ELECTROMAGNETIC EMISSIONS TEST REPORT

BY

COM-SERVE CORPORATION

KITCHENER, ONTARIO

CANADA

RADIATED and CONDUCTED EMI TEST REPORT

November 12, 1999

CLIENT:

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

TESTED MODEL:

Model Number:	**R957M-2-5**
Serial Number:	RADIO # 01
Description:	Proton Handheld Device
Date tested:	November 04, 1999
Tested with:	Host computer, IBM ThinkPad 770ED-S97-3819-2, Serial # 78-X1980 09/98, FCC ID 4U6JPN-31879-DTE; Canon Printer, Model BJC-4300, Serial # EMV00101, FCC ID AZDK10148; Associated cables and cords.

IN ACCORDANCE WITH:

- **FCC Part 2 and FCC Part 90 Transmitters; Certification.**
- 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. Johnathan Doll and Mr. Masud Attayi (Research in Motion)

FILE NUMBER: RIM 027

RESULTS R957M-2-5 RIM 027

		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 j	(N/T)	( )

SYSTEM DESCRIPTION RIM 027

The R957M-2-5 PROTON Pager

The Research In Motion model, R957M-2-5 handheld device, is a stand-alone, wireless, two-way data communications device operating on the Mobitex 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. 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 for data backup, transfer and synchronized information between the Proton and desktop PC, the EUT is inserted into a charging enabled cradle. The charging cradle comes complete with a serial I/O cable that connects between the Proton pager and a desktop or laptop computer. The cradle can be obtained from Research In Motion under part number ASY-02289-001. 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 is used to supply power for charging the lithium ion battery in the device. The power adapter connects between the RS-232 end of the cable that plugs into the back of a computer and then to a wall outlet. The wireless service providers and their resellers will make the charging cradle available as an approved accessory.

The 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 R957M-2-5 pager 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 to this device.

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 device 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.

SYSTEM DESCRIPTION; CONTINUED

For FCC/IC EMI 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 on a fixed frequency. Transmit modes include unmodulated carrier and repetitive or scrambled data modulation. 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 EMI testing, the radio specification allows the Proton to transmit with and without modulation, generated from scrambler sequence or fixed sequence data. The transmit test modes were used for testing the radio for compliance to CFR47 standards.

All RF TX radiated tests were performed for each of the following configurations:

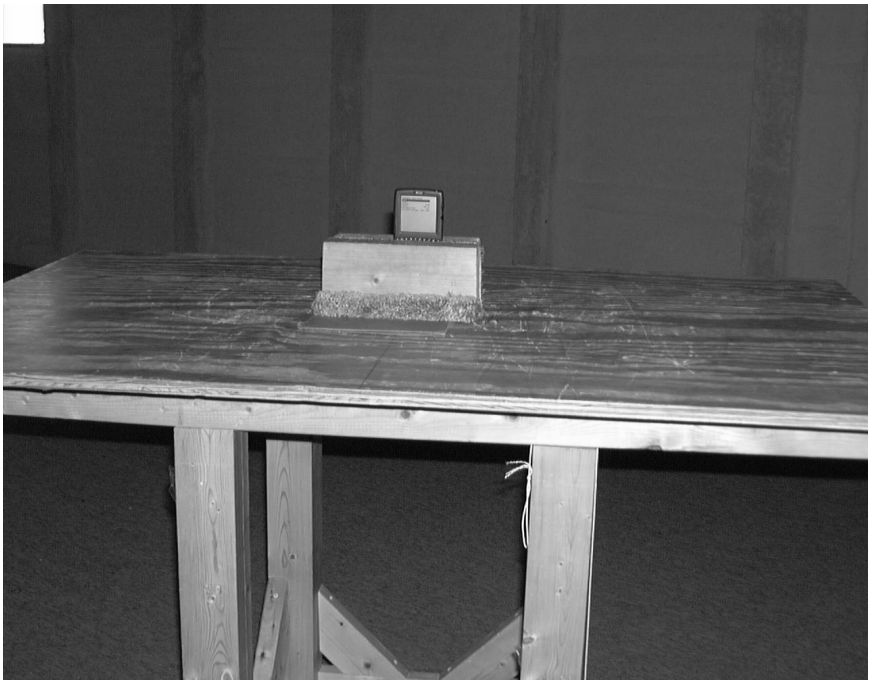
- the RIM PROTON pager installed into a RIM charging cradle assembly
- the RIM PROTON pager as a stand alone product.

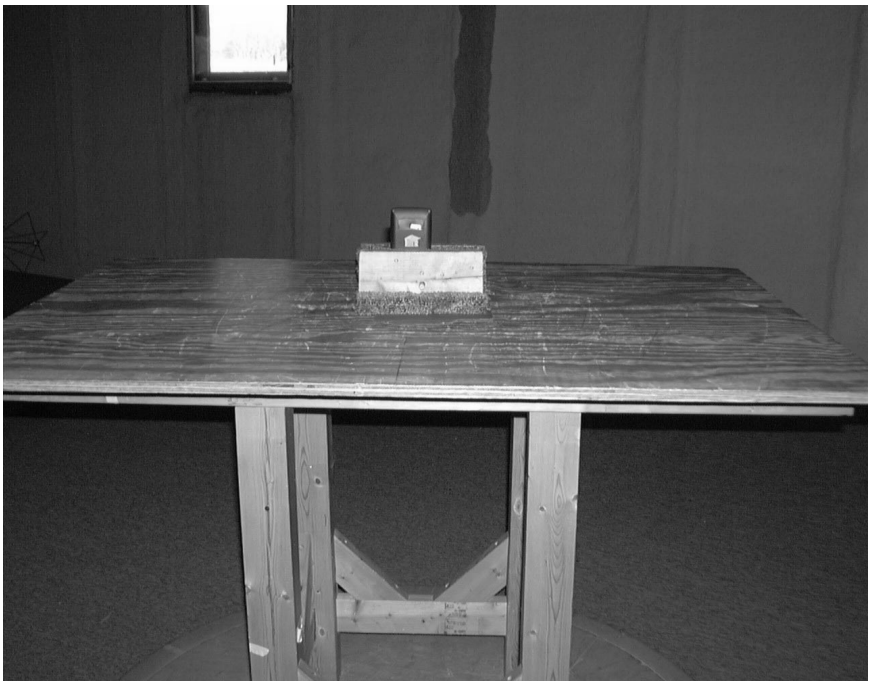
FUNCTIONAL DESCRIPTION:

The R957M-2-5 is a 900 MHz band, half duplex (two frequency simplex) two (2) Watt transceiver system for wireless data communications on Mobitex wireless systems. The transmitter is capable of transmitting at carrier frequencies from 896 MHz to 902 MHz with a 12.5 KHz resolution. The firmware for use with the US Bell South Wireless Data System limits the highest transmit frequency to 901 MHz. The active 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 capable of modifying the frequency of operation of the device.

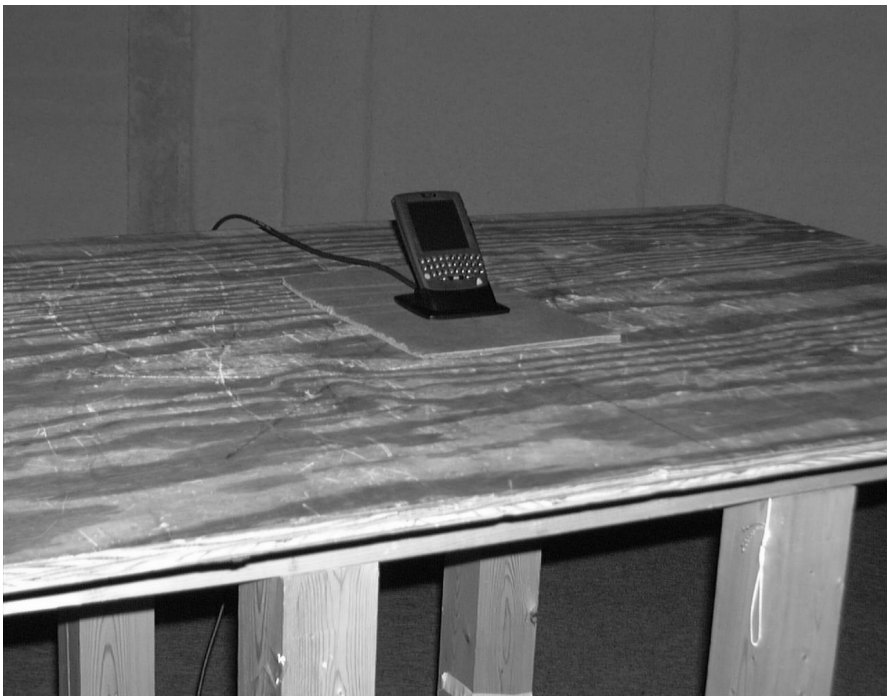
The transmitter is capable of the generation of RF power at several calibrated levels. The levels are 2000 milliwatts, 1000 milliwatts, 500 milliwatts, 250 milliwatts, 125 milliwatts, and 60 milliwatts (+33, +30, +27, +24, +21, +18 dBm respectively). The various power levels are used to balance the receive and transmit radio link. The power level is controlled by the radio device in response to the received signal strength and power level instructions received from the Mobitex system. The output power level of the device cannot be modified by the user.

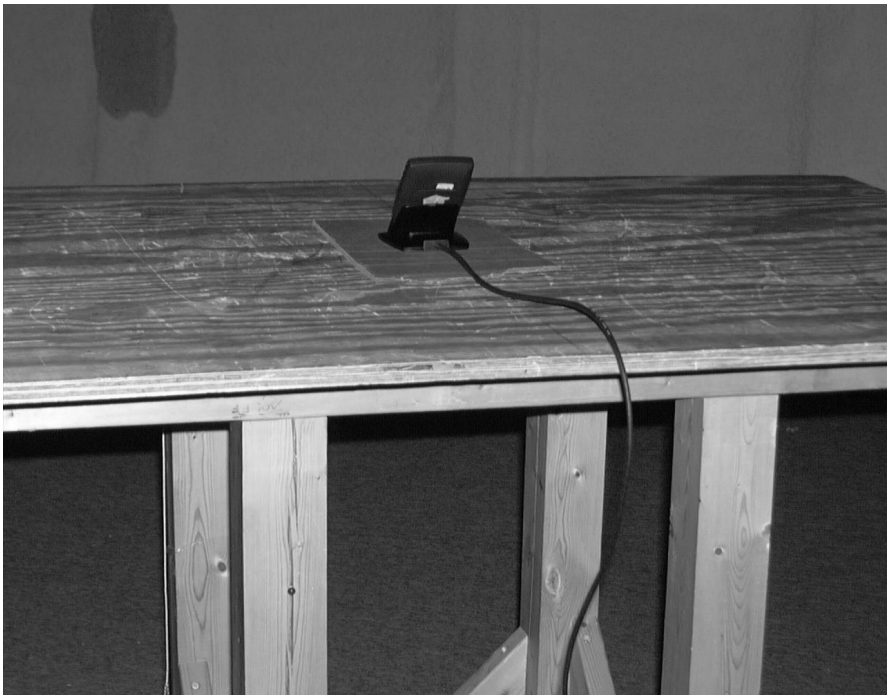
SYSTEM DESCRIPTION Photos





SYSTEM DESCRIPTION Photos





TEST PROCEDURE: RADIATED EMISSIONS RIM 027

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

The Research In Motion Limited R957M-2-5 PROTON pager, was connected together with a RIM 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 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 Research In Motion Limited R957M-2-5 PROTON pager, by itself and with the RIM charging cradle, were placed on top of the turntable while the power supply for the charging cradle 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 PROTON pager was processing data in a worst case NORMAL manner, and included normal operating transmitter and receiver modes. 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 ERP level was also checked with the pager transmitting as a stand-alone device.

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:	Anritsu 2601 A Spectrum Analyzer	
	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 027

BW: 100/120 KHz
Span: 05 to 50 MHz
Configuration: ***Pager Only***

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 TX	**899.00**	**40300.00**	**RT.4 V**	**45.7**	**1,841,710**	**3300000**	**-5.07**
02 TX	**1798.04**	**508.1**	**L/P V**	**3.7**	**1880.0**	**7400**	**-11.90**

NOTES:

A) The ERP, based upon a measurement of the actual carrier level, is **0.620W**. 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 47.92 dBc below the relative radiated power (ERP) output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

C) Limit Calculations:

Attenuation= 50 + 10 × Log of ERP (0.620W)
= 50 + (-2.08)
= 47.92 **dBc**
Limit (FS) = 1.841 V/m less 47.92dB
= 0.007400 V/m or 7400 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| = 1.841 V/m and D = 3 metres, the ERP is 0.620W

RADIATED EMISSION RESULTS RIM 027

BW: 100/120 KHz
Span: 05 to 50 MHz
Configuration: ***Pager in Charging Cradle***

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 TX	**899.00**	**23200.00**	**RT.4 V**	**45.7**	**1,060,240**	**3300000**	**-9.86**
02 TX	**1798.18**	**150.0**	**L/P V**	**3.7**	**555.0**	**7386**	**-22.48**

NOTES:

A) The ERP, based upon a measurement of the actual carrier level, is **0.206W**. 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 43.14 dBc below the relative radiated power (ERP) output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

C) Limit Calculations:

Attenuation= 50 + 10 × Log of ERP (0.206W)
= 50 + (-6.86)
= 43.14 **dBc**
Limit (FS) = 1.060 V/m less 43.14dB
= 0.007386 V/m or 7386 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| = 1.060 V/m and D = 3 metres, the ERP is 0.206W

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-216)
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

Test Data	Date	Document No.
J. Doll	November 22, 1999	02165-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 R957M-2-5 Proton device was connected together with a host computer, external power supply and a 20 dB external attenuator. The R957M-2-5 antenna output terminal was connected to the input of a 50 Ω spectrum analyzer through a matched 20 dB attenuator. The R957M-2-5 transmitter was operating at full output power with and without internal data modulation.

TEST RESULTS:

UNMODULATED CARRIER, High Power: **12.97 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: **-1.30** 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

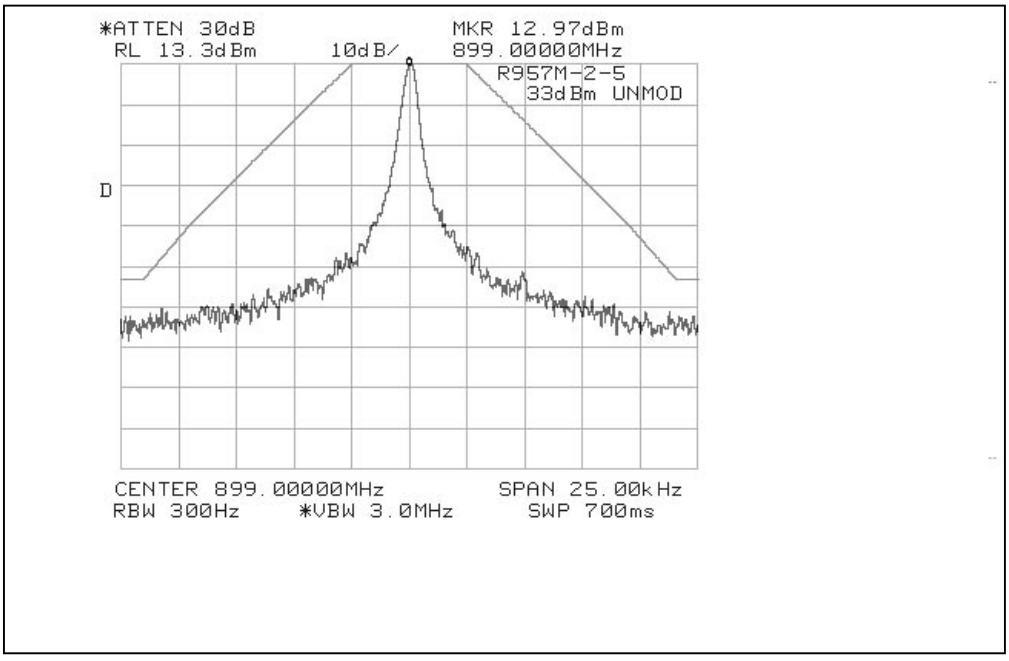
0.0115	157 log (f_d/5.3)	-53	-175
26500	50+10 log (P)	-53	-175

EQUIPMENT:

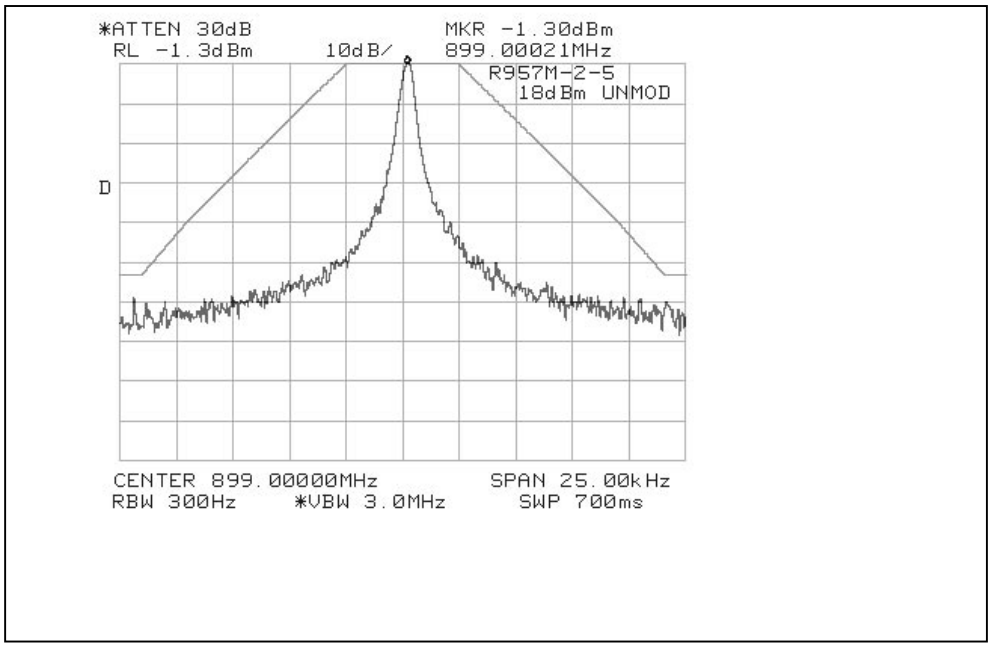
- H.P. 8563E Spectrum Analyzer 9.0 KHz - 26.5 GHz
- HP6632A DC POWER SUPPLY
- Mini Circuits 20 dB att. # NAT-20 0 Hz - 1.5 GHz

SETTING: RBW: 300 Hz; VBW: 3 MHz; SPAN: 25 KHz; SWP: 700 ms

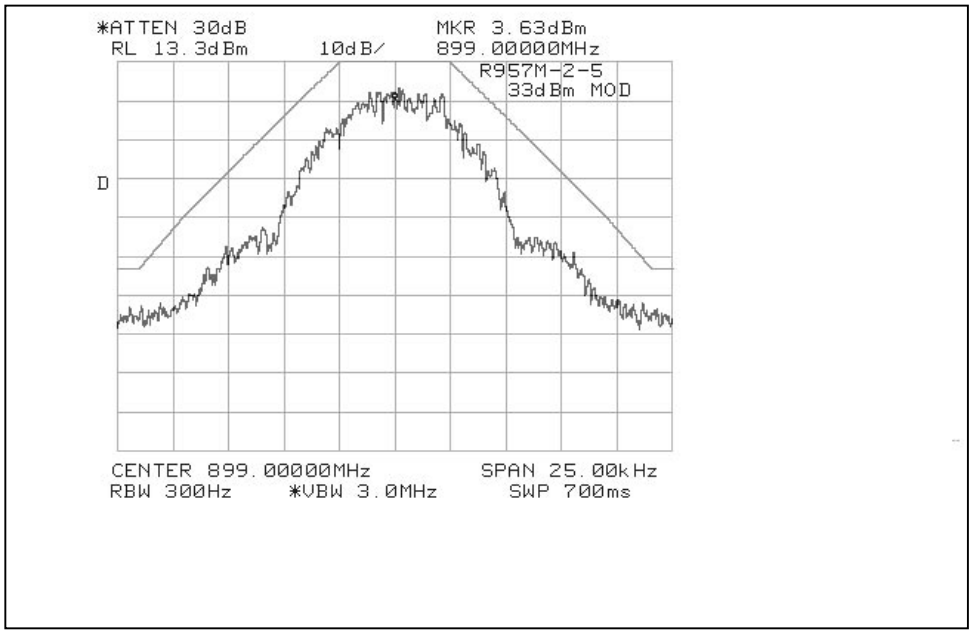
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
UNMODULATED CARRIER – HIGH POWER



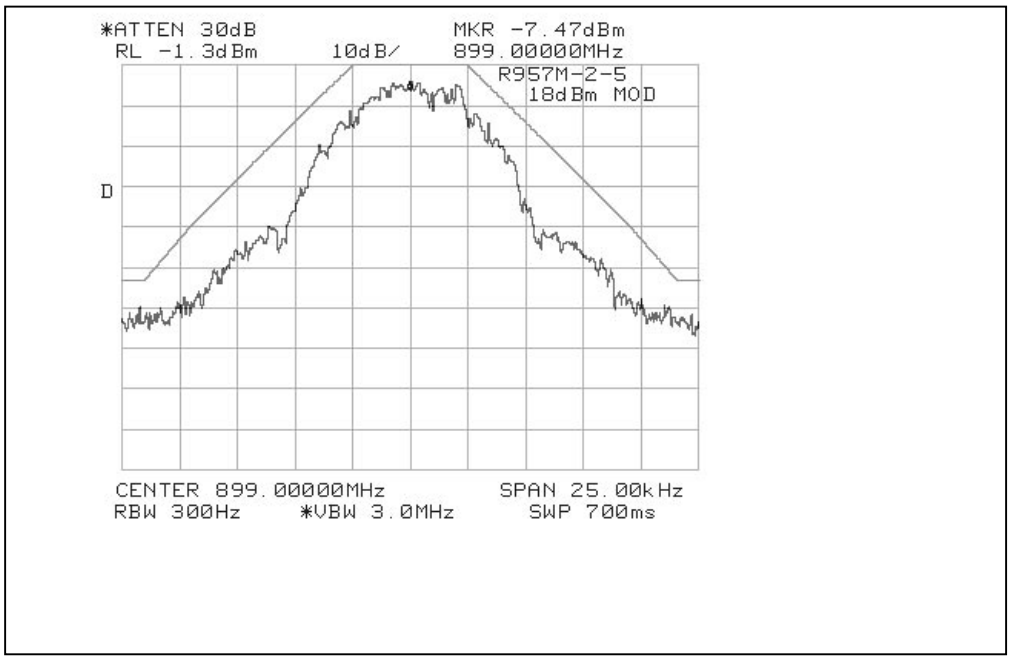
OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
UNMODULATED CARRIER – LOW POWER



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – HIGH POWER



OCCUPIED BANDWIDTH/BANDWIDTH LIMITATIONS
MODULATED CARRIER – LOW POWER



Test Data	Date	Document No.
J. Doll	November 22, 1999	02165-CERT-FCC-TEST-SPURIOUS
Approved	Rev	File / Reference
M. Attayi		Spurious.doc

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

TEST PROCEDURE:

The Research In Motion Limited R957M-2-5 Proton radio device was connected together with a host computer, external power supply, a 20 dB external attenuator, and a coaxial cable. The R957M-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 carrier at +12.30 dBm, including the 20.66 dB external attenuator and cable loss, is 32.96 dBm. The actual limit is 52.96 dBc lower, or -20.0 dBm.

TEST RESULTS:

Ref 899 +32.96 (- 52.96) -20.0

FREQUENCY MHz	LEVEL dBm	LIMIT dBm
899.00	32.96	
1798.00	-34.79	-20.00
2697.00	-53.05	-20.00
3596.00	-48.47	-20.00
4495.00	-38.26	-20.00
5394.00	-53.26	-20.00
6293.00	-40.73	-20.00
7192.00	-53.03	-20.00
8990.00	-52.63	-20.00

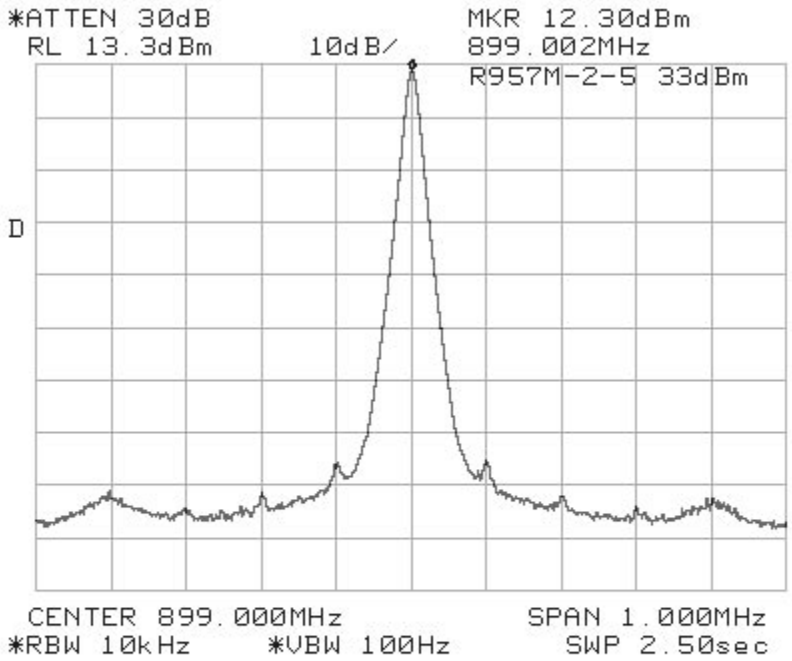
NOTE:

The above limits take into account the unmodulated carrier level of 32.96 dBm inclusive of the 20.66 dB 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

UNMODULATED CARRIER



Test Data	Date	Document No.
J. Doll	November 22, 1999	02165-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 (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 2.00 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 HP85033D Calibration Kit	S/N 3423A00734	Cal on 05/08/99

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

Procedure: These results were obtained using the test procedure described in document 02165-CERT-FCC-TEST-013.

The 8720D was calibrated using the 85033D. 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)	Output Power (dBm)	Output Power (W)
896.000	13.02	19.98	33.00	2.00
899.000	13.02	19.98	33.00	2.00
901.000	13.00	19.98	32.98	1.99

Author Data	Date	Document No.
M. Attayi	November 22, 1999	02165-CERT-FCC-TEST-013
Approved	Rev	File / Reference
		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 0.00015 % (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: November 19th, 1999
Time: 15:21:48.

Instruments used:

Instrument	Serial Number	Calibrated on
Network Analyzer HP 8720D	US36140834	05/08/99
Calibration Kit HP85033D	3423A00734	05/08/99

Procedure:

Full Two port Calibration of 8720D using the 85033D 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 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 899.0 +/- 3 MHz.

Power and frequency measurements of RIM Radio at different temperatures:

Place: RF Lab in RIM
Date: November 19th, 1999

Instruments used:

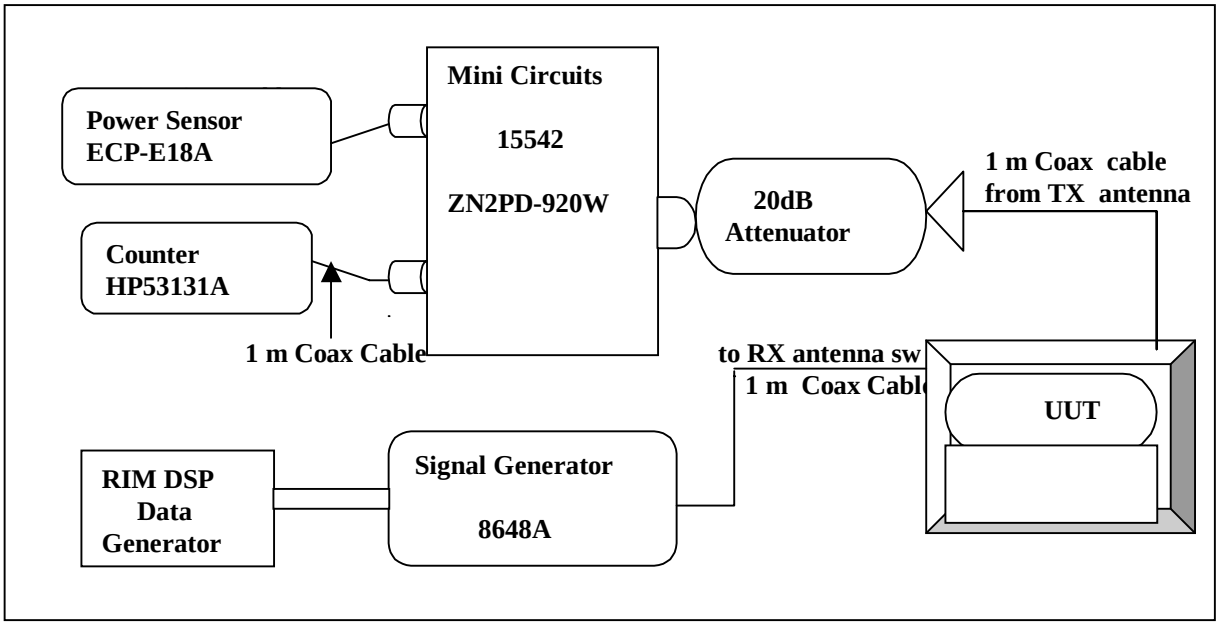
Instrument	Serial number	Calibrated on
DC Power supply HP 6632B	US37472173	28/07/99
Universal Counter HP 53131A	3736A18844	03/08/99
Power Meter HP EPM-441A	GB37481300	05/08/99
Power Sensor HP ECP-E18A	US37181260	05/08/99
Signal Generator HP 8648A	3636A02799	29/07/99
RIM 2181 DSP board		

Temperature Chamber used:

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

Procedure:

The RIM Proton device R957M-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 (896 MHz to 901 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 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 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 frequency to 896 MHz, and power to 33 dBm on RIM Radio.
3. Set the initial Environmental Chamber temperature (-30 Degrees Celsius) and hold for initial soak.
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. Measure temperature of product.

7. Measure power output.
8. Measure frequency output.
9. Repeat steps 4 - 9 for twenty measurements every 24 seconds for 8 minutes.
10. Increase temperature by 5°C and soak for 1/2 hour, repeat steps 4 – 9 for temperatures –25 to +60 Degrees Celsius.
11. Repeat steps 2 - 10 for 899 MHz and 901 MHz.

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.
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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 0.00015 % (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 02165-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	-27.4	-27.2	-0.3850	-0.4051
-25	-22.4	-22.2	-0.3460	-0.3694
-20	-17.6	-17.4	-0.3047	-0.3170
-15	-12.6	-12.5	-0.2366	-0.2645
-10	-7.8	-7.6	-0.1585	-0.1953
-5	-2.9	-2.7	-0.1172	-0.1339
0	2	2.1	-0.0871	-0.1272
5	6.2	6.3	-0.0625	-0.0960
10	10.9	11	-0.0033	-0.0558
15	15.9	16	0.0123	-0.0458
20	20.6	20.7	-0.0067	-0.0458
25	25.3	25.5	-0.0257	-0.0379
30	30.2	30.4	-0.0201	-0.0547
35	35.2	35.3	-0.0257	-0.0569
40	40	40.1	-0.0246	-0.0926
45	44.9	45	-0.0792	-0.1250
50	49.9	50	-0.0926	-0.1406
55	54.9	55	-0.1172	-0.1696
60	60	60.1	-0.1228	-0.2143

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	-27.4	-27.2	-0.3882	-0.4171
-25	-22.3	-22.2	-0.3259	-0.3504
-20	-17.5	-17.3	-0.2914	-0.3126
-15	-12.6	-12.4	-0.2202	-0.2436
-10	-7.8	-7.6	-0.1646	-0.1924
-5	-2.9	-2.7	-0.1290	-0.1402
0	2	2.2	-0.0667	-0.1012
5	6.1	6.2	-0.0523	-0.1001
10	10.9	11	0.0044	-0.0667
15	15.8	16	-0.0578	-0.0578
20	20.7	20.8	-0.0145	-0.0712
25	25.4	25.5	-0.0478	-0.0768
30	30.4	30.5	-0.0178	-0.0378
35	35.2	35.3	-0.0289	-0.0601
40	40	40.1	-0.0768	-0.0890
45	44.9	45.1	-0.0723	-0.1201
50	49.9	50	-0.1068	-0.1457
55	55	55.1	-0.1491	-0.1780
60	60	60.2	-0.1913	-0.2236

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	-27.2	-27.1	-0.4007	-0.4351
-25	-22.5	-22.3	-0.3740	-0.3740
-20	-17.7	-17.5	-0.3119	-0.3130
-15	-12.8	-12.6	-0.2286	-0.2564
-10	-7.9	-7.7	-0.1865	-0.2175
-5	-3.1	-2.9	-0.1132	-0.1365
0	1.9	2	-0.0954	-0.0988
5	6	6.2	-0.0511	-0.1110
10	10.8	11	-0.0488	-0.0555
15	15.8	15.9	-0.0289	-0.0522
20	20.6	20.7	-0.0189	-0.0533
25	25.3	25.5	-0.0200	-0.0455
30	30.3	30.4	-0.0255	-0.0522
35	35.2	35.3	-0.0100	-0.0622
40	39.9	40.1	0.0089	-0.0588
45	44.9	45	-0.0877	-0.1221
50	49.8	49.9	-0.0877	-0.1443
55	54.9	55	-0.1454	-0.1576
60	60	60.1	-0.1232	-0.1754

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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 0.00015 % (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 02165-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	3.8	-0.0770	-0.0770
25	4.1	-0.0257	-0.0379
25	4.4	-0.0279	-0.0603

Results: 899 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25	3.8	0.0033	-0.0400
25	4.1	-0.0478	-0.0768
25	4.4	-0.0501	-0.0712

Results: 901 MHz. nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25	3.8	-0.0855	-0.0855
25	4.1	-0.0200	-0.0455
25	4.4	-0.0166	-0.0688