ENGINEERING REPORT

SUBJECT: Maximum Permissible Exposure Evaluation with Respect to FCC Rule Part 47CFR §2.1091

PRODUCT: OEM Radio-Modem with 3dB Larsen Vehicle-Top Mounting Antenna

FCC ID #: L6AR900M-2-O

MODEL: R900M-2-O Radio-Modem and NMO 3E 900B SMA Antenna

CLIENT: Research in Motion Limited

PROJECT #: RIMB-R900M2O Larsen NMO3E900B-3109

ADDRESS: 295 Phillip Street
Waterloo, Ontario
Canada N2L 3W8

PREPARED BY: *APREL Laboratories,*
Regulatory Compliance Division

APPROVED BY: Paul G Cardinal DATE: 12 Nov 98
Dr. Paul G. Cardinal
Director, Laboratory Operations

RELEASED BY: DATE: Nov 12/98
Dr. Jacek J. Wojcik, P.Eng.

REGISTERED PROFESSIONAL ENGINEER
J. J. Wojcik
PROVINCE OF ONTARIO

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FCC ID: **L6AR900M-2-O**
Client : Research in Motion Limited
Equipment : OEM Radio-Modem attached to a Larsen Vehicle-Top Mounting Antenna
Part No. : R900M-2-O Radio-Modem and NMO 3E 900B SMA Antenna
Serial No. : Prototype

ENGINEERING SUMMARY

This report contains the results of the maximum permissible exposure (MPE) evaluation performed on the equipment under test (EUT) which was comprised of a Research in Motion R900M-2-O OEM radio-modem, an IBM 760ED ThinkPad laptop, and a Larsen NMO 3E 900B antenna. The tests were carried out in accordance with the applicable requirements of FCC rules found in 47CFR §2.1091 and the standards ANSI/IEEE C95.1-1992 and C95.3-1992.

The methodology and results for the test are described in the appropriate section of this report.

The EUT will not exceed the MPE requirements for 896 - 901MHz band, provided that the antenna is installed at least 25cm from any edge of a vehicle rooftop. This can be accomplished by putting a prominent warning in the equipment manual as to how the antenna should be installed.

TABLE OF CONTENTS

SECTION	TITLE	PAGE

ACRONYMS

EUT	Equipment Under Test
FCC	Federal Communications Commission
MPE	Maximum Permissible Exposure
N/A	Not Applicable
NTS	Not To Scale
OATS	Open Area Test Site
OEM	Original Equipment Manufacturer
QA	Quality Assurance
RIM	Research in Motion

1.0 INTRODUCTION

1.1 General

This report describes the Maximum Permissible Exposure (MPE) tests for a Research in Motion R900M-2-O OEM radio-modem, an IBM 760ED ThinkPad laptop, and a Larsen NMO 3E 900B vehicle-top mounted 3dB antenna, the combination hereinafter called the EUT (Equipment Under Test).

1.2 Scope

MPE evaluation was performed on the EUT in accordance with the requirements of the FCC rules for RF compliance found in 47CFR §2.1091 and the standard ANSI/IEEE C95.3-1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave. This Engineering Report contains the following:

1.2.1 Methodology as to how the tests were performed.
1.2.2 Test results and analysis.
1.2.3 Identification of the test equipment used for the testing.
1.2.4 Test set-up diagram.

1.3 Schedule

The MPE tests were completed on November 11, 1998.

2.0 APPLICABLE DOCUMENTS

FCC Rule Part 47CFR §2.1091

ANSI/IEEE C95.1-1992, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz.

ANSI/IEEE C95.3-1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

OET Bulletin 65 (Edition 97-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.

3.0 TEST SAMPLE

The MPE tests described in this procedure was performed on:

- Research in Motion Model R900M-2-O OEM radio-modem (see specification sheets in Appendix A),
- IBM ThinkPad Laptop Model 760ED, FCC ID ANOGCF2704AT, Type 9546-U9A, S/N 78-ACPW2 97/02.
- Larson Model NMO 3E 900 B SMA 3dB Superflex enclosed coil vehicle-mounted antenna (see specification sheets in Appendix B)

4.0 GENERAL REQUIREMENTS

4.1 Location of Test Facilities

The tests were performed by APREL Laboratories at APREL's test facility located in Nepean, Ontario, Canada. The laboratory operates a 3 and 10 meter Open Area Test Site (OATS) measurement facility. The test site is calibrated to ANSI C63.4-1992.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria in ANSI C63.4-1992 is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations. APREL's registration number is 31070/SIT(1300F2).

APREL is accredited by Standard Council of Canada, under the PALCAN program (ISO Guide 25). All equipment used is calibrated or verified in accordance with the intent of AQAP-6/MIL-STD-45662. APREL is also accredited by Industry Canada (formerly DOC) and recognized by the Federal Communications Commission (FCC).

4.2 Personnel

Radiation Hazard technical staff member, Heike Wuenschmann, carried out all MPE tests.

4.3 Failure Criteria

The equipment under test was considered to have failed if any of the following occurred:

When the MPE limits exceeded those permitted by appropriate limits defined by the FCC.

4.4 Power Source Required

The following nominal DC Power was maintained during the test:

Voltage: 12 VDC.

4.5 Tolerance

The following tolerances on test conditions, exclusive of equipment accuracy, were maintained:

Voltage: ± 10%.

5.0 TEST INSTRUMENTATION & CALIBRATION

5.1 General

APREL Laboratories, located in Nepean, Ontario is equipped with the necessary instrumentation to ensure accurate measurement of all data recorded during the tests outlined in this document. To ensure continued accuracy, each instrument is re-calibrated at intervals established by APREL and based on standards traceable to the National and International Standards. Accuracy surveillance is a function of APREL Quality Assurance.

5.2 MPE Test Equipment Required

The test equipment required to perform the MPE testing was selected from the equipment available at APREL.

5.3 Calibration Requirements

All test equipment instrumentation required for MPE qualification testing was calibrated and controlled.

6.0 ELECTRICAL/MECHANICAL DESCRIPTION

The MPE Test Program was performed on one OEM radio-modem attached to an IBM ThinkPad laptop computer and a Larsen vehicle-top mounting antenna, the combination hereinafter called the EUT. The test sample consisted of the components supplied by the customer and described below.

6.1 Test Unit Description

The RIM 2 watt OEM radio-modem transceiver equipped with a Larsen 3dB Superflex enclosed coil antenna and controlled by an IBM ThinkPad laptop computer, consisted of the following components:

Part Number	Description
R900M-2-O	RIM OEM radio-modem
01585002	RIM interface board (ITB)
SRB01519/9743D59235	RIM execution lock
760ED ThinkPad	IBM laptop computer
NMO 3E 900 B SMA	Larsen 3dB Superflex enclosed coil antenna
0820-0004	6 Gates 2V 25AH BC DC cells

6.2 MPE Test Setup

a) The EUT antenna shall be installed in the centre of a ground plane simulating the rooftop of a vehicle. The other components shall be located underneath this ground plane to simulate operation from inside of the vehicle (see Figures 6.2.1 and 6.2.2).

b) The vehicle simulator shall be positioned on the turntable in the OATS in such a way that the antenna will be located on the centre of rotation.

c) The EUT shall be connected to the 12 VDC power supply.

d) For the selection and placement of the measuring probe, the requirements of ANSI/IEEE C95.3-1992 shall be met.

Figure 6.2.1. Photograph of the Setup.

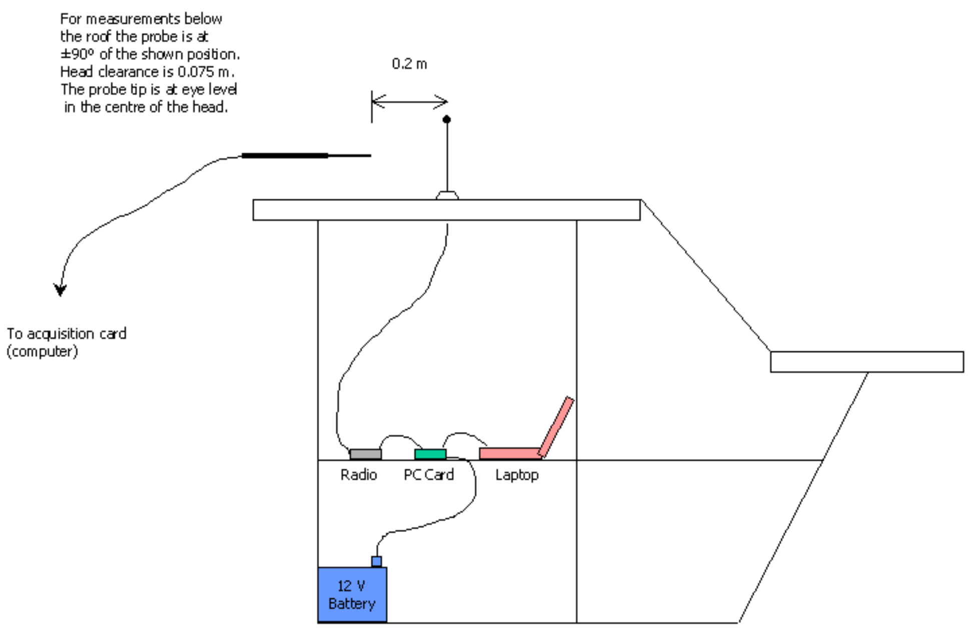


Figure 6.2.2. Elevation View of the Setup.

7.0 MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

7.1 Purpose

This test method is used to verify that the EUT meets the MPE requirements as defined in the criteria for general population/uncontrolled exposure when operating at maximum power levels and in all operating modes.

7.2 Test Equipment

Description	Manufacturer	Model No.
E-Field Probe	Narda	8021B

7.3 Criteria

Power Density Limits – The EUT shall not generate a power density beyond the limits in the frequency band listed in the left hand column of Table 7.3.1, and the power density given in the right hand column. The power density shall be measured 20 cm from the radiating antenna axis above the vehicle-top simulating ground plane, as well as and in the radiating antenna axis above the vehicle-top simulating ground plane, as well as and in the approximate location of the head of possible vehicle drivers or passengers below the ground plane (see Figure 7.3.1). The measured values shall be recorded.

Table 7.3.1

Power Density Limits
for General Population/Uncontrolled Exposure

Frequency Range	Power Density (mW/cm^2)
300 - 1500 MHz	f/1500

Note: f = frequency in MHz

The measurements shall be performed at one transmitting frequency, the highest of the high, middle or low channels, with the EUT operating at the full rated output power.

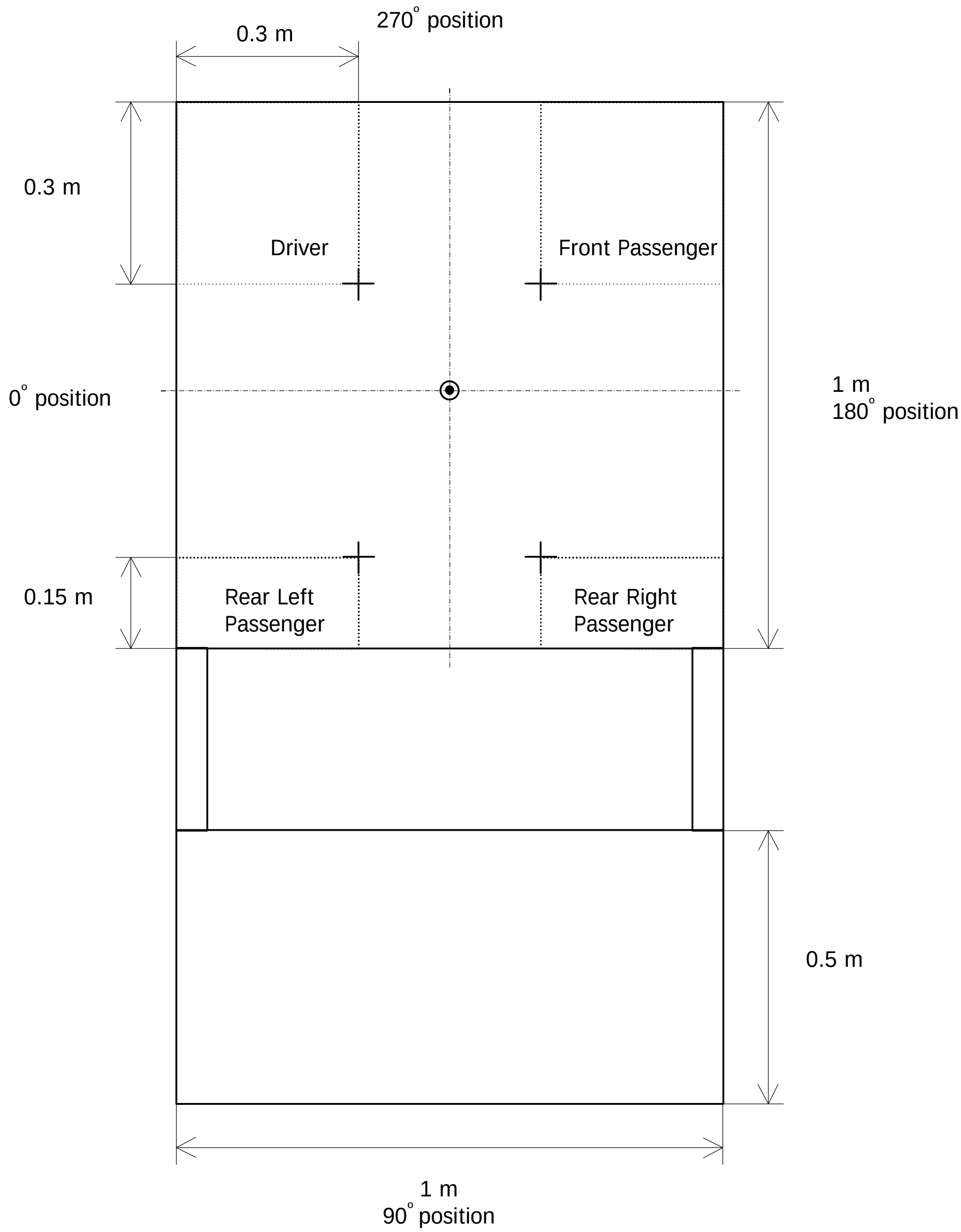


Figure 7.3.1. Plan View of Vehicle Simulator and Setup.

7.4 Test Procedure

a) The probe shall be positioned close to, and parallel to, the vehicle rooftop simulation with its tip 20 cm from the radiating antenna, and its axis normal to the antenna.

b) Rotate the turntable so that the probe is at the 0° position (see Figure 7.3.1).

c) Turn on the EUT and allow a sufficient time for stabilization. Turn on the transmitter and simulate normal operation conditions. Operate the transmitter at full rated output power.

d) Determine the location of the maximum power density: locate the maximum emissions by scanning vertically along the EUT's antenna. Take and record measurements of the power density at a number of points along the length of the antenna as well as just past its tip.

e) At every 45° of rotation take and record a measurement of the power density at the maximum power density height as for at least the following locations:

- half the maximum power density height
- height halfway between the maximum power density height and the tip of the radiating antenna
- just above the tip of the antenna

f) Turn off the EUT.

g) Position the probe under the vehicle rooftop simulating ground plane in the approximate location of the centre of the head of a potential driver of the simulated vehicle (see Figure 7.3.1).

h) Turn on the EUT and allow a sufficient time for stabilization. Turn on the transmitter and simulate normal operation conditions. Operate the transmitter at full rated output power.

i) Take and record the measurement of the power density at this location.

j) Turn off the EUT.

k) Repeat steps g) through j) for the positions of the other potential occupants of the simulated vehicle as shown in Figure 7.3.1.

7.5 Results

Table 7.5.1 presents the results of the measurements made along the length of the antenna in order to find the location of the maximum power density (the Larsen NMO 3E 900B antenna has a height of 31 cm). Column 1 shows the height at which the measurements were taken and column 2 shows the result ("total" indicates that this is the sum of the power density measured by each of the three orthogonal sensors in the probe). The cable loss associated with the supplied 17ft Belden 8240 cable was adjusted to the nominal loss for a 6 foot length. Column 3 indicates the correction for the excess cable loss (11ft × 0.16 dB/ft) that was applied to measured power density (column 2) to obtain the final adjusted power density.

The data in Table 7.5.1 is presented in Figure 7.5.1.

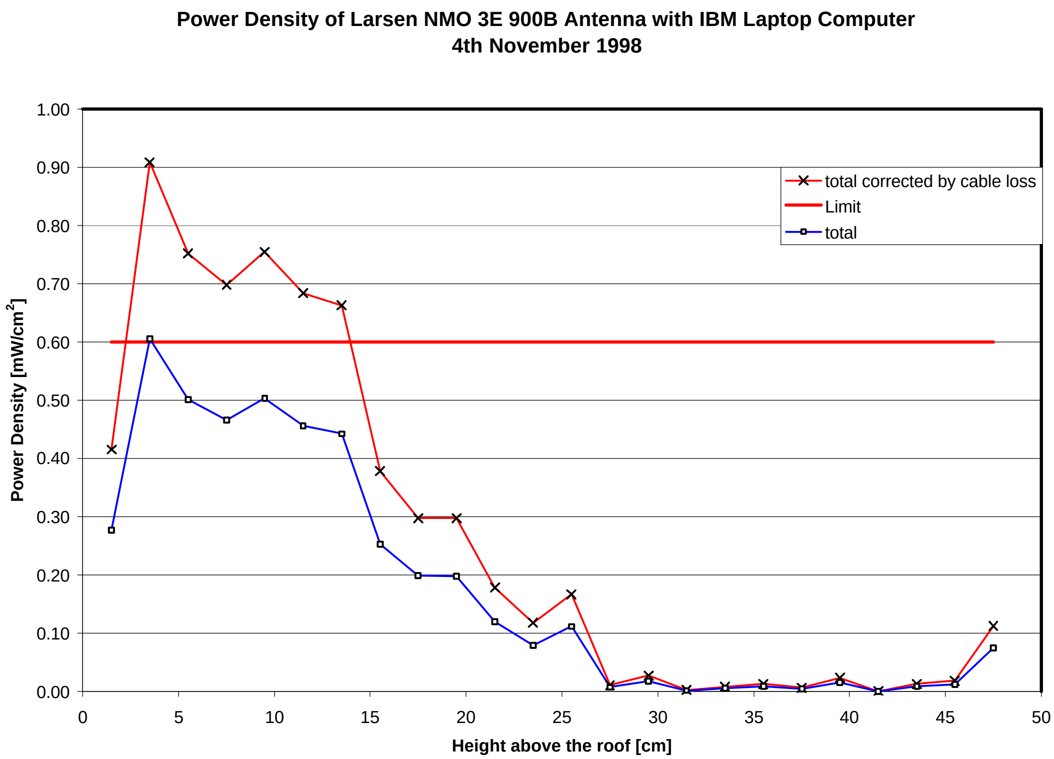


Figure 7.5.1

Table 7.5.1

Power Density Measured
at 0° as a Function of Height

Height	Total	Excess cable loss	Adjusted total	MPE Limit
[cm]	[mW/cm²]	[dB]	[mW/cm²]	[mW/cm²]
1.5	0.28	1.76	0.42	0.6
3.5	0.61	1.76	0.91	0.6
5.5	0.50	1.76	0.75	0.6
7.5	0.47	1.76	0.70	0.6
9.5	0.50	1.76	0.75	0.6
11.5	0.46	1.76	0.68	0.6
13.5	0.44	1.76	0.66	0.6
15.5	0.25	1.76	0.38	0.6
17.5	0.20	1.76	0.30	0.6
19.5	0.20	1.76	0.30	0.6
21.5	0.12	1.76	0.18	0.6
23.5	0.08	1.76	0.12	0.6
25.5	0.11	1.76	0.17	0.6
27.5	0.01	1.76	0.01	0.6
29.5	0.02	1.76	0.03	0.6
31.5	0.00	1.76	0.00	0.6
33.5	0.01	1.76	0.01	0.6
35.5	0.01	1.76	0.01	0.6
37.5	0.00	1.76	0.01	0.6
39.5	0.02	1.76	0.02	0.6
41.5	0.00	1.76	0.00	0.6
43.5	0.01	1.76	0.01	0.6
45.5	0.01	1.76	0.02	0.6
47.5	0.07	1.76	0.11	0.6

Table 7.5.2 presents the results of the measurements made around the antenna at every 45° of rotation. Column 1 shows the angle at which the measurements were taken and columns 2 through 5 show the final adjusted power density (see discussion surrounding Table 7.5.1) at the different measurement heights. The measured exposure level is determined by averaging the adjusted total power density along a vertical line up to the height of a tall typical individual, taken here as 6ft or 180cm. Since the height for the rooftop of the simulated vehicle is 143cm, then the averaging is over those measurements made between 0 and 37cm above the simulated vehicle rooftop. Column 6 shows the results of this averaging.

Table 7.5.2

Power Density Measured
at every 45° as a Function of Height

Angular	Adjusted Total Power Density				Average of	MPE
Position	h1 (cm)	h2 (cm)	h3 (cm)	h4 (cm)	Values up	Limit
	4.5	13.5	17.5	31.5	to 37 cm	
[°]	[mW/cm²]	[mW/cm²]	[mW/cm²]	[mW/cm²]	[mW/cm²]	[mW/cm²]
0	1.0432	0.9729	0.8827	0.1525	0.7628	0.6
45	1.0432	1.1468	1.0295	0.2510	0.8676	0.6
90	1.0420	0.8996	0.9289	0.0521	0.7307	0.6
135	1.2913	0.9962	1.0021	0.0734	0.8408	0.6
180	1.0672	0.8495	0.8275	0.0277	0.6930	0.6
225	1.1908	0.8961	0.8298	0.2491	0.7915	0.6
270	0.9933	0.9475	0.8316	0.0030	0.6938	0.6
315	1.2662	0.9518	0.7533	0.0263	0.7494	0.6
360	1.0432	0.9729	0.8827	0.1525	0.7628	0.6

The data in Table 7.5.2 is presented in Figure 7.5.2.

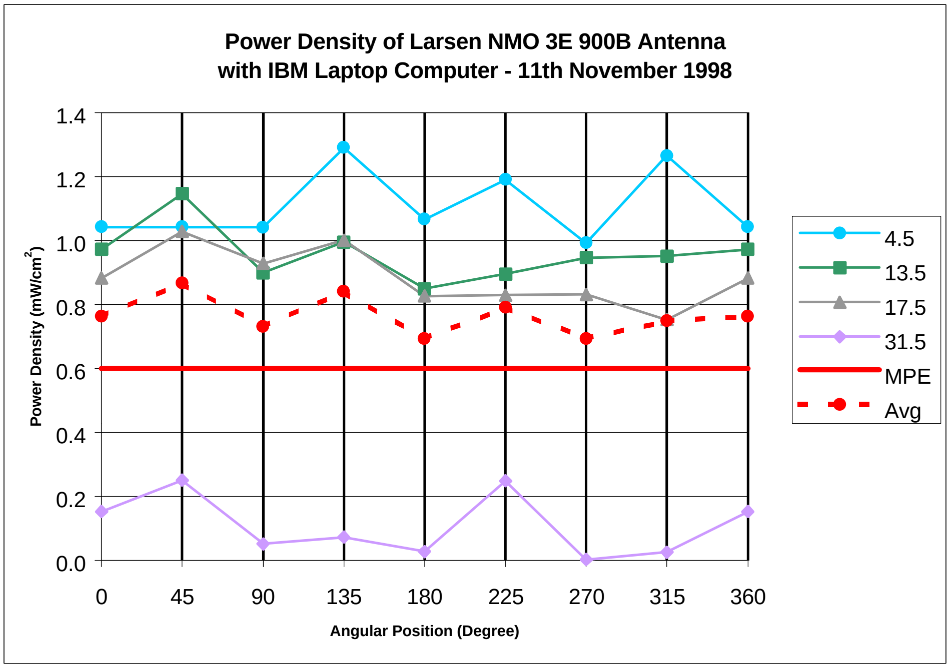

Power Density of Larsen NMO 3E 900B Antenna
with IBM Laptop Computer - 11th November 1998
Power Density (mW/cm^2)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
45
90
135
180
225
270
315
360
Angular Position (Degree)
4.5
13.5
17.5
31.5
MPE
Avg

Figure 7.5.2.

Measurements were made below the simulated vehicle rooftop, in the approximate location of the centre of the head of potential occupants. It was assumed that this typical position occurred 17.5cm below the roof of the simulated vehicle (the clearance between the top of an occupant's head and a vehicle's roof is ~3" (7.5cm) and distance between the top of the head and the eyes is ~4" (10cm)). Figure 7.3.1 shows the location of measurements for the 4 potential occupants. Table 7.5.3 presents the results of the measurements. Column 1 shows the height at which the measurements were taken and column 2 shows the result ("total" indicates that this is the sum of the power density measured by each of the three orthogonal sensors in the probe). The cable loss associated with the supplied 17ft Belden 8240 cable was adjusted to the nominal loss for a 6 foot length. Column 3 indicates the correction for the excess cable loss (11ft × 0.16 dB/ft) that was applied to measured power density (column 2) to obtain the final adjusted power density.

Table 7.5.3

Power Density Measured
at Position of Potential Vehicle Occupants

Position	Total	Excess cable loss	Adjusted Total	MPE Limit
	[mW/cm^2]	[dB]	[mW/cm^2]	[mW/cm^2]
driver	0.05	1.76	0.08	0.6
front passenger	0.01	1.76	0.02	0.6
rear left	0.02	1.76	0.03	0.6
rear right	0.00	1.76	0.00	0.6

7.6 Discussion

The maximum exposure determined for this EUT was 0.87 mW/cm^2 at a distance of 20 cm from the antenna. The MPE at this wavelength (899MHz) is 0.6mW/cm^2. Since the power density will decrease in proportion to the square of the distance from the antenna then the EUT will meet the MPE limit at distances greater than 24.1cm from the antenna.

8.0 CONCLUSION

The EUT consisting of a Research in Motion R900M-2-O OEM radio-modem, an IBM 760ED ThinkPad laptop, and a Larsen NMO 3E 900B antenna will not exceed the MPE requirements for 899MHz provided that the antenna is installed at least 25cm from any edge of a vehicle rooftop. This can be accomplished by putting a prominent warning in the equipment manual as to how the antenna should be installed.

APPENDIX A

Transmitter Specifications

RIM 901M

OEM radio-modem for Mobitex

High performance for OEMs

The RIM 901M radio-modem is a high-performance RF transceiver designed for system integration by original equipment manufacturers. Operating in the 900 MHz frequency range, the RIM 901M is compatible with Mobitex wide-area wireless data communication networks.

Providing high tolerance to noise generated by nearby microprocessors, the RIM 901M is ideal for integration into Mobitex terminals and embedded applications, including compact devices with minimal shielding or physical separation of the terminal unit and the radio-modem. Typical applications include:

- Hand-held terminals
- Laptop Computers
- Telemetry
- Automatic Vehicle Location/Transport
- POS/ATM
- Alarming
- Vending Machines

Efficient power management

Power consumption is a critical issue for mobile products because end-users want long-lasting devices without heavy battery packs. The RIM 901M sets new power consumption standards for OEM-style radio-modems by reducing stand-by power consumption to only 12mA, and transmit power to as little as 300mA.

Small and lightweight

Based on a single-board design, the RIM 901M has a footprint about the size of a credit card. Uncommonly thin and lightweight, the RIM 901M is ideal for hand-held computers and installation in existing equipment enclosures.

Powerful and efficient transmitter

The RIM 901M transmitter can supply a full 2 Watts to the antenna, enhancing in-building and fringe-area use. When close to a network base-station, the RIM 901M conserves battery power by quickly decreasing output power to as little as 62 mW. The RIM 901M extends battery life, providing consistent transmitting performance efficiency throughout its range of operational voltage.

Noise immunity

The RIM 901M includes ground-breaking technology that minimizes interference from RF noise generated by nearby electronics. Noise immunity significantly extends battery life, increases message exchange reliability, and will increase the effective range of operation of the RIM 901M compared to other radio-modems. And since the RIM 901M is not de-sensitized by RF noise emitted by nearby electronics, it is ideal for integration into products such as handheld terminals where shielding or physical separation is not possible.

Powerful software tools

The RIM 901M includes two link-level serial interface protocols: Radio Access Protocol (RAP) and MASC. RAP is significantly more efficient than the older MASC protocol and is specifically designed for embedded-system applications. RAP dramatically shortens the time needed to develop a wireless solution because a RAP interface will typically only require about 1-3 Kbytes compared to 10-50Kbyte for a comparable MASC implementation. This reduced code footprint makes software maintenance easier and eliminates the need for a third-party API.

Set-up & Diagnostic Firmware

The RIM 901M firmware includes a simple-to-use utility that can display the Mobitex Access Number, RSSI level, battery status and various network and diagnostic parameters. Accessed with a standard PC-based terminal emulation program, this utility can be used to switch the RIM 901M between different Mobitex networks or "ping" the network to confirm the modem is fully operational on the network.

Autonomous Radio Telemetry

A wireless telemetry solution typically requires an expensive controller that collects information from I/O devices and manages data communications with the wireless network. A large portion of the system cost is often the controller, which may include a microprocessor, memory, I/O control circuits, and firmware to control a radio-modem.

Autonomous Radio Telemetry (ART) turns the RIM 901M into an intelligent and programmable device controller. Without any external software or control circuitry, the RIM 901M can detect digital input from an external source, collect data, control external devices, and transmit status information. No instructions from an external controller or from a remote server are required; the RIM 901M will operate completely independently.

Two of the data lines of the RIM 901M can be used as an I^2C communication bus. The RIM 901M can periodically send I^2C commands to an external device, without any special logic or software running on the device. Data requested by the RIM 901M can be accumulated in an event log, and the RIM 901M can send the log to a server.

RIM 901M

OEM radio-modem for Mobitex

Developer's Kit

The RIM 901M Developer's Kit helps system designers and engineers start interfacing the RIM 901M OEM radio-modem to the target device in minutes.

The kit offers all of the following tools and accessories to begin using the RIM 901M:

- RIM 901M OEM radio-modem
- Magnetic-mount +6 dBi antenna
- Interface and Test Board including:
  - TTL-to-RS232 level conversion and FPC cable connector
  - DB-9 serial port for RS-232 connection to the host computer
  - Regulated power for the RIM 901M
  - LED indicators show when the RIM 901M is receiving power, transmitting, or exchanging data with the host
  - Test points for the 14-pin data cable
  - A jumper to set automatic DTR
- Cables (data, power and antenna)
- Power supply (AC to DC)
- DB-9 to DB-9 straight through serial cable
- Protocol analyzer
- Hardware Integrator's Guide
- Programmer's Guide to RAP and MPAKs: *Protocols for Mobitex wireless communications*

Protocol analyzer

The Developer's Kit includes a Mobitex-aware serial-line protocol analyzer which captures and interprets traffic between the RIM 901M and the terminal. MobiView is a powerful development tool that can significantly simplify application testing. Data capture and display options include raw or ASCII serial, MASC, network, or transport protocol interpreted.

Hardware Integrator's Guide

The Hardware Integrator's Guide includes helpful information about the RIM 901M, such as:

- Hardware design recommendations
- Suppliers of cables, connectors, and antennas
- Antenna matching guidelines
- Schematics for power supplies and RS-232 serial port interfaces
- Software development suggestions and tools.
- Detailed electrical and serial port specifications

Technical Specifications

Mechanical & environmental properties

- Weight: 2.3 oz. (64g)
- Footprint: 3.5" x 2.7" (87.5 x 65mm)
- Thickness: 0.3" to 0.38" (7.5 to 9.6mm)
- Power connector: 2mm pitch Wire-to-Board Header (Molex 53015-0210), mates to Molex 51004-0200
- TTL level serial connector: 14 pin FPC connector
- MMCX Antenna cable connector
- Tested to IEC 68-2-6 Part 2 for vibration
- Operating temperature: -30°C to +55°C (at 5-95% relative humidity, non-condensing)
- Storage temperature: -40°C to +85°C

RF properties

- Transmit frequency: 896-902 MHz
- Transmit power range: 62 mW to 2.0 W at antenna port
- Transmitter can reduce output power by up to 15 dBm (to 62 mW) to balance radio link and conserve power
- Receive frequency: 935-941 MHz
- Receive sensitivity: -119 dBm
- 8000 bps 0.3 BT GMSK
- FCC Parts 15 & 90 PENDING
- Industry Canada RSS 122 PENDING

Power supply & typical current usage

- Single power supply; operating range: 6.0 to 9.5 VDC
- Maximum off current consumption: 100µA
- Battery save stand-by mode: 12 mA
- Receive / express stand-by mode: 70 mA
- Transmit mode: 300-900 mA
- Average current usage: 24mA (based on 94% standby, 5% receive, 1% transmit)

Serial communications

- TTL asynchronous serial port
- 7 bit with parity (MASC) or 8 with no parity (RAP)
- Link speed: 1200-9600 bps
- Link level protocols: Radio Access Protocol (RAP) and Mobitex Asynchronous Communications (MASC)

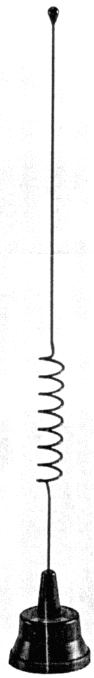
Other features

- Single TTL-level logic line to turn radio on/off
- Software can activate radio
- Flow control options: Hardware, Xon/Xoff, or None
- Radio parameters stored at power down
- Terminal devices may power-down while radio-modem remains operational

APPENDIX B

Antenna Specifications

Mobile Cellular, SMR, Data 800/900 MHz



3dB open coil antenna, standard NMO base

3dB open coil antenna, standard NMO base, heavy duty whip

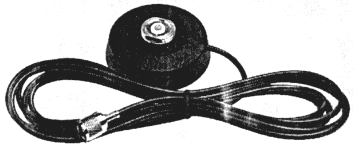
3dB SuperFlex enc. coil antenna, standard NMO base

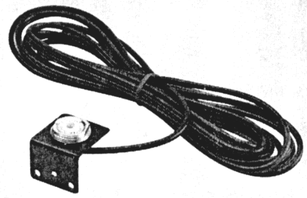
MODEL	FREQUENCY
NMO 3 800 B	806-866 MHz
NMO 3 825 B	825-896 MHz
NMO 3 900 B	890-960 MHz
SPECIFICATIONS	
GAIN	3dB
TYPE	5/8 over 1/4 wave
VSWR	1.5:1 or less
COLOR	Black
WHIP	.070, open coil
COAX	Order separately
BASE SIZE	1 5/8"
POWER RATING	200 watts
MAX HEIGHT	13 3/4"

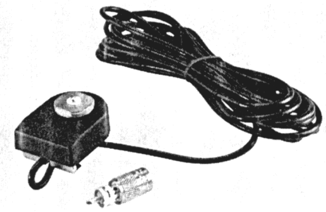
MODEL	FREQUENCY
NMO3HD800B	806-866 MHz
NMO3HD825B	824-896 MHz
NMO3HD900B	890-960 MHz
SPECIFICATIONS	
GAIN	3dB
TYPE	5/8 over 1/4 wave
VSWR	1.5:1 or less
COLOR	Black
WHIP	.100, open coil
COAX	Order separately
BASE SIZE	1 5/8"
POWER RATING	200 watts
MAX HEIGHT	13 3/4"

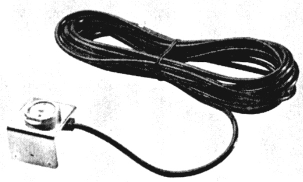
MODEL	FREQUENCY
NMO 3E 800 B	806-866 MHz
NMO 3E 825 B	825-896 MHz
* NMO 3E 900 B	890-960 MHz
SPECIFICATIONS	
GAIN	3dB
TYPE	5/8 over 1/4 wave
VSWR	1.5:1 or less
COLOR	Black
WHIP	.070, enc. coil
COAX	Order separately
BASE SIZE	1 5/8"
POWER RATING	200 watts
MAX HEIGHT	13 1/2"

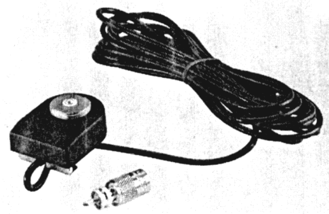
Mounts

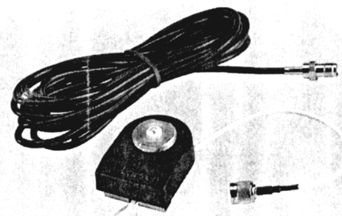












MODEL	CONNECTOR
NMO MM R DS	None
NMO MM R DS FME	FME CRIMP (installed)
NMO MM R DS MPL	MPL CRIMP
NMO MM R DS N	N CRIMP
NMO MM R DS PL	PL-259T
NMO MM R DS TNC	TNC CRIMP
SPECIFICATIONS	
SIZE	3 1/2" Round
TYPE	Motorola Style Round Mag Mount
COAX	12' RG-58A/U Dual Shield
PULL STRENGTH	90#

MODEL	CONNECTOR
NMO TMB DS	None
SPECIFICATIONS	
SIZE	1 3/4" x 1 3/4"
TYPE	Motorola Style Trunk Gutter Bracket, Chrome
COAX	17' RG-58A/U Dual Shield

MODEL	CONNECTOR
NMO TMB B	PL-259
SPECIFICATIONS	
SIZE	1 3/4" x 1 3/4"
TYPE	Motorola Style Trunk Gutter Bracket, Black
COAX	17' RG-58A/U

MODEL	CONNECTOR
NMO TLP	PL-259
SPECIFICATIONS	
SIZE	2 1/2" x 2"
TYPE	Motorola Style Trunk Lid Mount
COAX	17' RG-58A/U

MODEL	CONNECTOR
NMO TLP DS	None
SPECIFICATIONS	
SIZE	2 1/2" x 2"
TYPE	Motorola Style Trunk Lid Mount
COAX	17' RG-58A/U Dual Shield

MODEL	CONNECTOR
NMO TLP SC UD	None
SPECIFICATIONS	
SIZE	2 1/2" x 2"
TYPE	Motorola Style Trunk Lid Mount
COAX	1' RG174, 16'RG-58A/U Dual Shield