RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

RF Maximum Permissible Exposure (MPE) Report
for
Controlled and Uncontrolled Environments

Harris Corporation
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Model: M7300/M5300 700/800 MHz Mobile Radio

FCC ID: OWDTR-0060-E
IC: 3636B-0051

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These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

Table of Contents

1 MPE Measurements and Applicable Regulations

This test report presents the results of Maximum Permissible Exposure (MPE) measurements performed on the Harris Corporation M7300/M5300, which operates in the 700 MHz and 800 MHz frequency bands. The tests were performed in accordance with TCB training material and the following FCC Rules and Regulations:

- IEEE Std C95.1: 2005: "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz",
- IEEE Std C95.3: 2002: "IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz – 300 GHz",
- FCC OET Bulletin 65, Edition 97-01: "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields",
- FCC Supplement C to OET Bulletin 65, Edition 01-01: "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emission",
- Subpart I, Part 1 of 47 CFR FCC Rules and Regulations, Edition 10-1-09: "Procedures Implementing the National Environmental Policy Act of 1969." Specifically, Paragraph 1.1310: "Radiofrequency Radiation Exposure Limits",
- Subpart J, Part 2 of 47 CFR FCC Rules and Regulations, Edition 10-1-09: "Equipment Authorization Procedures." Specifically, Paragraph 2.1091: "Radiofrequency Radiation Exposure Evaluation: Mobile Devices"
- IC RSS-102 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), Issue 4 March 2010 (updated December 2010)

2 Identification of the EUT

The EUT is a combination of a mobile radio mounted inside a motorcycle mount enclosure and an antenna. This MPE report covers the EUT with the antenna described below.

Manufacturer's Name	Harris Corporation
Manufacturer's Address	221 Jefferson Ridge Parkway Lynchburg, VA 24501, USA
Device Type	Mobile
Model of the EUT	M7300/M5300 700
Serial Number of the Radio	A4011E029005
FCC ID	OWDTR-0060-E
IC	3636B-0051
Operating Frequency Ranges (for the specific configuration in this report)	FCC: 769 – 775 MHz, 799 – 805 MHz, 806 – 824 MHz, and 851 – 869 MHz
RF Max Conducted Power, Rated	30 W (700 MHz band), 35 W (800 MHz band) (note that the maximum power used in the motorcycle mount configuration is 20 W)
TX Duty Cycle	50%
Antenna Tested	AN-225001-003 (700/800 MHz 3 dBd Gain) with AN-125001-006 (Motorcycle Mount Base)
Year of Manufacture	2011

3 Modifications

No modifications were made to the EUT during testing.

4 Test Laboratory

Testing was performed at the Rhein Tech Laboratories (RTL) test facility located at 360 Herndon Parkway, Suite 1400, Herndon, VA, 20170, by RTL personnel. Various regulatory bodies, including the FCC, approved this facility for conducting tests and measurements on a contractual basis.

5 Test Dates

Testing was performed June 21 – 24, 2011.

6 Antenna Information

The following antenna/mount was tested for the MPE investigation.

Description	Gain	Mount Type	Antenna Part #
Dual Band Antenna 700/800 MHz	3 dBd (5.15 dBi)	Motorcycle	AN-225001-003
Motorcycle Mount Base	N/A	Motorcycle	AN-125001-006

7 Test Equipment, Accessories and Test Setup

Test equipment used for the measurements is shown in Table 7-1.

Table 7-1: Test Equipment

RTL Asset #	Manufacturer	Model	Equipment Type	Serial Number	Calibration Due Date
901177	Narda	TYPE-9	Field Probe	N-0050	1/21/14
901183	Narda	EMC 200	Field Meter	AE-0024	1/21/14
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	1/11/13
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	1/20/13

Table 7-2: EUT and Accessories

Part	Manufacturer	Model	Serial Number	RTL Barcode
Mobile Radio	Harris Corporation	M7300/M5300 700/800	A4011E029005	20087
Remote Mount	Harris Corporation	CH721	96002333	20086
Antenna	Harris Corporation	AN-225001-003	N/A	20088
Motorcycle Mount Base	Harris Corporation	AN-125001-006	N/A	N/A

Details of the test setup are as follows:

- The EUT was mounted on a wood table 80 cm tall.
- The antenna was mounted on the Harris motorcycle mount assembly and placed on a table with azimuth indicators.
- The control unit and power supply were located at a distance of at least 1.5 meters from the EUT's antenna to minimize interference.
- The test probe was solidly connected to the radiation meter, and then attached to the plastic mast in front of the EUT's antenna.
- During the MPE measurements, the EUT was set to transmit at maximum RF power with a 50% duty cycle.

8 Justification of Transmitting Mode and Frequency

The EUT is able to transmit with a non-modulated carrier and with various types of modulations at a maximum rated power of 30 W (700 MHz band) and 35 W (800 MHz band); the motorcycle mount application is limited to a maximum power of 20 W. Analog modulation was chosen to represent worst-case for the MPE measurements. The MPE distance measurements were conducted at two representative carrier frequencies since there are two bands of operation for this radio. The frequencies chosen had the highest actual measured conducted powers in each of the bands.

9 MPE Limits for the EUT

Shown below in Tables 9-1 and 9-2 are the MPE limits for uncontrolled and controlled environments respectively. The limits are based on the recommended MPE Guidelines published by the National Council on Radiation Protection and Measurements in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields".

Table 9-1: FCC MPE Limit and Averaging Time in an Uncontrolled Environment

Frequency Range, MHz	Power Density (S), mW/cm^2	Averaging Time, min
300-1500	f/1500, where "f" is the frequency in MHz	30

Table 9-2: FCC MPE Limit and Averaging Time in a Controlled Environment

Frequency Range, MHz	Power Density (S), mW/cm^2	Averaging Time, min
300-1500	f/300, where "f" is the frequency in MHz	6

The MPE limits for the EUT are shown in Table 9-3.

Table 9-3: MPE Limits for the Investigated Frequencies

Frequency (MHz)	MPE Limit (S) Controlled Environment (mW/cm^2)	MPE Limit (S) Uncontrolled Environment (mW/cm^2)
767.0000	2.56	0.51
867.9875	2.89	0.58

10 Calculating the Safe Distance from the EUT's Antenna

Before starting MPE measurements, we calculated the safe distance, R_{safe} using the following formula:

$$\text{Rsafe} = \sqrt{\frac{P\max \cdot Gn \cdot \eta}{4\pi \cdot S}}$$

G_n: antenna gain (numeric)
P_{max}: maximum power input to the antenna (W)
S: power density limit (W/m^2)
η: duty cycle (decimal number), for these measurements $\eta = 0.5$

The cable loss of the RF cable connecting the EUT and the antenna under test decreases the RF power delivered to the antenna and influences the value of the safe distance.

Based on the specification for the cable supplied with this antenna, the cable loss in the frequency range of interest is approximately 0.6 dB; the cable loss is assumed to be zero in the calculations below.

Table 10-1 presents the results of **R_{safe}** calculations:

Table 10-1: Calculated R_{safe}

Antenna Gain (dBi)	R_{safe}, Controlled Environment (cm)	R_{safe}, Uncontrolled Environment (cm)
5.15	42	94

11 Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were fulfilled during the testing:

1. ANSI C63.4 requires the ambient temperature and relative humidity to be within the ranges of 10°C to 40°C and 10% to 90%, respectively. With respect to the narrower ranges recommended for the power meter used for the measurements, ambient conditions shall be in line with the power meter ranges. Actual values of ambient temperature and relative humidity are shown in Section 13 of this test report.

2. Measurement results presented in Section 13, Test Results, unless otherwise noted, show the highest measured level of MPE.

12 Measurement Procedure

1. The test setup was as described in Section 7 of this test report.
2. Polarization of the EUT's antenna was vertical, which is its polarization in actual use.
3. The EUT at the chosen modulation was set to transmit at the chosen frequency at maximum RF power and at 50% duty cycle (50% duty cycle is simulated either by lowering the radio's power by 3 dB, or by using a 3 dB pad on the output of the radio). During preliminary measurements, we set the distance between the power density probe and the investigated EUT's antenna equal to the average calculated R_{safe} (Table 10-1) applicable either for controlled or uncontrolled environments.
4. Power density measurements were taken at different heights of the probe from the ground (0.1 to 2 meters) while rotating versus azimuth (from 0° to 360°) the antenna.
5. The azimuth between the probe and the antenna position corresponding to the highest MPE level was chosen as the "worst case" position for the final measurements.
6. For the final measurements, we adjusted the distance between the test probe and the tested antenna to the real safe distance, R_{real}, such that the measured highest power density in the "worst case" position was the same or slightly less than the test limit.
7. The measurement results of final measurements conducted at the chosen azimuth and different heights of the probe above the ground are shown in Section 13.
8. Average values of power density were calculated for the imaginary whole human body (0.1–2.0 m), for the lower part of the body (0.1–0.9 m), and for the upper part of the body (1.0–2.0 m). The results of calculations are shown in Section 13.

13 Test Results

Ambient conditions during the MPE investigation were as follows:

- Temperature: 23.0°C
- Relative humidity: 34%

The MPE measurement procedure was performed per the description in Section 12. Tables 13-1 through 13-3 demonstrate the test results.

Table 13-1: MPE Data – 767.0000 MHz

Measuring Antenna Height (cm)	General Population/ Uncontrolled Environment	Occupational/ Controlled Environment
	5.15 dBi Antenna, 50 cm (mW/cm^2)	5.15 dBi Antenna, 50 cm (mW/cm^2)
10	0.03	0.03
20	0.02	0.02
30	0.02	0.02
40	0.04	0.04
50	0.03	0.03
60	0.04	0.04
70	0.05	0.05
80	0.07	0.07
90	0.10	0.10
100	**0.47**	**0.47**
110	0.32	0.32
120	0.26	0.26
130	0.30	0.30
140	0.33	0.33
150	0.22	0.22
160	0.08	0.08
170	0.03	0.03
180	0.02	0.02
190	0.00	0.00
200	0.00	0.00

Table 13-2: MPE Data – 867.9875 MHz

Measuring Antenna Height (cm)	General Population/ Uncontrolled Environment	Occupational/ Controlled Environment
	5.15 dBi Antenna, 50 cm (mW/cm^2)	5.15 dBi Antenna, 50 cm (mW/cm^2)
10	0.05	0.05
20	0.03	0.03
30	0.06	0.06
40	0.06	0.06
50	0.08	0.08
60	0.08	0.08
70	0.12	0.12
80	0.16	0.16
90	0.31	0.31
100	**0.55**	**0.55**
110	0.46	0.46
120	0.35	0.35
130	0.28	0.28
140	0.26	0.26
150	0.17	0.17
160	0.07	0.07
170	0.02	0.02
180	0.02	0.02
190	0.00	0.00
200	0.00	0.00

Table 13-3: MPE for Body Parts (Worst-Case)

Part of the body / averaging points	General Population/ Uncontrolled Environment	Occupational/ Controlled Environment
	5.15 dBi Antenna, 50 cm (mW/cm^2)	5.15 dBi Antenna, 50 cm (mW/cm^2)
Whole body (0.1 m to 2.0 m)	0.16	0.16
Lower body (0.1 m to 0.9 m)	0.11	0.11
Upper body (1.0 m to 2.0 m)	0.20	0.20

14 Conclusion

1. The MPE measurements for controlled and uncontrolled environments shown in this report were conducted per the applicable FCC Rules, Regulations and Guidance, and determined the minimum safe distances between a user and the EUT antenna.

2. As is shown in Section 13, the measured MPE are below the maximum allowed limits.

3. The User Manual shall include RF radiation safety warnings and the following table:

Antenna	Safe Distance, R_{safe}, (cm)	
	Uncontrolled Environment	Controlled Environment
AN-225001-003	50	50