



MOTOROLA



CGISS EME Test Laboratory

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S.A.R. EME Compliance Test Report
Addendum to S.A.R. report dated 6/25/02
and responses to FCC correspondences 23693/23587

Date of Report: June 13, 2003
Report Revision: Rev. O
Manufacturer: Motorola
Product Description: VHF 1-6 Watts Digital Handheld Transceiver
FCC ID: **AZ489FT3804**
Device Model: H18KEH9PW7AN

Test Period: 06/3/03-06/04/03
EME Technician: Ed Church
EME Engineer: Deanna Zakharia
Elect. Principle Staff Eng.
Author: Michael Sailsman
Global EME Regulatory Affairs Liaison

Note: Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 2.0 of this report.

Signature on File

Ken Enger
Senior Resource Manager, Laboratory Director, CGISS EME Lab

6/13/03

Date Approved

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REVISION HISTORY

Date	Revision	Comments
6/13/03	O	Pilot results

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (S.A.R.) measurements performed at the CGISS EME Test Lab for FCC ID: AZ489FT3804. A new battery option model NTN9862A is being offered with this product and this report discloses updated compliance results.

The applicable exposure environment is Occupational/Controlled.

The test results included herein represent the highest S.A.R. levels applicable to this product and clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8.0 mW/g per the requirements of 47 CFR 2.1093(d).

2.0 Reference Standards and Guidelines

This product is designed to comply with the following national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; 47CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Terminal frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Terminal communications (Electromagnetic Radiation - Human Exposure) Standard 2001
- ANATEL, Brazil Regulatory Authority, Resolution 256 (April 11, 2001) "additional requirements for SMR, cellular and PCS product certification."

3.0 Description of Test Sample



The portable handheld transceiver, FCC ID: AZ489FT3804, operates using traditional simplex two-way radio transmission protocol. The intended use is by professionals in public safety agencies such as police, fire and medical emergency response. The intended operating positions are “at the face” with the microphone 1 to 2 inches from the mouth or “at the abdomen” secured to the user’s belt. Audio and PTT operation while the radio is at the abdomen is accomplished by means of optional remote accessories that connect to the side of the radio. The maximum transmit duty cycle is a conservative 50% and is controlled by the user via the PTT function.

FCC ID: AZ489FT3804 is capable of operating in the 136 to 174 MHz band. The rated power is 1 to 6 watts with a maximum output capability of 6.6watts as defined by the upper limit of the production line final test station.

FCC ID: AZ489FT3804 is offered with the following additional options and accessories:

Battery:

NTN9862A 7.5 V Smart Li-Ion battery

3.1 Test Signal

Test Signal mode:

Test Mode	☒	Base Station	☐	Simulator	☐
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Transmission Mode:

CW	☒
Native Transmission	☐
TDM:	☐
Other	☐

3.2 Test Output Power

Output power was measured before each test. The DASY 3 system's S.A.R. drift function was used to determine the power slump characteristic of the device. A characteristic power slump table based on 50 ohms measurements is provided in APPENDIX A for the batteries producing the highest S.A.R. results.

4.0 Description of Test Equipment

4.1 Descriptions of S.A.R. Measurement System

The laboratory utilizes a Dosimetric Assessment System (DASY3™) S.A.R. measurement system manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot with an ET3DV6 E-Field probe. Please reference the SPEAG user manual and application notes for detailed probe, robot, and S.A.R. computational procedures.

The S.A.R. measurements were conducted with probe model/serial number ET3DV6/SN1393. The system performance check was conducted daily and within 24 hours prior to testing. DASY output files of the system performance test results and the probe/dipole calibration certificates are included in appendices C and D respectively. The table below summarizes the system performance check results normalized to 1W.

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	System Perf. Result when normalized to 1W (mW/g)	Reference S.A.R @ 1W (mW/g)	Test Date(s)
1393	FCC Body	4/16/03	SPEAG D300V2 MHz /1002	2.765+/-0.025	2.60 +/- 10%	6/3/03-6/04/03
1393	IEEE Head	4/16/03	SPEAG D300V2 MHz /1002	2.79 +/- 0.000	2.72 +/- 10%	6/04/03

Note: see APPENDIX C for an explanation of the reference S.A.R. targets stated above.

The DASY3™ system is operated per the instructions in the DASY3™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME S.A.R. compliance was calibrated according to 17025 A2LA guidelines.

4.2 Description of Phantom

4.2.1 Flat Phantom

A rectangular shaped box made of high-density polyethylene (HDPE) with a dielectric constant of 2.26 and a loss tangent of less than 0.00031. The phantom is mounted on a wooden supporting structure that has a loss tangent of < 0.05. The structure has a 68.58 cm x 25.4 cm opening at its center to allow positioning the DUT to the phantom's surface. The table below shows the flat phantom dimensions used for S.A.R. performance assessment at the abdomen and face.

	Abdomen
Length	80cm
Width	60cm
Height	20cm
Surface Thickness	0.2cm

4.2.2 SAM Phantom

SAM Phantom assessment was not applicable for this filing.

4.3 Simulated Tissue Properties

4.3.1 Type of Simulated Tissue

The simulated tissue used is compliant to that specified in FCC Supplement C (Edition 01 - 01) to OET Bulletin 65 (Edition 97 - 01).

Simulated Tissue	Body Position
FCC Body	Abdomen
IEEE Head	Face

4.3.2 Simulated Tissue Composition

Tissue Ingredient (%) @ 300 MHz		
	Head	Body
Sugar	56	47.1
DGBE (Glycol)	-	-
De ionized -Water	37.5	49.48
Salt	5.4	2.32
HEC	1.0	1.0
Bact.	0.1	0.1

Characterization of Simulated tissue materials and ambient conditions:

Simulated tissue prepared for S.A.R. measurements is measured daily and within 24 hours prior to actual S.A.R. testing to verify that the tissue is within 5% of target parameters at the center of the transmit band. This measurement is done using the Agilent (HP) probe kit model 85070C and a HP8753D Network Analyzer.

Target tissue parameters

FCC Body				
Frequency (MHz)	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. (Range) S/m
155	61.8	61.7-61.8	0.80	0.78-0.79
300	58.2	58.3-58.4	0.92	0.88-0.88

IEEE Head				
Frequency (MHz)	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. S/m
155	52.1	53.6-53.6	0.76	0.76
300	45.3	47.1-47.1	0.87	0.88

4.4 Test conditions

The EME Laboratory ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within $\pm 2^{\circ}\text{C}$ of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was 15cm $\pm$ 0.5cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the S.A.R. tests reported herein:

	Target	Measured
Ambient Temperature	20 - 25 $^{\circ}\text{C}$	Range: 21.7-23.8 $^{\circ}\text{C}$ Avg. 22.8 $^{\circ}\text{C}$
Relative Humidity	30 - 70 %	Range: 50.3-65.0% Avg. 60.4%
Tissue Temperature	NA	Range: 21.0-21.3 $^{\circ}\text{C}$ Avg: 21.15 $^{\circ}\text{C}$

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the S.A.R. scans are repeated. However, the lab environment is sufficiently protected such that no S.A.R. impacting interference has been experienced to date.

5.0 Description of Test Procedure

The new battery being offered was used to assess compliance performance using the highest test configuration for each body position previously reported. S.A.R. measurements were performed using a flat phantom to assess performance at the abdomen and face. All assessments were done using the flat phantom with the DUT in CW mode. Applicable tissue parameters were used for each body location assessment.

The DUT was assessed against the flat phantom, using the worst-case configuration previously reported at the shoulder, with the offered battery, in CW transmission mode.

The DUT was assessed against the flat phantom, using the worst-case configuration previously reported at the abdomen, with the offered battery, in CW transmission mode.

The DUT was assessed with 2.5cm separation distance from the flat phantom, using the worst-case configuration previously reported at the face, with the offered battery, in CW transmission mode.

5.1 Device Test Positions

Reference figure 1 for the device orientation and position which exhibited the highest S.A.R. performance.

5.1.1 Abdomen

The DUT was positioned such that the applicable carry case accessory were centered against the flat phantom. The offered PSM and associated clip was centered against the flat phantom. The DUT was positioned with 2.5cm separation distance from the flat phantom.

5.1.2 Head

Assessments at the head was not applicable for this filing

5.1.3 Face

The DUT was positioned at the center of the flat phantom with a 2.5cm separation distance from the front housing.

5.2 Test Position Photographs

**Figure 1: Highest S.A.R. Test Position
(DUT with PSM model NMN6251A/NTN8327A against the flat phantom)**

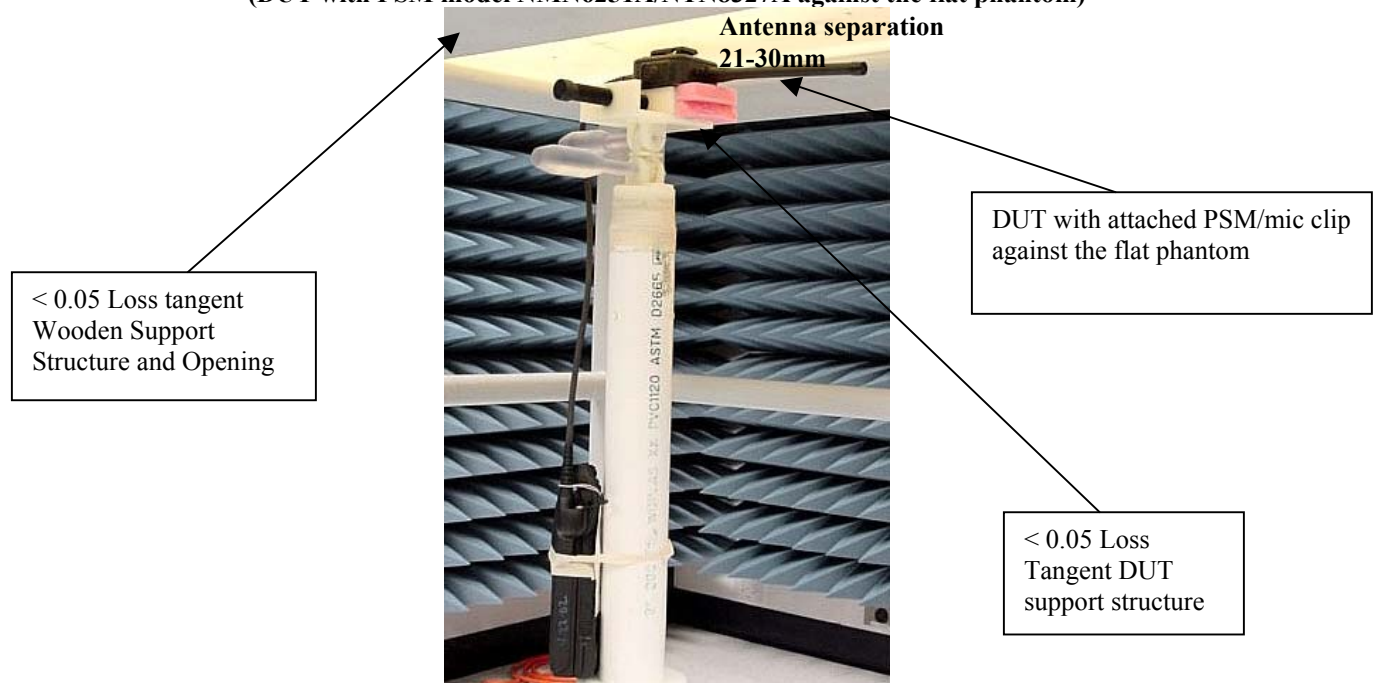


Figure 2. Assessment @ the Abdomen; DUT w/ belt loop model NTN9179A against the flat phantom and attached RSM model NMN6191C

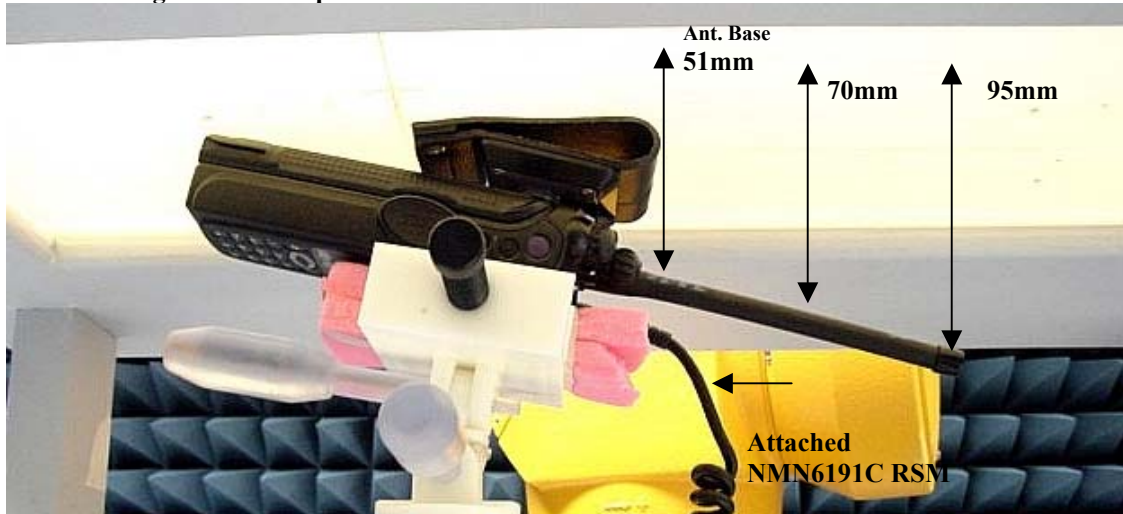


Figure 3. Assessment @ the Face; DUT with 2.5cm separation distance

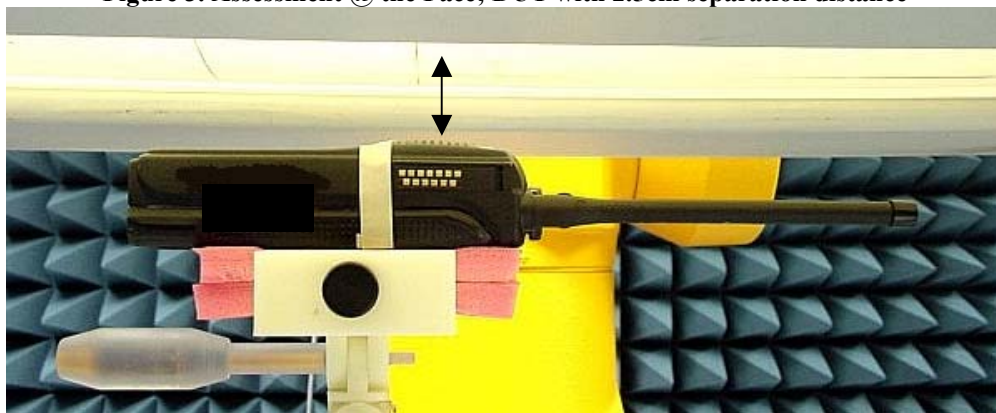
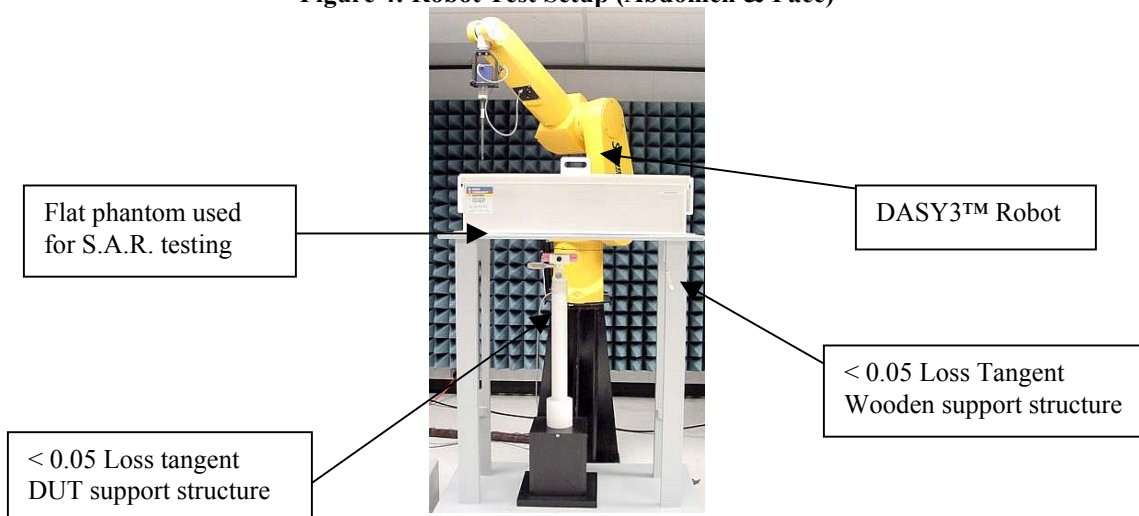


Figure 4: Robot Test Setup (Abdomen & Face)



5.3 Probe Scan Procedures

The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum S.A.R. distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

6.0 Measurement Uncertainty

Table 1: Uncertainty Budget for Device Under Test

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	Section of IEEE P1528	Tol. (± %)	Prob. Dist.	Divisor	<i>c_f</i> (1 g)	<i>c_g</i> (10 g)	1 g <i>u_f</i> (± %)	10 g <i>u_g</i> (± %)	<i>v_f</i>
Measurement System									
Probe Calibration	E.2.1	4.8	N	1.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	1.3	R	1.73	1	1	0.8	0.8	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.6	N	1.00	1	1	3.6	3.6	29
Device Holder Uncertainty	E.4.1	2.8	N	1.00	1	1	2.8	2.8	8
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				11.72	11.09	1363
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> =2				22.98	21.75	

Table 2: Uncertainty Budget for System Performance Check

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i> = <i>f</i> (<i>d</i> , <i>k</i>)	<i>f</i>	<i>g</i>	<i>h</i> = <i>c</i> <i>x</i> <i>f</i> / <i>e</i>	<i>i</i> = <i>c</i> <i>x</i> <i>g</i> / <i>e</i>	<i>k</i>
	Section of IEEE P1528	Tol. (± %)	Prob. Dist.	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</i>
Uncertainty Component									
Measurement System									
Probe Calibration	E.2.1	4.8	N	1.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	1.0	R	1.73	1	1	0.6	0.6	∞
Input Power and SAR Drift Measurement	8, 6.6.2	4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				10.16	9.43	∞
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				19.92	18.48	

Notes for Tables 1 and 2

a) Column headings *a-k* are given for reference.

b) Tol. - tolerance in influence quantity.

c) Prob. Dist. – Probability distribution

d) N, R - normal, rectangular probability distributions

e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty

f) *c_i* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.

g) *u_i* – SAR uncertainty

h) *v_i* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty.

7.0 S.A.R. Test Results

All S.A.R. results obtained by the tests described in Section 5.0 are listed in section 7.1 below. The bolded result indicates the highest observed S.A.R. performance. DASY3™ S.A.R. measurement scans are provided in APPENDIX B for the highest observed S.A.R.

7.1 S.A.R. results

Compliance Assessment at the abdomen; CW mode												
Run Number/ SN	Freq. (MHz)	Battery	Test position	Body- worn Acc.	Additional attachments	Initial Power (W)	End Power (W)	S.A.R. Drift (dB)	Measured 1g-S.A.R. (mW/g)	Max Calc. 1g-S.A.R. (mW/g)	Meas. 10g-S.A.R. (mW/g)	Max Calc. 10g-S.A.R. (mW/g)
Assessment of offered battery using the worst-case test configuration previously reported (Antenna model NAD6568)												
EC-Ab-R3-030603- 11/50	162.125	NTN9862A	Against phantom	None	PSM NMN6251A& NTN8327A	6.270	5.980	-0.090	6.430	3.46	3.490	1.88
EC-Ab-R3-030604- 04/50	168.125	NTN9862A	Against phantom	NTN9179A	RSM NMN6191C	6.360	6.310	-0.140	0.674	0.36	0.523	0.28

Compliance Assessment at the Face; CW mode												
Run Number/ SN	Freq. (MHz)	Battery	Test position	Body- worn Accessories	Additional attachments	Initial Power (W)	End Power (W)	S.A.R. Drift (dB)	Measured 1g-S.A.R. (mW/g)	Max Calc. 1g-S.A.R. (mW/g)	Meas. 10g-S.A.R. (mW/g)	Max Calc. 10g-S.A.R. (mW/g)
Assessment of offered batteries using worst-case the test configuration previously reported (Antenna model NAD6568)												
EC-Face-R3-030604- 09/50	162.125	NTN9862A	DUT Front 2.5cm	None	None	6.310	5.750	-0.270	4.580	2.55	3.530	1.97

7.2 Peak S.A.R. location

Refer to APPENDIX B for detailed S.A.R. scan distributions.

7.3 Highest S.A.R. results calculation methodology

The calculated maximum 1-gram averaged S.A.R. value is determined by scaling the measured S.A.R. to account for power leveling variations and power output slump below the reported maximum power during the S.A.R. measurements. For this device the Maximum Calculated 1-gram and 10-gram averaged peak S.A.R. is calculated using the following formula:

$$\text{Max. Calc. 1-g and 10-g Avg. SAR} = ((\text{S.A.R. meas.} / (10^{(\text{Pdrift}/10)})) * (\text{Pmax}/\text{Pint})) * \text{DC}\%$$

P_{max} = Maximum Power (W)

P_{int} = Initial Power (W)

P_{drift} = DASY drift results (dB)

$\text{SAR}_{\text{meas.}}$ = Measured 1 gram averaged peak S.A.R. (mW/g)

DC % = Transmission mode duty cycle in % where applicable

8.0 Conclusion

The highest Operational Maximum Calculated 1-gram average S.A.R. values found for FCC ID: AZ489FT3804 using the new battery option model NTN9862A are:

At the Abdomen: 1-g Avg. = 0.36 mW/g
At the shoulder: 1-g Avg. = 3.46 mW/g
At the Face: 1-g Avg. = 2.55 mW/g

The previously reported highest maximum calculated 1-gram compliance results were 4.98 mW/g at the shoulder (w/ PSM), 2.08 mW/g at the face, and 1.28 mW/g at the abdomen.

The new compliance results for FCC ID: AZ489FT3804 are as follows:

At the Abdomen: 1-g Avg. = 1.28 mW/g
At the shoulder: 1-g Avg. = 4.98 mW/g
At the Face: 1-g Avg. = 2.55 mW/g

These test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of **8.0 mW/g** per the requirements of 47 CFR 2.1093(d)

APPENDIX A
Power Slump Data

Model XTS5000 H18KEH9PW7AN

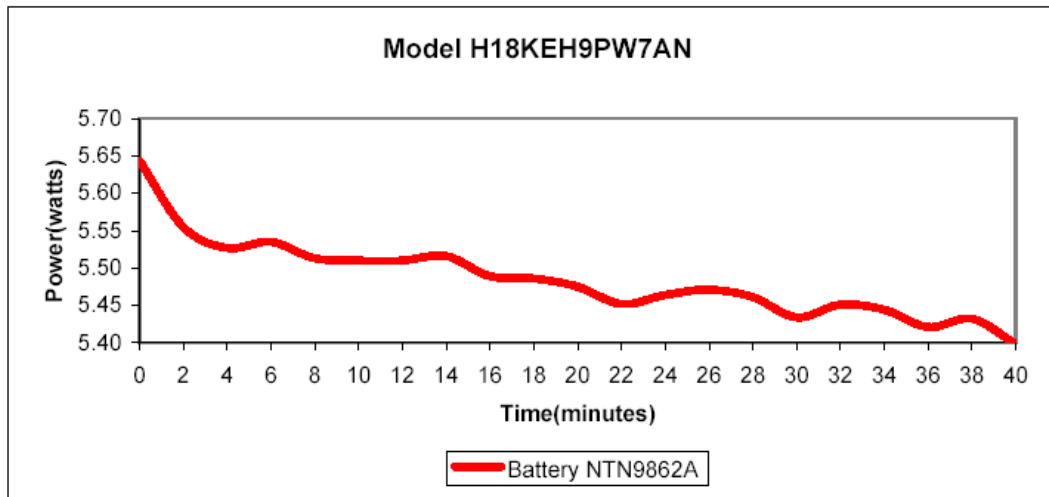
Radio s/n 50

Frequency 156.125 MHz

Mode CW

Battery NTN9862A

Time (Minutes)	Power(watts)
0	5.64
2	5.56
4	5.53
6	5.54
8	5.51
10	5.51
12	5.51
14	5.52
16	5.49
18	5.49
20	5.48
22	5.45
24	5.46
26	5.47
28	5.46
30	5.43
32	5.45
34	5.44
36	5.42
38	5.43
40	5.40



APPENDIX B

Data Results

FCC ID: AZ489FT3804; Test Date: 06/03/02

Motorola CGISS EME Laboratory

RUN #: Ab-R3-030603-11

MODEL #: H18KEH9PW7AN SER #: 50

TX FREQ: 162.1250 MHz

SIM TEMP: 21.3 C

ANTENNA KIT #: NAD6568

BATTERY KIT #: NTN9862A

Body worn ACCESSORIES: NONE

AUDIO ACCESSORIES: PSM #: NMN6251A

RF ADAPTER #: NTN8327A

DUT w/ attached PSM against the phantom

Phantom; Section; Position: (90°,90°);

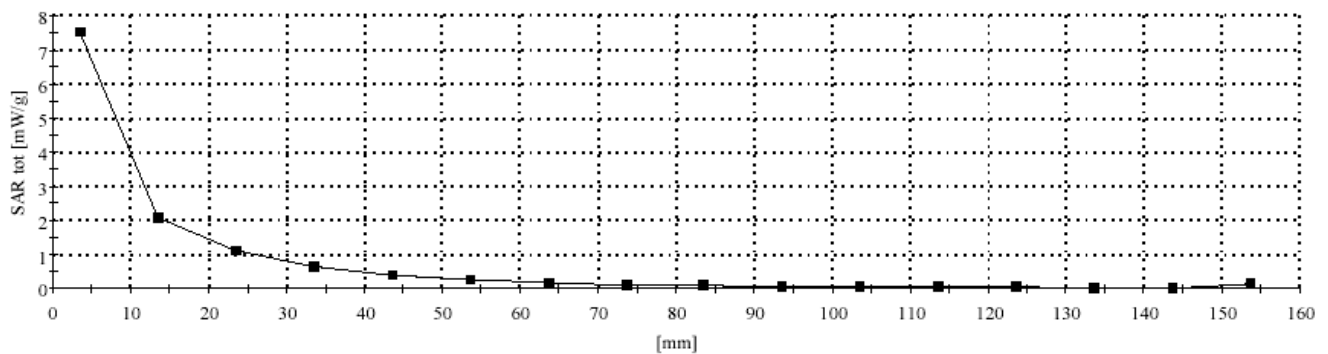
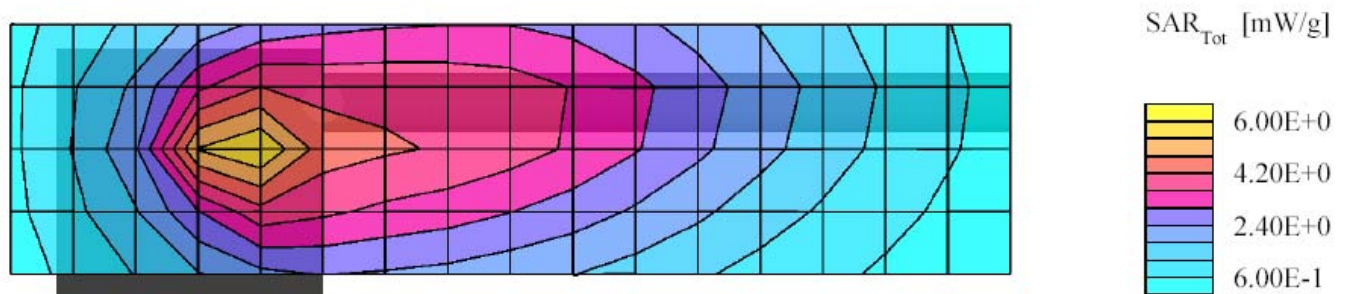
Probe: ET3DV6 - SN1393; ConvF(8.80,8.80,8.80); Probe cal date: 16/04/03; Crest factor: 1.0; FCC Body 155: $\sigma = 0.78$

mho/m $\epsilon = 61.7$ $\rho = 1.00$ g/cm³; DAE3 SN: 374 DAE CAL DATE: 02-19-03

Cube 7x7x7: SAR (1g): 6.43 mW/g, SAR (10g): 3.49 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0; Max at 30.0, 55.5, 3.6

Power Drift: -0.09 dB



FCC ID: AZ489FT3804; Test Date: 06/04/02

Motorola CGISS EME Laboratory

RUN #: Ab-R3-030604-04

MODEL #: H18KEH9PW7AN SER #: 50

TX FREQ: 168.1250 MHz

SIM TEMP: 21.3 C

ANTENNA KIT #: NAD6568

BATTERY KIT #: NTN9862A

ACCESSORIES: Belt loop#: NTN9179A

DUT w/ belt loop against the phantom

Phantom; Section; Position: (90°,90°);

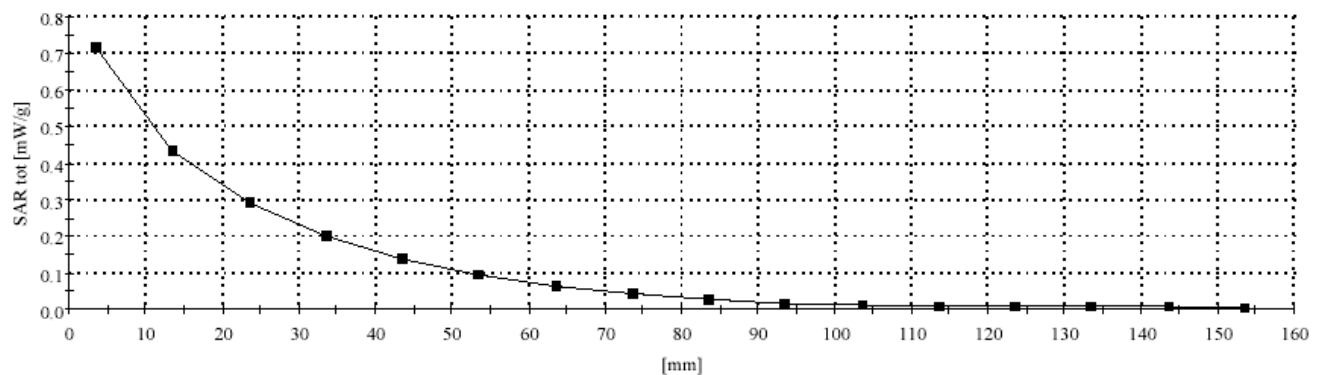
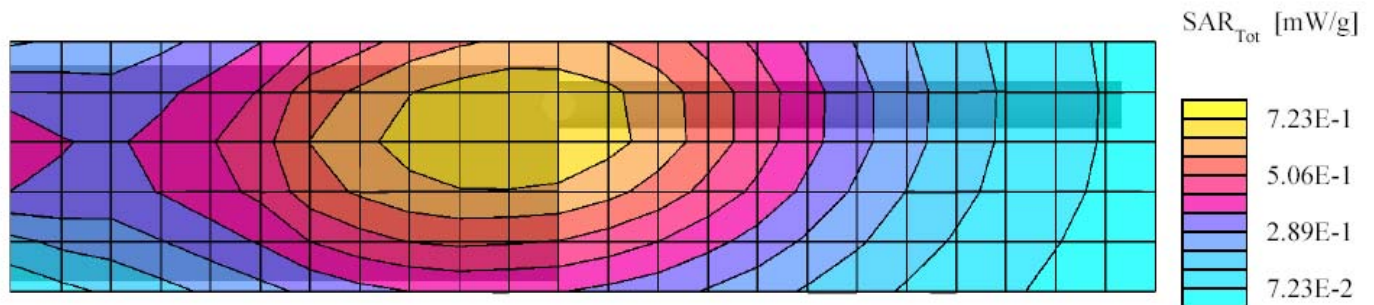
Probe: ET3DV6 - SN1393; ConvF(8.80,8.80,8.80); Probe cal date: 16/04/03; Crest factor: 1.0; FCC Body 155: $\sigma = 0.79$

mho/m $\epsilon = 61.8$ $\rho = 1.00$ g/cm³; DAE3 SN: 374 DAE CAL DATE: 02-19-03

Cube 7x7x7: SAR (1g): 0.674 mW/g, SAR (10g): 0.523 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0; Max at 25.5, 153.0, 3.6

Power Drift: -0.14 dB



FCC ID: AZ489FT3804; Test Date: 06/04/02

Motorola CGISS EME Laboratory

RUN #: Face-R3-030604-09

MODEL #: H18KEH9PW7AN SER #: 50

TX FREQ: 162.1250 MHz

SIM TEMP: 21.0 C

ANTENNA KIT #: NAD6568

BATTERY KIT #: NTN9862A

Body Worn ACCESSORIES: NONE

AUDIO ACCESSORIES: NONE

DUT w/ front separated 2.5 cm from phantom

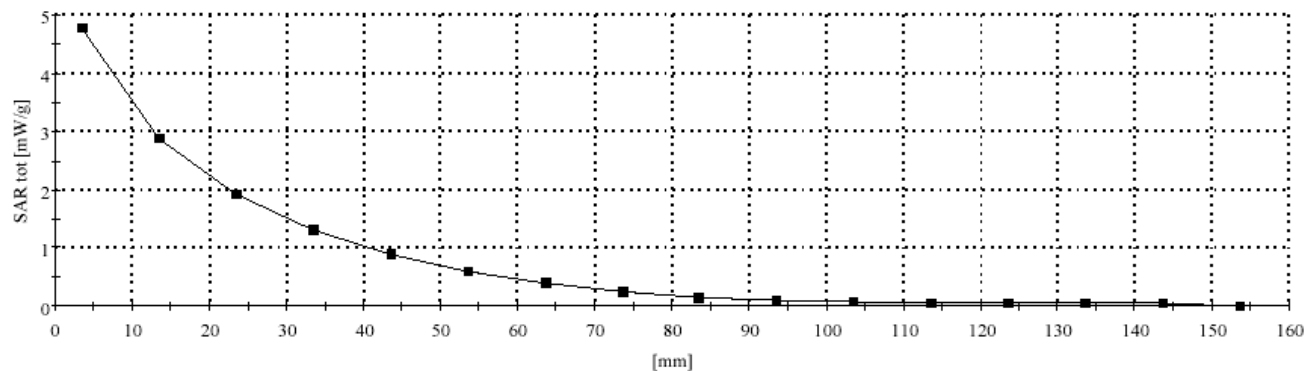
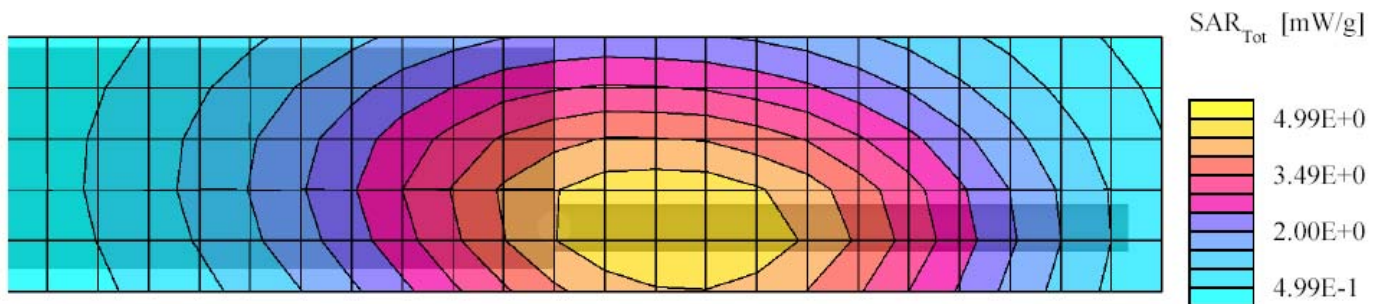
Phantom; Section; Position: (90°,90°);

Probe: ET3DV6 - SN1393; ConvF(9.70,9.70,9.70); Probe cal date: 16/04/03; Crest factor: 1.0; IEEE Head 155 MHz: $\sigma = 0.76$ mho/m $\epsilon = 53.6$ $\rho = 1.00$ g/cm³; DAE3 SN: 374 DAE CAL DATE: 02-19-03

Cube 7x7x7: SAR (1g): 4.58 mW/g, SAR (10g): 3.53 mW/g * Max outside, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0; Max at 57.0, 204.0, 3.6

Power Drift: -0.27 dB



APPENDIX C

Dipole System Performance Check Results

Dipole validations at the head from SPEAG are provided in APPENDIX D herein. The CGISS EME lab validated the SPEAG dipole to the applicable IEEE system performance targets. System validation was performed using FCC body tissue parameters to generate the system performance target values for body at the applicable frequency. The results of the CGISS' EME daily system performance checks as well as the new target assessment at the body are provided in this appendix.

CGISS Dipole 300MHz; SN 1002; Test Date: 06/03/02

Motorola CGISS EME Lab

Run #: Sys Perf-R3-030603-01

TX Freq: 300 MHz

Sim Tissue Temp: 21.3 (Celsius)

Start Power: 250mW

Target at 1W is 2.60 mW/g (1g); and 1.76 mW/g (10g avg.)

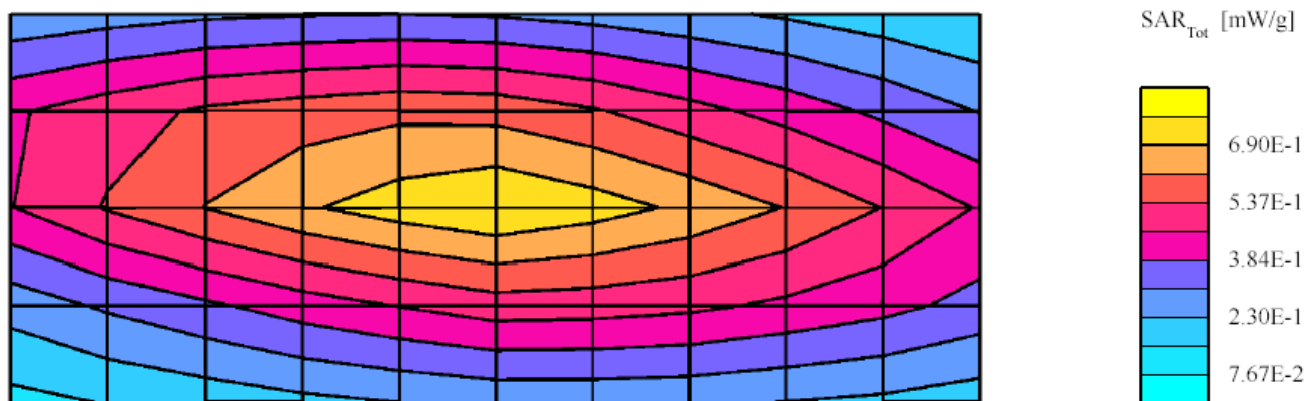
SAR calculated 1g is 2.79 mW/g percent from target (including drift) + 7.38 %

SAR Calculated 10g is 1.89 mW/g Percent from target (including drift) is + 7.50 %

Flat Phantom; Probe: ET3DV6 - SN1393; Probe Cal Date: 16/04/03 ConvF(8.40,8.40,8.40); Crest factor: 1.0; FCC Body 300: $\sigma = 0.88$ mho/m $\epsilon = 58.3$ $\rho = 1.00$ g/cm³; DAE3: SN:374 DAE Cal Date: 02/19/03

Cubes (3): Peak: 0.718 mW/g $\pm$ 19.93 dB, SAR (1g): 0.465 mW/g $\pm$ 0.00 dB, SAR (10g): 0.315 mW/g $\pm$ 0.00 dB, (Worst-case extrapolation) Penetration depth: 13.6 (11.4, 16.2) [mm]

Power drift: -0.00 dB



CGISS Dipole 300MHz; SN 1002; Test Date: 06/04/02

Motorola CGISS EME Lab

Run #: Sys Perf-R3-030604-01

TX Freq: 300 MHz

Sim Tissue Temp: 21.3 (Celsius)

Start Power; 250mW

Target at 1W is 2.60 mW/g (1g); and 1.76 mW/g (10g avg.)

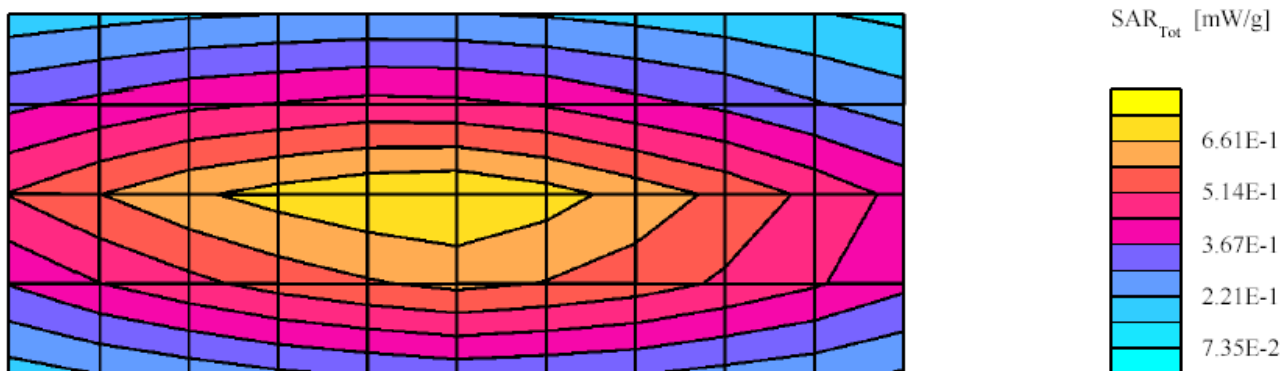
SAR calculated 1g is 2.74 mW/g percent from target (including drift) is + 5.43 %

SAR Calculated 10g is 1.87 mW/g Percent from target (including drift) is + 6.20 %

Flat Phantom; Probe: ET3DV6 - SN1393; Probe Cal Date: 16/04/03 ConvF(8.40,8.40,8.40); Crest factor: 1.0; FCC Body 300: $\sigma = 0.88$ mho/m $\epsilon = 58.4$ $\rho = 1.00$ g/cm³; DAE3: SN:374 DAE Cal Date: 02/19/03

Cubes (3): Peak: 1.04 mW/g ± 0.00 dB, SAR (1g): 0.452 mW/g ± 0.00 dB, SAR (10g): 0.308 mW/g ± 0.00 dB, (Worst-case extrapolation) Penetration depth: 13.6 (11.7, 16.0) [mm]

Power drift: -0.04 dB



CGISS Dipole 300MHz; SN 1002; Test Date: 06/04/02

Motorola CGISS EME Lab

Run #: Sys Perf-R3-030604-05

TX Freq: 300 MHz

TX Freq: 300 MHz

Sim Tissue Temp: 21.0 (Celsius)

Start Power; 250mW

Target at 1W is 2.72 mW/g (1g); and 1.83 mW/g (10g avg.)

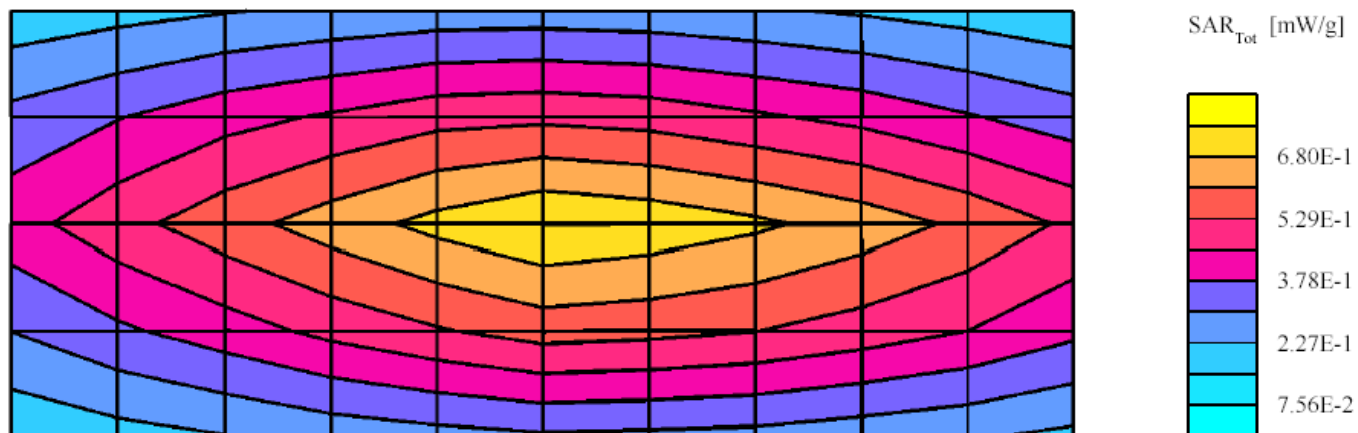
SAR calculated 1g is 2.77 mW/g percent from target (including drift) + 1.85 %

SAR Calculated 10g is 1.85 mW/g Percent from target (including drift) is + 1.00 %

Flat Phantom; Probe: ET3DV6 - SN1393; Probe Cal Date: 16/04/03 ConvF(8.50,8.50,8.50); Crest factor: 1.0; IEEE Head 300: $\sigma = 0.88$ mho/m $\epsilon = 47.1$ $\rho = 1.00$ g/cm³; DAE3: SN:374 DAE Cal Date: 02/19/03

Cubes (3): Peak: 0.718 mW/g ± 20.17 dB, SAR (1g): 0.461 mW/g ± 0.00 dB, SAR (10g): 0.307 mW/g ± 0.00 dB, (Worst-case extrapolation) Penetration depth: 13.1 (11.2, 15.5) [mm]

Power drift: -0.01 dB



SYSTEM VALIDATION

Date:	<u>10/24/2002</u>	Frequency (MHz):	<u>300</u>
Lab Location:	<u>CGISS</u>	Mixture Type:	<u>IEEE Head</u>
Robot System:	<u>CGISS 3</u>	Ambient Temp.(°C):	<u>23, (Humid: 48.5%)</u>
Probe Serial #:	<u>ET3DV6-1393</u>	Tissue Temp.(°C):	<u>22</u>
DAE Serial #:	<u>406</u>		

Tissue Characteristics

Permittivity:	<u>46.5</u>	Phantom Type/SN:	<u>80602002B/S2</u>
Conductivity:		Distance (mm):	<u>15 (tissue/dipole cnt)</u>

Reference Source: D300V2 (Dipole)
Reference SN: _____

Power to Dipole: 250 mW
Power Output (radio): _____ mW

Target SAR Value: 2.83 mW/g, 1.89 mW/g (10g avg.)
(normalized to 1.0 W)

Measured SAR Value: 0.676 mW/g, 0.455 mW/g (10g avg.)
Power Drift: -0.03 dB

Measured SAR Value: 2.72 mW/g, 1.83 mW/g (10g avg.)
(normalized to 1.0 W, including drift)

Percent Difference From Target (MUST be within System Uncertainty): 3.79 % (1g ave)
3.04 % (10g ave)

Test performed by: J. Fortier Initial: 

Dipole D300V2 SN1002; Test date:10/24/02

Run #: Sys Val_R3_021024-07

Phantom #: 80602002B/S2

Model #: D300V2

SN: 1002

Robot: CGISS-3

Tester: J. Fortier

TX Freq: 300 MHz

Sim Tissue Temp: 22.0 (Celsius)

Start Power: 250mW

DAE3: SN:406

DAE Cal Date: 02/08/02

- Comments-

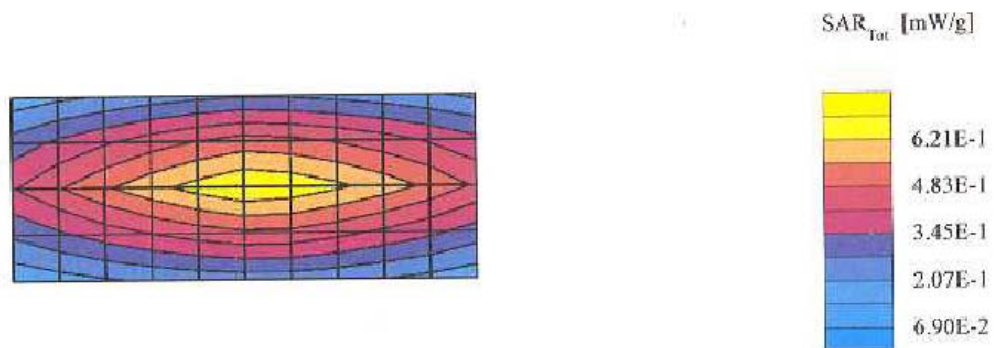
Target at 1W is 2.72 mW/g (1g); 1.83 mW/g (10g).

Flat; Probe: ET3DV6 - SN1393 SPEAG; ConvF(8.40,8.40,8.40); Crest factor: 1.0; IEEE Head 300: $\sigma = 0.85$ mho/m $\epsilon_r = 46.5$ $\rho = 1.00$ g/cm³

Cubes (2): Peak: 1.03 mW/g ± 0.04 dB, SAR (1g): 0.676 mW/g ± 0.05 dB, SAR (10g): 0.455 mW/g ± 0.05 dB, (Worst-case extrapolation)

Penetration depth: 13.2 (11.6, 15.2) [mm]

Powerdrift: -0.03 dB



Motorola CGISS EME Lab

SYSTEM PERFORMANCE CHECK TARGET SAR

Date:	<u>10/24/2002</u>	Frequency (MHz):	<u>300</u>
Lab Location:	<u>CGISS</u>	Mixture Type:	<u>FCC Body</u>
Robot System:	<u>CGISS 3</u>	Ambient Temp.(°C):	<u>23, (Humid: 48.3%)</u>
Probe Serial #:	<u>ET3DV6-1393</u>	Tissue Temp.(°C):	<u>21.7</u>
DAE Serial #:	<u>406</u>		

Tissue Characteristics

Permittivity:	<u>58.7</u>	Phantom Type/SN:	<u>80602002D</u>
Conductivity:		Distance (mm):	<u>15 (tissue/dipole cnt)</u>

Reference Source:	<u>D300V2</u>	(Dipole)
Reference SN:	<u></u>	

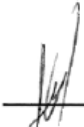
Power to Dipole: 250 mW

Measured SAR Value:	<u>0.65 mW/g,</u>	<u>0.441 mW/g (10g avg.)</u>
Power Drift:	<u>0 dB</u>	

New Target/Measured

SAR Value:	<u>2.60 mW/g,</u>	<u>1.76 mW/g (10g avg.)</u>
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(normalized to 1.0 W, including drift)

Test performed by: J. Fortier Initial: 

Sys. Per. Chk. Form: 021024

Dipole D300V2 SN1002; Test date:10/24/02

Run #: Sys Val_R3_021024-06

Phantom #: 80602002D/S4

Model #: D300V2

SN: 1002

Robot: CGISS-3

Tester: J. Fortier

TX Freq: 300 MHz

Sim Tissue Temp: 21.7 (Celsius)

Start Power: 250mW

DAE3: SN:406

DAE Cal Date: 02/08/02

- Comments-

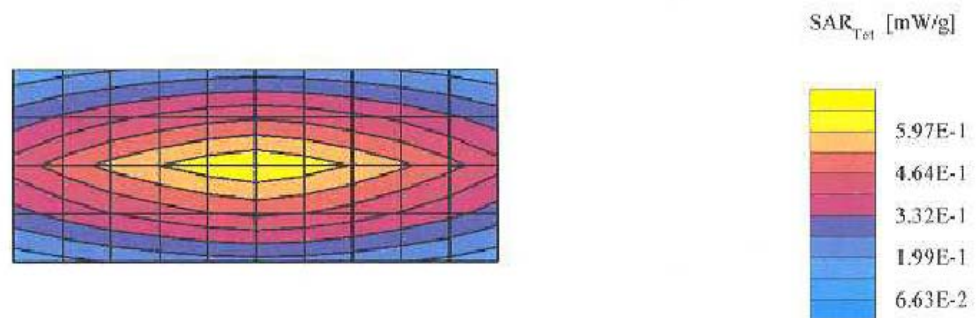
Target at 1W is 2.60 mW/g (1g); 1.764 mW/g (10g).

Flat; Probe: ET3DV6 - SN1393 SPEAG; ConvF(8.60,8.60,8.60); Crest factor: 1.0; FCC Body 300; $\sigma = 0.88$ mho/m $\epsilon_r = 58.7$ $\rho = 1.00$ g/cm³

Cubes (2): Peak: 0.989 mW/g ± 0.08 dB, SAR (1g): 0.650 mW/g ± 0.07 dB, SAR (10g): 0.441 mW/g ± 0.07 dB, (Worst-case extrapolation)

Penetration depth: 13.7 (11.9, 15.9) [mm]

Powerdrift: -0.00 dB



APPENDIX D
Calibration Certificates

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

300 MHz System Validation Dipole

Type:

D300V2

Serial Number:

1002

Place of Calibration:

Zurich

Date of Calibration:

September 11, 2002

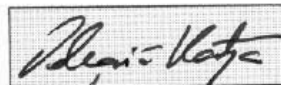
Calibration Interval:

24 months

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:



Approved by:



1. Measurement Conditions

The measurements were performed in the flat phantom filled with head simulating liquid of the following electrical parameters at 300 MHz:

Relative Dielectricity	45.8	$\pm 5\%$
Conductivity	0.93 mho/m	$\pm 5\%$

The DASY System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 8.5 at 300 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the longer side of the phantom. The standard measuring distance was 15mm from dipole center to the liquid surface including the 6mm thick phantom shell. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 20mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.

The dipole input power (forward power) was 400 mW $\pm 3\%$. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm ³ (1 g) of tissue:	2.83 mW/g (Advanced Extrapolation)
averaged over 10 cm ³ (10 g) of tissue	1.89 mW/g (Advanced Extrapolation)

Advanced extrapolation has been applied to the measured SAR values to compensate for the probe boundary effect (see DASY User Manual for details).

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	1.738 ns	(one direction)
Transmission factor:	0.995	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 300 MHz:	$\text{Re}\{Z\} = 56.3 \, \Omega$
	$\text{Im}\{Z\} = -3.6 \, \Omega$
Return Loss at 300 MHz	-23.5 dB

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

6. Power Test

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Validation Dipole D300V2 SN:1002, d = 15 mm

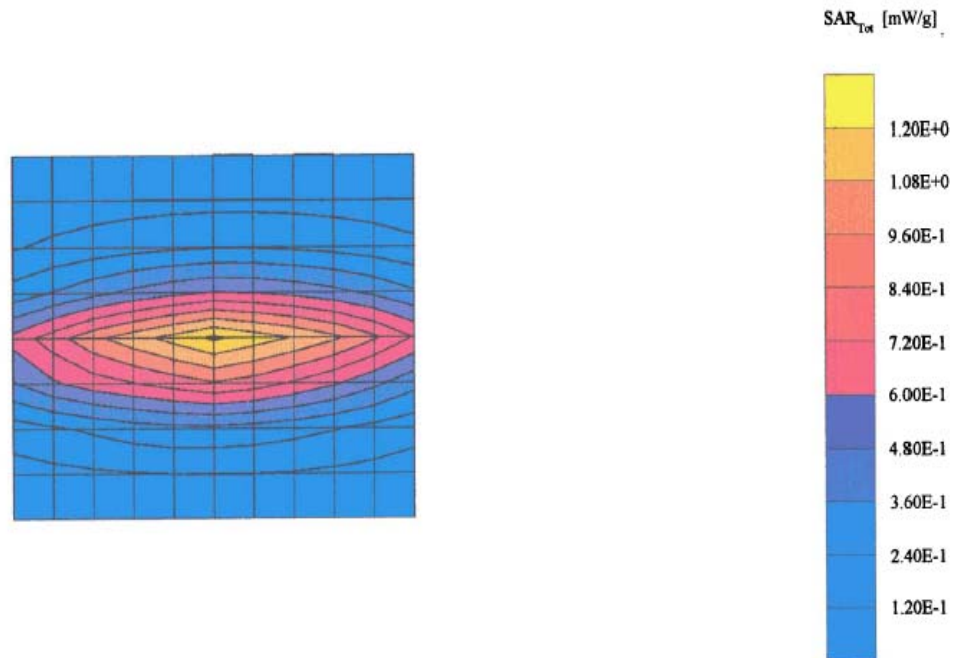
Frequency: 300 MHz; Antenna Input Power: 400 [mW], Flat Phantom (shell thickness = 6mm)

Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0

Probe: ET3DV6 - SN1507; ConvF(8.50,8.50,8.50); Crest factor: 1.0; Head 300 MHz: $\sigma = 0.93$ mho/m $\epsilon_r = 45.8$ $\rho = 1.00$ g/cm³

Cubes (2): Peak: 1.88 mW/g ± 0.01 dB, SAR (1g): 1.19 mW/g ± 0.02 dB, SAR (10g): 0.779 mW/g ± 0.02 dB, (Worst-case extrapolation)

Penetration depth: 12.2 (10.6, 14.4) [mm]



Schmid & Partner Engineering AG, Zurich, Switzerland

Client

Motorola CGISS

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1393**

Calibration procedure(s) **QA CAL-01.v2**
Calibration procedure for dosimetric E-field probes

Calibration date: **April 16, 2003**

Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

Calibrated by:	Name Nico Vetterli	Function Technician	Signature 
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Approved by:	Katja Pokovic	Laboratory Director	
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Date issued: April 16, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

DASY - Parameters of Probe: ET3DV6 SN:1393

Sensitivity in Free Space

NormX	$1.80 \mu\text{V}/(\text{V}/\text{m})^2$
NormY	$1.49 \mu\text{V}/(\text{V}/\text{m})^2$
NormZ	$1.80 \mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	94
DCP Y	94
DCP Z	94

Sensitivity in Tissue Simulating Liquid

Head 900 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to IEEE P1528-200X

ConvF X	$7.0 \pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	$7.0 \pm 9.5\%$ (k=2)	Alpha	0.31
ConvF Z	$7.0 \pm 9.5\%$ (k=2)	Depth	2.71

Head 1800 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to IEEE P1528-200X

ConvF X	$5.5 \pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	$5.5 \pm 9.5\%$ (k=2)	Alpha	0.48
ConvF Z	$5.5 \pm 9.5\%$ (k=2)	Depth	2.51

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary	1 mm	2 mm
SAR _{be} [%] Without Correction Algorithm	9.0	5.3
SAR _{be} [%] With Correction Algorithm	0.3	0.5

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary	1 mm	2 mm
SAR _{be} [%] Without Correction Algorithm	12.2	8.3
SAR _{be} [%] With Correction Algorithm	0.1	0.3

Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	0.9 ± 0.2	mm

Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1393

Place of Assessment:

Zurich

Date of Assessment:

April 21, 2003

Probe Calibration Date:

April 16, 2003

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:1393

Conversion factor ($\pm$ standard deviation)

150 MHz	ConvF	8.8 $\pm$ 8 %	$\epsilon_r = 61.9$ $\sigma = 0.80$ mho/m (body tissue)
236 MHz	ConvF	8.6 $\pm$ 8 %	~~$\epsilon_r = 59.8$~~ ~~$\sigma = 0.87$ mho/m~~ (body tissue)
300 MHz	ConvF	8.4 $\pm$ 8 %	~~$\epsilon_r = 58.2$~~ ~~$\sigma = 0.92$ mho/m~~ (body tissue)
350 MHz	ConvF	8.4 $\pm$ 8 %	~~$\epsilon_r = 57.7$~~ ~~$\sigma = 0.93$ mho/m~~ (body tissue)
450 MHz	ConvF	8.0 $\pm$ 8 %	$\epsilon_r = 56.7$ $\sigma = 0.94$ mho/m (body tissue)
784 MHz	ConvF	7.0 $\pm$ 8 %	$\epsilon_r = 55.4$ $\sigma = 0.97$ mho/m (body tissue)
1450 MHz	ConvF	5.6 $\pm$ 8 %	$\epsilon_r = 54.0$ $\sigma = 1.30$ mho/m (body tissue)

Dosimetric E-Field Probe ET3DV6 SN:1393

Conversion factor ($\pm$ standard deviation)

150 MHz ConvF $9.7 \pm 8\%$

$\epsilon_r = 52.3$
 $\sigma = 0.76 \text{ mho/m}$
(head tissue)

236 MHz ConvF $8.8 \pm 8\%$

$\epsilon_r = 48.3$
 $\sigma = 0.82 \text{ mho/m}$
(head tissue)

300 MHz ConvF $8.5 \pm 8\%$

$\epsilon_r = 45.3$
 $\sigma = 0.87 \text{ mho/m}$
(head tissue)

350 MHz ConvF $8.5 \pm 8\%$

$\epsilon_r = 44.7$
 $\sigma = 0.87 \text{ mho/m}$
(head tissue)

400 MHz ConvF $8.1 \pm 8\%$

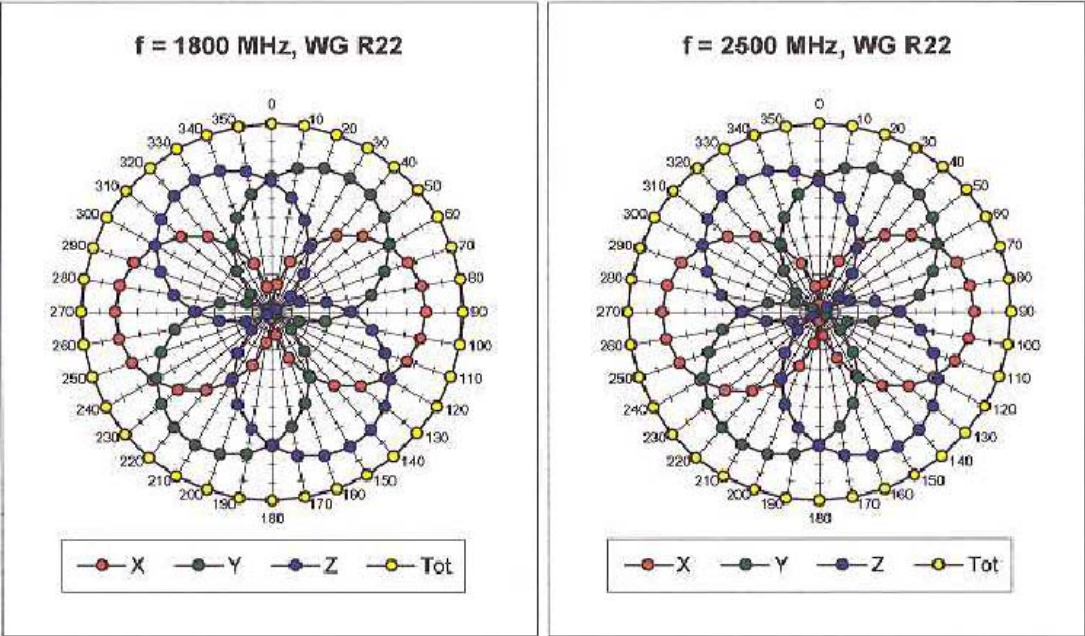
$\epsilon_r = 44.4$
 $\sigma = 0.87 \text{ mho/m}$
(head tissue - CENELEC)

450 MHz ConvF $8.1 \pm 8\%$

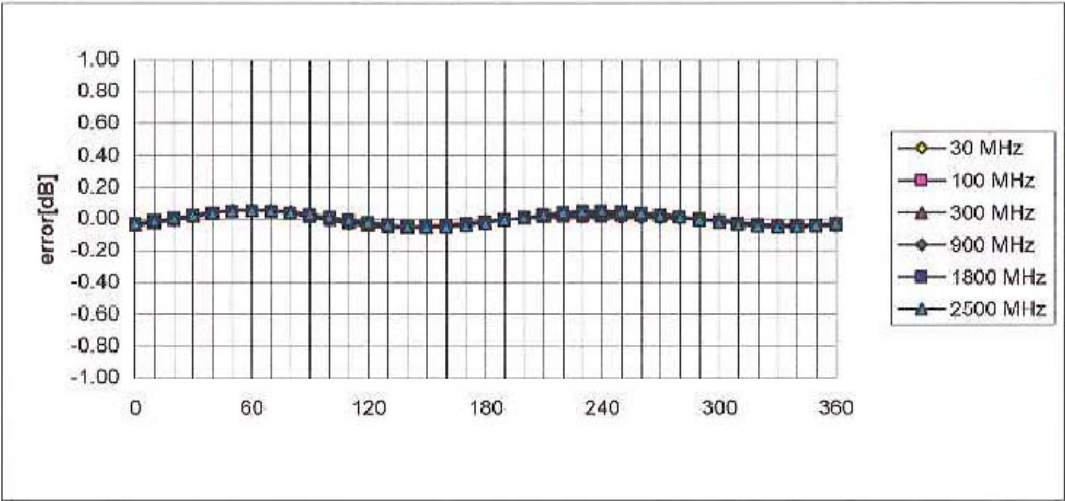
$\epsilon_r = 43.5$
 $\sigma = 0.87 \text{ mho/m}$
(head tissue)

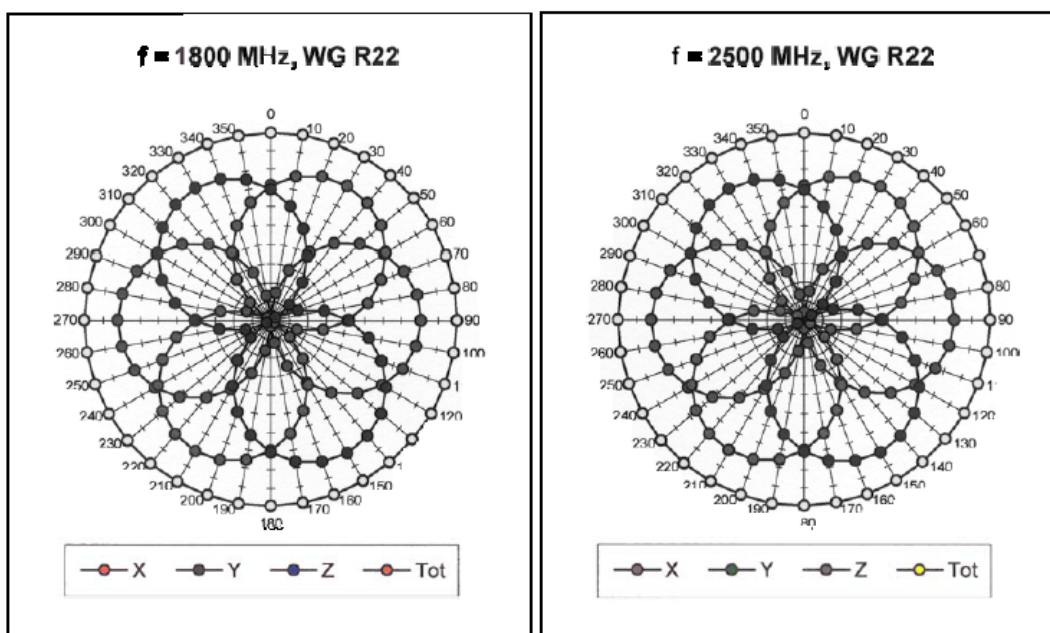
784 MHz ConvF $7.3 \pm 8\%$

$\epsilon_r = 41.8$
 $\sigma = 0.90 \text{ mho/m}$
(head tissue)

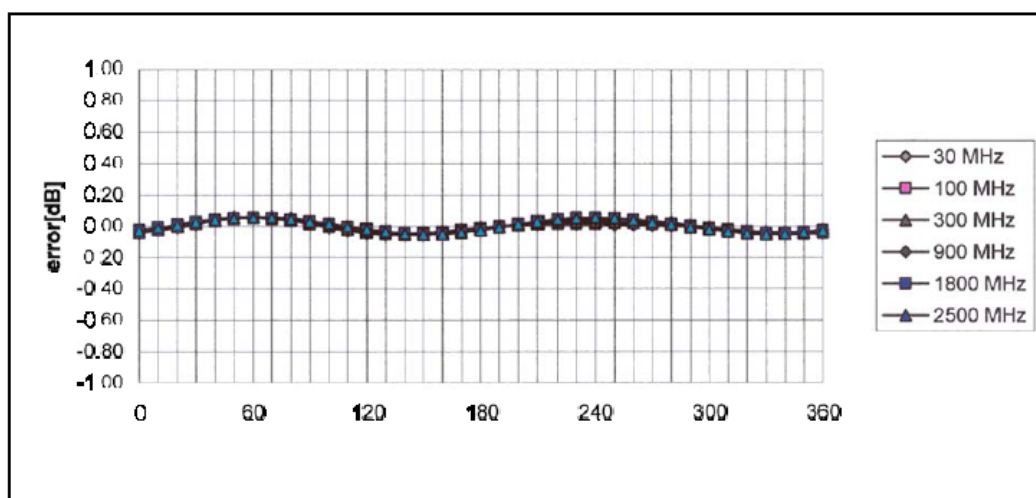


Isotropy Error (ϕ), $\theta = 0^\circ$



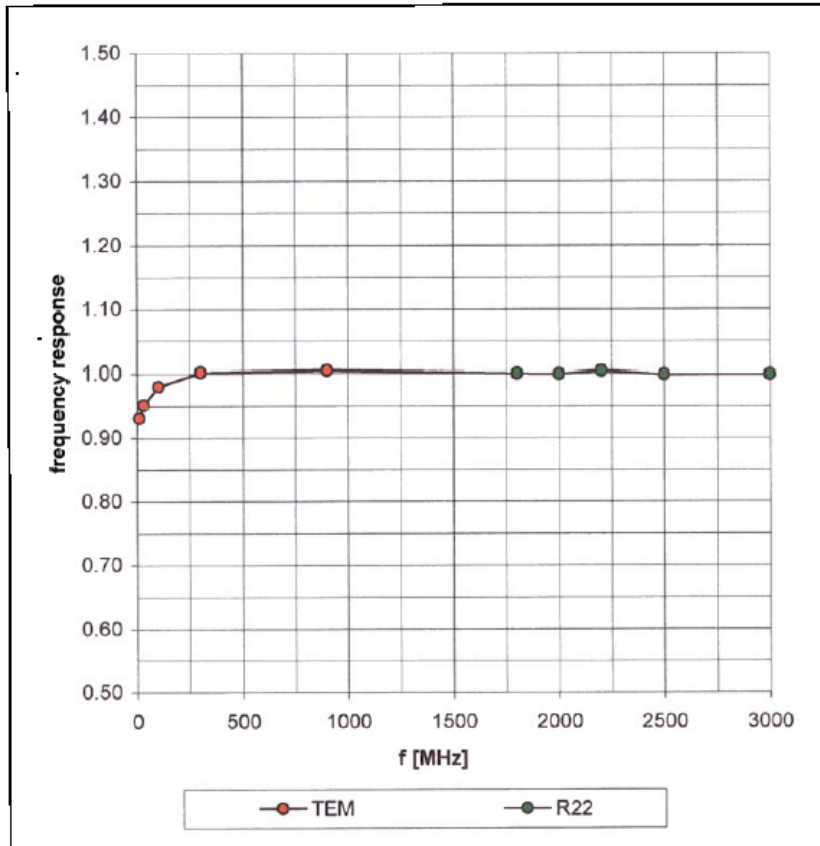


Isoropy Error $\phi \quad \theta = 0$

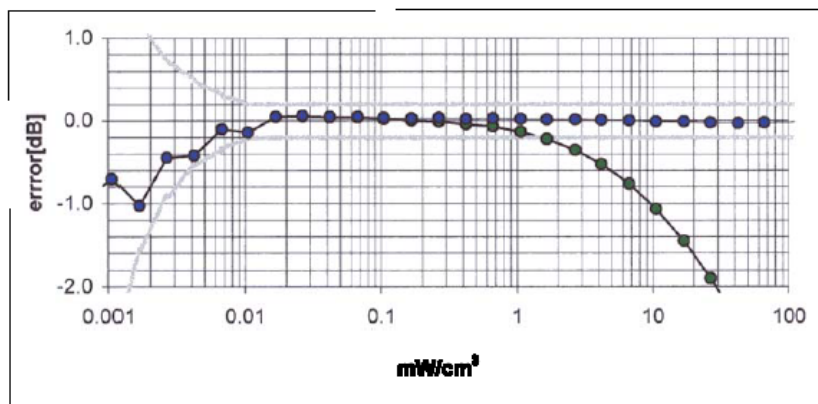
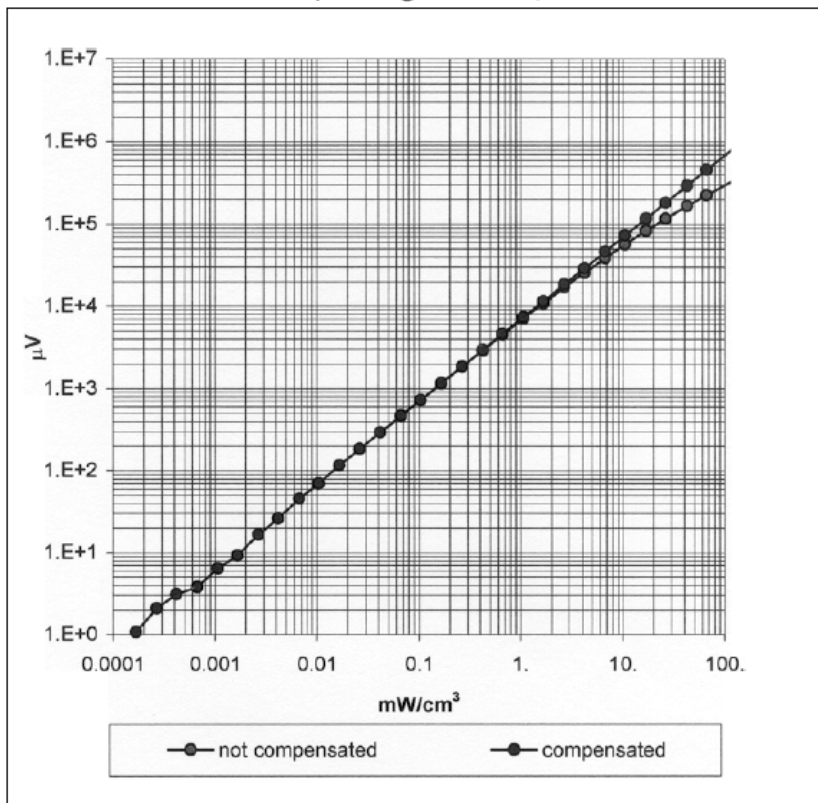


Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain}) (Waveguide R22)



APPENDIX E
Illustration of Body-Worn Accessories

The purpose of this appendix is to illustrate the body-worn accessories used to assess S.A.R. compliance of FCC ID: AZ489FT3804. The radio used in the following photos represents the radio used to obtain the results presented herein and was used in this section solely to demonstrate the body-worn accessory used for the compliance assessment presented herein.



Photo 1.
Kit NTN9179A
Includes
NTN9212A&NTN9213A
Back View



Photo 2.
Kit NTN9179A
Includes
NTN9212A&NTN9213A
Side View