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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

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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:

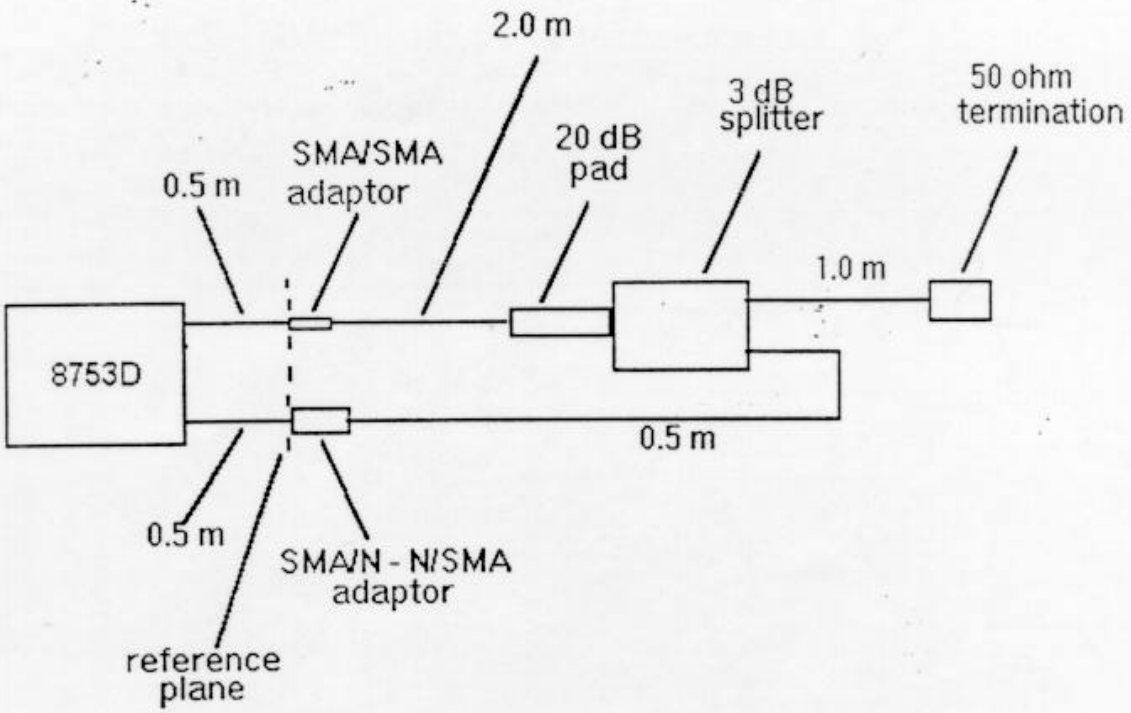
Instrument	Serial Number	Calibrated on
Network Analyzer HP 8753D	3410A05905	09.08.95
Calibration Kit HP85033D	3423A00734	20.07.95

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



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.

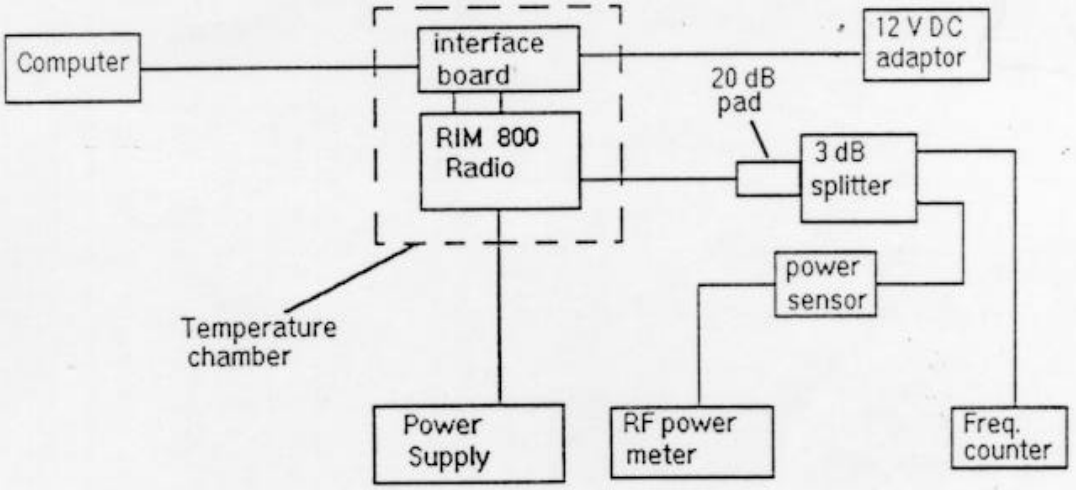
Instruments used:

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

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.

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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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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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