January 10, 2002

Federal Communications Commission
Equipment Approval Services
7435 Oakland Mills Road
Columbia, MD 21046
Attn: Martin Perrine

**SUBJECT: E F Johnson Company**
**FCC ID: ATH2425110**
**731 Confirmation No.: EA649893**
**Correspondence Ref. No.: 21627**

Dear Martin:

Submitted on behalf of E F Johnson Company is our response to SAR items 3-5 referenced in your e-mail dated January 3, 2002 requesting additional information for the subject application.

1. The tissue parameters listed in the SAR measurement report were target parameters. Please find attached revised SAR test report pages (3, 4, 7, & 8) listing the measured dielectric tissue parameters, and dielectric property measurement printouts for all measured liquid.
2. Please find attached Z axis SAR scan data for the highest measured face and body SAR test points.
3. Please see the attached documentation regarding worst-case SAR analysis.

If you have any further questions regarding the above, please do not hesitate to contact me.

Sincerely,

Shawn McMillen
General Manager
Celltech Research Inc.
Testing & Engineering Lab

cc: E F Johnson Company
Rhein Tech Labs

## *4.0 MEASUREMENT SUMMARY*

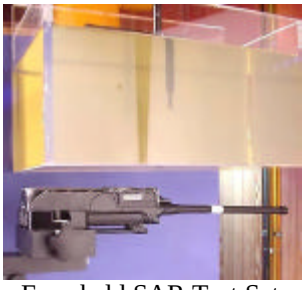
The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

**Face-Held SAR Measurements**

| Freq. (MHz) | Chan. | Mode | Cond. Power Before (W) | Cond. Power After (W) | Antenna Position | Antenna P/N | Separation Distance (cm) | SAR (w/kg) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 100% Duty Cycle | 50% Duty Cycle |
| 136.00 | Low | CW | 5.8 | 5.76 | Fixed | 501-0017-101 | 2.5 | 0.310 | 0.155 |
| 155.00 | Mid | CW | 5.8 | 5.72 | Fixed | 501-0017-103 | 2.5 | 1.54 | 0.770 |
| 174.00 | High | CW | 5.8 | 5.74 | Fixed | 501-0017-105 | 2.5 | 0.752 | 0.376 |
| **Mixture Type: Brain (Measured)<br>Dielectric Constant: 53.4<br>Conductivity: 0.76** | | | | | **ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak Controlled Exposure / Occupational<br>BRAIN: 8.0 W/kg (averaged over 1 gram)** | | | | |

Notes:

1. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest face-held SAR value found was 1.54 w/kg (100% duty cycle).
3. The EUT was tested for face-held SAR with a 2.5cm separation distance between the front of the EUT and the outer surface of the planar phantom.
4. Ambient TEMPERATURE: 23.3 °C
   Relative HUMIDITY: 57.5 %
   Atmospheric PRESSURE: 100.4 kPa
5. Fluid Temperature 23.0 °C
6. During the entire test the conducted power was maintained to within 5% of the initial conducted power.



Face-held SAR Test Setup
2.5cm Separation Distance

# 150MHz

## Measured Liquid Dielectric Parameters (Brain)

October 24, 2001 09:15 AM

| Frequency | e' | e'' |
|---|---|---|
| 100.000000 MHz | 58.7508 | 128.7991 |
| 102.000000 MHz | 58.6384 | 126.3042 |
| 104.000000 MHz | 58.4864 | 124.6116 |
| 106.000000 MHz | 58.6159 | 122.3152 |
| 108.000000 MHz | 57.7789 | 120.4905 |
| 110.000000 MHz | 57.8157 | 118.5415 |
| 112.000000 MHz | 57.2508 | 117.0199 |
| 114.000000 MHz | 57.2948 | 115.1633 |
| 116.000000 MHz | 56.7854 | 113.5748 |
| 118.000000 MHz | 56.4515 | 111.7548 |
| 120.000000 MHz | 56.3756 | 110.1522 |
| 122.000000 MHz | 56.2139 | 108.2044 |
| 124.000000 MHz | 55.8820 | 106.7239 |
| 126.000000 MHz | 55.7927 | 105.3746 |
| 128.000000 MHz | 55.4237 | 104.1468 |
| 130.000000 MHz | 55.3640 | 102.6565 |
| 132.000000 MHz | 55.3516 | 101.4561 |
| 134.000000 MHz | 55.0268 | 100.1567 |
| 136.000000 MHz | 54.5424 | 99.0859 |
| 138.000000 MHz | 54.2357 | 97.7990 |
| 140.000000 MHz | 54.2366 | 96.6478 |
| 142.000000 MHz | 54.1785 | 95.5032 |
| 144.000000 MHz | 53.9541 | 94.4287 |
| 146.000000 MHz | 53.7658 | 93.4097 |
| 148.000000 MHz | 53.4879 | 92.2299 |
| 150.000000 MHz | 53.4424 | 91.1765 |
| 152.000000 MHz | 53.1347 | 90.2482 |
| 154.000000 MHz | 52.8883 | 89.3406 |
| 156.000000 MHz | 52.7711 | 88.3164 |
| 158.000000 MHz | 52.7139 | 87.3920 |
| 160.000000 MHz | 52.6788 | 86.4120 |
| 162.000000 MHz | 52.3739 | 85.5754 |
| 164.000000 MHz | 52.1083 | 84.8573 |
| 166.000000 MHz | 52.0927 | 84.0902 |
| 168.000000 MHz | 51.8483 | 83.2099 |

| | | |
|---|---|---|
| 170.000000 MHz | 51.8867 | 82.5004 |
| 172.000000 MHz | 51.7323 | 81.7965 |
| 174.000000 MHz | 51.6222 | 81.0111 |
| 176.000000 MHz | 51.3086 | 80.3049 |
| 178.000000 MHz | 51.3327 | 79.3822 |
| 180.000000 MHz | 51.2051 | 78.6051 |
| 182.000000 MHz | 51.0729 | 78.0492 |
| 184.000000 MHz | 51.1536 | 77.3103 |
| 186.000000 MHz | 50.8783 | 76.5913 |
| 188.000000 MHz | 50.7765 | 76.0724 |
| 190.000000 MHz | 50.5976 | 75.3747 |
| 192.000000 MHz | 50.3535 | 74.6322 |
| 194.000000 MHz | 50.4678 | 74.0692 |
| 196.000000 MHz | 50.3078 | 73.5384 |
| 198.000000 MHz | 50.1878 | 72.9528 |
| 200.000000 MHz | 50.1683 | 72.3088 |

## Body-Worn SAR Measurements

| Freq. (MHz) | Chan. | Mode | Cond. Power Before (W) | Cond. Power After (W) | Antenna Position | Antenna Type | Belt-Clip Separation Distance (cm) | SAR (w/kg) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 100% Duty Cycle | 50% Duty Cycle |
| 136.00 | Low | CW | 5.8 | 5.78 | Fixed | 501-0017-101 | 1.3 | 1.55 | 0.775 |
| 155.00 | Mid | CW | 5.8 | 5.75 | Fixed | 501-0017-103 | 1.3 | 1.15 | 0.575 |
| 174.00 | High | CW | 5.8 | 5.76 | Fixed | 501-0017-105 | 1.3 | 1.28 | 0.640 |
| **Mixture Type: Body (Measured)<br>Dielectric Constant: 60.3<br>Conductivity: 0.80** | | | | | **ANSI / IEEE C95.1 1992 - SAFETY LIMIT<br>Spatial Peak Controlled Exposure / Occupational<br>BODY: 8.0 W/kg (averaged over 1 gram)** | | | | |

Notes:

1. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest body-worn SAR value found was 1.55 w/kg (100% duty cycle).
3. The EUT was tested for body-worn SAR with the attached belt-clip providing a 1.3cm separation distance between the back of the EUT and the outer surface of the planar phantom.
4. Ambient TEMPERATURE: 23.3 °C
   Relative HUMIDITY: 57.5 %
   Atmospheric PRESSURE: 100.4 kPa
5. Fluid Temperature 23.0 °C
6. During the entire test the conducted power was maintained to within 5% of the initial conducted power.

Body-worn SAR Test Setup
1.3cm Belt-Clip Separation

# 150MHz

## Measured Liquid Dielectric Parameters (Body)

October 24, 2001 09:09 AM

| Frequency | e' | e'' |
|---|---|---|
| 100.000000 MHz | 62.3282 | 139.4229 |
| 102.000000 MHz | 62.2571 | 137.1549 |
| 104.000000 MHz | 62.2352 | 135.0896 |
| 106.000000 MHz | 62.1281 | 132.1750 |
| 108.000000 MHz | 62.1046 | 130.1626 |
| 110.000000 MHz | 62.1784 | 127.9181 |
| 112.000000 MHz | 61.7700 | 125.7054 |
| 114.000000 MHz | 61.4578 | 123.7459 |
| 116.000000 MHz | 61.3396 | 121.9496 |
| 118.000000 MHz | 61.3144 | 119.9294 |
| 120.000000 MHz | 61.3040 | 118.2149 |
| 122.000000 MHz | 61.2530 | 116.4232 |
| 124.000000 MHz | 61.2270 | 114.5209 |
| 126.000000 MHz | 61.1426 | 112.7799 |
| 128.000000 MHz | 60.9348 | 111.1324 |
| 130.000000 MHz | 60.8973 | 109.6200 |
| 132.000000 MHz | 60.9937 | 108.2691 |
| 134.000000 MHz | 60.8763 | 106.5404 |
| 136.000000 MHz | 60.6650 | 105.2321 |
| 138.000000 MHz | 60.8056 | 103.7591 |
| 140.000000 MHz | 60.7156 | 102.4602 |
| 142.000000 MHz | 60.7441 | 101.1894 |
| 144.000000 MHz | 60.5970 | 99.9078 |
| 146.000000 MHz | 60.5589 | 98.5404 |
| 148.000000 MHz | 60.5534 | 97.6535 |
| 150.000000 MHz | 60.2902 | 96.2573 |
| 152.000000 MHz | 60.3779 | 95.1443 |
| 154.000000 MHz | 60.2501 | 94.0751 |
| 156.000000 MHz | 60.0889 | 93.2477 |
| 158.000000 MHz | 60.0572 | 92.0126 |
| 160.000000 MHz | 60.0832 | 91.2171 |
| 162.000000 MHz | 60.0135 | 90.1925 |
| 164.000000 MHz | 59.7739 | 89.2562 |
| 166.000000 MHz | 59.9697 | 88.4082 |
| 168.000000 MHz | 59.9379 | 87.2521 |

| | | |
|---|---|---|
| 170.000000 MHz | 59.9380 | 86.5099 |
| 172.000000 MHz | 59.8467 | 85.8402 |
| 174.000000 MHz | 59.8768 | 84.8897 |
| 176.000000 MHz | 59.9218 | 84.1473 |
| 178.000000 MHz | 59.7924 | 83.0162 |
| 180.000000 MHz | 59.7307 | 82.1346 |
| 182.000000 MHz | 59.7391 | 81.5397 |
| 184.000000 MHz | 59.7810 | 80.8189 |
| 186.000000 MHz | 59.6335 | 79.9956 |
| 188.000000 MHz | 59.7083 | 79.1700 |
| 190.000000 MHz | 59.4896 | 78.5185 |
| 192.000000 MHz | 59.4475 | 77.8648 |
| 194.000000 MHz | 59.4394 | 77.1140 |
| 196.000000 MHz | 59.4642 | 76.5023 |
| 198.000000 MHz | 59.3412 | 75.8951 |
| 200.000000 MHz | 59.2750 | 75.2114 |

## *8.0 SYSTEM VALIDATION*

Prior to the assessment, the system was verified in a large planar phantom with a 300MHz dipole. A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±10%. The applicable verifications are as follows (see Appendix B for validation test plots and calibration information):

| Dipole Validation Kit | Target SAR 1g (w/kg) | Measured SAR 1g (w/kg) | Validation Date |
|---|---|---|---|
| 300MHz | 0.878 | 0.898 | October 24, 2001 |

| VALIDATION TISSUE MIXTURE (300MHz Brain) | |
|---|---|
| **INGREDIENT** | **%** |
| Water | 37.56 |
| Sugar | 55.32 |
| Salt | 5.95 |
| HEC | 0.98 |
| Bactericide | 0.19 |

| VALIDATION TISSUE PARAMETERS (300MHz) | | | |
|---|---|---|---|
| **Tissue Mixture** | **Dielectric Constant $e_r$** | **Conductivity s (mho/m)** | **r ($Kg/m^3$)** |
| Brain (Target) | 45.3 ± 5% | 0.87 ± 5% | 1000 |
| Brain (Measured) | 44.8 | 0.87 | 1000 |

# 300MHz

## Measured Liquid Dielectric Parameters (Brain)

October 24, 2001 09:30 AM

| Frequency | e' | e'' |
|---|---|---|
| 200.000000 MHz | 49.0492 | 70.4154 |
| 204.000000 MHz | 48.8455 | 69.4194 |
| 208.000000 MHz | 48.5921 | 68.2276 |
| 212.000000 MHz | 48.4481 | 67.3447 |
| 216.000000 MHz | 48.1427 | 66.3163 |
| 220.000000 MHz | 48.0076 | 65.4242 |
| 224.000000 MHz | 47.8414 | 64.5664 |
| 228.000000 MHz | 47.6364 | 63.6330 |
| 232.000000 MHz | 47.4837 | 62.8344 |
| 236.000000 MHz | 47.2913 | 61.9433 |
| 240.000000 MHz | 47.0525 | 61.2588 |
| 244.000000 MHz | 46.9296 | 60.4677 |
| 248.000000 MHz | 46.7282 | 59.7090 |
| 252.000000 MHz | 46.5412 | 59.0556 |
| 256.000000 MHz | 46.3593 | 58.4061 |
| 260.000000 MHz | 46.2009 | 57.7905 |
| 264.000000 MHz | 46.0324 | 57.1946 |
| 268.000000 MHz | 45.8466 | 56.5406 |
| 272.000000 MHz | 45.7241 | 56.0224 |
| 276.000000 MHz | 45.6464 | 55.4694 |
| 280.000000 MHz | 45.4431 | 54.8402 |
| 284.000000 MHz | 45.3044 | 54.3694 |
| 288.000000 MHz | 45.2172 | 53.8050 |
| 292.000000 MHz | 45.0196 | 53.2672 |
| 296.000000 MHz | 44.9712 | 52.6296 |
| 300.000000 MHz | 44.8149 | 52.1595 |
| 304.000000 MHz | 44.6388 | 51.7317 |
| 308.000000 MHz | 44.5427 | 51.2521 |
| 312.000000 MHz | 44.3520 | 50.8758 |
| 316.000000 MHz | 44.2542 | 50.3397 |
| 320.000000 MHz | 44.0382 | 49.9088 |
| 324.000000 MHz | 43.9359 | 49.4113 |
| 328.000000 MHz | 43.7706 | 49.0227 |
| 332.000000 MHz | 43.6568 | 48.6126 |
| 336.000000 MHz | 43.5309 | 48.1885 |

| | | |
|---|---|---|
| 340.000000 MHz | 43.4751 | 47.8158 |
| 344.000000 MHz | 43.3123 | 47.4642 |
| 348.000000 MHz | 43.2359 | 47.0986 |
| 352.000000 MHz | 43.0892 | 46.7376 |
| 356.000000 MHz | 42.9813 | 46.3803 |
| 360.000000 MHz | 42.9295 | 46.0827 |
| 364.000000 MHz | 42.8095 | 45.6954 |
| 368.000000 MHz | 42.6766 | 45.3757 |
| 372.000000 MHz | 42.6423 | 45.0051 |
| 376.000000 MHz | 42.5619 | 44.7155 |
| 380.000000 MHz | 42.3916 | 44.4100 |
| 384.000000 MHz | 42.3553 | 44.0055 |
| 388.000000 MHz | 42.2019 | 43.7118 |
| 392.000000 MHz | 42.1371 | 43.4128 |
| 396.000000 MHz | 42.0346 | 43.1461 |
| 400.000000 MHz | 41.9526 | 42.8609 |

## *9.0 EVALUATION SIMULATED TISSUES*

The brain and body 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 (permitivity and conductivity).

| INGREDIENT | MIXTURE % | |
|---|---|---|
| | 150MHz Brain | 150MHz Body |
| Water | 38.35 | 46.6 |
| Sugar | 55.5 | 49.7 |
| Salt | 5.15 | 2.6 |
| HEC | 1.0 | 1.0 |
| Bactericide | 0.1 | 0.1 |

## *10.0 EVALUATION TISSUE PARAMETERS*

The dielectric parameters of the fluids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer. The dielectric parameters of the fluid are as follows:

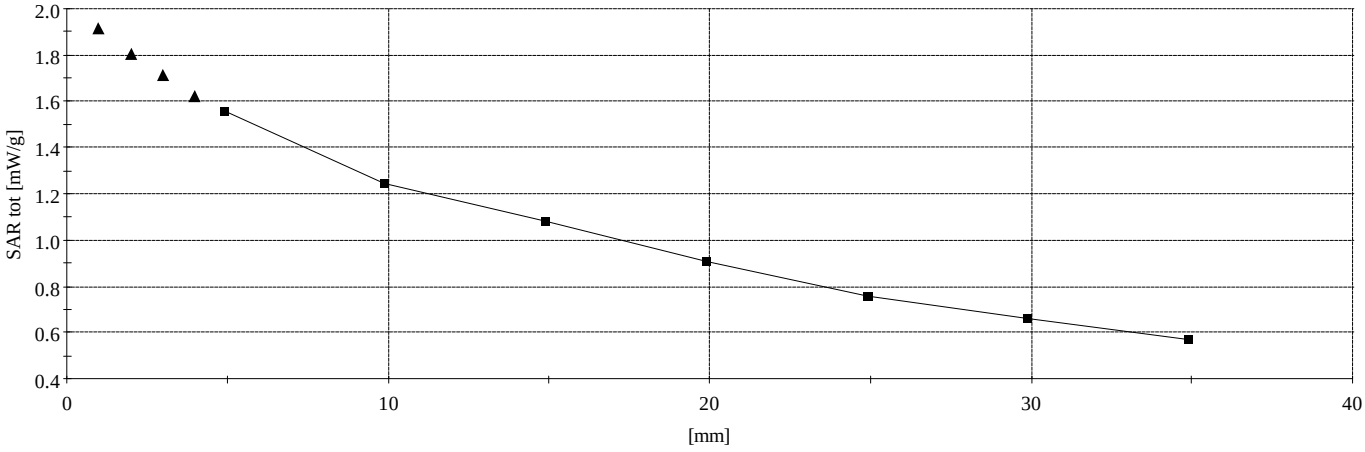
| Equivalent Tissue 150MHz | Dielectric Constant $\varepsilon_r$ | Conductivity $\sigma$ (mho/m) | $\rho$ (Kg/m$^3$) |
|---|---|---|---|
| Brain (Target) | 52.3 ± 5% | 0.76 ± 5% | 1000 |
| Brain (Measured) | 53.4 | 0.76 | 1000 |
| Body (Target) | 61.9 ± 5% | 0.80 ± 5% | 1000 |
| Body (Measured) | 60.3 | 0.80 | 1000 |

# EF Johnson FCC ID: ALH2425110

Small Planar Phantom; Planar Section
Probe: ET3DV6 - SN1590; ConvF(7.71,7.71,7.71); Crest factor: 1.0;
150 MHz Brain : $\sigma$ = 0.76 mho/m $\varepsilon_r$ = 52.3 $\rho$ = 1.00 g/cm$^3$
Cube 4x4x7

Z-Axis Extrapolation at Peak SAR Location

Face SAR at 2.5 cm Separation Distance
Portable VHF PTT Radio Transceiver
Antenna P/N: 501-0017-103
EF Johnson Model: 242-5110/5111
Continuous Wave Mode
Mid Channel [155.000 Mhz]
Conducted Power: 5.80 Watts
Date Tested: October 24, 2001

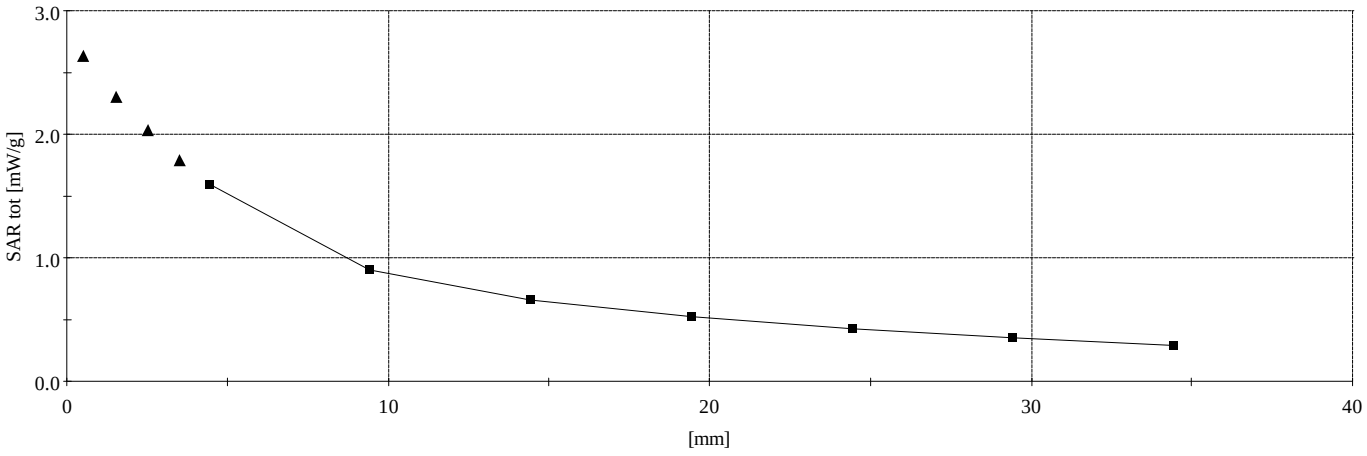


# EF Johnson FCC ID: ALH2425110

Small Planar Phantom; Planar Section
Probe: ET3DV6 - SN1590; ConvF(7.71,7.71,7.71); Crest factor: 1.0;
150 MHz Muscle: $\sigma$ = 0.80 mho/m $\varepsilon_r$ = 61.9 $\rho$ = 1.00 g/cm$^3$
Cube 4x4x7

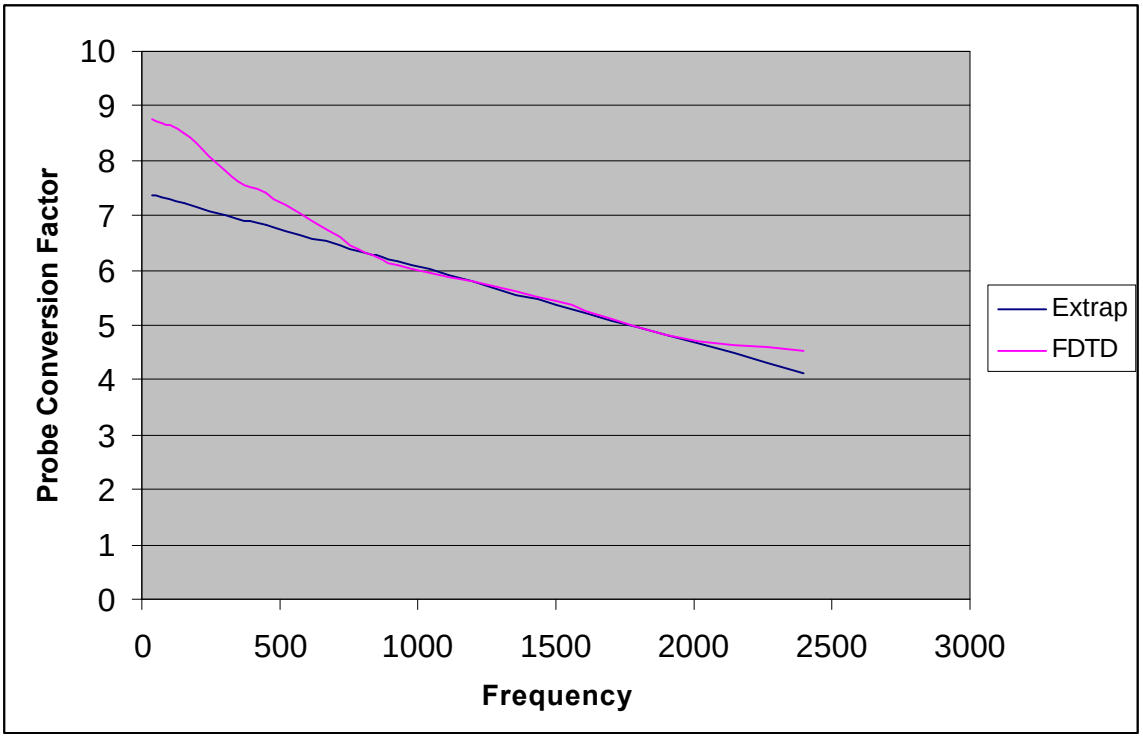
Z-Axis Extrapolation at Peak SAR Location

Body-Worn SAR with 1.3 cm Belt-Clip Separation
Portable VHF PTT Radio Transceiver
Antenna P/N: 501-0017-101
EF Johnson Model: 242-5110/5111
Continuous Wave Mode
Low Channel [136.000 Mhz]
Conducted Power: 5.80 Watts
Date Tested: October 24, 2001



The worst-case SAR analysis using the extrapolated probe conversion factors at 150MHz is as follows:

1. The probe conversion factors at 150MHz were determined using a linear regression based on the two calibrated points of 900 and 1800MHz. Below is an example of an identical probe in which the conversion factors have been determined using numerical methods. As indicated on the graph, as the frequency decreases below 800MHz the numerically derived conversion factors deviate from the linear extrapolated results. At 150MHz, there is approximately an 18% variance between the two conversion factors. For this particular EUT, the maximum face-held SAR measured was 1.54mW/g at 100% duty cycle. By re-evaluating the SAR with 18% lower conversion factors the resulting SAR value at 100% was 1.82mW/g.




2. The probe conversion factors were varied in order to determine the conversion factor value required for the SAR to reach the occupational exposure limit. It was found that a conversion factor of 1.5 gave a SAR value of 7.92mW/g (see SAR test plot - next page).

# EF Johnson FCC ID: ALH2425110

Small Planar Phantom; Planar Section; Position: (90°,0°)
Probe: ET3DV6 - SN1590; ConvF(1.50,1.50,1.50); Crest factor: 1.0
150 MHz Brain : $\sigma$ = 0.76 mho/m $\varepsilon_r$ = 52.3 $\rho$ = 1.00 g/cm$^3$
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Cube 4x4x7 Powerdrift: -0.37 dB
SAR (1g): 7.92 mW/g, SAR (10g): 6.35 mW/g

Face SAR at 2.5 cm Separation Distance
Portable VHF PTT Radio Transceiver
Antenna P/N: 501-0017-103
EF Johnson Model: 242-5110/5111
Continuous Wave Mode
Mid Channel [155.000 Mhz]
Conducted Power: 5.80 Watts
Date Tested: October 24, 2001