

MPE EVALUATION REPORT

FOR THE

MOBILE STATION DATA RADIO TRANSCEIVER, M09150-12

**FCC OET BULLETIN 65, EDITION 97-01, ANSI / IEEE C95.1-1992,
AND ANSI / IEEE C95.3-1992**

RF EXPOSURE COMPLIANCE

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PREPARED FOR:

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ADMINISTRATIVE INFORMATION

PURPOSE OF TEST:

To demonstrate the compliance of the Mobile Station Data Radio Transceiver, M09150-12 with the RF Exposure Requirements for mobile devices.

REPRESENTATIVE:

Jim Lukes

SUMMARY OF RESULTS

VEHICLE MOUNTED ANTENNA

For Occupational / Controlled Exposure, the Maximum Permissible Exposure (MPE) limit for the operating frequency range of 163-173 MHz is 61.4 V/m. For General Population / Uncontrolled Exposure, the Maximum Permissible Exposure (MPE) limit for the operating frequency range of 163-173 MHz is 27.5 V/m. The data in this report demonstrates that this device complies with the Maximum Permissible Exposure (MPE) requirements set forth in 47 CFR §2.1091, §1.1310, and OET Bulletin 65, Edition 97-01 for Occupational / Controlled Exposure environment at a minimum distance of 10 cm through a ground plane from the vehicle mounted antenna (operator requirement), and for General Population / Uncontrolled Exposure environment at a minimum distance of 50 cm laterally from the vehicle mounted antenna (bystander requirement).

APPROVALS

Steve Behm, Director of Engineering Services

QUALITY ASSURANCE:



Joyce Walker, Quality Assurance Administrative
Manager

TEST PERSONNEL:



Randy Clark, EMC Engineer

EQUIPMENT UNDER TEST

EUT

Manuf: IP Mobilenet
Model: M19150G12
Serial: 03402483
FCC ID: MI7-M1617-12

DC Power Supply

Manuf: Samlex America
Model: SEC1212
Serial: 03051-0F03-0330
FCC ID: DoC

Vehicle Mounted Antenna

Manuf: Antennex
Model: 0dBi Whip
Serial: NA
FCC ID: NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Host Laptop

Manuf: Panasonic
Model: CF-27
Serial: CF-27EB6GCEM
FCC ID: DoC

Laptop Power Supply

Manuf: Panasonic
Model: CF-AA
Serial: 1639A
FCC ID: DoC

Preamp

Manuf: Mini-Circuits
Model: ZHL-42-SMA
Serial: D030204-#19
FCC ID: DoC

Signal Generator

Manuf: HP
Model: E4437B
Serial: MY41310476
FCC ID: DoC

SPECIFICATIONS AND REQUIREMENTS

The following summarizes the specifications and requirements for Maximum Permissible Exposure for mobile devices applied during RF exposure evaluation.

Excerpt from 47 CFR §1.1310 Radio Frequency radiation exposure limits

Table 1. - Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (V/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1	6
300-1500	---	---	f/300	6
1500- 100,000	---	---	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (V/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500- 100,000	---	---	1	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

SUMMARY OF RF EXPOSURE CONDITIONS

Operating Frequency Range (MHz)	163-173 MHz
Rated Power Output (Watts)	60 (conducted)

MPE Limit(Uncontrolled) =	61.4 V/m
MPE Limit(controlled) =	27.5 V/m

Operator Exposure Condition

X	Occupational / Controlled Exposure
	General Population / Uncontrolled Exposure

Bystander Exposure Condition

	Occupational / Controlled Exposure
X	General Population / Uncontrolled Exposure

Device and Antenna Operating Configuration

Vehicle Mounted Antenna

Antenna used for test is a magnetically mounted vehicle antenna with gain of 0dBi in the frequency range of 163-173 MHz. Transmitter is connected to support laptop for control over transmitter operation.

REPORT OF MEASUREMENTS

The following tables show the measurements performed to determine conformity with the applicable limits for RF exposure. Measurements are performed a representative frequency with the operating band.

Following the intended use of the equipment under normal installation conditions the duty cycle of this equipment is expected to be less than 1%. For the purposes of evaluating the worst case of RF Exposure, a higher duty cycle is imposed on the equipment. Since this equipment is similar to VHF keyed radio systems, the maximum duty cycle used for RF Exposure Evaluation is 50%. Only the worst case of all measurements are reported. All other recorded measurements were below those shown in the tables that follow.

Frequency investigated: 163 MHz

Operator Exposure Measurements

Measurement of the operator exposure condition was made directly under the ground plane at the location of the antenna at a separation distance of 10cm beneath the base of the transmitting antenna (evaluated using 100% duty cycle)

d (m)	V/m	Limit	Result
0.1	5	61.4	Pass

Bystander Exposure Measurements

Measurement of the bystander exposure condition was made along a radial 90° separated from the direction of the antenna (indicated by the coaxial cable entry point to the base of the transmit antenna).

Measurements on point grid in V/m including 50% duty cycle time averaging.

	A	B	C	Height
1	20.80	20.10	20.60	1.75
2	39.00	41.30	38.00	1.00
3	10.70	9.60	10.30	0.50

The spatially averaged field is shown below at the stated measurement distance.

X (m)	V/m	Limit	Result
0.5	26.3406	27.5	Pass

Evaluation was performed at the following measurement distances: 0.50m, 0.60m and 0.70m. The maximum power density measurements were obtained at 0.50m representing the edge of the conductive plane simulating vehicular installation.

TEST CONFIGURATION

The EUT antenna is placed in a configuration typical of normal installation. Where antenna mounting is required, non-conductive materials are used for support structures. In the special case of magnetically mounted vehicle antennas, a reference ground plane is used to simulate actual installation. In order to limit external interference effects, the test is performed in a semi-anechoic chamber. The EUT equipment is setup in a configuration representative of normal use. Support equipment for the measurement instruments are located outside of the chamber.

TEST PROCEDURE

The method for performing spatially averaged measurements is as follows:

1. Determine the location of the maximum field.
2. Establish around the location of the maximum field a grid of points within approximately 0.35 m (width) x 1.25 m (height) surface area, at a reasonable distance (e.g., 0.5 m) above the floor or ground and perpendicular to it. These points should be uniformly spaced within the grid with the point of the maximum field included.
3. Measure the field strength in all points of the grid.
4. Calculate the average field.

To determine the location of the maximum field, the detector is moved throughout the RF field generated by the transmit antenna. The detector is positioned at a minimum of 12 radials and at varying distances from the antenna along each radial. The area of maximum RF energy determined during preliminary investigation shall be used for the remainder of the tests. In the case where a transmitter may have multiple frequency bands, the preliminary investigation shall be repeated for each band.

To determine the spatially averaged value, local values including the maximum value are measured over a surface area of 0.35 m (width) x 1.25 m (height) perpendicular to the ground beginning at 0.50m from the ground reference plane. Preliminary investigation is performed in order to determine the orientation and height which yields the highest power density or field strength measurements. The height of the center row of local points is determined during preliminary investigation and corresponds to a location at which a local maximum exists. Where the field is reasonably uniform (within +20%), e.g., in the far-field, measurements will suffice in one location, representative of the space that is occupied by a person. Where the field is not uniform, measurements are made at a series of locations. The measurement points are uniformly spaced within the sampling area. Local values are measured at nine points within the sampling grid.

Since the applicable limits exist in several different measurement units, the following outlines the most common calculations used for determining the spatially averaged field.

Case 1: Where limits are applied in electric field strength (V/m), the spatially averaged electric field strength along a grid of n points is calculated using:

$$E = \left[\frac{1}{n} \sum_{i=1}^n E_i^2 \right]^{\frac{1}{2}}$$

Case 2: Where limits are applied in units of power density (mW/cm^2), assuming measurements are made in the far field, where the E and H vectors are mutually orthogonal, power density is first calculated using:

$$S = \frac{E^2}{3770}$$

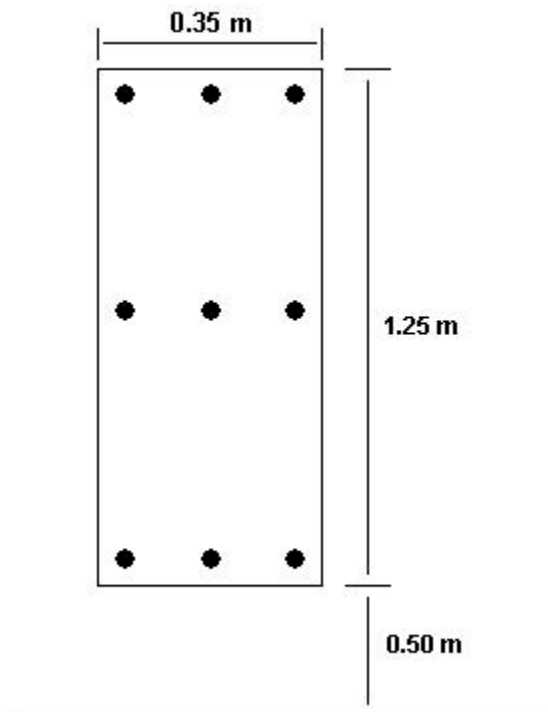
And the spatially averaged power density along a grid of n points is calculated using:

$$S = \frac{1}{n} \sum_{i=1}^n S_i$$

The following diagram is an example of the grid used to perform local measurements for RF exposure evaluation over a whole-body spatial average.

**Example Grid used for
RF Exposure Measurements**

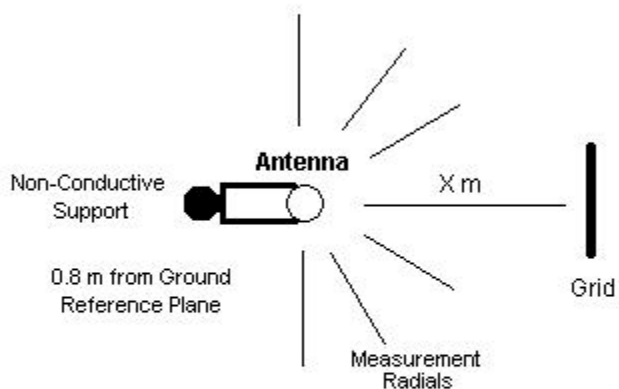
- Represents local points used for whole-body spatial averaging



The following diagram is an example of the setup used for most tests, excluding magnetically mounted vehicle antennas. The letter X represents the test distance used for RF exposure measurements. The distance X is measured from the phase center of the transmitting antenna to the volumetric center of the measurement instrument.

Setup Used for RF Evaluation Measurements

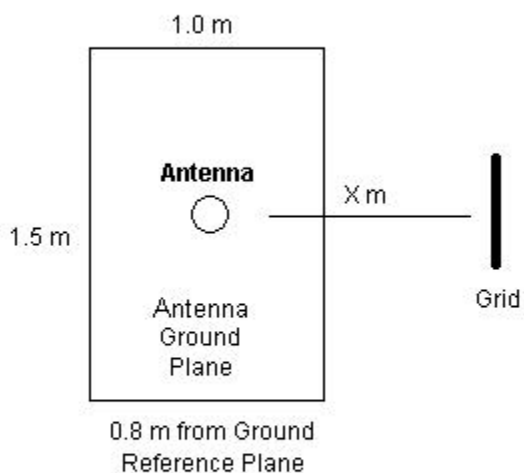
(excluding magnetically mounted vehicle antennas)



Top View

The following diagram is an example of the setup used for vehicle-mounted antennas. In the case where vehicle glass mounted antennas are used, this setup shall not apply. The letter X represents the test distance used for RF exposure measurements. The distance X is measured from the phase center of the transmitting antenna to the volumetric center of the measurement instrument. In order to more accurately simulate normal installation, the antenna ground plane is not bonded to the ground reference plane. The transmitting antenna is placed in the center of the antenna ground plane.

Setup Used for Vehicle-Mounted Antennas



Top View

REFERENCE DOCUMENTS

ANSI IEEE C95.1-1991. IEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz.

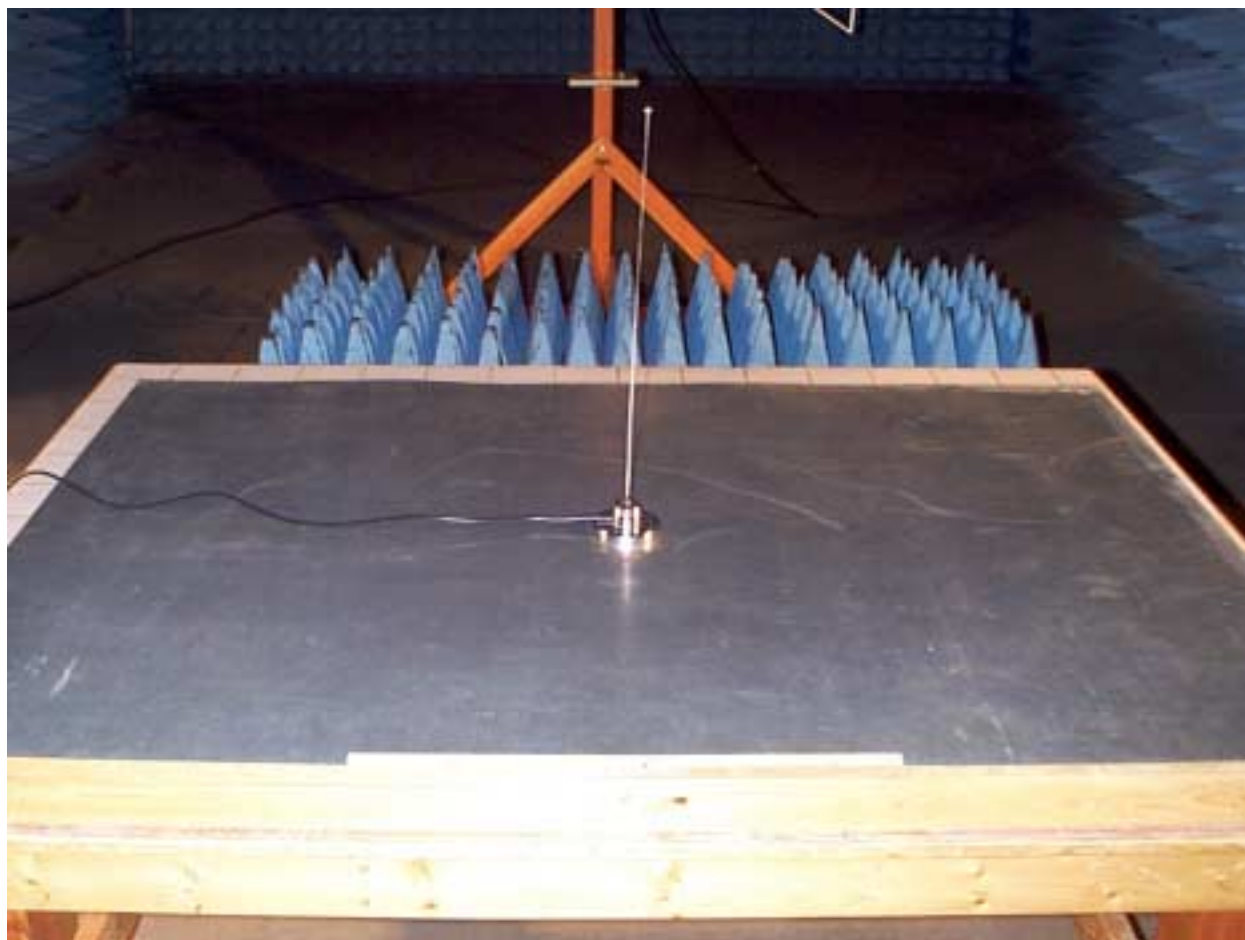
ANSI IEEE C95.3-1991. IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave

FCC OET Bulletin 65 Supplement C. Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

Health Canada Safety Code 6. Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz.

APPENDIX A

PHOTOGRAPH OF THE TEST SETUP USED



APPENDIX B

TEST EQUIPMENT LIST

<i>Description</i>	<i>Asset #</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Cal Date</i>	<i>Cal Due</i>
Field Monitor	02007	AR	FM1000	11757	9/26/02	9/25/04
Field Probe	02024	AR	FP1000	11836	9/26/02	9/25/04
Power Sensor	00774	HP	8481A	2349A41124	8/12/02	8/11/04
Power Meter	00613	HP	435B	2702A16632	8/12/02	8/11/04
Spectrum Analyzer, 9kHz to 26.5 GHz	02111	HP	8593EM	3624A00159	5/12/03	5/11/05