ELECTROMAGNETIC EMISSIONS TEST REPORT

BY

COM-SERVE CORPORATION

KITCHENER, ONTARIO

CANADA

RADIATED and CONDUCTED EMI TEST REPORT

March 17, 2000

CLIENT:

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

TESTED MODEL:

Model Number:	**R857D-2-5**
Serial Number:	ESN 128/00/000005
Description:	Proton Handheld Device
Date tested:	March 13, 2000
Tested with:	Host computer, IBM ThinkPad 770ED-S97-3819-2, Serial # 78-X1980 09/98, FCC ID 4U6JPN-31879-DTE; Research in Motion Direct Plug-in Transformer, Model ASY-02343-001, 12Vdc @ 500mA; 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. Jonathan Doll and Mr. Vijay Kohli (Research in Motion)

FILE NUMBER: RIM 028

RESULTS R875D-2-5 RIM 028

		COMPLIANCE (yes)	(no)
RF POWER OUTPUT			
Transmitter:	2.1046	(X)	( )
OCCUPIED BANDWIDTH			
Transmitter:	2.1049	(N/T)	( )
SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS			
Transmitter:	2.1051	(N/A)	( )
FIELD STRENGTH OF SPURIOUS RADIATION			
Transmitter:	2.1053	(X)	( )
FREQUENCY STABILITY			
Transmitter:	2.1055	(N/T)	( )
BANDWIDTH LIMITATIONS			
Transmitter:	90.210 g	(N/T)	( )

SYSTEM DESCRIPTION RIM 028

The R857D-2-5 PROTON Handheld Device

The Research In Motion R857D-2-5 PROTON handheld device is a stand alone, wireless, two-way data communications device, operating on the DataTAC packet-switched wireless data network. The intended users are business people and executives who travel or work away from the office. Also targeted are mobile computer users, cellular telephone users and alpha-numeric pager users. It is a complete, secure, integrated wireless e-mail solution designed specifically for the mobile professional.

The PROTON has a standard EIA/TIA 232 level compatible serial asynchronous interface, allowing it to communicate directly with an external computer and/or terminal device. In order to make a serial connection to backup data, transfer data, and synchronize information between the RIM device and a personal computer, the R857D-2-5 PROTON can be inserted into a charging enabled cradle with the cradle I/O cable connected to the computer. The cradle can be obtained from Research In Motion under part number ASY-02343-001. The I/O cable is 2.0 metres long and has standard connections for RS-232 at one end and a connector that mates with the PROTON on the other end. A UL/CSA listed class II direct plug-in transformer connects to the RS-232 end of the cable that plugs into the back of a computer and then to a standard 120VAC outlet to supply power for charging the lithium ion battery in the R857D-2-5. The wireless service providers and their resellers will make the charging cradle and I/O cable available as approved accessories that will be sold with the R857D-2-5 PROTON handheld device.

The R857D-2-5 PROTON is a self-contained, battery powered device. It contains an embedded lithium ion battery pack operating at 4.15 VDC that provides system power.

The antenna for the R857D-2-5 PROTON is internal to the device. It is located inside the case around the left side of the liquid crystal display and the keypad. There is NO facility for connecting an external antenna.

Normal PROTON operation for live use is called burst packet activity. The device is normally in receive mode listening to all network activity. When a data packet is received that is explicitly addressed to the PROTON, it transmits a short acknowledgement packet. When data is to be transmitted from the device, the radio first receives system information from the network to determine when to transmit. There is no deterministic pattern to network traffic or transmit packet timing.

For FCC Part 90 testing purposes, the system was configured with an IBM ThinkPad 770ED laptop computer and RIM proprietary test software executing under Windows 95. The test software, the "RIM Config Tool" can place the device in certain test modes to continuously receive or transmit for several seconds on a fixed frequency. Transmit modes include carrier and repetitive or scrambled data modulation.

SYSTEM DESCRIPTION; CONTINUED

There is also the ability to select several different modes that keep the serial connection between the host computer and the PROTON continuously active. To facilitate FCC testing, the radio specification allows the PROTON to transmit with and without modulation, generated from scrambler sequence or fixed sequence data, for several seconds. The transmit test modes were used for testing the radio for compliance to CFR47 standards.

FUNCTIONAL DESCRIPTION:

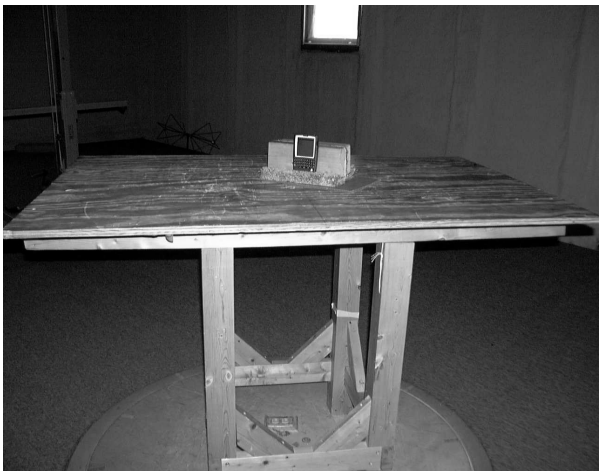
The R857D-2-5 is an 800 MHz band, half duplex (two frequency simplex), 2.0 Watt transceiver system for wireless data modem communications on the DataTAC wireless system.

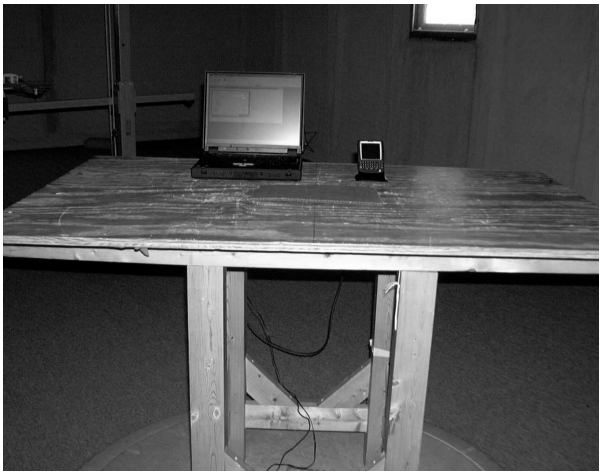
The transmitter is capable of transmitting at carrier frequencies from 806 MHz to 825 MHz, with discrete channels at 12.5 KHz steps having channel bandwidths of 25 KHz each.

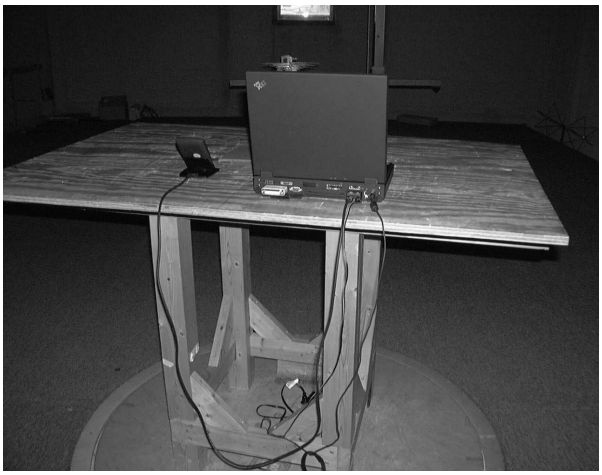
The active transmit frequencies are determined by the radio firmware for nationally allocated DataTAC system channels and by the DataTAC system for operational local channels. The user is not capable of modifying the frequency of operation for the device.

The transmitter will only generate RF power at a single level of 2000 milliwatts (+33 dBm). The output power level of the device cannot be modified by the user.

SYSTEM DESCRIPTION Photos







TEST PROCEDURE: RADIATED EMISSIONS RIM 028

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

The Research In Motion Limited R857D-2-5 PROTON handheld device was connected together with a host laptop computer and charging cradle 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 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 IBM laptop computer, the R857D-2-5 PROTON and the RIM charging cradle were placed on top of the turntable while the power supply for the RIM charging cradle and the IBM ThinkPad computer were 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 Research in Motion handheld device was processing data to and from the IBM PC. To evaluate radiated power or ERP, the transmitter was tested while connected to the charging cradle in the entire system and was retested while standing alone on the test table. 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.

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 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:

	Advantest R3261A Spectrum Analyzer and	
	H.P. 8563E Spectrum Analyzer	9.0 KHz - 26.5 GHz
Setting:	BW: 300 Hz, 100 KHz or 120 KHz (Q.P), as required.	
	LNA, HP 8449B Preamplifier (30 dB)	1.0 to 26.5 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
	EATON dipole antennas; T1, T2, T3	25 MHz - 1.0 GHz
CDI	ROBERTS dipole antennas T1 T2 T3 T4	25 MHz - 1.0 GHz

NOTE: 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. (ANSI C63.4/FCC OET-55)

RADIATED EMISSION RESULTS RIM 028

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

PART 2/90 TRANSMITTER RADIATED TESTS

TEST #	FREQ. G Hz	LEVEL µV	ANT. TYPE (PZ)	ANT. FAC.	F.S. µV/M	LIMIT µV/M	DIFF. TO LIMIT; dB
01 TX	815.00	91700.0	RT.4 V	41.4	3796380	N/A	N/A
02 TX	1630.00	3016.0	L/P V	3.0	9048.0	16515	-5.23
03 TX	2445.00	466.0	L/P V	5.5	2563.0	16515	-16.18

NOTES:

A) The EUT integral antenna is not, and does not perform like a ½ wave dipole antenna, therefore the ERP based upon a measurement of the actual carrier level, is **2.64W**. It also should be noted that a preamplifier (LNA) in conjunction with a 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 47.23 dBc below the relative radiated power (ERP) output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

C) Limit Calculations:

Attenuation= 43 + 10 × Log of ERP (2.64W)
= 43 + (4.23)
= 47.23 **dBc**
Limit (FS) = 3.79638 V/m less 47.23dB
= 0.016515 V/m or 16515 µV/m

ERP = $(|E|^2 \times D^2) \div (30 \times 1.64)$ where |E| is the measured field strength at the receiving antenna, and 1.64 is antenna factor relative to a dipole reference. The distance (= 3 metres) is the distance between the transmitting antenna of the EUT/device and the receiving antenna.

- For |E| = 3.79638 V/m and D = 3 metres, the ERP is 2.64W

RADIATED EMISSION RESULTS RIM 028

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

PART 2/90 TRANSMITTER RADIATED TESTS - WITH CRADLE

TEST #	FREQ. G Hz	LEVEL µV	ANT. TYPE (PZ)	ANT. FAC.	F.S. µV/M	LIMIT µV/M	DIFF. TO LIMIT; dB
01 TX	**815.00**	**38200.0**	**RT.4 V**	**41.4**	**1581480**	**N/A**	**N/A**
02 TX	**1630.00**	**2982.0**	**L/P V**	**3.0**	**8946.0**	**16541**	**-5.34**
03 TX	**2445.00**	**583.4**	**L/P V**	**5.5**	**3208.7**	**16541**	**-14.24**

NOTES:

A) The EUT integral antenna is not, and does not perform like a ½ wave dipole antenna, therefore the ERP based upon a measurement of the actual carrier level, is **0.458W**. It also should be noted that a preamplifier (LNA) in conjunction with a 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 39.61 dBc below the relative radiated power (ERP) output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

C) Limit Calculations:

Attenuation= 43 + 10 × Log of ERP (0.458W)
= 43 + (-3.39)
= 39.61 **dBc**
Limit (FS) = 1.58148 V/m less 39.61 dB
= 0.016541 V/m or 16541 µV/m

ERP = $(|E|^2 \times D^2) \div (30 \times 1.64)$ where |E| is the measured field strength at the receiving antenna, and 1.64 is antenna factor relative to a dipole reference. The distance (= 3 metres) is the distance between the transmitting antenna of the EUT/device and the receiving antenna.

- For |E| = 1.58148 V/m and D = 3 metres, the ERP is 0.458W

FEDERAL COMMUNICATIONS COMMISSION
Equipment Authorization Division
7435 Oakland Mills Road
Columbia, MD 21046
September 17, 1998

31010EQU 4-3-1

Mr. Bryan Taylor
Research In Motion Ltd
295 Phillip Street
Waterloo, Ontario, CANADA

Re: Your application for equipment authorization dated March 30, 1998.
Equipment Classification: Low Power Communication Device Receiver
FCC ID: L6AR900M-2-PW (Receiver portion)

Dear Mr. Taylor:

The above referenced application is hereby DISMISSED without action and returned as unnecessary pursuant to Section 2.917(b) of the rules.

Any receiver that is part of a transmitter and is required to be "Notified" under the Commission's present rules, will be reduced to a "verification" self-approval when the transmitter is certified or Type Accepted, see Section 15. 101(b) of our rules.

The Commission's Laboratory staff will begin the process to refund the filing fee of $895.00. Since refund checks are issued by the U.S. Treasury Department, it may take as long as eight week for the refund to arrive.

Sincerely,

Charles M. Cobbs, Chief
Applications Processing Branch

Enclosure
Incoming

Mail to:

Marstech Limited
11 Kelfield Street
Etobicoke, Ontario, CANADA
M9W 5A1

Test Data	Date	Document No.
J. Doll	April 5, 2000	02464-CERT-FCC-TEST-BW_MASK
Approved	Rev	File / Reference
M. Attayi		BW_MASK.doc

OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS

TEST PROCEDURE:

The Research In Motion Limited R857D-2-5 Proton device was connected together with a host computer, external power supply and a 20 dB external attenuator. The R857D-2-5 antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator. The R857D-2-5 transmitter was operating at full output power with and without internal data modulation.

TEST RESULTS:

UNMODULATED CARRIER, High Power: **12.87dBm** with a 20dB external pad and a 1 m Sucoflex cable with a total loss of 0.18 dB.

> Internal Modulation: Please refer to the attached spectrum analyzer plots. 100% of the in-band modulation is below the specified mask per 90.210(g) for both RD_LAP and MDC protocols.

Below is the **description of the mask** for band 806-821/851-866 MHz (DataTAC) : 2.0 Watts transmitter

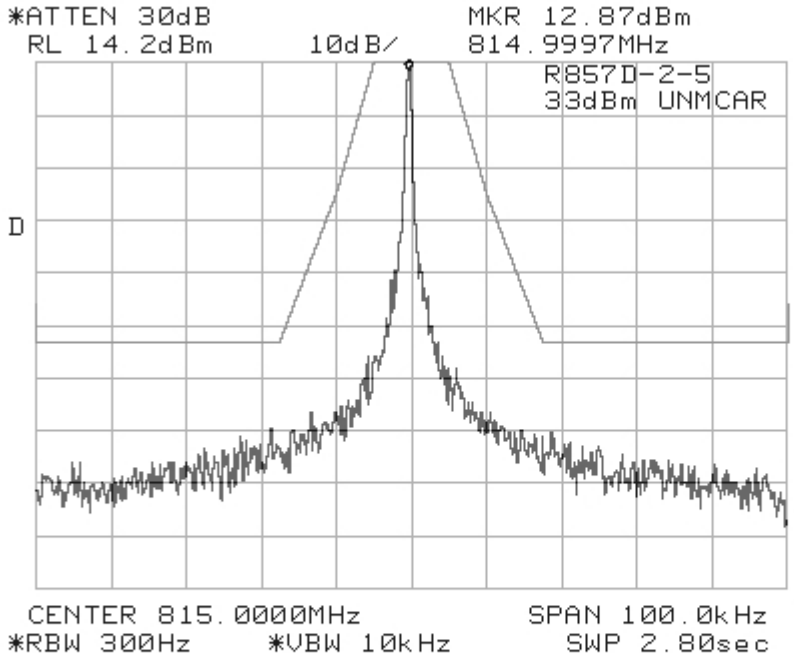
Frequency (MHz)	Formula	Limit (dB)
-26500	43+10 log (P)	-46
-0.050	43+10 log (P)	-46
-0.050	50+10 log (P)	-53
-0.0175	116 log (f_d / 6.1)	-53
-0.010	116 log (f_d / 6.1) or 83 log (f_d / 5)	-25
-0.005	83 log (f_d / 5)	0.0
0.005	83 log (f_d / 5)	0.0
0.010	116 log (f_d / 6.1) or 83 log (f_d / 5)	-25
0.0175	116 log (f_d / 6.1)	-53
0.050	50+10 log (P)	-53
0.050	43+10 log (P)	-46
26500	43+10 log (P)	-46

EQUIPMENT:

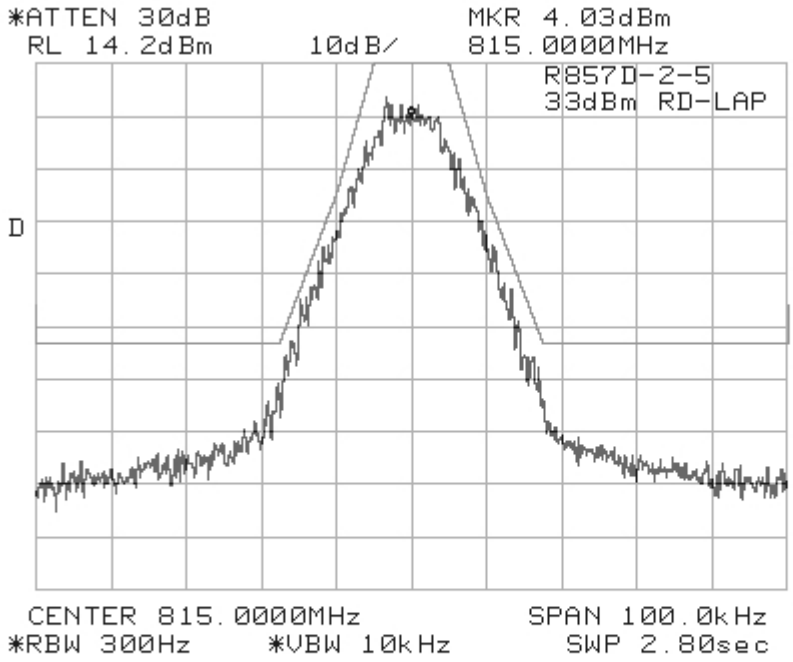
- H.P. 8563E Spectrum Analyzer 9.0 KHz - 26.5 GHz
- HP6632B DC POWER SUPPLY
- Mini Circuits 20 dB att. # NAT-20 0 Hz - 1.5 GHz

SETTING: RBW: 300 Hz; VBW: 10KHz; SPAN: 100 KHz; SWP: 2.8sec

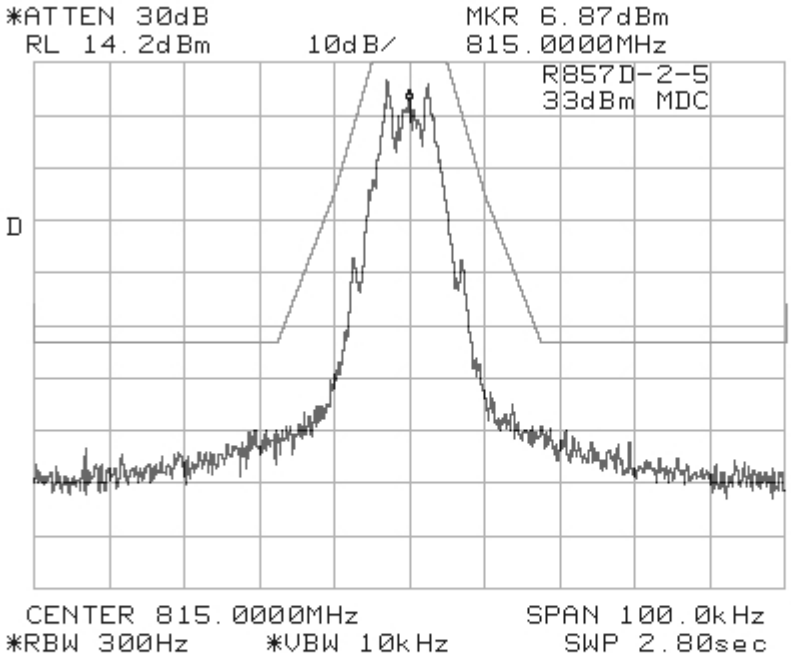
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
UNMODULATED CARRIER



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – RD_LAP



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – MDC



Test Data	Date	Document No.
J. Doll	April 5, 2000	02464-CERT-FCC-TEST-SPURIOUS
Approved	Rev	File / Reference
M. Attayi		Spurious.doc

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

TEST PROCEDURE:

The Research In Motion Limited R857D-2-5 DataTAC Proton handheld device was connected together with a host computer, external power supply, a 20 dB external attenuator, and a coaxial cable. The R857D-2-5 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 unmodulated, including the external attenuator and cable loss, is 33 dBm. The actual limit is 46 dBc lower, or -13.0 dBm.

TEST RESULTS:

Ref 815 +33 (- 46) -13.0

FREQUENCY MHz	LEVEL dBm	LIMIT dBm
815	33.00	N/A
1630	-32.86	-13.00
2445	-45.24	-13.00
3260	-42.98	-13.00
4075	-46.93	-13.00
4890	-39.86	-13.00
5705	-56.44	-13.00
6520	-56.37	-13.00
8150	-56.26	-13.00

NOTE:

The above limits take into account the unmodulated carrier level of 33 dBm inclusive of the external attenuator and 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
- 1R-20 DC to 10GHz Coaxial Attenuator

Test Data	Date	Document No.
J. Doll	April 5, 2000	02464-CERT-FCC-TEST-012
Approved	**Rev**	**File / Reference**
M. Attayi		012.doc

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement
2.1046 (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, Subsection 90.635 (806-824 MHz band).

Part 90 - Subpart S : Use of Frequencies in 806-824 MHz Band
90.635 Limitations on Output Power
(d) Mobile station maximum output power is 100 W (20dBW)

We are rating the device as 2.00 W transmitter output power across a 50 ohm load, thus a maximum power level of 2.00 W (33.0 dBm) is requested. Upper limit on the device output power would therefore be 2.00 W (33.0 dBm).

Calibrated power measurement using the following equipment:

HP EPM-441A Power Meter	S/N GB37481294	Cal on 05/08/99
HP ECP-E18A Power Sensor	S/N US37181260	Cal on 05/08/99
HP 8720D Network Analyzer	S/N US36140834	Cal on 05/08/99
HP HP85052D Calibration Kit	S/N 3101A04308	Cal on 15/08/99

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

Procedure: These results were obtained using the test procedure described in document 02464-CERT-FCC-TEST-013.

The 8720D was calibrated using the 85052D. The cable assembly and microwave attenuator used for the measurements were calibrated using the 8720D. The EPM-441A and ECP-E18A were calibrated using the internal power reference. The radio was tuned by the procedure as provided for sections 2.1033 (c) (8) and 2.1033 (c) (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: 2.00 W (33.0 dBm)
Results:

Carrier Frequency (MHz)	Measured Level (dBm)	Calibrated Attenuation (dB)	Cable Attenuation (dB)	Output Power (dBm)	Output Power (W)
806.000	12.90	19.90	0.20	33.00	2.00
815.000	12.90	19.90	0.20	33.00	2.00
821.000	12.89	19.90	0.20	32.99	1.99

Test Data	Date	Document No.
J. Doll	April 5, 2000	02464-CERT-FCC-TEST-013
Approved	Rev	File / Reference
M. Attayi		013.doc

CFR 47 Chapter 1 - Federal Communications Commission Rules

Part 2 Required Measurement
2.1055 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 0.00025 % (2.5 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 13th, 2000

Instruments used:

Instrument	Serial Number	Calibrated on
Network Analyzer HP 8720D	US36140834	05/08/99
Calibration Kit HP85052D	3101A04308	15/08/99

Procedure:

Full Two port Calibration of 8720D using the 85052D was done.

An assembly of Cables, Attenuator, power splitter, and connectors were set up to complete the RF power measurements.

Attenuator: 20dB, DC to 1.5 GHz - Mini-Circuits model no: NAT-20
Power splitter 2 Port: 3.23 dB - Mini-Circuits model no: MCL ZN2PD-900W

The total loss of this cable assembly from the RF input to the RF output was measured to be **24.63 dB** at 815 +/- 6 MHz.

Power and frequency measurements of RIM Radio at different temperatures:

Place: RF Lab in RIM
Date: March 13th, 2000

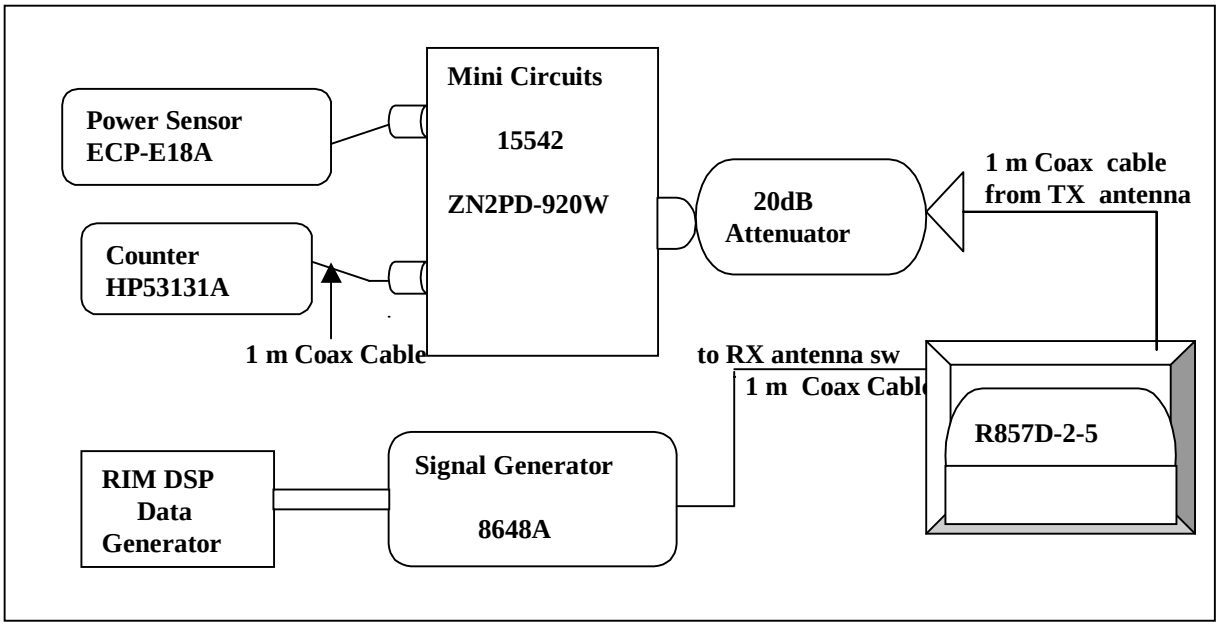
Instruments used:

Instrument	Serial number	Calibrated on
DC Power supply HP 6632B	US37472173	28/07/99
Universal Counter HP 53131A	3736A18844	03/08/99
Power Meter HP EPM-441A	GB37481300	05/08/99
Power Sensor HP ECP-E18A	US37181260	05/08/99
Signal Generator HP 8648A	3636A02799	29/07/99
RIM 2181 DSP board		

Temperature Chamber used:
Manufacturer: Envirotronics
Model: SH8C
Serial No: 01984093-S-10860

Procedure:

The RIM Proton device R857D-2-5 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 controlled 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 60°C), and transmit frequency (806 MHz to 821 MHz) at an output power of 33 dBm.

The Radio power and frequency were measured at voltages of **3.8, 4.1, and 4.4 VDC**. The transmit frequency was varied in 3 steps consisting of 806 MHz, 815 MHz and 821MHz. 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 60°C in +5 °C steps. The Radio was interrogated for data every **24 seconds for each measurement and 8 minutes for each temperature step.** 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.

The initial temperature soak was allowed for one hour and for subsequent 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 4.10 V
2. Set the initial Environmental Chamber temperature (-30 Degrees Celsius) and hold for initial soak.
3. Set the frequency to 806 MHz, and power to 33 dBm on RIM Radio Modem.
4. Activate Carrier on RIM Radio Modem.
5. Take initial HP EPM-441A power meter measurement.
6. Take initial HP 53131A frequency counter measurement.
7. Measure temperature of product.

8. Measure power output.
9. Measure frequency output
10. Increase temperature by 5°C and soak for 1/2 hour. Repeat steps 8 - 10 for twenty measurements every 24 seconds for 8 minutes.
11. Repeat steps 3 - 10 for 815 MHz and 821 MHz.
12. Increase temperature by 5°C and soak for 1/2 hour.
13 Repeat steps 2-12 for temperatures –30 degrees to 60 degrees Celsius

Procedure 3 to 12 was then repeated at 25°C with the power supply voltage set to **3.8, 4.1, and 4.4 VDC.**

Test Data	Date	Document No.
J. Doll	April 5, 2000	02464-CERT-FCC-TEST-014
Approved	Rev	File / Referenc
M. Attayi		014.doc

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement
2.1055 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 0.00025 % (2.5 ppm) of the assigned frequency.
(b) Maximum power output used for measurement

Procedure: These results were obtained using the test procedure described in document 02464-CERT-FCC-TEST-013.

Results: 806 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	-29.7	-29.3	-0.0831	-0.0918
-25	-25.1	-24.2	-0.1551	-0.1600
-20	-20.1	-19.3	-0.3102	-0.3102
-15	-15.1	-14.3	-0.4392	-0.4404
-10	-10.3	-9.6	-0.5658	-0.5658
-5	-5	-4.6	-0.6563	-0.6576
0	0	0.4	-0.7494	-0.7494
5	5	5.4	-0.7792	-0.7792
10	10	10.2	-0.8176	-0.8176
15	15	15.3	-0.8288	-0.8325
20	19.8	20.2	-0.8226	-0.8288
25	25	25.2	-0.7940	-0.7978
30	29.9	30.2	-0.7395	-0.7432
35	35	35.1	-0.6787	-0.6849
40	39.9	40	-0.5980	-0.6154
45	44.8	45.1	-0.5918	-0.6055
50	49.9	50.1	-0.5670	-0.5906
55	54.9	55.1	-0.4839	-0.5149
60	59.9	60	-0.3337	-0.3834

Results: 815 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	-30	-29.4	-0.0687	-0.0748
-25	-25	-24.3	-0.1264	-0.1264
-20	-20.2	-19.5	-0.2773	-0.2773
-15	-15	-14.4	-0.4110	-0.4110
-10	-10	-9.7	-0.5288	-0.5288
-5	-5.2	-4.5	-0.6319	-0.6319
0	-0.1	0.3	-0.7276	-0.7276
5	4.9	5.2	-0.7595	-0.7595
10	9.9	10.2	-0.8074	-0.8074
15	14.9	15.2	-0.8245	-0.8282
20	19.9	20.2	-0.8196	-0.8270
25	25	25.2	-0.7840	-0.7963
30	29.9	30.1	-0.7362	-0.7509
35	35	35.2	-0.6773	-0.6883
40	39.9	40.1	-0.6110	-0.6258
45	44.9	45	-0.5951	-0.6012
50	49.9	50.1	-0.5767	-0.5988
55	54.9	55.2	-0.5043	-0.5276
60	59.9	60	-0.3436	-0.3791

Results: 821 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	-29.9	-29.2	0.0305	0.0305
-25	-25	-24.4	-0.0219	-0.0219
-20	-19.8	-19.5	-0.1681	-0.1681
-15	-14.9	-14.4	-0.2911	-0.2911
-10	-10	-9.7	-0.4153	-0.4153
-5	-5.1	-4.7	-0.5371	-0.5371
0	-0.1	0.2	-0.6346	-0.6358
5	4.9	5.3	-0.6955	-0.6955
10	9.9	10.3	-0.7491	-0.7491
15	14.9	15.2	-0.7820	-0.7820
20	20	20.2	-0.7832	-0.7881
25	25	25.2	-0.7600	-0.7661
30	30	30.2	-0.7125	-0.7199
35	35	35.1	-0.6529	-0.6590
40	39.9	40.1	-0.5883	-0.5993
45	44.9	45.1	-0.5262	-0.5396
50	49.9	50	-0.5238	-0.5384
55	54.8	55	-0.4604	-0.4848
60	59.9	60	-0.3764	-0.4117

Test Data	Date	Document No.
J. Doll	April 5, 2000	02464-CERT-FCC-TEST-15
Approved	Rev	File / Reference
M. Attayi		015.doc

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement
2.1055 Frequency Stability - Procedures
(d) Frequency Stability - Voltage Variation

Part 90 Subpart I : Technical Standards
90.213 Frequency Tolerance
(a) Maintain the carrier frequency within 0.00025 % (2.5 ppm) of the assigned frequency.
(b) Maximum power output used for measurement

Procedure: These results were obtained using the test procedure described in document 02464-CERT-FCC-TEST-013.

Results: 806 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25	3.8	-0.7916	-0.7978
25	4.1	-0.7940	-0.7978
25	4.4	-0.8077	-0.8077

Results: 815 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25	3.8	-0.7988	-0.8037
25	4.1	-0.7840	-0.7963
25	4.4	-0.7877	-0.7975

Results: 821 MHz. nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25	3.8	-0.7625	-0.7698
25	4.1	-0.7600	-0.7661
25	4.4	-0.7345	-0.7649