

FCC ID: O2SNURIT3010RT

Exhibit 2

Engineering Report
e)Frequency Stability (2.1055)



Author Data Masud S. Attayi	Date April 8, 1999	Document No. 01947-CERT-FCC-TEST-013
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CFR 47 Chapter 1 - Federal Communication 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 0.00015 % (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: March 14, 1999
 Time: 08:26:00.

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 899.0 +/- 3 MHz.

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Power and frequency measurements of RIM Radio at different temperatures:

Place: RF Lab in RIM

Date: March 23 1999

Instruments used:

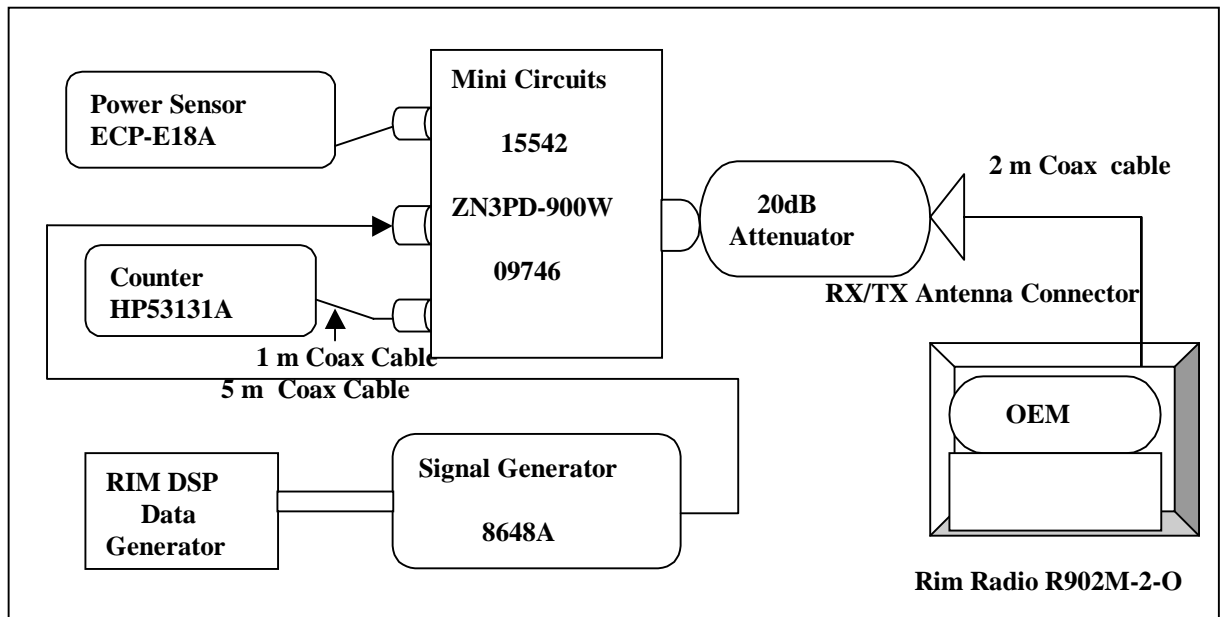
Instrument	Serial number	Calibrated on
DC Power supply HP 6632A	3524A14012	05/08/98
Universal Counter HP 53131A	3325A00988	04/08/98
Power Meter HP EPM-441A	GB37481300	29/04/98
Power Sensor HP ECP-E18A	US37181260	05/05/98
Signal Generator HP 8648A	3636A02799	25/11/98
RIM 2181 DSP board		

Temperature Chamber used:

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

Procedure:

The RIM Radio modem device R902M-2-O 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.





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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 controls 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 75°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 4.15, 4.45, AND 4.75 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 75°C in $+5^{\circ}\text{C}$ 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.

Before the initial temperature one hour soak was allowed and for other 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 4.15 V.
2. Set the initial Environmental Chamber temperature (-30 Degrees Celsius) and hold for initial soak.
3. Set the frequency to 896 MHz, and power to 33 dBm on RIM Radio.
4. Command the RIM Radio to receive mode and adjust its frequency to that of the HP 8648A signal generator and measure BERT.



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5. Activate Carrier on RIM Radio.
6. Take initial HP EPM-441A power meter measurement.
7. Take initial HP 53131A frequency counter measurement.
8. Measure temperature of product.
9. Measure power output.
10. Measure frequency output.
11. Repeat steps 8 - 10 for twenty measurements every 29 seconds for 10 minutes.
12. Repeat steps 3 - 11 for 899 MHz and 901 MHz.
13. Increase temperature by 5°C and soak for 1/2 hour.
14. Repeat steps 2-13 for temperatures -25 degrees to 75 degrees Celsius.

Procedure 3 to 12 was then repeated at 25°C with the power supply voltage set to 4.15, 4.45 and 4.75V.



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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 0.00015 % (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 01947-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]
-30.0	-24.60	-24.30	-0.1027	-0.1217
-25.0	-19.70	-19.30	-0.1194	-0.1250
-20.0	-15.40	-15.10	-0.1116	-0.1239
-15.0	-11.00	-10.60	-0.1016	-0.1161
-10.0	-6.10	-5.80	-0.1038	-0.1116
-5.0	-1.20	-0.80	-0.0848	-0.0971
0	3.70	4.00	-0.0781	-0.0882
5.0	8.30	8.50	-0.0692	-0.0781
10.0	13.20	13.40	-0.0681	-0.0681
15.0	18.10	18.40	-0.0536	-0.0558
20.0	23.30	23.50	-0.0424	-0.0502
25.0	28.30	28.60	-0.0223	-0.0435
30.0	33.60	33.80	--0.0547	-0.0547
35.0	38.20	38.50	-0.0558	-0.0558
40.0	43.20	43.40	-0.0513	-0.0513
45.0	48.30	48.50	-0.0759	-0.0960
50.0	53.10	53.40	-0.0971	-0.1038
55.0	58.20	58.40	-0.1027	-0.1094
60.0	63.20	63.40	-0.1049	-0.1205
65.0	67.90	68.20	-0.1183	-0.1239
70.0	72.60	72.90	-0.1083	-0.1250
75.0	77.30	77.70	-0.1150	-0.1373



STABILITY - TEMPERATURE VARIATION

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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]
-30.0	-24.80	-24.40	-0.1034	-0.1135
-25.0	-19.70	-19.30	-0.1224	-0.1324
-20.0	-15.40	-15.10	-0.1201	-0.1324
-15.0	-11.10	-10.70	-0.1190	-0.1190
-10.0	-6.10	-5.80	-0.0879	-0.1068
-5.0	-1.10	-0.80	-0.0857	-0.0890
0	3.70	4.00	-0.0745	-0.0934
5.0	8.30	8.60	-0.0578	-0.0701
10.0	13.10	13.30	-0.0512	-0.0701
15.0	18.20	18.50	-0.0389	-0.0512
20.0	23.30	23.50	-0.0501	-0.0501
25.0	28.40	28.50	-0.0289	-0.0378
30.0	33.40	33.70	-0.0423	-0.0501
35.0	38.30	38.50	-0.0489	-0.0612
40.0	43.20	43.40	-0.0456	-0.0634
45.0	48.20	48.40	-0.0756	-0.0857
50.0	53.10	53.40	-0.1034	-0.1034
55.0	58.20	58.40	-0.0979	-0.1123
60.0	63.10	63.40	-0.1057	-0.1190
65.0	67.90	68.20	-0.1090	-0.1268
70.0	72.60	72.80	-0.0990	-0.1257
75.0	77.30	77.50	-0.1201	-0.1257



STABILITY - TEMPERATURE VARIATION

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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]
-30.0	-24.40	-23.90	-0.1265	-0.1265
-25.0	-20.70	-19.00	-0.1210	-0.1443
-20.0	-14.80	-14.30	-0.1188	-0.1232
-15.0	-9.70	-9.30	-0.1021	-0.1154
-10.0	-4.90	-4.60	-0.0966	-0.1065
-5.0	-0.10	0.30	-0.0966	-0.0966
0	4.60	5.10	-0.0810	-0.0910
5.0	9.30	9.60	-0.0688	-0.0844
10.0	14.10	14.50	-0.0577	-0.0733
15.0	18.20	18.40	-0.0622	-0.0655
20.0	23.30	23.50	-0.0544	-0.0577
25.0	28.30	28.50	-0.0366	-0.0577
30.0	33.30	33.50	-0.0477	-0.0688
35.0	38.10	38.40	-0.0622	-0.0744
40.0	43.00	43.30	-0.0688	-0.0810
45.0	48.10	48.20	-0.0721	-0.0899
50.0	53.00	53.20	-0.0954	-0.1054
55.0	57.80	58.00	-0.0966	-0.1143
60.0	62.60	62.80	-0.1110	-0.1232
65.0	66.90	67.60	-0.1321	-0.1354
70.0	71.90	72.10	-0.1199	-0.1365
75.0	76.60	77.20	-0.1265	-0.1354



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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 0.00015 % (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 01947-CERT-FCC-TEST-013.

Results: 896 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	4.15	-0.0826	-0.1038
25.0	4.45	-0.0223	-0.0435
25.0	4.75	-0.0257	-0.0491

Results: 899 MHz nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	4.15	-0.0634	-0.0634
25.0	4.45	-0.0289	-0.0378
25.0	4.75	-0.0289	-0.0467

Results: 901 MHz. nominal transmitter.

Ambient Temperature [degrees Celsius]	Device Supply Voltage [Volts]	Initial Frequency Deviation [ppm]	Maximum Deviation [ppm]
25.0	4.15	-0.0910	-0.1132
25.0	4.45	-0.0366	-0.0577
25.0	4.75	-0.0433	-0.0677