



Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

ComSpace Corporation
955 Freeport Parkway
Suite 100
Coppell, TX 75019
(972) 745-1367

MODEL: CDRTL841FL0001

FCC ID: PCKCDRTL841FL0001

November 20, 2000

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	2.5	18K4D7W
Industry Canada	Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
RS-119; 1996, RSS-102; 1999	851-869 MHz	90	2.5	18K4D7W

REPORT PREPARED BY:

Test Engineer: Daniel Baltzell
Technical Writer: Daniel Baltzell

Rhein Tech Laboratories, Inc.

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360 Herndon Parkway, Suite 1400
Herndon, VA 20170
Phone: 703-689-0368; Fax: 703-689-2056; Metro: 703-471-6441



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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: PCKCDRTL841FL0001**. 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.



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1.3 Conformance Statement

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: December 4, 2000

Typed/Printed Name: Bruno Clavier

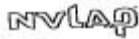
Position: Vice President of Operations

Signature: _____

Date: November 14, 2000

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:

$$FI(\text{dBuV/m}) = SAR(\text{dBuV}) + SCF(\text{dB/m})$$

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:

$$SCF(\text{dB/m}) = -PG(\text{dB}) + AF(\text{dB/m}) + CL(\text{dB})$$

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:

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

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:

$$49.3 \text{ dBuV} - 11.5 \text{ dB/m} = 37.8 \text{ dBuV/m}$$

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



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. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane.

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.



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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.

2.2 Test Data

The following channels (in MHz) were tested: 815.0125, 805.0125.
The worst-case Output Power (highest) levels are shown.

CARRIER OUTPUT POWER (UNMODULATED)

Frequency (MHz)	RF Power measured (Watt)*
868.9875	85.5
860.0125	90.0
851.0125	88.0

*Measurement accuracy: +/- 3%

Rated Power:

Rated Power (W)
85

2.3 Test Equipment

Power Meter	Gigatronics HP437B	8651A (Meter) 80401A(sensor) s/n 2949A02966
Power Sensor	HP 8901A HP8481B	s/n 2545A04102 (power mode) 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 $10 \times F_c$

Limits: Mask B (dBm): $P(\text{dBm}) - (43 + 10 \times \log P(\text{W}))$

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.

(860.0125) – 90 Watt and 25 kHz Channel Bandwidth: Mask B

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
.05472	-41.1	-13.0	-28.1
1720.025	-35.0	-13.0	-22.0
2580.0375	-32.6	-13.0	-20.6
3440.05	*NF		
4300.0625	*NF		
5160.075	*NF		
6020.0875	*NF		
6880.1	*NF		
7740.1125	*NF		
8600.125	*NF		

NF: Noise Floor

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.

90 W 25 kHz						
Radiated Emissions (860.0125 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	-27.0	7.1	-4.8	-15.1	-13.0	-2.1
2580.000	-45.4	11.3	-4.8	-29.3	-13.0	-16.3
3440.000	**N.F.					
4300.000	**N.F.					
5160.000	-55.0	21.3	-4.8	-28.9	-13.0	-15.9
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 $\frac{1}{2}$ wave 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



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

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

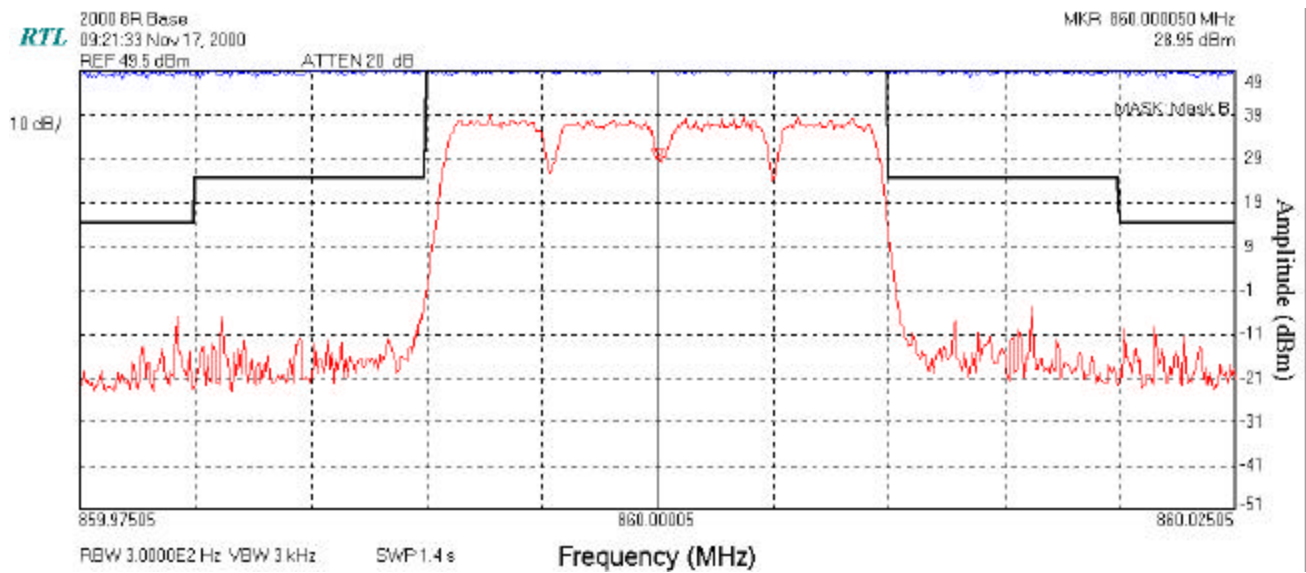
5.1 Test Procedure

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



5.3 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 Data

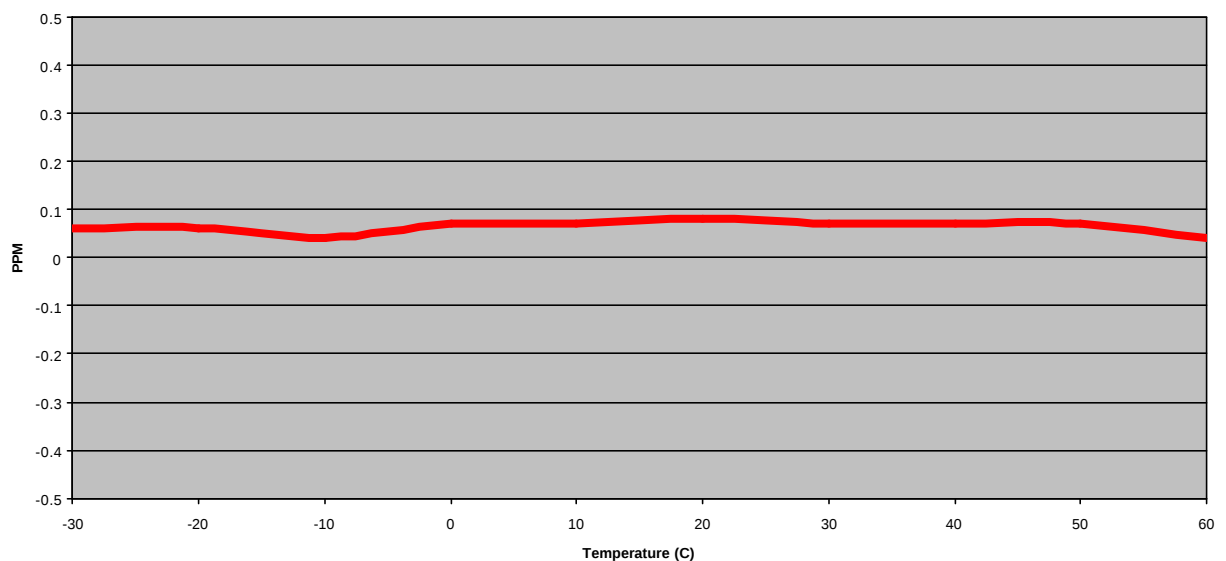
6.2.1 FREQUENCY STABILITY/FREQUENCY VARIATION

Limit is 5 ppm for device with a 25 kHz channel bandwidth

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

Assigned Frequency 860.0125 MHz

Temperature Frequency Stability





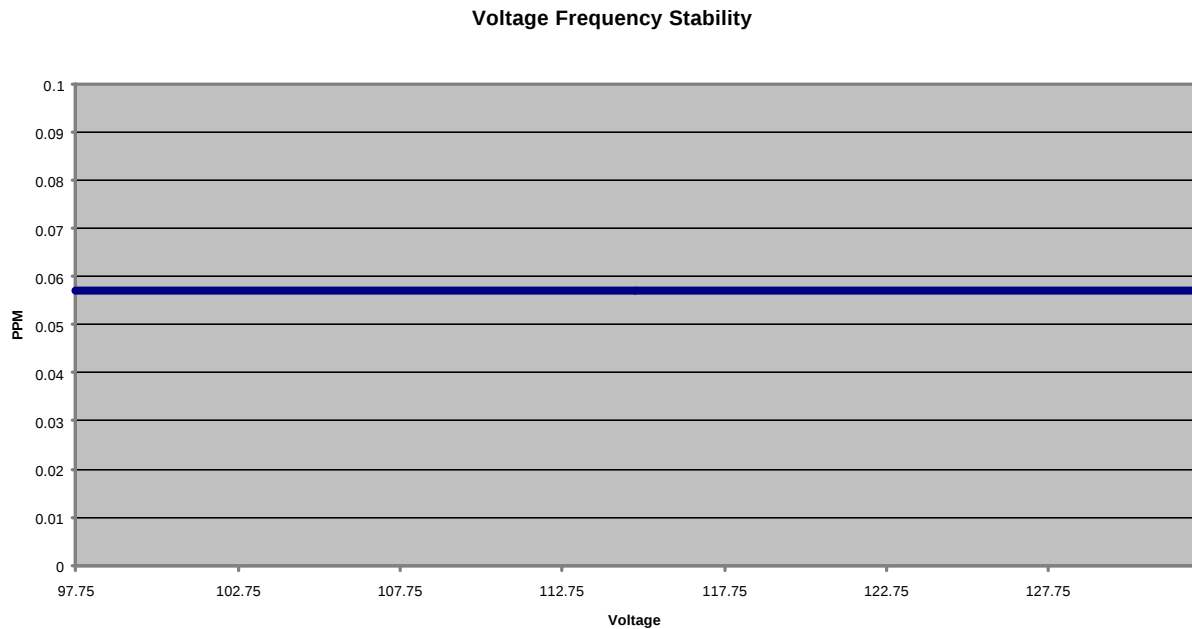
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6.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION

Limit is 5 ppm for device with a 25 kHz channel bandwidth

90 Watts was tested with a 25 kHz channel bandwidth. The worst-case voltage deviation is 0.057 PPM.

Assigned Frequency 860.0125 MHz



6.3 Test Equipment

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



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

Digital NEUTRAL SIDE (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dB)
0.693	Pk	33.5	0.6	34.1	48.0	-13.9
2.109	Pk	39.7	1.2	40.9	48.0	-7.1
6.447	Pk	37.5	2.0	39.5	48.0	-8.5
6.499	Pk	41.6	2.0	43.6	48.0	-4.4
6.552	Pk	39.1	2.1	41.2	48.0	-6.8
8.125	Pk	37.6	2.2	39.8	48.0	-8.2
15.393	Qp	41.1	3.2	44.3	48.0	-3.7
15.393	Av	34.6	3.2	37.8	48.0	-10.2
29.183	Pk	35.9	3.7	39.6	48.0	-8.4

HOT SIDE (Line 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dB)
6.447	Pk	36.0	2.2	38.2	48.0	-9.8
6.447	Pk	36.0	2.2	38.2	48.0	-9.8
6.498	Pk	41.5	2.2	43.7	48.0	-4.3
6.498	Pk	41.5	2.2	43.7	48.0	-4.3
8.123	Pk	36.9	2.4	39.3	48.0	-8.7
9.750	Pk	37.0	2.7	39.7	48.0	-8.3
14.379	Pk	40.0	3.2	43.2	48.0	-4.8
28.572	Pk	32.0	3.9	35.9	48.0	-12.1

PA NEUTRAL SIDE (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dB)
1.914	Pk	36.4	1.2	37.6	48.0	-10.4
1.914	Pk	36.4	1.2	37.6	48.0	-10.4
2.010	Pk	37.1	1.2	38.3	48.0	-9.7
2.108	Pk	36.4	1.2	37.6	48.0	-10.4
15.183	Qp	43.4	3.1	46.5	48.0	-1.5
15.174	Av	38.1	3.1	41.2	48.0	-6.8
17.046	Pk	39.2	3.3	42.5	48.0	-5.5
23.530	Pk	38.9	3.8	42.7	48.0	-5.3



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HOT SIDE (Line 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dB)
1.819	Pk	35.3	1.1	36.4	48.0	-11.6
6.801	Pk	31.1	2.3	33.4	48.0	-14.6
8.813	Pk	30.9	2.5	33.4	48.0	-14.6
15.284	Av	39.5	3.4	42.9	48.0	-5.1
17.078	Pk	40.7	3.6	44.3	48.0	-3.7
22.988	Pk	39.0	4.0	43.0	48.0	-5.0



8 FCC RULES AND REGULATIONS PART 15 §15.109 (A): RADIATED EMISSIONS (CLASS B 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	0	1.0	67.2	-21.4	45.8	49.5	-3.7
129.995	Qp	V	100	1.0	67.9	-15.4	52.5	54.0	-1.5
142.995	Qp	V	0	1.0	63.0	-16.3	46.7	54.0	-7.3
166.995	Qp	V	90	1.0	69.8	-17.2	52.6	54.0	-1.4
208.745	Qp	V	90	1.0	65.6	-17.2	48.4	54.0	-5.6
246.995	Qp	V	270	1.0	69.7	-15.2	54.5	56.9	-2.4
250.495	Qp	V	10	1.0	67.5	-15.1	52.4	56.9	-4.5
272.995	Qp	V	270	1.0	66.3	-14.5	51.8	56.9	-5.1
285.995	Qp	V	270	1.0	67.5	-14.0	53.5	56.9	-3.4
298.995	Qp	V	250	1.0	69.3	-14.0	55.3	56.9	-1.6

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

Using resolution bandwidths to 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)

B_n = 18.4 kHz