

**ELECTROMAGNETIC EMISSIONS TEST
REPORT**

BY

COM-SERVE CORPORATION

KITCHENER, ONTARIO

CANADA

RADIATED and CONDUCTED EMI TEST REPORT

February 28, 1997

CLIENT:

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

TESTED MODEL:

Model Number: **R800D-15-O**
Serial Number: 128/02/000001
Description: 800 MHz PACKET DATA RADIO
Date tested: February 18, 19 & 21, 1997
Tested with: Host computer, IBM Thinkpad 760ED Laptop, FCC ID # ANOGCF2704AT, Serial No. 78-VGY28 96/11 with AC/DC power adapter, Part number 85G6704; Printer, Epson, Model FX-80, Serial # 319837, FCC ID BKM9A8P80FA; AC/DC adapter power supply, Mfr. Globtek, Part No. WD1E1000L00, 12 VDC @ 1A; Antenna Company 800 MHz "Cell" antenna, Model Eclipse II/8110-MOD; RIM Radio Monitor Board Model 01585002; 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

TECHNICIAN:

Jim Sims with Mr. Muhammad Dajani (Research in Motion)

FILE NUMBER: RIM 014

RESULTS R800D-15-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 g (X) ()

SYSTEM DESCRIPTION

The Research In Motion Limited R800D-15-0 800 MHz packet data radio is intended to facilitate wireless data communication. The R800D-15-0 has a standard TTL level serial asynchronous interface allowing it to communicate directly with imbedded controllers. Radio evaluation and application development is facilitated by the radio monitor board. (RIM Model 01585002) The Radio Monitor Board translates the TTL level serial interface signals to standard RS-232 level signals. The RS-232 level signals can be directly interfaced to a microcomputer serial port. The R800D-15-0 radio is primarily intended for battery powered applications and a standard battery power connector is provided.

To facilitate the required EMI tests, the Radio Monitor Board provided a regulated and filtered 7.8 VDC supply to the R800D-15-0 radio. The Radio Monitor Board was also connected between the serial I/O (COM-1 of the IBM laptop) and the RIM R800D-15-0 radio. The R800D-15-0 radio, Radio Monitor Board, AC adapter, 8110-MOD cellular antenna and all required interface cables will be typically marketed as the "RIM800 Radio Evaluation and Development Kit".

Normal radio 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 explicitly addressed to a particular radio, it then transmits a short acknowledgement packet. When the radio receives system information from the network to determine when to transmit, it transmits its data in packets.

For testing purposes, an IBM Laptop computer was connected to the R800D-15-0 radio along with the AC/DC power supply adapter. The laptop was also connected to the level shift PCB, or the Radio Monitor Board with an RS-232 DB-9 shielded 1.5 metre cable. A 2.0 metre RF antenna cable was used to connect the Eclipse II/8110-MOD antenna to the R800D-15-0 radio. Several test modes for transmitting continuous carrier with modulation and without modulation generated from scrambler sequence or fixed sequence data were used.

SYSTEM DESCRIPTION; CONTINUED

TEST SETUP FOR:
SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS
AND OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS

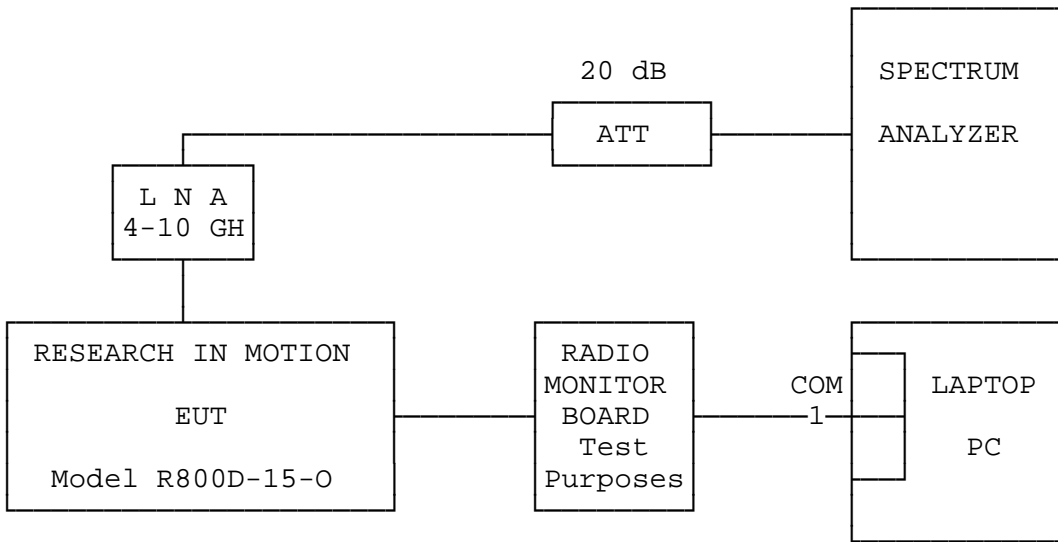
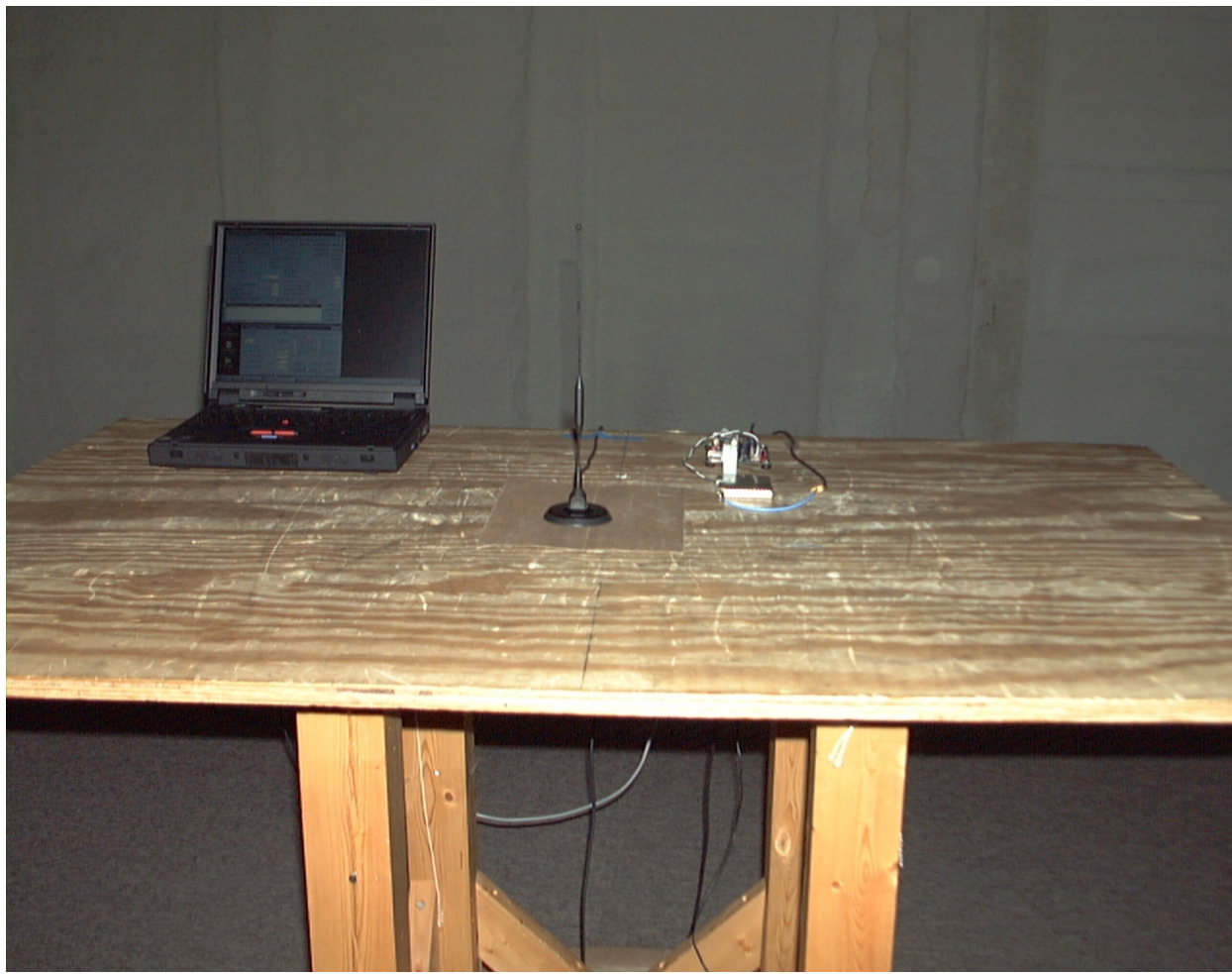


FIGURE # 1

TEST SETUP FOR:
SPURIOUS RADIATED EMISSIONS



FIGURE # 2



TEST PROCEDURE: RADIATED EMISSIONS

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

The Research In Motion Ltd. 800 MHz Packet Data Radio model R800D-15-0, was connected together with a host laptop computer, Epson printer, radio monitor board RIM Model 01585002, 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 01585002 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 center 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 RIM Radio Monitor Board 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 ten (10) 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:

	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 Preamplifier, Model 8449B	1.0 GHz - 26.5 GHz
	SPECTRA 20 dB attenuator, 5.0 W	0.0 Hz - 18.0 GHz
	A.H. Systems log periodic antenna;	1.0 GHz - 12.4 GHz
	Electro Mechanics model 3104C Biconical Antenna	
	Schwarzbeck model UHALP9107 Log Periodic Antenna	
	Electro Mechanics model 3115 Dual Ridge Guide Antenna	
	EATON dipole antennas; T1, T2, T3	25 MHz - 1.0 GHz

NOTE: The ten 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

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

PART 2/90 TRANSMITTER RADIATED TESTS TO 10 G HZ

TEST #	FREQ. G Hz	LEVEL μ V	ANT. TYPE (PZ)	ANT. FAC.	F.S. μ V/M	LIMIT μ V/M	DIFF. TO LIMIT; dB
01	0.816	35481.3	ET.3 V	50.1	1.78(V)	---	
02	1.6321	1500.0	L/P V	5.5	8250.0	10,289	-1.92
03	2.4481	130.0	L/P V	9.2	1196.0	10,289	-18.69

NOTE:

A) 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 44.8 dB below the actual measured carrier field strength as specified in test number 01.

OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS

TEST PROCEDURE

The Research In Motion Ltd. 800 MHz Packet Data Radio model R800D-15-0, was connected together with a host laptop computer, radio monitor board model RIM Model 01585002 and 20 dB external attenuator as described on the "Title and System Description" pages. The R800D-15-0 antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator. The R800D-15-0 transmitter was operating at full output power with and without internal data modulation.

TEST RESULTS:

UNMODULATED CARRIER LEVEL: **11.0 dBm** with a 20 dB external pad.

- 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(g)

NOTE:

The above limits take into account the unmodulated carrier level of +31.0 dBm inclusive of the 20 dB external attenuator. The modulation used was a worst case, random data pattern, causing maximum deviation while still representing a normal modulation pattern.

EQUIPMENT:

	H.P. 8563E Spectrum Analyzer	9.0 KHz - 26.5 GHz
Setting:	BW: 300 Hz, 100 KHz or 120 KHz (Q.P), as required	
	HP PREAMPLIFIER, Model 8449B	1.0 GHz - 26.5 GHz
	SPECTRA 20 dB attenuator, 5.0 W	0.0 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

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

TEST PROCEDURE:

The Research In Motion Ltd. 800 MHz Packet Data Radio model R800D-15-0, was connected together with a host laptop computer, radio monitor board, RIM Model 01585002, 816 MHz notch filter and 20 dB external attenuator as described on the "Title and System Description" pages. The R800D-15-0 antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator. The R800D-15-0 transmitter was operating at full output power with internal data modulation.

TEST RESULTS:

<u>FREQUENCY</u> <u>MHZ</u>	<u>LEVEL</u> <u>dBm</u>	<u>LIMIT</u> <u>dBm</u>
Ref 815.98	+32.2	(- 44.8) -12.6
84.22	-28.8	-12.6
385.15	-52.0	-12.6
1,632.03	-25.3	-12.6
2,448.08	-42.0	-12.6
3,264.40	-58.5	-12.6
4,080.20	-57.0	-12.6
4,896.20	-64.5	-12.6
5,712.10	-65.5	-12.6
7,344.30	-53.3	-12.6

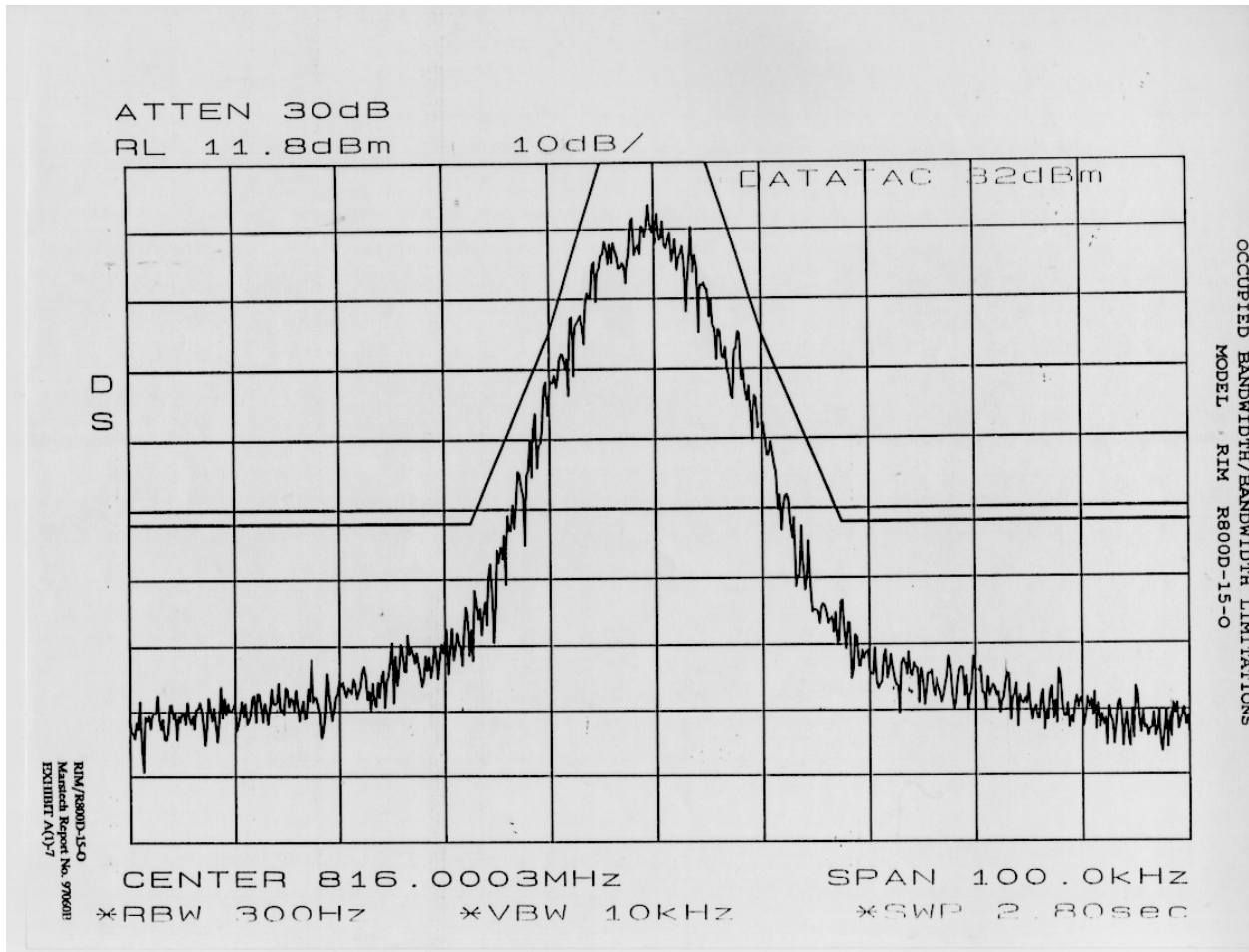
NOTE:

The above limits take into account the unmodulated carrier level of +32.17 dBm inclusive of the 20 dB external attenuator. For emissions beyond 1 GHz, the 20 dB attenuator was removed and replaced with an 816 MHz notch filter having an insertion loss of -8 dB. The modulation used was a worst case, random data pattern while still representing a normal modulation pattern.

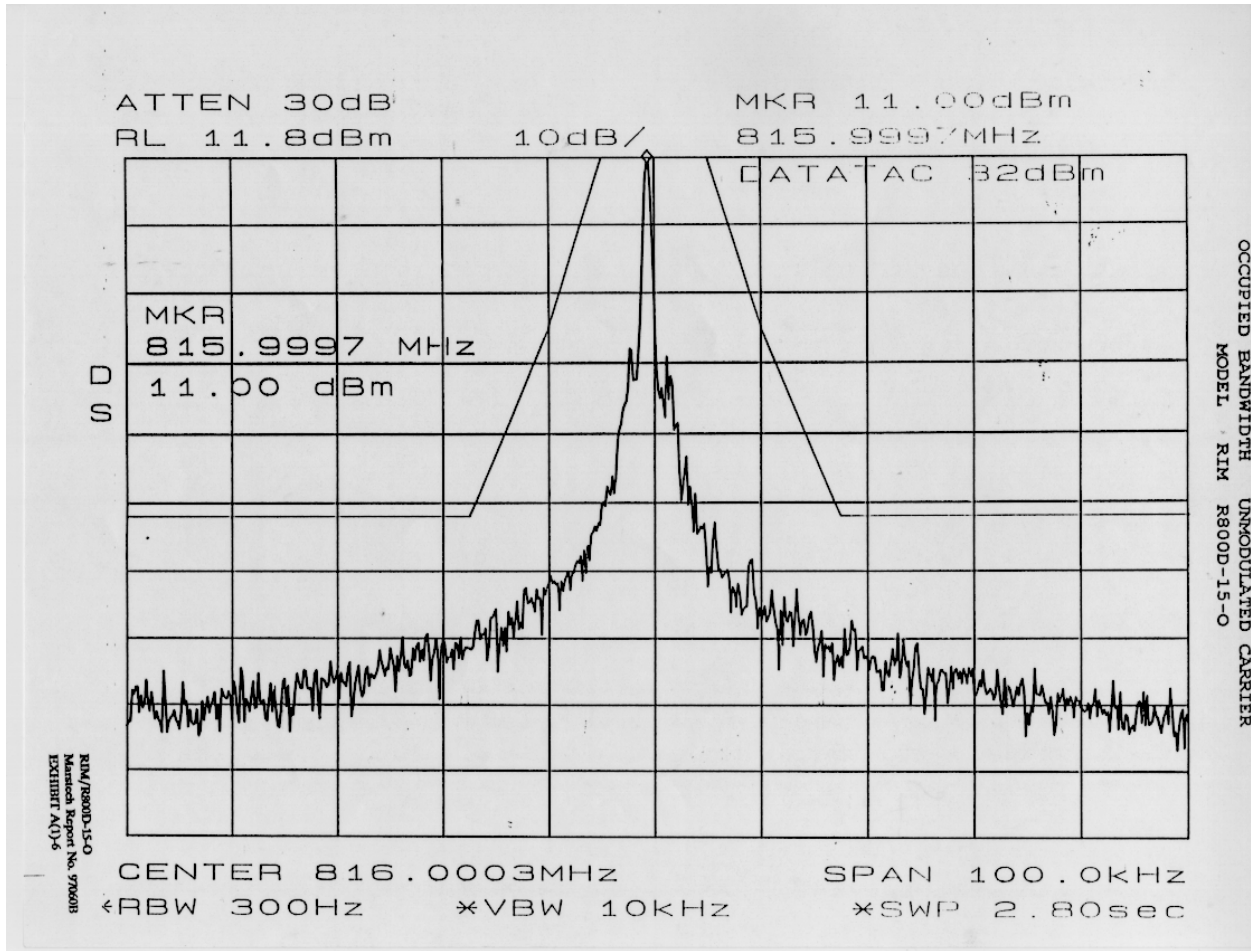
EQUIPMENT:

Setting:	H.P. 8563E Spectrum Analyzer	9.0 KHz - 26.5 GHz
	BW: 100/120 KHz and 1.0 MHz,	as required.
	HP PREAMPLIFIER, Model 8449B	1.0 GHz - 26.5 GHz
	SPECTRA 20 dB attenuator, 5.0 W	0.0 Hz - 18.0 GHz

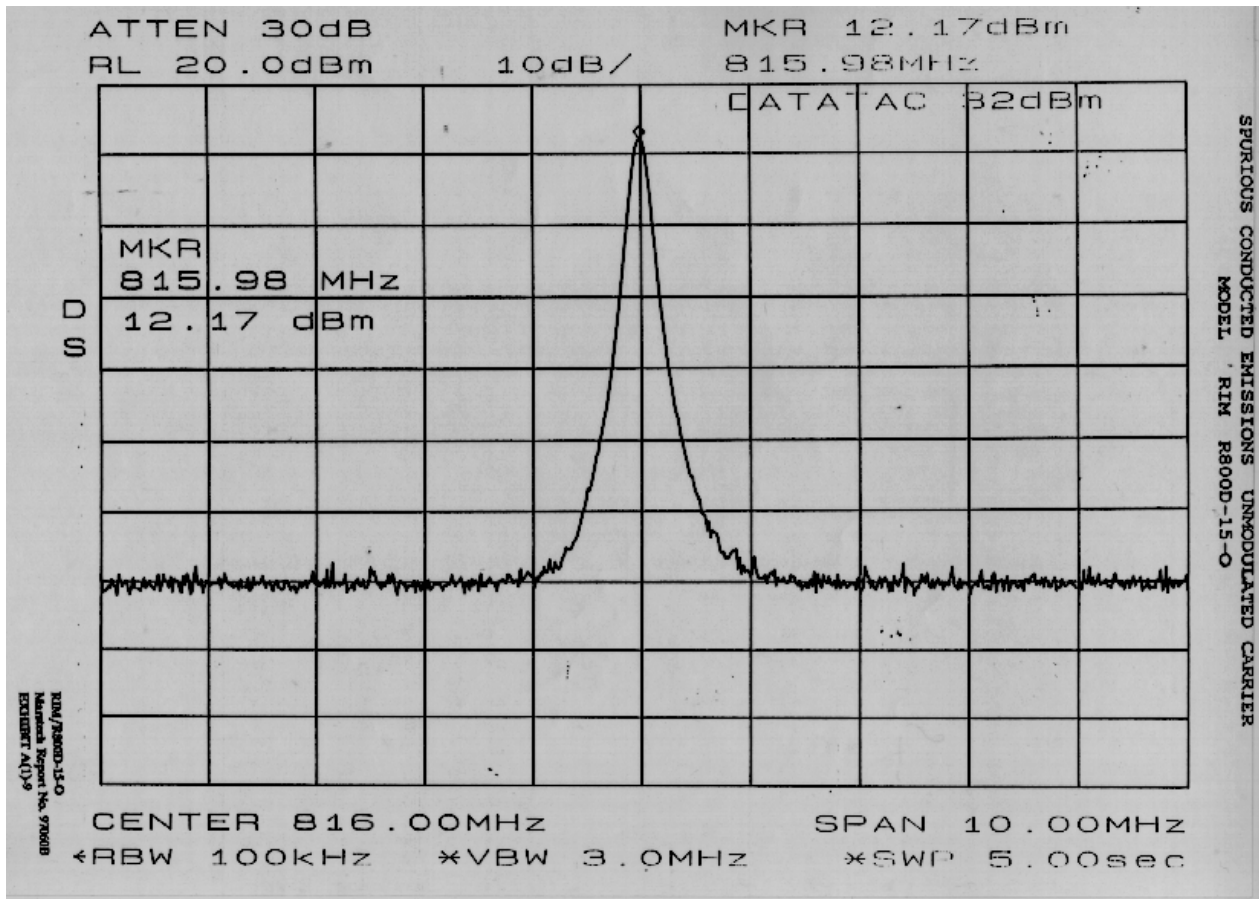
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODEL RIM R800D-15-0



OCCUPIED BANDWIDTH UNMODULATED CARRIER
MODEL RIM R800D-15-0



SPURIOUS CONDUCTED EMISSIONS UNMODULATED CARRIER
MODEL RIM R800D-15-0



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KITCHENER, ONTARIO***

CANADA

RADIATED and CONDUCTED EMI TEST REPORT

February 28, 1997

CLIENT:

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

TESTED MODEL:

Model Number: **01585002**
Serial Number: Not Marked, Production sample
Description: RADIO MONITOR BOARD
Date tested: February 18 & 19, 1997
Tested with: Host computer, IBM Thinkpad 760ED Laptop, FCC ID #
 ANOGCF2704AT, Serial No. 78-VGY28 96/11 with AC/DC
 power adapter, Part number 85G6704; Printer, Epson,
 Model FX-80, Serial # 319837, FCC ID BKM9A8P80FA;
 AC/DC adapter power supply, Mfr. Globtek, Part No.
 WD1E1000L00, 12 VDC @ 1A; Antenna Company 800 MHz
 "Cell" antenna, Model Eclipse II/8110-MOD; RIM
 Radio Monitor Board Model 01585002; Associated
 cables and cords.

IN ACCORDANCE WITH:

**FCC Part 15, Unintentional Radiator, Class "B" Digital (Computing) Device
& the DOC/IC Radio Interference Regulations, C.R.C., c 1374.**
Test procedure(s) MP-4 and ANSI C63

TESTED BY:

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

TECHNICIAN:

Jim Sims and Mr. Muhammad Dajani (Research in Motion)

FILE NUMBER: RIM 014

RESULTS

RADIATED:

The Research In Motion Limited Radio Monitor Board model 01585002, **MEETS** the limits for a Class "B" Digital (Computing) Device Peripheral, pursuant to the rules and test procedures of the Federal Communications Commission and INDUSTRY CANADA, formerly the Canadian Department of Communications.

LIMITS:	30 to 88 M Hz	.....	30 μ V/M
	88 to 216 M Hz	.....	45 μ V/M
10	216 to 960 M Hz	.....	60 μ V/M
Metres	Above 960 M Hz	.....	150 μ V/M

CONDUCTED:

The Research In Motion Limited Radio Monitor Board model 01585002, **MEETS** the limits for a Class "B" Digital (Computing) Device Peripheral, pursuant to the rules and test procedures of the Federal Communications Commission and INDUSTRY CANADA, formerly the Canadian Department of Communications.

LIMITS:	450 K Hz to 1.705 M Hz	.....	250 μ V (48 dB μ V)
	1.705 M Hz to 30 M Hz	.....	250 μ V (48 dB μ V)

Jim Sims
Com-Serve Corporation
February 28, 1997

SYSTEM DESCRIPTION

The Research In Motion Limited Radio Monitor Board model 01585002 is intended to facilitate RIM RF radio evaluation and application development. The radio monitor board is an interface between a serial I/O (COM-1 of the IBM laptop) and the RIM R800D-15-0 radio. The board translates the TTL level 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 also provides a regulated and filtered 7.8 VDC power supply to the radio. The radio power and the level translation circuit power, are derived from a 12V/1A AC/DC power adapter. The R800D-15-0 radio, radio monitor board, AC adapter, 8110-MOD cellular antenna and all required interface cables will be typically marketed as the "RIM800 Radio Evaluation and Development Kit".

For testing purposes, an IBM Laptop computer was connected to the R800D-15-0 radio via the Radio Monitor Board model 01585002. An AC/DC power supply adapter was used to power the board and the radio. The laptop was connected to the level shift PCB with an RS-232 DB-9 shielded 1.5 metre cable. A 2.0 metre RF antenna cable was used to connect the generic cellular antenna to the RF radio. In order to simulate worst case normal operating conditions, several test modes were used. First the radio monitor PCB was operating while transmitting and receiving data on all I/Os while connected to the laptop computer and the RF radio. Secondly the tests were repeated with the R800D-15-0 radio set in the receive mode of operation.

TEST PROCEDURE

RADIATED:

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

The Research In Motion Limited Radio Monitor Board model 01585002, was connected together with a host laptop computer, Epson printer, R800D-15-0 radio, 800 MHz antenna and an AC/DC power supply 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 01585002 Radio Monitor Board, laptop computer, Epson printer, RF radio and RF antenna were placed on top of the turntable. The power supply was placed at the bottom center 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 RIM Radio Monitor Board was processing data in a worst case normal manner, and separately the R800D-15-0 radio was operating in the receive mode. 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 ten (10) metres with the receiving antennas in both the horizontal and vertical planes at each emission frequency.

EQUIPMENT:

Rohde & Schwarz model ESBI-RF Spectrum Analyzer
Rohde & Schwarz model ESAI-D Analyzer Display
Setting: BW: 100 KHz or 120 KHz (Q.P)
H.P. 8563E Spectrum Analyzer 9 KHz - 26.5 GHz
LNA,HP 8449B Preamplifier (30 dB)... 1 KHz - 26.5 GHz
A.H. Systems biconical antenna; ... 20 MHz - 330 MHz
A.H. Systems log periodic antenna; 300 MHz - 1.8 GHz
Eaton dipole antenna; T3 at 900 MHz
Electro Mechanics model 3104C Biconical Antenna
Schwarzbeck model UHALP9107 Log Antenna
Electro Mechanics model 3115 Dual Ridge Guide Antenna

The radiated emissions from the unit under test were measured while using the methods outlined in ANSI C63.4; 1992 on a 10 metre open area test site. The test sample was placed on a turntable to facilitate rotation.

RADIATED EMISSION RESULTS

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

TEST #	FREQ. M Hz	LEVEL μ V	ANT. TYPE (PZ)	ANT. FACT.	F.S. μ V/M	LIMIT μ V/M	DIFF. TO LIMIT; dB
01	188.33	04.1	B/C V	7.5	30.8	45.0	-3.31
02	209.44	04.2	B/C H	7.6	31.9	45.0	-2.98
03	219.44	06.8	B/C V	7.0	47.6	60.0	-2.01
04	221.11	07.6	B/C V	6.9	52.4	60.0	-1.17
05	239.44	05.6	B/C V	7.1	39.8	60.0	-3.57
06	263.33	03.0	B/C H	9.1	27.3	60.0	-6.84
07	651.11	01.6	L/P V	16.3	26.1	60.0	-7.24
08	762.22	02.2	L/P V	20.1	44.2	60.0	-2.65
09	957.79	01.9	L/P V	24.4	46.4	60.0	-2.24

TEST PROCEDURE

CONDUCTED:

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

The Research In Motion Limited Radio Monitor Board model 01585002, was connected together with a host laptop computer, RF radio, Epson printer, 800 MHz antenna and an AC/DC power supply 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 test table 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 01585002 Radio Monitor Board, laptop computer, Epson printer, RF radio and RF antenna were placed on top of the test table. The power supply was placed at the bottom of the test table. All of the cables and cords were moved about so as to create the highest level of EMI. Special software was employed in order that the RIM Radio Monitor Board was processing data in a worst case normal manner, both while in quiescent or receive mode and also in the transmit mode.

The direct plug-in power supply for the Radio Monitor Board model 01585002, and the power supply for the IBM Thinkpad laptop computer, were connected to a 50 micro-henry line impedance stabilization network. (LISN) The RF voltages on each side of the power line were coupled to the input of a spectrum analyzer and recorded. See the attached results.

The conducted emissions measurements were performed in three (3) different test modes:

- PCB transferring data via the RS-232 serial port on the PC.
- PCB connected to the system while the radio is operating in receive.
- The IBM Thinkpad laptop computer was tested while transferring data to the Radio Monitor PCB.

EQUIPMENT:

Rohde & Schwarz model ESBI-RF Spectrum Analyzer
Rohde & Schwarz model ESAI-D Analyzer Display
Electro-Mechanics model 3816/2 L.I.S. Network

Setting: BW: 10 K Hz or 9 K Hz (Q.P)

The EUT was installed in the semi-anechoic room with the turntable surface used as the reference ground plane. The product was located on a non-metallic test table which represents a 0.8 M ground plane to EUT isolation spacing. A vertical ground plane was positioned 0.4 M from the rear face of the EUT. The EUT conducted emissions were measured within a shielded enclosure (28 x 24 x 10 feet) while using the test procedure outlined in ANSI Publication C63.4; 1992.



Author Data RIM Bryan D. Taylor	Date 1997-03-31	Document No CERT-01677-012
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
 (a) Request no more power than necessary for satisfactory operation.
 (b) Maximum power output limit : reference to subpart S (806-825 MHz band).
 (c) exceed by no more than 20% manufacturer's rated output power.

Part 90 - Subpart S : Use of Frequencies in 806-825 MHz Band
 90.635 Limitations on Output Power - 100W 20dbw
 (d) Mobile station maximum output power is 100 W (20dBW)

We are requesting and rating the device as 1.5 W (31.7 dBm) output across a 50 ohm load.
 Limit on device output power would be 120% of 1.5 W which is 1.8 W (32.6 dBm).

Calibrated power measurement using the following equipment:

HP 437B Power Meter	S/N 3125U10666	Cal on 19/05/95
HP 8482A Power Sensor	S/N 3318A24237	Cal on 23/05/95
HP 8753D Network Analyzer	S/N 3410A05905	Cal on 09/08/95
HP 85033D Calibration Kit	S/N 3423A00734	Cal on 20/07/95
Mini-Circuits NAT-20 DC to 1500 MHz Coaxial Attenuator		

Procedure: These results were obtained using the test procedure described in document CERT-01677-013.

The 8753D was calibrated using the 85033D. The cable assembly and microwave attenuator used for the measurements were calibrated using the 8753D. The 437B and 8482A 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 437B and 8482A. 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: 1.8 W (32.6 dBm)

Results:	Carrier Frequency	Measured Level	Calibrated Attenuation	Output Power	Output Power
	806.000 MHz	7.47 dBm	24.40 dB	31.87 dBm	1.54 W
	815.500 MHz	7.36 dBm	24.40 dB	31.76 dBm	1.50 W
	824.9875 MHz	7.32 dBm	24.40 dB	31.72 dBm	1.49 W

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



Author Data RIM Bryan D. Taylor	Date 1997-03-25	Document No CERT-01677-013
Approved	Rev	File Reference 013

CFR 47 Chapter 1 - Federal Communication Commission Rules

Part 2 Required Measurement

- 2.983 Frequency Stability - Procedures
 - (a.c) 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 at Research In Motion.
Date: February 4th, 1997.
Time: 1900 Hr.

Instruments used:

Instrument	Serial Number	Calibrated on
Network Analyzer HP 8753D	3410A05905	09.08.95
Calibration Kit HP85033D	3423A00734	20.07.95

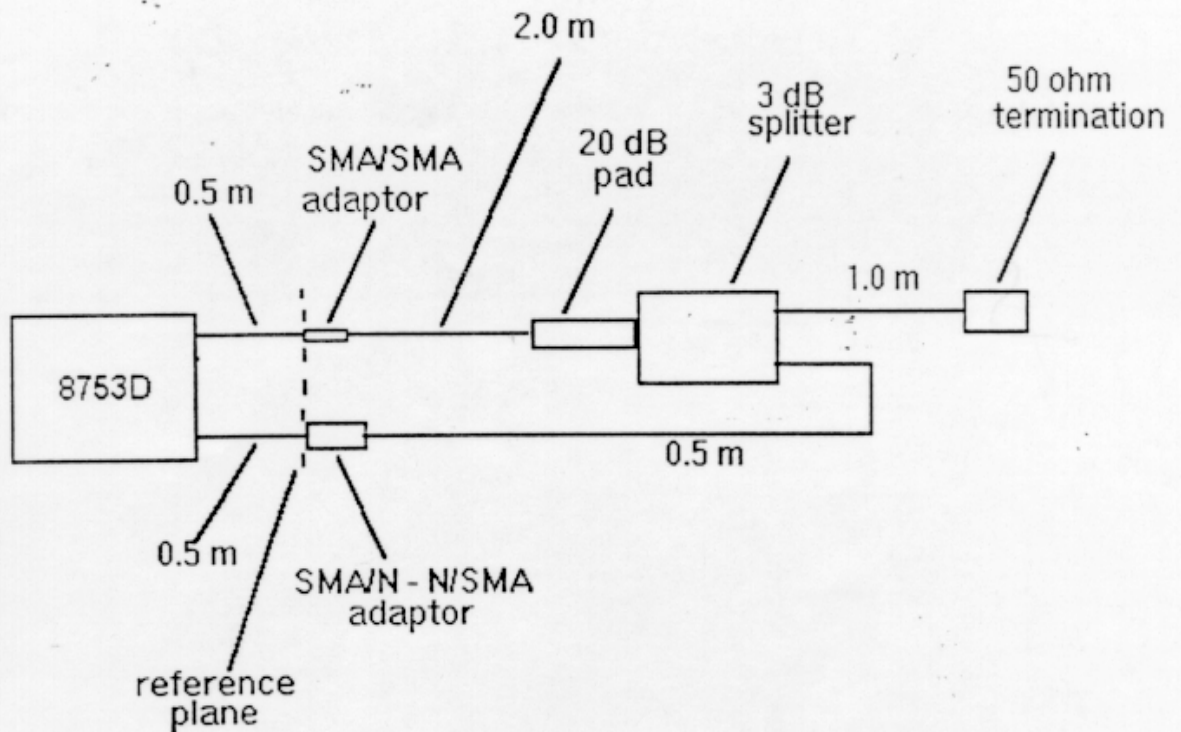
Procedure:

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

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

Attenuator: 20dB, DC to 1500 MHz - Mini-Circuits model no: NAT-20
Power splitter: 3 dB 15542 ZN3PD-900W 9518 03

Date 1997-03-25	Rev	Document No CERT-01677-013
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The total loss of this cable assembly from the RF input to the RF output was measured to be 24.40 dB at 815.5 +/- 3Mhz.

Power and frequency measurements of RIM 800 Radio at different temperatures:

Place: RF Lab at Research In Motion.
 Date: February 4th, 1997 to February 5th, 1997.

Instruments used:

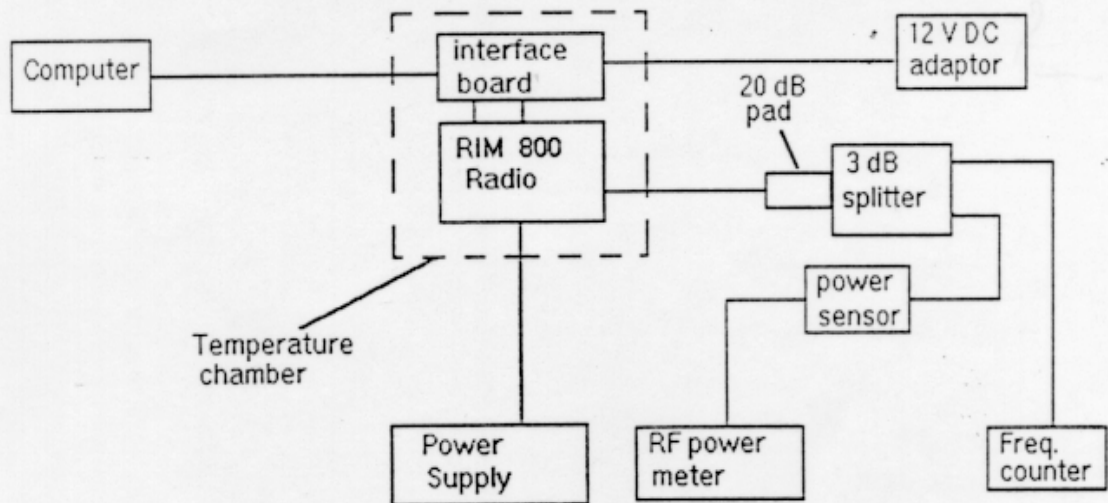
Instrument	Serial number	Calibrated on
DC Power supply HP 6623A	3448A04132	18.08.95
Universal Counter HP 53131A	3325A00988	19.05.95
RF Power meter HP 437B	3125U10666	19.05.95
RF Power sensor HP 8482A	3318A24237	23.05.95

Temperature Chamber used:
 Manufacturer: Envirotronics
 Model: SH27C
 Serial No: 08953119-S-10606

Date 1997-03-25	Rev	Document No CERT-01677-013
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Procedure:

The RIM 800 Radio and the Interface board were 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 power supply was adjusted to the required value. The chamber was switched on and the temperature was set to +50°C. After the chamber stabilized at +50°C there was an initial soak period of one hour to ensure that all moisture is driven out. 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 and HP 437B power meter by GPIB Bus. The Environmental Chamber was instructed through a RS-232 serial line. The RIM 800 Radio dialogue was passed through the interface board. The software time stamps the measurements and stores the data in a file.

The software utility produces tab delimited data files numbered sequentially. All data from this test has been formatted from the initial files into a single Spreadsheet.

The RIM 800 Radio output was characterized through its power and frequency across temperature (-30°C to 50°C), and transmit frequency (806 MHz to 825 MHz) at an output power of 31.7 dBm.

The transmit frequency was described in 3 steps consisting of 806 MHz, 815.0 MHz and 824.0 MHz. This frequency generated by the RIM 800 Radio was recorded in MHz and also as error from expected in Parts Per Million.



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The output from the RIM 800 Radio was accounted from 50 °C to -30 °C in -10 °C steps. The radio was interrogated for data every six seconds for four minutes at each temperature. 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 10°C intervals.

After the initial one hour soak each time the temperature was decreased a one hour soak was accomplished. After each measurement at a specific frequency a 30 minute soak was accomplished.

PROCEDURE

This process was affected through automation.

1. Switch on the HP 6623A, power supply and set the Voltage to 7.2 V.
2. Set the initial Environmental Chamber temperature (50 Degrees Celsius) and hold for initial soak.
3. Set the frequency to 806 MHz, and power on RIM 800 Radio.
4. Activate Carrier on RIM 800 Radio.
5. Take initial HP 437 power meter measurement.
6. Take initial HP 53131 frequency counter measurement.
7. Measure temperature of product.
8. Measure frequency output.
9. Measure power output.
10. Repeat steps 7 - 9 every six seconds for 4 minutes.
11. Repeat steps 3 - 10 for 815.0 MHz, and 824.0 MHz after waiting for 30 minute soak.
12. Decrease temperature by 10°C and soak for one hour.
13. Repeat steps 3-12 for temperatures down to and including -30°C.

Procedure 3 to 11 was then repeated at 25°C with the power supply Voltage set to 6.0 V and 9.1 V.



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CFR 47 Chapter 1 - Federal Communication Commission Rules

- Part 2 Required Measurement
2.983 Frequency Stability - Procedures
(a.c) 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 CERT-01677-013.

Results: 806 MHz nominal transmitter.

Ambient Temperature (degrees Celsius)	Device Temperature Range (degrees Celsius)	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
-30	-30.6 to -29.7	-0.162903	0.248139
-20	-20.4 to -19.8	0.374566	0.523697
-10	-10.4 to -9.9	0.493052	0.929777
0	-0.4 to 0.1	0.754839	1.143176
10	9.8 to 10.1	1.122457	1.268983
20	19.8 to 20.1	1.318486	1.474194
30	30.0 to 30.1	1.445409	1.619603
40	39.9 to 40.0	1.692432	1.723201
50	49.8 to 50.0	1.007072	1.193921

Results: 815 MHz nominal transmitter.

Ambient Temperature (degrees Celsius)	Device Temperature Range (degrees Celsius)	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
-30	-30.5 to -29.7	-0.344049	-0.344049
-20	-20.3 to -19.7	0.205031	0.540982
-10	-10.3 to -9.8	0.274601	0.937423
0	-0.4 to 0.1	0.551656	1.163067
10	9.7 to 10.1	0.804049	1.292515
20	19.8 to 20.1	0.910429	1.433006
30	29.9 to 30.1	1.130061	1.611534
40	39.9 to 40.0	1.253252	1.560613
50	49.8 to 49.9	1.076074	1.247853



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Results: 824 MHz nominal transmitter.

Ambient Temperature (degrees Celsius)	Device Temperature Range (degrees Celsius)	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
-30	-30.3 to -29.7	-0.370024	-0.370024
-20	-20.4 to -19.8	0.173665	0.559951
-10	-10.5 to -9.8	0.266383	0.949757
0	-0.4 to 0.1	0.536893	1.175607
10	9.8 to 10.1	0.795874	1.296117
20	19.8 to 20.1	0.940898	1.512864
30	29.9 to 30.1	1.154369	1.609587
40	39.9 to 40.0	1.242476	1.542961
50	49.8 to 50.0	1.108981	1.263107



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CFR 47 Chapter I - Federal Communication Commission Rules

- Part 2 Required Measurement
- 2.983 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 CERT-01677-013.

Results: 806 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	6.0	-0.1290	-0.1588
25.0	7.2	-0.1227	0.3541
25.0	9.1	-0.2195	-0.3018

Results: 815 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	6.0	-0.0760	0.2177
25.0	7.2	0.2923	0.3382
25.0	9.1	-0.0479	-0.2478

Results: 824 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	6.0	0.1893	0.2215
25.0	7.2	0.0766	0.0896
25.0	9.1	-0.2331	-0.4534