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CERTIFICATE OF COMPLIANCE

(SAR EVALUATION)

Manufacture;	Date of Issue: March 19, 2008
Midland Radio Corporation	Test Report No.: HCT-SAR08-0310
1120 Clay St., North Kansas City, MO 64116	Test Site: HCT CO., LTD.

FCC ID : **MMAGXT775**

APPLICANT : Midland Radio Corporation

EUT Type:	22 CH Combination FRS/GMRS Transceiver
Model(s):	GXT775
Additional model (s):	GXT720
Tx Frequency:	462.5500 MHz – 462.7250 MHz (GMRS)
	462.5625 MHz – 467.7125 MHz (FRS)
Max. SAR Measurement(s):	1.035 mW/g (1g) GMRS Face SAR
	0.887 mW/g (1g) GMRS Body SAR
Max. RF Output Power:	1.202 W ERP (30.80 dBm) GMRS ; 0.150 W ERP (21.76 dBm) FRS
Conducted Power:	3.04 W (34.82 dBm) GMRS ; 0.386 W (25.87 dBm) FRS
Emission Designator:	10K5F3E
Channel Capacity:	22
Application Type:	Certification
Trade Name(s):	Midland
FCC Rule Part(s):	§95(A)(B), 2(J)

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled Environment Occupational exposure limits specified in ANSI/ IEEE Std. C95.1- 2005 and had been tested in accordance with the measurement procedures specified in ANSI FCC/OET Bulletin 65 Supplement C and IEEE Std. 1528-2003. (See Test Report). I attest to the accuracy of data. All measurements reported herein 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.

HCT Co., Ltd. Certifies that no party to this application has been denied FCC benefits pursuant to section 5301 of the Anti- Drug Abuse Act of 1998, 21 U.S. C. 853(a)

Report prepared by	Approved by
: Young-Kwan Kim	: Nam-Wook Kang
Test Engineer of SAR Part	Manager of SAR Part

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SAR MEASUREMENT REPORT

1. SCOPE

Environmental evaluation measurements of specific absorption rate [1] (SAR) distributions in emulated human head and body tissues exposed to radio frequency(RF) radiation from wireless portable devices for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).[2]

Applicant

Company Name : Midland Radio Corporation
Address : 1120 Clay St. North Kansas City, MO 64116
Attention : Mr. Ki Choi / General Manager

• FCC ID:	MMAGXT775
• EUT Type:	22 CH Combination FRS/GMRS Transceiver.
• Trade Name:	Midland
• Model(s):	GXT775
• Additional model (s):	GXT720
• Tx Frequency:	462.5500 MHz – 462.7250 MHz (GMRS)
	462.5625 MHz – 467.7125 MHz (FRS)
• Application Type:	Certification
• Modulation(s):	FM
• Power Supply:	(x4) AA Alkaline batteries (1.5 V DC)
	Manufacture(Ⅰ : Bexel / Ⅱ : Duracell / Ⅲ : Energize
	Ⅳ : Rechargeable Battery 6.0 V, 700 mAh)
• Place of Test(s):	HCT SAR Lab.
• Date(s) of Tests:	March 13, 2008
• Report No.:	HCT-SAR08-0310

2. INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-2005 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (r). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body.

$$\boxed{SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho\, dv}\right)}$$

Figure 2. SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \sigma E^2 / \rho$$

where:

σ = conductivity of the tissue-simulant material (S/m)

ρ = mass density of the tissue-simulant material (kg/m^3)

E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

3. DESCRIPTION OF TEST EQUIPMENT

3.1 SAR MEASUREMENT SETUP

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig.3.1).

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC consists of the HP Pentium IV 3.0GHz computer with Windows XP system and SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. 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 PC plug-in card.

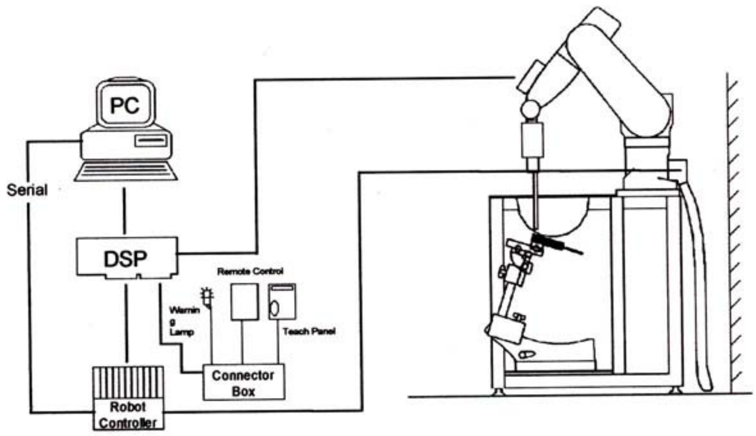

Figure 3.1 HCT SAR Lab. Test Measurement Set-up

The DAE4 consists of 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 PC-card 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. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

3.2 DASY E-FIELD PROBE SYSTEM

3.2.1 ET3DV6 Probe Specification

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection System Built-in shielding against static charges
Calibration	In air from 10 MHz to 2.5 GHz In brain and muscle simulating tissue at Frequencies of 450 MHz, 900 MHz and 1.8 GHz (accuracy : 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 probe axis)
Dynamic	5 μW/g to > 100 mW/g;
Range 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 dissymmetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

Figure 3.2 Photograph of the probe and the Phantom

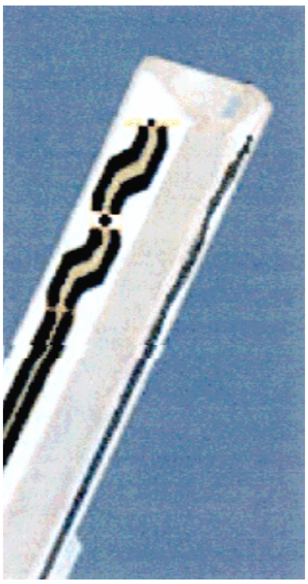

Figure 3.3 ET3DV6 E-field Probe

The SAR measurements were conducted with the dosimetric probe ET3DV6, designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches a maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped at reaching the maximum.

3.3 PROBE CALIBRATION PROCESS

3.3.1 E-Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with an accuracy better than ± 10 %. The spherical isotropy was evaluated with the proper procedure and found to be better than ± 0.25 dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

SAR is proportional to $\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

$$SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

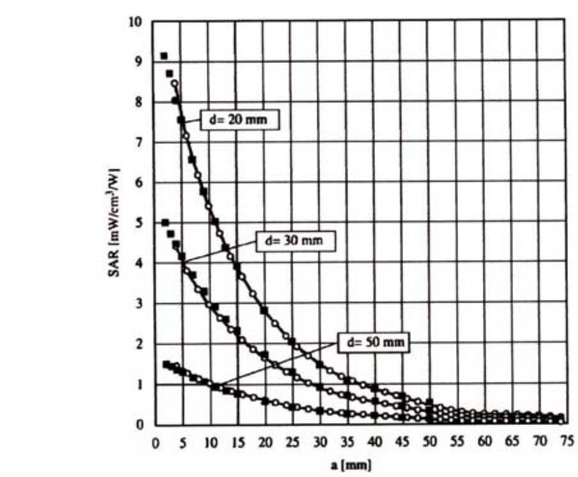

Figure 3.4 E-Field and Temperature measurements at 900 MHz

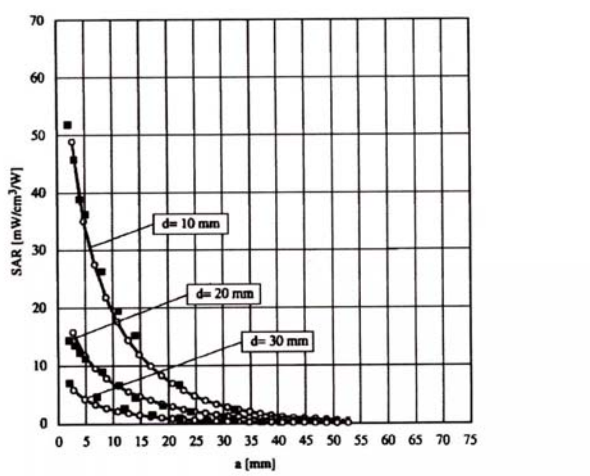

Figure 3.5 E-Field and temperature measurements at 1.8 GHz

3.3.2 Data Extrapolation

The DASY4 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given like below;

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = compensated signal of channel i (i=x,y,z)
U_i = input signal of channel i (i=x,y,z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

with V_i = compensated signal of channel i (i = x,y,z)
$Norm_i$ = sensor sensitivity of channel i (i = x,y,z) $\mu V/(V/m)^2$ for E-field probes
ConvF = sensitivity of enhancement in solution
E_i = electric field strength of channel i in V/m

The RSS value of the field components gives the total field strength (Hermetian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in W/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770}$$

with P_{pwe} = equivalent power density of a plane wave in W/cm^2
E_{tot} = total electric field strength in V/m

3.4 SAM Phantom

The SAM Phantom is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

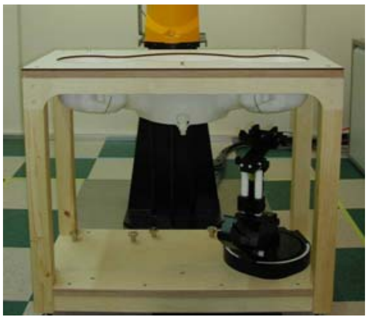

Figure 3.6 SAM Phantom

Shell Thickness	2.0 mm
Filling Volume	About 30 L
Dimensions	810 mm x 1 000 mm x 500 mm (H x L x W)

3.5 Device Holder for Transmitters

In combination with the SAM Phantom V 4.0, the Mounting Device (POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatable positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations. To produce the Worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Fig. 3.7 Device Holder

3.6 Brain & Muscle Simulating Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydrox-ethyl cellulose (HEC) gelling agent and saline solution (see Table 3.1). Preservation with a bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1 900		2 450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7

Salt:	99 % Pure Sodium Chloride	Sugar:	98 % Pure Sucrose
Water:	De-ionized, 16M resistivity	HEC:	Hydroxyethyl Cellulose
DGBE:	99 % Di(ethylene glycol) butyl ether,[2-(2-butoxyethoxy) ethanol]		
Triton X-100(ultra pure):	Polyethylene glycol mono[4-(1,1,3,3-tetramethylbutyl)phenyl] ether		

Table 3.1 Composition of the Tissue Equivalent Matter

4. SYSTEM SPECIFICATIONS

4.1 Robotic System Specifications

Specifications

POSITIONER:	Stäubli Unimation Corp. Robot Model: RX90LB
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller	
Processor:	Pentium IV
Clock Speed:	3.0 MHz
Operating System:	Windows XP
Data Card:	DASY4 PC-Board
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

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE4 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

E-Field Probes

Model:	ET3DV6 S/N: 1609
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	0.2 dB (30 MHz to 3 GHz)

Phantom

Phantom:	SAM
Shell Material:	Fiberglass
Thickness:	2.0 mm

Tissue Parameters

Freq. [MHz]	Liquid	Liquid Temp [°C]	Parameters	Target Value	Measured Value	Deviation [%]	Limit [%]
450MHz	Head	21.2	ε_r	43.5	45.6	+ 4.83	± 5
			σ	0.87	0.849	- 2.41	± 5
	Body	21.2	ε_r	56.7	54.4	- 4.06	± 5
			σ	0.94	0.961	+ 2.23	± 5

5. MEASUREMENT PROCESS

5.1 System Verification

Prior to assessment, the system is verified to the ± 10 % of the specifications at 450 MHz by using the system validation kit.

Freq. [MHz]	Liquid	Liquid Temp [°C]	SAR Average	Target Value (mW/g)	Measured Value (mW/g)	Deviation [%]	Limit [%]
450 MHz	Head	21.2	1 g	5.03	5.33	+5.96	± 10

5.2 Dosimetric Assessment Setup

The evaluation was performed with the following procedure:

1. The SAR value at a fixed location above the ear point was measured and was used as a reference value for assessing the power drop.
2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20 mm x 20 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.
3. Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 5 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:
   a. The data at the surface were extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm [13]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
   b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x,y, and z directions) [13][14]. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

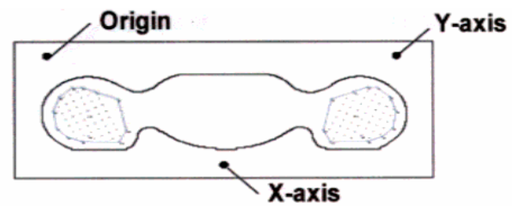

Fig. 10. SAR Measurement Point in Area Scan

6. ANSI/ IEEE C95.1 - 2005 RF EXPOSURE LIMITS

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT Occupational (W/kg) or (mW/g)
SPATIAL PEAK SAR * (Brain)	1.60	8.00
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.40
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 2. Safety Limits for Partial Body Exposure

NOTES:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole-body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e.as a result of employment or occupation).

7. MEASUREMENT UNCERTAINTIES

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than 15-25 % [16].

According to ANSI/IEEE C95.3, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ± 1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ± 2dB can be expected.[3]

According to CENELEC [17], typical worst-case uncertainty of field measurements is ± 5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ± 3 dB.

Error Description	Uncertainty value [%]	Probability Distribution	Divisor	ci	ci^2	Standard Uncertainty [%]	Stand Uncert^2	(Stand Uncert^2) X (ci^2)	Vi & Veff
1. Measurement System									
Probe Calibration	5.5	Normal	1.00	1	1	5.50	30.25	30.25	∞
Axial Isotropy	4.7	Rectangular	1.73	0.7	0.49	2.71	7.36	3.61	∞
Hemispherical Isotropy	9.6	Rectangular	1.73	0.7	0.49	5.54	30.72	15.05	∞
Linearity	4.7	Rectangular	1.73	1	1	2.71	7.36	7.36	∞
System Detection limits	1.0	Rectangular	1.73	1	1	0.58	0.33	0.33	∞
Boundary effect	1.0	Rectangular	1.73	1	1	0.58	0.33	0.33	∞
Response time	0.8	Rectangular	1.73	1	1	0.46	0.21	0.21	∞
RF Ambient conditions	3.0	Rectangular	1.73	1	1	1.73	3.00	3.00	∞
Readout Electronics	0.3	Normal	1.00	1	1	0.30	0.09	0.09	∞
Integration time	2.6	Rectangular	1.73	1	1	1.50	2.25	2.25	∞
Probe positioner	0.4	Rectangular	1.73	1	1	0.23	0.05	0.05	∞
Probe positionering	2.9	Rectangular	1.73	1	1	1.67	2.80	2.80	∞
Maximum SAR evaluation	1.0	Rectangular	1.73	1	1	0.58	0.33	0.33	∞
2.Test Sample Related							Sub Total	65.69	
Device Positioning	1.8	Normal	1.00	1	1	1.81	3.28	3.28	9
Device Holder	3.6	Normal	1.00	1	1	3.60	12.96	12.96	∞
Power Drift	5.0	Rectangular	1.73	1	1	2.89	8.33	8.33	∞
3. Phantom and Setup							Sub Total	24.57	
Phantom Uncertainty	4.0	Rectangular	1.73	1	1	2.31	5.33	5.33	∞
Liquid conductivity (target)	5.0	Rectangular	1.73	0.5	0.25	2.89	8.33	2.08	∞
Liquid conductivity (measurement error)	2.5	Normal	1.00	0.5	0.25	2.50	6.25	1.56	∞
Liquid permittivity (target)	5.0	Rectangular	1.73	0.5	0.25	2.89	8.33	2.08	∞
Liquid permittivity (measurement error)	2.5	Normal	1.00	0.5	0.25	2.50	6.25	1.56	∞
							Sub Total	12.63	
Combined standard uncertainty [%]						**10.14**		102.88	-
Expanded uncertainty [*k* =2, approximately confidence level 95 %]						**± 20.28 %**			

Table 3. Breakdown of Errors [18]

8. SAR TEST DATA SUMMARY

Mixture Type: 450 MHz
Dielectric Constant: 45.6
Conductivity: 0.849
Phantom Position: Face
Closest Distance (between E-Probe & Phone): 2.5 cm

8.1 Measurement Results (Mouth/ Face SAR)

Channel / Freq. (MHz)	Mode	Ant.	Battery Manufacture	Power (W)			Measured SAR 1g (W/kg)		Max. Power Drift (dB)	Scaled SAR 1g (W/kg)	
				Initial	End	Power Drift (dB)	100% Duty Cycle	50% Duty Cycle		100% Duty Cycle	50% Duty Cycle
1 (462.5625)	GMRS	Fixed	Bexel	3.020	2.350	-1.09	1.610	0.805	-1.09	2.069	1.035
15 (462.5500)	GMRS	Fixed	Bexel	3.000	2.339	-1.08	1.550	0.775	-1.09	1.992	0.996
22 (462.7250)	GMRS	Fixed	Bexel	3.010	3.768	0.98	1.520	0.760	-1.09	1.954	0.977
8 (467.5625)	FRS	Fixed	Bexel	0.386	0.316	-0.86	0.297	0.149	-1.09	0.382	0.191
1 (462.5625)	GMRS	Fixed	Duracell	3.000	2.350	-1.06	1.590	0.795	-1.09	2.044	1.022
1 (462.5625)	GMRS	Fixed	Energizer	3.040	2.492	-0.86	1.540	0.770	-1.09	1.979	0.990
1 (462.5625)	GMRS	Fixed	Rechargeable	3.320	3.281	-0.05	0.903	0.452	-1.09	1.161	0.580
1 (462.5625)	GMRS	Fixed	Bexel	3.020	2.917	-0.15	2.030	1.015	-1.09	2.609	*1.305
ANSI/ IEEE C95.1 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							**Mouth/ Face 1.6 W/kg (mW/g)** Averaged over 1 gram				

Measured Depth of Simulating Tissue: 15.0 cm / Liquid Temperature: 21.2 ℃

NOTES:

1. The SAR values found were below the maximum limit of 1.6 W/kg (uncontrolled exposure).
2. The highest face-held SAR value found was 1.035 W/kg(based 50% duty cycle).
3. The EUT was tested for face-held SAR with a 2.5 cm separation distance between the front of the EUT and the outer surface of the planer phantom.
4. Battery Type ☒ Standard (x4) AA Alkaline batteries (1.5VDC)
5. Power Measured ☒ Conducted ☐ EIRP ☐ ERP
6. SAR Measurement System ☒ SPEAG
7. SAR Configuration ☒ Face/ Mouth ☐ Body ☐ Hand
8. SAR Measurement Time: 25 minutes
9. Highest SAR value measurement in this Face SAR and Body SAR repeated with * Shortened Scan

8. SAR TEST DATA SUMMARY

Mixture Type: 450 MHz
Dielectric Constant: 54.4
Conductivity: 0.961
Phantom Position: Body
Closest Distance (between E-Probe & Phone): 1.5 cm

8.2 Measurement Results (Body SAR)

Channel / Freq. (MHz)	Mode	Ant.	Battery Manufa-cture	Power (W)			Measured SAR 1g (W/kg)		Max. Power Drift (dB)	Scaled SAR 1g (W/kg)	
				Initial	End	Power Drift (dB)	100% Duty Cycle	50% Duty Cycle		100% Duty Cycle	50% Duty Cycle
1 (462.5625)	GMRS	Fixed	Bexel	3.020	2.371	-1.05	1.220	0.610	-1.09	1.568	0.784
15 (462.5500)	GMRS	Fixed	Bexel	3.000	2.448	-0.88	1.380	0.690	-1.09	1.774	0.887
22 (462.7250)	GMRS	Fixed	Bexel	3.010	2.488	-0.83	1.140	0.570	-1.09	1.465	0.733
8 (467.5625)	FRS	Fixed	Bexel	0.386	0.332	-0.66	0.256	0.128	-1.09	0.329	0.165
15 (462.5500)	GMRS	Fixed	Duracell	2.980	2.484	-0.79	1.000	0.500	-1.09	1.285	0.643
15 (462.5500)	GMRS	Fixed	Energizer	3.010	2.487	-0.83	1.120	0.560	-1.09	1.440	0.720
15 (462.5500)	GMRS	Fixed	Rechargeable	3.333	3.012	-0.44	0.468	0.234	-1.09	0.602	0.301
ANSI/ IEEE C95.1 2005 – Safety Limit Spatial Peak Uncontrolled Exposure/ General Population							**Body 1.6 W/kg (mW/g)** Averaged over 1 gram				

Measured Depth of Simulating Tissue: 15.0 cm/ Liquid Temperature: 21.2 ℃

NOTES:
1. The SAR values found were below the maximum limit of 1.6 W/kg (uncontrolled exposure).
2. The highest body SAR value found was 0.887 W/kg(based 50% duty cycle).
3. The EUT was tested for body SAR with a 1.5 cm separation distance between the back of the EUT and the outer surface of the planer phantom.
4. Battery Type ☒ Standard (x4) AA Alkaline batteries (1.5VDC)
5. Power Measured ☒ Conducted ☐ EIRP ☐ ERP
6. SAR Measurement System ☒ SPEAG
7. SAR Configuration ☐ Face/ Mouth ☒ Body ☐ Hand
8. SAR Measurement Time: 25 minutes

9. SAR TEST EQUIPMENT

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	SAM Phantom	-	N/A	N/A	N/A
Staubli	Robot RX90L	F01/5K09A1/A/01	N/A	N/A	N/A
Staubli	Robot ControllerCS7MB	F99/5A82A1/C/01	N/A	N/A	N/A
HP	Pavilion t000_puffer	KRJ51201TV	N/A	N/A	N/A
SPEAG	Light Alignment Sensor	265	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	D221340.01	N/A	N/A	N/A
SPEAG	DAE4V1	447	Sep.13, 2007	Annual	Sep.13, 2008
SPEAG	E-Field Probe ET3DV6	1609	Aug.30, 2007	Annual	Aug.30, 2008
SPEAG	Validation Dipole D450V2	1007	May.15, 2007	Annual	Mar. 15, 2008
SPEAG	Validation Dipole D835V2	481	May 24, 2007	Annual	May 24, 2008
SPEAG	Validation Dipole D1800V2	2d066	May 23, 2007	Annual	May 23, 2008
SPEAG	Validation Dipole D1900V2	5d038	Nov.20, 2007	Annual	Nov.20, 2008
Agilent	Power Meter(F) E4419B	MY40330223	Nov.05, 2007	Annual	Nov.05, 2008
Agilent	Power Sensor(G) 8481	MY41090870	Nov.05, 2007	Annual	Nov.05, 2008
HP	Dielectric Probe Kit 85070C	00721521	N/A	N/A	N/A
HP	Dual Directional Coupler	16072	Nov. 05, 2007	Annual	Nov. 05, 2008
R&S	Base Station CMU200	838207/050	Nov. 05, 2007	Annual	Nov. 05, 2008
Agilent	Base Station E5515C	GB44400269	Feb.10, 2008	Annual	Feb.10, 2009
HP	Signal Generator E4438C	MY42082646	Dec.24, 2007	Annual	Dec.24, 2008
HP	Network Analyzer 8753ES	JP39240221	Apr.11, 2007	Annual	Apr.11, 2008
EM POWER	Power Amp BBS3Q7ELU	1013-D/C-0127	Apr.17, 2007	Annual	Apr.17, 2008

10. CONCLUSION

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the ANSI/ IEEE C95.1 2005.

These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests.

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