Certificate Number: 1449-02

ELECTROMAGNETIC EXPOSURE (EME) TESTING LABORATORY

8000 West Sunrise Blvd.
Fort-Lauderdale, Florida

S.A.R. TEST REPORT

FCC ID: AZ489FT5803
[PMUF1059A]

August 27, 2001 –Rev. A

Tested By:	Jim Fortier Lead EME Engineer
Tested and Prepared By:	Stephen C. Whalen Sr. EME Engineer
Reviewed and Approved By:	Ken Enger Sr. Resource Manager Product Safety and EME Lab Director

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

REVISION HISTORY

Date	Revision	Comments
21 March 2001	O	Original release
27 August 2001	A	Revision reflecting implementation of Head tissue for face measurements and other comments per FCC Correspondence 19504. Test unit reflects latest available hardware, pilot run PMUF1059A.

1.0 Introduction

This report details the test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurement performed at CGISS EME laboratory for the Two-way Portable Radio Product, model number PMUF1059A (FCC ID: AZ489FT5803). Testing was conducted from June 13, 2001 through July 6, 2001 during which time the Revised Supplement C to OET Bulletin 65 was released.

The applicable exposure environment is Occupational/Controlled.

The test results included herein represent the highest SAR levels applicable to this product and clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8.0 W/kg 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; 47 CFR 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
- National Council on Radiation Protection and Measurements (NCRP) of the United States, Report 86, 1986
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 1999 (applicable to wireless phones only)]

3.0 Description of Test Sample

The Portable Radio, Model number PMUF1059A is a handheld transceiver which operates as a traditional simplex 2-way radio. It will be marketed to and used by employees solely for work - related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies, who can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two - way radios.

The intended use positions are "at the face" with the microphone 1 to 2 inches from the mouth or "at the waist or abdomen" secured to the user's belt. When operated at the waist or abdomen, the audio and push-to-talk functions are routed to a remote accessory which connects to the side of the radio. The transmit duty cycle, 50% maximum for this type of device, is controlled by the user via the push – to - talk button.

This device transmits in the 896-902MHz and 935-941MHz bands with a rated conducted power of 2.85 watts. The maximum conducted power, as defined by the production line final test station upper limit, is 3.25 watts.

The sample unit tested for this report is an identical pilot to intended production units.

The Portable Radio product is offered with various antennas, and accessories, listed below. (Refer to appendix D
for a complete illustration of Body - worn accessories.)

Antenna:

- NAF5038A ½ wave 18cm whip, non-retractable, freq. range 896-941MHz
- NAF5042A ¼ wave 9cm stubby, non-retractable, freq. range 806-941MHz

Battery:

- HNN9008A NiMH high capacity battery, 21mm thick
- HNN9009A NiMH Ultra high capacity, standard, 24mm thick
- HNN9010A NiMH Ultra high capacity factory mutual, standard, 24mm thick
- HNN9011A NiCd High capacity factory mutual, standard, 24mm thick
- HNN9012A NiCd High capacity, standard, 24mm thick
- HNN9013B Lithium Ion High capacity, thin, 17mm thick

Body-worn accessories:

- HLN9844A Spring belt clip for 1.5" belt width
- HLN9714A Spring belt clip for 2.5" belt width
- HLN9952A Belt clip carry holder
- HLN9701B Nylon case w/ belt loop
- PMLN4280A Full thin leather case
- PMLN4281A Basic thin leather case
- HLN9690A Standard leather case, swivel belt loop, thin batteries
- HLN9694A Standard leather case, swivel belt loop, standard batteries
- HLN9955A Standard leather case, swivel belt loop, thin batteries
- HLN9998A Standard leather case, swivel belt loop, standard batteries
- HLN9670A Standard leather case, swivel belt loop, thin batteries
- HLN9676A Standard leather case, swivel belt loop, standard batteries
- HLN9677A Standard leather case, belt loop, thin batteries
- HLN9689A Standard leather case, belt loop, standard batteries
- HLN9945A Standard leather case, belt loop, thin batteries
- HLN9946A Standard leather case, belt loop, standard batteries
- HLN9652A Standard leather case, belt loop, thin batteries
- HLN9665A Standard leather case, belt loop, standard batteries
- NTN5243A Carry strap
- RLN4815A Fanny pack

Audio/push-to-talk:

Many different audio/push – to - talk accessories are available. They can generally be grouped into categories of 1) microphones, 2) earpieces, and 3) headsets depending on how they are used relative to the body. Representative samples were chosen as being typical within each group:

- HMN9052D Remote Speaker Microphone
- RMN4018A Light Weight Headset with PTT
- ENMN4014A 3-Wire min Lapel Ear/Microphone Piece
- NTN1722A Comport, Integrated Ear/Microphone Piece
- HLN9717A Audio Adapter (used with NTN1722A)

For clarification, CommPort, NTN1722A, is a device worn on the ear which contains an integrated microphone and earpiece connected to the radio via a cable and interface module. The other accessories are self explanatory.

Accessories listed in the manual may have additional prefixes and suffixes, which only represent geographical areas and packaging types. Example, “AA” indicates North America and “R” indicates an item was shipped in a box.

All the accessories listed in this report may not necessarily be available when the radio becomes available to the Market.

3.1 Test Signal

Test Signal Source:

Test Mode ☐ Base Station ☐ Simulator ☐ Native Transmission Mode ☒ X

Signal Modulation:

CW	X
TDMA	
Other	

3.2 Test Output Power

The conducted output power was measured across the transmit band using a HP power meter model E4419B for the HP power meter. This power was used to calculate the end power at the completion of each SAR test.

4.0 Description of Test Equipment

4.1 Descriptions of SAR Measurement System

The laboratory utilizes a Dosimetric Assessment System (DASY™) SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The SAR measurements were conducted with the ET3DV6 serial number 1547 and ET3DV6 serial number 1383 probes. A copy of the calibration certificates are included in appendix C, and the DASY output files of the system performance test results are included in appendix B. The Dipole validation results are list in the table below and each is within the required accuracy of ± 10%, and thus the measured SAR values are considered correct.

Probe	Probe Calibration date	Dipole Antenna Kit - (S/N)	SAR result when normalized to 1W (mW/g)	Reference SAR (mW/g)
ET3DV6-1547	14 Nov. 2000	925-002	12.06	11.98
ET3DV6-1383	23 May 2001	925-002	11.95	11.98

The DASY™ system is operated per the instructions in the DASY™ Users Manual. The entire manual is available directly from SPEAG™.

4.2 Description of Phantom

4.2.1 Flat Phantom:

A rectangular shaped box made of Plexi-glass and mounted on a supporting non-metallic structure that has an opening at the center for positioning the device.

Length	40.5 cm
Width	23.6 cm
Bottom Shell Thickness (mm)	0.2 cm

4.3 Simulated Tissue Properties:

The simulated Head tissue used is compliant to that specified in FCC Supplement C (Edition 01 - 01) to OET Bulletin 65 (Edition 97 - 01). Testing at the abdomen was done before the release of FCC Supplement C (Edition 01 - 01) and therefore traditional Motorola Muscle tissue was used.

4.3.1 Type of Simulated Tissue

Simulated Tissue	Body Position
Muscle	Abdomen
Head	Face

4.3.2 Simulated Tissue Composition

	Frequency 925MHz	
	Muscle	Head
Di-Water	48.4%	41.05%
Sugar	49%	56.5%
Salt	1.5%	1.35%
HEC	1%	1%
Dowicil75	0.1%	0.1%

Note: HEC (HYDROXYETHYL CELLULOSE) is a gelling agent and Dowicil 75 is anti bacterial compound.

Characterization of Simulated tissue materials and ambient conditions:
Simulated tissue prepared for SAR measurements is measured routinely to verify tissue is within 5% of target parameters at the center of the transmit band. This measurement was done filling a coaxial slotted line with the tissue and probing the amplitude and phase changes versus distance in the simulated tissue. A Hewlett Packard HP8753D Network Analyzer is used to perform the measurements.

Target tissue parameters for 925MHz.

	925MHz	
	Muscle	**Head**
Di-electric Constant	52.0	41.5
Conductivity – S/m	1.20	0.98

4.4 Test Conditions:

The EME Laboratory ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. 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 EME Lab RF environment is monitored with a Spectrum Analyzer to preclude extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the SAR scans are repeated however the lab environment is sufficiently protected that no SAR impacting interference has ever been experienced.

5.0 Description of Test Procedure

All antennas, batteries, and accessories listed in section 3.0 were included in the SAR test plan in order to determine the highest SAR levels. The radio design incorporates power leveling versus frequency circuitry however it is not perfect and some variation across frequency is noted; the measured SAR results are scaled to 3.25 watts to account for this as well as power slump during the scan. This scaling is described in section 7.4; engineering judgment and SAR test experience indicate that SAR is sufficiently linear with transmit power output to warrant this approach which is conservative in itself. The radio was always placed in continuous transmit mode (100% duty cycle) for the duration of the scan and each SAR scan was initiated with a fully charged battery.

Each body-worn carry case providing the closest body spacing within each group having identical metal components was tested. Table 5.1 shows the body spacing provided for each body-worn carry case, identifies the specific ones tested, and explains the similarity allowing test exclusion for each of the other body-worn cases. Appendix D illustrates the Body-worn carry accessories.

Table 5.1 Body-worn Carry Accessories Tested and Not Tested

Model	Type	Tested	Description (Refer to appendix D) *By-Similarity to tested model*	Separation Dist. From Ant. Base to phantom. (Ant. NAF5042A) Three diff. Battery thickness (mm) Thin / Med. / Stdrd
HLN9844A	Belt Clip	yes	1.5” belt width	24 / 27 / 30
HLN9714A	Belt clip	yes	2.5” belt width	23 / 26 / 29
HLN9952A HLN9844A	Carry holder Belt clip	yes	Carry holder tested with belt clip	31 / 33 / 35
HLN9701B	Nylon case	yes	Nylon case w/belt loop	32 / 35 / 39
PMLN4281A	Thin leather Basic thin	yes	No display window	30 / 33 / 36
PMLN4280A	Thin leather Full thin	no	Display/keypad window *PMLN4281A*	30 / 33 / 36
HLN9670A	Std. leather Swivel belt loop	yes	No display/keypad window Thin battery	51 / 55 / NA
HLN9676A	Std. leather Swivel belt loop	no	No display/keypad window Std. battery * HLN9670A*	NA / 55 / 58
HLN9955A	Std. leather Swivel belt loop	no	Keypad window Thin battery *HLN9670A*	51 / 55 / NA
HLN9998A	Std. leather Swivel belt loop	no	Keypad window Std. battery *HLN9670A*	NA / 55 / 58
HLN9690A	Std. leather Swivel belt loop	no	Display/Keypad window Thin battery *HLN9670A*	51 / 55 / NA
HLN9694A	Std. leather Swivel belt loop	no	Display/Keypad window Std. battery *HLN9670A*	NA / 55 / 58

Table 5.1 Body-worn Carry Accessories Tested and Not Tested continued.

Model	Type	Tested	Description (Refer to appendix D) *By-Similarity to tested model*	Separation Dist. From Ant. Base to phantom. (Ant. NAF5042A) Three diff. Battery thickness (mm) Thin / Med. / Stdrd
HLN9652A	Std. leather Belt loop	yes	No display/keypad window Thin battery	38 / 40 / NA
HLN9665A	Std. leather Belt loop	no	No display/keypad window Std. battery *HLN9652A*	NA / 40 / 43
HLN9945A	Std. leather Belt loop	no	Keypad window Thin battery *HLN9652A*	38 / 40 / NA
HLN9646A	Std. leather Belt loop	no	Keypad window Std. battery *HLN9652A*	NA / 40 / 43
HLN9677A	Std. leather Belt loop	no	Display/Keypad window Thin battery *HLN9652A*	38 / 40 / NA
HLN9689A	Std. leather Belt loop	no	Display/Keypad window Std. battery *HLN9652A*	NA / 40 / 43
RLN4815A	Fanny Pack	yes	Belt with holster and storage bag.	32 / 35 / 38
NTN5243A HLN9652A	Carry Strap	yes	Shoulder strap that connects to the Std. Leather carry cases.	38 / 40 / NA

5.0.1 Abdomen

At the abdomen initial SAR tests identified the lower transmit sub-band (896-901 MHz), the 1/4 wave NAF5042A antenna, and the HLN9844A belt clip to be the combinations providing the highest SAR. With this in mind SAR searches were conducted varying the antenna, the battery, the body-worn carry case, the frequency, and the audio accessory. The combination of antenna, battery, and frequency resulting in the highest SAR was repeated with the antenna spaced 2.5 cm from the flat phantom surface. This data is summarized in Table 7.1.

All abdomen tests were conducted with an audio/push - to - talk accessory connected to the radio. Although SAR is not expected to be influenced by different audio accessories additional tests were included to cover the different categories of audio accessories: microphones, earpieces, and headsets. Engineering judgment concludes that any SAR variation observed when testing different audio accessories is due to repeatability and well within the system uncertainty; hence testing representative samples of audio accessories is more than adequate to demonstrate compliance.

5.0.2 Face

At the abdomen it was confirmed that the primary contribution of the different batteries to SAR variation was due to the variation in body spacing each battery provided. At the face the battery is at the back side of the radio and therefore has no impact on body spacing and furthermore is not a potential re-radiator; therefore engineering judgment concludes that the battery is not expected to affect SAR variation and for convenience battery HNN9013A was selected. At the face both antennas were tested at the band ends of each transmit sub - band. This data is summarized in Table 7.2

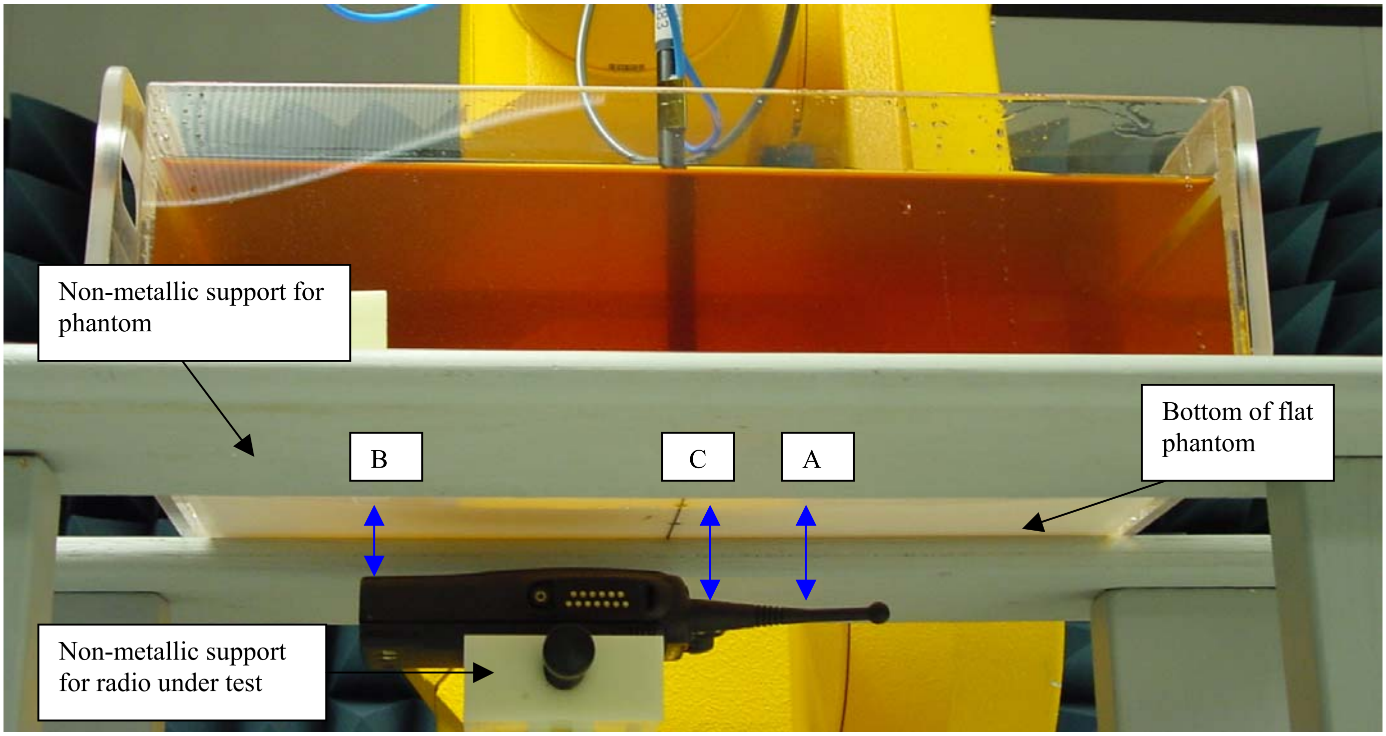
5.1 Device Test Positions

Abdomen - The test sample is positioned in a body - worn accessory and positioned under a flat phantom with the back of the body - worn accessory adjacent and parallel to the phantom. An audio/push-to-talk accessory and cable is connected to the radio with the cable routed orthogonal to and away from the radio at the point of connection to the radio. For the 2.5 cm tests the test sample is positioned under a flat phantom and parallel to the phantom with the base of the antenna spaced 2.5 cm from the phantom surface.

Face - The test sample is positioned under a flat phantom with radio housing parallel to the phantom with the radio's microphone spaced 2.5cm from the bottom of the phantom surface.

Reference figures 1 and 2 for portable radio antenna orientation and distances relative to phantoms. Figure 3 provides an overall perspective of the phantom and support structure

Figure 1: Facial Position



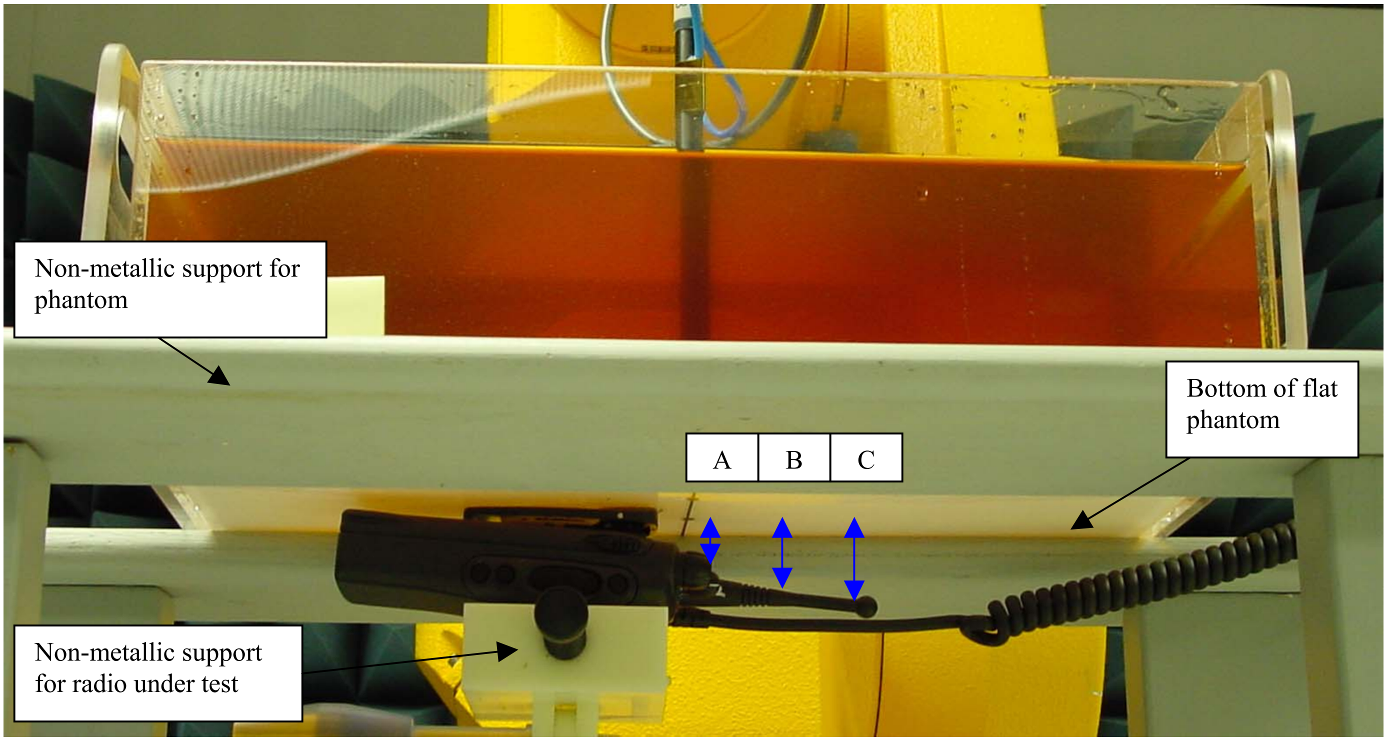
DIM A = Distance from center of antenna surface to phantom = 38mm

DIM B = Closest distance between bottom of radio to phantom = 30mm

DIM C = Closest distance between base of antenna to phantom = 36mm

Note: Radio is positioned with microphone 2.5cm from flat phantom.

Figure 2: Abdominal Position

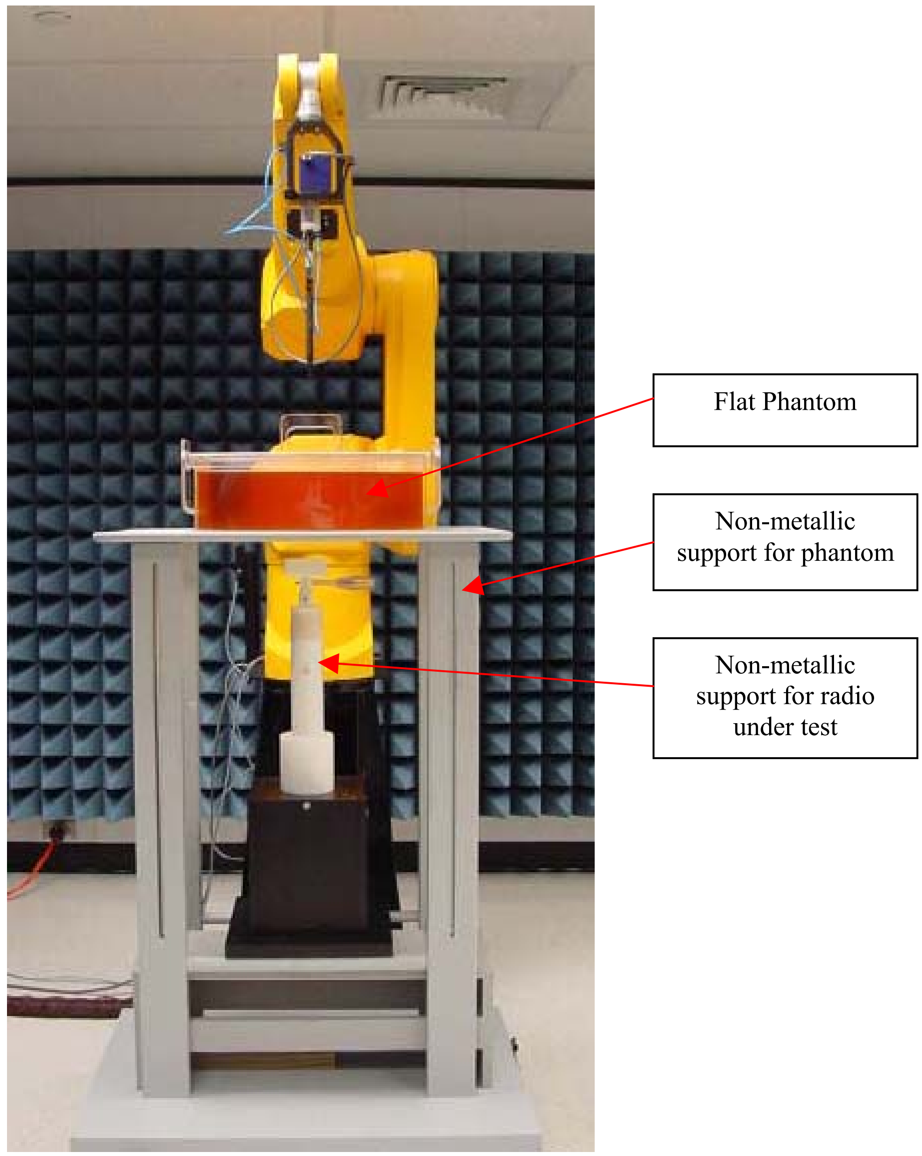


Dim A = Distance from surface of antenna base to phantom surface = 24mm

Dim B= Distance from surface of antenna center to phantom surface = 32mm

Dim C= Distance from antenna surface tip to phantom = 36mm

Figure 3: Robot Test System



5.2 Probe Scan Procedures

The E-field probe is first scanned in a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR 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 for reference for the cube evaluations.

6.0 Measurement Uncertainty:

The table below list the uncertainty estimate of the possible errors that are associated with the measurement system.

Uncertainty Description	Standard Uncertainty
Probe Uncertainty	
- Axial Isotropy	± 2.4 %
- Spherical Isotropy	± 4.8 %
- Spatial Resolution	± 0.5 %
- Linearity Error	± 2.7 %
- Calibration Error	± 8 %
Evaluation Uncertainty	
- Data Acquisition Error	± 0.60 %
- ELF and RF Disturbances	± 0.25 %
- Conductivity Assessment	± 5 %
Spatial Peak SAR Evaluation Uncertainty	
- Extrapolation and boundary effects	± 3%
- Probe positioning	± 1 %
- Integration and cube orientation	± 3 %
- Cube shape inaccuracies	± 1.2 %
- Device positioning	± 1.0 %

The Total Measurement Uncertainty is ± 12.1 %. The Expanded Measurement Uncertainty is ± 24.2 % (k=2)

7.0 SAR Test Results:

All SAR results yielded by the tests described in Section 5.0 are listed in the tables below for each body position. The DASY™ measurement system's output files for bolded data indicated in tables below are provided in appendix A.

7.1 SAR results at the abdomen:

Antenna/ Run Number	Freq. (MHz)	Battery	Carry Acc	Audio Acc	Dist. @ Antenna Base to Phantom (mm)	Initial Power (W)	End Power (W)	Measured 1g-SAR 100% duty cycle (mW/g)	Max Cal 1g-SAR 50% duty cycle (mW/g)
Antenna Search									
NAF5042A/ 010613-03	901	HNN9013B	HLN9844A	RMN4018A	24	2.65	2.27	8.27	**5.87**
NAF5038A/ 010613-04	901	HNN9013B	HLN9844A	RMN4018A	24	2.65	2.24	2.55	1.85
Battery Search									
NAF5042A/ 010614-01	901	HNN9008B	HLN9844A	RMN4018A	27	2.65	2.28	6.54	4.66
NAF5042A/ 010614-02	901	HNN9009B	HLN9844A	RMN4018A	31	2.65	2.28	4.83	3.44
NAF5042A/ 010614-03	901	HNN9010B	HLN9844A	RMN4018A	31	2.65	2.28	4.16	2.96
NAF5042A/ 010614-04	901	HNN9011B	HLN9844A	RMN4018A	30	2.65	2.28	2.91	2.07
NAF5042A/ 010614-05	901	HNN9012B	HLN9844A	RMN4018A	30	2.65	2.28	4.32	3.08
NAF5042A/ 010613-03	901	HNN9013B	HLN9844A	RMN4018A	24	2.65	2.29	8.27	**5.87**
Body-Worn Carry Accessory Search									
NAF5042A/ 010613-03	901	HNN9013B	HLN9844A	RMN4018A	24	2.65	2.29	8.27	**5.87**
NAF5042A/ 010613-01	901	HNN9013B	HLN9714A	RMN4018A	23	2.65	2.27	6.55	4.69
NAF5042A/ 010614-06	901	HNN9013B	PMLN4281A	RMN4018A	29	2.65	2.28	6.55	4.67
NAF5042A/ 010614-07	901	HNN9013B	HLN9701B	RMN4018A	32	2.65	2.28	5.08	3.62
NAF5042A/ 010615-01	901	HNN9013B	HLN9670A	RMN4018A	51	2.65	2.28	2.68	1.91
NAF5042A/ 010614-09	901	HNN9013B	HLN9652A NTN5243A	RMN4018A	38	2.65	2.28	4.98	3.55
NAF5042A/ 010615-02	901	HNN9013B	RLN4815A	RMN4018A	32	2.65	2.28	4.60	3.28
NAF5042A/ 010614-08	901	HNN9013B	HLN9844A HLN9952A	RMN4018A	30	2.65	2.28	7.46	5.32

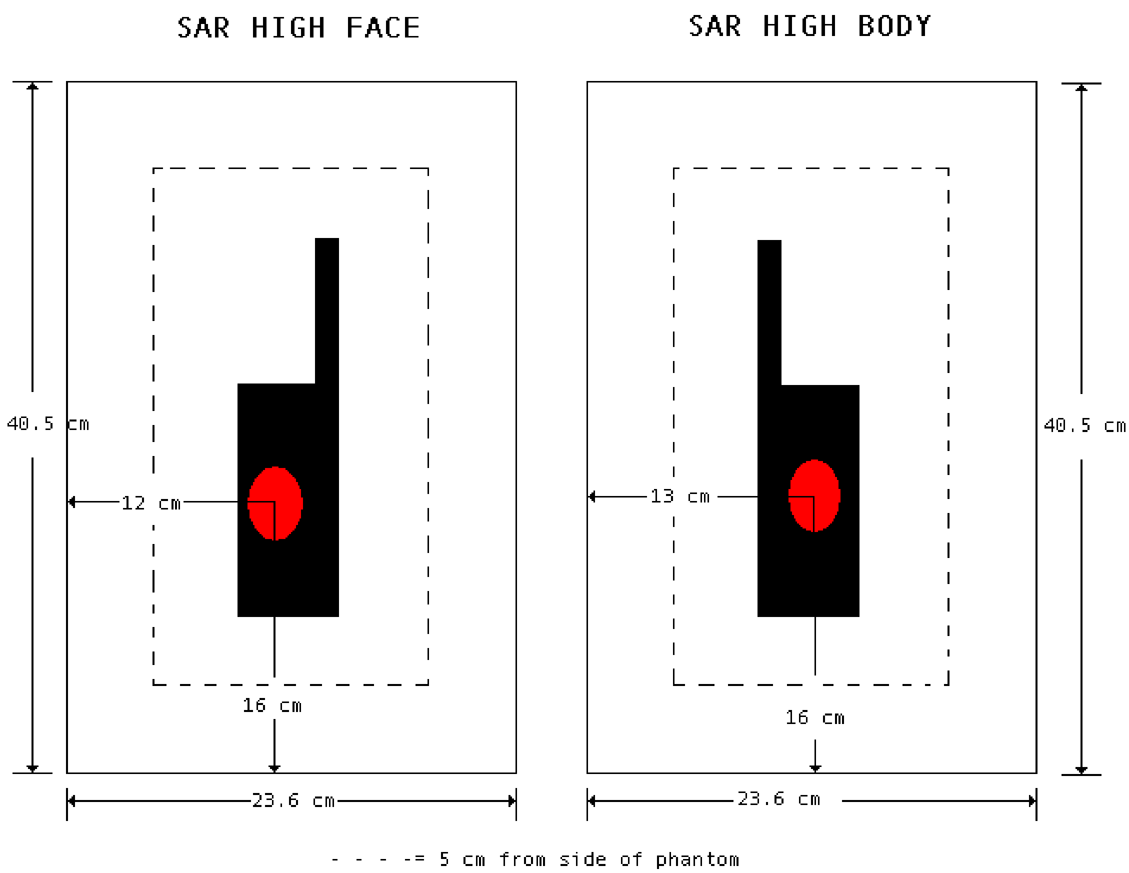
Antenna/ Run Number	Freq. (MHz)	Battery	Carry Acc	Audio Acc	Dist. @ Antenna Base to Phantom (mm)	Initial Power (W)	End Power (W)	Measured 1g-SAR 100% duty cycle (mW/g)	Max Cal 1g-SAR 50% duty cycle (mW/g)
Frequency Search									
NAF5042A/ Test-9	896	HNN9013B	HLN9844A	HMN9052D	24	2.59	2.22	10.7	**7.83**
NAF5042A/ 010618-01	901	HNN9013B	HLN9844A	HMN9052D	24	2.65	2.28	9.50	6.77
NAF5042A/ 010618-03	935	HNN9013B	HLN9844A	HMN9052D	24	3.0	2.58	7.74	4.88
NAF5042A/ 010618-04	941	HNN9013B	HLN9844A	HMN9052D	24	2.77	2.38	6.35	4.34
Audio Accessory Search									
NAF5042A/ Test-9	896	HNN9013B	HLN9844A	HMN9052D	24	2.59	2.22	10.7	**7.83**
NAF5042A/ 010705-03	896	HNN9013B	HLN9844A	ENMN4014A	24	2.59	2.22	9.06	6.63
NAF5042A/ Test-5	896	HNN9013B	HLN9844A	NTN1722A HLN9717A	24	2.59	2.22	10.2	7.47
NAF5042A/ 010626-05	896	HNN9013B	HLN9844A	RMN4018A	24	2.59	2.21	10.3	7.57
Measured at 2.5 cm									
NAF5042A/ 010618-07	896	HNN9013B	@ 2.5 cm		25	2.59	2.22	4.24	**3.10**

7.2 SAR results at the Face:

Antenna/ Run Number	Freq.	Battery	Dist. @ Antenna Base to Phantom (mm)	Initial Power (W)	End Power (W)	Measured 1g-SAR 100% duty cycle (mW/g)	Max Cal 1g-SAR 50% duty cycle (mW/g)
Antenna Search							
NAF5042A/ 010618-08	901	HNN9013B	36	2.65	2.30	3.23	**2.28**
NAF5038A/ 010619-01	901	HNN9013B	36	2.65	2.25	2.44	1.76
Frequency Search							
NAF5042A/ 010618-08	901	HNN9013B	36	2.65	2.30	3.23	2.28
NAF5042A/ 010619-02	896	HNN9013B	36	2.59	2.27	3.36	2.41
NAF5042A/ 010619-03	935	HNN9013B	36	3.0	2.57	5.42	**3.43**
NAF5042A/ 010619-04	941	HNN9013B	36	2.77	2.36	4.55	3.12

7.3 Peak SAR location

The following figures illustrate the peak SAR location relative to the flat phantom and the test sample for the abdomen and face scans which resulted in the highest SAR. Refer to Appendix A for the detailed SAR scan distributions.



7.4 Maximum Calculated SAR

The calculated maximum 1-gram averaged SAR value is determined by scaling up the measured SAR to adjust for (1) imperfect power leveling and power slump during the SAR scan below the maximum power and (2) duty cycle differences between test mode and normal operation. Therefore the Maximum Calculated 1-gram averaged peak SAR becomes:

$$\text{Maximum Calculated 1-gram Average Peak SAR} = \frac{P_{max}}{P_{end}} \text{ x (D1 x D2) x } SAR_{meas.}$$

<u>Abdomen</u>

$$\text{Maximum Calculated 1-gram Average Peak SAR} = \frac{3.25}{2.22} \text{ x (0.5 x 1) x 10.7mW/g = 7.83 mW/g}$$

<u>Face</u>

$$\text{Maximum Calculated 1-gram Average Peak SAR} = \frac{3.25}{2.57} \text{ x (0.5 x 1) x 5.42mW/g = 3.43mW/g}$$

P_{max} = Maximum Power (Factory upper limit)
P_{end} = Lowest measured power at end of SAR
$SAR_{meas.}$ = Measured 1 gram averaged peak SAR

D1 = the transmission mode duty cycle, i.e., the ratio of the service mode and the tested mode.

D2 = the Push To Talk duty cycle.
For two-way radio (dispatch) = 0.5,

8.0 Conclusion

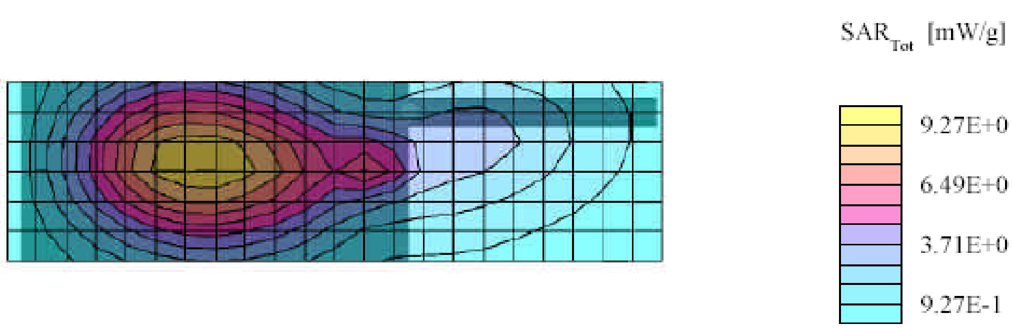
The highest Operational Maximum Calculated 1-gram average SAR values found for the portable radio model number H18UCH9PW7AN were:
At the abdomen: 7.83 mW/g
At the face: 3.43 mW/g

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

Appendix A: Data Results

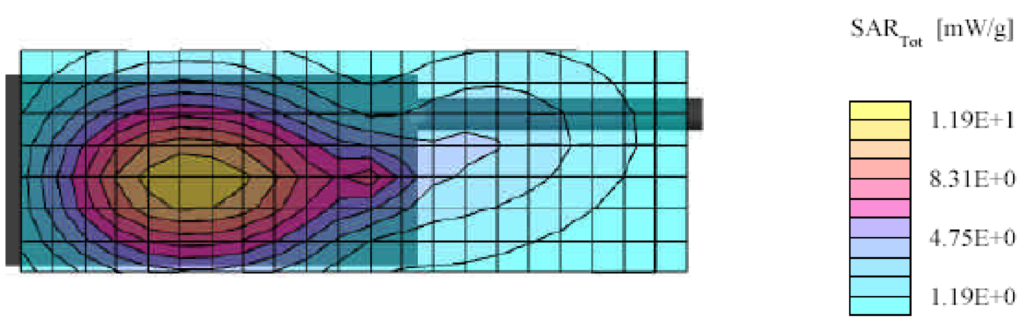
Waris 900 Ab; Test Date: 06/13/01

Run: 01061303, Run Time: 25 min
Model #: PMUF1059A, SN: 921TBC2463
Tx Freq: 901.9875 MHz, Antenna Position: Fixed
Accessories: Antenna: NAE5042A, Battery: HNN9013B
Belt Clip: HLN9844, Headset: RMN4018A
Flat Phantom Phantom; Flat_H Section; Position: (90°,90°);
Probe: ET3DV6 - SN1547; ConvF(6.16,6.16,6.16); Probe cal date: 11/00; Crest factor: 1.0; Muscle 925 MHz
: σ = 1.17 mho/m ε_r = 51.6 ρ = 1.07 g/cm³
Cube 5x5x7: SAR (1g): 8.27 mW/g, SAR (10g): 5.72 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0; Max at 27.0, 67.0, 4.0



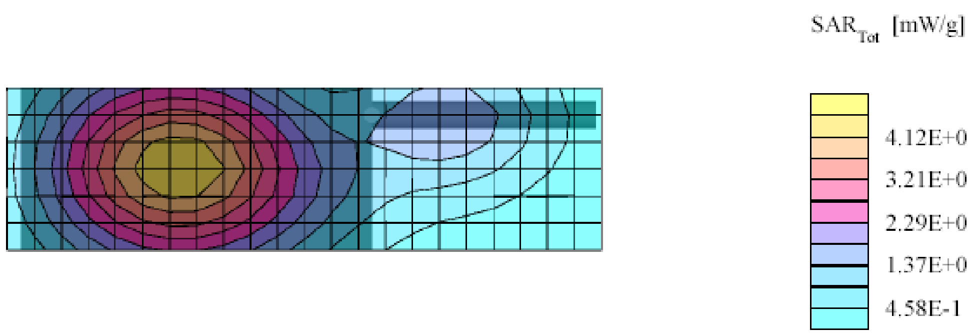
Waris 9cm Whip Ant- Ab; Test Date: 06/23/01

tests 9 run time 28 min
Model #: PMUF1059A, SN: 921TBC2463
Tx Freq: 896.0125 MHz, Antenna Position: Fixed
Accessories: Antenna: NAF5042A, Battery: HNN9013B
RSM HMN9052
Flat Phantom Phantom; Flat_H Section; Position: (90°,90°);
Probe: ET3DV6 - SN1383; ConvF(6.31,6.31,6.31); Probe cal date: 05/23/01; Crest factor: 1.0; Muscle 925 MHz : σ = 1.17 mho/m ε_r = 49.7 ρ = 1.07 g/cm³
Cube 5x5x7: SAR (1g): 10.7 mW/g, SAR (10g): 7.40 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0; Max at 41.0, 53.0, 4.3



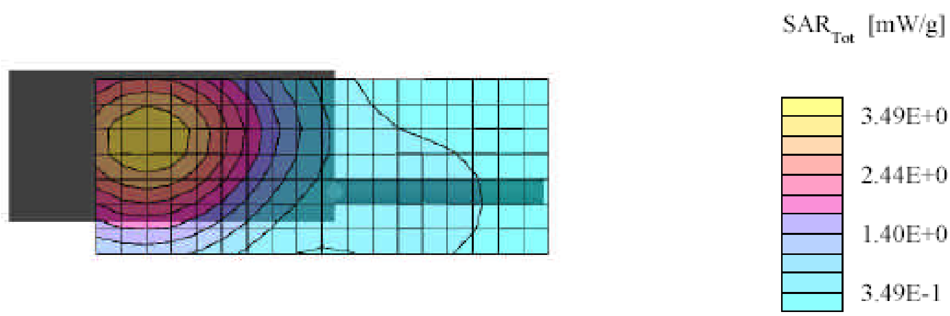
Waris 900 Ab; Test Date: 06/18/01

Run: 01061807, Run Time: 26 min
Model #: PMUF1059A, SN: 921TBC2463
Tx Freq: 896.0125 MHz, Antenna Position: Fixed
Accessories: Antenna: NAF5042A, Battery: HNN9013B
Measured @ 2.5 cm
Flat Phantom Phantom; Flat_H Section; Position: (90°,90°);
Probe: ET3DV6 - SN1547; ConvF(6.16,6.16,6.16); Probe cal date: 11/00; Crest factor: 1.0; Muscle 925 MHz : σ = 1.17 mho/m ε_r = 51.6 ρ = 1.07 g/cm³
Cube 5x5x7: SAR (1g): 4.24 mW/g, SAR (10g): 2.98 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0; Max at 29.0, 64.0, 4.0
Powerdrift: -0.35 dB



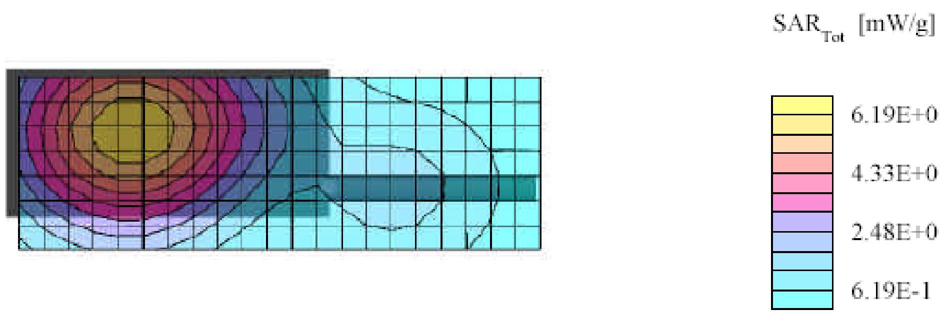
Waris 8cm Whip Ant- Face; Test Date: 06/18/01

Run: 01061808, Run Time: 24 min
Model #: PMUF1059A, SN: 921TBC2463
Tx Freq: 901.9875 MHz, Antenna Position: Fixed
Accessories: Antenna: NAF5042A, Battery: HNN9013B
Flat Phantom Phantom; Flat_H Section; Position: (90°,90°);
Probe: ET3DV6 - SN1383; ConvF(6.37,6.37,6.37); Probe cal date: 05/23/01; Crest factor: 1.0; Head (IEEE)
925 MHz : $\sigma = 0.98$ mho/m $\varepsilon_r = 41.8$ $\rho = 1.04$ g/cm³
Cube 5x5x7: SAR (1g): 3.23 mW/g, SAR (10g): 2.30 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0; Max at 24.0, 21.0, 4.3



Waris 8cm Whip Ant- Face; Test Date: 06/19/01

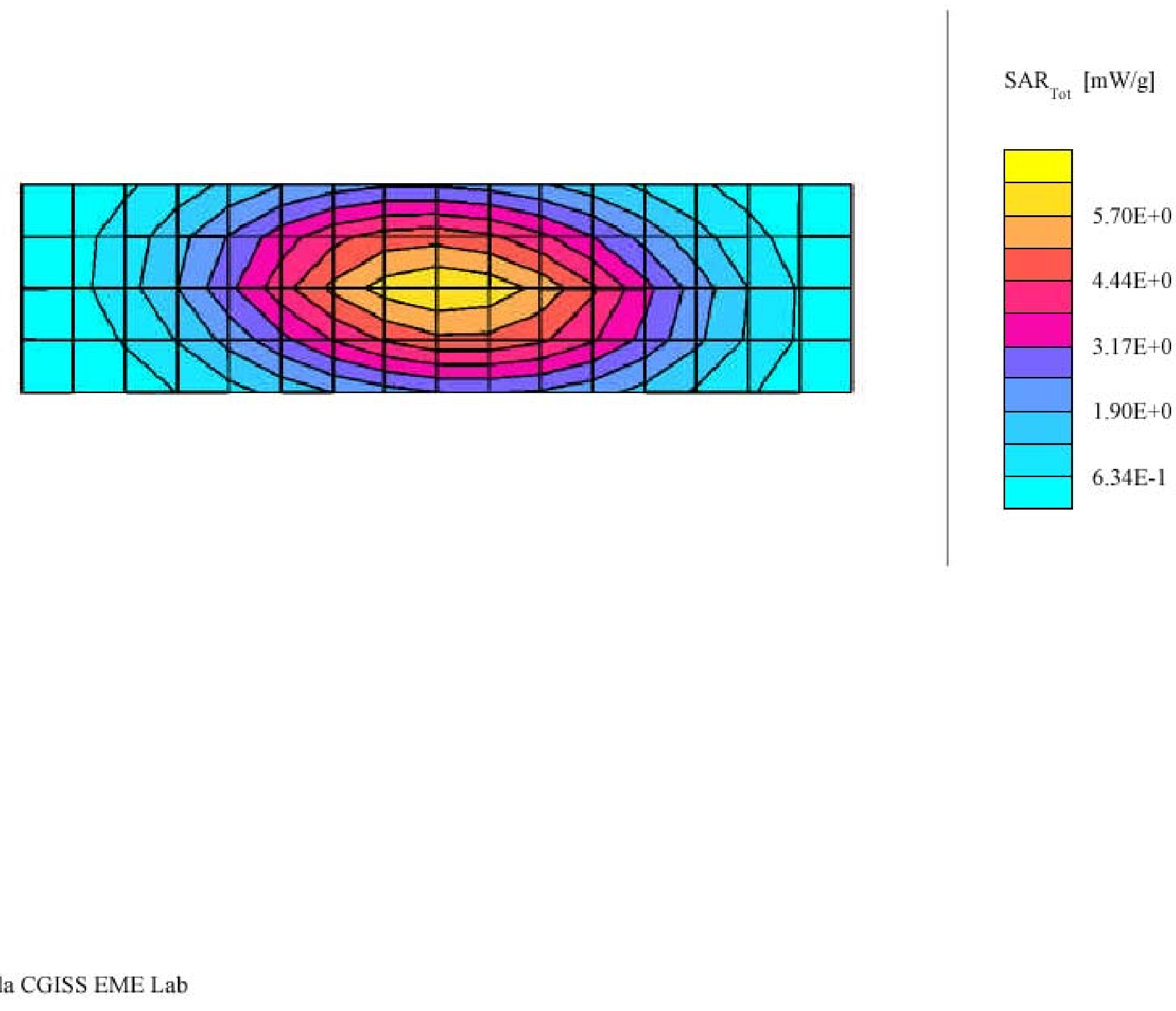
Run: 01061903, Run Time: 28min
Model #: PMUF1059A, SN: 921TBC2463
Tx Freq: 935.0125 MHz, Antenna Position: Fixed
Accessories: Antenna: NAF5042A, Battery: HNN9013B
Flat Phantom Phantom; Flat_H Section; Position: (90°,90°);
Probe: ET3DV6 - SN1383; ConvF(6.37,6.37,6.37); Probe cal date: 05/23/01; Crest factor: 1.0; Head (IEEE)
925 MHz : $\sigma = 0.98$ mho/m $\varepsilon_r = 41.8$ $\rho = 1.04$ g/cm³
Cube 5x5x7: SAR (1g): 5.42 mW/g, SAR (10g): 3.85 mW/g, (Worst-case extrapolation)
Coarse: Dx = 10.0, Dy = 10.0, Dz = 10.0; Max at 22.0, 45.0, 4.3



Appendix B: Dipole System Performance Check Results

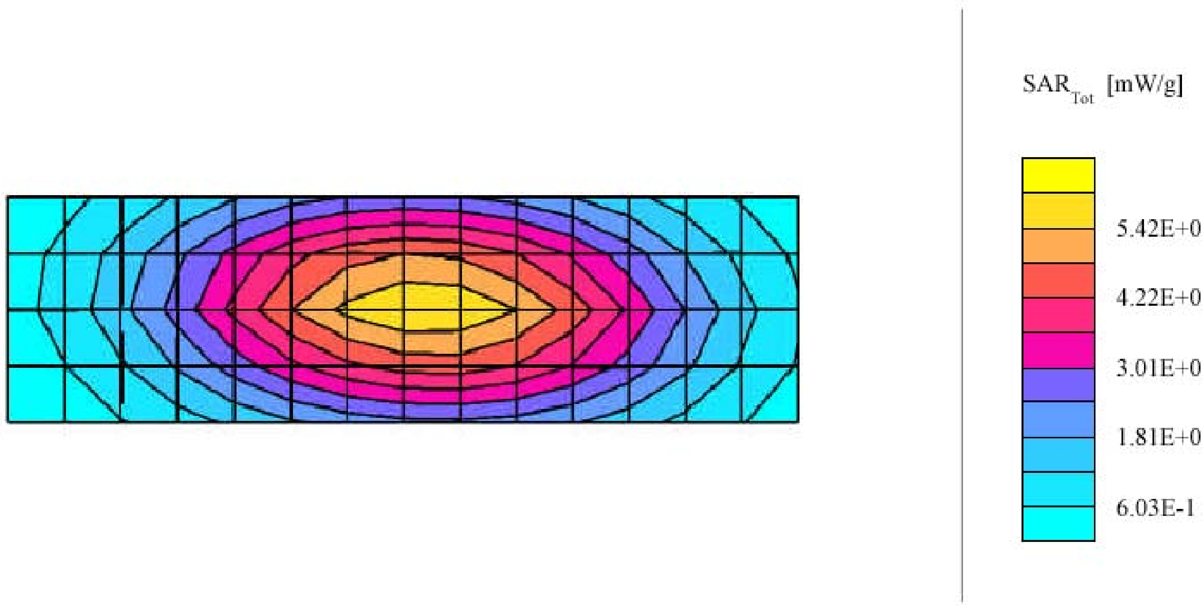
925 CGISS Dipole 002

Validation Target: 5.99 mW/g (0.5 W measured), 11.98 mW/g (1.0 W)
Flat Phantom;
Probe: ET3DV6 - SN1547; ConvF(6.16,6.16,6.16); Crest factor: 1.0; Muscle 925 MHz : σ= 1.17 mho/m ε_r = 51.6 ρ= 1.07 g/cm 3
Cube 5x5x7: Peak: 9.45 mW/g, SAR (1g): 5.89 mW/g, SAR (10g): 3.74 mW/g, (Worst-case extrapolation)
Penetration depth: 11.6 (10.3, 13.4) [mm]
Powerdrift: -0.03 dB
06/13/01



925 CGISS Dipole 002

Validation Target: 5.99 mW/g (0.5 W measured);11.98 mW/g (1.0 W)
Flat Phantom;
Probe: ET3DV6 - SN1383; ConvF(6.31,6.31,6.31); Crest factor: 1.0; Muscle 925 MHz : σ= 1.17 mho/m ϵ_r = 51.6 ρ= 1.07 g/cm 3
Cube 5x5x7: Peak: 9.21 mW/g, SAR (1g): 5.81 mW/g, SAR (10g): 3.68 mW/g, (Worst-case extrapolation)
Penetration depth: 11.5 (10.5, 12.9) [mm]
Powerdrift: 0.01 dB



Motorola CGISS EME Lab

Appendix C: Measurement Probe Calibration Certificate

Schmid & Partner Engineering AG

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

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1547**
Place of Calibration:	**Zurich**
Date of Calibration:	**Nov. 14, 2000**
Calibration Interval:	**12 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:

Engineering AG

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	ET3DV6
Serial Number:	1547
Place of Assessment:	Zurich
Date of Assessment:	Nov. 16, 2000
Probe Calibration Due Date:	Nov. 14, 2001

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:1547

Conversion factor (± standard deviation)

150 MHz	ConvF	**8.26 ± 8%**	ε_r = 70.0 σ = 0.75 mho/m (muscle tissue)
450 MHz	ConvF	**6.95 ± 8%**	ε_r = 58.0 σ = 1.0 mho/m (muscle tissue)
784 MHz	ConvF	**6.39 ± 8%**	ε_r = 52.79 σ = 1.09 mho/m (muscle tissue)
835 MHz	ConvF	**6.30 ± 8%**	ε_r = 52.0 σ = 1.10 mho/m (muscle tissue)
925 MHz	ConvF	**6.16 ± 8%**	ε_r = 52.0 σ = 1.20 mho/m (muscle tissue)
1500 MHz	ConvF	**5.45 ± 8%**	ε_r = 52.74 σ = 1.35 mho/m (muscle tissue)
1900 MHz	ConvF	**5.00 ± 8%**	ε_r = 50.16 σ = 1.83 mho/m (muscle tissue)
2450 MHz	ConvF	**4.41 ± 8%**	ε_r = 47.11 σ = 2.56 mho/m (muscle tissue)

**Schmid & Partner
Engineering AG**

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

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1383**
Place of Calibration:	**Zurich**
Date of Calibration.	**May 23, 2001**
Calibration Interval:	**12 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	Nikolos E. Neviana
Approved by	Ilusic Katja

Schmid & Partner
Engineering AG

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	ET3DV6
Serial Number:	1383
Place of Assessment:	Zurich
Date of Assessment:	May 28, 2001
Probe Calibration Date:	May 23, 2001

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: [signature]

Page 1 of 3

Dosimetric E-Field Probe ET3DV6 SN:1383

Conversion factor (± standard deviation)

400 MHz	ConvF	**7.64 ± 8%**	$\varepsilon_r = 44.4$ $\sigma = 0.87$ mho/m (CENELEC head tissue)
835 MHz	ConvF	**6.54 ± 8%**	$\varepsilon_r = 42.5$ $\sigma = 0.98$ mho/m (CENELEC head tissue)
900 MHz	ConvF	**6.41 ± 8%**	$\varepsilon_r = 42.3$ $\sigma = 0.99$ mho/m (CENELEC head tissue)
350 MHz	ConvF	**7.76 ± 8%**	$\varepsilon_r = 44.7$ $\sigma = 0.87$ mho/m (IEEE head tissue)
450 MHz	ConvF	**7.52 ± 8%**	$\varepsilon_r = 43.5$ $\sigma = 0.87$ mho/m (IEEE head tissue)
835 MHz	ConvF	**6.53 ± 8%**	$\varepsilon_r = 41.5$ $\sigma = 0.90$ mho/m (IEEE head tissue)
925 MHz	ConvF	**6.37 ± 8%**	$\varepsilon_r = 41.45$ $\sigma = 0.98$ mho/m (IEEE head tissue)
1500 MHz	ConvF	**6.04 ± 8%**	$\varepsilon_r = 40.43$ $\sigma = 1.23$ mho/m (IEEE head tissue)
1900 MHz	ConvF	**5.41 ± 8%**	$\varepsilon_r = 40.0$ $\sigma = 1.40$ mho/m (IEEE head tissue)
2450 MHz	ConvF	**5.18 ± 8%**	$\varepsilon_r = 39.2$ $\sigma = 1.8$ mho/m (IEEE head tissue)
2450 MHz	ConvF	**5.40 ± 8%**	$\varepsilon_r = 37.2$ $\sigma = 2.09$ mho/m (H1800 at 2450 MHz)

Schmid & Partner
Engineering AG

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

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1383**
Place of Assessment:	**Zurich**
Date of Assessment:	**June 25, 2001**
Probe Calibration Date:	**May 23, 2001**

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: [signature]

Dosimetric E-Field Probe ET3DV6 SN:1383

Conversion factor (± standard deviation)

35 MHz	ConvF	**8.68 ± 15%**	**ε_r = 78.0** **σ = 0.65 mho/m** (muscle tissue)
75 MHz	ConvF	**8.69 ± 10%**	**ε_r = 70.0** **σ = 0.70 mho/m** (muscle tissue)
150 MHz	ConvF	**8.62 ± 8%**	ε_r = 70.00 σ = 0.75 mho/m (muscle tissue)
450 MHz	ConvF	**7.30 ± 8%**	ε_r = 58.0 σ = 1.00 mho/m (muscle tissue)
835 MHz	ConvF	**6.46 ± 8%**	ε_r = 52.0 σ = 1.10 mho/m (muscle tissue)
925 MHz	ConvF	**6.27 ± 8%**	ε_r = 52.0 σ = 1.20 mho/m (muscle tissue)
1500 MHz	ConvF	**6.13 ± 8%**	**ε_r = 41.2** **σ = 1.48 mho/m** (muscle tissue)
1920 MHz	ConvF	**5.21 ± 8%**	ε_r = 51.5 σ = 1.95 mho/m (muscle tissue)

Appendix D: Illustrations of Body-worn Accessories

Body-worn Accessories for Professional Series Radios

The purpose of this appendix is to illustrate the body-worn carry accessories for Professional Series Radios. The radio that is used in the following photos is of the Professional Series type and was used solely to demonstrate the different body-worn carry accessories. There are four types of body-worn carry cases 1) Belt clip 2) Nylon case 3) Thin leather carry case 4) Standard leather belt loop.

1) Belt Clip

Belt clips are available in two styles, spring belt clip 1.5"(HLN9844A) and spring belt clip 2.5"(HLN9714A) refer to photos 1-5 below. A belt clip carry holder (HLN9952A) is an optional nonmetallic holder for which either belt clip can be attached. Photo five illustrates the metallic spring clips for both belt clips.

Photo 1. Side view of HLN9844A

Photo 2. Side view of HLN9714A

Photo 3. Front view of HLN9844A, HLN9714A and HLN9952A

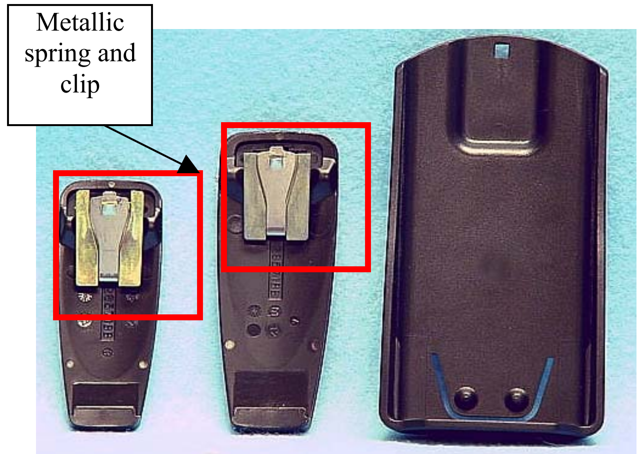


Photo 4. Rear view of HLN9844A, HLN9714A and HLN9952A

Photo 5. Angled view of HLN9952A and HLN9844A with radio not in holder

Photo 5a. Side view of HLN9952A and HLN9844A with radio in holder

2) Nylon Carry Case

The Nylon carry case is only available in one style, Nylon with belt loop (HLN9701B) refer to photos 6-8.

Photo 6, Side view of HLN9701B (nylon)

Photo 7, Front view of HLN9701B (nylon)

Photo 8, Rear view of HLN9701B (nylon)

3) Thin Leather Carry Case

Thin leather carry cases are available in two styles, full thin (PMLN4280A) and basic thin (PMLN4418A). These two styles are the same except for a clear plastic window located on the front of the full thin leather (PMLN4280A) refer to photo 11 below. This window can be used for viewing displays and/or keypads.

Photo 9, Side view PMLN4280A (full thin)

Photo 10, Side view PMLN4281A (basic thin)

Photo 11, Front view PMLN4280A (full thin) and PMLN4281A (basic thin)

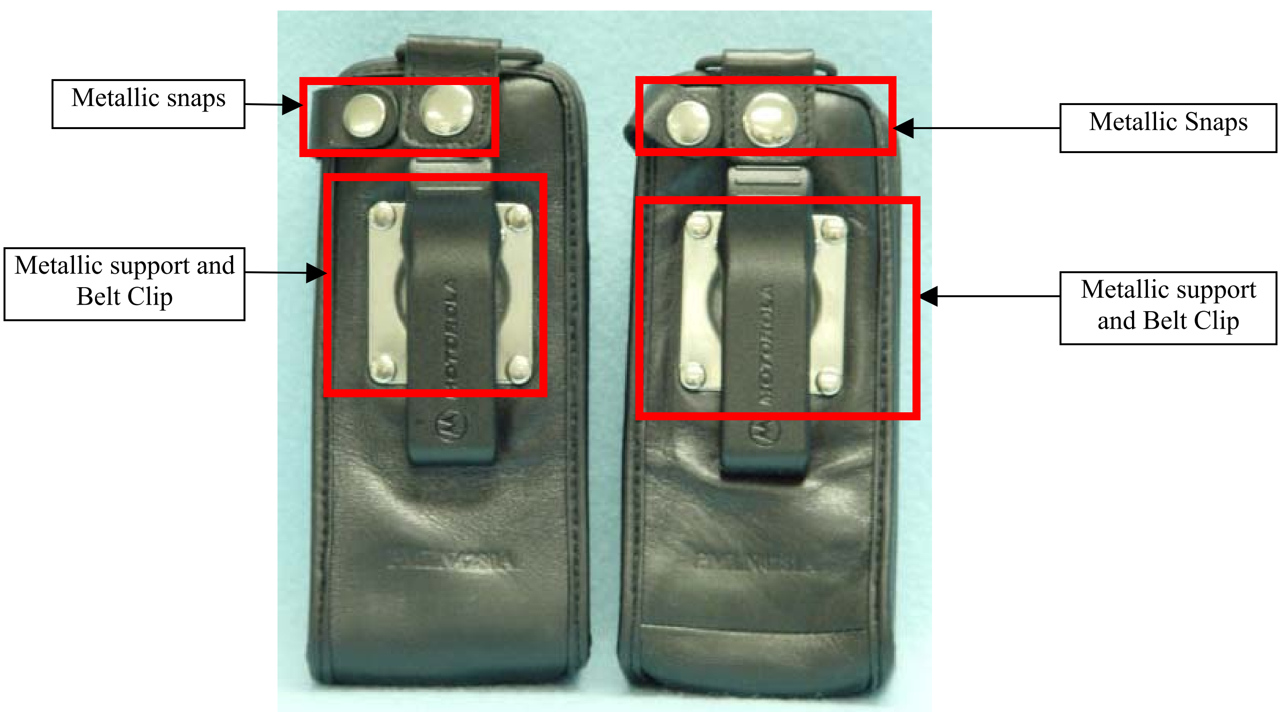


Photo 12, Rear view PMLN4280A (full thin) and PMLN4281A (basic thin)

4) Standard Leather Belt Loop Carry Cases

Standard leather belt loop carry cases are available in two styles, swivel belt loop (HLN9690A) and belt loop (HLN9677A) refer to the photos 13-17 below. Motorola manufactures a variety of radios with/without displays and keypads. For this reason Motorola has designed similar leather carry cases that allow for these options. The swivel belt loop and belt loop carry cases are available in three models; 1) Leather cut-outs for the speaker, key pad and display 2) Leather cut outs for the speaker and key pad 3) Leather cut-outs for the speaker. Each of the three models has the option for a thin or standard battery. All swivel belt loop carry cases are the same and all belt loop carry cases are the same, except for specific leather cut-outs and battery size (see list below).

Swivel belt loop Kit number	**Belt loop** Kit number	Leather cut-outs	Battery size
HLN9690A	HLN9677A	speaker, keypad, display	thin
HLN9694A	HLN9689A	speaker, keypad, display	standard
HLN9955A	HLN9945A	speaker, keypad	thin
HLN9998A	HLN9946A	speaker, keypad	standard
HLN9670A	HLN9652A	speaker	thin
HLN9676A	HLN9665A	speaker	standard

Photo 13, Side view HLN9690A (swivel)

Photo 14, Side view HLN9677A (Belt Loop)

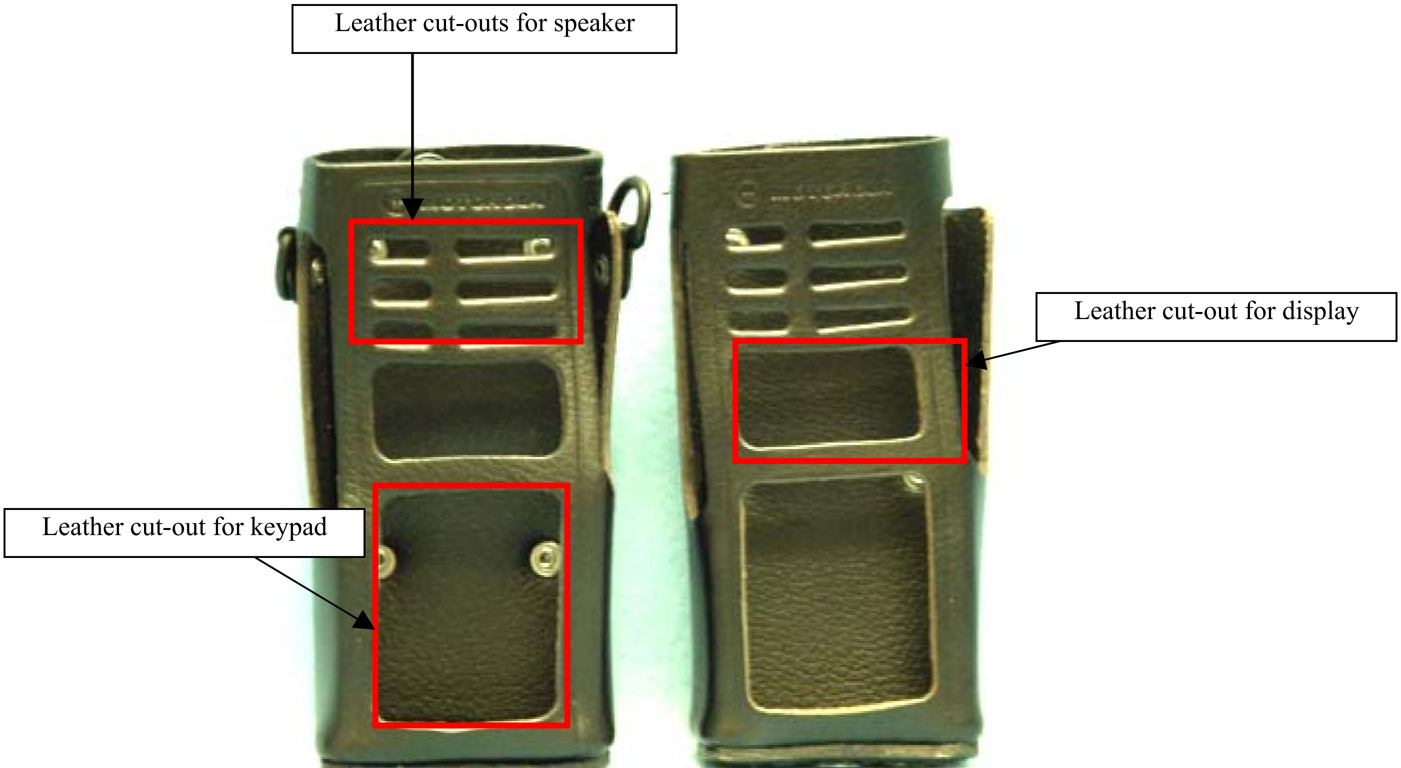


Photo 15, Front view HLN9677A (Belt Loop) and HLN9690A (swivel)

Photo 16, Rear view of HLN9690A (swivel) and HLN9677A

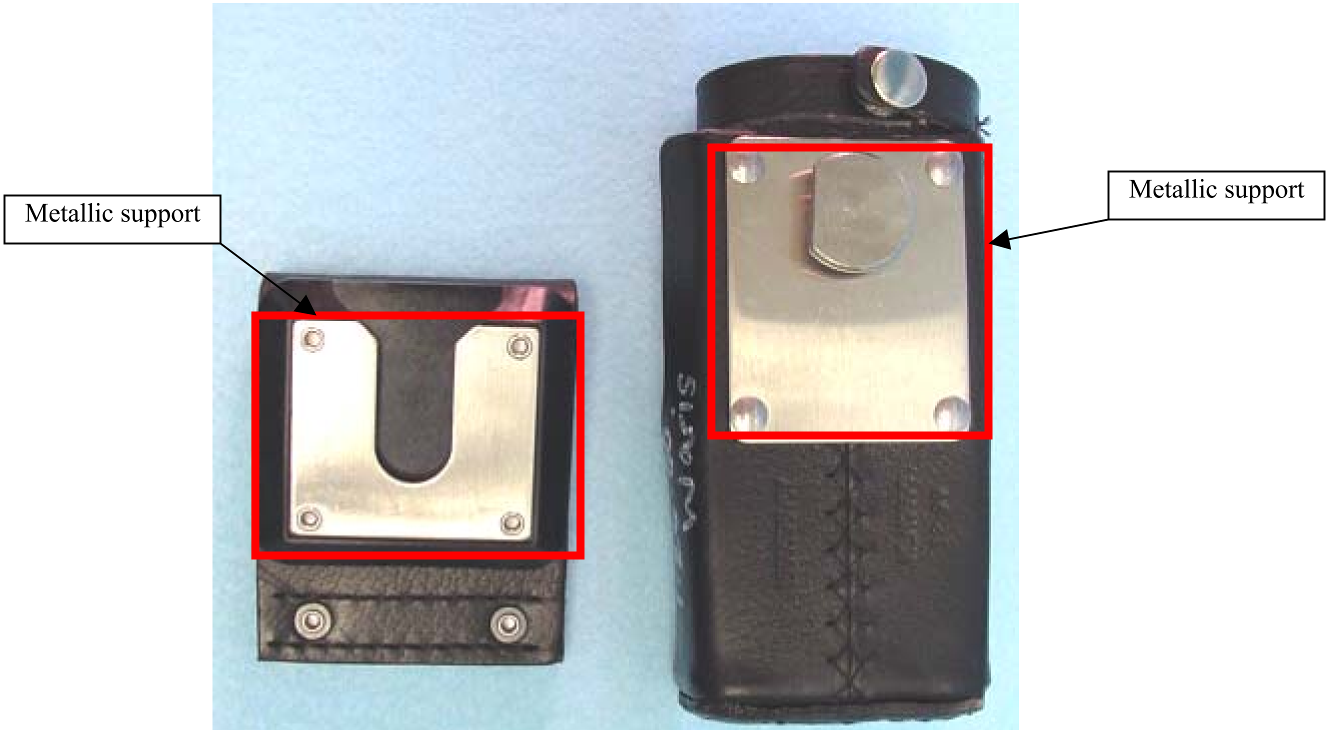


Photo 17, The HLN9690A has metallic supports for swivel purpose.