# APPLICATION FOR FCC CLASS II PERMISSIVE CHANGE

*for*

# A LOW POWER PART 15 TRANSMITTER

**Backgrounds Unlimited, Inc.**
**Old Town Hall Road**
**P.O. Box 327**
**Mt. Sidney, VA 24467**
**540-248-0355**

## Model: FWV-TXBD-01A

## FCC ID: NH5FWVTXBD01A

***March 11, 1999***

| | |
|---|---|
| **This report concerns (check one): Original Grant: Class II Change:** X<br>**Equipment Type**: **Transmitter Module** | |
| **Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? Yes: No**: X<br>**If yes, defer until:** _____<br>***Date***<br><br>**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<br>**If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision..** | |

**REPORT PREPARED BY:**

**EMI Technician: Daniel W. Baltzell**
**Administrative Writer: Dixie L. Shetter**

**Rhein Tech Laboratories, Inc.**

*Document Number: 990129*
*Reference Number: QRTL99-048*

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# 1.0 GENERAL INFORMATION

The following Application for FCC Certification of a Class II Permissive Change for a transmitter module is prepared on behalf of Backgrounds Unlimited, Inc. in accordance with Part 15.247 of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the Backgrounds Unlimited, Inc., FWV-TXBD-01A Transmitter Module, FCC ID: NH5FWVTXBD01A. 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 PRODUCT DESCRIPTION

The EUT was developed from the commercially available printed circuit board (PCB). Twelve-volt (12v) power from an AC adapter or Battery Pack is brought to the PCB via solder pads. A 470 MFD electrolytic capacitor and a 0.1 MFD capacitor provide power supply filtering at the PCB. The inputted 12v then is regulated to 8 volts by LM7808 voltage regulator. The 8-volt power is filtered via a 2200 MFD electrolytic capacitor and a 0.1-capacitor and feeds pin 9 of the transmitter module. The transmitter module contains a 10-pin header, which are soldered to the PCB. Although there are only 10 header pins exiting the transmitter module they are aligned for a 12-pin footprint. Pin 12 is attached to the ground plane, NTSC video from the CCD camera is hardwired to pin 8, and if audio is utilized it is hard wired to pin 11. The transmitter module's antenna pad is left intact and utilized in the applications.

## 1.2 RELATED SUBMITTAL(S)/GRANT(S)

The original grant is dated November 4, 1997.

### 1.2.1 CLASS II PERMISSIVE CHANGES

Class II Permissive change is applied for the following reasons:

A new power supply printed circuit board with filtering including a microphone amplifier was designed to replace the existing power supply board. No other modifications were made.

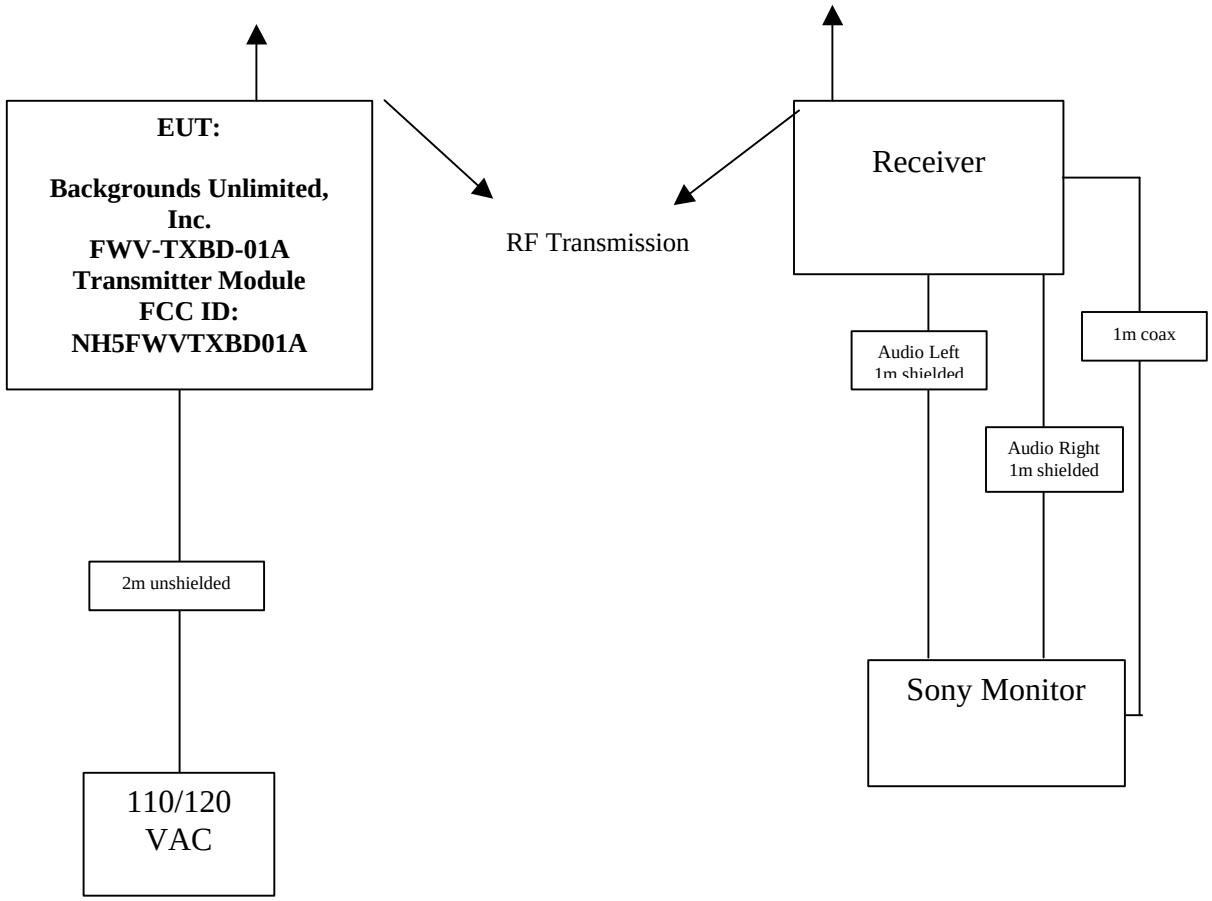
## 1.3 TEST SYSTEM DETAILS

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 |
|---|---|---|---|---|---|---|
| **TRANSMITTER MODULE (EUT)** | **BACKGROUNDS UNLIMITED, INC.** | **FWV-TXBD-01A** | **12A6** | **NH5FWVTXBD01A** | **UNSHIELDED POWER** | **7138** |
| TELEVISION | SONY CORPORATION | PVM-1354Q | 2019597 | N/A | SHIELDED I/O, UNSHIELDED POWER | 900470 |
| RECEIVER | RF-LINK TECHNOLOGY, INC. | WAVECOM FR101J | 7B052J | N/A | SHIELDED I/O, UNSHIELDED POWER, SHIELDED COAXIAL CABLE | 7140 |

## 1.4 CONFIGURATION OF TESTED SYSTEM



## 1.5 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.

## 1.6 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).

# 2.0 PRODUCT LABELING

## FIGURE 1: FCC ID LABEL

The information only exists in the original grant (FCC ID: NH5FWVTSBD01A) dated November 4, 1997.

## FIGURE 2: LOCATION OF LABEL ON EUT

Information exists on file with original grant.

# 3.0 SYSTEM TEST CONFIGURATION

## 3.1 JUSTIFICATION

To complete the test configuration required by the FCC, the transmitter was connected to an AC/DC Power supply. No other peripherals were attached to the device since the EUT is a complete video transmitter with built-in camera and microphone. A monitoring receiver was used outside the test range to monitor the EUT.

## 3.2 EUT EXERCISE SOFTWARE

The transmitter was powered on so that it was continuously transmitting video of the surrounding background. A receiver connected to an NTSC monitor was used to monitor the transmitted video from inside the building. The system was tested in all three orthogonal planes. Worst case emissions are recorded in the data tables.

## 3.3 SPECIAL ACCESSORIES

The interface cable on the Backgrounds Unlimited, Inc. transmitter was an unshielded power cable

## 3.4 MODULATED BANDWIDTH

Presented in Appendix E is the worst-case modulated channel plot. The frequency band edges were also investigated for compliance. All other channels investigated were investigated and found to be in compliance.

## 3.5 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 modification 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: March 25, 1999

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

*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.**

# 5.0 Conducted Field Strength Calculation, and Radiated Test Methodology

## 5.1 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

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

## 5.2 Radiated measurement

Before final measurements of radiated emissions were made on the open-field three 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 24GHz ($10^{th}$ 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.

*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.*

## 6.0 CONDUCTED EMISSION DATA

The following table lists worst case conducted emission date. Specifically: Emission Frequency, Test Detector, Analyzer Reading, Site Correction Factor, corrected Emission Level, Quasi Peak Limit and Margin, and the Average Limit and Margin.

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 450 kHz to 30 MHz on the NEUTRAL SIDE and HOT SIDE, herein referred to as L1 and L2, respectively.

**TABLE 1: CONDUCTED EMISSIONS (CHANNEL 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) |
|---|---|---|---|---|---|---|
| 0.452 | Pk | 42.3 | 0.5 | 42.8 | 48.0 | -5.2 |
| 1.000 | Pk | 26.9 | 0.7 | 27.6 | 48.0 | -20.4 |
| 2.000 | Pk | 16.1 | 1.0 | 17.1 | 48.0 | -30.9 |
| 7.488 | Pk | 18.8 | 1.9 | 20.7 | 48.0 | -27.3 |
| 8.076 | Pk | 19.0 | 1.9 | 20.9 | 48.0 | -27.1 |
| 15.314 | Pk | 17.9 | 2.9 | 20.8 | 48.0 | -27.2 |

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) |
|---|---|---|---|---|---|---|
| 0.457 | Pk | 36.0 | 0.4 | 36.4 | 48.0 | -11.6 |
| 0.501 | Pk | 33.7 | 0.4 | 34.1 | 48.0 | -13.9 |
| 1.064 | Pk | 20.0 | 0.6 | 20.6 | 48.0 | -27.4 |
| 3.092 | Pk | 17.9 | 1.1 | 19.0 | 48.0 | -29.0 |
| 18.687 | Pk | 18.9 | 3.1 | 22.0 | 48.0 | -26.0 |
| 27.651 | Pk | 18.1 | 3.4 | 21.5 | 48.0 | -26.5 |

**(1)Pk = Peak; QP = Quasi-Peak; Av = Average**

**TEST PERSONNEL:**

**Typed/Printed Name**: Daniel W. Baltzell **Date:** March 9, 1999

**Signature:**

## 6.1 Conducted Measurement Photos

## 7.0 RADIATED EMISSION DATA

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit. Explanation of the Correction Factor is given in paragraph 6.3.

**TABLE 1: RADIATED EMISSIONS (CHANNEL 2)**

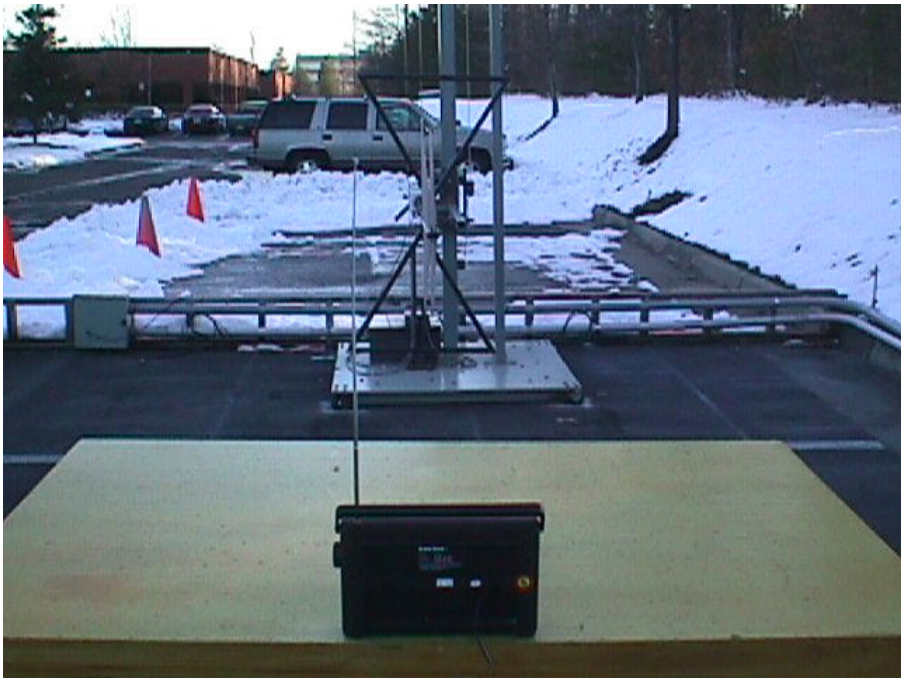
| EMISSION FREQUENCY (MHz) | ANTENNA POLARITY (H/V) | ANALYZER READING (dBuV) | SITE CORRECTION FACTOR (dB/m) | EMISSION LEVEL (dBuV/m) | FCC LIMIT (dBuV/m) | FCC MARGIN (dBuV/m) |
|---|---|---|---|---|---|---|
| 2.4330 | V | 93.0 | -0.4 | 92.6 | 94.0 | -1.4 |
| 4.8676 | H | 71.2 | -3.5 | 50.8 | 54.0 | -3.2 |
| 7.30106 | H | 62.3 | -0.8 | 49.5 | 54.0 | -4.5 |
| 12.168597 | H | 40.6 | 4.9 | 45.5 | 54.0 | -8.5 |
| 19.469722 | V | 37.7 | 15.2 | 42.9 | 54.0 | -11.1 |

**TEST PERSONNEL:**

Typed/Printed Name: Daniel W. Baltzell Date: March 11, 1999

Signature:

## 7.1 Radiated Measurement Photos



# APPENDIX A: Emissions Equipment List

| DESCRIPTION | MANUFACTURER | MODEL NUMBER | SERIAL NUMBER | CAL. LAB |
|---|---|---|---|---|
| AMPLIFIER | HEWLETT PACKARD | 11975A | 2304A00348 | TEST EQUITY |
| AMPLIFIER (S/A 1) | RHEIN TECH | PR-1040 | 00001 | RTL |
| AMPLIFIER (S/A 2) | RHEIN TECH | RTL2 | 900723 | RTL |
| AMPLIFIER (S/A 3) | RHEIN TECH | 8447F | 2944A03783 | RTL |
| AMPLIFIER (S/A 4) | RHEIN TECH | 8447D | 2727A05397 | RTL |
| BICONICAL/LOG ANTENNA 1 | ANTENNA RESEARCH | LPB-2520 | 1037 | LIBERTY LABS |
| BICONICAL/LOG ANTENNA 2 | ANTENNA RESEARCH | LPB-2520 | 1036 | LIBERTY LABS |
| FIELD SITE SOURCE | EMCO | 4610 | 9604-1313 | RTL |
| FILTER (ROOM 1) | SOLAR | 8130 | 947305 | RTL |
| FILTER (ROOM 2) | SOLAR | 8130 | 947306 | RTL |
| HARMONIC MIXER 1 | HEWLETT PACKARD | 11970K | 2332A00563 | TELOGY |
| HARMONIC MIXER 2 | HEWLETT PACKARD | 11970A | 2332A01199 | TELOGY |
| HORN ANTENNA 1 | EMCO | 3160-10 | 9606-1033 | EMCO |
| HORN ANTENNA 2 | EMCO | 3160-9 | 9605-1051 | EMCO |
| HORN ANTENNA 3 | EMCO | 3160-7 | 9605-1054 | EMCO |
| HORN ANTENNA 4 | EMCO | 3160-8 | 9605-1044 | EMCO |
| HORN ANTENNA 5 | EMCO | 3160-03 | 9508-1024 | EMCO |
| LISN (ROOM 1/L1) | SOLAR | 7225-1 | 900727 | ACUCAL |
| LISN (ROOM 1/L2) | SOLAR | 7225-1 | 900726 | ACUCAL |
| LISN (ROOM 2/L1) | SOLAR | 7225-1 | 900078 | ACUCAL |
| LISN (ROOM 2/L2) | SOLAR | 7225-1 | 900077 | ACUCAL |
| PRE-AMPLIFIER | HEWLETT PACKARD | 8449B OPT | 3008A00505 | TELOGY |
| QUASI-PEAK ADAPTER (S/A 1) | HEWLETT PACKARD | 85650A | 3145A01599 | ACUCAL |
| QUASI-PEAK ADAPTER (S/A 2) | HEWLETT PACKARD | 85650A | 2811A01276 | ACUCAL |
| QUASI-PEAK ADAPTER (S/A 3) | HEWLETT PACKARD | 85650A | 2521A00473 | ACUCAL |
| QUASI-PEAK ADAPTER (S/A 4) | HEWLETT PACKARD | 85650A | 2521A01032 | ACUCAL |
| RF PRESELECTOR (S/A 1) | HEWLETT PACKARD | 85685A | 3146A01309 | ACUCAL |
| SIGNAL GENERATOR (HP) | HEWLETT PACKARD | 8660C | 1947A02956 | ACUCAL |
| SIGNAL GENERATOR (WAVETEK) | WAVETEK | 3510B | 4952044 | ACUCAL |
| SPECTRUM ANALYZER 1 | HEWLETT PACKARD | 8566B | 3138A07771 | ACUCAL |
| SPECTRUM ANALYZER 2 | HEWLETT PACKARD | 8567A | 2841A00614 | ACUCAL |
| SPECTRUM ANALYZER 4 | HEWLETT PACKARD | 8567A | 2727A00535 | ACUCAL |
| TUNABLE DIPOLE | EMCO | 3121 | 274 | LIBERTY LABS |
| ANTENNA | ATM | WR08 | 08443-6 | ATM |
| MIXER | OLESON | M08HW | F80814-1 | OLESON |
| MIXER | OLESON | M05HW | G80814-1 | OLESON |
| DIPLEXER | OLESON | M05HW | G80814-1 | OLESON |
| MIXER | HEWLETT PACKARD | 11970U | 2332A01110 | ACUCAL |
| MIXER | HEWLETT PACKARD | 11970V | 2521A00512 | TELOGY |
| MIXER | HEWLETT PACKARD | 11970W | 2521A00710 | TELOGY |
| ANTENNA | ATM | WR15 | 15-443-6 | ATM |
| ANTENNA | ATM | WR10 | 10-443-6 | ATM |
| ANTENNA | ATM | WR05 | 05-443-6 | ATM |
| SWEEP GENERATOR | HEWLETT PACKARD | 83752A | 3610A00866 | HEWLETT PACKARD |

Calibration Certification available upon request.

# 8.0 PHOTOS OF TESTED EUT

**Figure 3: Transmitter Module, Front, External**

**Figure 4: Transmitter Module, Back, External**

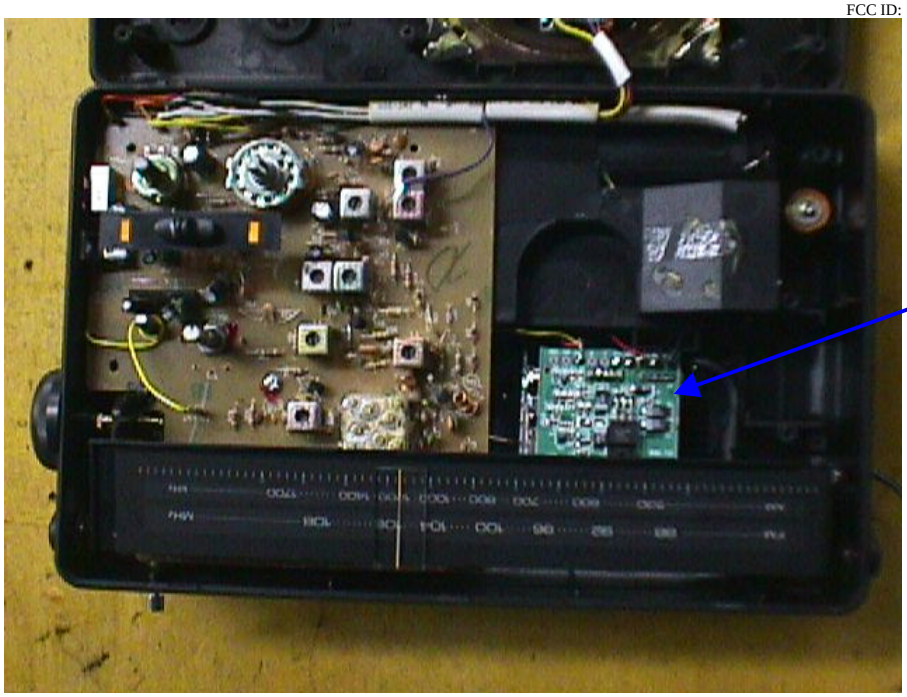



**Figure 5: Transmitter, Front, Facing Removed, Internal**

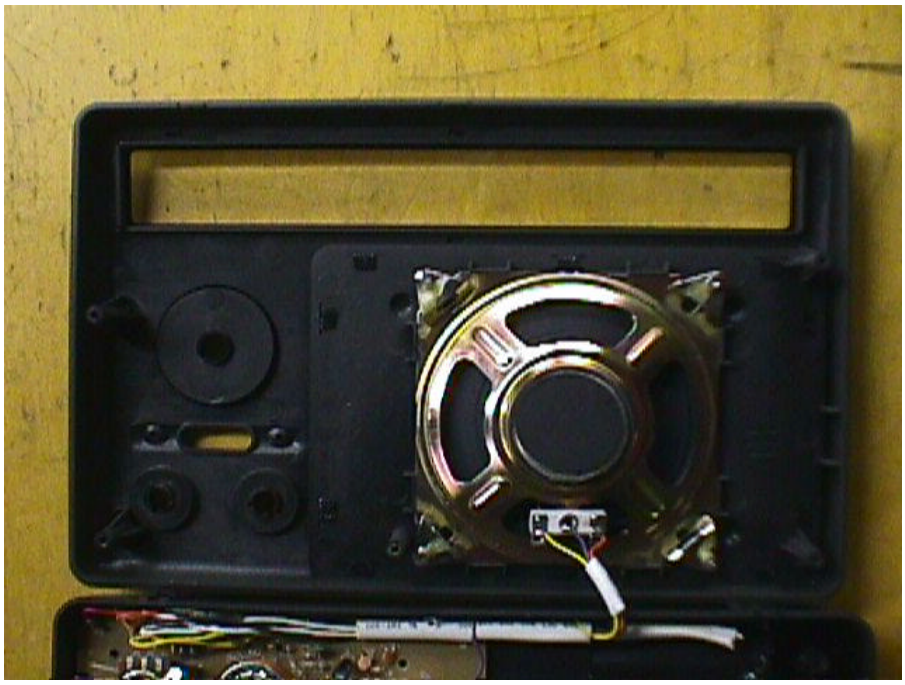


**Figure 6: Transmitter, Front, Facing Removed, Internal with Speaker**

# APPENDIX B:

# USER'S MANUAL

***The User's Manual can be found in the original grant (FCC ID: NH5FWVTXBD01A) dated November 4, 1997.***

# APPENDIX C:

# PCB BOARD CHANGE

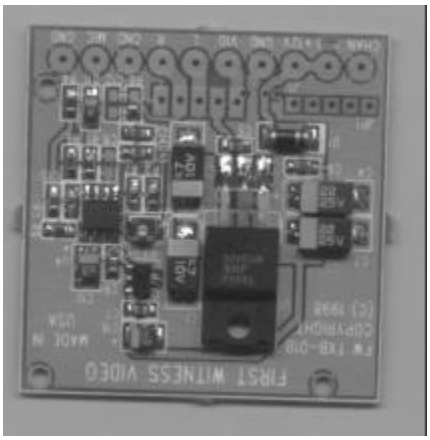



**Figure 7: Power/Amp PCB Board, Component Side**

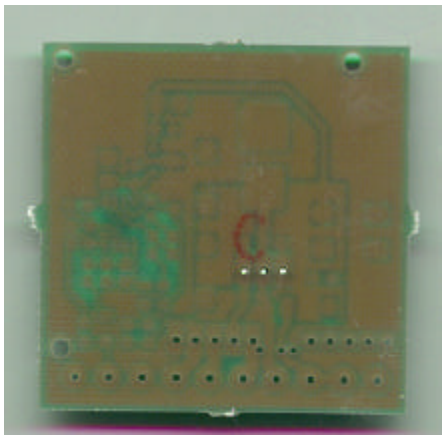
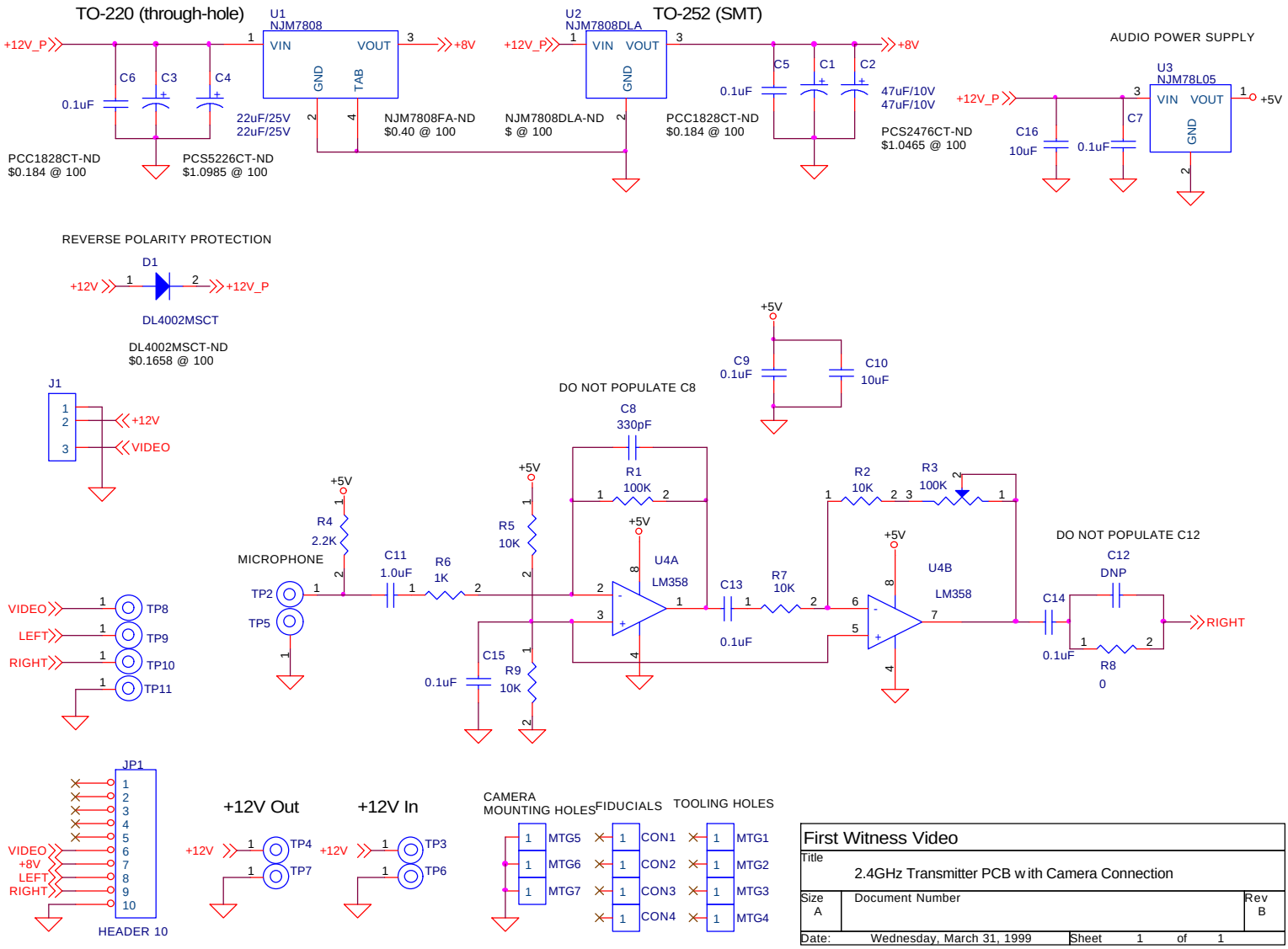


**Figure 8: Power/Amp PCB Board, Solder Side**

# APPENDIX D:

# SCHEMATIC




| | | | |
|---|---|---|---|
| First Witness Video | | | |
| Title | 2.4GHz Transmitter PCB w ith Camera Connection | | |
| Size A | Document Number | | Rev B |
| Date: Wednesday, March 31, 1999 | Sheet 1 of 1 | | |

# APPENDIX E:

# PLOTS

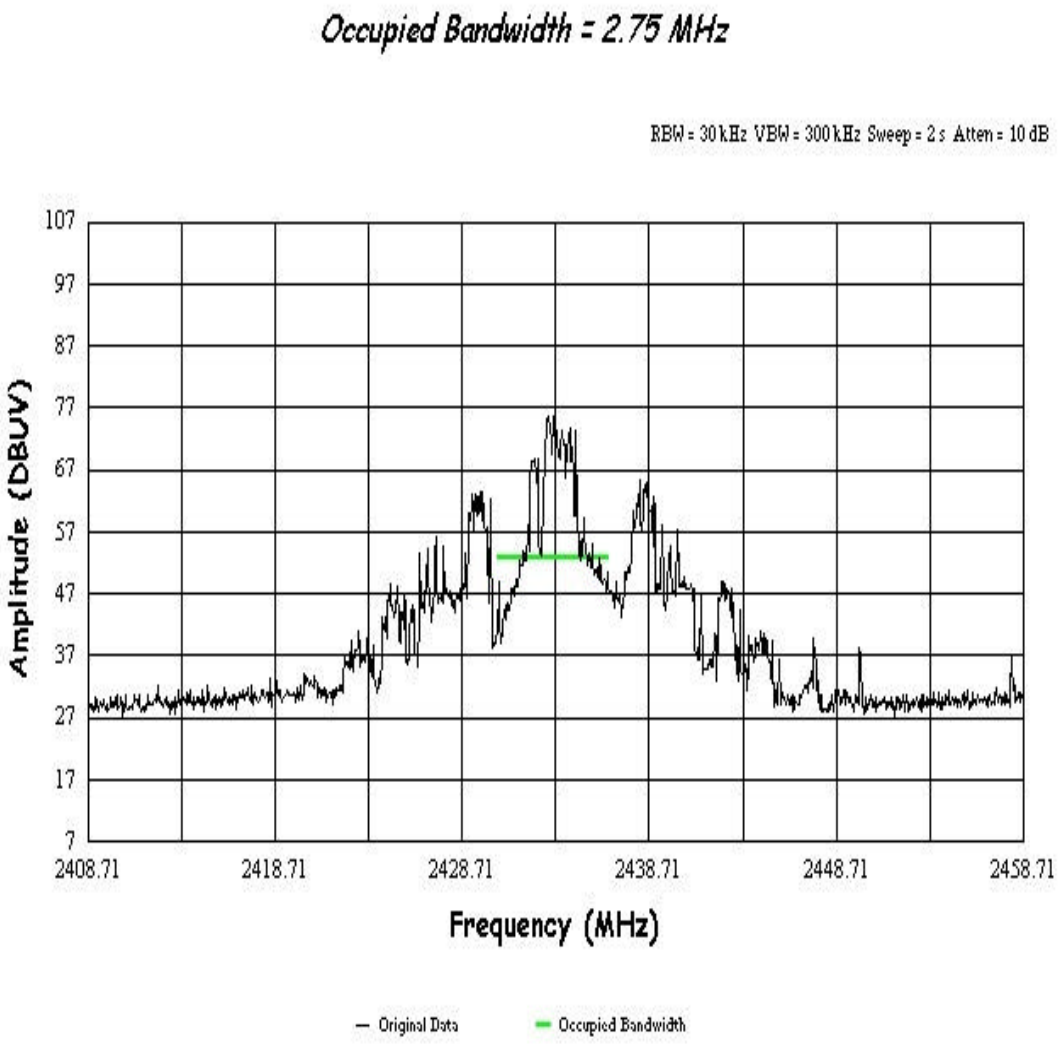



**Figure 9: Occupied Bandwidth Plot – Channel 2 – 2.433GHz**