ELECTROMAGNETIC EMISSIONS TEST REPORT

BY

COM-SERVE CORPORATION

KITCHENER, ONTARIO

CANADA

RADIATED and CONDUCTED EMI TEST REPORT

April 05, 1999

CLIENT:

Research In Motion
295 Phillip Street
Waterloo, Ontario
N2L 3W8

TESTED MODEL:

Model Number:	**R902M-2-O**
Serial Number:	RADIO # 6
Description:	900 MHz RADIO MODEM DEVICE
Date tested:	March 08 & 09, 1999
Tested with:	Host computer, IBM ThinkPad 760 Type 9546, Serial # 78-ACPW2 97/02, FCC ID ANOGCF2704AT; Printer, Epson Model FX-80, Serial # 319837, FCC ID BKM9A8P80FA; AC/DC adapter power supply, Part No. WR91A2400CCP, 05 VDC @ 2.4A; Antenna Company 900 MHz "Cell" antenna, Model Eclipse II/9123; RIM Radio Monitor Board Model 02120001; Associated cables and cords.

IN ACCORDANCE WITH:

- **FCC Part 2 and FCC Part 90 Transmitters; Type Acceptance.**
- Test procedure(s) MP-4 and ANSI C63.4

TESTED BY:

Com-Serve Corporation
17 Old Carriage Court
Kitchener, Ontario
N2P 1V3

Jim Sims
Com-Serve Corporation

TECHNICIAN:

Jim Sims
With: Mr. Adam Stevenson and Mr. Masud Attayi (Research in Motion)

FILE NUMBER: RIM 019

RESULTS R902M-2-O

		COMPLIANCE (yes)	(no)
RF POWER OUTPUT			
Transmitter:	2.985	( )	( )
OCCUPIED BANDWIDTH			
Transmitter:	2.989	(X)	( )
SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS			
Transmitter:	2.991	(X)	( )
FIELD STRENGTH OF SPURIOUS RADIATION			
Transmitter:	2.993	(X)	( )
FREQUENCY STABILITY			
Transmitter:	2.995	( )	( )
BANDWIDTH LIMITATIONS			
Transmitter:	90.210(j)	(X)	( )

SYSTEM DESCRIPTION

The R902M-2-O Radio Modem Device

The R902M-2-O radio modem is intended for integration into other equipment to allow wireless data communication. The R902M-2-O has a standard TTL level serial asynchronous interface allowing it to communicate directly with embedded controllers and host processors.

Radio evaluation and application development is facilitated by the radio monitor board (PCB-02120-001). The radio monitor board translates the TTL serial interface signals to standard RS-232 level signals. The RS-232 level signals can be directly interfaced to a personal computer serial port. The radio monitor board acts as an interface between a standard serial I/O and the RIM R902M-2-O radio. The board translates the 3.0 volt serial interface signals to standard RS-232 level signals. The radio monitor board also provides a regulated and filtered 4.3 VDC to the RIM R902M-2-O radio. The radio power and the level translation circuit power, are derived from a 05V @ 2.4A AC/DC power adapter, model number WR91A2400CCP. The R902M-2-O radio, radio monitor board, AC adapter, 9123 Eclipse II cellular antenna and all required interface cables will be typically marketed as the “RIM 902M Radio Evaluation and Development Kit”.

The OEM 900 MHz packet data radio modem is formally known as model **R902M-2-O**. The RIM radio monitor board, RS-232 converter is formally model **02120-001**.

The antenna used for testing and to be included in the evaluation and development kit is an ECLIPSE II magnet mount cellular antenna Model 9123 from the Antenna Company International Limited. Please refer to the attached data sheet for Model 9123. The model 9123 is a semi-custom device with a 6 feet RG58A/U cable and a SMA male connector. All other specifications are the same as standard models 9110, 9114, or 9119.

Normal radio modem operation for live use is called burst packet activity. The radio is normally in receive mode listening to all network activity. When a data packet is received that is explicitly addressed to the radio, it then transmits a short acknowledgment packet. When data is to be transmitted from the radio modem, the radio modem first receives system information from the network to determine when to transmit. There is no deterministic pattern to the network traffic or transmit packet timing. To facilitate testing, the network's radio specification allows several test modes for transmitting continuous carrier without modulation, or with modulation generated from scrambler sequence or fixed sequence data. The transmit test modes were used for testing the radio for compliance to CFR47 standards.

SYSTEM DESCRIPTION CONTINUED

The R902M-2-O Radio Modem Device

FUNCTIONAL DESCRIPTION

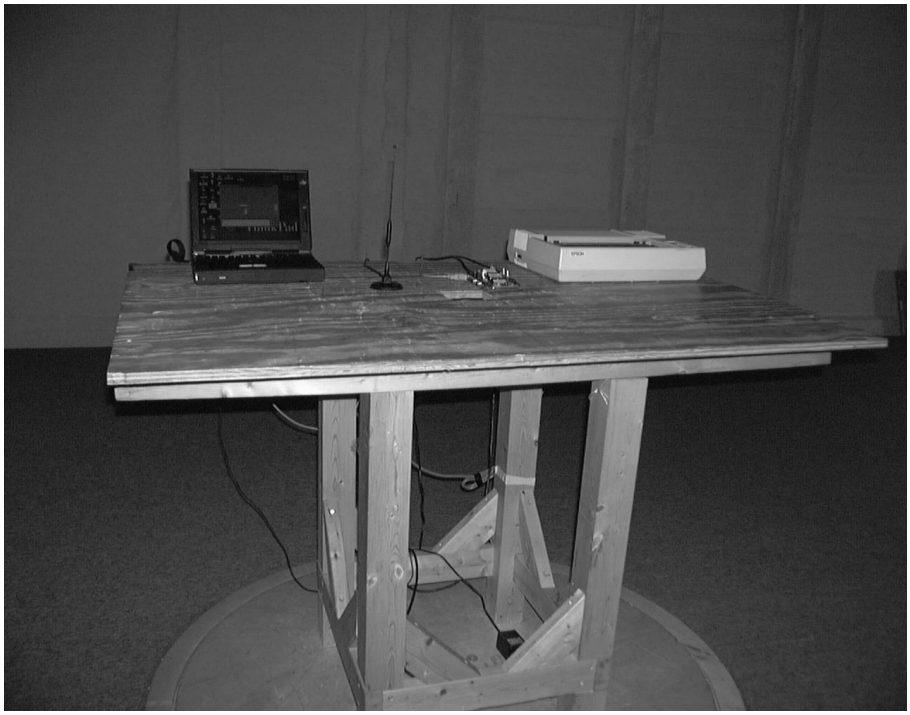
The R902M-2-O is a 900 MHz band, half duplex (two frequency simplex), 2 Watt, transceiver system for wireless data modem communications on Mobitex wireless systems.

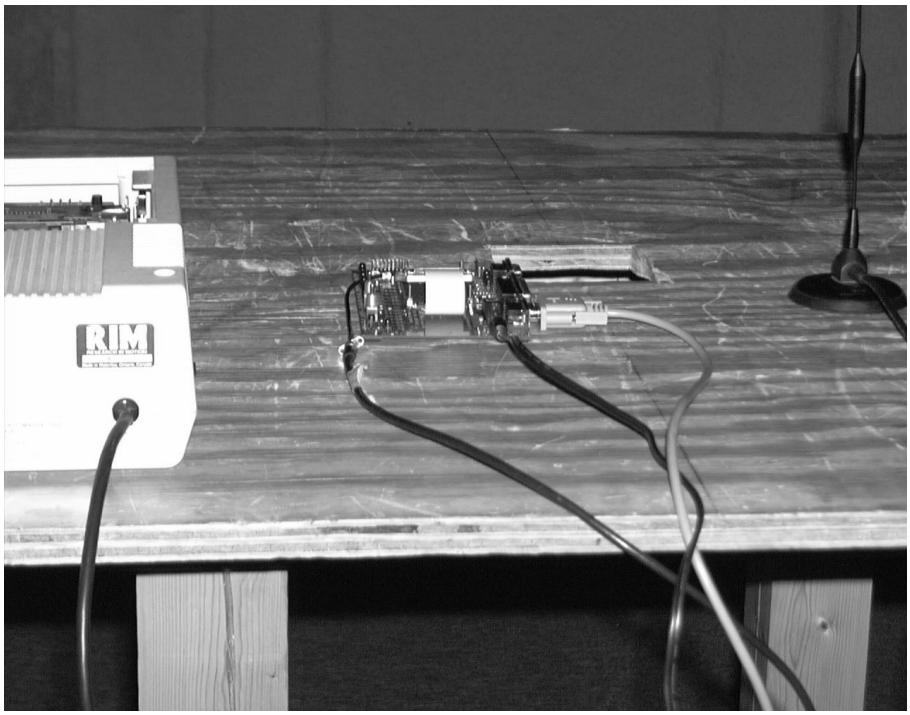
The transmitter is capable of transmitting on frequencies from 896 MHz to 902 MHz with a 12.5 KHz resolution. The active receive and transmit frequencies are determined by the radio firmware for nationally allocated Mobitex system channels and by the Bell South Wireless Data system for operational local channels. The user is not able to modify the frequency of operation of the device.

The transmitter is capable of the generation of RF power at several calibrated levels. The levels are 2,000 milliwatts, 1,000 milliwatts, 500 milliwatts, 250 milliwatts, 125 milliwatts, and 60 milliwatts: (+33, +30, +27, +24, +21, +18 dBm respectively). The various power levels are used to balance the receive and transmit radio link. The power level is controlled by the Mobitex system in response to the received signal strength and power level instructions received. The output power level of the device cannot be modified by the user

SYSTEM DESCRIPTION; CONTINUED

TEST SETUP FOR:
SPURIOUS RADIATED EMISSIONS





TEST PROCEDURE: RADIATED EMISSIONS

All tests were performed in accordance with FCC/MP-4, & ANSI C63.4.

The Research In Motion Ltd. 900 MHz radio modem device model R902M-2-O, was connected together with a host IBM laptop computer, Epson printer, ECLIPSE II magnet mount cellular antenna Model 9123 and a RIM Model 02120-001 radio monitor board as described on the “Title and System Description” pages. The system was arranged in a typical configuration of use and placed on top of a one metre non-conducting turntable as per ANSI C63.4. All of the system parts were connected together with cables that are sold with each piece or generic cables purchased for the specific connection involved. Several different equipment placements were tried so as to establish the worst normal case of equipment positioning. In this case the 02120-001 radio monitor board, laptop computer, RF radio, Epson printer, and RF antenna were placed on top of the turntable. The power supply was placed at the bottom centre of the test table. All of the cables and cords were moved about so as to create the highest level of EMI. The complete system was operating as it would be in normal use. Special software was employed in order that the 900 MHz Packet Data Radio, model R902M-2-O was processing data in a worst case normal manner. The turntable was rotated through 360 degrees.

A preliminary radio frequency scan was performed on the system to determine the worst case cable and equipment configuration. The attached results represent the system configuration maximized for worst case emissions in each frequency band. Please refer to the System Description.

The tests were conducted at a distance of three (3) metres with the receiving antennas in both the horizontal and vertical planes at each emission frequency. It should be noted that a preamplifier (LNA) in conjunction with a 900 MHz notch filter was used above 1.0 GHz. The test results table entry referred to as "ANT. FAC." include cable loss, antenna correction factor, LNA gain and notch filter insertion loss.

EQUIPMENT:

	Anritsu 2601 A Spectrum Analyzer	
	H.P. 8563E Spectrum Analyzer	9.0 KHz - 26.5 GHz
Setting:	BW: 300 Hz, 100/120 KHz and 1.0 MHz as required.	
	HP/LNA Preamplifier, Model 8449B	1.0 GHz - 26.5 GHz
	A.H. Systems log periodic antenna;	1.0 GHz - 12.4 GHz
	MA-COM 20 dB att. # 2082-6502-20	0 Hz - 18.0 GHz
	A.H. Systems biconical antenna;	20 MHz - 330 MHz
	A.H. Systems log periodic antenna;	300 MHz - 1.8 GHz
	A.H. Systems log periodic antenna;	1.0 GHz - 12.4 GHz
CDI	ROBERTS dipole antennas T1 T2 T3 T4	25 MHz - 1.0 GHz

NOTE: The spectrum analyzer used are calibrated annually, and that calibration is directly traceable to the National Research Council of Canada. (NRC) This equipment is only used by qualified technicians and only for the purpose of EMI measurements. The three metre test range has been carefully evaluated to the ANSI C63.4, and will be remeasured for reflections and losses every three years. (FCC OET/55)

RADIATED EMISSION RESULTS

BW: 100/120 KHz
Span: 05 to 50 MHz

PART 2/90 TRANSMITTER RADIATED TESTS TO 10 G HZ

TEST #	FREQ. M HZ	LEVEL µV	ANT. TYPE (PZ)	ANT. FAC.	F.S. µV/M	LIMIT µV/M	DIFF. TO LIMIT; dB
01	899.00	72400.0	RT.4 V	45.7	3308680	3300000	N/A
02	1797.20	1121.00	L/P V	3.7	4147.7	7393	-5.02
03	2697.00	311.00	L/P V	7.2	2239.2	7393	-10.37

NOTE:

A) A preamplifier (LNA) in conjunction with a 900 MHz notch filter was used above 1.0 GHz. The test results table entry referred to as "ANT. FAC." include cable loss, antenna correction factor, LNA gain and notch filter insertion loss.

B) The limit as specified in the above table, is 52.86 dB below the measured maximum conducted power output of the transmitter; 1.93W.

C) Limit Calculations:

Attenuation= 50 + 10 × Log of Pt (1.93W)
= 50 + (2.86)
= 52.86 **dB**

Limit (Power) = 1.930 Watts less 52.86 dB
= 10µ Watts.

Radiated Limit $= \left(\sqrt{49.2 \times P_t}\right) \div \mathbf{D}$ or
$= \left(\sqrt{49.2 \times 10\mu W}\right) \div 3$ metres.
= **.007393 V/m**

9110- TNC connector
9115- Mini-UHF connector
9119- SAP connector

GSM/ETACS

The ECLIPSE II Magnet Mount Cellular Antenna

The ECLIPSE II Magnet Mount incorporates features that clearly define it a proven performer, and outstanding performance booster, for portable and transportable phones.

The small magnetic base gives it an aerodynamic look, and allows for compact storage. A specially formulated rubber boot fits snugly over the magnetic base to prevent scratching of the vehicle surface.

An extended strain relief where cable enters the base, assures uncompromising performance and durability.

The ECLIPSE II is made in the USA and is backed by a LIFETIME WARRANTY.

FEATURES

- Provides service in fringe areas where reception is poor.
- Mounts in seconds.
- Stranded centre conductor cable for maximum magnetic strength.
- Connector with extended protective strain relief.
- Power balanced magnet delivers maximum magnetic strength.
- UV stabilized rubber boot protects vehicle surface.
- Made in the USA.
- Lifetime warranty.
- GSM and ETACS compatible.

ELECTRICAL SPECIFICATIONS

Power Input	60 Watts
Gain	3dB
Frequency Range	872-960
VSWR	Less than 1.5 over specified range
Impedance	50 Ohms

MECHANICAL SPECIFICATIONS

Height of Mast	35.6 cm
Mount Type	Magnetic Mount
Connector	TNC/Mini-UHF/SAP Factory-crimped with strain relief
Cable	RG58 A/U, 4 m., 95% shielded with stranded centre conductor
Outside Metal Parts	All stainless steel and brass

The Antenna Company, International, Ltd.
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Facsimile: 301-344-2050

September 23, 1997

IN REPLY REFER TO
31040/SIT
1300F2

Electrohome Electronics Ltd
809 Wellington Street, North
Kitchener, Ontario N2G 4J6, Canada

Attention: Gerry Gallagher

Re: Measurement facility located at Roseville
(3 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is published periodically and is also available on the Laboratory's Public Access Link as described in the enclosed Public Notice.

Sincerely,

Thomas W. Phillips
Electronics Engineer
Customer Service Branch

Author Data	Date	Document No.
Masud S. Attayi	April 8, 1999	01947-CERT-FCC-TEST-BW_MASK
Approved	Rev	File / Reference
		BW_MASK

OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS

TEST PROCEDURE:

The Research In Motion Limited R902M-2-O radio modem device was connected together with a radio monitor board 02120-001, host computer, external power supply, a 20 dB external attenuator, and a coaxial cable. The R902M-2-O antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator and a coaxial cable. The R902M-2-O transmitter was operating at full and low output power with and without internal data modulation.

TEST RESULTS:

UNMODULATED CARRIER, High Power: **11.97 dBm** with a 20 dB external attenuator and a 1 m coaxial cable.

a) Internal Modulation: Please refer to the attached spectrum analyzer plots. 100% of the in-band modulation is below the specified mask per 90.210(j)

UNMODULATED CARRIER, Low Power: **-2.53** dBm with a 20 dB external attenuator and 1 m coaxial cable.

b) Internal Modulation: Please refer to the attached spectrum analyzer plots. 100% of the in-band modulation is below the specified mask per 90.210(j)

Below is the **description of the mask** for band 896-901/935-940 MHz (Mobitex) : 2 Watts transmitter

Frequency (MHz)	Formula	Upper Limit (dB)	Lower Limit (dB)
-26500	50+10 log (P)	-53	-175
-0.0115	157 log (f_d/5.3)	-53	-175
-0.0095	157 log (f_d/5.3) or 103 log(f_d/3.9)	-39.8	-175
-0.0062	103 log (f_d/3.9) or 53 log (f_d/2.5)	-21.1	-175
-0.0025	53 log (f_d/2.5)	0.0	-175
0.0025	53 log (f_d/2.5)	0.0	-175
0.0062	103 log (f_d/3.9) or 53 log (f_d/2.5)	-21.1	-175

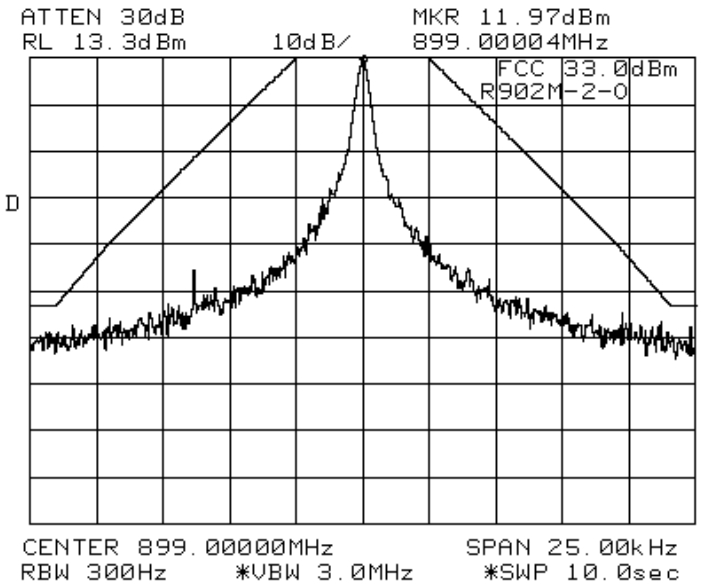
0.0095	157 log (f_d/5.3) or 103 log (f_d/3.9)	-39.8	-175
0.0115	157 log (f_d/5.3)	-53	-175
26500	50+10 log (P)	-53	-175

EQUIPMENT:

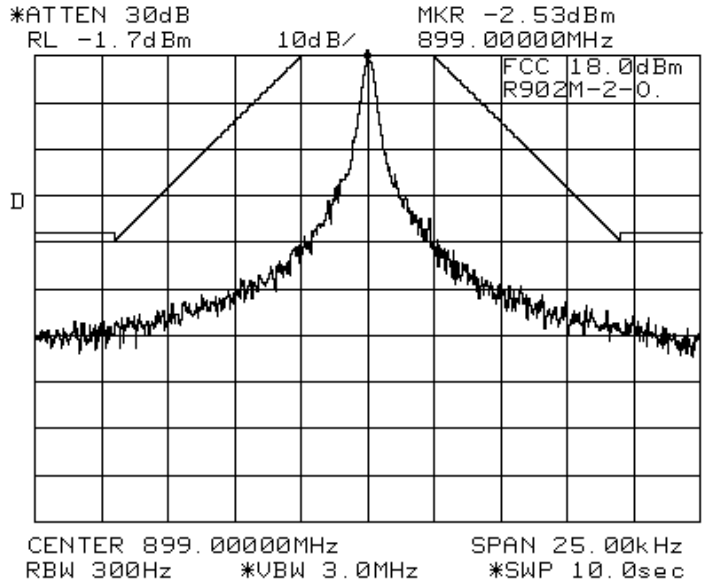
- H.P. 8563E Spectrum Analyzer 9.0 KHz - 26.5 GHz
- HP6632A DC POWER SUPPLY
- Mini Circuits 20 dB att. # NAT-20 0 Hz - 1.5 GHz

SETTING: RBW: 300 Hz; VBW: 3 MHz; SPAN: 25 KHz; SWP: 10 Sec

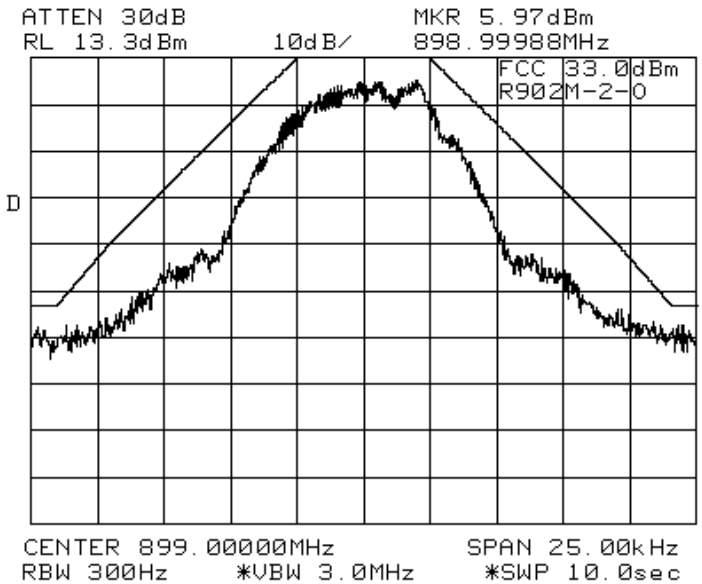
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
UNMODULATED CARRIER – HIGH POWER



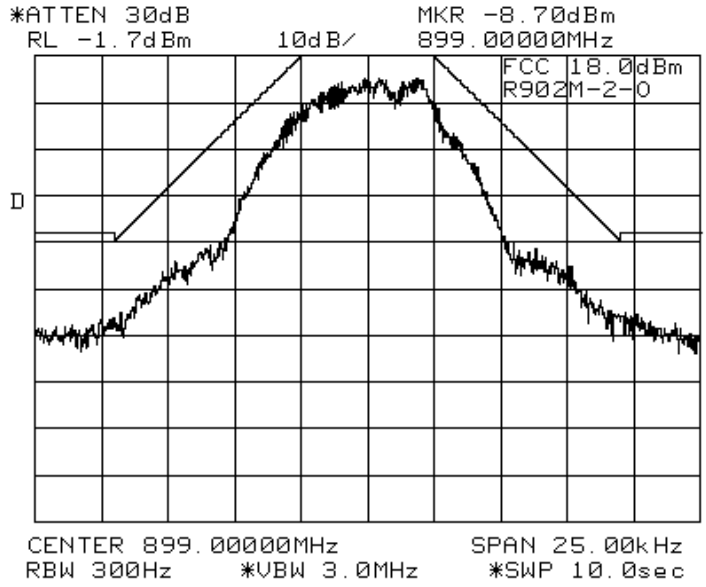
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
UNMODULATED CARRIER – LOW POWER



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – HIGH POWER



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – LOW POWER



Author Data	Date	Document No.
Masud S. Attayi	April 8, 1999	01947-CERT-FCC-TEST-SPURIOUS
Approved	Rev	File / Reference
		Spurious

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

TEST PROCEDURE:

The Research In Motion Limited R902M-2-O radio modem device was connected together with a radio monitor board 02120-001, host computer, external power supply, a 20 dB external attenuator, and a coaxial cable. The R902M-2-O antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator and a coaxial cable. The transmitter was operating at full output power with and without internal data modulation. The calculated limit below the unmodulated carrier at +12.1 dBm, including the 20 dB external attenuator and 1 dB cable loss, is +33.1 dBm. The actual limit is 53.1 dBc lower, or -20.0 dB.

TEST RESULTS:

Ref 899 **+33.1 (- 53.1)** **-20.0**

FREQUENCY MHz	LEVEL dBm	LIMIT dB
899	33.1	
1,798	-37.0	-20.0
2,697	-39.3	-20.0
3,596	-62.9	-20.0
4,495	-55.1	-20.0
5,394	-39.8	-20.0
6,293	-41.7	-20.0
7,192	-73.1	-20.0
8,091	-57.2	-20.0
8,990	-66.5	-20.0

NOTE:

The above limits take into account the unmodulated carrier level of 33.1 dBm inclusive of the 20 dB external attenuator and 1 dB coaxial cable loss. The modulation used was a worst case, random data pattern while still representing a normal modulation pattern.

EQUIPMENT:

- H.P. 8563E Spectrum Analyzer 9.0 KHz - 26.5 GHz
- HP6632A DC POWER SUPPLY
- Mini Circuits 20 dB att. # NAT-20 0 Hz - 1.5 GHz

Author Data	Date	Document No.
Masud S. Attayi	April 8, 1999	01947-CERT-FCC-TEST-012
Approved	Rev	File / Reference
		012

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement
2.985 (a,c) RF Power Output
Part 90 Subpart I : Technical Standards
90.205 RF Power Output
(i) Maximum power output limit : reference to subpart S, Subpart 90.635 (896-901 MHz band).
Part 90 - Subpart S : Use of Frequencies in 896-901 MHz Band
90.635 Limitations on Output Power
(d) Mobile station maximum output power is 100 W (20dBW)

We are rating the device as 2 W (33 dBm) output across a 50 ohm load.
But we are requesting 2.25 W (33.5 dBm) as an absolute maximum device output power due to the 0.5 dB tolerance in our Calibration software tool.
Calibrated power measurement using the following equipment:

HP EPM-441A Power Meter	S/N GB37481300	Cal on 29/04/98
HP ECP-E18A Power Sensor	S/N US37181260	Cal on 05/05/98
HP 8753D Network Analyzer	S/N 3410A05905	Cal on 08/08/98
HP 85033D Calibration Kit	S/N 3423A00734	Cal on 20/08/98

Mini-Circuits NAT-20 DC to 1500 MHz Coaxial Attenuator

Procedure: These results were obtained using the test procedure described in document 01947-CERT-FCC-TEST-013.

The 8753D was calibrated using the 85033D. The cable assembly and microwave attenuator used for the measurements were calibrated using the 8753D. The EPM-441A and ECP-E18A were calibrated using the internal power reference. The radio was tuned by the procedure as provided for sections 2.983(d)(5) and 2.983(d)(9). At three transmit frequencies the maximum radio output power level was measured using the EPM-441A and ECP-E18A. Output levels were measured for both modulated and unmodulated carrier. The calibrated insertion loss measured for the attenuator and cable assembly was added to the calibrated power measurements which produced the following results:

Maximum requested: 2.25 W (33.5 dBm)

Results:

Carrier Frequency (MHz)	Measured Level (dBm)	Calibrated Attenuation (dB)	Output Power (dBm)	Output Power (W)
896.000	6.25	26.83	33.08	2.03
899.000	6.02	26.83	32.85	1.93
901.000	6.01	26.83	32.84	1.92

Identical output power levels were recorded for both modulated and unmodulated carrier.

Author Data	Date	Document No.
Masud S. Attayi	April 8, 1999	01947-CERT-FCC-TEST-013
Approved	Rev	File / Reference
		013

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement
2.995 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation
(d) Frequency Stability - Voltage Variation

Part 90 Subpart I : Technical Standards
90.213 Frequency Tolerance
(a) Maintain the carrier frequency within 0.00015 % (1.5 ppm) of the assigned frequency.
(b) Maximum power output used for measurement

Frequency and power measurements were performed together with the same set up. Frequency and power data were both recorded across temperature and voltage. The set up used a cable assembly with a power splitter to allow concurrent measurements with the frequency counter, the power meter and the signal generator. The cable assembly was calibrated to allow compensation of the insertion loss between the transmitter and the power meter.

Calibration for the Cable and Attenuator Loss:

Place: RF Lab in RIM.
Date: March 14, 1999
Time: 08:26:00.

Instruments used:

Instrument	Serial Number	Calibrated on
Network Analyzer HP 8753D	3410A05905	08/08/98
Calibration Kit HP85033D	3423A00734	20/08/98

Procedure:

Full Two port Calibration of 8753D using the 85033D was done.

An assembly of Cables, Attenuator, power splitter, and connectors was made for making RF power measurements.

Attenuator: 20dB, DC to 1500 MHz - Mini-Circuits model no: NAT-20
Power splitter: 4.93 dB - Mini-Circuits model no: 15542 ZN3PD 900W

The total loss of this cable assembly from the RF input to the RF output was measured to be 26.83 dB at 899.0 +/- 3 MHz.

Power and frequency measurements of RIM Radio at different temperatures:

Place: RF Lab in RIM
Date: March 23 1999

Instruments used:

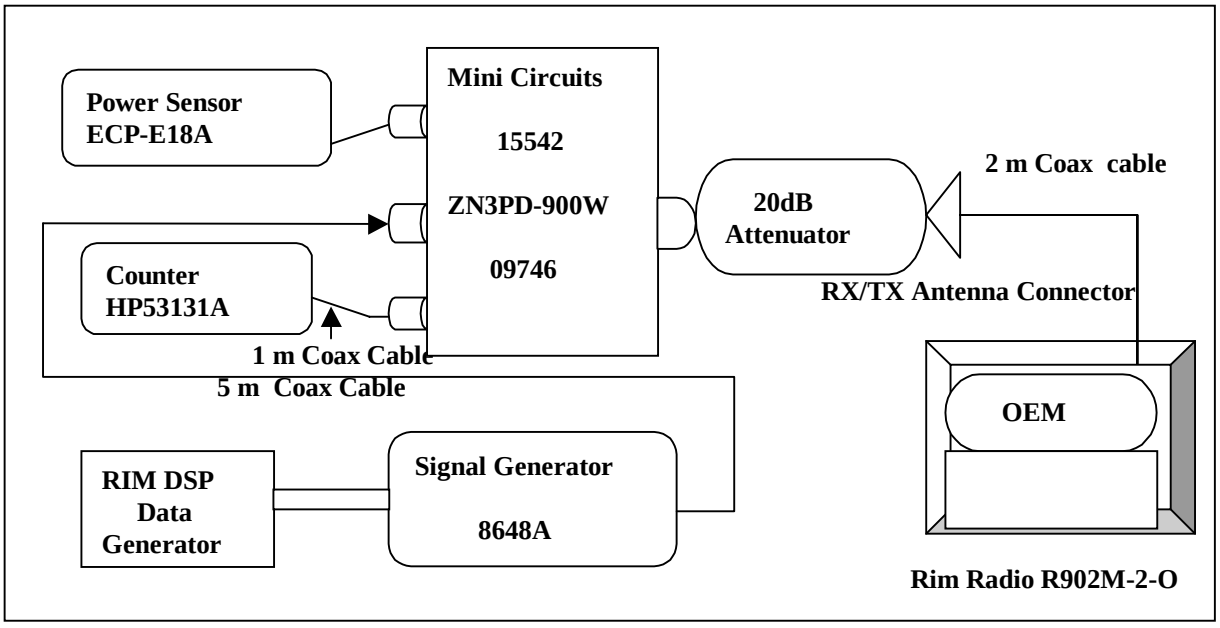
Instrument	Serial number	Calibrated on
DC Power supply HP 6632A	3524A14012	05/08/98
Universal Counter HP 53131A	3325A00988	04/08/98
Power Meter HP EPM-441A	GB37481300	29/04/98
Power Sensor HP ECP-E18A	US37181260	05/05/98
Signal Generator HP 8648A	3636A02799	25/11/98
RIM 2181 DSP board		

Temperature Chamber used:

Manufacturer: Envirotronics
Model: SH8C
Serial No: 01984093-S-10860

Procedure:

The RIM Radio modem device R902M-2-O was placed in the Temperature chamber and connected to the instruments outside as shown in the figure below. Dry air was pumped inside the temperature chamber to maintain a back pressure during the test. The Radio was kept in the off condition at all times except when the measurements were to be made.



The chamber was switched on and the temperature was set to -30°C.
After the chamber stabilized at -30 °C there was a soak period of one hour to alleviate moisture in the chamber. The Radio was switched on and frequency and power measurements were made as follows:

The RIM Radio automated test utility was controlled by computer. This application was given ward of activating all machines intrinsic to the temperature test. It controls the HP 53131A universal counter, HP 6623A power supply, HP EPM-441A power meter and HP 8648A signal generator by GPIB Bus. The Environmental Chamber was instructed through a RS-232 serial line. The RIM Radio dialogue was passed through a serial connection with a special Serial-to-Radio message converter. The Radio was put in repetitive alternating receive and transmit modes and the power and frequency levels were measured and recorded by the RIM automated test utility.

The RIM Radio Automated test utility produces data files in text format. All data from this test has been formatted from the initial files into a single Spreadsheet.

The RIM Radio output was characterized through its power and frequency across temperature (-30°C to 75°C), and transmit frequency (896 MHz to 901 MHz) at an output power of 33 dBm.

The Radio power and frequency were measured at voltages of 4.15, 4.45, AND 4.75 VDC. The transmit frequency was varied in 3 steps consisting of 896 MHz, 899 MHz and 901 MHz. This frequency generated by the RIM Radio has been recorded in MHz and also as deviation from nominal in Parts Per Million.

The output from the RIM Radio was accounted from -30°C to 75°C in +5 °C steps. The Radio was interrogated for data every 29 seconds for each measurement and 10 minutes for each voltage readings. From activity the Radio heats up and produces different signals. This heating led to much data which characterizes the Radio over most temperatures, not just at 5°C intervals.

Before the initial temperature one hour soak was allowed and for other temperature steps 1/2 hour soak was accomplished.

PROCEDURE

This process was affected through automation.

1. Switch on the HP 6632B, power supply and set the Voltage to 4.15 V.
2. Set the initial Environmental Chamber temperature (-30 Degrees Celsius) and hold for initial soak.
3. Set the frequency to 896 MHz, and power to 33 dBm on RIM Radio.
4. Command the RIM Radio to receive mode and adjust its frequency to that of the HP 8648A signal generator and measure BERT.

5. Activate Carrier on RIM Radio.
6. Take initial HP EPM-441A power meter measurement.
7. Take initial HP 53131A frequency counter measurement.
8. Measure temperature of product.
9. Measure power output.
10. Measure frequency output.
11. Repeat steps 8 - 10 for twenty measurements every 29 seconds for 10 minutes.
12. Repeat steps 3 - 11 for 899 MHz and 901 MHz.
13. Increase temperature by 5°C and soak for 1/2 hour.
14. Repeat steps 2-13 for temperatures –25 degrees to 75 degrees Celsius.

Procedure 3 to 12 was then repeated at 25°C with the power supply voltage set to 4.15, 4.45 and 4.75V.

Author Data	Date	Document No.
Masud S. Attayi	April 8, 1999	01947-CERT-FCC-TEST-014
Approved	Rev	File / Reference
		014

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement
2.995 Frequency Stability - Procedures
(a,b) Frequency Stability - Temperature Variation

Part 90 - Subpart I : Technical Standards
90.213 Frequency Tolerance
(a) Maintain the carrier frequency within 0.00015 % (1.5 ppm) of the assigned frequency.
(b) Maximum power output used for measurement

Procedure: These results were obtained using the test procedure described in document 01947-CERT-FCC-TEST-013.

Results: 896 MHz nominal transmitter

Ambient Temperature (Degrees Celsius)	Minimum Device Temperature (Degrees Celsius)	Maximum Device Temperature (Degrees Celsius)	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
-30.0	-24.60	-24.30	-0.1027	-0.1217
-25.0	-19.70	-19.30	-0.1194	-0.1250
-20.0	-15.40	-15.10	-0.1116	-0.1239
-15.0	-11.00	-10.60	-0.1016	-0.1161
-10.0	-6.10	-5.80	-0.1038	-0.1116
-5.0	-1.20	-0.80	-0.0848	-0.0971
0	3.70	4.00	-0.0781	-0.0882
5.0	8.30	8.50	-0.0692	-0.0781
10.0	13.20	13.40	-0.0681	-0.0681
15.0	18.10	18.40	-0.0536	-0.0558
20.0	23.30	23.50	-0.0424	-0.0502
25.0	28.30	28.60	-0.0223	-0.0435
30.0	33.60	33.80	--0.0547	-0.0547
35.0	38.20	38.50	-0.0558	-0.0558
40.0	43.20	43.40	-0.0513	-0.0513
45.0	48.30	48.50	-0.0759	-0.0960
50.0	53.10	53.40	-0.0971	-0.1038
55.0	58.20	58.40	-0.1027	-0.1094
60.0	63.20	63.40	-0.1049	-0.1205
65.0	67.90	68.20	-0.1183	-0.1239
70.0	72.60	72.90	-0.1083	-0.1250
75.0	77.30	77.70	-0.1150	-0.1373

Results: 899 MHz nominal transmitter.

Ambient Temperature (Degrees Celsius)	Minimum Device Temperature (Degrees Celsius)	Maximum Device Temperature (Degrees Celsius)	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
-30.0	-24.80	-24.40	-0.1034	-0.1135
-25.0	-19.70	-19.30	-0.1224	-0.1324
-20.0	-15.40	-15.10	-0.1201	-0.1324
-15.0	-11.10	-10.70	-0.1190	-0.1190
-10.0	-6.10	-5.80	-0.0879	-0.1068
-5.0	-1.10	-0.80	-0.0857	-0.0890
0	3.70	4.00	-0.0745	-0.0934
5.0	8.30	8.60	-0.0578	-0.0701
10.0	13.10	13.30	-0.0512	-0.0701
15.0	18.20	18.50	-0.0389	-0.0512
20.0	23.30	23.50	-0.0501	-0.0501
25.0	28.40	28.50	-0.0289	-0.0378
30.0	33.40	33.70	-0.0423	-0.0501
35.0	38.30	38.50	-0.0489	-0.0612
40.0	43.20	43.40	-0.0456	-0.0634
45.0	48.20	48.40	-0.0756	-0.0857
50.0	53.10	53.40	-0.1034	-0.1034
55.0	58.20	58.40	-0.0979	-0.1123
60.0	63.10	63.40	-0.1057	-0.1190
65.0	67.90	68.20	-0.1090	-0.1268
70.0	72.60	72.80	-0.0990	-0.1257
75.0	77.30	77.50	-0.1201	-0.1257

Results: 901 MHz nominal transmitter.

Ambient Temperature (Degrees Celsius)	Minimum Device Temperature (Degrees Celsius)	Maximum Device Temperature (Degrees Celsius)	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
-30.0	-24.40	-23.90	-0.1265	-0.1265
-25.0	-20.70	-19.00	-0.1210	-0.1443
-20.0	-14.80	-14.30	-0.1188	-0.1232
-15.0	-9.70	-9.30	-0.1021	-0.1154
-10.0	-4.90	-4.60	-0.0966	-0.1065
-5.0	-0.10	0.30	-0.0966	-0.0966
0	4.60	5.10	-0.0810	-0.0910
5.0	9.30	9.60	-0.0688	-0.0844
10.0	14.10	14.50	-0.0577	-0.0733
15.0	18.20	18.40	-0.0622	-0.0655
20.0	23.30	23.50	-0.0544	-0.0577
25.0	28.30	28.50	-0.0366	-0.0577
30.0	33.30	33.50	-0.0477	-0.0688
35.0	38.10	38.40	-0.0622	-0.0744
40.0	43.00	43.30	-0.0688	-0.0810
45.0	48.10	48.20	-0.0721	-0.0899
50.0	53.00	53.20	-0.0954	-0.1054
55.0	57.80	58.00	-0.0966	-0.1143
60.0	62.60	62.80	-0.1110	-0.1232
65.0	66.90	67.60	-0.1321	-0.1354
70.0	71.90	72.10	-0.1199	-0.1365
75.0	76.60	77.20	-0.1265	-0.1354

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Part 2 Required Measurement
2.995 Frequency Stability - Procedures
(d) Frequency Stability - Voltage Variation

Part 90 Subpart I : Technical Standards
90.213 Frequency Tolerance
(a) Maintain the carrier frequency within 0.00015 % (1.5 ppm) of the assigned frequency.
(b) Maximum power output used for measurement

Procedure: These results were obtained using the test procedure described in document 01947-CERT-FCC-TEST-013.

Results: 896 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	4.15	-0.0826	-0.1038
25.0	4.45	-0.0223	-0.0435
25.0	4.75	-0.0257	-0.0491

Results: 899 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	4.15	-0.0634	-0.0634
25.0	4.45	-0.0289	-0.0378
25.0	4.75	-0.0289	-0.0467

Results: 901 MHz. nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	4.15	-0.0910	-0.1132
25.0	4.45	-0.0366	-0.0577
25.0	4.75	-0.0433	-0.0677