UHF BAND MOBILE UNIT (ANTENNA) REPORT: SAR MEASUREMENTS

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OBJECTIVE

The objective of the following test was to perform SAR measurements in the near field of an UHF band (403 MHz- 470 MHz) Mobile unit. The test consisted of SAR measurements in a whole-body phantom exposed to field intensities similar to an external vehicle exposure as described in the MPE Test report generated by Jim Fortier (FCC ID: AZ492FT4835). The reflections present at this frequency can produce standing waves that will increase experimental uncertainty.

EQUIPMENT

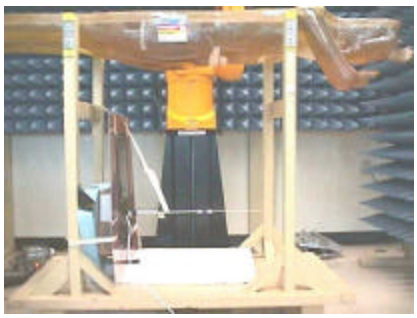
- Mobile unit system (WARIS UHF-band mobile unit).
- Antennas: HAE4011A 3.5 dB gain and HAE 4003A quarter wave
- Power supply
- Holaday E-field survey meter
- DASY3 dosimetry system
- Muscle medium with relative dielectric constant 61 and conductivity 0.87 S/m @ 450 MHz (ambient temperature 22 ^{o}C)
- SPEAG probe calibration at 450 MHz $\pm$ 8 % on calibration conversion factor ($\pm$ standard deviation)

METHOD OF MEASUREMENT

- The antenna and ground plane was arranged with antenna parallel to the ground. The E-field strength was recorded at the 60-cm distance from the antenna. The antenna was positioned at a distance of 60 cm from the phantom with the ground plane at the mid-section of the phantom.

- A course scan and a cube scan from the DASY3 system localized the hotspot. Due to long runs, the mobile unit was allowed to cool down and the cube scan was rescanned for a better measurement corresponding to higher radiated power (no drift or power slump).

- Two types of antennas (3.5 dB "HAE4011A" and quarter wavelength "HAE4003A") were tested with the same power out of the mobile unit (Channel 3 high power @ 469.84 MHz was recorded to be 25 watts). See illustrations below.



HAE 4011A (3.5 dB gain)

HAE 4003A ¼ wave whip

RESULTS

Scanned area revealed hotspots at the abdomen. Peak spatial SAR for the HAE 4011A antenna was 0.197 mW/g, and for the HAE 4003A antenna was 0.145 mW/g.

DISCUSSION AND CONCLUSION

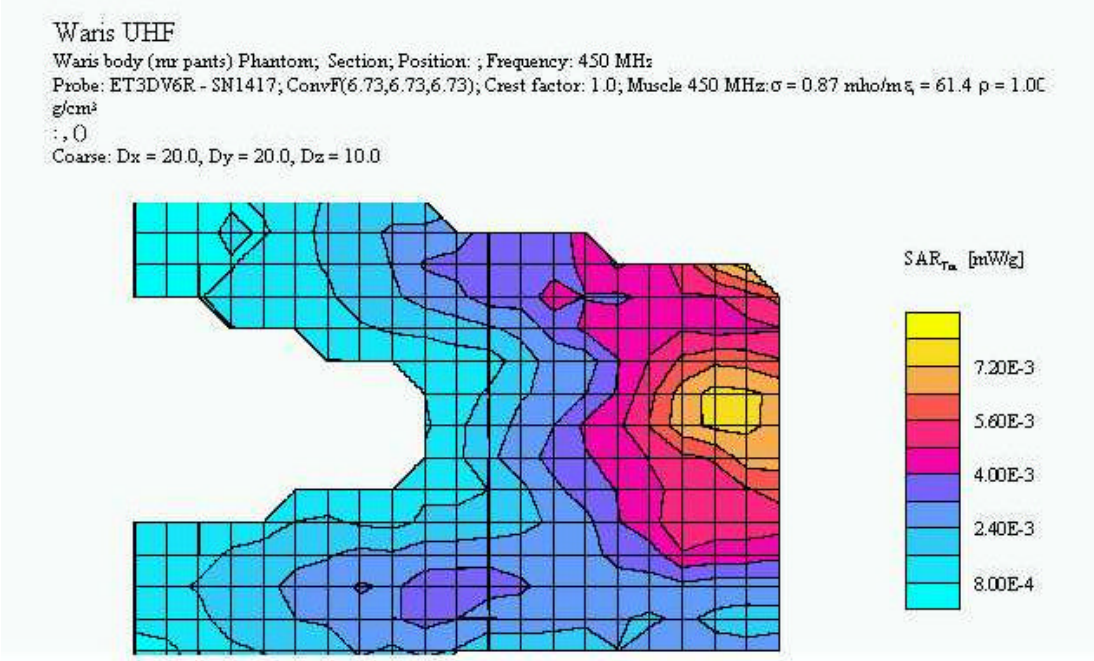
At 60 cm away from the antenna position without the phantom, the near-filed maximal field strength was 44 V/m or 0.53 mW/cm^2. The mobile unit RF power was 22 % lower than maximum spec. The conductivity was 12 % below validation spec at tested frequency and the probe was calibrated 20 MHz below tested frequency. To compensate for the differences, the projected SAR can be calculated:

$$SAR_{measured}\left[\frac{POWER_{\max}}{POWER_{test}}\right]^{\left[\frac{\leftarrow target}{\leftarrow measured}\right]} SAR_{projected}$$

$$SAR_{measured}\ 0.197mW/g\left(\frac{32watts}{25watts}\right)\left(\frac{1.01S/m}{0.88S/m}\right)\ SAR_{projected}\ 0.289mW/g$$

The probe conversion factor accounts for ± 8 % of calibration uncertainty. For lower frequency range antennas 403-430 MHz 3.5 dB and quarter wavelength antennas, the SARs are lower due to the lower tissue conductivity and slightly longer antenna length. For a top mount antenna, the SAR is expected to be less than a trunk mount antenna, which is closer to a bystander.

Although tested at 450 MHz using the 3.5 dB gain and quarter wave antennas with 32 W power at 60 cm distance, due to the large margin from 0.289 W/kg to the 1.6 W/kg limit, we expect that the SAR in a person exposed to mobile radio fields at the frequency range of 403-512 MHz and power up to 125 W will be below the 1.6 W/kg SAR limit, certainly at 90 cm (3 ft) from the antenna for radios greater than 50 W. Based on the results, we conclude that the maximal spatial SAR in a bystander exposed to UHF band mobile radios near a vehicle at distances according to the users manual is below the 1.6 W/kg limit for the uncontrolled environment.



HAE 4011A (3.5 dB gain) COARSE SCAN

Waris UHF

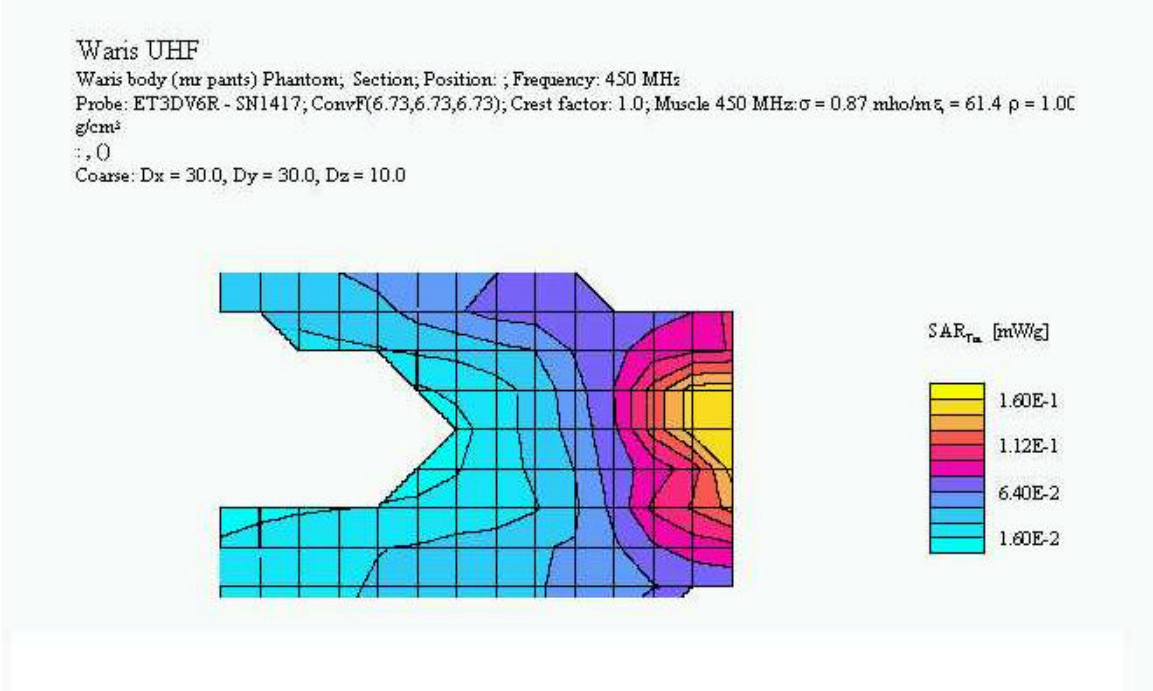
Waris body (mr pants) Phantom; Section; Position: ; Frequency: 450 MHz

Probe: ET3DV6R - SN1417; ConvF(6.73,6.73,6.73); Crest factor: 1.0; Muscle 450 MHz: σ = 0.87 mho/m ε_r = 61.4 ρ = 1.00 g/cm³

Cube 5x5x7: SAR (1g): 0.197 mW/g, SAR (10g): 0.156 mW/g, (Worst-case extrapolation)

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0

HAE4011A (3.5 dB gain) CUBE SCAN



HAE 4003A ¼ whip COARSE SCAN

Waris UHF

Waris body (mr pants) Phantom; Section; Position: ; Frequency: 450 MHz

Probe: ET3DV6R - SN1417; ConvF(6.73,6.73,6.73); Crest factor: 1.0; Muscle 450 MHz: σ = 0.87 mho/m ε_r = 61.4 ρ = 1.00 g/cm³

Cube 5x5x7: SAR (1g): 0.145 mW/g, SAR (10g): 0.115 mW/g * Max outside, (Worst-case extrapolation)

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0

HAE 4003A ¼ whip CUBE SCAN