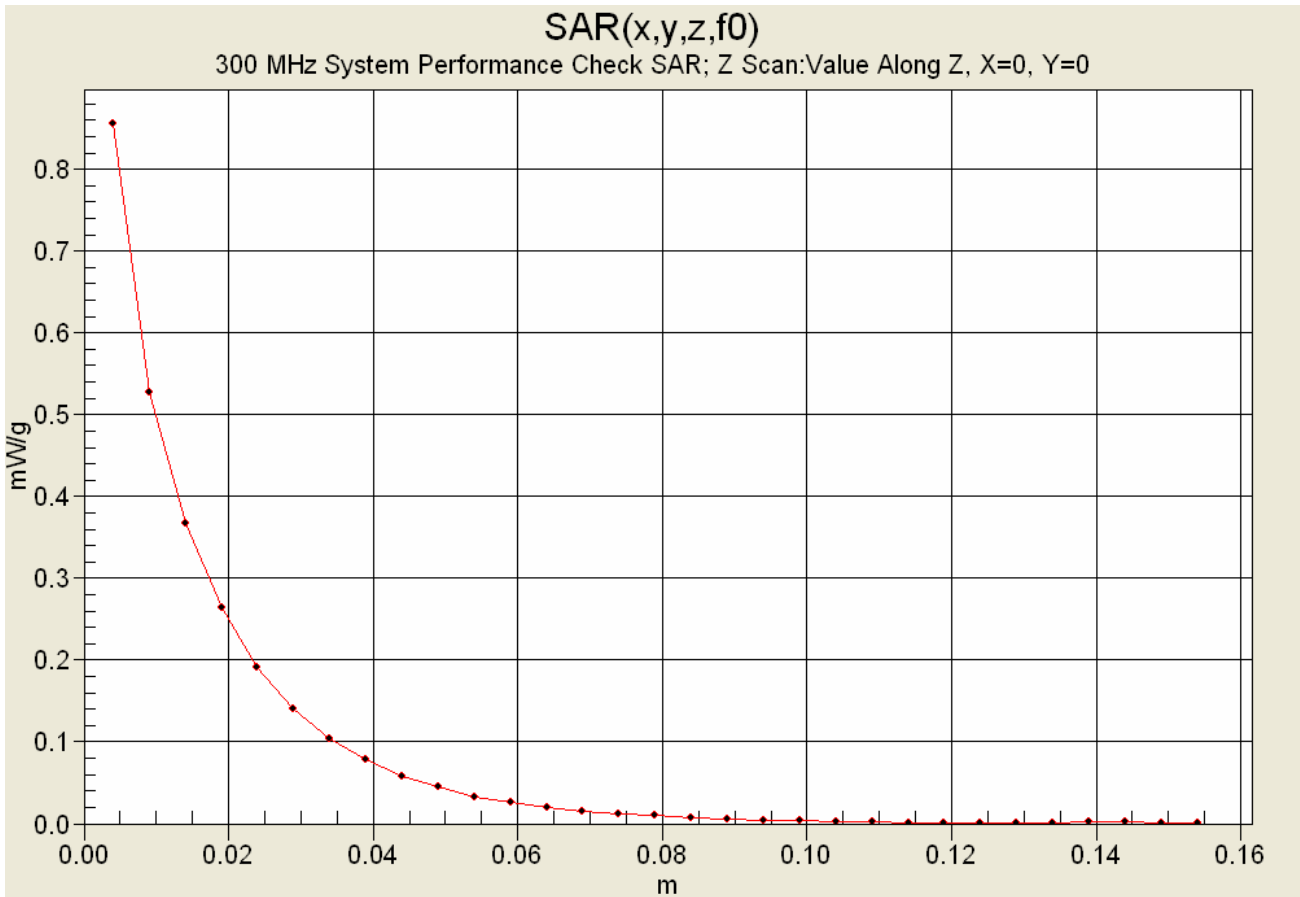
Peak SAR (extrapolated) = 1.41 W/kg

SAR(1 g) = 0.803 mW/g; SAR(10 g) = 0.523 mW/g




| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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Z-Axis Scan



| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

| | | | | | | |
|-------------------------|--|----------------|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | |
|-------------------------|----------------------|--------------------|--------------------|
| Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

300 MHz System Performance Check (Brain)

Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Thu 22/Dec/2005

Frequency(GHz)

FCC_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma

Test_e Epsilon of UIM

Test_s Sigma of UIM

| Freq | FCC_eHFCC_sH | Test_e | Test_s |
|--------|--------------|--------|--------|
| 0.2000 | 49.97 0.80 | 49.49 | 0.79 |
| 0.2100 | 49.50 0.80 | 47.92 | 0.80 |
| 0.2200 | 49.03 0.81 | 47.58 | 0.80 |
| 0.2300 | 48.57 0.82 | 47.49 | 0.81 |
| 0.2400 | 48.10 0.83 | 46.47 | 0.82 |
| 0.2500 | 47.63 0.83 | 46.67 | 0.83 |
| 0.2600 | 47.17 0.84 | 46.12 | 0.84 |
| 0.2700 | 46.70 0.85 | 45.75 | 0.84 |
| 0.2800 | 46.23 0.86 | 45.53 | 0.86 |
| 0.2900 | 45.77 0.86 | 45.19 | 0.86 |
| 0.3000 | 45.30 0.87 | 45.01 | 0.87 |
| 0.3100 | 45.18 0.87 | 44.42 | 0.88 |
| 0.3200 | 45.06 0.87 | 43.98 | 0.88 |
| 0.3300 | 44.94 0.87 | 43.79 | 0.89 |
| 0.3400 | 44.82 0.87 | 43.57 | 0.90 |
| 0.3500 | 44.70 0.87 | 43.12 | 0.91 |
| 0.3600 | 44.58 0.87 | 42.86 | 0.91 |
| 0.3700 | 44.46 0.87 | 42.45 | 0.93 |
| 0.3800 | 44.34 0.87 | 42.35 | 0.94 |
| 0.3900 | 44.22 0.87 | 42.01 | 0.95 |
| 0.4000 | 44.10 0.87 | 41.89 | 0.96 |

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---------------|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 | |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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|-------------------------|----------------------|--------------------|--------------------|
| Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

150 MHz DUT Evaluation (Face)

Celltech Labs Inc.
 Test Result for UIM Dielectric Parameter
 Fri 23/Dec/2005
 Frequency(GHz)
 FCC_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
 FCC_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma
 Test_e Epsilon of UIM
 Test_s Sigma of UIM

| Freq | FCC_eHFCC_sH | Test_e | Test_s |
|---------------|--------------|-------------|---------------------|
| 0.0500 | 56.97 | 0.69 | 59.91 0.74 |
| 0.0600 | 56.50 | 0.69 | 58.37 0.74 |
| 0.0700 | 56.03 | 0.70 | 57.28 0.73 |
| 0.0800 | 55.57 | 0.71 | 58.46 0.76 |
| 0.0900 | 55.10 | 0.72 | 59.06 0.75 |
| 0.1000 | 54.63 | 0.72 | 58.09 0.76 |
| 0.1100 | 54.17 | 0.73 | 58.11 0.77 |
| 0.1200 | 53.70 | 0.74 | 55.66 0.77 |
| 0.1300 | 53.23 | 0.75 | 56.04 0.78 |
| 0.1400 | 52.77 | 0.75 | 54.88 0.79 |
| 0.1500 | 52.30 | 0.76 | 54.91 0.7953 |
| 0.1600 | 51.83 | 0.77 | 53.72 0.81 |
| 0.1700 | 51.37 | 0.77 | 52.65 0.81 |
| 0.1800 | 50.90 | 0.78 | 52.92 0.82 |
| 0.1900 | 50.43 | 0.79 | 52.15 0.84 |
| 0.2000 | 49.97 | 0.80 | 51.71 0.85 |
| 0.2100 | 49.50 | 0.80 | 51.49 0.86 |
| 0.2200 | 49.03 | 0.81 | 50.93 0.86 |
| 0.2300 | 48.57 | 0.82 | 50.58 0.88 |
| 0.2400 | 48.10 | 0.83 | 50.57 0.87 |
| 0.2500 | 47.63 | 0.83 | 49.89 0.89 |



| | | | |
|-------------------------|----------------------|--------------------|--------------------|
| Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |


150 MHz DUT Evaluation (Body)

Celltech Labs Inc.
 Test Result for UIM Dielectric Parameter
 Fri 23/Dec/2005
 Frequency(GHz)
 FCC_eHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
 FCC_sHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
 FCC_eB FCC Limits for Body Epsilon
 FCC_sB FCC Limits for Body Sigma
 Test_e Epsilon of UIM
 Test_s Sigma of UIM

| Freq | FCC_eB | FCC_sB | Test_e | Test_s |
|--------|--------|--------|--------|--------|
| 0.0500 | 64.37 | 0.72 | 63.78 | 0.77 |
| 0.0600 | 64.12 | 0.73 | 63.80 | 0.76 |
| 0.0700 | 63.87 | 0.74 | 62.29 | 0.76 |
| 0.0800 | 63.63 | 0.74 | 64.27 | 0.78 |
| 0.0900 | 63.38 | 0.75 | 65.99 | 0.77 |
| 0.1000 | 63.13 | 0.76 | 65.47 | 0.78 |
| 0.1100 | 62.89 | 0.77 | 64.56 | 0.79 |
| 0.1200 | 62.64 | 0.78 | 62.43 | 0.79 |
| 0.1300 | 62.39 | 0.78 | 63.74 | 0.79 |
| 0.1400 | 62.15 | 0.79 | 62.92 | 0.80 |
| 0.1500 | 61.90 | 0.80 | 62.76 | 0.80 |
| 0.1600 | 61.65 | 0.81 | 62.51 | 0.82 |
| 0.1700 | 61.41 | 0.82 | 61.03 | 0.81 |
| 0.1800 | 61.16 | 0.82 | 61.10 | 0.83 |
| 0.1900 | 60.91 | 0.83 | 61.17 | 0.84 |
| 0.2000 | 60.67 | 0.84 | 60.75 | 0.85 |
| 0.2100 | 60.42 | 0.85 | 60.36 | 0.85 |
| 0.2200 | 60.17 | 0.86 | 60.83 | 0.86 |
| 0.2300 | 59.93 | 0.86 | 59.85 | 0.88 |
| 0.2400 | 59.68 | 0.87 | 59.88 | 0.87 |
| 0.2500 | 59.43 | 0.88 | 59.36 | 0.88 |

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

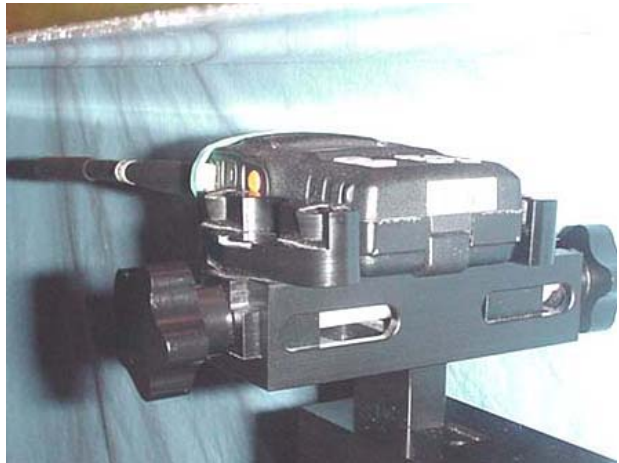
APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

| | | | | | | |
|-------------------------|--|----------------|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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FACE-HELD SAR TEST SETUP PHOTOGRAPHS
2.5 cm Separation Distance from Front of Radio to Planar Phantom
with NIMH Battery Pack (P/N: FNB-83)

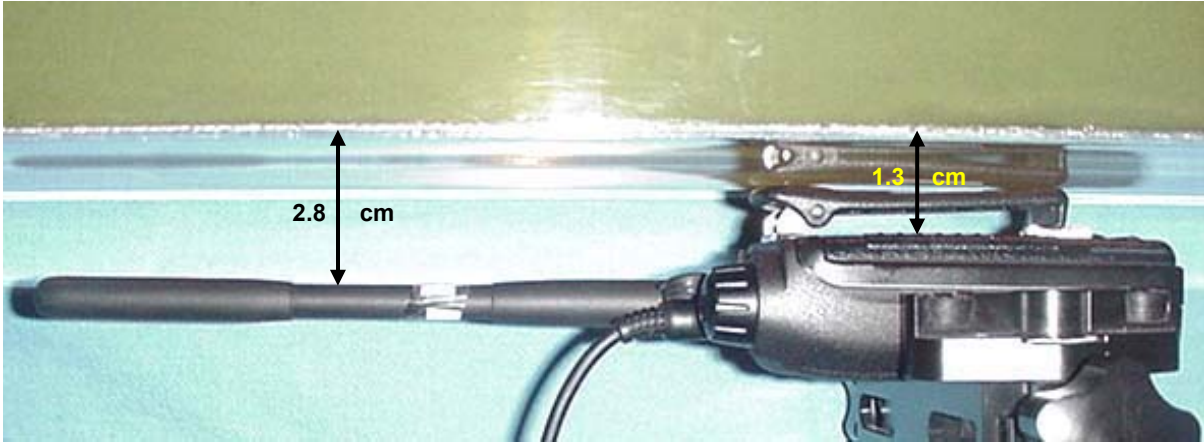


FACE-HELD SAR TEST SETUP PHOTOGRAPHS
2.5 cm Separation Distance from Front of Radio to Planar Phantom
with Alkaline Battery Case (P/N: FBA-25A)

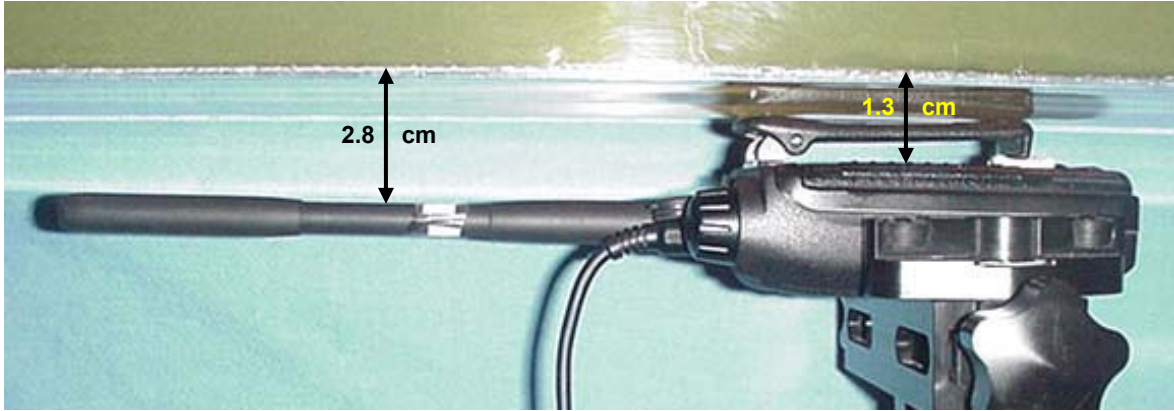


BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
 Speaker-Microphone Audio Accessory (P/N: MH-57A4B)
 NiMH Battery Pack (P/N: FNB-83)

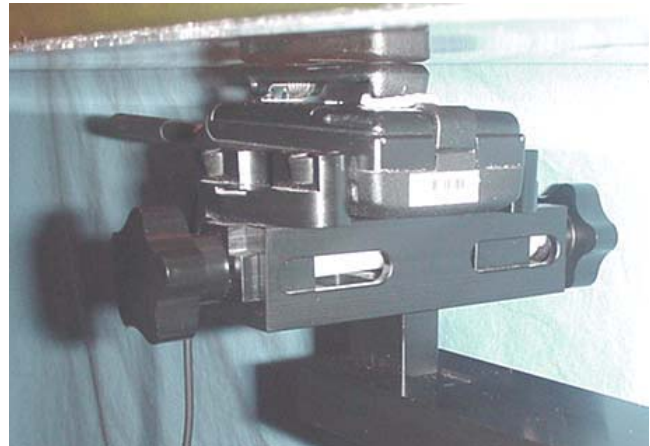


BODY-WORN SAR TEST SETUP PHOTOGRAPHS
1.3 cm Belt-Clip Separation Distance to Planar Phantom
Noise-Canceling Speaker Microphone Audio Accessory (P/N: CMP460)
NiMH Battery Pack (P/N: FNB-83)



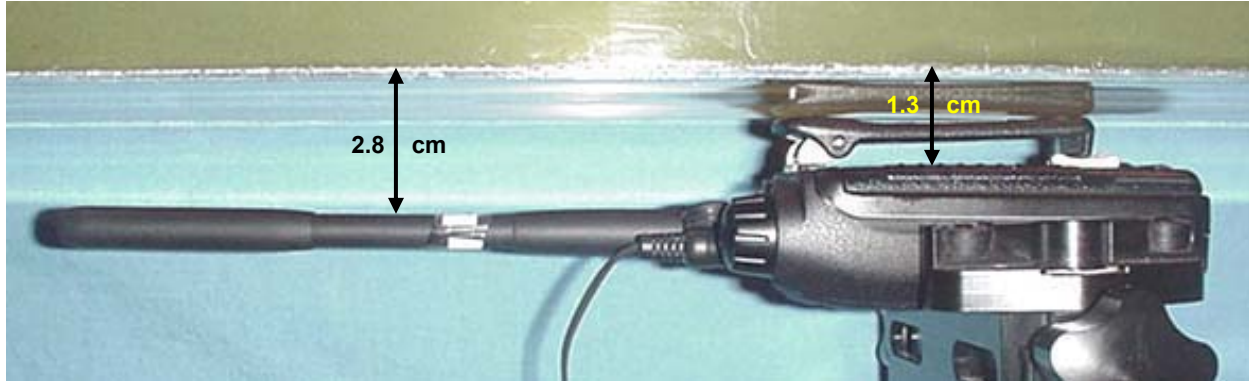
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
 VOX Headset Audio Accessory (P/N: VC-24)
 NiMH Battery Pack (P/N: FNB-83)



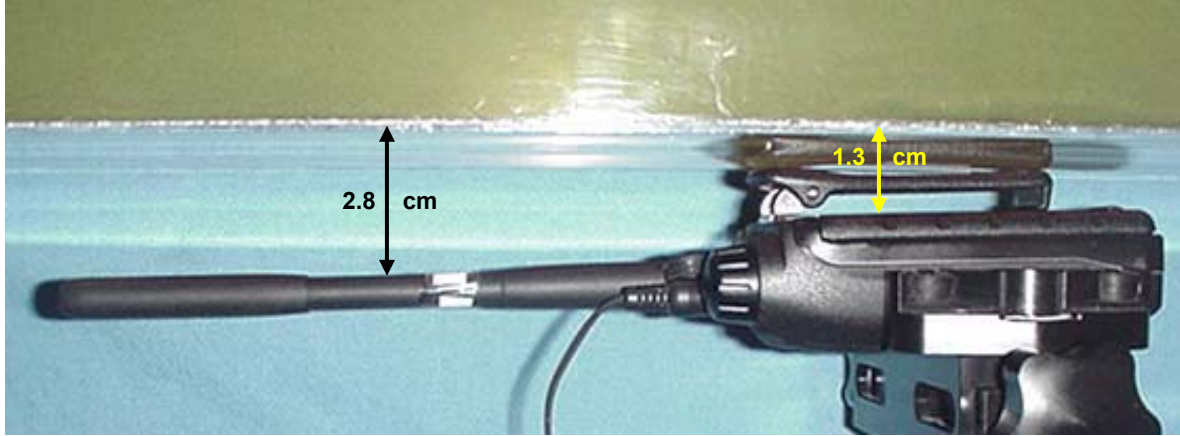
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
 VOX Earpiece Audio Accessory (P/N: VC-27)
 NiMH Battery Pack (P/N: FNB-83)



BODY-WORN SAR TEST SETUP PHOTOGRAPHS

1.3 cm Belt-Clip Separation Distance to Planar Phantom
 VOX Earpiece Audio Accessory (P/N: VC-27)
 Alkaline Battery Case (P/N: FBA-25A)



SAR TEST SETUP PHOTOGRAPHS



Face-Held Test Setup Configuration



Body-Worn Test Setup Configuration

DUT PHOTOGRAPHS



Front of DUT



Back of DUT



Back of DUT with Belt-Clip

DUT PHOTOGRAPHS




Top end view of DUT



Bottom end view of DUT



Whip Antenna (P/N: CAT460)

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

DUT PHOTOGRAPHS




Left Side of DUT with Belt-Clip



Right Side of DUT with Belt-Clip



Belt-Clip accessory - 1.3 cm thickness
(Plastic with metal spring - P/N: BA0102700)

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

DUT PHOTOGRAPHS



DUT Battery Compartment




NiMH Battery Pack (P/N: FNB-83)



Alkaline Battery Case (P/N: FBA-25A)



Duracell Procell Alkaline Batteries

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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DUT PHOTOGRAPHS



**DUT with Speaker-Microphone
Audio Accessory (P/N: MH-57A4B)**



**DUT with Noise-Canceling Speaker-Microphone
Audio Accessory (P/N: CMP460)**

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |


DUT PHOTOGRAPHS



**DUT with VOX Earpiece Audio Accessory
(P/N: VC-27)**




**DUT with VOX Headset Audio Accessory
(P/N: VC-24)**

| | | | | | | |
|-------------------------|---------------------------|--|---|---------------|---------------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | | 156.0 - 157.425 MHz | |
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| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

APPENDIX E - SYSTEM VALIDATION

| | | | | | | |
|-------------------------|--|----------------|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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300 MHz SYSTEM VALIDATION DIPOLE

Type:

300 MHz Validation Dipole

Asset Number:

00023

Serial Number:

135

Place of Calibration:

Celltech Labs Inc.

Date of Calibration:

October 25, 2005

Celltech Labs Inc. hereby certifies that this device has been calibrated on the date indicated above.

Calibrated by:



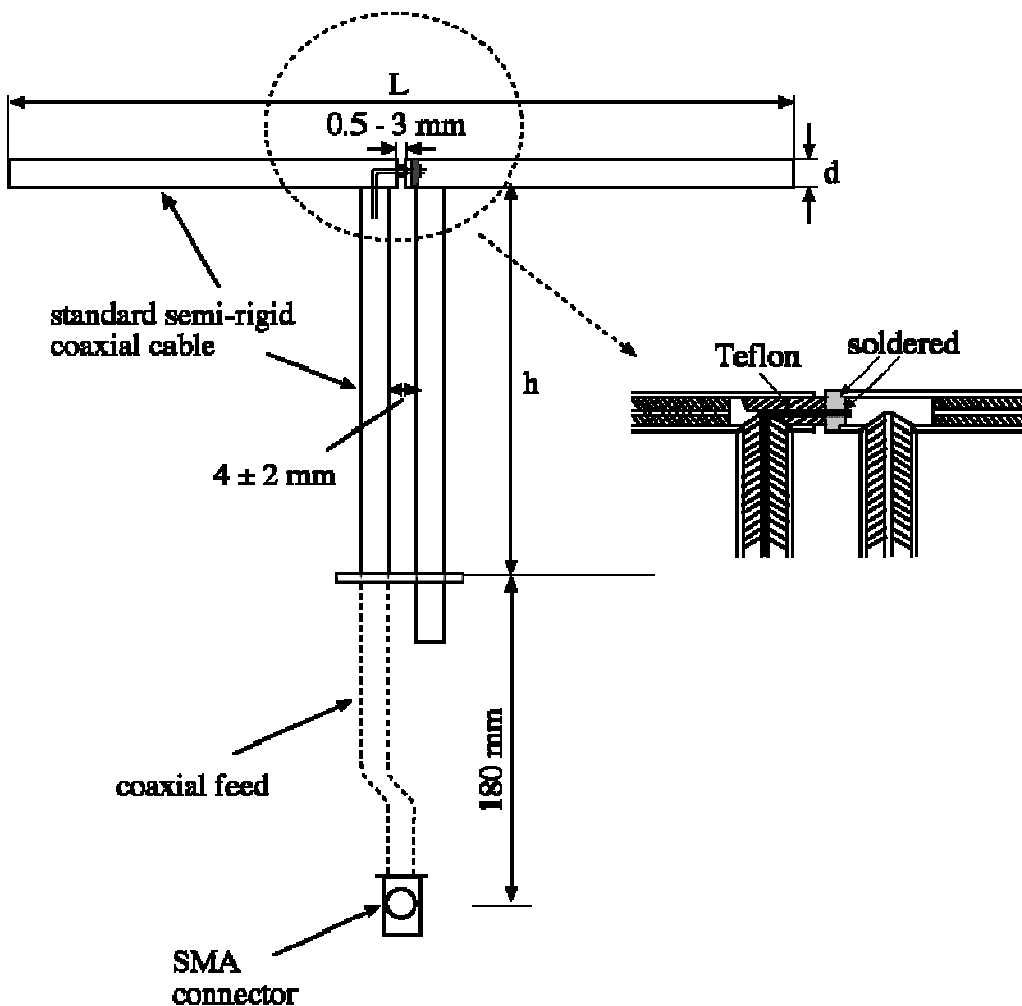
Approved by:



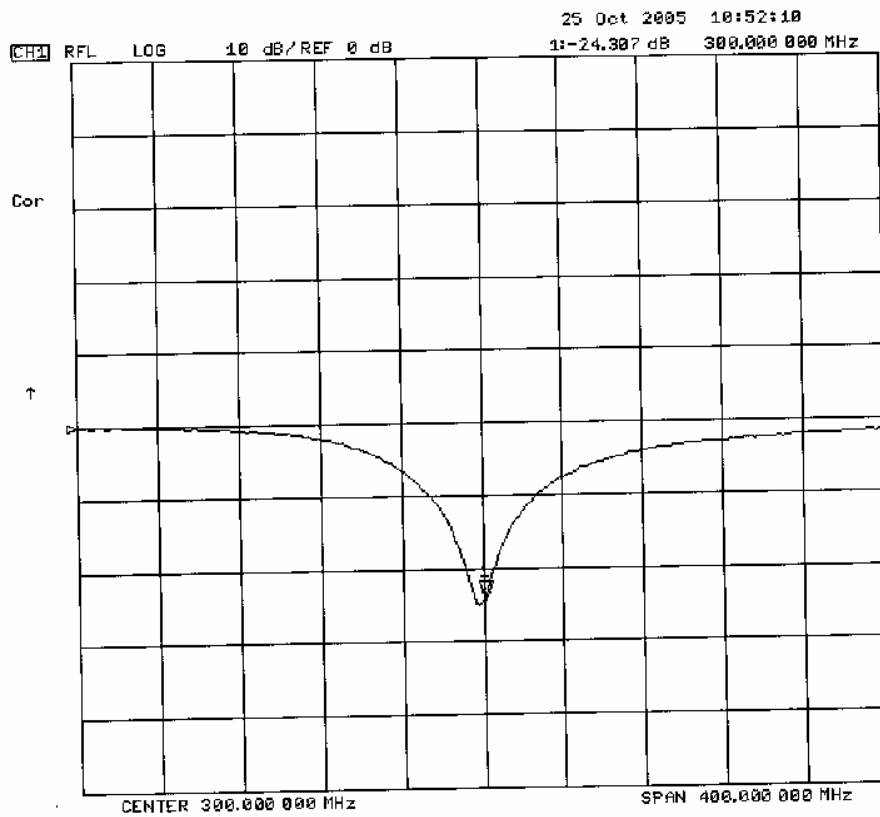
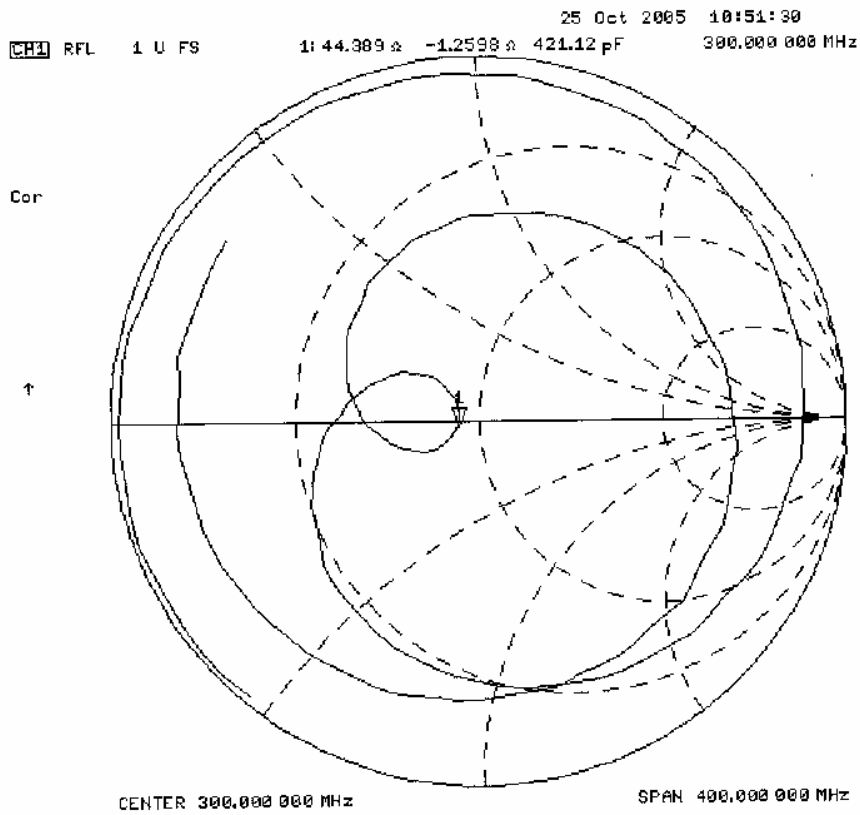
1. Validation Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Std. "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques". The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

| | |
|--------------------------------|---------------------------|
| Feed point impedance at 300MHz | $Re\{Z\} = 44.389\Omega$ |
| | $Im\{Z\} = -1.2598\Omega$ |
| Return Loss at 300MHz | -24.307dB |



2. Validation Dipole VSWR Data



3. Validation Dipole Dimensions

| Frequency (MHz) | L (mm) | H (mm) | D (mm) |
|-----------------|--------|--------|--------|
| 300 | 420.0 | 250.0 | 6.2 |
| 450 | 288.0 | 167.0 | 6.2 |
| 835 | 161.0 | 89.8 | 3.6 |
| 900 | 149.0 | 83.3 | 3.6 |
| 1450 | 89.1 | 51.7 | 3.6 |
| 1800 | 72.0 | 41.7 | 3.6 |
| 1900 | 68.0 | 39.5 | 3.6 |
| 2000 | 64.5 | 37.5 | 3.6 |
| 2450 | 51.8 | 30.6 | 3.6 |
| 3000 | 41.5 | 25.0 | 3.6 |

4 Validation Phantom

The validation phantom was constructed using relatively low-loss tangent Plexiglas material. The inner dimensions of the phantom are as follows:

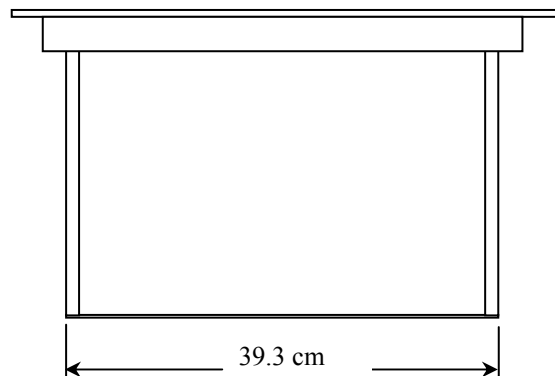
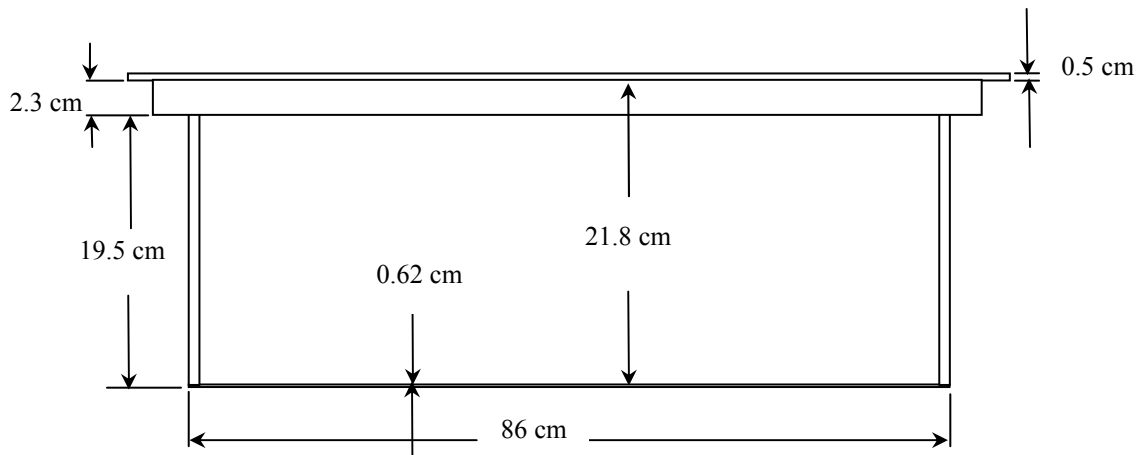
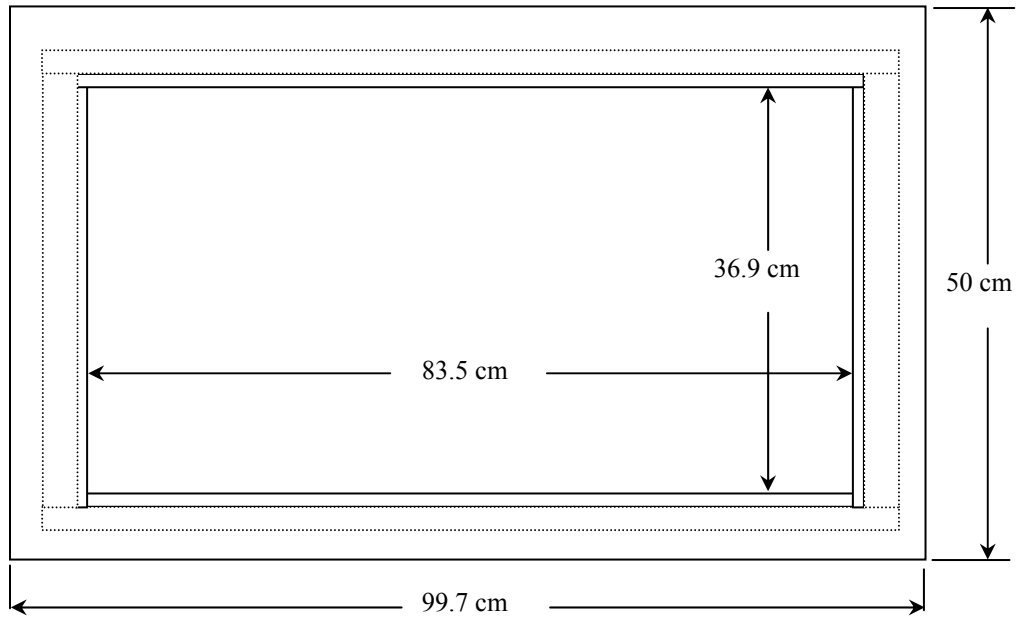
Length: 83.5 cm

Width: 36.9 cm

Height: 21.8 cm

The bottom section of the validation phantom is constructed of 6.2 ± 0.1 mm Plexiglas.

5. Dimensions of Plexiglas Planar Phantom



6. 300 MHz System Validation Setup



7. 300 MHz Validation Dipole Setup



8. Measurement Conditions

The planar phantom was filled with brain tissue simulant having the following parameters at 300 MHz:

| | |
|------------------------|------------|
| Relative Permittivity: | 44.3 |
| Conductivity: | 0.84 mho/m |
| Fluid Temperature: | 21.8 °C |
| Fluid Depth: | ≥ 15 cm |

Environmental Conditions:

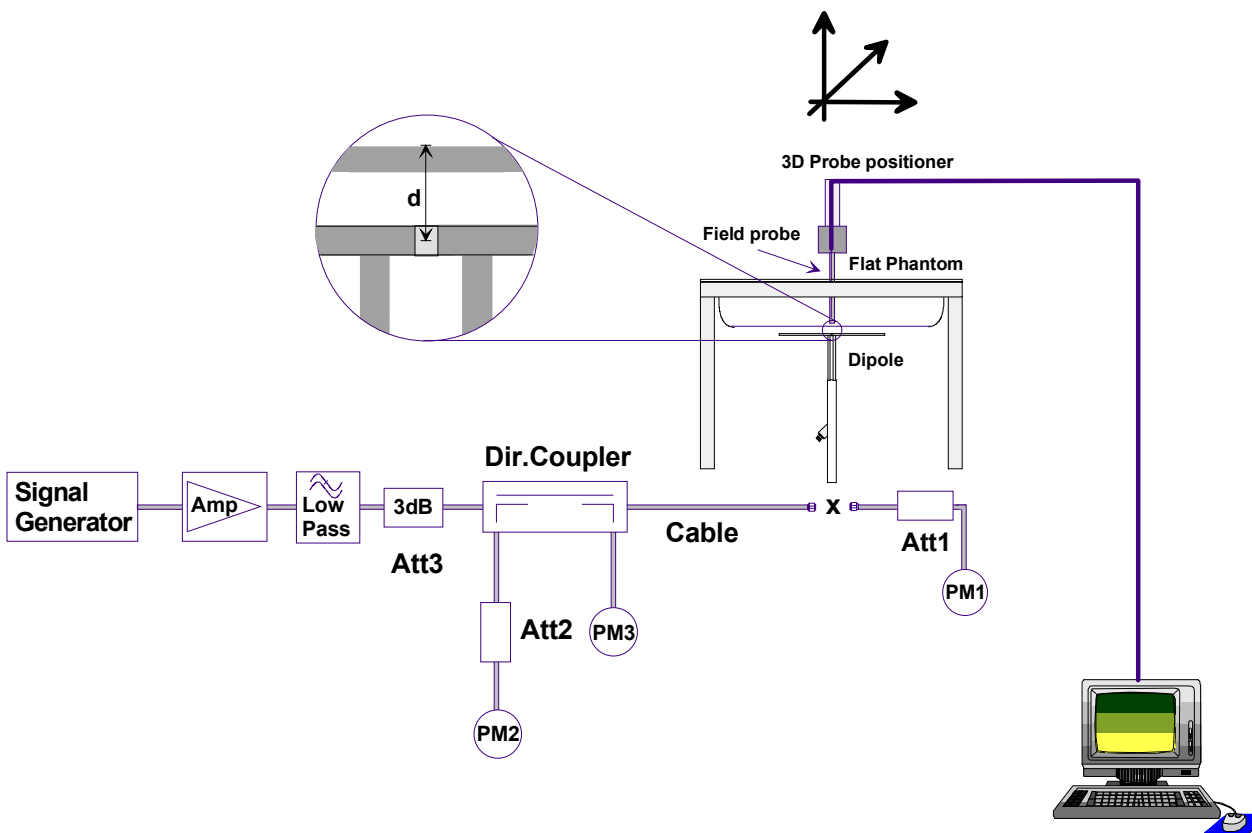
| | |
|----------------------|-----------|
| Ambient Temperature: | 23.1°C |
| Humidity: | 33 % |
| Barometric Pressure: | 101.7 kPa |

The 300 MHz brain tissue simulant consists of the following ingredients:

| Ingredient | Percentage by weight |
|--|--|
| Water | 37.56% |
| Sugar | 55.32% |
| Salt | 5.95% |
| HEC | 0.98% |
| Dowicil 75 | 0.19% |
| 300 MHz Target Dielectric Parameters at 22°C | $\epsilon_r = 45.3$ $\sigma = 0.87 \text{ S/m}$ |

9. SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.



First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power should be 20dB below the forward power.

10. Validation Dipole SAR Test Results

Ten SAR measurements were performed in order to achieve repeatability and to establish an average target value.

| Validation Measurement | SAR @ 0.25W Input averaged over 1g | SAR @ 1W Input averaged over 1g | SAR @ 0.25W Input averaged over 10g | SAR @ 1W Input averaged over 10g | Peak SAR @ 0.25W Input |
|------------------------|------------------------------------|---------------------------------|-------------------------------------|----------------------------------|------------------------|
| Test 1 | 0.747 | 2.988 | 0.487 | 1.948 | 0.786 |
| Test 2 | 0.744 | 2.976 | 0.485 | 1.94 | 0.782 |
| Test 3 | 0.748 | 2.992 | 0.488 | 1.952 | 0.783 |
| Test 4 | 0.753 | 3.012 | 0.489 | 1.956 | 0.794 |
| Test 5 | 0.751 | 3.004 | 0.488 | 1.952 | 0.792 |
| Test 6 | 0.755 | 3.02 | 0.490 | 1.96 | 0.794 |
| Test 7 | 0.751 | 3.004 | 0.489 | 1.956 | 0.791 |
| Test 8 | 0.749 | 2.996 | 0.487 | 1.948 | 0.789 |
| Test 9 | 0.749 | 2.996 | 0.487 | 1.948 | 0.788 |
| Test 10 | 0.749 | 2.996 | 0.488 | 1.952 | 0.788 |
| Average Value | 0.750 | 2.998 | 0.488 | 1.951 | 0.789 |

The results have been normalized to 1W (forward power) into the dipole.

| Target SAR @ 1 Watt Input averaged over 1 gram (W/kg) | | Measured SAR @ 1 Watt Input averaged over 1 gram (W/kg) | Deviation from Target (%) | Target SAR @ 1 Watt Input averaged over 10 grams (W/kg) | | Measured SAR @ 1 Watt Input averaged over 10 grams (W/kg) | Deviation from Target (%) |
|---|---------|---|---------------------------|---|---------|---|---------------------------|
| 3.00 | +/- 10% | 2.998 | -0.07% | 2.00 | +/- 10% | 1.951 | -2.5% |

450 MHz System Validation - October 25, 2005

DUT: Dipole 300 MHz; Model: D300V2; Serial: 135; Calibrated: 10/25/2005
Ambient Temp: 23.1 °C; Fluid Temp: 21.8 °C; Barometric Pressure: 101.7 kPa; Humidity: 33%
Communication System: CW
Frequency: 300 MHz; Duty Cycle: 1:1
Medium: 300 HSL ($\sigma = 0.84$ mho/m; $\epsilon_r = 44.3$; $\rho = 1000$ kg/m³)
- Probe: ET3DV6 - SN1387; ConvF(7.9, 7.9, 7.9); Calibrated: 18/03/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: Validation Planar; Type: Plexiglas; Serial: 137
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

300 MHz System Validation/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.753 mW/g

300 MHz System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.7 V/m; Power Drift = -0.056 dB
SAR(1 g) = 0.747 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 0.786 mW/g

300 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.4 V/m; Power Drift = -0.016 dB
SAR(1 g) = 0.744 mW/g; SAR(10 g) = 0.485 mW/g
Maximum value of SAR (measured) = 0.782 mW/g

300 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = 0.001 dB
SAR(1 g) = 0.748 mW/g; SAR(10 g) = 0.488 mW/g
Maximum value of SAR (measured) = 0.783 mW/g

300 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.4 V/m; Power Drift = 0.013 dB
SAR(1 g) = 0.753 mW/g; SAR(10 g) = 0.489 mW/g
Maximum value of SAR (measured) = 0.794 mW/g

300 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.6 V/m; Power Drift = 0.003 dB
SAR(1 g) = 0.751 mW/g; SAR(10 g) = 0.488 mW/g
Maximum value of SAR (measured) = 0.792 mW/g

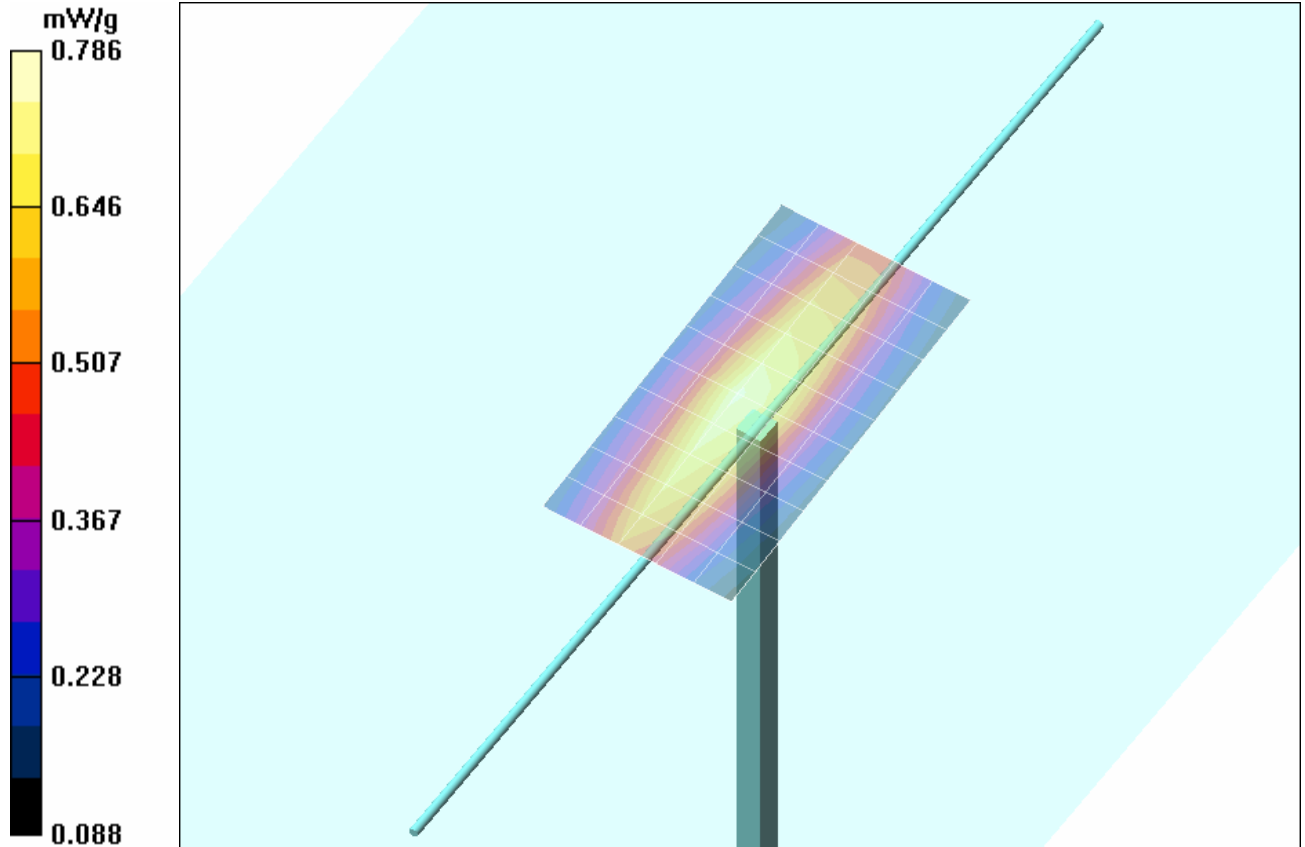
300 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.7 V/m; Power Drift = 0.017 dB
SAR(1 g) = 0.755 mW/g; SAR(10 g) = 0.490 mW/g
Maximum value of SAR (measured) = 0.794 mW/g

300 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.6 V/m; Power Drift = 0.005 dB
SAR(1 g) = 0.751 mW/g; SAR(10 g) = 0.489 mW/g
Maximum value of SAR (measured) = 0.791 mW/g

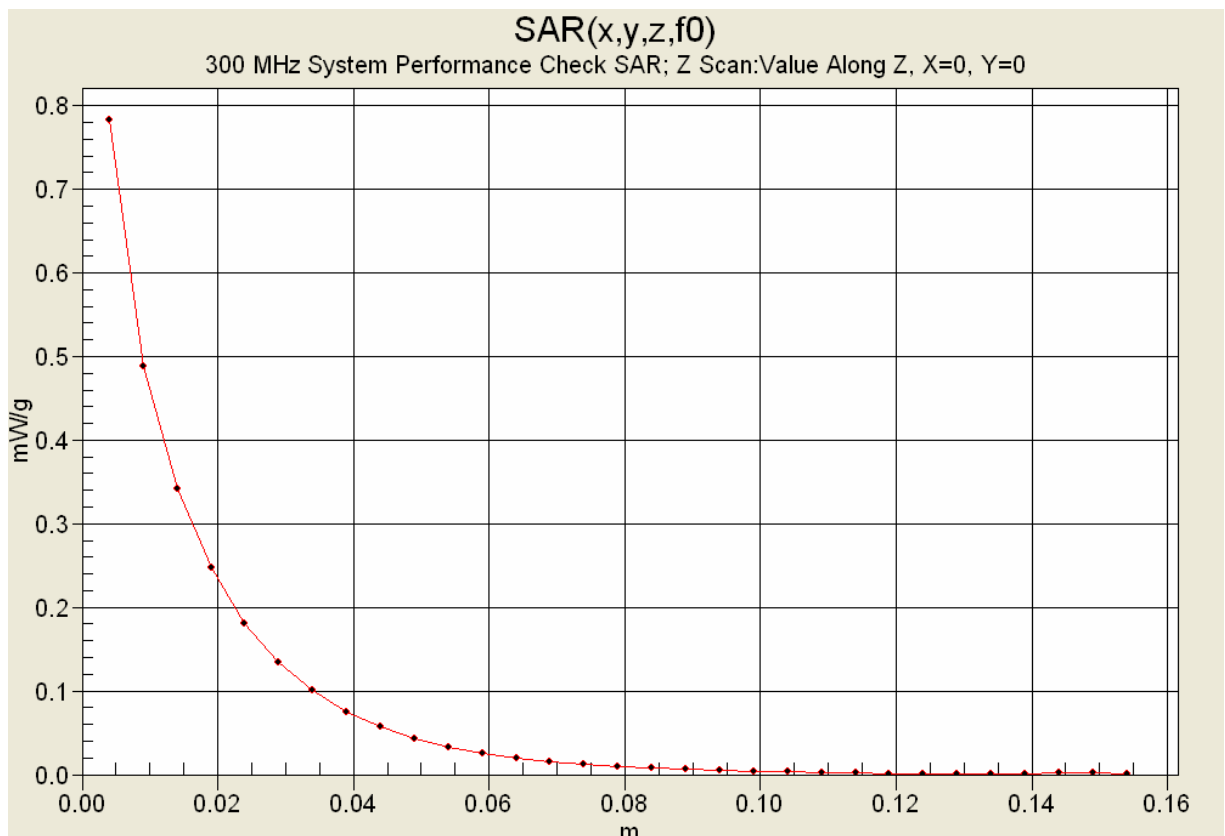
300 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = -0.001 dB
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 0.789 mW/g

300 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = 0.008 dB
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.487 mW/g
Maximum value of SAR (measured) = 0.788 mW/g

300 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.5 V/m; Power Drift = 0.001 dB
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.488 mW/g
Maximum value of SAR (measured) = 0.788 mW/g



1 g average of 10 measurements: 0.750 mW/g
 10 g average of 10 measurements: 0.488 mW/g



11. Measured Fluid Dielectric Parameters

System Validation (Brain) - 450 MHz Dipole

Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Tue 25/Oct/2005

Freq Frequency(GHz)


FCC_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon

FCC_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma


Test_e Epsilon of UIM

Test_s Sigma of UIM

| Freq | FCC_e | FCC_s | Test_e | Test_s |
|---------------|--------------|-------------|--------------|-------------|
| 0.2000 | 49.97 | 0.80 | 50.42 | 0.74 |
| 0.2100 | 49.50 | 0.80 | 47.25 | 0.76 |
| 0.2200 | 49.03 | 0.81 | 48.21 | 0.76 |
| 0.2300 | 48.57 | 0.82 | 45.83 | 0.78 |
| 0.2400 | 48.10 | 0.83 | 46.47 | 0.78 |
| 0.2500 | 47.63 | 0.83 | 46.33 | 0.79 |
| 0.2600 | 47.17 | 0.84 | 44.51 | 0.80 |
| 0.2700 | 46.70 | 0.85 | 45.05 | 0.80 |
| 0.2800 | 46.23 | 0.86 | 44.67 | 0.82 |
| 0.2900 | 45.77 | 0.86 | 44.68 | 0.83 |
| 0.3000 | 45.30 | 0.87 | 44.28 | 0.84 |
| 0.3100 | 45.18 | 0.87 | 42.39 | 0.84 |
| 0.3200 | 45.06 | 0.87 | 43.12 | 0.85 |
| 0.3300 | 44.94 | 0.87 | 42.20 | 0.85 |
| 0.3400 | 44.82 | 0.87 | 42.13 | 0.89 |
| 0.3500 | 44.70 | 0.87 | 42.29 | 0.89 |
| 0.3600 | 44.58 | 0.87 | 41.56 | 0.90 |
| 0.3700 | 44.46 | 0.87 | 41.43 | 0.89 |
| 0.3800 | 44.34 | 0.87 | 41.87 | 0.90 |
| 0.3900 | 44.22 | 0.87 | 41.01 | 0.92 |
| 0.4000 | 44.10 | 0.87 | 40.97 | 0.92 |

| | | | | |
|---|-------------------------|----------------------|--------------------|--------------------|
|  | Test Report Serial No.: | 121405K66-F706-S80V | Report Issue Date: | January 12, 2006 |
| | Date(s) of Evaluation: | December 22-23, 2005 | Report Issue No.: | S706-011206-R0 |
| | Description of Test(s): | RF Exposure SAR | FCC 47 CFR §2.1093 | IC RSS-102 Issue 2 |

APPENDIX F - PROBE CALIBRATION

| | | | | | | |
|-------------------------|--|----------------|---|---------------------|---------------|---|
| Applicant: | Vertex Standard Co., Ltd. | FCC ID: | K6630183X20 | IC ID: | 511B-30183X20 |  |
| Model(s): | HX500S | DUT: | Portable VHF PTT Marine Radio Transceiver | 156.0 - 157.425 MHz | | |
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Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Celltech Labs**

Certificate No: **ET3-1387_Mar05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1387**

Calibration procedure(s) **QA CAL-01.v5
Calibration procedure for dosimetric E-field probes**

Calibration date: **March 18, 2005**


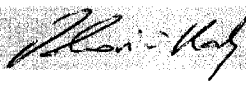
Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|---|------------------------|
| Power meter E4419B | GB41293874 | 5-May-04 (METAS, No. 251-00388) | May-05 |
| Power sensor E4412A | MY41495277 | 5-May-04 (METAS, No. 251-00388) | May-05 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 10-Aug-04 (METAS, No. 251-00403) | Aug-05 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 3-May-04 (METAS, No. 251-00389) | May-05 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 10-Aug-04 (METAS, No. 251-00404) | Aug-05 |
| Reference Probe ES3DV2 | SN: 3013 | 7-Jan-05 (SPEAG, No. ES3-3013_Jan05) | Jan-06 |
| DAE4 | SN: 617 | 19-Jan-05 (SPEAG, No. DAE4-617_Jan05) | Jan-06 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power sensor HP 8481A | MY41092180 | 18-Sep-02 (SPEAG, in house check Oct-03) | In house check: Oct 05 |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (SPEAG, in house check Dec-03) | In house check: Dec-05 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Nov-04) | In house check: Nov 05 |

| | | | |
|----------------|------------------------------|--|--|
| Calibrated by: | Name Nico Vetterli | Function Laboratory Technician | Signature  |
| Approved by: | Name Katja Pokovic | Function Technical Manager | Signature  |

Issued: March 18, 2005

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

| | |
|--------------------------|--|
| TSL | tissue simulating liquid |
| NORM _{x,y,z} | sensitivity in free space |
| ConF | sensitivity in TSL / NORM _{x,y,z} |
| DCP | diode compression point |
| Polarization ϕ | ϕ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1387

| | |
|------------------|--------------------|
| Manufactured: | September 21, 1999 |
| Last calibrated: | March 18, 2004 |
| Recalibrated: | March 18, 2005 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1387**Sensitivity in Free Space^A**

| | | |
|-------|--------------|-------------------------------------|
| NormX | 1.61 ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | 1.70 ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | 1.70 ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |

Diode Compression^B

| | |
|-------|-------|
| DCP X | 92 mV |
| DCP Y | 92 mV |
| DCP Z | 92 mV |

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **900 MHz** **Typical SAR gradient: 5 % per mm**

| | | | |
|---|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance | | 3.7 mm | 4.7 mm |
| SAR _{be} [%] | Without Correction Algorithm | 9.4 | 4.9 |
| SAR _{be} [%] | With Correction Algorithm | 0.1 | 0.3 |

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

| | | | |
|---|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance | | 3.7 mm | 4.7 mm |
| SAR _{be} [%] | Without Correction Algorithm | 14.3 | 9.6 |
| SAR _{be} [%] | With Correction Algorithm | 0.6 | 0.1 |

Sensor Offset

Probe Tip to Sensor Center **2.7 mm**

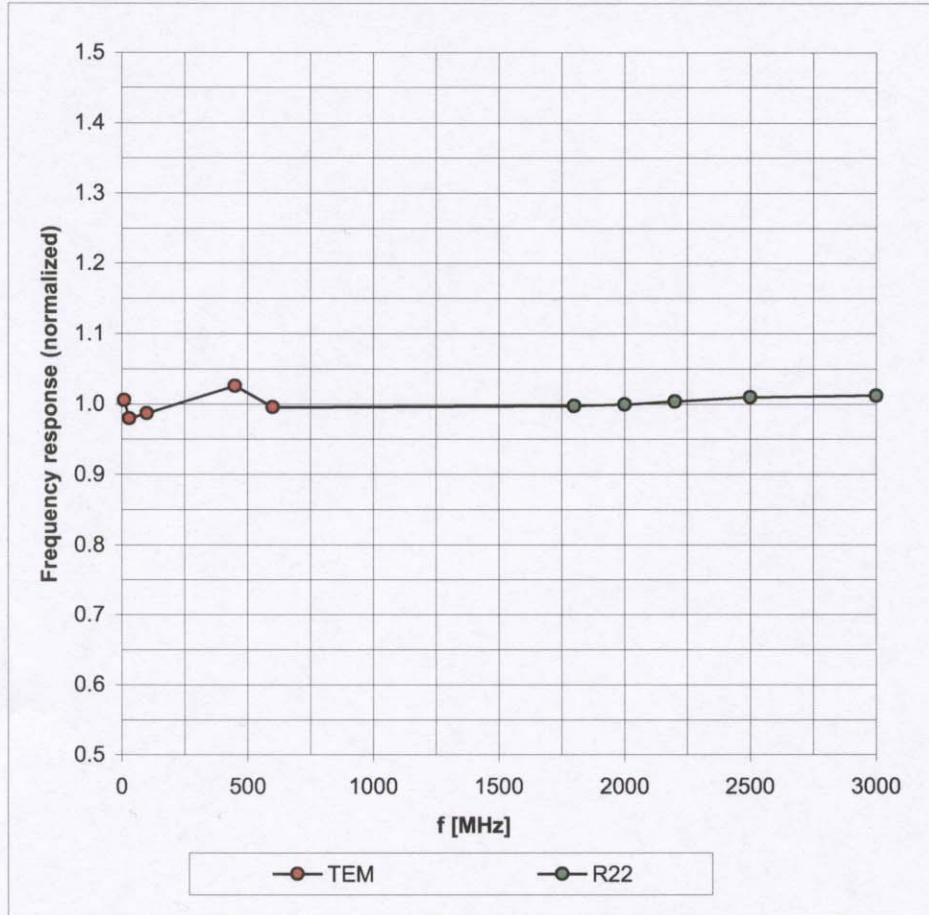
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

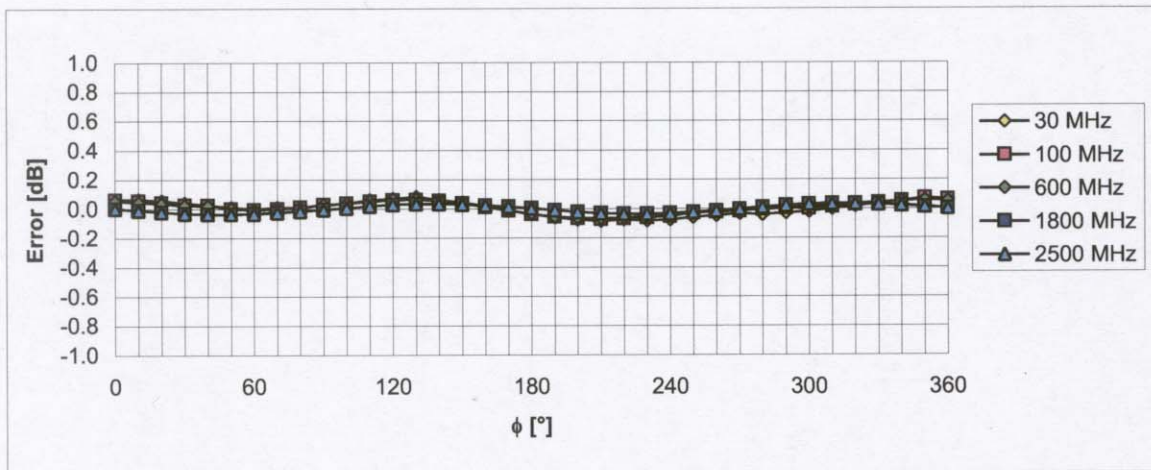
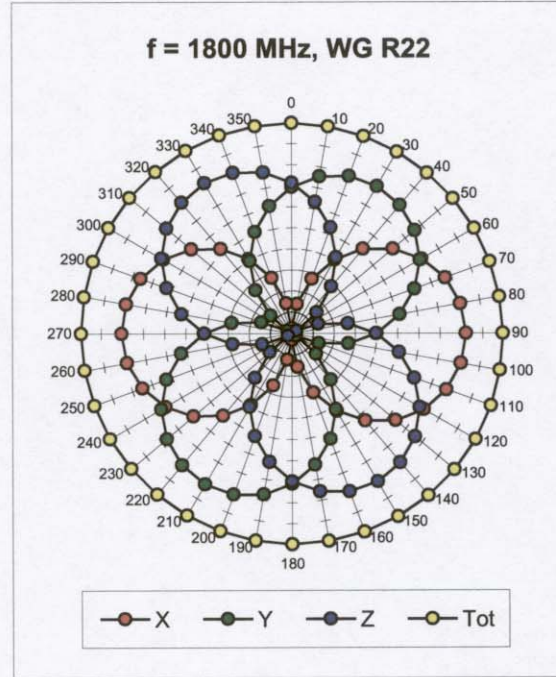
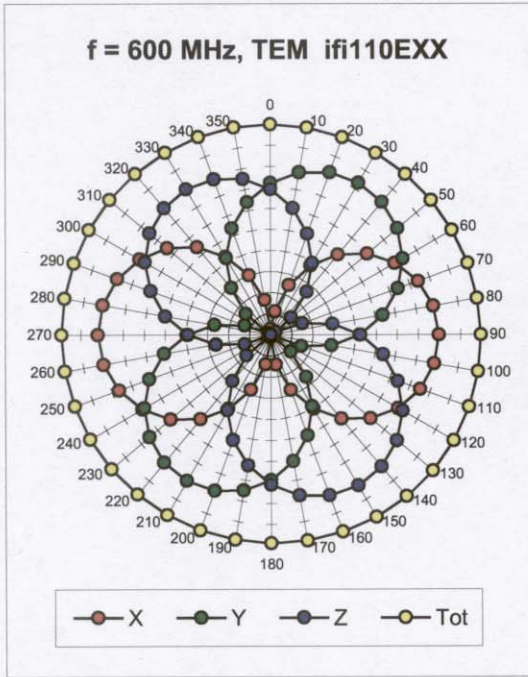
Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



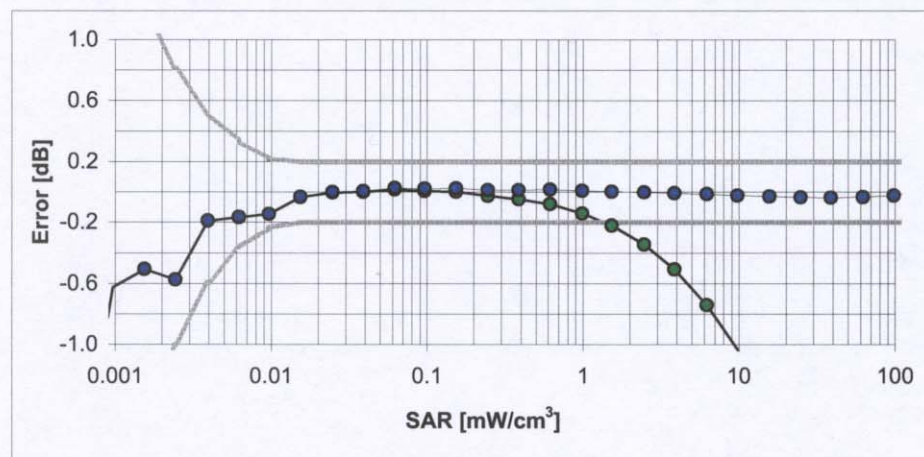
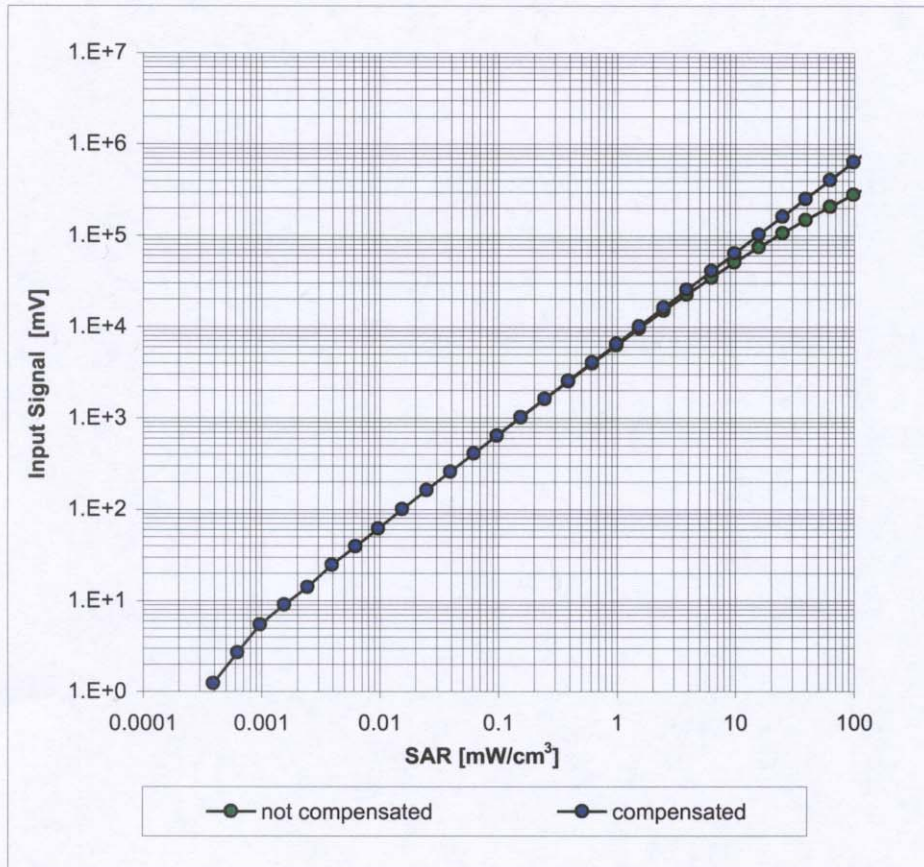
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$



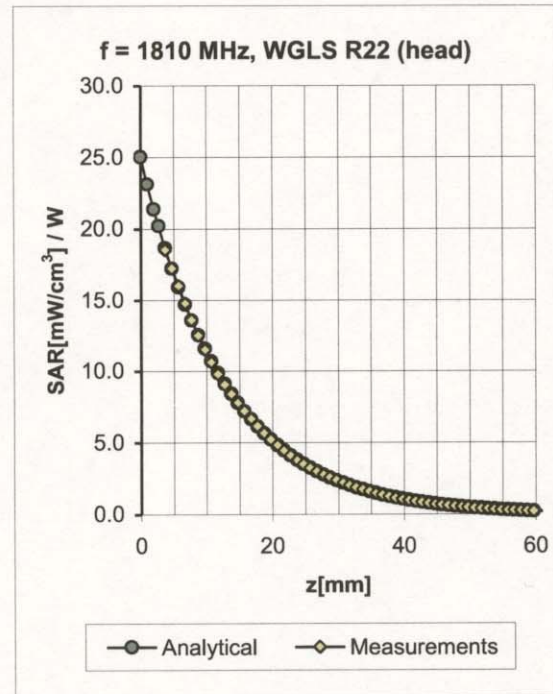
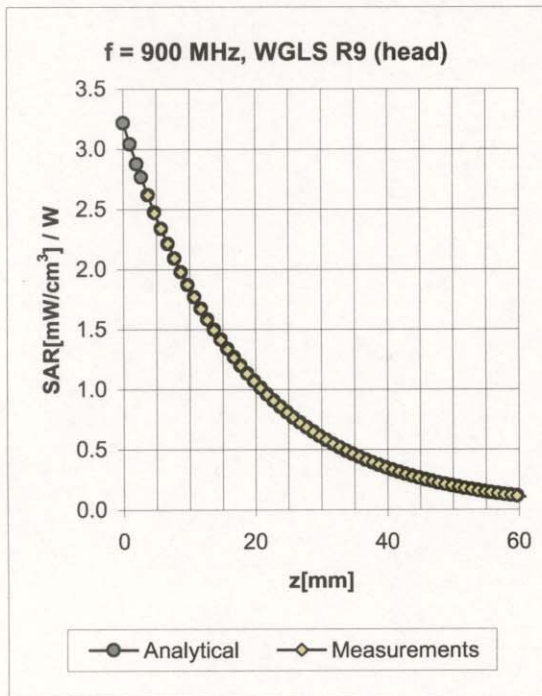
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$)



Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment

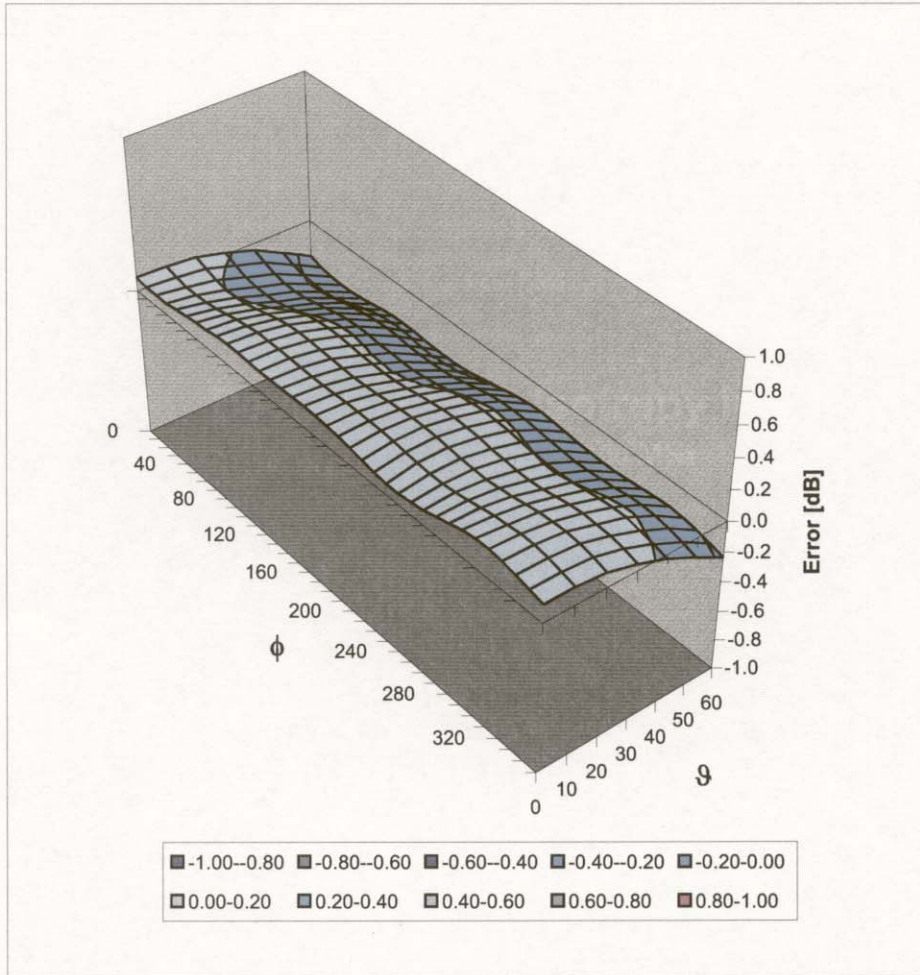


| f [MHz] | Validity [MHz] ^c | TSL | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---------|-----------------------------|------|--------------|--------------|-------|-------|--------------------|
| 900 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.97 ± 5% | 0.65 | 1.81 | 6.47 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.62 | 2.39 | 5.18 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.76 | 2.09 | 4.56 ± 11.8% (k=2) |
| 900 | ± 50 / ± 100 | Body | 55.0 ± 5% | 1.05 ± 5% | 0.60 | 2.01 | 6.10 ± 11.0% (k=2) |
| 1810 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.60 | 2.67 | 4.75 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.82 | 1.82 | 4.30 ± 11.8% (k=2) |

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (ϕ , ϑ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1387

Place of Assessment:

Zurich

Date of Assessment:

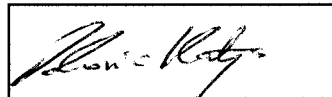
March 21, 2005

Probe Calibration Date:

March 18, 2005

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Dosimetric E-Field Probe ET3DV6 SN:1387Conversion factor (\pm standard deviation)

| | | | |
|--------------------|-------|---------------------------------|---|
| f = 150 MHz | ConvF | 8.8 \pm 10% | $\epsilon_r = 52.3 \pm 5\%$ $\sigma = 0.76 \pm 5\%$ mho/m (head tissue) |
| f = 300 MHz | ConvF | 7.9 \pm 9% | $\epsilon_r = 45.3 \pm 5\%$ $\sigma = 0.87 \pm 5\%$ mho/m (head tissue) |
| f = 450 MHz | ConvF | 7.5 \pm 8% | $\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 5\%$ mho/m (head tissue) |
| f = 150 MHz | ConvF | 8.4 \pm 10% | $\epsilon_r = 61.9 \pm 5\%$ $\sigma = 0.80 \pm 5\%$ mho/m (body tissue) |
| f = 450 MHz | ConvF | 7.5 \pm 8% | $\epsilon_r = 56.7 \pm 5\%$ $\sigma = 0.94 \pm 5\%$ mho/m (body tissue) |

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.