Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR FCC CERTIFICATION

LOW POWER TRANSCEIVER AND AMPLIFIER UNIT

Frequency Hoping Spread Spectrum (FHSS) Transceiver

Breezecom Ltd.
Atidim Technological Park, Bldg. #1
Tel Aviv 61131, Israel

MODEL: BreezeNet Pro.11 and AMP2400S
FCC ID: LKTEAP-11AMP

September 8, 2000

This report concerns (check one): Original Grant: X **Class II Change:** **Equipment Type**: **Transceiver and Amplifier Unit**		
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? **If yes, defer until:**	**Yes:**	**No**: X
	______________ ***Date***	
Company name agrees to notify the Commission by: ____________________(date) of the intended date of announcement of the product so that the grant can be issued on that date.		
Transition Rules Request per 15.37? Yes:		**No:** X
If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision..		

REPORT PREPARED BY:

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1 GENERAL INFORMATION

The following Application for FCC Certification of a low power transmitter is prepared on behalf of **BreezeCOM Ltd.** in accordance with Part 15.247 of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the BreezeCOM Ltd. FHSS 2.4GHz-2.48GHz Transceiver and Amplifier Model numbers **BreeezeNet PRO.11** and AMP2400S: The FCC ID for the device is LKTEAP-11AMP. The EUT configuration consisted of a transceiver unit, an amplifier, a DC power injector, three Uni-directional antennas, and one Omni-directional antennas, one twelve volt AC-DC power supply, and one AC-DC power supply including 10 inch and 250 feet low loss cables. 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 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. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech, Labs, Inc. is on the FCC accepted lab list as a Facility available to do measurement work for others on a contract basis.

1.1 RELATED SUBMITTAL(S)/GRANT(S)

N/A

1.2 TEST SYSTEM DETAILS

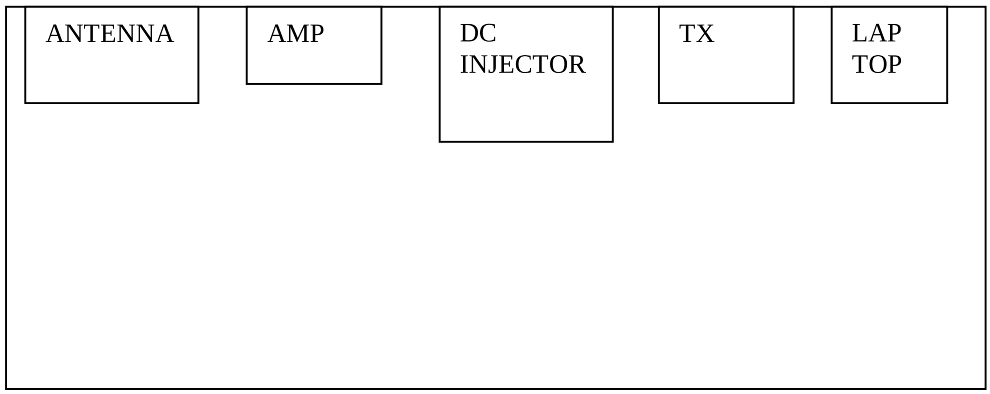
The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

External Components

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
RADIO EUT[1]	BREEZECOM, INC.	AP-10D PRO.11	S2187914	DOC	SHIELDED I/O UNSHIELDED POWER	012204
LAPTOP COMPUTER	AST	ASCENTIA 800N 4/50 CS9	60950	HFSB95P		012216
POWER SUPPLY	AST	ADP-BK	S96121624	N/A	UNSHIELDED POWER	012215
SMARTAMP EUT[2]	TELETRONICS INTERNATIONAL INC.	2400S	26	DOC	SHIELDED I/O UNSHIELDED POWER	012214
DC INJECTOR EUT[3]	TELETRONICS INTERNATIONAL INC.	N/A	N/A	DOC	SHIELDED I/O UNSHIELDED POWER	012213
CABLE	TELETRONICS INTERNATIONAL INC.	10”- LMR -400	COAX	N/A		012210
CABLE	TELETRONICS INTERNATIONAL INC.	38”- LMR-400	CO-AX	N/A		012209
POWER SUPPLY	TELETRONICS INTERNATIONAL INC.	SA-071A2F-1	LR104697	N/A	UNSHIELDED POWER	012208
POWER SUPPLY	SUN POWER	MA15-090	9909-11	N/A	UNSHIELDED POWER	012207
CABLE	TELETRONICS INTERNATIONAL INC.	250' - LMR-400	COAX	N/A		012217
POWER SUPPLY	BREEZECOM, INC.	UWP01021050U	0002	N/A	UNSHIELDED POWER	012205
ANTENNA	BREEZECOM, INC.	QD2415 (16DBI) PANEL	005696	N/A		012192
ANTENNA	BREEZECOM, INC.	T2400 (2400-2500MHZ)	067790	N/A		012203
POWER SUPPLY	BREEZECOM, INC.	UWP01021050U	0008	N/A	UNSHIELDED W/FERRITE AT PS END POWER	012202
POWER SUPPLY	TELETRONICS INTERNATIONAL INC.	SA-071A2F-1	000742	N/A	UNSHIELDED POWER	012200
CABLE	TELETRONICS INTERNATIONAL INC.	INJECTOR TO SMARTAMP	N/A	N/A		012199
ANTENNA	BREEZECOM, INC.	OMNI ANTENNA (8DBI)	MMK1924	N/A		012195
ANTENNA	BREEZECOM, INC.	9 DBI PANEL	N/A	N/A		012194
ANTENNA	BREEZECOM, INC.	DL-2420 (11DBI) PANEL	002653	N/A		012193
POWER SUPPLY	UNIV POWER	SA-121A2F-11	S19750698	N/A	UNSHIELDED POWER	012206

There were two versions of the amplifiers used, a 250mW version and a 500mW version.

1.3 Configuration of Tested System



1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters. Emissions above 1 GHz were video averaged.

1.5 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).

2 SYSTEM TEST CONFIGURATION

2.1 GENERAL PROCEDURES

To complete the test configuration required by the FCC, the transceiver was powered with the supplied AC/DC adapter. Conducted emission was performed on the AC adapter powering the Transceiver as well as the AC power supply providing power to the DC power injector. The DC power injector supplies power to the amplifier. There was no change in the conducted emission profile when the EUT's channels 2, 41, and 80 were enabled in conjunction with all the various antenna configuration presented in this report. The worst case configuration is presented in this report. The EUT was also tested in all three orthogonal planes in order to determine worst case radiated emission. Three channels were investigated: lower channel, middle channel, and upper channel. All channels were properly investigated and the appropriate worst case results are presented in this report. For conducted emission the emission profile was investigated and tested for all three channels, all three modulating modes (8FSK, 4FSK, 2 FSK), and the four antenna configurations. The results were the same for all channels and antenna configuration. Worst case final conducted emission data is presented for both the DC power injector and the transceiver unit in the data tables. For antenna conducted spurious noise and radiated noise all three modulating modes were investigated, it was determined that the worst-case emission profiles occurred when the EUT was enabled in the 8FSK-modulating mode.

2.2 EUT EXERCISE SOFTWARE

The EUT was enabled to continuously transmit data in the 8FSK-modulating mode that produced the worst case profiles for most of the individual tests. Except for specific tests i.e. occupied bandwidth measurement, that requires enabling the 2FSK and 4FSK modulating modes in-order to determine the worst case profile. This data was verified by a receiving unit during testing. The carrier was also checked to verify that the information was being transmitted.

2.3 SPECIAL ACCESSORIES

N/A

2.4 15.203 Professional Installation in support of the Use of standard N Type connectors

The EUT is intended to be used for point to point professional installations. It will not be marketed to the general public, but to Breezecom approved dealers familiar with these types of devices. The EUT will be professionally installed by Breezecom trained professional installers, hence the use of standard N type connectors. See Users manual.

2.5 15.247(a)(1) EUT Channel Utilization Test

The EUT channel utilization was checked per section 15.247(a)(1) of the Commission's Rules and Regulations. The Spectrum analyzer was set as follows: RBW = 100 kHz, VBW = 300 kHz, sweet time = 10 ms, and the Spectrum analyzers Max hold mode enabled. The EUT was investigated between 2.4 GHz and 2.48 GHz. The 500mW configuration was the only configuration used for this measurement since the results are frequency/time base dependent and not amplitude dependent. The 250 mW EUT configuration was investigated and found to produces the same result as the 500 mW configuration. The EUT channel utilization plots can be found in section 4 of this report.

1. Carrier frequency separation = 997 KHz
2. number of hopping channels = 79
3. Receiver input bandwidth is 1MHz - The receiver is always and continuously synchronized to the transmitter. If a packet is retransmitted it will use the frequency that is currently based on the hopping sequence and dwell time that is constant and never changes.
4. Pseudorandom ordered list of hopping channels. See attached list

2.5.1 15.247 (a)(1)(ii) Channel Occupancy

The EUT uses 79 hopping channels with each channel 1 MHz wide selected from a pseudo randomly ordered list. On the average, each channel is used equally. The number of frequency hopping channels was verified by counting the number of channel frequency by setting the channel 41 at 2.441GHz to 0 span. See plot in section 4.

2.5.2 EUT Average Time of Channel Occupancy and Dwell Time

The EUT average occupancy time and dwell time was checked for compliance. The customer provided a theoretical sequence analysis that can be found in Appendix A from which the parameters were used to check the EUT. The selected channel frequency for dwell time measurement was 2.402 GHz with the 8FSK modulating mode. The EUT was found to be in compliance. See plots in section 4.

2.5.3 HOPPING DWELL TIME

The EUT hopping dwell time as provided by the manufacturer is 20 ms of which 88.65% is used for transmission (17.73msec) and the rest is guard time. The dwell time was verified to be 21.0 ms (see dwell time plot). The total transmission time at 79 hopping frequencies per the manufacturers specification is 0.02 X 79 = 1.58 sec. Each frequency used within 30sec period is 30÷1.58 = 18.98 times. The average time of occupancy on any frequency within 30 sec period is 0.02 X 18.98 = 0.38 sec (less than 0.4 sec). The number of hopping frequency was verified at 18 (see plots). Therefore the average occupancy time = 0.38 sec was determined by multiplying the verified dwell time at 21.0 ms and the verified number of hopping frequency 18.0. The dwell time was measured by setting the Spectrum analyzer to 0 span, RSW/VID = 100 kHz/1MHz. The analyzer was set to 30 sec sweep time for average occupancy time. See section plots.

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3 TEST RESULTS

3.1 15.247(A)(1)(II) OCCUPIED BANDWIDTH

The minimum 20dB bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. With the EUT transmitting antenna removed, the antenna port was connected directly to the spectrum analyzer. The EUT was operated in continuous transmitting mode with the hopping function disable. The measurements were performed at three channels low, middle, and high. These channels correspond to LO = 2.402 GHz, Middle = 2.441 GHz, and High = 2.480 GHz with three the types of available modulations 2 FSK (1Mbits/sec), 4FSK (2 Mbits/sec), 8FSK (3 Mbits/sec). See section 4 for 20dB bandwidth plots. The occupied bandwidth measurements were performed on 2 configuration of the EUT; namely 250 mW and 500 mW configurations. The 250 mW version was thoroughly measured. The 500 mW configuration was investigated and the maximum and minimum occupied bandwidths for the worst case channels recorded. The minimum 20 dB occupied bandwidth for each channel on each EUT configuration was found less than one MHz.

3.1.1 20DB OCCUPIED BANDWIDTH 250 MW

Frequency GHz	Modulation	20 dB Occupied bandwidth (kHz)
2.402	2FSk	810
2.402	4FSK	860
2.402	8FSK	880
2.441	2FSk	880
2.441	4FSK	870
2.441	8FSK	890
2.480	2FSk	870
2.480	4FSK	850
2.480	8FSK	900

3.1.2 20DB OCCUPIED BANDWIDTH 500MW

Frequency GHz	Modulation	20 dB Occupied bandwidth (kHz)
2.402	2FSk	809
2.402	8FSK	881
2.480	2FSk	872
2.408	8FSK	901

TEST PERSONNEL:

Signature: ________________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

3.2 15.247 (B)(1) Power Output

The power output per FCC 15.247(b) for a FHSS device must be no more than 1 watt. The power was measured on both EUT configurations using an RF peak power meter HP model number HP437. The EUT was configured for the maximum modulation rate at 8FSK. The Peak power was measured at three frequencies 2.402 GHz, 2.441 GHz, and 2.480 GHz. The EUT was configured based on the diagram below. The output power was measured with the 10 inches low loss coaxial cable that will be shipped with the system.

3.2.1 EUT OUTPUT POWER LEVEL TABLE

		AMP OUTPUT 10 INCH LOW LOSS COAX CABLE		AMP OUTPUT 250 FEET LOW LOSS COAX CABLE	
Channel	Frequency (GHz)	250mW Version (dBm)	500mW Version (dBm)	250mW Version (dBm)	500mW Version (dBm
2	2.402	21.9	25.8	23.0	25.7
41	2.441	22.9	26.3	23.0	25.7
80	2.480	23.2	26.5	23.0	25.8

Note: The 10 inch low loss coaxial cable and channel 80 represent the worst case (maximum possible output power) condition. This is the minimum cable length that will be shipped and professionally installed with the system. The output power was obtained using an HP437 power meter.

3.2.2 15.247 (B)(3) AND (B)(3)(I) PERMISSIBLE OUTPUT POWER CALCULATIONS (DEFACTO EIRP LIMIT)

The output power on the EUT was corrected per section 15.247 (b) (3) ii for antennas with greater than 6 dBi isotropic gain using the table below. The EUT type to be used with the various antenna configurations is listed in the table above.

UNI-DIRECTIONAL ANTENNAS VS EUT AMP POWER OUTPUT SETTING									
Antenna Type	Gain (dBi)	Corrected EIRP 10 inch cable/Amp (dBm)	FCC Limit (dBm)	10 inch Cable/Amp Output power (dBm)	250 feet Cable/Amp Output power (dBm)	EUT version (mW)	10 inch cable-Amp	250 feet cable-Amp	Point to Point/ Point to Multi Point
UNI Grid -24	24	29.2	30	23.2	23.0	250	O.K.	O.K.	Point to Point
UNI Patch -16	16	26.5	30	23.2	23.0	250	O.K.	O.K.	Point to Point
UNI Patch -16	16	29.8	30	26.5	25.8	500	O.K.	O.K.	Point to Point
UNI Patch -11	11	24.9	30	23.2	23.0	250	O.K.	O.K.	Point to Point
UNI Patch -11	11	28.2	30	26.5	25.8	500	O.K.	O.K.	Point to Point
UNI Patch -9	9	24.2	30	23.2	23.0	250	O.K.	O.K.	Point to Point
UNI Patch -9	9	27.5	30	26.5	25.8	500	O.K.	O.K.	Point to Point
OMNI-8	8	31.2	36	23.2	23.0	250	O.K.	O.K.	Point to Multi Point
OMNI-8	8	34.5	36	26.5	25.8	500	O.K.	O.K.	Point to Multi Point

Note: O.K. = EUT configuration to be used with the appropriate cable length.
Cable Type for 250 feet and 10 inch : LMR400 (From Times Microwave),
Cable loss per unit length = 6.7 dB/100ft

3.3 15.247 (f) Hybrid system

The EUT is not a hybrid system**.**

3.4 15.247(g) Hopping channels during each transmission

Each sequence uses 79 channels in a cyclic way. The hopping timers/counters are always running regardless of actual transmission taking place. The receiver is always synchronized with the transmitter. When a packet is re-transmitted it will use the frequency that the current based on the hopping sequence and the dwell time that is constant and never changes.

3.5 15.247(h) Avoidance of other FHSS systems

The EUT cannot coordinate its hopping sequence with other FHHH devices. Each basic service set BSS is independent and has no way to coordinate its hopping sequences with other BSS's. the Access point (AP) is using one and only one predefined sequence and all other stations that are synchronized to this AP will use the same sequences. The other transmitters in the same air space will not influence or change the hopping sequence used. When interference is present the radio will back-off until the end of the interference but the hopping timers are still running at the background.

3.6 Antenna Conducted Spurious Emissions

Antenna spurious emission per FCC 15.247(c) was measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carriers were identified at 2.402GHz, 2,441GHz, and 2.48GHz. All harmonics or spurs found within 20 dB of the carrier level, and from 30 MHz to the carrier 10^{th} harmonic. See antenna conducted spurious noise plots.

3.7 15.247(c) Radiated Spurious Emissions

Radiated spurious emissions apply to harmonics and spurious emissions that fall in the restricted bands and outside the restricted band. The restricted band is listed in Section 15.205. The out of restricted band radiated spurious must meet the peak output power level of each channel less 20 dB. The restricted bands must meet the maximum permitted average field strength listed in Section 15.209. The EUT spurious radiation in the non-restricted bands is less than 20dB of the peak output power. Please, refer to section 5.0 for data test results.

3.8 COMPLIANCE WITH THE BAND EDGES

Compliance with the band edges was performed using the FCC's "Radiated Measurement at a Band Edge" guidance document. The final data derived below were from radiated measurements only. The data taken in this report represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance. The worst case antennas with the highest gain were used namely, the Grid, Patch, and omni antennas.

3.9 DELTA VALUE TABLE

Band Edge measurements (10 inch cable; 8FSK)		
24 dBi Grid antenna, 250mW amp		
	Peak	Delta
Lower Band Edge	107.7	67.7
Upper Band Edge	106	72.4
8dBi Omni, 500mW amp		
	Peak	Delta
Lower Band Edge	104.6	68.1
Upper Band Edge	102.2	70.6
16dBi patch, 500mW amp		
	Peak	Delta
Lower Band Edge	105.3	71
Upper Band Edge	102.1	73.9

3.10 BANDEDGE DATA

BANDEDGE MEASUREMENT						
Antenna Type/Frequency	**Radiated Level (dBµV)**	**Site Correction Factor**	**Corrected Level (dBµV)**	**Delta Value (dBµV)**	**BANDEDGE Emissions Level(dBµV)**	**FCC Limit(dBµV)**
Omni Antenna Channel 2						
2402.006	103.2	0.0	103.2	-68.1	35.1	54
Omni Antenna Channel 80						
2480.000	102.9	0.5	103.4	-70.6	32.8	54
Patch Antenna Channel 2						
2402.006	104.1	0.0	104.1	-71.0	33.1	54
Patch Antenna Channel 80						
2480.000	108.6	0.5	109.1	-73.9	35.2	54
Grid Antenna Channel 2						
2402.006	116.2	0.0	116.2	-67.6	48.6	54
Grid Antenna Channel 80						
2480.000	118.1	0.5	118.6	-72.0	46.6	54

TEST PERSONNEL:

Signature: ________________ **Date:** June 24, 2000

Typed/Printed Name: Daniel Baltzell

3.11 DUTY CYCLE CALCULATION

The average factor calculation is given in table below: The specification was supplied by the manufacturer.

Dwell time		**20 msec**
Average packet length		**500 byte**
Average Tx duration		**2.12 msec**
Tx duration at 100 msec	**= average Tx duration x (100 / dwell time)**	**10.6 msec**
Duty cycle	**= 10.6 msec / 100 msec**	**0.106**
Averaging factor	**= 20 x $\log_{10}$ (calculated duty cycle)**	**-19.49 dB**

3.12 RF EXPOSUE CALCULATION

From FCC 1.1310 table 1A, the maximum permissible RF exposure for an uncontrolled environment is 1mW/cm$^{2.}$ The Electric field generated for a 1mW/cm^2 exposure (S) is calculated as follows:

$S = E^2/Z$

where:
S = Power density
E = Electric field
Z = Impedance.

3.12.1 $E = \sqrt{S \times Z}$

1mW/cm^2= 10 W/m^2

The impedance of free space is 337 ohms, where E and H fields are perpendicular.

Thus:

$E = \sqrt{10 \times 377}$ = 61.4 V/m which is equivalent to 1mW/cm^2

Using the relationship between Electric field E, Power in watts P, and distance in meters d, the corresponding Antenna numeric gain G and the transmitter output power and solving for d,

$$d = \sqrt{\frac{P_{eak} \times 30 \times G}{E}}$$

1. The Numeric gain G of antenna with a gain specified in dB is determined by:

$G = \mathrm{Log}^{-1}$ (dB gain/10)

$G = \mathrm{Log}^{-1}$ 2.15 = 1.64

The table below identifies the distances where the 1mW/cm^2 exposure limits may be exceeded during continuous transmission using the proposed fixed antennas

Antenna Type	Gain (dBi)	Numeric gain	Channel	Amp defacto Peak output Power (mW)	Calculated Distance (m)	Minimum RF Exposure Separation Distance (m)
Uni Grid 24	24	251.2	80	208.9	0.65	2
Uni Patch 16	16	39.8	80	446.7	0.38	2
Uni Patch 16	16	39.8	80	208.9	0.26	2
Uni Patch 11	11	12.6	80	446.7	0.21	2
Uni Patch 11	11	12.6	80	208.9	0.14	2
Uni Patch 9	9	7.9	80	446.7	0.17	2
Uni Patch 9	9	7.9	80	208.9	0.11	2
Omni 8	8	6.3	80	446.7	0.15	2
Omni 8	8	6.3	80	208.9	0.10	2

WARNING: It is the responsibility of the professional installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only these antenna configurations shown in the table in section 1.4 are used. The use of any antenna other than those listed is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

Notice in Installation Manual:

FCC Radiation Exposure Statement

i) This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment when installed as directed. This equipment should be installed and operated with fix-mounted antennas that are installed with a minimum of 2 meters of separation distance between the antenna and all persons body during normal operation and the antennas as shown below:

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3.13 EUT AS A DIGITAL INTERFACE DEVICE

MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency MHz	Ant. Pol.	Radiated Emissions dB (µV/m)	Spec. Limit dB (µV/m)	Spec. Margin dB	Pass/ Fail
39.085	V	33.97	40.0	6.03	Pass
109.007	V	36.07	43.5	7.43	Pass
249.997	H	30.74	46.0	15.26	Pass
598.288	H	39.83	46.0	6.17	Pass
997.146	V	45.69	54.0	8.31	Pass

2.10 CONFORMANCE STATEMENT

I, 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 during testing to the equipment in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Signature: ______________________________ Date: September 7, 2000

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

NVLAP *Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.*

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

4 FIELD STRENGTH CALCULATION, CONDUCTED AND RADIATED TEST METHODOLOGY

4.1 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.

4.2 CONDUCTED WORST CASE PROFILE RATIONALE

Conducted emission was measured on the AC/DC adaptor providing power to the transceiver unit and the DC Power Injector for both the 500 and 250 mW amplifiers. Channels 2, 41 and 80 were investigated in conjunction with the Uni-24, Uni-16, Uni-11, and the Omni-9 directional antennas. The conducted emission profile did not change based on the type of antenna used. The other channels 2 and 80 were investigated and found to be in compliance. The worst case conducted data is presented in this report for the transceiver and power injector units at channel 80.

4.3 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

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

4.4 RADIATED MEASUREMENT

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one meter and three meter distances if necessary 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. The spectrum was examined from 9 kHz to 10GHz MHz (10^{th} harmonic of carrier frequency) using a Hewlett Packard 8566B spectrum analyzer, a Hewlett Packard 85650A quasi-peak adapter, HP11790 mixers, and EMCO log periodic, EMCO horn antennas and biconical antenna. In order to gain sensitivity, a cougar preamplifier (from 30 to 2GHZ), and an HP preamplifier (from 1GHz to 26.5 GHz) was connected in series between the antenna and the input of the spectrum analyzer.

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. The spectrum analyzer's 6 dB resolution bandwidth was set to 120 kHz for measurements below 1GHz, and 1MHz for measurements above 1GHz. The analyzer was operated in peak detection mode below 1GHz and in the peak mode with 10Hz video averaging above 1 GHz. No video filter less than 10 times the resolution bandwidth was used when measuring below 1GHz. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

4.5 RADIATED WORST CASE PROFILE RATIONALE

Radiated emission profile was investigated and measured with the transceiver unit set at channel 2, 41, and 80 using the following: Uni-24, Uni-16, Uni-11, Uni-9, and Omni-8 directional antennas. All antennas and amplifier versions namely 250 and 500 mW were thoroughly investigated from 9kHz to the 10^{th} harmonic fundamental within and out of the restricted band. The worst case radiated data is presented in section 5.0 of this report.

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 daily calibration methods, technician training, and emphasis to employees on avoiding error.

5 CONDUCTED EMISSION DATA

Pk = Peak; QP = Quasi-Peak; Av = Average

5.1 Conducted Emissions: (TRANSCEIVER AND 250MW AMP UNIT)

5.1.1 HOT SIDE (LINE 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dBuV)
0.540	Pk	30.8	0.7	31.5	48.0	-16.5
1.810	Pk	28.8	1.2	30.0	48.0	-18.0
3.260	Pk	27.6	1.5	29.1	48.0	-18.9
9.610	Pk	23.7	2.4	26.1	48.0	-21.9
10.970	Pk	23.8	2.5	26.3	48.0	-21.7
19.600	Pk	20.5	3.3	23.8	48.0	-24.2
27.990	Pk	20.1	3.5	23.6	48.0	-24.4

5.1.2 NEUTRAL SIDE (LINE 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dBuV)
0.450	Pk	32.2	0.8	33.0	48.0	-15.0
1.690	Pk	30.4	1.3	31.7	48.0	-16.3
1.930	Pk	32.6	1.4	34.0	48.0	-14.0
11.710	Pk	27.9	2.6	30.5	48.0	-17.5
14.160	Pk	23.0	2.8	25.8	48.0	-22.2
26.840	Pk	19.1	3.5	22.6	48.0	-25.4

Uni-24 Antenna at Channel 80

TEST PERSONNEL:

Signature: Daniel W. Baltzell   **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

5.2 Conducted Emissions: **(DC Power Injector and 250mW Amp Unit)**

5.2.1 HOT SIDE (LINE 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dBuV)	Pass/ Fail
0.450	Pk	41.3	0.7	42.0	48.0	-6.0	Pass
1.179	Pk	45.5	1.0	45.5	48.0	-2.5	Pass
1.179	Pk	45.5	1.0	45.5	48.0	-2.5	Pass
1.336	Av	40.9	1.0	41.9	48.0	-6.1	Pass
1.336	Qp	46.8	1.0	45.8	48.0	-2.2	Pass
1.483	Av	41.8	1.1	42.9	48.0	-5.1	Pass
1.626	Pk	45.9	1.1	46.0	48.0	-2.0	Pass
1.756	Pk	41.8	1.2	43.0	48.0	-5.0	Pass
12.060	Pk	26.6	2.7	29.3	48.0	-18.7	Pass
27.870	Pk	26.1	3.5	29.6	48.0	-18.4	Pass

5.2.2 NEUTRAL SIDE (LINE 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC Limit (dBuV)	FCC Margin (dBuV)	Pass/ Fail
0.450	Pk	34.7	0.8	35.5	48.0	-12.5	Pass
1.347	Pk	43.8	1.1	44.9	48.0	-3.1	Pass
1.446	Av	43.0	1.2	44.2	48.0	-3.8	Pass
1.477	Pk	43.3	1.2	44.5	48.0	-3.5	Pass
1.636	Pk	42.4	1.3	43.7	48.0	-4.3	Pass
1.781	Pk	38.5	1.3	39.8	48.0	-8.2	Pass
22.640	Pk	22.4	3.4	25.8	48.0	-22.2	Pass

[1]Pk = Peak; QP = Quasi-Peak; Av = Average

Uni-24 Antenna at Channel 80

TEST PERSONNEL:

Signature: Daniel W. Baltzell ________________ **D**ate: 6/24/2000

Typed/Printed Name: Daniel Baltzell

6 RADIATED TEST DATA

6.1 CHANNEL 2; GRID ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Avg. Factor	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1791.362	Pk	V	350	1.4	54.5	4.9	-19.5	39.9	116.2	-76.3
2362.450	Pk	V	355	1.2	46.8	-0.3	-19.5	27.0	74.0	-47.0
2402.006	Pk	V	355	1.2	116.2	0.0		116.2		
2442.450	Pk	V	355	1.2	52.1	0.3	-19.5	32.9	116.2	-83.3
2602.020	Pk	V	355	1.2	55.7	1.2	-19.5	37.4	116.2	-78.8
4804.000	NF	V								
7206.000	NF	V								
9608.000	NF	V								
12010.000	NF	V								
14412.000	NF	V								
16814.000	NF	V								
19216.000	NF	V								
21618.000	NF	V								
24020.000	NF	V								

6.2 CHANNEL 41; GRID ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Avg. Factor	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1850.360	Pk	V	350	1.4	54.2	6.5	-19.5	41.2	118.8	-77.6
2400.913	Pk	V	350	1.2	56.3	0.0	-19.5	36.8	118.8	-82.0
2441.000	Pk	V	350	1.2	118.5	0.3		118.8		
2481.000	Pk	V	350	1.2	56.5	0.5	-19.5	37.5	74.0	-36.5
4882.000	Pk	V	350	1.1	34.2	18.7	-19.5	33.4	74.0	-40.6
7323.000	Pk	V	350	1.1	46.5	18.6	-19.5	45.6	74.0	-28.4
9764.000	NF	V								
12205.000	NF	V								
14646.000	NF	V								
17087.000	NF	V								
19528.000	NF	V								
21969.000	NF	V								
24410.000	NF	V								

TEST PERSONNEL:

Signature: ________________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.3 CHANNEL 80; GRID ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
1909.402	Pk	V	350	1.4	40.6	8.2	-19.5	29.3	118.9	-89.6
2319.700	Pk	V	350	1.2	57.3	-0.6	-19.5	37.2	74.0	-36.8
2361.000	Pk	V	350	1.2	54.0	-0.3	-19.5	34.2	74.0	-39.8
2480.000	Pk	V	350	1.2	118.4	0.5		118.9		
4960.000	Pk	V	350	1.4	44.1	19.3	-19.5	43.9	74.0	-30.1
7440.000	Pk	V	350	1.1	46.3	18.9	-19.5	45.7	74.0	-28.3
9920.000	NF	V								
12400.000	NF	V								
14880.000	NF	V								
17360.000	NF	V								
19840.000	NF	V								
22320.000	NF	V								
24800.000	NF	V								

6.4 CHANNEL 2; PATCH ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2360.680	Pk	V	350	1.2	43.9	-0.3	-19.5	24.1	111.0	-86.9
2402.000	Pk	V	350	1.2	111.0	0.0		111.0		111.0
2443.715	Pk	V	350	1.1	42.5	0.3	-19.5	23.3	111.0	-87.7
2601.580	Pk	V	350	1.2	52.9	1.2	-19.5	34.6	111.0	-76.4
4804.000	NF	V								
7206.000	NF	V								
9608.000	NF	V								
12010.000	NF	V								
14412.000	NF	V								
16814.000	NF	V								
19216.000	NF	V								
21618.000	NF	V								
24020.000	NF	V								

TEST PERSONNEL:

Signature: ______________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.5 CHANNEL 41 PATCH ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2399.400	Pk	V	350	1.2	47.6	0.0	-19.5	28.1	114.2	-86.1
2441.140	Pk	V	350	1.2	113.9	0.3		114.2		
2479.980	Pk	V	350	1.2	50.9	0.5	-19.5	31.9	114.2	-82.3
4882.000	NF	V								
7323.000	NF	V								
9764.000	NF	V								
12205.000	NF	V								
14646.000	NF	V								
17087.000	NF	V								
19528.000	NF	V								
21969.000	NF	V								
24410.000	NF	V								

6.6 CHANNEL 80; PATCH ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2320.377	Pk	V	350	1.1	49.8	-0.6	-19.5	29.7	74.0	-44.3
2360.160	Pk	V	350	1.1	42.1	-0.3	-19.5	22.3	74.0	-51.7
2480.079	Pk	V	350	1.1	115.4	0.5		115.9		
4960.000	NF	V								
7440.000	NF	V								
9920.000	NF	V								
12400.000	NF	V								
14880.000	NF	V								
17360.000	NF	V								
19840.000	NF	V								
22320.000	NF	V								
24800.000	NF	V								

TEST PERSONNEL:

Signature: Daniel W. Baltzell **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.7 CHANNEL 2; OMNI ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2402.110	Pk	V	90	1.4	104.5	0		104.5		
2602.000	Pk	V	260	1.8	43.6	1.2	-19.5	25.3	104.5	-79.2
4804.000	NF	V								
7206.000	NF	V								
9608.000	NF	V								
12010.000	NF	V								
14412.000	NF	V								
16814.000	NF	V								
19216.000	NF	V								
21618.000	NF	V								
24020.000	NF	V								

6.8 CHANNEL 41; OMNI ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2401.150	Pk	V	230	1.4	43.6	0.0	-19.5	24.1	109.9	-85.8
2441.110	Pk	V	230	1.4	109.6	0.3		109.9		
2480.650	Pk	V	300	1.4	41.8	0.5	-19.5	22.8	109.9	-87.1
4882.000	NF	V								
7323.000	NF	V								
9764.000	NF	V								
12205.000	NF	V								
14646.000	NF	V								
17087.000	NF	V								
19528.000	NF	V								
21969.000	NF	V								
24410.000	NF	V								

TEST PERSONNEL:

Signature: ______________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.9 CHANNEL 80; OMNI ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Avg. Factor	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2320.000	Pk	V	90	1.3	46.9	-0.6	-19.5	26.8	74.0	-47.2
2360.044	Pk	V	90	1.3	41.8	-0.3	-19.5	22.0	74.0	-52.0
2480.084	Pk	V	90	1.3	109.5	0.5		110.0		
4960.000	NF	V								
7440.000	NF	V								
9920.000	NF	V								
12400.000	NF	V								
14880.000	NF	V								
17360.000	NF	V								
19840.000	NF	V								
22320.000	NF	V								
24800.000	NF	V								

6.10 CHANNEL 2; GRID ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Avg. Factor	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1791.362	Av	V	350	1.4	49.6	4.9	-19.5	35.0	96.2	-61.2
2362.450	Av	V	355	1.2	33.0	-0.3	-19.5	13.2	54.0	-40.8
2402.006	Av	V	350	1.2	116.2	0.0		116.2		
2442.450	Av	V	355	1.0	41.2	0.3	-19.5	22.0	96.2	-74.2
2602.020	Av	V	355	1.2	53.3	1.2	-19.5	35.0	96.2	-61.2
4804.000	NF	V								
7206.000	NF	V								
9608.000	NF	V								
12010.000	NF	V								
14412.000	NF	V								
16814.000	NF	V								
19216.000	NF	V								
21618.000	NF	V								
24020.000	NF	V								

TEST PERSONNEL:

Signature: _______________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.11 CHANNEL 41; GRID ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
1850.360	Av	V	350	1.4	48.7	6.5	-19.5	35.7	98.5	-62.8
2400.913	Av	V	350	1.2	44.1	0.0	-19.5	24.6	98.5	-73.9
2441.000	Av	V	350	1.2	118.2	0.3		118.5		
2481.000	Av	V	350	1.2	45.3	0.5	-19.5	26.3	98.5	-72.2
4882.000	Av	V	0	1.0	31.0	18.7	-19.5	30.2	54.0	-23.8
7323.000	Av	V	350	1.1	36.2	18.6	-19.5	35.3	54.0	-18.7
9764.000	NF	V								
12205.000	NF	V								
14646.000	NF	V								
17087.000	NF	V								
19528.000	NF	V								
21969.000	NF	V								
24410.000	NF	V								

6.12 CHANNEL 80; GRID ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
1909.402	Av	V	350	1.4	29.2	8.2	-19.5	17.9	98.6	-80.7
2319.700	Av	V	350	1.2	52.1	-0.6	-19.5	32.0	54.0	-22.0
2361.000	Av	V	350	1.2	42	-0.3	-19.5	22.2	54.0	-31.8
2480.000	Av	V	350	1.2	118.1	0.5		118.6		
4960.000	Av	V	350	1.4	33.6	19.3	-19.5	33.4	54.0	-20.6
7440.000	Av	V	350	1.1	37..3	18.9	-19.5	36.7	54.0	-17.3
9920.000	NF	V								
12400.000	NF	V								
14880.000	NF	V								
17360.000	NF	V								
19840.000	NF	V								
22320.000	NF	V								
24800.000	NF	V								

TEST PERSONNEL:

Signature: ________________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

6.13 CHANNEL 2; PATCH ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Avg. Factor	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
84.002	Qp	V	90	1.0	48.3	-21.3	-19.5	7.5	84.1	-76.6
2360.680	Av	V	350	1.1	30.6	-0.3	-19.5	10.8	54.0	-43.2
2402.000	Av	V	350	1.2	104.1	0.0		104.1		
2443.715	Av	V	350	1.1	29.5	0.3	-19.5	10.3	84.1	-73.8
2601.580	Av	V	350	1.2	45.4	1.2	-19.5	27.1	84.1	-57.0
4804.000	NF	V								
7206.000	NF	V								
9608.000	NF	V								
12010.000	NF	V								
14412.000	NF	V								
16814.000	NF	V								
19216.000	NF	V								
21618.000	NF	V								
24020.000	NF	V								

6.14 CHANNEL 41 PATCH ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Avg. Factor	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1850.360	Av	V	0	1.0	26.2	6.5	-19.5	13.2	87.0	-73.8
2399.400	Av	V	350	1.2	35.2	0.0	-19.5	15.7	87.0	-71.3
2441.140	Av	V	350	1.2	106.7	0.3		107.0		
2479.980	Av	V	350	1.2	36.6	0.5	-19.5	17.6	87.0	-69.4
4882.000	NF	V								
7323.000	NF	V								
9764.000	NF	V								
12205.000	NF	V								
14646.000	NF	V								
17087.000	NF	V								
19528.000	NF	V								
21969.000	NF	V								
24410.000	NF	V								

TEST PERSONNEL:

Signature: ________________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.15 CHANNEL 80; PATCH ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
1909.402	Av	V	0	1.0	26.1	8.2	-19.5	14.8	89.1	-74.3
2320.377	Av	V	350	1.1	37.5	-0.6	-19.5	17.4	54.0	-36.6
2360.160	Av	V	350	1.1	29.7	-0.3	-19.5	9.9	54.0	-44.1
2480.079	Av	V	350	1.1	108.6	0.5		109.1		
4960.000	NF	V								
7440.000	NF	V								
9920.000	NF	V								
12400.000	NF	V								
14880.000	NF	V								
17360.000	NF	V								
19840.000	NF	V								
22320.000	NF	V								
24800.000	NF	V								

6.16 CHANNEL 2; OMNI ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2402.110	Av	V	90	1.4	103.2	0.0		103.2		
2602.000	Av	V	269	1.8	31.2	1.2	-19.5	-18.3	83.2	-101.5
4804.000	NF	V								
7206.000	NF	V								
9608.000	NF	V								
12010.000	NF	V								
14412.000	NF	V								
16814.000	NF	V								
19216.000	NF	V								
21618.000	NF	V								
24020.000	NF	V								

TEST PERSONNEL:

Signature: ________________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell

6.17 CHANNEL 41; OMNI ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2401.150	Av	V	230	1.4	29.6	0.0	-19.5	10.1	83.4	-73.3
2441.110	Av	V	230	1.2	103.1	0.3		103.4		
2480.650	Av	V	230	1.4	30.0	0.5	-19.5	11.0	83.4	-72.4
4882.000	NF	V								
7323.000	NF	V								
9764.000	NF	V								
12205.000	NF	V								
14646.000	NF	V								
17087.000	NF	V								
19528.000	NF	V								
21969.000	NF	V								
24410.000	NF	V								

6.18 CHANNEL 80; OMNI ANTENNA

Temperature: 67°F Humidity: 80%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (deg)**	**Antenna Height (m)**	**Analyzer Reading (dBuV/m)**	**Site Correction Factor (dB/m)**	**Avg. Factor**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**
2320.000	Av	V	90	1.3	34.1	-0.6	-19.5	14.0	54.0	-40.0
2360.044	Av	V	90	1.3	28.4	-0.3	-19.5	8.6	54.0	-45.4
2480.084	Av	V	90	1.3	102.9	0.5		103.4		
4960.000	NF	V								
7440.000	NF	V								
9920.000	NF	V								
12400.000	NF	V								
14880.000	NF	V								
17360.000	NF	V								
19840.000	NF	V								
22320.000	NF	V								
24800.000	NF	V								

TEST PERSONNEL:

Signature: _______________ **Date:** 6/24/2000

Typed/Printed Name: Daniel Baltzell