ELECTROMAGNETIC EMISSIONS TEST REPORT

BY

COM-SERVE CORPORATION

KITCHENER, ONTARIO

CANADA

RADIATED and CONDUCTED EMI TEST REPORT

March 19, 1999

CLIENT:

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

TESTED MODEL:

Model Number:	**R800D-2-PW**
Serial Number:	Not Marked (FCC # 2)
Description:	Interactive Pager
Date tested:	February 23, 25 & 26, 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; 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 018

RESULTS R800D-2-PW RIM 018

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

SYSTEM DESCRIPTION RIM 018

The R800D-2-PW Inter@ctive Pager

The Research In Motion R800D-2-PW Inter@ctive pager 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, cell phone users and alpha-numeric pager users. The device is a high end consumer communications product.

The Inter@ctive Pager has a standard EIA/TIA 232 level serial asynchronous interface, allowing it to backup and transfer information between the pager and a host computer and/or other terminal device. The serial connection to an external device requires the use of a serial interface cable or an optional “cradle assembly”. The recommended cable is a Molex, part number 92601-0028. It can also be acquired directly from Research In Motion under part number WIR-01985-001. This is a 2.0 metre cable which has standard connections for RS-232 at one end, and a connector that mates with the R800D-2-PW Inter@ctive pager at the EUT end. As an alternative to the cable, the pager can be inserted into a charging-enabled cradle. This charging cradle is in turn connected to the host computer. The cradle can be obtained from Research In Motion under part number ASY-02215-001. The cradle 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 pager on the other end. A UL/CSA listed, class II, direct plug-in power transformer is used to supply power to the charging cradle. The wireless service providers and their resellers will make the cable and the charging cradle available as approved accessories to the Inter@ctive Pager.

The Inter@ctive pager is a self-contained, battery powered device. It contains an embedded 4.15 V Lithium Ion battery pack that provides system power. The pager also contains a compartment for one removable standard AA cell, which is used as a charging source for the internal Lithium Ion battery.

The antenna for the Inter@ctive pager is internal to the device. It is located inside the case around the device's liquid crystal display. There is no facility for connecting an external antenna to this device.

Normal pager operation for live use is called burst packet activity. The pager is normally in receive mode listening to all network activity. When a data packet is received that is explicitly addressed to the pager, it then transmits a short acknowledgment packet. When data is to be transmitted from the pager, the pager radio first receives system information from the network to determine when to transmit. The transmitter duty factor is inherently limited to 9%. There is no deterministic pattern to the network traffic or transmit packet timing.

SYSTEM DESCRIPTION; CONTINUED

During testing, the system was connected to an IBM ThinkPad 760ED laptop computer running RIM proprietary test software executing under Windows 95. The test software, the “RIM Config Tool”, can place the device in different test modes, allowing it to receive continuously or transmit for several seconds on a fixed frequency. Transmit modes include unmodulated carrier and/or a repetitive or a scrambled data modulation. To facilitate compliance testing to CFR47 standards, the RIM Config Tool can also allow the operator to select several different modes which keep the serial connection between the host computer and the Inter@ctive pager continuously active. Tests were performed while the RIM pager was transmitting carrier for several seconds without modulation and/or with scrambler sequence modulation or fixed sequence data modulation.

FUNCTIONAL DESCRIPTION:

The R800D-2-PW 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 channels at discrete 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 of 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 018

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

The Research In Motion Limited R800D-2-PW Inter@ctive pager, was connected together with a host laptop computer and printer 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 IBM laptop computer with the Inter@ctive pager and printer were placed on top of the turntable, while the power supply for the IBM ThinkPad computer 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 Research in Motion Inter@ctive pager 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 018

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	815.14	34000.0	RT.4 V	38.5	1309000	3300000	-8.03
02 TX	1630.00	1284.00	L/P V	3.0	3852.0	16550	-12.66
03 TX	2445.00	175.00	L/P V	5.5	962.5	16550	-24.71

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 **0.313W**. 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 37.96 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 (0.313w)
= 43 + (-5.05)
= 37.96 **dBc**

Limit (FS) = 1.309 V/m less 37.96dB
= 0.01655 V/m or 16550 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| = 1.309 V/m and D = 3 metres, the ERP is 0.313W

RADIATED EMISSION RESULTS RIM 018

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	815.14	41000.0	RT.4 V	38.5	1578500	3300000	-6.41
02 TX	1630.17	1936.0	L/P V	3.0	5808.0	16550	-9.10
03 TX	2445.17	525.0	L/P V	5.5	2887.5	16550	-15.17

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 **0.456W**. 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 39.59 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 (0.456w)
= 43 + (-3.41)
= 39.59 **dBc**
Limit (FS) = 1.5785 V/m less 39.59 dB
= 0.01655 V/m or 16550 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| = 1.5785 V/m and D = 3 metres, the ERP is 0.456W.

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
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	1999-03-26	02131-CERT-FCC-TEST-BW_MASK
Approved	Rev	File / Reference
		BW_MASK

OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS

TEST PROCEDURE:

The Research In Motion Limited R800D-2-PW Inter@ctive pager was connected together with a host computer, external power supply and a 20 dB external attenuator. The R800D-2-PW antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator. The R800D-2-PW transmitter was operating at full output power with and without internal data modulation.

TEST RESULTS:

UNMODULATED CARRIER, High Power: **11.50 dBm** with a 20dB external pad and a coaxial cable.

> 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 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

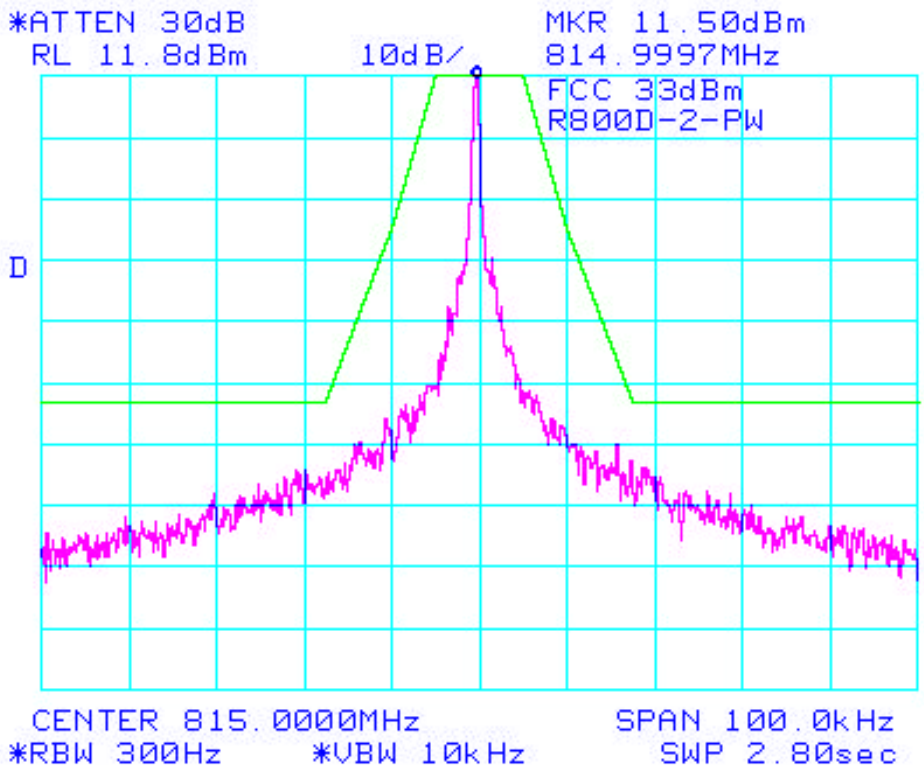
26500	43+10 log (P)	-46

EQUIPMENT:

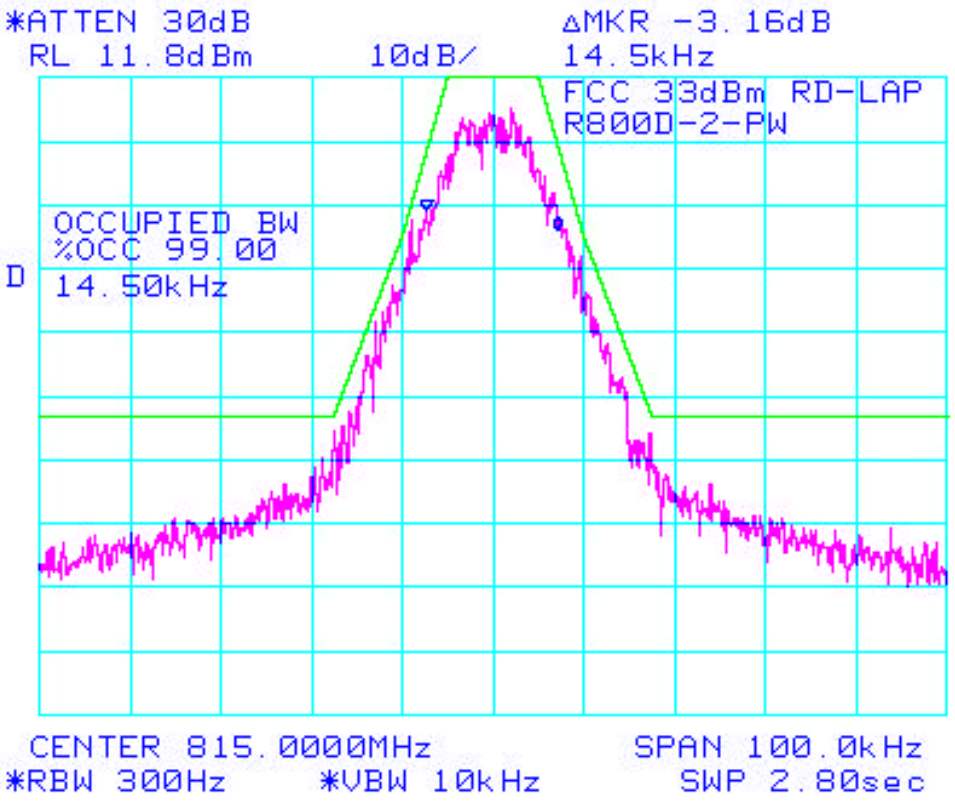
- H.P. 8563E Spectrum Analyzer 9.0 KHz - 26.5 GHz
- HP6632A DC POWER SUPPLY
- Mini Circuits 20 dB att. # NAT-20 0 Hz - 1.5 GHz

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

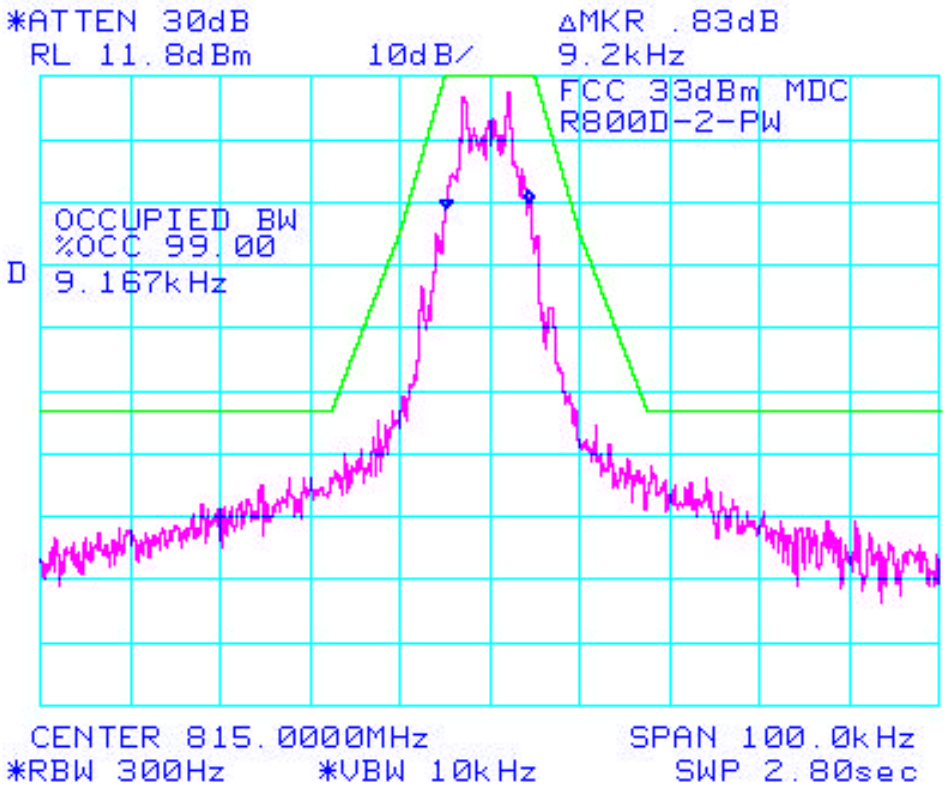
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
UNMODULATED CARRIER



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – RD_LAP



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER - MDC



Author Data	Date	Document No.
Jonathan Doll	1999-03-26	02131-CERT-FCC-TEST-012
Approved	Rev	File / Reference
Masud S. Attayi		012

CFR 47 Chapter 1 - Federal Communications 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, 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 (20 dBW)

We are rating the device as 2.00 W (33 dBm) transmitter output power across a 50 ohm load, but due to the 0.5 dB uncertainty in our Calibration Software Tool, we are requesting 2.25 W (33.5 dBm).
Limit on device output power would therefore be 2.25 W (33.5 dBm).

Calibrated power measurement using the following equipment:

Instrument	Serial Number	Calibrated on
HP EPM-441A Power Meter	GB37481300	29/04/98
HP ECP-E18A Power Sensor	US37181260	05/05/98
HP 8753D Network Analyzer	3410A05905	08/08/98
HP 85033D Calibration Kit	3423A00734	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 02131-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:

Limit: 2.25 W (33.5 dBm)

Results:

Carrier Frequency (MHz)	Measured Level (dBm)	Calibrated Attenuation (dB)	Output Power (dBm)	Output Power (W)
806.000	6.27	26.83	33.10	2.04
815.000	6.17	26.83	33.00	2.00
821.000	6.10	26.83	32.93	1.96

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

Author Data	Date	Document No.
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Masud S. Attayi		013

CFR 47 Chapter 1 - Federal Communications 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 0.00025 % (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, and the power meter. 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 3, 1999

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 815.0 ± 6 MHz.

Power and frequency measurements of RIM Pager Radio at different temperatures:

Place: RF Lab in RIM
Date: March 3, 1999

Instruments used:

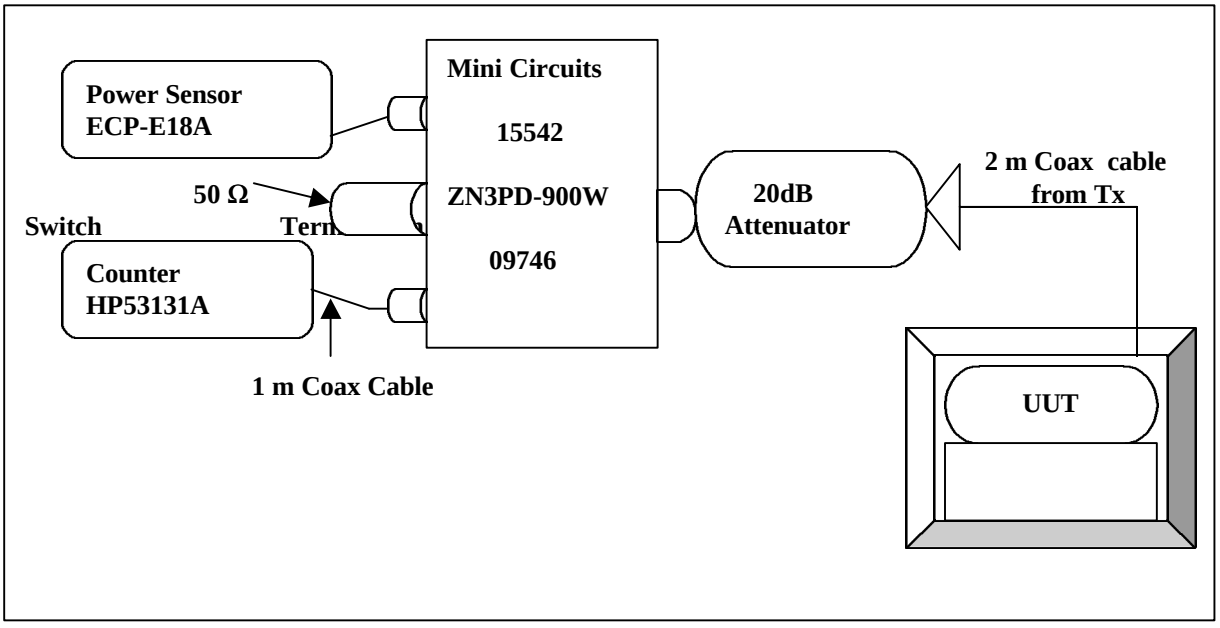
Instrument	Serial number	Calibrated on
DC Power supply HP 6632A	3524A14012	05/08/98
Universal Counter HP 53131A	3325A00988	04/08/98
Power Meter HP EPM-441A	GB37481300	29/04/98
Power Sensor HP ECP-E18A	US37181260	05/05/98

Temperature Chamber used:

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

Procedure:

The RIM Pager Radio 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 the command of activating all machines intrinsic to the temperature test. It controls the HP 53131A universal counter, HP 6632A power supply, and HP EPM-441A power meter by GPIB Bus. The Environmental Chamber was instructed through an RS-232 serial line. The RIM Pager Radio dialogue was passed through a serial connection with a special Serial-to-Pager message converter. The radio was put in repetitive transmit modes and the power and frequency levels were measured and recorded by the RIM automated test utility.

The RIM Pager 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 Pager Radio output was characterized through its power and frequency across temperature (-30°C to 65°C), and transmit frequency (806 MHz to 821 MHz) at an output power of 33 dBm.

The Pager Radio power and frequency were measured at voltages of 3.5, 3.8 and 4.1 VDC. The transmit frequency was varied in 3 steps consisting of 806 MHz, 815 MHz and 821 MHz. This frequency generated by the RIM Pager Radio has been recorded in MHz and also as deviation from nominal in Parts Per Million.

The output from the RIM Pager Radio was accounted from -30°C to 65°C in +10°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.

After the initial one hour soak each time the temperature was increased, a 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 3.8 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 Pager Radio.
4. Activate Carrier on RIM Pager Radio.
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. Repeat steps 8 - 10 for twenty measurements every 29 seconds for 10 minutes.
11. Repeat steps 3 - 11 for 815 MHz and 821 MHz.

12. Increase temperature by 5°C and soak for 1/2 hour.
13. Repeat steps 2-13 for temperatures –30 degrees to 65 degrees Celsius.

Procedure 3 to 12 was then repeated at 25°C with the power supply voltage set to 3.5, 3.8 and 4.1V.

Author Data	Date	Document No.
Jonathan Doll	1999-03-26	02131-CERT-FCC-TEST-014
Approved	Rev	File / Reference
Masud S. Attayi		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 0.00025 % (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 02131-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	-27.70	-26.90	0.7891	0.8213
-25	-23.40	-23.20	0.5744	0.6799
-20	-18.50	-18.30	0.7035	0.7035
-15	-13.50	-13.30	0.5968	0.5968
-10	-8.70	-8.50	0.4851	0.4851
-5	-3.70	-3.60	0.3797	0.3797
0	1.10	1.20	0.2767	0.2767
5	5.60	5.70	0.1886	0.1886
10	10.50	10.80	0.0931	0.0931
15	15.30	15.40	0.0112	0.0112
20	20.00	20.10	-0.0422	-0.0422
25	25.00	25.10	-0.0918	-0.0918
30	30.30	30.60	-0.1414	-0.1414
35	35.10	35.20	-0.1737	-0.1737
40	40.30	40.40	-0.2221	-0.2221
45	44.90	45.40	-0.3201	-0.3201
50	49.90	50.10	-0.4640	-0.4640
55	55.20	55.40	-0.7345	-0.7345
60	60.20	60.30	-1.1104	-1.1104
65	65.20	65.30	-1.4876	-1.0285

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	-28.10	-27.80	0.7890	0.8135
-25	-23.30	-23.10	0.5963	0.6307
-20	-18.50	-18.30	0.4110	0.4577
-15	-13.50	-13.30	0.2564	0.3153
-10	-8.70	-8.40	0.1325	0.1890
-5	-3.70	-3.50	0.0196	0.0847
0	1.10	1.20	-0.0822	0.0172
5	5.80	6.00	-0.1644	-0.0478
10	10.40	10.50	-0.2282	-0.1203
15	15.30	15.30	-0.2589	-0.1804
20	20.00	20.10	-0.2687	-0.2110
25	25.10	25.20	-0.2797	-0.1931
30	30.60	30.70	-0.3230	-0.2508
35	35.10	35.20	-0.4218	-0.3674
40	39.90	40.00	-0.6138	-0.5683
45	45.00	45.20	-0.9445	-0.9123
50	50.10	50.30	-1.2719	-1.2431
55	55.30	55.40	-1.5649	-1.5094
60	60.20	60.30	-1.6726	-1.5438
65	65.20	65.30	-1.3740	-1.0078

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	-27.10	-25.50	0.9513	0.9513
-25	-23.20	-22.90	0.7320	0.8343
-20	-18.40	-18.20	0.8404	0.8404
-15	-13.40	-13.20	0.7393	0.7393
-10	-8.50	-8.20	0.5871	0.5871
-5	-3.60	-3.40	0.4470	0.4470
0	1.30	1.40	0.3459	0.3459
5	5.60	5.80	0.2497	0.2497
10	10.50	10.50	0.1742	0.1742
15	15.30	15.40	0.0840	0.0840
20	20.00	20.20	0.0353	0.0353
25	24.90	25.10	-0.0341	-0.0341
30	29.90	30.10	-0.0816	-0.0816
35	34.90	35.00	-0.1523	-0.1523
40	39.80	39.90	-0.1937	-0.1937
45	44.80	45.00	-0.2619	-0.2619
50	50.10	50.30	-0.4373	-0.4373
55	55.20	55.30	-0.6894	-0.6894
60	59.80	60.10	-1.0463	-1.0462
65	64.70	65.10	-1.4019	-1.4019

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CFR 47 Chapter 1 - Federal Communication Commission Rules

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 0.00025 % (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 02131-CERT-FCC-TEST-013.

Results: 806 MHz. nominal transmitter.

Ambient Temperature [Degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	3.5	-0.3511	-0.3127
25.0	3.8	-0.3102	-0.3102
25.0	4.1	-0.0918	-0.0918

Results: 815 MHz. nominal transmitter.

Ambient Temperature [Degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	3.5	-0.3092	-0.2834
25.0	3.8	-0.2908	-0.2908
25.0	4.1	-0.3092	-0.2135

Results: 821 MHz. nominal transmitter.

Ambient Temperature [Degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	3.5	-0.2826	-0.2582
25.0	3.8	-0.2497	-0.2497
25.0	4.1	-0.0341	-0.0341