LOW BAND MOBILE UNIT (ANTENNA) REPORT: SAR MEASUREMENTS

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OBJECTIVE

The objective of the following test was to perform an investigation of low-band mobile units and the SAR generated at near-field conditions (external vehicle EME measurements). The test consisted of a reproduction of E-field measurements that represent similar conditions as stated on a typical MPE Test report prepared by Jim Fortier (FCC ID: AZ492FT1628). However, the antenna was positioned in such a way as to perform in a whole-body phantom SAR measurement. The long waves present at this frequency can produce standing waves that will increase experimental uncertainty. However, this was the most practical setup.

EQUIPMENT

- Mobile unit system (WARIS Low-band mobile unit)
- Antenna RAB 4002A
- Power supply
- Holaday / NARDA field survey meter
- DASY3 dosimetry system
- Muscle Medium with Relative Dielectric 78 and Conductivity of 0.65 S/m @ 35 MHz (ambient Temperature 22 ^{o}C)
- SPEAG probe calibration at 35 MHz $\pm$ 15 % on Calibration Conversion Factor ($\pm$ standard Deviation)

METHOD OF MEASUREMENT

- A set-up of an antenna mounted on a ground plane (60cm x 60cm) and positioned vertically was measured to assure similar conditions as that of a *trunk mounted antenna.* Power density at specific distances was identical to that near a car as described in the MPE Test Report.
- The antenna and the ground plane were then arranged horizontally with antenna parallel to the ground. This condition led to a drop in power transmitted and field strength. The maximum E-field position also shifted to a new location away from tip. However, the radiating field maintained a uniform radial distribution, i.e., no apparent lobes.
- The antenna and the ground plane were then positioned underneath a phantom with the appropriate field strengths as that representative of a

vertical set-up. The antenna distance was decreased from 90 cm to 53 cm to compensate for the drop in field strength. The ground plane was first positioned at the knees to determine if the high e-field point could generate a measurable SAR value (see Figure 1). As expected, the field strength topography revealed that the maximal SAR located in the knees (at the ground plane H-fields are maximum and a small cross-section in knees will produce higher current densities).

Figure 1 Antenna positioned in front of the phantom man model with the ground plane near knees.

- The set-up was then shifted so as to locate the ground plane at the abdomen, as actual conditions, and data collected (Figure 2). The entire defined area was probed to assure that the maximal SAR would fall within the scan and that no possibilities of other higher SARs exist. A smaller area was probed once the peak was determined to be in the abdominal region.

Figure 2 Antenna positioned in front of the phantom man model with the ground plane near abdomen.

RESULTS

Attachment 1 shows the area scanned. When the ground plane was positioned at the knees, the SAR was 0.0044 mW/g averaged over 1 g (Attachment 2) at the abdomen where the tip of antenna is located (Fig.1). The highest SAR was 0.021 mW/g averaged over 1 g in the knees (Attachment 3).

When the ground plane was moved to the abdomen as in a realistic condition, the search of SAR only need to be done near the abdomen where the maximal H field is. The maximal SAR was near the abdomen as expected (Attachment 4). Smaller area scan (Attachment 5) shows the maximal SAR was 0.0055 mW/g averaged over 1 g.

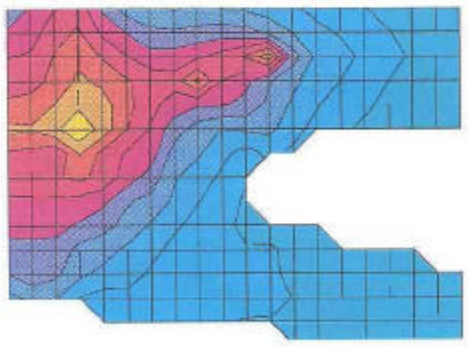
DISCUSSION AND CONCLUSION

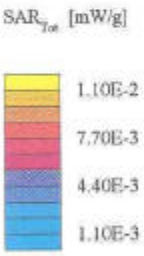
The maximal SAR measured in the abdomen was in the range of 0.0055 mW/g. The field strength was 31.5 V/m or 0.265 mW/cm^2 in the near field. Power slump fell from 51 to 42 watts output to the antenna. Worst case if the power is doubled (i.e., 80 watts), the maximal SAR is 0.011 mW/g. Within the same band (25 to 50 MHz), the same type of antennas, and power up to 110 W, the SARs due to the other antennas are expected to be similar in magnitude. One can conclude that even with increased experimental uncertainty, the measured SAR is more than two orders of magnitude below the 1.6 W /kg limit for the uncontrolled environment.

This data support that the Waris Low Band radios can be safely operated with bystanders near the car under uncontrolled environment. There is no need to modify the existing manual.

Attchment 1

Mobile unit (antenna)
MR PANTS BODY Phantom; Section; Position: ; Frequency: 33 MHz
Probe: ET3DV6R - SN1417; ConvF(8.24,8.24,8.24); Crest factor: 1.0; Muscle 35 MHz: σ = 0.66 mho/m ε_r = 78.0 ρ = 1.04 g/cm^3
: , 0
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0



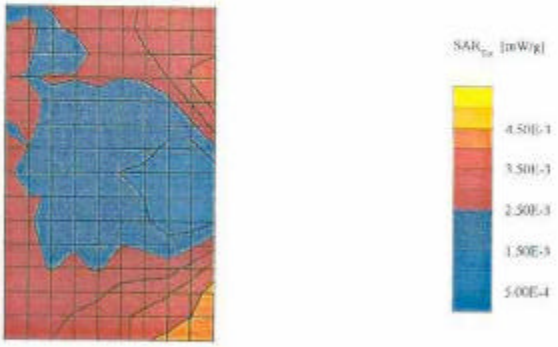


Attachment 2

Mobile unit (antenna)

MR.PANTS.BODY: Phantom; Section; Position: ; Frequency: 33 MHz
Probe: ET3DV6R - SN1417; ConvF(8.24,8.24,8.24); Crest factor: 1.0; Muscle 35 MHz: σ = 0.66 mho/m ε_r = 78.0 ρ = 1.04 g/cm³
Cube 4x4x7: SAR (1g): 0.0044 mW/g, SAR (10g): 0.0038 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0

Ground plane near knees. High E field at abdomen.
SAR is low in this area, the high SAR occurs in the knees.



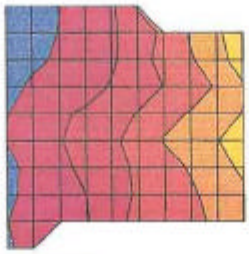
Attachment 3

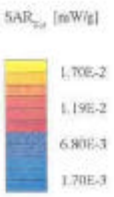
Mobile unit (antenna)

MR PANTS BODY Phantom; Section; Position: ; Frequency: 33 MHz
Probe: ET3DV6R - SN1417; ConvF(8.24,8.24,8.24); Crest factor: 1.0; Muscle 35 MHz: σ = 0.66 mho/m ε_r = 78.0 ρ = 1.04 g/cm³
Cube 4x4x7: SAR (1g): 0.0210 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0

TESTED AT THE RIGHT LEG (KNEE AREA)

Ground plane at the knees.
SAR in one knees.





Attachment 4

Mobile unit (antenna)
MR.PANTS BODY Phantom; Section; Position: ; Frequency: 33 MHz
Probe: ET3DV6R - SN1417; ConvF(8.24,8.24,8.24); Crest factor: 1.0; Muscle 35 MHz: σ = 0.66 mho/m ε_r = 78.0 ρ = 1.04 g/cm³
; ; O
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

Ground plane at abdomen.

Attachment 5

Mobile unit (antenna)

MR PANTS BODY Phantom; Section; Position: ; Frequency: 33 MHz
Probe: ET3DV6R - SN1417; ConvF(8.24,8.24,8.24); Crest factor: 1.0; Muscle 35 MHz: σ = 0.66 mho/m ε_r = 78.0 ρ = 1.04 g/cm^3
Cube 5x5x7: SAR (1g): 0.0055 mW/g *, SAR (10g): 0.0041 mW/g Max outside, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0

Ground plane at abdomen. SAR in abdominal region.