MOTOROLA

ACCREDITED

CGISS EME Test Laboratory
8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

EME Compliance Test Report

Attention:	Federal Communication Commission
Date of Report:	September 30, 2002
Report Revision(s):	Rev. O
Device Manufacturer:	Motorola
Device Description:	Mobile VHF analog radio 1-25 Watts; 4/8 Ch. Mini UHF
Classification:	Occupational/Controlled Exposure
FCC ID:	AZ492FT3805
Device Model:	FUD1182A

Test Period: 9/6/02

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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 all applicable national and international reference standards and guidelines.

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10/10/02
Date Approved

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REVISION HISTORY

Date	Revision	Comments
9/30/02	O	Initial release Prototype results

1.0 Product Description

FCC ID: AZ492FT3805, model FUD1182A is a mobile transceiver that utilizes frequency modulation (FM) half duplex transmission technology. The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a vehicle with an external antenna mounted at the center of the roof or trunk.
This device is marketed to Commercial, Government, and Industrial Users and therefore is classified as Occupational/Controlled Exposure. The intended users of this device are informed and aware professionals operating this device in accordance with the User Manual instructions including maintaining a maximum operational transmit duty cycle of 50%. In accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle are evaluated to the General Population/Uncontrolled Exposure Limits. The transmit frequency band is 146-174 MHz. The rated power of the device is 1 to 25 watts with a maximum conducted power output of 28 watts.

2.0 Offered Options and Accessories

Antenna

HAD4007A	144-150.8 MHz ¼ wave 0dBi; 48.1cm
HAD4008A	150.8 -162 MHz ¼ wave 0dBi; 44.6cm
HAD4009A	162-174 MHz ¼ wave 0dBi; 41.8cm
HAD4014AR	140-174 MHz 3dBi gain ; 1.2m

3.0 Measurement Standards

Measurements were performed according to FCC Limits Per 47 CFR 2.1091 (b) for General Population/Uncontrolled RF Exposure.
For frequencies ranging from 146-174 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is 0.20 mW/cm^2.

4.0 Data Collection Consideration

Power density testing was performed with DUT installed in a 1991 Ford Taurus (4-door). Measurement data was taken with the vehicle running at idle and the vehicle battery measuring 14.0 volts.

5.0 Measurement System Uncertainty Levels

The information below presents an estimate of the possible errors that are associated with the measurement system.

Description	Error
NARDA Survey Meter	**± 3%**
Repeatability Accuracy	**± 7%**

6.0 Method of Measurement

6.1 EME measurements made on trunk mounted antennas
(for reference, see Antenna Location Layout drawings in Appendix)

6.1.1 External vehicle EME measurement
(Antenna mounted in trunk center)

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 60 cm to the antenna, from the back of the vehicle in a vertical line and then average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing behind a vehicle during a mobile radio transmission.

6.1.2 Internal vehicle EME measurement
(Antenna mounted in trunk center)

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, scan the inside of the vehicle, both front and back seating areas, for the highest level in each location. After the highest level is found, scan vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that will be averaged.

a) Head area

b) Chest area

c) Lower Trunk area

6.2 EME measurements made on center roof mounted antennas
(for reference, see Antenna Location Layout drawings in Appendix)

6.2.1 External vehicle EME measurement

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 60 cm from the vehicle-mounted antenna, in a vertical line and then

average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing next to a vehicle during a mobile radio transmission.
Note: Actual test distance was 110cm; this is the closest distance that can be achieved to an antenna mounted to the center of the vehicle used for MPE compliance assessment.

6.2.2 Internal vehicle EME measurement

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, scan the inside of the vehicle, both front and back seating areas, for the highest level in each location. After the highest level is found, scan vertically making two (2) additional measurements within an area approximately 40 cm wide (representing the width of a person) so as to have a total of three (3) measured points as indicated below that will be averaged.

a) Head area

b) Chest area

c) Lower Trunk area

7.0 Test Site

The test site is the Motorola Commercial Government Industrial Solution Sector (CGISS) world wide electromagnetic exposure (EME) open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

8.0 Measurement System/Equipment

The minimum equipment required will mainly consist of a test vehicle, radio frequency radiation test set consisting of an Electromagnetic Radiation Survey Meter, E-Field Test Probe, H-Field Test Probe and typical antenna configurations.
Below are the test equipment used to assess compliance:

a) Automobile: 1991 Ford Taurus, 4-Door

b) E-Field Survey Meter - NARDA Model 8718; Calibration date: 4/23/02

c) E-Field (Electric Field) Probe - NARDA Model 8722B (300 kHz - 40 Ghz);

Calibration date: 3/28/02

d) H-Field Survey Meter – NARDA Model 8718; Calibration date: 4/23/02

e) H-Field (Magnetic field) Probe – NARDA Model 8732; Calibration date: 4/1/02

f) Antennas - (1/4 wave 0dBi and 3dBi gain)

9.0 Test Unit Description

Power density measurements were performed on a 1-25 watt mobile radio; model number FUD1182A serial number 17. The frequency band of the mobile was 146-174 MHz; the test frequencies were 146.625, 161.425, and 173.9925 MHz. The ¼ wave 0dBi and 3dBi gain mobile antennas listed in section 2.0 were used to assess MPE compliance.

10.0 Test Set-Up Description

Following are the standard mobile antenna test configurations used for this product. (for reference, see Antenna Location Layout drawings in Appendix)

a) ¼ wave antenna model HAD4007A, HAD4008A, HAD4009AR mounted on the center of the trunk.
b) 3 dBi gain antenna model HAD4014AR antenna mounted on the center of the trunk.

c) ¼ wave antenna, model HAD4007A mounted on the center of the roof. This antenna was selected because it exhibited the highest MPE results during the 60 cm trunk testing.

11.0 Test Results

Measurements were taken with the antenna located in two areas: the roof center, and trunk center. Below is the raw MPE data for all measured grid points. Results are based on a 50% duty cycle with the radio operating in accordance with the User Manual instructions.

Raw MPE Data; Test Frequencies and Po = 146.625 (Po =24.0W), 161.425 (Po =25.8W), 173.9925 MHz (Po =28.0W)
Meter reads in % of controlled limit; controlled limit = 1.0 for 30-300MHz
(Cal factors presented herein are automatically accounted for in the meter used for assessments)
Vehicle spec. limits = 0.20 mW/cm^2
External Vehicle Power Density (Pwr. Den. (cal.)) = average over body/2
Internal Vehicle Power Density (Pwr. Den. (cal.)) = average over (head/chest/leg)/2

Note: The average over the body test methodology is consistent with IEEE/ANSI C95.1-1999 guidelines

External Vehicle MPE Assessment @ 146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4007A/0dB	60	E	0.89	0.31	**0.155**

Measurement grid					
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**
1	20	9	6	120	59
2	40	14	7	140	56
3	60	20	8	160	41
4	80	29	9	180	25
5	100	42	10	200	15

External Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4007A/0dB	60	H	0.88	0.154	0.077
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	9	6	120	31	
2	40	7	7	140	18	
3	60	11	8	160	8	
4	80	26	9	180	3.50	
5	100	38	10	200	2.50	

External Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4008A/0dB	60	E	0.92	0.256	0.128
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	5	6	120	59	
2	40	8	7	140	45	
3	60	10	8	160	28	
4	80	21	9	180	17	
5	100	54	10	200	8.5	

External Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4008A/0dB	60	H	0.94	0.156	0.078
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	8	6	120	26	
2	40	7	7	140	16	
3	60	15	8	160	10	
4	80	32	9	180	5	
5	100	32	10	200	4	

External Vehicle MPE Assessment @173.9925 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4009AR/0dB	60	E	0.95	0.24	0.12
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	1.50	6	120	55	
2	40	4	7	140	45	
3	60	5	8	160	26	
4	80	26	9	180	13	
5	100	56	10	200	8	

External Vehicle MPE Assessment @173.9925 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4009AR/0dB	60	H	0.98	0.13	0.066
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	2.50	6	120	33	
2	40	2.50	7	140	23	
3	60	6	8	160	13	
4	80	15	9	180	5	
5	100	28	10	200	3	

External Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4014AR/3dB	60	E	0.92	0.24	0.12
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	0.50	6	120	36	
2	40	1.50	7	140	47	
3	60	5	8	160	49	
4	80	12	9	180	39	
5	100	20	10	200	32	

External Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Trunk	HAD4014AR/3dB	60	H	0.94	0.199	0.099
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	1	6	120	4.3	
2	40	1.30	7	140	23	
3	60	3	8	160	50	
4	80	6	9	180	60	
5	100	2	10	200	48	

External Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Roof	HAD4007A/0dB	110	E	0.89	0.068	0.034
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	2	6	120	7	
2	40	5.80	7	140	11	
3	60	3	8	160	13	
4	80	1.50	9	180	11	
5	100	3	10	200	10	

External Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Body (mW/cm^2)**	**Pwr. Density (mW/cm^2)**
Roof	HAD4007A/0dB	110	H	0.88	0.056	0.028
Measurement grid						
Test position	**Height (cm)**	**% of control limit**	**Test position**	**Height (cm)**	**% of control limit**	
1	20	1	6	120	4.30	
2	40	1	7	140	6.50	
3	60	2	8	160	10.50	
4	80	4	9	180	11.50	
5	100	4.3	10	200	10.50	

Internal Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4007A/0dB	Highest reading	E	0.89	0.53/0.04	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	125		28		6	
Front seat	7		3		2	

Internal Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4007A/0dB	Highest reading	H	0.88	0.21/0.048	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	37		13		14	
Front seat	8		3.50		3	

Internal Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4008A/0dB	Highest reading	E	0.92	0.397/0.077	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	90		24		5	
Front seat	14		5		4	

Internal Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4008A/0dB	Highest reading	H	0.94	0.197/0.05	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	36		13		10	
Front seat	6		5		4	

Internal Vehicle MPE Assessment @173.9925 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4009AR/0dB	Highest reading	E	0.95	0.40/0.087	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	85		30		5	
Front seat	17		5		4	

Internal Vehicle MPE Assessment @173.9925 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4009AR/0dB	Highest reading	H	0.98	0.19/0.011	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	45		6		7	
Front seat	1		0.80		1.50	

Internal Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4014AR/3dB	Highest reading	E	0.92	0.07/0.042	<= 0.25
Measurement grid						
Test position	**% of control limit Head**	**% of control limit Chest**		**% of control limit Leg**		
Back seat	14	4		3		
Front seat	7.50	2		3		

Internal Vehicle MPE Assessment @161.425 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Trunk	HAD4014AR/3dB	Highest reading	H	0.94	0.035/0.017	<= 0.25
Measurement grid						
Test position	**% of control limit Head**	**% of control limit Chest**		**% of control limit Leg**		
Back seat	5	3		2.50		
Front seat	2.70	2		0.50		

Internal Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Roof	HAD4007A/0dB	Highest reading	E	0.89	0.197/0.037	<= 0.25
Measurement grid						
Test position	**% of control limit Head**	**% of control limit Chest**		**% of control limit Leg**		
Back seat	48	8		3		
Front seat	4	4		3		

Internal Vehicle MPE Assessment @146.625 MHz						
Antenna Location	**Antenna /gain**	**Meas. Distance (cm)**	**E/H Field**	**Calibration Factor**	**Average over Head, Chest, Leg Back/Front seats (mW/cm^2)**	**S.A.R. calculated Back/Front seats (mW/g)**
Roof	HAD4007A/0dB	Highest reading	H	0.88	0.037/0.015	<= 0.25
Measurement grid						
Test position	**% of control limit Head**		**% of control limit Chest**		**% of control limit Leg**	
Back seat	7.70		2		1.50	
Front seat	2.30		1.30		1	

12.0 Conclusion

Although the rated power of this product is 25 watts, the actual measured RF power ranged from 24.0 – 28.0 watts depending upon the tested frequency. As a result, the highest power density results of 0.155 mW/cm^2 presented above will be 0.180 mW/cm^2 when the measured power of 24 watts at 146.625 MHz is scaled to the maximum reported power of 28 watts. The maximum RF power delivered to the antenna connector of this radio will not exceed 28 watts. The maximum RF power is equal to the upper limit of the final test factory transmit power specification.

Note: EQUIVALENT SAR FOR FREQUENCIES OF 100-300 MHz
The final SAR (Specific Absorption Rate) values are evaluated through the following calculation based on measurements completed by MFRL (Motorola Florida Research Lab) on both VHF and UHF high power mobile radios feeding a quarter-wave length monopole antenna, trunk mounted, on a phantom located on the back seat of test vehicle: Reference: "Field Strengths and Specific Absorption Rates in Automotive Environments", by D. McCoy, D. Zakharia, and Q. Balzano, IEEE Trans. Vehicular Tech. Vol. 48 (4): pp. 1287-1303, July, 1999

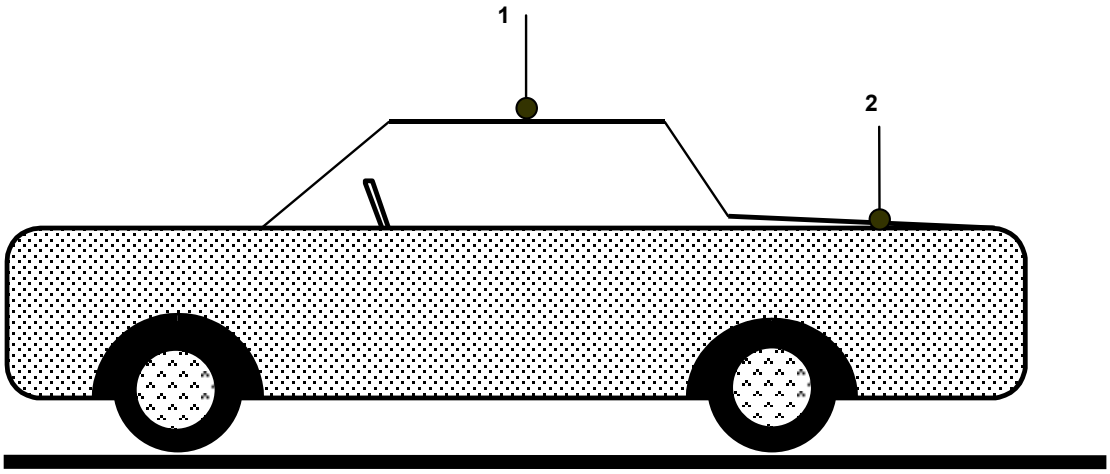
PTT (PUSH-TO-TALK) OPERATION

SAR (mW/g) = ((measured RF power out/130)*2.292)/2 [50% duty cycle]
Formula definitions:
"130" = RF mobile power (W) feeding a quarter-wave length antenna in original research document.
"2.292" = the SAR resulting from that 130 Watt mobile feeding a quarter-wave length antenna in original research document.

The measurement results clearly demonstrate compliance with the FCC Limits Per 47 CFR 2.1091 (b) for General Population/Uncontrolled RF Exposure.

APPENDIX

ANTENNA LOCATION DRAWING



1 - Roof (center)
2 - Trunk (center)