Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

ComSpace Corporation
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Coppell, TX 75019
(972) 745-1367

MODEL: CDRTL841FL001

FCC ID: PCKCDRTL841FL0011

March 13, 2001

STANDARDS REFERENCED FOR THIS REPORT	
PART 2; 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15; 1999	§15.109: RADIATED EMISSIONS LIMITS
PART 90; 1998	PRIVATE LAND MOBILE RADIO SERVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
ANSI/TIA/EIA603; 1992	LAND MOBILE FM OR PM COMMUNICATIONS EQUIPMENT MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA 603-1; 1998	ADDENDUM TO ANSI/TIA/EIA 603-1992
RSS-119; 1996	LAND MOBILE AND FIXED RADIO TRANSMITTERS AND RECEIVERS

FCC Rules Parts	Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
2, 15, 90	851-869 MHz	90	1.0	18K4D7W
Industry Canada	**Frequency Range**	**Output Power (W)**	**Freq. Tolerance**	**Emission Designator**
RS-119; 1996, RSS-102; 1999	851-869 MHz	90	1.0	18K4D7W

REPORT PREPARED BY:

Test Engineer: Daniel Baltzell
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Rhein Tech Laboratories, Inc.
Document Number: 2001064

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1 GENERAL INFORMATION

The following Report of a Type Certification is prepared on behalf of ***ComSpace Corporation*** in accordance with the Federal Communications Commissions and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the ***CDRTL841FL001; FCC ID: PCKCDRTL841FL0011***. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47: Part 2, 15 and 90 Rules and Regulations, Industry Canada RSS-119 and RSS-102 and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application report.

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
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1.3 CONFORMANCE STATEMENT

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We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from the FCC Part 2, Part 15, and Part 90 also with Industry Canada RSS-119 and RSS-102 Certification methodology.

Signature: _____ **Date: March 27, 2001**

Typed/Printed Name: Desmond A. Fraser **Position: President (NVLAP Signatory)**

Signature: _____ Date: March 27, 2001

Typed/Printed Name: Daniel W. Baltzell Position: Test Engineer

Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 200061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

1.4 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)
FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(uV/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

49.3 dBuV - 11.5 dB/m = 37.8 dBuV/m

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

1.5 CONDUCTED MEASUREMENT

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power-outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6dB bandwidth was set to 9 kHz. Video filters less than 10 times the resolution bandwidth was not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 450 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

1.6 RADIATED MEASUREMENT

Before final measurements of radiated emissions were made on the open-field three meter range, the EUT was scanned indoors at a three meter distance in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

2 FCC RULES AND REGULATIONS PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED

2.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance, which was connected to the Gigatronics power meter.

2.2 TEST DATA

The following channels (in MHz) were tested: 851.0125, 860.0, and 868.9875.
The worst-case Output Power (highest) levels are shown.

CARRIER OUTPUT POWER (UNMODULATED)

Frequency (MHz)	RF Power measured (Watt)*
851.0125	87.5
860.0000	90.0
868.9875	85.0

*Measurement accuracy: +/- 3%

Rated Power:

Rated Power (W)
90

2.3 TEST EQUIPMENT

Power Meter	Gigatronics	8651A (Meter) 80401A(sensor)
	HP437B	s/n 2949A02966
	HP 8901A	s/n 2545A04102 (power mode)
Power Sensor	HP8481B	s/n 2702A05059
Frequency Counter	HP8901A	s/n 2545A04102 (Frequency mode)

3 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

3.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, Section 2.2.13

The transmitter is terminated with a 50Ω load and interfaced with a spectrum analyzer.
The transmitter is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1000 Hz.

3.2 TEST DATA

3.2.1 CFR PART 90 REQUIREMENTS

Frequency range of measurement per Part 2.1057: 9kHz to 10 x Fc

Limits: Mask Part 90.691(G) (dBm): P(dBm) – (50+10xLOG P(W))

The worst case (unwanted emissions) are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit does not need to be recorded. A notch filter was used to notch off the carrier during the test. The data was then corrected by adding the filter insertion loss to the table below.

(851.0125) – 90 Watt and 25 kHz Channel Bandwidth: Mask Part 90.691(G)

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
1702.0250	-63.3	-20.0	-43.3
2553.0375	-62.8	-20.0	-42.8
3404.0500	-64.9	-20.0	-44.9
4255.0625	-64.5	-20.0	-44.5
5106.0750	-51.0	-20.0	-31.0
5957.0875	-54.3	-20.0	-34.3
6808.1000	-45.6	-20.0	-25.6
7659.1125	-54.1	-20.0	-34.1
8510.1250	-54.8	-20.0	-34.8

(860.0) – 90 Watt and 25 kHz Channel Bandwidth: Mask Part 90.691(G)

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
1720.0	-61.2	-20.0	-41.2
2580.0	-64.9	-20.0	-44.9
3440.0	-57.8	-20.0	-37.8
4300.0	-54.2	-20.0	-34.2
5160.0	-41.3	-20.0	-21.3
6020.0	-48.2	-20.0	-28.2
6880.0	-50.0	-20.0	-30.0
7740.0	-50.6	-20.0	-30.6
8600.0	-53.3	-20.0	-33.3

(868.9875) – 90 Watt and 25 kHz Channel Bandwidth: Mask Part 90.691(G)

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
1737.9750	-66.2	-20.0	-46.2
2606.9625	-61.9	-20.0	-41.9
3475.9500	-64.1	-20.0	-44.1
4344.9375	-61.7	-20.0	-41.7
5213.9250	-54.2	-20.0	-34.2
6082.9125	-56.2	-20.0	-36.2
6951.9000	-51.3	-20.0	-31.3
7820.8875	-56.0	-20.0	-36.0
8689.8750	-47.9	-20.0	-27.9

3.3 TEST EQUIPMENT

Audio Generator:
Synthesized Level Generator HP3336B s/n 2127A00559
Audio Signal Analyzer Tektronix ASG 100 s/n B032374

Spectrum Analyzer:
HP8564E s/n 3943A01719
HP8546A s/n 3525A00159

4 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION

4.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.12. The transmitter is terminated with a 50 Ω.
Refer to section "Radiated Measurement" in this report for further information.

4.2 TEST DATA

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit does not need to be recorded. The data in the table below was measured using the substitution method of EIA/TIA-603-1992.

90 W 25 kHz Channel Bandwidth Mask Part 90.691(G)						
Radiated Emissions (860.0000 MHz) Substitution Method						
Frequency	**S/G level (dBm)**	**Cable Loss***	**TX Ant. gain diff. (ref. To 1/2 wave dipole)**	**Emission level (dBm)**	**Limit (dBm) Mask B**	**Margin**
1720.000	-35.2	7.1	4.8	-37.5	-20.0	-17.5
2580.000	-57.7	11.0	5.4	-63.3	-20.0	-43.3
3440.000	-42.3	14.4	6.1	-50.6	-20.0	-30.6
4300.000	-34.8	18.2	6.6	-46.4	-20.0	-26.4
5160.000	**N.F.					
6020.000	**N.F.					
6880.000	**N.F.					
7740.000	**N.F.					
8600.000	**N.F.					

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½wave dipole antenna.
** NF: Noise Floor

4.3 TEST EQUIPMENT

Antenna:	CHASE CBL6112 s/n 2099	
Amplifier:	HP8449B	s/n 3008A00505
Spectrum analyzer:	HP8564E	s/n 3943A01719
RF Signal Generator	HP8648C	s/n 3537A01741
Synthesized Sweeper	HP83752A	s/n 3610A00846

5 FCC RULES AND REGULATIONS PART 2 §2.1049 (C) (1): OCCUPIED BANDWIDTH

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

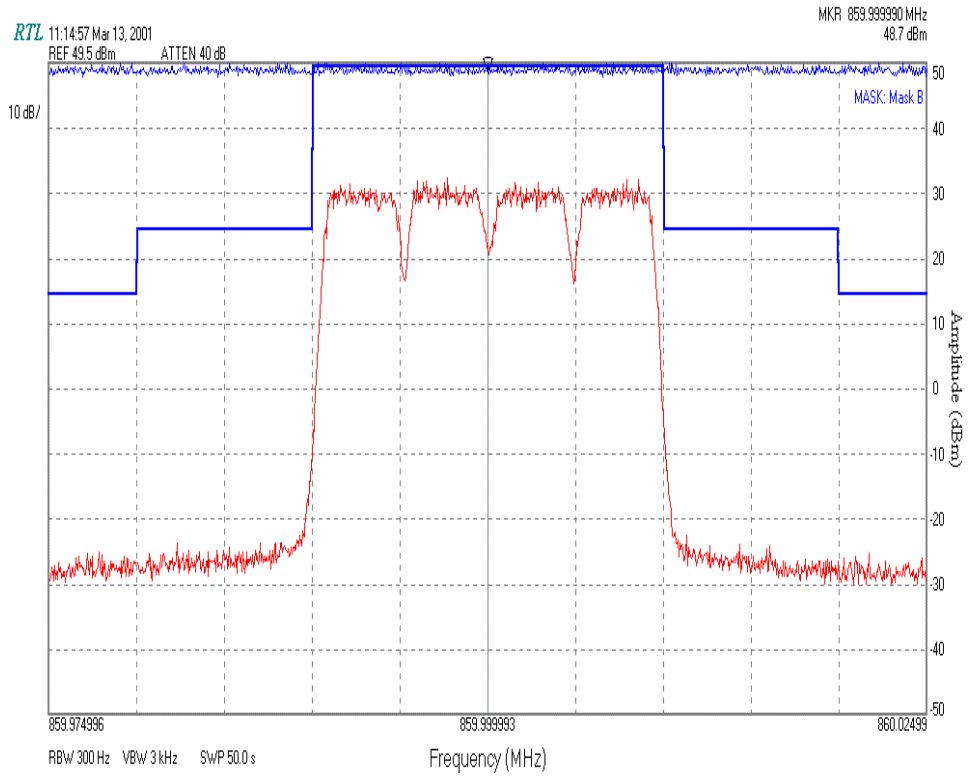
5.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.11

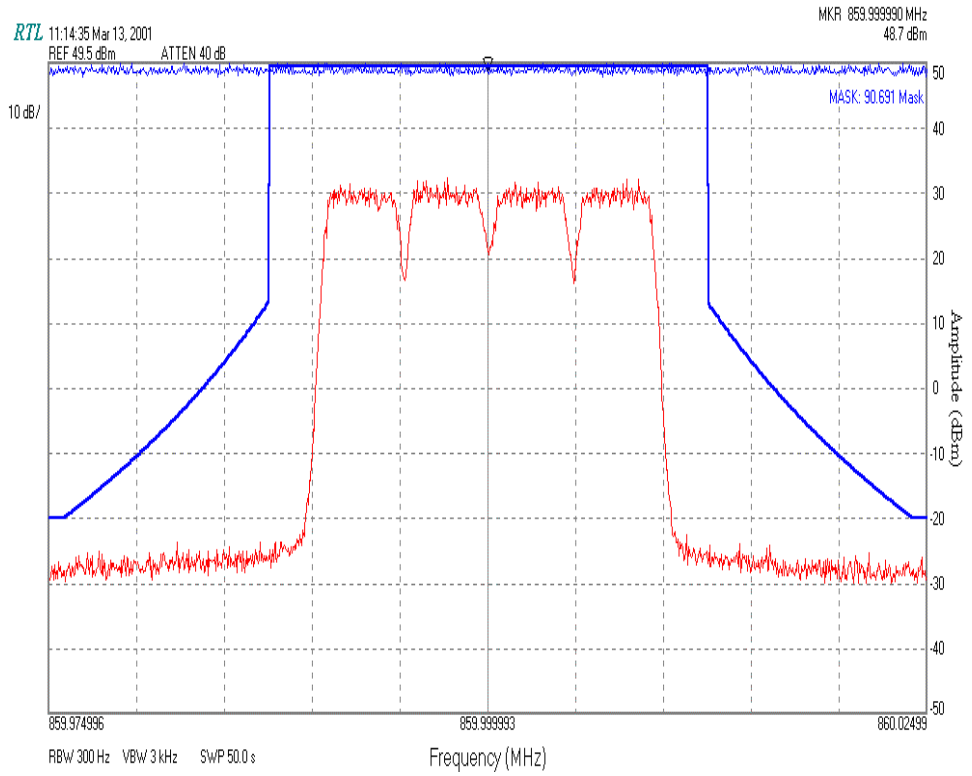
Device with digital modulation: Operated to its maximum extent

5.2 TEST DATA

5.2.1 90 W FOR 25 KHZ CHANNEL BANDWIDTH: MASK B



5.2.2 90 W FOR 25 KHZ CHANNEL BANDWIDTH: MASK PART 90.691(G)



5.3 TEST EQUIPMENT

Spectrum Analyzer HP8564E s/n 3943A01719

6 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY

6.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +50°C.

The temperature was initially set to -30°C and a period was observed for stabilization of the EUT.
The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A sufficient period of time was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter.

Additionally, the power supply voltage of the EUT was varied from 85% to 115% of the nominal voltage of 115VAC

The worst-case test data are shown.

6.2 TEST EQUIPMENT

Temperature Chamber	Tenney TH65	s/n 11380
Frequency Counter	HP8901A (Frequency Mode)	s/n 2545A04102

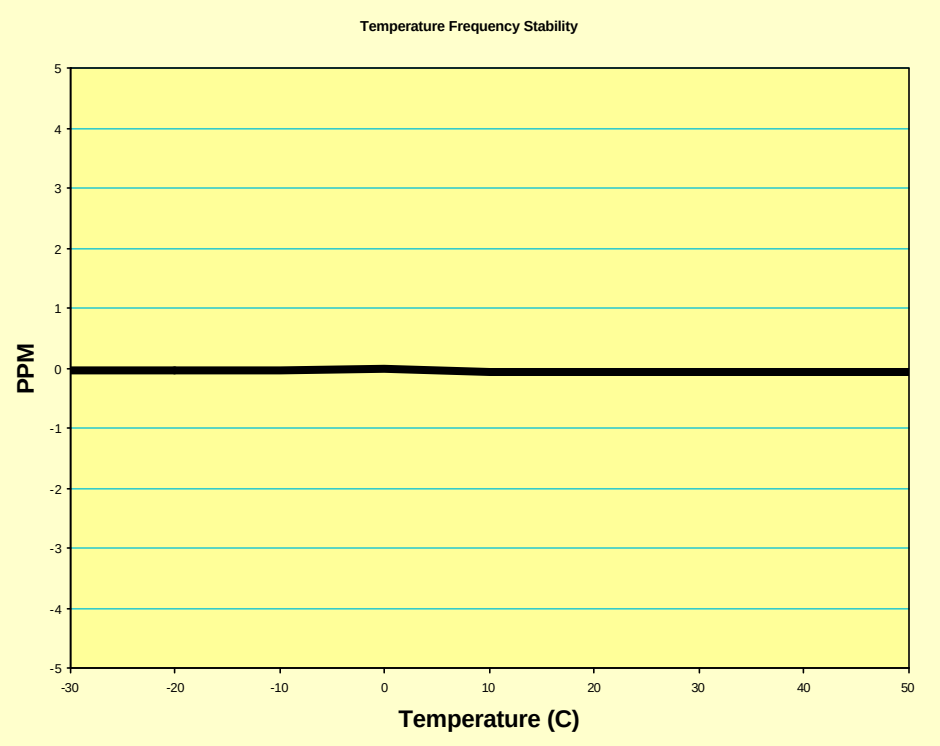
6.3 TEST DATA

6.3.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

Limit is 1 ppm for device with a 25 kHz channel bandwidth

90 Watts was tested with a 25 kHz channel bandwidth. The worst-case temperature deviation is 0.08 PPM.

Assigned Frequency 860.0000 MHz

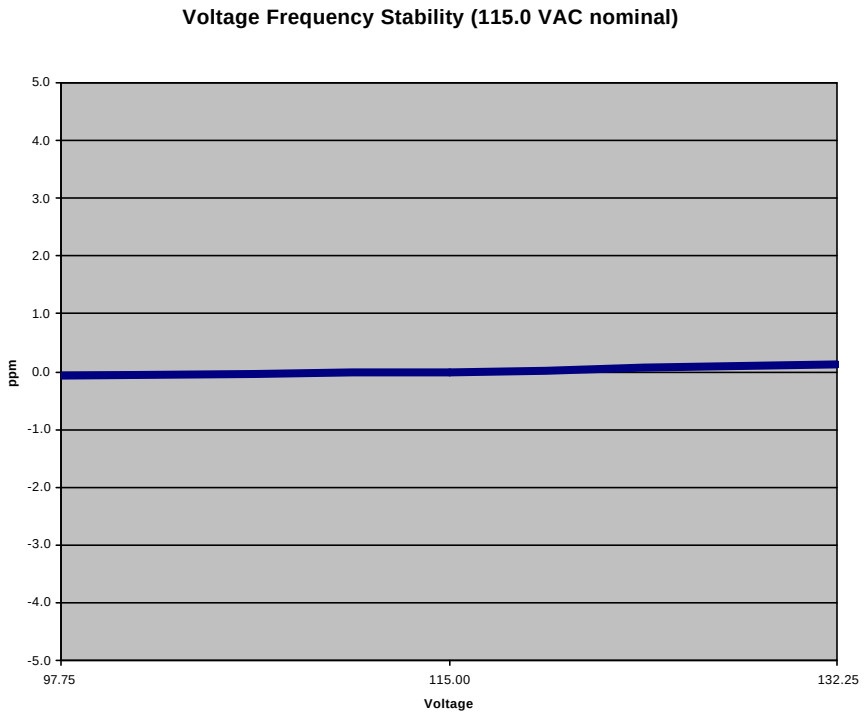


6.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION

Limit is 1 ppm for device with a 25 kHz channel bandwidth

90 Watt was tested with a 25 kHz channel bandwidth. The worst-case temperature deviation is 0.08 PPM. The worst-case voltage deviation is 0.06 PPM

Assigned Frequency 860.0000 MHz



7 FCC RULES AND REGULATIONS PART 15 §15.107 (A): CONDUCTED EMISSIONS (CLASS A LIMITS)

Connector J7
NEUTRAL SIDE (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.750	Pk	35.2	0.8	36.0	60.0	-24.0
4.470	Pk	35.8	1.6	37.4	69.5	-32.1
6.450	Pk	37.4	2.0	39.4	69.5	-30.1
9.760	Pk	41.8	1.7	43.5	69.5	-26.0
13.010	Pk	31.3	2.7	34.0	69.5	-35.5
14.660	Pk	29.9	2.6	32.5	69.5	-37.0
16.290	Pk	32.1	3.2	35.3	69.5	-34.2
19.600	Pk	22.3	3.3	25.6	69.5	-43.9

HOT SIDE (Line 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.750	Pk	34.9	0.8	35.7	60.0	-24.3
1.540	Pk	32.7	1.0	33.7	60.0	-26.3
4.500	Pk	26.7	1.6	28.3	69.5	-41.2
6.480	Pk	39.7	2.0	41.7	69.5	-27.8
8.130	Pk	37.4	2.2	39.6	69.5	-29.9
9.760	Pk	41.8	2.3	44.1	69.5	-25.4
13.040	Pk	33.3	2.7	36.0	69.5	-33.5
14.690	Pk	30.0	2.9	32.9	69.5	-36.6

Connector J8
NEUTRAL SIDE (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.830	Pk	35.9	0.7	36.6	60.0	-23.4
1.570	Pk	37.7	1.0	38.7	60.0	-21.3
3.200	Pk	41.9	1.4	43.3	69.5	-26.2
4.410	Pk	39.6	1.6	41.2	69.5	-28.3
6.480	Pk	38.1	2.0	40.1	69.5	-29.4
9.760	Pk	37.7	1.7	39.4	69.5	-30.1
13.040	Pk	33.2	2.7	35.9	69.5	-33.6
14.690	Pk	29.8	2.6	32.4	69.5	-37.1
16.290	Pk	31.2	3.2	34.4	69.5	-35.1
22.790	Pk	18.5	3.6	22.1	69.5	-47.4

HOT SIDE (Line 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
1.540	Pk	35.8	1.0	36.8	60.0	-23.2
2.670	Pk	33.7	1.3	35.0	69.5	-34.5
4.710	Pk	25.5	1.7	27.2	69.5	-42.3
10.440	Pk	28.2	2.3	30.5	69.5	-39.0
12.330	Pk	26.7	2.6	29.3	69.5	-40.2
13.690	Pk	23.5	2.8	26.3	69.5	-43.2
23.850	Pk	18.5	3.8	22.3	69.5	-47.2

8 FCC RULES AND REGULATIONS PART 15 §15.109 (A): RADIATED EMISSIONS (CLASS A LIMITS)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
83.495	Qp	V	190	1.1	65.4	-21.4	44.0	49.5	-5.5
324.999	Qp	V	180	1.5	67.3	-12.7	54.6	56.9	-2.3
334.012	Qp	V	180	1.8	63.5	-12.6	50.9	56.9	-6.0
390.007	Qp	V	275	1.3	58.9	-10.8	48.1	56.9	-8.8
572.002	Qp	V	200	1.0	51.9	-6.0	45.9	56.9	-11.0
623.996	Qp	V	270	1.3	53.0	-5.2	47.8	56.9	-9.1
741.003	Qp	V	200	1.0	51.8	-4.0	47.8	56.9	-9.1

9 FCC RULES AND REGULATIONS PART 15 §15.111 (A): ANTENNA POWER CONDUCTION FOR RECEIVERS

Using a spectrum analyzer resolution bandwidths of 100Hz no visible emissions were observed from 9kHz to 10 x the fundamental.

10 FCC RULES AND REGULATIONS PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

Type of Emission: D7W

Necessary Bandwidth: (measured at 99% power bandwidth)
Bn = 18.4 kHz