



Engineering Solutions & Electromagnetic Compatibility Services

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

**L3Harris Corporation
221 Jefferson Ridge Parkway
Lynchburg, VA 24501**

Model: XL-85M 7/800 MHz Land Mobile Radio

**FCC ID: OWDTR-0170-E
IC: 3636B-0170**

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This report replaces DRAFT R0.5.*

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1 MPE Measurements and Applicable Regulations

This test report presents the results of Maximum Permissible Exposure (MPE) measurements performed on the L3Harris Corporation XL-85M Mobile Radio, which operates in the 700 MHz and 800 MHz frequency bands, which were tested. The tests were performed in accordance with TCB training material and the following FCC Rules and Regulations and Industry Canada Radio Standard Specifications:

- IEEE Std C95.1: 2019: "IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz – 300 GHz",
- IEEE Std C95.3: 2021: "IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic, and Electromagnetic Fields with Respect to Human Exposure to Such Fields, 0 Hz – 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 2-15-24: "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 2-15-24: "Equipment Authorization Procedures." Specifically, Paragraph 2.1091: "Radiofrequency Radiation Exposure Evaluation: Mobile Devices",
- RSS-102, Issue 6: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

2 Modifications

No modifications were made to the EUT during testing.

3 Test Laboratory

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

CAB ID: US0079

4 Test Dates

Testing was performed February 25 – 27, 2024.

5 Antenna Information

The following antenna/mounts were tested for the MPE investigation.

Description	Gain (dBi)	Antenna Part #
Antenna, Element, 700/800	5.15	AN-225001-001
Antenna, Element, 800/900	7.15	14050-6611-01
Antenna, Yagi, 700 MHz	12.15	AN-025137-007
Antenna, Yagi, 800 MHz	12.15	AN-025137-008

6 Test Equipment, Accessories and Test Setup

Test equipment used for the measurements is shown in Table 6-1.

Table 6-1: Test Equipment

RTL Asset	Manufacturer	Model	Equipment Type	Serial Number	Calibration Due Date
901676	ETS Lindgren	HI-6053	Electric Field Probe	00200468	07/26/2025
901355	JFW Industries	50FH-003-300	300 W Attenuator	N/A	03/23/2024

Table 6-2: EUT and Accessories

Part	Manufacturer	Model/ HVIN	Serial Number	FCC ID	RTL Bar Code
Radio	L3Harris Corporation	XL-85M/ XLM-85M-7/8	EVM2b No. 04	OWDTR-0170-E	24399
Microphone	L3Harris Corporation	14050-6010-01 Rev C	AA49059	N/A	24401

Details of the test setup are as follows:

- The EUT was mounted on a Styrofoam table 80 cm tall.
- The antenna was mounted on a metal plate (roof mount only) with azimuth indicators and placed in the middle of a separate table.
- 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.

7 Justification of Transmitting Mode and Frequency

The EUT can transmit with a non-modulated carrier and with various types of modulations at a maximum rated power of 30 W in the 700 MHz band and 35 W in the 800 MHz band. Power was adjusted by 50% as a PTT radio, then increased by 20% per FCC Part 90.205(s) to allow for manufacturing tolerances. Analog modulation was chosen to represent the worst-case for the MPE measurements. The MPE distance measurements were conducted at two representative carrier frequencies since this radio has two bands of operation.

8 MPE Limits for the EUT

The FCC and ISCED MPE limits for uncontrolled and controlled environments are shown in the following tables. 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 8-1: 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 8-2: 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

Table 8-3: ISED MPE Limit and Averaging Time in an Uncontrolled Environment

Frequency range (MHz)	Electric field (V _{RMS} /m)	Magnetic field (A _{RMS} /m)	Power density (W/m ²)	Reference period (minutes)
10-20	27.46	0.0728	2	6
20-48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000 / f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

Note: f is frequency in MHz.

Table 8-8-4: ISED MPE Limit and Averaging Time in a Controlled Environment

Frequency range (MHz)	Electric field (V _{RMS} /m)	Magnetic field (A _{RMS} /m)	Power density (W/m ²)	Reference period (minutes)
10-20	61.4	0.163	10	6
20-48	$129.8 / f^{0.25}$	$0.3444 / f^{0.25}$	$44.72 / f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	$15.60 f^{0.25}$	$0.04138 f^{0.25}$	$0.6455 f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	$616000 / f^{1.2}$
150000-300000	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000 / f^{1.2}$

Note: f is frequency in MHz.

The MPE limits for the EUT are shown in Table 8-5.

Table 8-5: MPE Limits for the Investigated Frequencies

Transmit Frequencies (MHz)	Uncontrolled Exposure		Controlled Exposure	
	FCC Limit (mW/cm ²)	ISED Limit (mW/cm ²)	FCC Limit (mW/cm ²)	ISED Limit (mW/cm ²)
763.0125	0.51	0.24	2.5	1.78
806.0125	0.54	0.25	2.7	1.8

9 Calculating the Safe Distance from the EUT's Antenna

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

$$R_{\text{safe}} = \sqrt{\frac{P_{\text{max}} \cdot G_n \cdot \eta}{4\pi \cdot S}}$$

G_n : antenna gain (numeric)

P_{max} : maximum power input to the antenna (mW)

S : power density limit (mW/m²) respectively

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 these antennas, 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.

The calculated safe distances serve as a starting point for the MPE measurements, though it is acknowledged that the measured safe distances will be smaller.

Tables 9-1 and 9-2 present the results of R_{safe} calculations:

Table 9-1: Calculated R_{safe}

**Calculated Minimum Safe Distance from LMR Antenna
(Based on Maximum Gain of Non-Yagi/Non-Log Periodic Antennas)**

Antenna Gain (dBi)	Transmit Frequencies (MHz)	Uncontrolled Exposure		Controlled Exposure	
		United States (cm)	Canada (cm)	United States (cm)	Canada (cm)
5.15	763.0125	88	128	40	47
7.15	806.0125	116	170	52	63

Table 9-2: Calculated R_{safe}

**Calculated Minimum Safe Distance from LMR Antenna
(Based on the Maximum Gain of Yagi/Log Periodic Antennas)
Mobile Command Center Applications**

Antenna Gain (dBi)	Transmit Frequencies (MHz)	Uncontrolled Exposure		Controlled Exposure	
		United States (cm)	Canada (cm)	United States (cm)	Canada (cm)
12.15	763.0125	196	286	89	105
12.15	806.0125	206	302	92	113

10 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. Concerning the narrower ranges recommended for the power meter used for the measurements, ambient conditions shall align with the power meter ranges. Actual ambient temperature and relative humidity values are shown in Section 12 of this test report.
2. Unless otherwise noted, Measurement results presented in Section 13, Test Results show the highest measured level of MPE.

11 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 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) and $X 1.20$ (*per Part 90.205(s)*). 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 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, the distance was adjusted 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 12.
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 the calculations are shown in Section 12.

12 Test Results

Ambient conditions during the MPE investigation were as follows:

- Temperature: 23°C
- Relative humidity: 17%

The MPE measurement procedure was performed per the description in Section 11. Tables 12-1 through 12-4 provide the test results.

Table 12-1: MPE Data - General Population/Uncontrolled Environment

Measuring Antenna Height (cm)	FCC	FCC	FCC	FCC	ISED	ISED	ISED	ISED
	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi
	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz
	55 cm (mW/cm ²)	77 cm (mW/cm ²)	288 cm (mW/cm ²)	247 cm (mW/cm ²)	126 cm (mW/cm ²)	96 cm (mW/cm ²)	433 cm (mW/cm ²)	412 cm (mW/cm ²)
10	0.0403	0.0361	0.1277	0.2112	0.0228	0.0460	0.0297	0.0490
20	0.0137	0.0081	0.2156	0.3311	0.0194	0.0367	0.0561	0.0832
30	0.0393	0.0399	0.4274	0.5319	0.0053	0.0356	0.1173	0.1675
40	0.0439	0.0401	0.4695	0.4415	0.0189	0.0377	0.1573	0.2215
50	0.0608	0.0407	0.3618	0.2142	0.0692	0.0417	0.2400	0.2021
60	0.1030	0.0989	0.1474	0.0455	0.0623	0.0465	0.2161	0.1991
70	0.1376	0.1262	0.0320	0.0628	0.0895	0.0907	0.1884	0.1324
80	0.2917	0.1392	0.0389	0.2102	0.1786	0.0882	0.1127	0.0565
90	0.4344	0.2747	0.1583	0.3532	0.2218	0.1287	0.0483	0.0106
100	0.5042	0.4527	0.3025	0.3698	0.1887	0.0914	0.0129	0.0067
110	0.4927	0.5286	0.3818	0.3806	0.0888	0.1145	0.0063	0.0410
120	0.3212	0.4310	0.3551	0.1226	0.0575	0.1346	0.0332	0.0947
130	0.3754	0.3621	0.2559	0.0482	0.0465	0.1741	0.0903	0.1367
140	0.4259	0.2679	0.1346	0.0652	0.0293	0.2294	0.1413	0.1613
150	0.2557	0.1741	0.0580	0.1137	0.0167	0.1671	0.1850	0.1584
160	0.1207	0.1304	0.0399	0.1579	0.0254	0.1310	0.1828	0.1343
170	0.0446	0.0838	0.0694	0.1948	0.0544	0.0981	0.1559	0.0880
180	0.0308	0.0723	0.1227	0.1828	0.0678	0.0711	0.1088	0.0432
190	0.0358	0.0436	0.1500	0.1499	0.0736	0.0636	0.0771	0.0147
200	0.0421	0.0546	0.1653	0.1210	0.0648	0.0419	0.0488	0.0096
Limit	0.51	0.54	0.51	0.54	0.24	0.25	0.24	0.25

Table 12-2 MPE Data Occupational/Controlled Environment

Measuring Antenna Height (cm)	FCC	FCC	FCC	FCC	ISED	ISED	ISED	ISED
	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi
	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz
	17 cm (mW/cm ²)	32 cm (mW/cm ²)	52 cm (mW/cm ²)	32 cm (mW/cm ²)	25 cm (mW/cm ²)	39 cm (mW/cm ²)	66 cm (mW/cm ²)	49 cm (mW/cm ²)
10	0.0452	0.0545	0.2255	0.1228	0.0431	0.0527	0.4297	0.2689
20	0.0304	0.0219	0.2378	0.1403	0.0238	0.0258	0.4398	0.2838
30	0.0512	0.0970	0.2868	0.0978	0.0843	0.0692	0.3122	0.1888
40	0.0204	0.0369	0.5082	0.4197	0.0381	0.0554	0.5286	0.5217
50	0.0423	0.0787	1.0777	0.8206	0.0599	0.0918	0.9928	0.9115
60	0.0416	0.1010	1.4805	0.9581	0.0688	0.1381	1.1985	0.8831
70	0.0413	0.3422	1.5915	1.9902	0.1349	0.3179	1.3116	1.2798
80	0.1633	1.4833	1.9110	2.4481	0.3043	0.7870	1.4318	1.8128
90	2.4773	2.5903	2.5009	2.3668	1.6283	1.7775	1.6752	1.6647
100	1.2636	2.1281	2.2794	2.6134	0.998	1.8317	1.7753	1.4513
110	1.1744	1.2435	1.7206	2.5966	0.9511	1.1911	1.5216	1.4443
120	1.0652	0.7311	1.3390	1.9395	1.0272	0.7278	1.1436	1.3766
130	1.4885	0.3172	1.0963	1.1603	1.0206	0.4465	0.8871	1.1141
140	1.0766	0.1867	0.8268	0.6353	0.5635	0.3203	0.7090	0.7948
150	0.3993	0.1440	0.6139	0.3133	0.1599	0.1952	0.5835	0.5075
160	0.2991	0.0953	0.3567	0.1587	0.1125	0.0901	0.4308	0.2807
170	0.1596	0.0488	0.2006	0.0982	0.1182	0.0801	0.3322	0.1482
180	0.0949	0.0570	0.0837	0.0646	0.1004	0.0581	0.2168	0.0839
190	0.0527	0.0536	0.0376	0.0448	0.0798	0.0555	0.1184	0.0504
200	0.0430	0.0491	0.0118	0.0392	0.0605	0.0618	0.0632	0.0370
Limit	2.54	2.69	2.54	2.7	1.78	1.8317	1.78	1.83

Table 12-3 MPE for Body Parts – ISED

Part of the Body/ Averaging Points	General Population/ Uncontrolled Environment				Occupational/ Controlled Environment			
	ISED	ISED	ISED	ISED	ISED	ISED	ISED	ISED
	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi
	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz
	1.26 m (mW/cm ²)	96 cm (mW/cm ²)	433 cm (mW/cm ²)	412 cm (mW/cm ²)	25 cm (mW/cm ²)	39 cm (mW/cm ²)	66 cm (mW/cm ²)	49 cm (mW/cm ²)
Whole body (0.1 m to 2.0 m)	0.07	0.09	0.11	0.10	0.38	0.42	0.81	0.76
Lower body (0.1 m to 0.9 m)	0.08	0.06	0.13	0.12	0.27	0.37	0.92	0.87
Upper body (1.0 m to 2.0 m)	0.06	0.12	0.09	0.08	0.47	0.46	0.71	0.66

Table 12-4 MPE for Body Parts - FCC

Part of the Body/ Averaging Points	General Population/ Uncontrolled Environment				Occupational/ Controlled Environmental			
	FCC	FCC	FCC	FCC	FCC	FCC	FCC	FCC
	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi	5.15 dBi	7.15 dBi	12.15 dBi	12.15 dBi
	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz	763.0125 MHz	806.0125 MHz
	55 cm (mW/cm ²)	77 cm (mW/cm ²)	288 cm (mW/cm ²)	247 cm (mW/cm ²)	17 cm (mW/cm ²)	32 cm (mW/cm ²)	52 cm (mW/cm ²)	32 cm (mW/cm ²)
Whole Body (0.1 m to 2.0 m)	0.19	0.17	0.20	0.22	0.50	0.49	0.92	0.95
Lower Body (0.1 m to 0.9 m)	0.32	0.53	1.09	1.04	0.32	0.53	1.09	1.04
Upper Body (1.0 m to 2.0 m)	0.65	0.46	0.78	0.88	0.65	0.46	0.78	0.88

13 Conclusion

1. The MPE measurements for Controlled and Uncontrolled environments shown in this report were conducted per the applicable FCC/ISED Rules, Regulations, and Guidance and determined the minimum safe distances between a user and the EUT antennas with different gains.
2. As shown in Section 12, the measured MPE is below the maximum allowed limits.
3. The User Manual shall include RF radiation safety warnings and statements with the minimum separation distance between the user and the antennas per the following the following table:

Antenna	Gain (dBi)	Part #	Band (MHz)	Uncontrolled Exposure		Controlled Exposure	
				United States (cm)	Canada (cm)	United States (cm)	Canada (cm)
Antenna, Element, 700/800 MHz, 3dB	5.15	AN-225001-001	700	88	128	40	47
Antenna, Element, 800/900, 5dB	7.15	14050-6611-01	800	116	170	52	63
Antenna, Yagi, 700 MHz	12.15	AN-025137-007	700	196	286	89	105
Antenna, Yagi, 800 MHz	12.15	AN-025137-008	800	206	302	92	113