

DRAFT

V T X 2 K W - A INSTRUCTION MANUAL

SN: _____

PINEAPPLE TECHNOLOGY, INC.



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I — SAFETY NOTICES

****READ THIS SECTION BEFORE INSTALLATION****

SEVERE ELECTRICAL SHOCK OR BURNS MAY OCCUR IF
THIS EQUIPMENT IS USED IMPROPERLY.

~~~~~

NEVER WORK ON THIS EQUIPMENT ALONE. ALWAYS HAVE ANOTHER PERSON PRESENT  
WHILE WORKING ON ELECTRICAL CIRCUITS OR MOVING EQUIPMENT. COMMUNICATIONS  
TO EMERGENCY SERVICES SHOULD BE AVAILABLE AT ALL TIMES.

~~~~~

BEFORE CONNECTING THIS EQUIPMENT TO ANY AC ELECTRICAL SOURCE READ THE SEC-
TION ON INSTALLATION. ALL ELECTRICAL WIRING FOR THIS EQUIPMENT MUST BE PER-
FORMED BY QUALIFIED ELECTRICIANS. ALL WIRING MUST BE COMPLIANT WITH LOCAL
ELECTRICAL CODES.

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POWER AMPLIFIERS AND SUPPLIES ARE HEAVY. TO INSTALL THIS EQUIPMENT IN RACKS,  
USE TWO (2) PERSONS TO AVOID POSSIBLE INJURIES.

~~~~~

NEVER OPEN THE CABINET ENCLOSURE OR UNPLUG CABLES OR WIRES WHILE THIS
EQUIPMENT IS OPERATING.

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ALL SERVICE WORK MUST BE PERFORMED BY QUALIFIED TECHNICIANS ONLY.  
IF ONE IS NOT AVAILABLE LOCALLY, CONTACT PINEAPPLE TECHNOLOGY, INC. FOR  
A LIST IN YOUR AREA.



## **II — VTX2KWA SPECIFICATIONS**

### **OPERATING**

|                                 |                                |
|---------------------------------|--------------------------------|
| Power Output .....              | 2 KW Peak Sync                 |
| Aural Power.....                | 200 Watts                      |
| RF Output Impedance.....        | 50 ohms                        |
| Operating Frequency Range ..... | Channel 7 thru 13 NTSC         |
| Frequency Stability.....        | 1 PPM or better                |
| Harmonic and Spurious .....     | -60 dB or better ref to P-sync |
| Power Consumption .....         | 8 KW Maximum                   |
| AC Line Voltage .....           | 208-240 V AC SINGLE PHASE      |

### **VIDEO PERFORMANCE**

|                                   |                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------|
| Visual Frequency Response.....    | +/- 1 dB across the TV Channel -1.25 MHz to 4.75 MHz<br>relative to visual carrier. |
| Differential Gain.....            | <7 %                                                                                |
| Differential Phase .....          | <10 Degrees                                                                         |
| ICPM .....                        | <5 Degrees                                                                          |
| Low Frequency Linearity .....     | <15 %                                                                               |
| 2T K Factor.....                  | 3 %                                                                                 |
| Group Delay .....                 | Meets FCC Part 73 rule                                                              |
| Video Input Impedance.....        | 75 ohms                                                                             |
| Video Input Level.....            | 1 volt p-p                                                                          |
| Variation of output power .....   | <5 %                                                                                |
| Regulation of output power .....  | <5 % Typical                                                                        |
| Video Signal to Noise Ratio ..... | < 45 dB un-weighted                                                                 |

THESE SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE



**AUDIO PERFORMANCE**

|                            |                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------|
| Audio Response.....        | Meets FCC Pre-emphasis Curves                                                                                          |
| Distortion.....            | <1 % THD                                                                                                               |
| FM Noise.....              | 50 dB or better                                                                                                        |
| AM Noise.....              | 40 dB or better                                                                                                        |
| AM Synchronous Noise.....  | 40 dB typical                                                                                                          |
| Operating Temperature..... | -10 to +35 degrees Celsius Ambient                                                                                     |
| Altitude.....              | 5000 feet without additional cooling                                                                                   |
| Cooling requirements.....  | Unobstructed Air flow of 2000 CFM<br>Minimum required at sea level with ambient<br>temperature of < 37 degrees Celsius |
| RF Output connectors.....  | 7/8 EIA Flange                                                                                                         |
| Weight.....                | 700 pounds est.                                                                                                        |
| Dimensions.....            | 80" X 22" X 24" (H x W x L)                                                                                            |

THESE SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.



### **III — TRANSMITTER INSTALLATION**

To insure long and reliable trouble free service from the VTX2KWA transmitter the following steps for installation are recommended.

1. **MECHANICAL INSTALLATION:** The VTX2KWA was designed to be installed in a building protected from the weather. The building should have a hard surface floor such as concrete with a moisture barrier. This barrier could be pressure treated wood sub-flooring which could be anchored to the concrete and to the transmitter to make the installation earth quake resistant.

Allow a minimum of three feet around the transmitter cabinet for service access. The top of the transmitter should be clear for three feet to allow the air to exhaust from the transmitter.

Air flow thru the transmitter is approximately 2000 CFM. Provisions for air inlet and exhaust from the room must allow air flow with minimal obstruction. In the event that the room temperature exceeds 35 degrees Celsius, cooling air must be provided so that the room temperature will not exceed 35 degrees Celsius under worse case conditions.

Notice: This equipment is HEAVY and must be handled by professional movers with proper equipment. Any damage caused by the installers is not covered under warranty. Check to insure that installing crews have proper insurance coverage.

2. **GROUNDING:** Transmitter grounding is VERY IMPORTANT and must be done correctly for safety and operational reasons. A typical installation may be done as follows:

Use a heavy gauge wire such as #2 AWG stranded copper or solid copper buss 1 inch wide by 1/8 inch thick for connections. The bonding between the transmitter and the ground rods must be good quality and protected from corrosion. The ground wires should run over the floor and connected to the ground rods located outside the building. The wire should not go thru the concrete floor but over and around it.

3. **AC WIRING:** A ten foot cable has been provided with the transmitter to facilitate the connection to the AC Main power source. Connections to the AC Main should be made as follows:

RED and BLACK are connected to the 208-240 VAC SINGLE PHASE terminals

WHITE WIRE is connected to the NEUTRAL terminal

GREEN WIRE is connected to the SAFETY GROUND

NOTICE: All wiring of this type must be done by A QUALIFIED ELECTRICIAN and must conform to LOCAL and NATIONAL Wiring CODES.

Consult with your electrician to insure that the proper breaker size is selected for the main circuit.

4. **ANTENNA CONNECTION:** The transmitter is equipped with a 7/8 EIA Flange connector located at the top of the rack. Connecting the transmitter to the antenna must be performed by qualified personnel. Conditions vary from site to site so some engineering may be required to insure that the antenna is receiving the correct amount of power to comply with FCC licenses and to insure safety from lighting etc.



## **IV — TRANSMITTER TURN-ON PROCEDURE**

Before applying AC Power to the transmitter for initial turn on and check out, the installation should be approved by a qualified broadcast engineer. The Turn on procedure that follows is recommended by Pineapple Technology, Inc. engineering staff:

1. Check transmitter load or antenna for proper installation and connection to the transmitter.
2. Open the transmitter and inspect all cables and wires for loose connections or broken wires in the rack assembly
3. Check for damage to the equipment mounted in the rack.
4. Check all AC breakers and on/off switches to ensure that all are OFF.
5. TURN ON THE MAIN AC BREAKER LOCATED IN THE SUB-PANEL WHERE THE AC POWER CORD WAS CONNECTED.
6. TURN ON THE MAIN AC BREAKER LOCATED ON THE ACDIS2 POWER DISTRIBUTION PANEL LOCATED ON THE FRONT OF THE TRANSMITTER. A GREEN LIGHT SHOULD COME ON INDICATING POWER IS ON.
7. TURN ON THE AC SWITCH LOCATED ON THE FRONT OF THE ADP500. THE INDICATING LIGHTS SHOULD BE ON AND READY FOR OPERATION
8. TURN ON THE AUX BREAKER LOCATED ON THE ACDIS2 FRONT PANEL. THE PA FANS AND THE RACK EXHAUST FANS SHOULD COME ON.
9. TURN ON THE POWER SUPPLY BREAKERS LOCATED ON THE FRONT OF THE ACDIS2. CHECK THE AC 2008 POWER MODULES (6) EACH TO SEE IF THE GREEN LIGHTS ARE INDICATING NORMAL OPERATION.
10. USING THE ADP500 & PAS10 CHECK THE IDLING CURRENTS ON EACH PA TO ENSURE THAT THE CURRENTS ARE IN THE CORRECT RANGE. TYPICAL RANGE IS 1.5 TO 2.5 AMPS. SEE ADP500 OPERATING SECTION FOR DETAILS

NOTICE: The Modulator/driver has been set at the factory so that the output power indication on the ADP500 will show 100% or 2 KW p-sync power level. It is important to read the instruction manual supplied with the modulator to locate key adjustment devices on the front panel. The output level adjustment will be necessary for the next step in the turn on procedure.

11. Locate the level adjustment on the modulator/driver and turn the level down to minimum or CCW.
12. Turn on the power switch located on the modulator/up-converter rear panel.
13. Apply a video signal (1 volt P-P) to the video input terminal
14. Slowly increase the output level adjustment while watching the RF Output level on the ADP500 until it reads to 50%.



15. Using the ADP500 reflected power indication check the LOAD reflected power. This should be less than 5% reflected.
16. Return to the PA current readings on the ADP500 to verify that all the currents are approximately the same.
17. With successful performance to step 17, the transmitter output power can be increased using the output level adjustment on the modulator to achieve 100%. The aural power can be added at this time not exceeding 10% of output p-sync power as indicated on the ADP500.

## V — THEORY OF OPERATIONS

### **A. INTRODUCTION**

The VTX2KWA transmitter was designed to meet or exceed all FCC applicable specifications for TV Broadcast Equipment. Special attention was given to the selection of sub-assemblies and components to achieve maximum reliability and minimum down time. The construction of the VTX2KWA is BASIC and MODULAR with most components field replaceable. Special emphasis was placed on KEEPING IT SIMPLE and returning to more traditional transmitter layouts and instrumentation.

This transmitter was designed for Analog (NTSC) transmission with provisions and options available to convert to Digital Service when necessary.

Refer to the VTX2KWA block diagram (page 12) for an overview of the transmitter architecture. The key subassemblies are listed below followed by a brief description. This will give the technician basic information needed to understand the operations of the transmitter and the function of each subassembly.

SEE SECTION VI.A FOR PARTS LIST (page 13)

### **B. ACDIS2 AC & DC DISTRIBUTION**

The ACDIS2 is the primary AC power inlet module. The VTX2KWA transmitter was designed to except 208 to 240 V AC SINGLE PHASE using a FOUR (4) wire connection. The four wires are

- 2 wires for 208-240V AC single phase
- 1 wire for neutral connection
- 1 wire for safety ground connection

**CAUTION:** Connection to the AC Primary Source must be made using all four wires listed above. Follow the wiring instruction given in the AC WIRING section III. 3 (page 5). If not followed, severe damage to the transmitter and or electrical shock is possible.

The ACDIS2 performs the following functions:

1. Provides a primary AC power breaker point to shutdown the transmitter.
2. Provides 208 VAC single phase power to each of the 2 KW DC power supplies with individual breaker points for added safety.
3. Provides 110 VAC circuits for Modulator, ADP500, Auxiliary Power Source, and AUX Power where needed.



4. Analog metering is provided to monitor the Power supply voltage and current being applied to the RF Amplifier stages
5. Power supply current sharing test points are provided for checking current sharing between power supply modules.

SEE SECTION VI.B FOR SCHEMATIC AND PARTS LIST (page 14)

### **C. AC2008 2 KW POWER MODULE**

The VTX2KWA transmitter is designed with over 8 KW of DC power available to the transmitter. To achieve this level, the power supply is made up of four RR6000 (PTI P/N AC2008) power module mounted into TWO mainframe assemblies RU2 (PTI P/N AC2009) which are capable of managing three 2 KW modules each.

The power modules are “HOT PLUGGABLE” and can be removed or installed without turning off the transmitter.

Each power supply modules has OVER VOLTAGE, OVER CURRENT, AND OVER TEMPERATURE protection as well as a fault signal in the event of a failure.

REFER TO MANUFACTURER’S MANUAL PROVIDED WITH THE VTX2KWA.

### **D. PAS10 & ADP500 PERFORMANCE MONITOR**

The PAS10 & ADP500 PERFORMANCE MONITOR provides the following functions:

1. Monitors FORWARD AND REFLECTED POWER to the antenna and presents it as a percentage of power rating. The transmitter comes set to 100% P-Sync power based on the ratings of the transmitter.
2. Monitors Aural Power as a percentage of P-Sync rating (10 % typical)
3. Provides a HIGH ANTENNA VSWR MONITOR In the event of an antenna or coax failure where the reflected power exceeds 25% the transmitter will shutdown. Front panel LED with change from green to red in case of a fault.
4. Provides current monitoring of all the pallets used in the six V600LDV2 power amplifier assemblies. The current levels can be read directly from the multi-meter on the front panel. Individual pallets are selectable on the ADP500 and the PA assemblies are selected using the PAS10. In normal operations, a PA FAULT is indicated by going from green to red. RED indicates that the current level is below 500 ma and a transistor could have failed. To read the actual current, select the appropriate PA Bank using the PAS10. The ADP500 will now display status of each pallet in that PA. The multi-meter will read the actual current.
5. A PA INHIBIT switch is provided for failure diagnostic purposes. When activated, this switch allows the technician to monitor the bias currents for each pallet. These readings should be recorded when the transmitter is first installed and used as a reference. This is the best way to trouble shoot possible transistor problems. When in the PA INHIBIT mode, the RF PWR OFF LED will change from green to red indicating that the “SHUTDOWN LINE” Is at a TTL 0 state and the output power has been reduced to near zero.
6. An RF MONITOR port (BNC) is available to connect a spectrum analyzer or other test equipment for monitoring the output signal.



## THE METER SELECTOR SWITCHES

The PAS10 is used to select the appropriate PA Module (V600LDV2) for performance display on the ADP500. PA designations are PA1 starting from the top row going left to right with PA4 being on the right side in the second row down when viewed from the front of the transmitter.

The Rotor Switch on the ADP500 is the detail selector for the multi-meter. The various positions are defined as follows:

|                     |                                                                                                                                                                                                                                                      |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PA1 THRU PA5 .....  | Reads PA pallet currents as selected<br>Typical reading in INHIBIT MODE 1.5 TO 2.2 A<br>Typical reading 5-7 A for PA1-PA4 with normal picture or 50% APL test waveform<br>Typical reading 2-3 A for PA5 with normal picture or 50% APL test waveform |
| PA6 .....           | NO CONNECTION                                                                                                                                                                                                                                        |
| PS VOLTS .....      | Reads DC Voltage applied to PA Stages<br>Typical reading would be +29 to 32 VDC                                                                                                                                                                      |
| P FWRD.....         | Reads PA output power in P-Sync percentage of rating.<br>Full power reading would be 100%                                                                                                                                                            |
| P RFLD .....        | Reads PA output power being returned from the load and displayed as a percentage of forward power.<br>Typical reading would be < 5% indicated.                                                                                                       |
| P AURAL.....        | Reads the AURAL POWER component as a percentage of forward power. Typical reading would be 10%                                                                                                                                                       |
| AUX 1 & AUX 2 ..... | not used in this configuration                                                                                                                                                                                                                       |

REFER TO SECTION VI.H. FOR SCHEMATICS AND PARTS LIST (page 33)

## E. REMOTE MONITOR AND CONTROL WITH ABS

This equipment is OPTIONAL and may be required to ensure remote control operational capability.

The Remote Monitor is used to monitor the operational status of the transmitter and will allow the operator to turn RF on or off and adjust power levels. The following items are monitored or controlled:

1. Transmitter on/off function
2. Power output level monitor and adjustment.
3. AC Line voltage status. With ABS you can be notified if there is a power failure at the site.
4. Various other custom options are available. Specify these at the time the transmitter is purchased and they will be included if possible.

Remote monitoring requires a Phone line connection. Information can be accessed via a PC Terminal or via a 'VOICE COMMAND LINE'. Either option is standard with this system.

The Auxiliary power unit requires a battery connection. A common car battery (12 VDC) can be used with a charger as an ABS. This will run the Monitor and provide access to transmitter status for several hours.



A manual for this equipment is provided by the Manufacture and is included in the VTX2KWA package shipped with the transmitter. This manual is only included if this option was purchased for delivery with the transmitter.

REFER TO INSTRUCTION MANUAL PROVIDED WITH THIS PACKAGE

### **F. MODULATOR**

The heart of any TV Transmitter is the “MODULATOR”. This equipment receives the video and audio signals as well as any control signals needed. The base band signals are converted to RF with an output on the desired operating channel.

Detail operation of the Modulator with schematics and P/L is provided by the equipment manufacture.

REFER TO INSTRUCTION MANUAL PROVIDED WITH THIS PACKAGE

### **G. VS500 4-WAY SPLITTER**

The VS500 4-WAY splitter receives the output of the Modulator/Driver and splits it into 4 parts with phase and power levels equal. This unit is an isolated in-phase splitter and will provide some isolation in the event one PA fails.

### **H. MFA1KW PA MAINFRAME ASSEMBLY**

The MFA1KW is the main RF Power Amplifier housing which accommodates two (2) V600LDV2 Amplifiers. The housing includes the following:

- 2 ea..... 330 CFM cooling fans
- 2 each..... Air filter assemblies
- 2 each..... Front panel status PC Boards
- 1 each..... Main chassis
- 2 each..... Mechanical slide assemblies
- 1 each..... AC Filtered inlet for cooling fans

SEE SECTION VI.C. FOR SCHEMATICS AND PARTS LIST (page 19)



### **I. V600LDV2 POWER AMPLIFIER**

The V600LDV2 is the main RF Power Amplifier Assembly used in the VTX2KWA. Each Amplifier assembly is made up of five (5) VH200LD power pallets. Each power pallet uses two (2) Phillips BLF647 power LDMOS FETs. These amplifiers are operated in Class A/AB or sometimes referred to as “HARD AB”. This refers to the bias levels to achieve best linearity.

Each V600LDV2 amplifier assembly includes the following:

|             |                                     |
|-------------|-------------------------------------|
| 5 each..... | VH200LD power pallets               |
| 1 each..... | 4-way splitter                      |
| 1 each..... | 4-way combiner                      |
| 1 each..... | Pwr distribution module (1A0025)    |
| 2 each..... | thermal sensors                     |
| 1 each..... | remote monitor port (DB9)           |
| 1 each..... | front panel status port (Molex)     |
| 1 each..... | filtered DC input port              |
| 1 each..... | Type N panel mounted RF Input port  |
| 1 each..... | Type N Panel mounted RF Output port |

SEE SECTION VI.D. FOR SCHEMATICS AND PARTS LIST (page 21)

### **J. VC2KW-4 POWER COMBINER WITH COUPLER**

The VC2KW-4 is a 4-way in-phase combiner with built in 40 dB dual directional coupler.

This assembly has no user servicable parts.

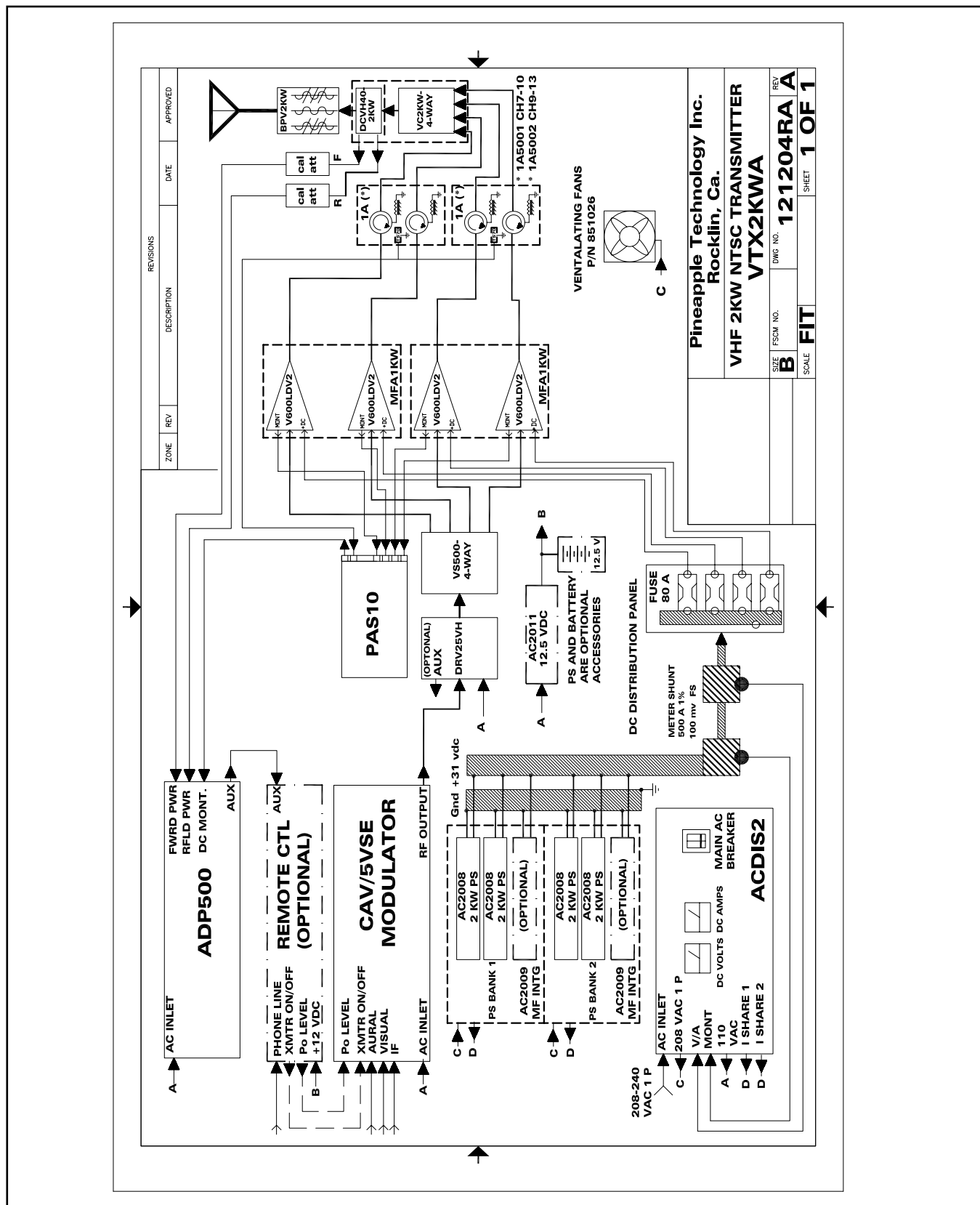
### **K. BPV2KW VHF BAND PASS FILTER**

This Band Pass filter was designed to meet FCC Certification requirements with minimum loss of RF Power. The BPV2KW comes tuned and tested to the operating frequency of the transmitter and should not be adjusted without proper equipment. Replacement filters are available as P/N BPV2KW VHF (+CHANNEL NUMBER).

This assembly has no user servicable parts.

## VI — SCHEMATICS AND PARTS LIST

### A. VTX2KW-A





## VI — SCHEMATICS AND PARTS LIST

### A. VTX2KW-A — Parts List

#### AssyTreeVTX2KWA

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#### VTX2KWA

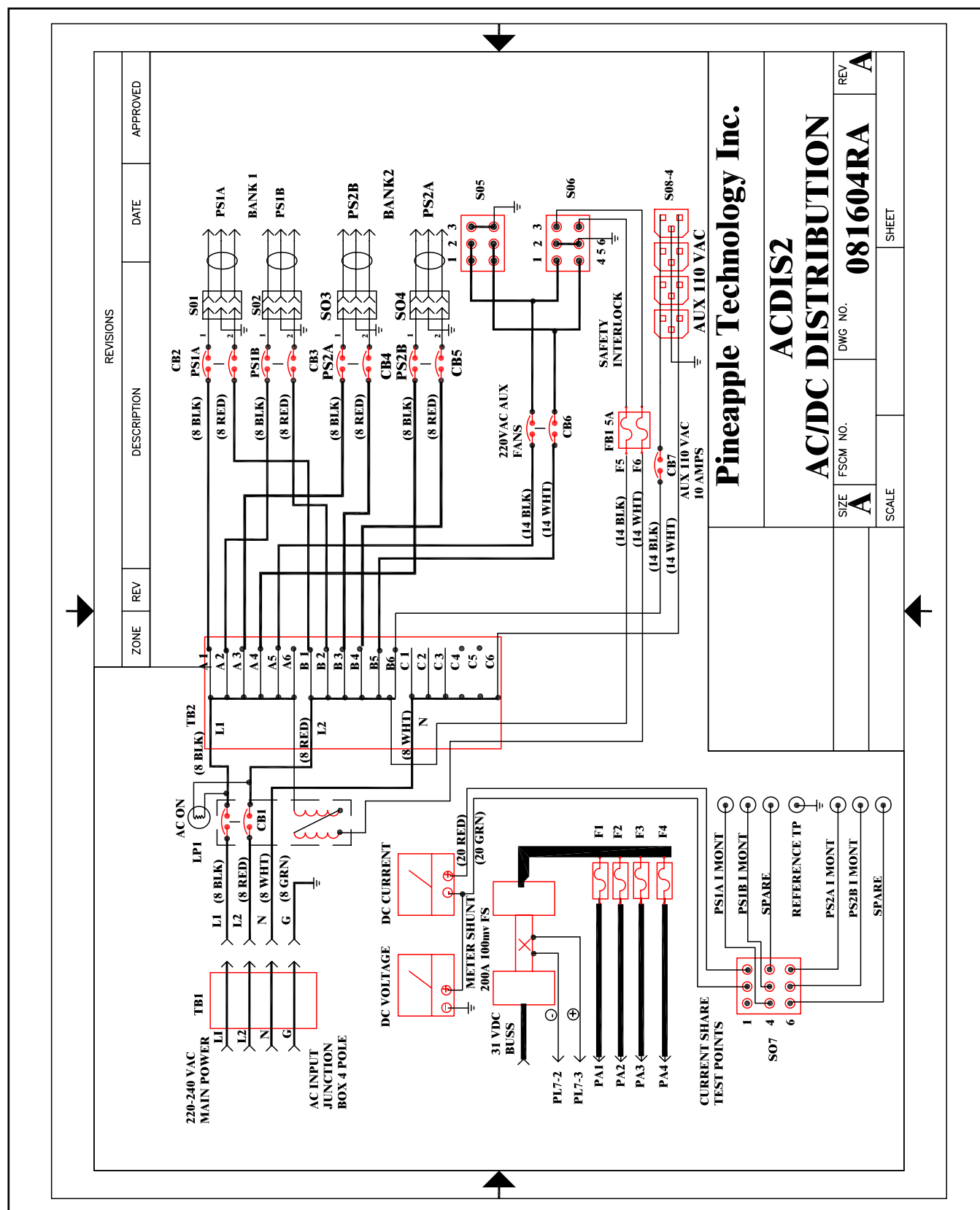
VHF HB TV TRANSMITTER 2 KW  
ANALOG TRANSMITTER

|          |            |       |
|----------|------------|-------|
| Type     | CAT        | User1 |
| Revision | A          | User2 |
| Status   | U          | User3 |
| Date     | 12/12/2004 | User4 |
| By       | RA         | User5 |

| Item | Qty | P/N      | Title                         | Detail                         |
|------|-----|----------|-------------------------------|--------------------------------|
| Top  |     | VTX2KWA  | VHF HB TV TRANSMITTER 2 KW    | ANALOG TRANSMITTER             |
| 1    | 1   | ACDIS2   | AC & DC DISTRIBUTION          | UTX2KWA TRANSMITTERS           |
| 2    | 1   | CAV/5VSE | MODULATOR                     | 5 WATT VHF                     |
| 3    | 4   | VH600LD  | VHF HB 600W LDMOS PA          | 5 EA VH200LD MODULES           |
| 4    | 2   | MFA1KW   | 1 KW MAIN FRAME               | UHF/VHF ASSEMBLIES             |
| 5    | 1   | ADP500   | DISPLAY PANEL, ANALOG         | SEL SW AND METER               |
| 6    | 1   | PAS10    | PA SEL SW FOR ADP500          | 10 POLE INPUT 1 OUTPUT         |
| 7    | 1   | VS500-4  | VHF HB 4-WAY N CON            | ISO 100 W DIGITAL/ANALOG       |
| 8    | 1   | VC2KWH-4 | VHF HB 2 KW COMBINER          | 4-WAY WITH DC BUILTIN          |
| 10   | 4   | AC2008   | 2 KW 31 VDC PWR SUPPLY        | UNI-PWR TRS6000-406            |
| 11   | 2   | AC2009   | 6KW 3EA PWR SUPPLY MAIN FRAME | UNIPOWER RRS2U                 |
| 12   | 2   | 1A5001   | ISOPATE VHF HB1 175-200 MHz   | INC ISOLATORS, TERM, MECH MTG  |
| 13   | 2   | 1A5002   | ISOPATE VHF HB2 190-220 MHz   | INC ISOLATOR, TERM, MECH PLATE |
| 16   | 1   | 851026   | FAN AC 208 2000 CFM EXHAUSE   | MULTIFAN VOSTERMANS 4VF1042A   |
| 17   | 1   | MFC40RU  | 40 RU ASSEMBLIED RACK         | BLACK CONTEMPRA 2 WELDED       |
| 18   | 1   | AC4352   | CABLE GRIP 0.67-0.87 OD       | MTG HOLE 1,325 WIRE SIZE 8/4   |

## VI — SCHEMATICS AND PARTS LIST

## B. ACDIS2





## VI — SCHEMATICS AND PARTS LIST

### B. ACDIS2 — Parts List

#### AssyTreeACDIS2

Printed 12/22/2004

#### ACDIS2

AC & DC DISTRIBUTION  
UTX2KWA TRANSMITTERS

|          |           |       |
|----------|-----------|-------|
| Type     | PL        | User1 |
| Revision | A         | User2 |
| Status   | U         | User3 |
| Date     | 6/28/2004 | User4 |
| By       | RA        | User5 |

| Item | Qty | P/N     | Title                       | Detail                                     |
|------|-----|---------|-----------------------------|--------------------------------------------|
| Top  |     | ACDIS2  | AC & DC DISTRIBUTION        | UTX2KWA TRANSMITTERS                       |
| 1    | 1   | 660110  | DC PANEL METER 50 V FS      | HOYT MODEL 3115 1-1/2 ANA PANEL            |
| 2    | 1   | 660113  | DC AMP METER 300 A FS       | HOYT 3115 100mv FS                         |
| 3    | 1   | 670300  | SHUNT, METER 100 mv FS      | Lightweight shunt, 100 Millivolt, 300 amp. |
| 4    | 1   | AC3110  | AC CKT BREAKER              | 115 VAC 10 AMPS RS TYPE                    |
| 5    | 1   | AC8000  | AC POWER DISTRIBUTION BLOCK | 3 POLE 840 A 600 VAC                       |
| 6    | 1   | AC5105  | AC PANEL MTG OUTLET         | 4 POSITION "GANGED" 15A 115VAC             |
| 8    | 4   | AC4111  | AC POWER PLUG 220AC 16A     | POWER INLET SCHURTER 4300.0922             |
| 9    | 2   | 480461  | MOLEX CRIMP TERM PLUG       | PLUG HOUSING 6 POLE                        |
| 10   | 4   | 480462  | MOLEX CAP STRAIN RELIEF     | ACDIS SUBASSEMBLIES                        |
| 11   | 2   | 480460  | MOLEX CRIMP TERM 6 POLE     | CAP HOUSING PANEL MTG                      |
| 12   | 12  | 480463  | MOLEX PIN CONTACTS LRG      | CONN PIN 14-20 AWG TIN CRIMP               |
| 13   | 12  | 480464  | MOLEX SOCKET CONTACTS       | CONN SOCKET 14-20 AWG TIN CRIMP            |
| 14   | 1   | 480465  | MOLEX PLUG HOUSING          | 9 POLE MATE-LOC                            |
| 15   | 1   | 480466  | MOLEX CAP HOUSING           | 9 POLE                                     |
| 16   | 2   | 480467  | MOLEX STRAIN RELIEFS        | 9 POLE                                     |
| 17   | 4   | 471380  | FUSE FAST ACTING 80 AMP     | USE WITH LFFB0001 HOLDER                   |
| 18   | 4   | 460190  | FUSE HOLDER 400A            | LITTELFUSE LFFB001                         |
| 19   | 5   | AC3315  | AC CKT BKR ELUMINATED       | U600LPA 220 15 A 2 POLE                    |
| 20   | 1   | MF9312  | ACDIS MAIN CHASSIS          | AL 090 MATERIAL ALODYNE/W SILK             |
| 21   | 1   | MF9313  | ACDIS MAIN COVER            | 1 & 2 KW 090 AL ALODYNE                    |
| 22   | 1   | MF9315A | ACDIS CHASSIS DIVIDER       | 063 AL ALODYNE                             |
| 23   | 1   | MF9311  | PLATE, FRONT ACDIS2         |                                            |
| 24   | 1   | AC3250  | AC CKT BRKR                 | 50 AMP 2-POLE 220V                         |
| 25   | 2   | 453000  | HW, TIP JACK                | RED, Insulated standard TIP JACK           |
| 26   | 2   | 453001  | HW TIP JACK                 | WHITE, Insulated standard TIP JACK         |
| 27   | 1   | 453002  | HW, TIP JACK                | BLACK, Insulated standard TIP JACK         |



VI — SCHEMATICS AND PARTS LIST

B. ACDIS2 — Parts List (Cont.)

AssyTreeACDIS2

AC & DC DISTRIBUTION  
UTX2KWA TRANSMITTERS

ACDIS2

Rev A

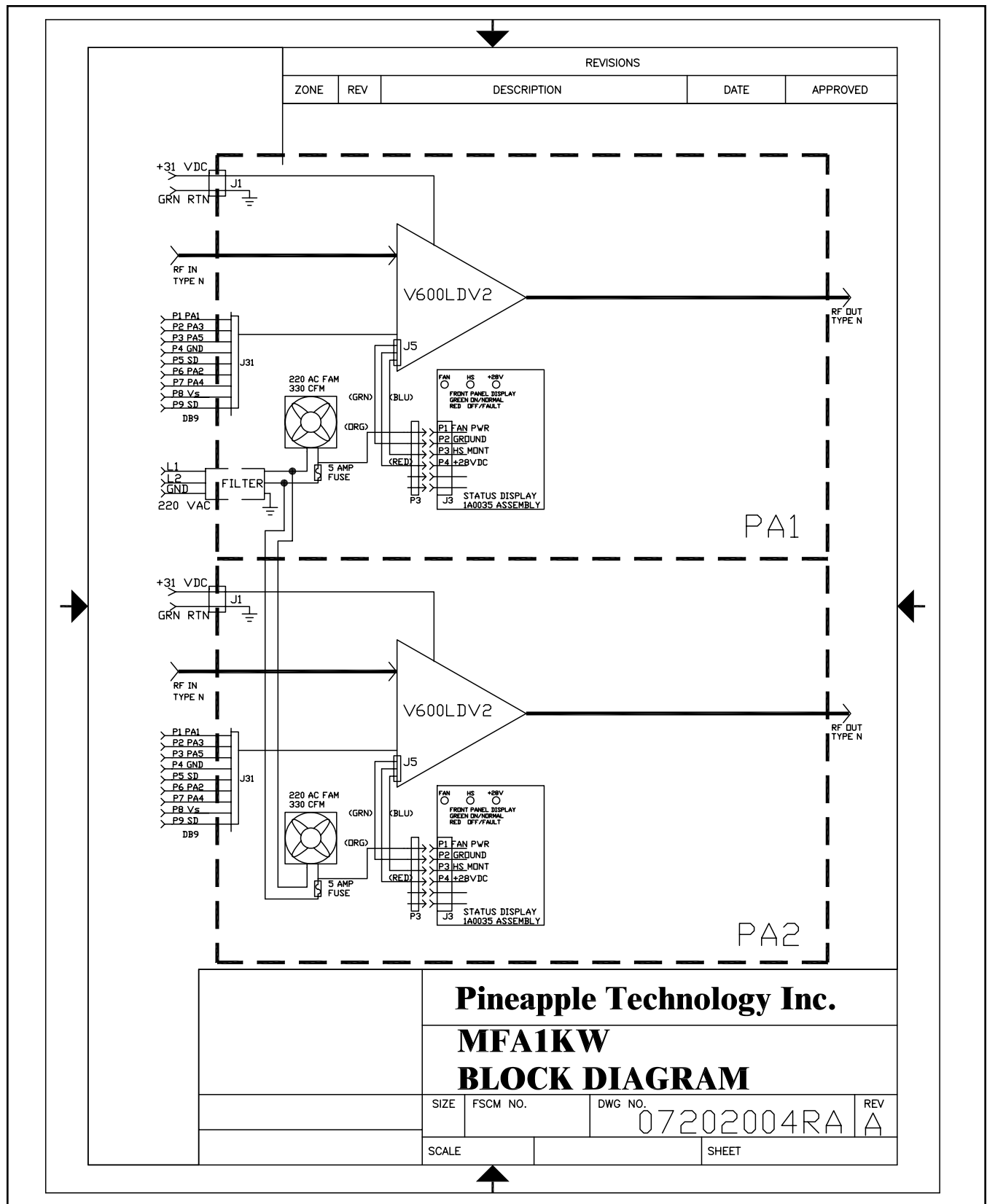
Printed 12/22/2004

| Item | Qty | P/N    | Title        | Detail                            |
|------|-----|--------|--------------|-----------------------------------|
| 28   | 2   | 453003 | HW, TIP JACK | BLUE, Insulated Standard TIP JACK |
| 29   | 1   | AC4302 | AC CORD GRIP | 0.98 OD CABLE 1.3 HOLE MTG        |



VI — SCHEMATICS AND PARTS LIST

C. MFA1KW — Block Diagram





VI — SCHEMATICS AND PARTS LIST

C. MFA1KW — Parts List

AssyTreeMFA1KW

Printed 12/22/2004

MFA1KW

1 KW MAIN FRAME  
UHF/VHF ASSEMBLIES

|          |           |       |
|----------|-----------|-------|
| Type     | PL        | User1 |
| Revision | A         | User2 |
| Status   | U         | User3 |
| Date     | 1/24/2000 | User4 |
| By       | RA        | User5 |

| Item | Qty | P/N           | Title                      | Detail                        |
|------|-----|---------------|----------------------------|-------------------------------|
| Top  |     | MFA1KW        | 1 KW MAIN FRAME            | UHF/VHF ASSEMBLIES            |
| 1    | 1   | MF9100E       | MAIN CHASSIS               | MFA1KW                        |
| 2    | 1   | MF9101        | DIVIDER, PLENUM            | MFA1KW                        |
| 3    | 1   | MF9102C       | DIVIDER, FAN               | MFA1KW                        |
| 5    | 1   | MF9104        | COVER, TOP                 | MFA1KW                        |
| 10   | 4   | MF9139        | SLED GUIDE                 | U600LP & MFA1KW               |
| 11   | 1   | MF9123D       | FRONT PANEL, PAINTED       | MFA1KW                        |
| 14   | 2   | 990199        | FILTER, AIR DRY            | FF-5 MFA/PS FP                |
| 16   | 2   | MF9127        | MTG BRACKET, MOLEX FEMALE  | MFA1KW                        |
| 17   | 6   | 480472        | MOLEX CRIMP TERM MFA1KW    | MOLEX MFG 39-00-0041          |
| 18   | 2   | 480400        | MOLEX PLUG 6 TERM MFA1KW   | MOLEX 15-06-0065 MINI-FIT BMI |
| 19   | 2   | 460150        | FUSE HOLDER PANEL MTG      | 3AG TYPE QC CON               |
| 20   | 2   | 1A0035        | PA STATUS BOARD            | PC9061A                       |
| 22   | 4   | INHOUSE_LABOR | PTI LABOR                  |                               |
| 24   | 2   | MF9308        | FAN FINGER GUARD           | MFA1KW & U600LPA              |
| 25   | 2   | MF9310        | AC FAN INLET HOLDER        | MFA1KW                        |
| 27   | 2   | MF9258        | BRACKET FILTER MTG PAINTED | U600LPA & MFA1KW              |
| 28   | 1   | MF9197B       | DIVIDER PA                 | MFA1KW                        |
| 29   | 2   | 851025        | FAN, AC 220 V              | COMAIR ROTRON TN3A2           |
| 30   | 2   | AC5110        | AC FAN PLUG & CORD         | FEMALE PLUG 24 IN CORD        |
| 31   | 2   | 451080        | TERM BLOCK EU STYLE        | 4 POLE 12-24 GAGE             |



## VI — SCHEMATICS AND PARTS LIST

## 1. 1A0035 STATUS BOARD — Schematic





## VI — SCHEMATICS AND PARTS LIST

### C. MFA1KW

#### 1. 1A0035 STATUS BOARD — Parts List

##### AssyTree1A0035

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##### 1A0035

PA STATUS BOARD  
PC9061A

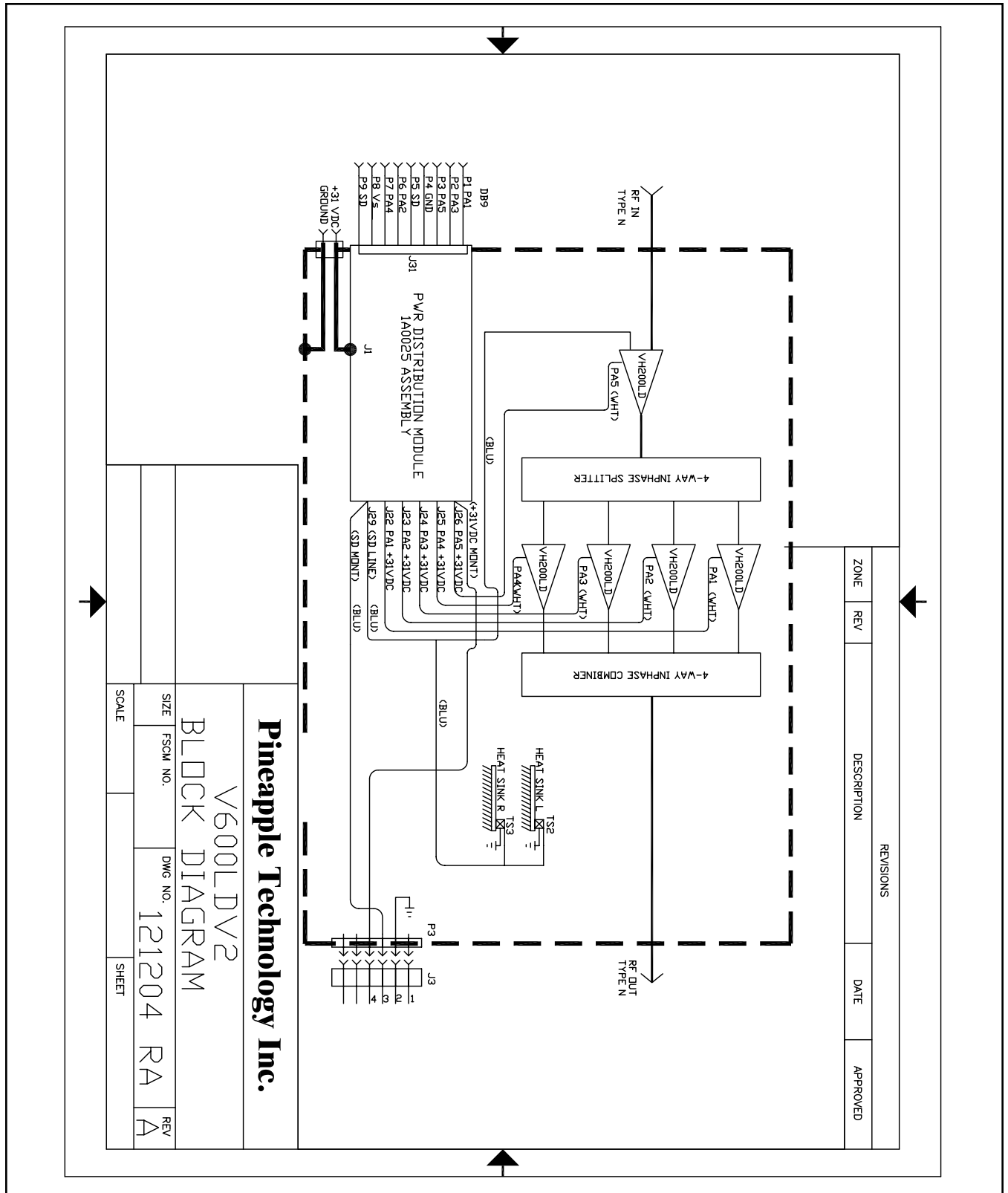
|          |          |       |
|----------|----------|-------|
| Type     | PL       | User1 |
| Revision | B        | User2 |
| Status   | U        | User3 |
| Date     | 8/1/2002 | User4 |
| By       | RA       | User5 |

| Item | Qty | P/N     | Title                    | Detail                   |
|------|-----|---------|--------------------------|--------------------------|
| Top  |     | 1A0035  | PA STATUS BOARD          | PC9061A                  |
| 1    | 2   | 114330  | RES ARRAY, SMT           | 330 OHMS                 |
| 2    | 5   | 115103  | RES CHIP 0805            | 10K OHM SMT 0805         |
| 3    | 1   | 115334  | RES CHIP 0805            | 330 K OHM SMT            |
| 4    | 1   | 115563  | RES CHIP 0805            | 56K OHM 0805 SM          |
| 5    | 3   | 115682  | RES CHIP 0805            | 6.8 K OHM SMT            |
| 6    | 6   | 21X005  | CAP CHIP 0805            | 100NF 10% XTR 0805 CASE  |
| 7    | 1   | 21X008  | CHIP CAP 0805            | 10NF 50 V 0805 SM        |
| 8    | 1   | 240109  | CAP TH POLYPROPYLENE     | 3N3 600 WVDC .033UF      |
| 9    | 1   | 240110  | CAP TAN SMD              | 3.3 UFD 35 V             |
| 10   | 1   | 240111  | CAP TAN SMD              | 47 UF 10 V TAN           |
| 11   | 1   | 241300  | CAP RADIAL TH            | 330 UF 35 VDC            |
| 12   | 1   | 241301  | CAP RADIAL TH            | 680 UF 10 V ELECTROLYTIC |
| 13   | 6   | 27022N  | FT CAP 22N SM            | AVX OR MURRATA PART      |
| 14   | 1   | 480500  | CON MICRO-FIT HEADER 3.0 | 8 PIN PC MTG             |
| 15   | 1   | 520230  | SEMI DIODE SHOTTKEY      | 1.5 A 60 VDC D-64        |
| 16   | 1   | 520275  | SEMI, DIODE DUAL         | FMMD6100                 |
| 17   | 2   | 530350  | HEX SCHMITH TRIG         | 74HD14                   |
| 18   | 1   | 538150  | IC SWITCHER SIMPLE       | SO8 PAK                  |
| 19   | 5   | 630200  | IND LED DUAL COLOR       | RED/GREEN T1-3/4 CLR     |
| 20   | 8   | 750001  | FERRITE BEAD SMT         | 0805 EMI FERRITE BEAD    |
| 21   | 1   | 830510  | IND, W/W                 | 82 UH .58A PWR SMD       |
| 22   | 2   | PC9061H | PA STAUS BRD             | FR4 060 1/1 CBR          |
| 23   | 2   | 115331  | RES CHIP 0805            | 330 OHM SMT              |
| 24   | 1   | 520120  | SEMI ZENER               | 5.6 V MELF               |
| 25   | 1   | 115683  | RES CHIP 0805            | 68K SM                   |



VI — SCHEMATICS AND PARTS LIST

D. V600LDV2 — Block Diagram





VI — SCHEMATICS AND PARTS LIST

D. V600LDV2 — Parts List

AssyTreeV600LD

Printed 12/22/2004

V600LD

VHF HB 600W LDMOS PA  
5 EA VH200LD MODULES

|          |            |       |
|----------|------------|-------|
| Type     | PL         | User1 |
| Revision | A          | User2 |
| Status   | U          | User3 |
| Date     | 12/26/2002 | User4 |
| By       | RA         | User5 |

| Item | Qty | P/N         | Title                       | Detail                         |
|------|-----|-------------|-----------------------------|--------------------------------|
| Top  |     | V600LD      | VHF HB 600W LDMOS PA        | 5 EA VH200LD MODULES           |
| 2    | 5   | 1A0032      | VH200LD PALLET              | VHF TV HIGH BAND BB 200W AMP   |
| 3    | 1   | MF9126C     | MOLEX BRACKET MTG PLATE     | U600LD ALL                     |
| 4    | 2   | 310010      | SW THERMAL                  | 140 DEG F N/C                  |
| 5    | 1   | MF9137E     | SLED                        | U500L AL                       |
| 6    | 1   | MF9140A     | HANDLE                      | U500L ALL                      |
| 7    | 4   | 180040-100R | RES PWR 40 W                | 100 OHM RES                    |
| 8    | 2   | 180150-100R | RES PWR 150 W               | 100 OHM RES                    |
| 9    | 1   | 180250-50T  | RES PWR 250 W               | 50 OHM TERM                    |
| 10   | 2   | 440101      | HW CS STANDOFF              | 1.0 x .375; Male/Female; 1032  |
| 11   | 1   | MF9203 B1   | PLATE, ISO/MONT BRD         | SM 09 AL W/MTG                 |
| 12   | 1   | MF9202B1    | COVER, REAR U600LD          | SM 09 AL                       |
| 13   | 1   | MF9206AMU   | Shield, PC9050A             | PCB SHIELD MONITOR/ISO BRD     |
| 14   | 1   | 1A0025      | DC ISO/MONITOR CKT          | REPLACED CB99                  |
| 15   | 1   | 452001      | HWRD TERM FEED THRU BLK     | 5 PIN; #10 STUD; 10-16 AWG     |
| 16   | 1   | 452050      | HWR TERM BLK COVER          | 5 PIN COVER W/MTG HWRD         |
| 17   | 1   | 480401      | MOLEX RECEPTACLE U600LD     | MOLEX 15-06-0061               |
| 18   | 3   | 480473      | MOLEX CRIMP TERMINAL U600LD | MOLEX 39-00-0039 FEMALE        |
| 19   | 1   | CA5030      | COAX CABLE ASSEMBLY         | ANDREWS ETS1 TO N PANEL FLG MT |
| 20   | 1   | PC9060A     | VHF HB 4-WAY COMBINER       | 060 FR4 PCB                    |
| 21   | 1   | PC9058A     | VHF HB 4-WAY SPLITTER       | FR4 030 PCB                    |
| 22   | 1   | MF9224A     | HEAT SINK VH600LD SIDE B    | AL HS FAB                      |
| 23   | 1   | MF9225A     | HEAT SINK SIDE A VH600LD    | AL HS FAB                      |
| 24   | 1   | CA5001      | COAX CABLE ASSEMBLY         | RG142 TO N PM FM 4 HOLE FLG    |
| 25   | 1   | MF9226A     | COMBINER PLATE VH600LD      | 1/4 AL PLATE                   |



## 1. VH200LD — Schematic





## VI — SCHEMATICS AND PARTS LIST

### D. V600LDV2

#### 1. VH200LD (1A0032) — Parts List

##### AssyTree1A0032

Printed 12/22/2004

##### 1A0032

VH200LD PALLET  
VHF TV HIGH BAND BB 200W AMP

|          |            |       |
|----------|------------|-------|
| Type     | PL         | User1 |
| Revision | C          | User2 |
| Status   | U          | User3 |
| Date     | 11/25/2002 | User4 |
| By       | RA         | User5 |

| Item | Qty | P/N         | Title            | Detail                       |
|------|-----|-------------|------------------|------------------------------|
| Top  |     | 1A0032      | VH200LD PALLET   | VHF TV HIGH BAND BB 200W AMP |
| 1    | 4   | 17L103      | RES VARI 1/8 W   | 10 K OHM SM                  |
| 3    | 6   | 116103      | RES CHIP 1/8 W   | 10 K OHM SM 1206             |
| 4    | 4   | 116101      | RES CHIP 1/8 W   | 100 OHM SM 1206              |
| 5    | 4   | 11Y2R4      | RES CHIP 1W      | CASE 2512 2.4 OHMS 1W        |
| 6    | 2   | 116104      | RES CHIP 1/8 W   | 100 K OHM SM 1206            |
| 7    | 4   | 116102      | RES CHIP 1/8     | 1 K OHM SM 1206              |
| 8    | 4   | 11627R43    | RES CHIP 1206    | 27.4K OHM                    |
| 9    | 1   | 1165R113    | RES CHIP 1206    | 5.11K OHM                    |
| 10   | 1   | 117333      | THERMISTOR       | 33K OHM 0603                 |
| 11   | 1   | 116561      | RES CHIP 1206    | 560 OHM 5% 1206 CASE         |
| 13   | 1   | 116391      | RES CHIP 1/8 W   | 390 OHM SM 1206              |
| 14   | 2   | 116000      | RES CHIP 1206    | 0.0 OHMS SM                  |
| 15   | 1   | 180040-100R | RES PWR 40 W     | 100 OHM RES                  |
| 16   | 1   | 180150-100R | RES PWR 150 W    | 100 OHM RES                  |
| 17   | 10  | 21Y042      | CAP CHIP         | 0.1 UF 50 V 1206             |
| 18   | 15  | 21Y038      | CHIP CAP 1206    | 470 PF NPO RF CAP            |
| 19   | 3   | 21X001      | CAP CHIP 0805    | 100 PF 50V SMD               |
| 20   | 0   | 2633R9      | CAP CHIP ATC     | 3.9 PF B CASE                |
| 21   | 2   | 241220      | CAP RADIAL SM    | 220 UF 50 V HA               |
| 22   | 1   | 241010      | CAP RADIAL SM    | 10UF 16V ALUM ELEC           |
| 23   | 2   | 27022N      | FT CAP 22N SM    | AVX OR MURRATA PART          |
| 24   | 2   | 750001      | FERRITE BEAD SMT | 0805 EMI FERRITE BEAD        |
| 25   | 2   | 520118      | SEMI ZENER       | 14V MINI 3P MA3140CT         |
| 26   | 3   | 520129      | SEMI DIODE GP    | 1N914 SM SOT-23              |
| 27   | 1   | 560108      | SEMI OP-AMP      | DUAL OP AMP                  |
| 28   | 1   | 560118      | VOLTAGE REG SMT  | 3V LP 50MA SOT-23-5          |
| 29   | 1   | 520300      | SEMI GP XSTR     | MMBT2222ALT1                 |
| 30   | 1   | 520301      | SEMI XISTOR      | MMBT2907ALT1                 |
| 31   | 2   | 530707      | FWR FET VHF LINE | 125 W 28V LDMOS              |



## VI — SCHEMATICS AND PARTS LIST

### D. V600LDV2

#### 1. VH200LD (1A0032) — Parts List (cont.)

##### AssyTree1A0032

VH200LD PALLET  
VHF TV HIGH BAND BB 200W AMP

1A0032

Rev C

Printed 12/22/2004

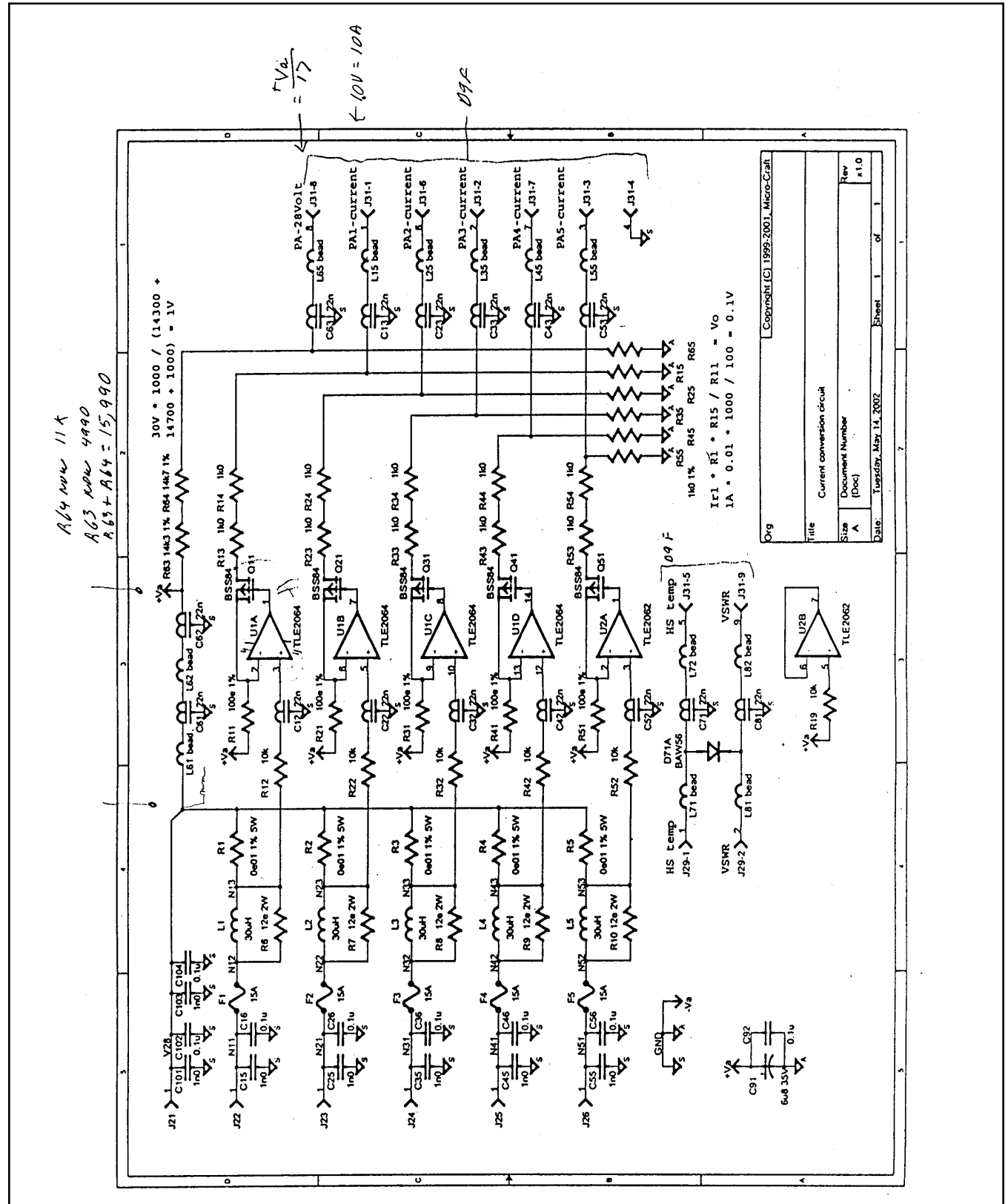
| Item | Qty | P/N      | Title                   | Detail                               |
|------|-----|----------|-------------------------|--------------------------------------|
| 32   | 4   | 822101   | IND CHIP                | 100nH SMT 0805                       |
| 33   | 10  | 263301   | CAP CHIP ATC            | 300 PF B CASE                        |
| 34   | 2   | 263750   | CAP CHIP ATC            | 75 PF B CASE                         |
| 35   | 2   | 2635R6   | CAP CHIP ATC            | 5.6 PF B CASE                        |
| 36   | 2   | TA220-01 | Z--XFMR 220 MHz VH200   | RG179 CUT & TRIM 9.6 IN              |
| 37   | 2   | TA220-02 | Z--XFMT 220 MHz VH200LD | RG316 5.6 IN CUT & TRIM              |
| 38   | 1   | TA220-03 | Z--XFMR 220 MHz VH200LD | RG316 9.6 IN CUT & TRIM              |
| 39   | 4   | TA220-20 | Z-XFMR 220 MHz VH200LD  | INS WIRE/SHIELDED 20AWG 4.5 IN       |
| 40   | 4   | TA220-30 | Z-XFMR 220 MHz VH200LD  | WIRE/SHIELDED 16 AWG 4.5 IN          |
| 41   | 2   | TA220-50 | Z-XFMR 220 MHz VH200LD  | UT85-TP SEMI-RIG COAX 5.6 INCHES     |
| 42   | 1   | TA220-51 | Z-XFMR 220 MHz VH200LD  | UT-85-TP SEMI RIG COAX 9.6 INCHES    |
| 43   | 2   | TA220-60 | Z-XFMR 220 MHz VH200LD  | UT-85-75-TP SEMI RIG COAX 9.6 INCHES |
| 44   | 1   | PC9057C  | PCB VH200LD             | FR4 060 1/1                          |
| 45   | 2   | 451070   | HW PWR TAP              | 6-32 STL KEYSTONE 8191               |
| 46   | 4   | 11Y100   | RES CHIP 1 W            | 10 OHM SM 2512                       |
| 47   | 4   | 21Y041   | CAP CHIP                | 0.01 UF SM 1206                      |
| 48   | 1   | 116223   | RES CHIP 1/8 W          | 22 K OHM SM 1206                     |
| 49   | 1   | 116331   | RES CHIP 1/8 W          | 330 OHM SM 1206                      |
| 50   | 2   | 1163322  | RES CHIP 1206           | 33.2 K OHM 1 %                       |



VI — SCHEMATICS AND PARTS LIST

D. V600LDV2

1. 1A0025 — Schematic





## VI — SCHEMATICS AND PARTS LIST

### D. V600LDV2

#### 1. 1A0025 — Parts List

##### AssyTree1A0025

Printed 12/22/2004

##### 1A0025

DC ISO/MONITOR CKT  
REPLACED CB99

|          |            |       |
|----------|------------|-------|
| Type     | PL         | User1 |
| Revision | B          | User2 |
| Status   | U          | User3 |
| Date     | 11/29/2001 | User4 |
| By       | RA         | User5 |

| Item | Qty | P/N     | Title                   | Detail                  |
|------|-----|---------|-------------------------|-------------------------|
| Top  |     | 1A0025  | DC ISO/MONITOR CKT      | REPLACED CB99           |
| 1    | 1   | PC9050C | PCB DC ISO/MONT BRD     | FR4 060                 |
| 2    | 1   | 560101  | OP-AMP QUAD PAK         | TLE2064AID TI           |
| 3    | 1   | 560102  | OP-AMP DUAL PAK         | 8-SOIC                  |
| 4    | 15  | 27022N  | FT CAP 22N SM           | AVX OR MURRATA PART     |
| 6    | 1   | 21X007  | CHIP CAP 0805           | 47NF 50WVDC X7R         |
| 7    | 5   | 472015  | FUSE PICO II EPOXY      | 15 A 32 VDC             |
| 8    | 1   | 481250  | CON DB9 SUB RT ANGLE FM | METAL CASE AMP7457814   |
| 9    | 5   | 1A0011  | TOROID IND              | 10 T #14 ON N40         |
| 10   | 5   | 590010  | XISTOR FET BSS84        | BSS84ZXCT               |
| 11   | 5   | 150R01  | RES 5 WATT AXIAL        | 0.01 OHM 1.0 %          |
| 12   | 5   | 140010  | RES 2W 10 OHM           | 10 OHM                  |
| 13   | 5   | 1151000 | RES CHIP 0805           | 100 OHM 1% 0805         |
| 14   | 6   | 1151002 | RES CHIP 0805           | 10 K OHM 1% 0805 CASE   |
| 15   | 10  | 1151001 | RES CHIP 0805           | 1 K OHM 1 %             |
| 17   | 5   | 451070  | HW PWR TAP              | 6-32 STL KEYSTONE 8191  |
| 18   | 1   | 480300  | CON 2 PIN HEADER        | AMP A23837-ND           |
| 19   | 1   | 480310  | CON 2 PIN PC POST       | AMP 640456-2            |
| 20   | 12  | 750001  | FERRITE BEAD SMT        | 0805 EMI FERRITE BEAD   |
| 21   | 7   | 21X005  | CAP CHIP 0805           | 100NF 10% XTR 0805 CASE |
| 22   | 7   | 21X006  | CHIP CAP 0805           | 1000 PF 10% 0805 CASE   |
| 23   | 1   | 1154991 | RES CHIP 0805           | 4.99K OHM 1% 0805 CASE  |
| 24   | 1   | 115113  | RES CHIP 0805           | 11K OHM 1% 0805 CASE    |
| 25   | 1   | 520260  | DIODE SWITCH            | 80V 100MA MINI 3P       |
| 26   | 1   | 240087  | CAP RADIAL SMT          | 4.7 UH 50 VDC           |



VI — SCHEMATICS AND PARTS LIST

E. VS500 4-WAY SPLITTER — Parts List

AssyTreeVS500-4

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VS500-4

VHF HB 4-WAY N CON  
ISO 100 W DIGITAL/ANALOG

|          |            |       |
|----------|------------|-------|
| Type     | CAT        | User1 |
| Revision | A          | User2 |
| Status   | U          | User3 |
| Date     | 12/11/2002 | User4 |
| By       | RA         | User5 |

| Item | Qty | P/N     | Title                | Detail                   |
|------|-----|---------|----------------------|--------------------------|
| Top  |     | VS500-4 | VHF HB 4-WAY N CON   | ISO 100 W DIGITAL/ANALOG |
| 1    | 1   | MF9243A | BASE PLATE, .5 IN AL | VS100D-4, TYPE N CON     |
| 2    | 1   | MF9244A | CHASSIS SIDES, AL    | VS100D-4 TYPE N CON      |
| 3    | 1   | MF9245A | COVER, AL TOP        | VS100D-4, TYPE N CON     |



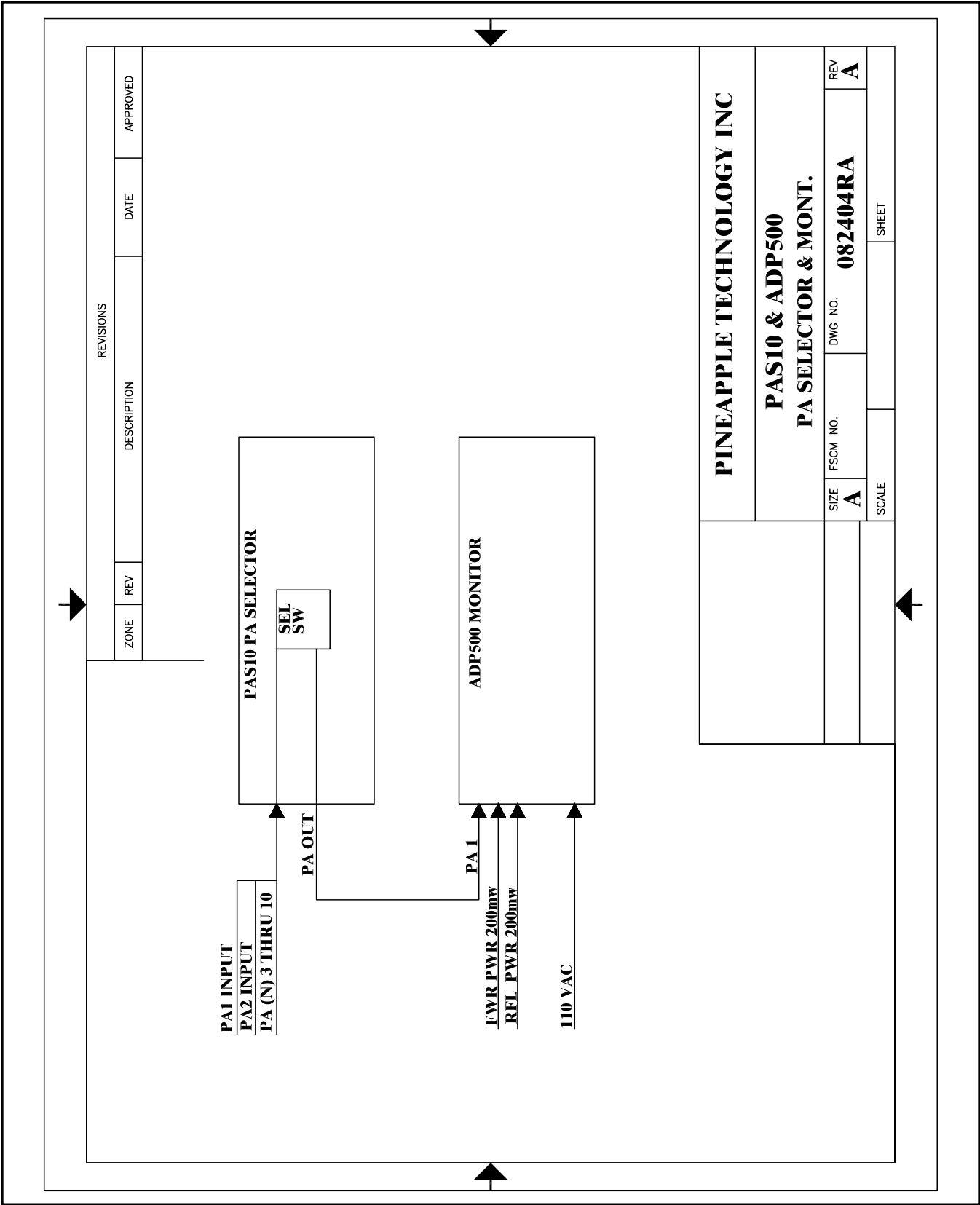
**VI — SCHEMATICS AND PARTS LIST**

**F. VC2KW COMBINER**

INFORMATION  
NOT AVAILABLE



VI — SCHEMATICS AND PARTS LIST  
G. PAS10 & ADP500 MONITOR — Block Diagram





VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR — PAS10 — Parts List

AssyTreePAS10

Printed 12/22/2004

PAS10

PA SEL SW FOR ADP500  
10 POLE INPUT 1 OUTPUT

|          |           |       |
|----------|-----------|-------|
| Type     | CAT       | User1 |
| Revision | A         | User2 |
| Status   | U         | User3 |
| Date     | 6/22/2004 | User4 |
| By       | RA        | User5 |

| Item | Qty | P/N      | Title                    | Detail                   |
|------|-----|----------|--------------------------|--------------------------|
| Top  |     | PAS10    | PA SEL SW FOR ADP500     | 10 POLE INPUT 1 OUTPUT   |
| 1    | 1   | PC9501   | PA SELECTER SWITCH       | 10 POLE ADP500           |
| 2    | 1   | 483010   | SW 10 POLE               | ADP500 PA SELECTOR PAS10 |
| 3    | 1   | 481250   | CON DB9 SUB RT ANGLE FM  | METAL CASE AMP7457814    |
| 4    | 5   | 481260   | CON DB9 2 SECTION RT ANG | PCB MTG 0.9 SPACING      |
| 5    | 1   | MF9342X1 | PLATE, FRONT PAS10       | W/ PAINT & SILKSCREEN    |
| 6    | 1   | MF9343X1 | CHASSIS, PAS10           | W/ ALODINE & SILKSCREEN  |
| 7    | 1   | MF9344X1 | COVER, TOP PAS10         | W/ ALODINE & SILKSCREEN  |



VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR — ADP500 — Parts List

Assy Tree for: ADP500

Printed 12/22/2004

**ADP500**

DISPLAY PANEL, ANALOG  
SEL SW AND METER

|          |           |       |
|----------|-----------|-------|
| Type     | CAT       | User1 |
| Revision | A         | User2 |
| Status   | U         | User3 |
| Date     | 9/15/2002 | User4 |
| By       | RA        | User5 |

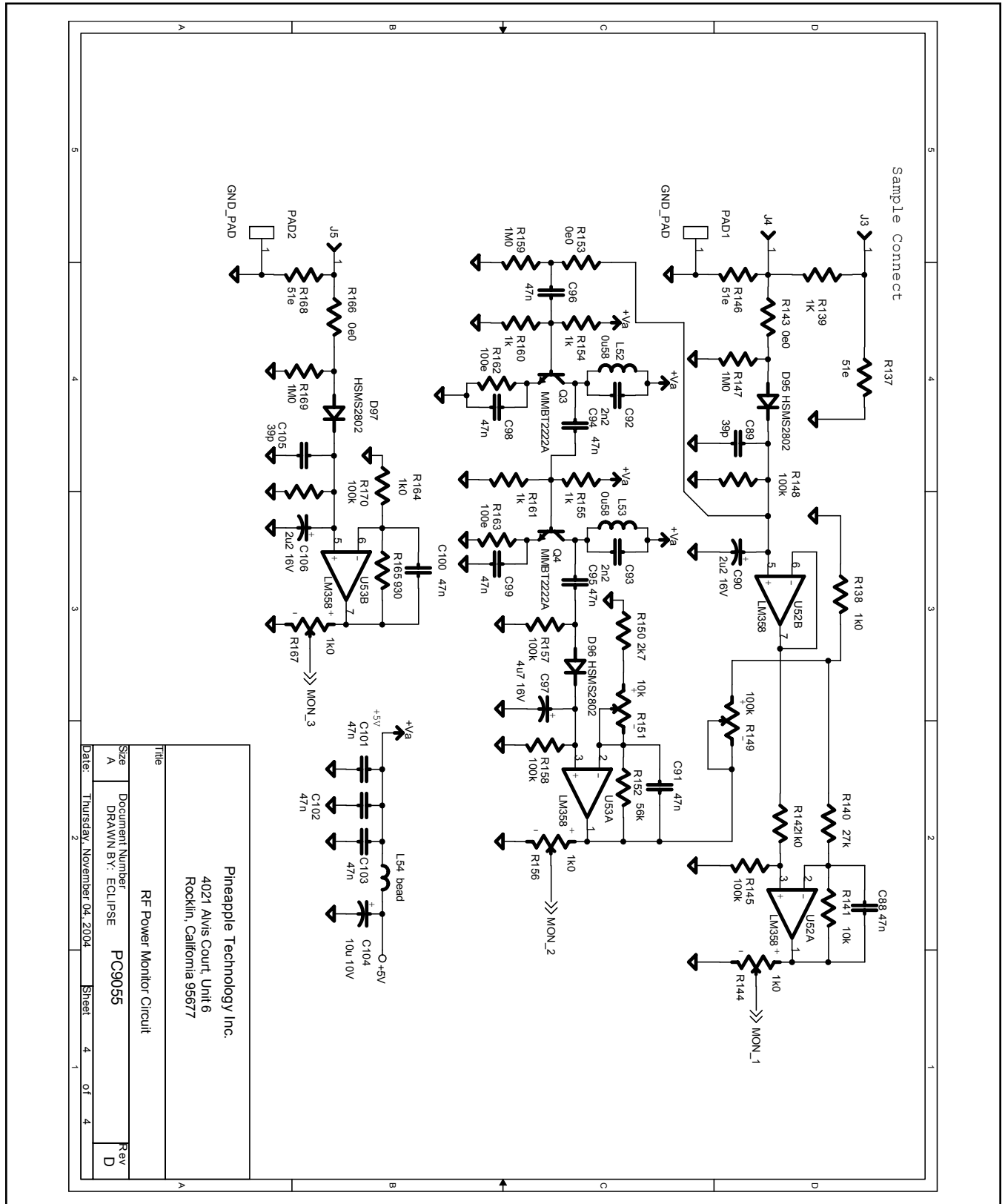
| Item | Qty | P/N    | Title                   | Detail                  |
|------|-----|--------|-------------------------|-------------------------|
| Top  |     | ADP500 | DISPLAY PANEL, ANALOG   | SEL SW AND METER        |
| 1    | 1   | 1A0029 | ADP1000 LOGIC PCB       | LOGIC BRD PARTS         |
| 2    | 1   | 1A0030 | ADP1000 FP PCB          | FP PCB AND PARTS        |
| 3    | 1   | 471306 | FUSE 3AG                | 6 AMP                   |
| 4    | 1   | 460150 | FUSE HOLDER PANEL MTG   | 3AG TYPE QC CON         |
| 5    | 1   | 484001 | SW, ON/OFF ROCKER AC    | CW IND. NAA-211-B121-00 |
| 6    | 1   | 660103 | METER, 2 VOLTS FS       | SELCO 39M-0-2VDC        |
| 7    | 1   | 1A0027 | PWR MONITOR CK          | PC9052B CBR             |
| 8    | 1   | PS2527 | POWER SUPPLY OPEN/FRAME | 110/220 VAC 27 V 25 W   |
| 9    | 1   | 484020 | TOGGEL SW MOMENTARY/ON  | 2 POLE                  |



VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR

1. 1A0029 — Schematic 1 of 4

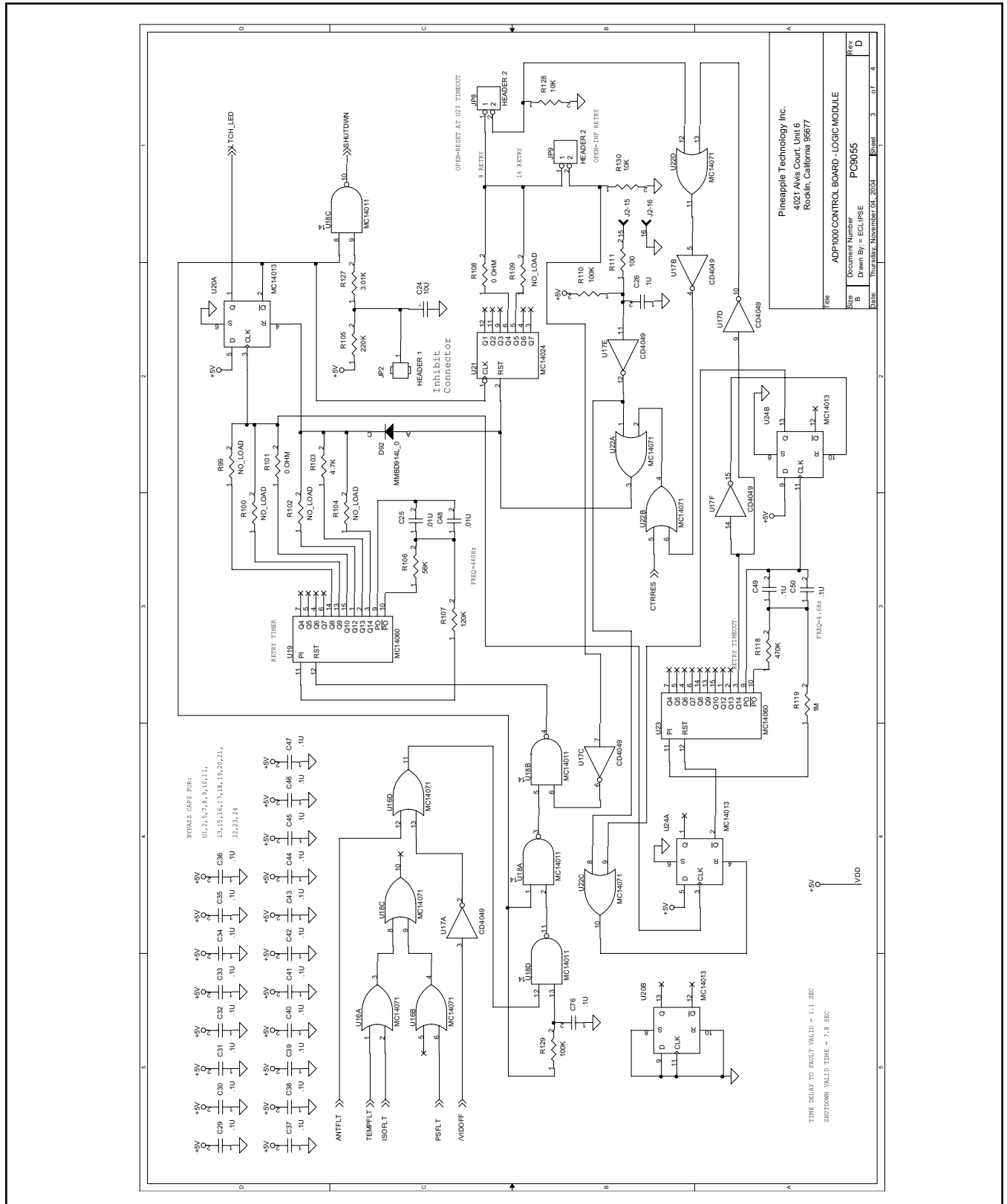




VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR

1. 1A0029 — Schematic 2 of 4





### 1. 1A0029 — Schematic 3 of 4

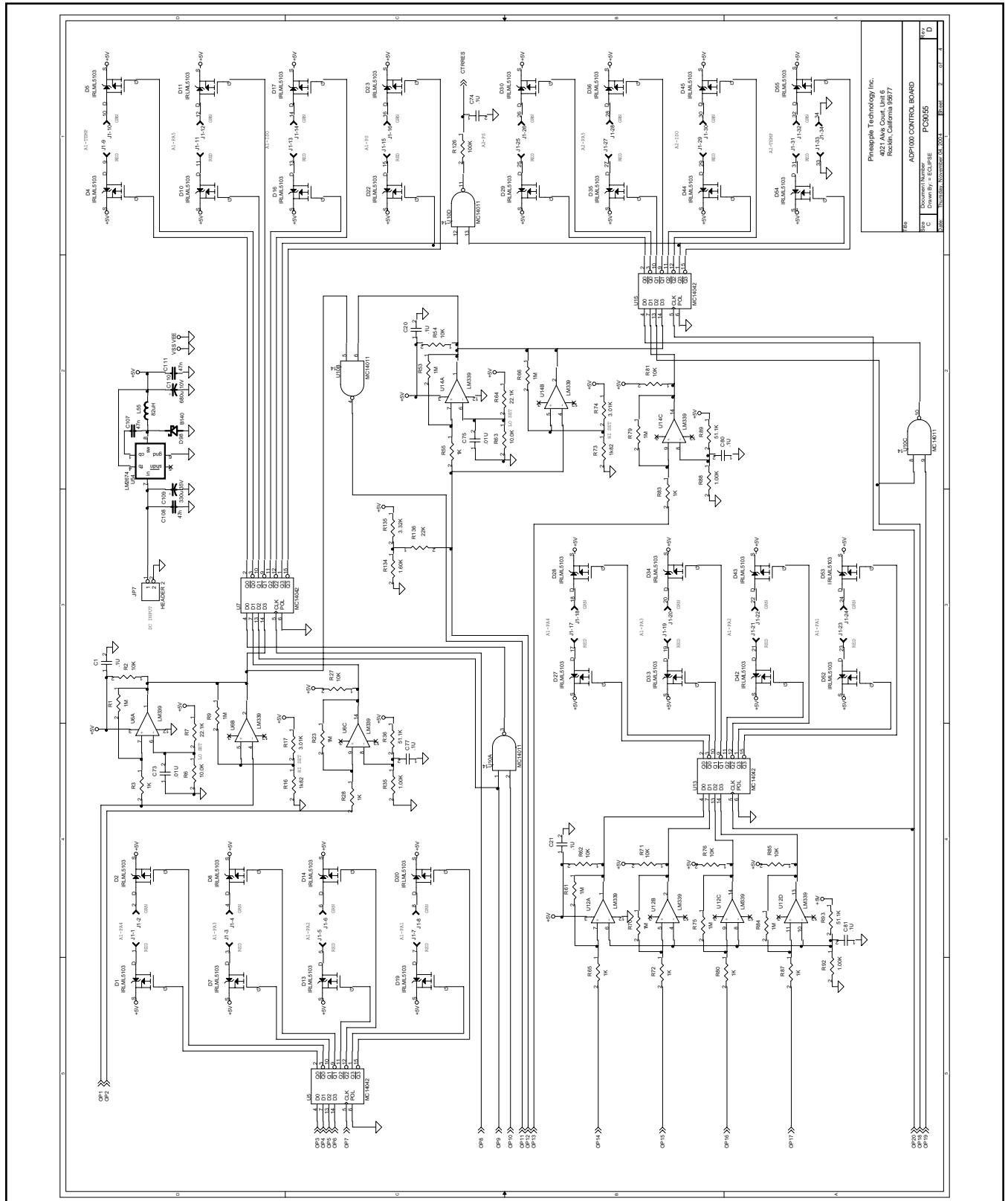




VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR

1. 1A0029 — Schematic 4 of 4





## VI — SCHEMATICS AND PARTS LIST

### G. PAS10 & ADP500 MONITOR

#### 1. 1A0029 — Parts List

##### Assy Tree for: 1A0029

Printed 12/22/2004

##### 1A0029

ADP1000 LOGIC PCB  
LOGIC BRD PARTS

|          |          |       |
|----------|----------|-------|
| Type     | PL       | User1 |
| Revision | A        | User2 |
| Status   | U        | User3 |
| Date     | 1/5/2002 | User4 |
| By       | RA       | User5 |

| Item | Qty | P/N      | Title                       | Detail                          |
|------|-----|----------|-----------------------------|---------------------------------|
| Top  |     | 1A0029   | ADP1000 LOGIC PCB           | LOGIC BRD PARTS                 |
| 1    | 1   | PC9055   | ADP1000 LOGIC BOARD         | PC9055 REV D INTEGRATED         |
| 2    | 2   | 560320   | LOGIC IC MC14013            | DUAL D F/F SOT 14               |
| 3    | 3   | 560315   | LOGIC IC MC14011BD          | LOG CMOS GATE NAND QUAD         |
| 4    | 5   | 560325   | LOGIC IC MC14042BD 16 PIN   | LOG CMOS LATCH QUAD TRAN        |
| 5    | 2   | 560310   | LOGIC IC MC14060BD          | CTR/DRIVER IC SOT 16            |
| 6    | 2   | 539100   | IC HEX INV BUFFER           | CD4049UBCM                      |
| 7    | 2   | 560330   | LOGIC IC MC14071BD          | LOG CMOS GATE OR QUAD SO14      |
| 8    | 4   | 539000   | IC DIF AMP QUAD             | LM339DR SO14                    |
| 9    | 1   | 560108   | SEMI OP-AMP                 | DUAL OP AMP                     |
| 10   | 2   | 562500   | ANALOG MC14551BD            | MUX/DE-MUX 2 CHANNEL            |
| 11   | 1   | 538100   | IC SWITCHER/REG LM2674M-5.0 | 28 V IN 5 VOLTS OUT 500MA       |
| 12   | 1   | 539110   | LOGIC IC CD4024BM           | 7 STAGE COUNTER SO14            |
| 13   | 2   | 11622R13 | RES CHIP 1206               | 22.1K OHM SMT                   |
| 14   | 4   | 1155112  | RES 0805 CASE               | 51.1 K OHM 1%                   |
| 15   | 1   | 1153242  | RES 0805 CASE               | 32.4 K OHM 1%                   |
| 16   | 2   | 520300   | SEMI GP XSTR                | MMBT2222ALT1                    |
| 17   | 42  | 520272   | DIODE HEX FET P             | HEX FET SOT-3                   |
| 18   | 1   | 830510   | IND, W/W                    | 82 UH .58A PWR SMD              |
| 19   | 4   | 520129   | SEMI DIODE GP               | 1N914 SM SOT-23                 |
| 21   | 17  | 116105   | RES CHIP 1/8 W              | 1 M OHM SM 1206                 |
| 22   | 27  | 116103   | RES CHIP 1/8 W              | 10 K OHM SM 1206                |
| 23   | 14  | 116102   | RES CHIP 1/8                | 1 K OHM SM 1206                 |
| 24   | 36  | 21Y042   | CAP CHIP                    | 0.1 UF 50 V 1206                |
| 25   | 18  | 27022N   | FT CAP 22N SM               | AVX OR MURRATA PART             |
| 26   | 18  | 750001   | FERRITE BEAD SMT            | 0805 EMI FERRITE BEAD           |
| 27   | 1   | 241310   | CAP RADIAL TH               | 680 UF 35 WVDC AL ELECTROLYTIC  |
| 28   | 1   | 241320   | CAP RADIAL TH               | 1200 UF 10 WVDC AL ELECTROLYTIC |
| 29   | 1   | 240200   | CAP SM 1206 CASE            | 10 UF 10 WVDC                   |
| 30   | 4   | 21Y041   | CAP CHIP                    | 0.01 UF SM 1206                 |



VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR

1. 1A0029 — Parts List (cont.)

Assy Tree for: 1A0029

ADP1000 LOGIC PCB  
LOGIC BRD PARTS

1A0029

Rev A

Printed 12/22/2004

| Item | Qty | P/N      | Title                     | Detail                  |
|------|-----|----------|---------------------------|-------------------------|
| 31   | 3   | 21Y022   | CAP SM 1206               | 47 NF 50 V              |
| 32   | 1   | 1163321  | RES CHIP 1206             | 3.32 K OHM 1%           |
| 33   | 1   | 1162252  | RES CHIP 1206             | 25.5K OHM 1206 CASE     |
| 34   | 1   | 116474   | RES CHIP 1206             | 470K OHM 1/8 W          |
| 35   | 1   | 116124   | RES CHIP 1206 CASE        | 120 K OHM 5%            |
| 36   | 1   | 116563   | RES CHIP 1206 CASE        | 56K OHM 5%              |
| 37   | 1   | 116224   | CHIP RES 1206             | 220 K OHM 1206 CASE 5%  |
| 38   | 3   | 116000   | RES CHIP 1206             | 0.0 OHMS SM             |
| 39   | 7   | 116XXX   | CHIP RES 1206             | +++NO LOAD+++           |
| 40   | 3   | 116101   | RES CHIP 1/8 W            | 100 OHM SM 1206         |
| 41   | 2   | 116223   | RES CHIP 1/8 W            | 22 K OHM SM 1206        |
| 42   | 2   | 116100   | RES CHIP 1/8 W            | 10 OHM SM 1206          |
| 43   | 3   | 1163011  | RES CHIP 1206             | 3.01K OHM 1206 CASE     |
| 44   | 4   | 116472   | RES CHIP 1206             | 4.7K OHM 1/8 W SMT      |
| 45   | 1   | 116392   | RES CHIP 1/8 W            | 3.9 K OHM SM 1206       |
| 46   | 4   | 116162   | RES CHIP 1206             | 1.6K OHM 5% 1206 CASE   |
| 47   | 6   | 116104   | RES CHIP 1/8 W            | 100 K OHM SM 1206       |
| 48   | 1   | 17L102XT | RES VAR 12 TURN           | 1K SMT POT 12 TURN      |
| 49   | 2   | 480600   | CON HEADER 0.1 CTRS       | PROTECTED HEADER 34 PIN |
| 50   | 1   | 485001   | HEADER 10 PIN TH          | AMP 0.1 CTR 103308-1    |
| 51   | 2   | 480310   | CON 2 PIN PC POST         | AMP 640456-2            |
| 52   | 1   | 480320   | CON 4 PIN PC LOCKING POST | MOLES MALE              |
| 53   | 1   | 520212   | SEMI DIODE SHOTKEY        | 40V 1A                  |
| 54   | 3   | 481250   | CON DB9 SUB RT ANGLE FM   | METAL CASE AMP7457814   |



VI — SCHEMATICS AND PARTS LIST

G. PAS10 & ADP500 MONITOR

1. 1A0030 — Parts List

Assy Tree for: 1A0030

Printed 12/22/2004

1A0030

ADP1000 FP PCB  
FP PCB AND PARTS

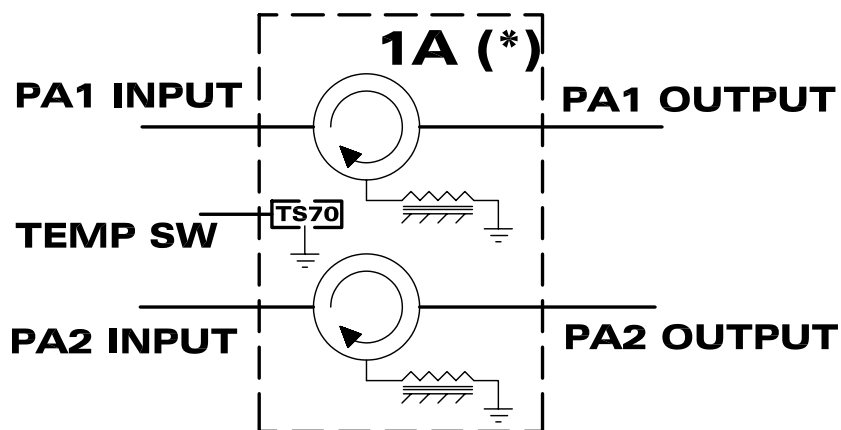
|          |          |       |
|----------|----------|-------|
| Type     | PL       | User1 |
| Revision | A        | User2 |
| Status   | U        | User3 |
| Date     | 1/5/2002 | User4 |
| By       | RA       | User5 |

| Item | Qty | P/N     | Title               | Detail                  |
|------|-----|---------|---------------------|-------------------------|
| Top  |     | 1A0030  | ADP1000 FP PCB      | FP PCB AND PARTS        |
| 1    | 1   | PC9054A | ADP1000 DISPLAY BRD | FR4 060 1/1 CRB         |
| 2    | 1   | 483001  | SW, 12 POS ROTOR    | SIG SEL SW ADP1000      |
| 3    | 3   | 484050  | SW, MOMENTARY PB    | OMRON B3WN-6002         |
| 4    | 22  | 150330  | RES 1/4W AXIAL TH   | 1.4 W 330 OHM TH AXIAL  |
| 5    | 22  | 630200  | IND LED DUAL COLOR  | RED/GREEN T1-3/4 CLR    |
| 6    | 2   | 480600  | CON HEADER 0.1 CTRS | PROTECTED HEADER 34 PIN |



VI — SCHEMATICS AND PARTS LIST

H. 1A5001/2 ISOLATOR ASSEMBLY



\* 1A5001 CH7-10

\* 1A5002 CH9-13

VHF ISOLATOR ASSEMBLY  
121304 RA  
PINEAPPLE TECHNOLOGY INC.



## VI — SCHEMATICS AND PARTS LIST

### H. 1A5001/2 ISOLATOR ASSEMBLY — Parts List

Assy Tree for: 1A5001/2

Printed 12/22/2004

#### 1A5001/2

2-WAY ISOLATOR ASSEMBLYLIT  
VHF HB 2KW TWO BAND SPLIT

|          |            |       |
|----------|------------|-------|
| Type     | PL         | User1 |
| Revision | A          | User2 |
| Status   | U          | User3 |
| Date     | 12/12/2004 | User4 |
| By       | RA         | User5 |

| Item | Qty | P/N       | Title                      | Detail                            |
|------|-----|-----------|----------------------------|-----------------------------------|
| Top  |     | 1A5001/2  | 2-WAY ISOLATOR ASSEMBLYLIT | VHF HB 2KW TWO BAND SPLIT         |
| 1    | 2   | U500T     | 500 W TERMINATION          | TYPE N CONNECTOR                  |
| 2    | 2   | CT-1682-N | CIR TYPE N 172-200 MHz     | VHF HB 600 W TYPE N               |
| 3    | 2   | CT-1683-N | CIR TYPE N 190-220 MHz     | VHF HB 600 W TYPE N               |
| 4    | 1   | 310013    | SW THERMAL                 | Thermostat; Auto Reset; 1/2" disc |



## **VII — ROUTINE MAINTENANCE**

The following KEY MAINTENANCE AND PERFORMANCE CHECKS should be made monthly or more frequently in some environments where dust is a problem:

### **TRANSMITTER**

- Remove and clean the air filters with a light detergent and dry completely before re-installing. **Dirty filters will cause PA amps to shutdown resulting in a loss of RF Power.** Spare filter P/N 990199 is available from Pineapple Technology Inc.
- Check and record the Voltage and Current meter readings on the ACDIS2 (AC AND DC DISTRIBUTION UNIT LOCATED NEAR THE POWER SUPPLIES). NOTE: current readings will vary with picture content.
- Using the ADP500 & PAS10 record the bias level settings on each PA Pallet by selecting the appropriate PA with the selector switch. To make this measurement of BIAS ONLY it is necessary to activate the PA INHIBIT switch momentarily for each reading.
- Using the ADP500 check and record the RF Output power level to insure that it is still reading 100% +/- 10% from the previous settings.
- Using the ADP500 check and record the VSWR (Reflected power) to insure that it is still reading only a few percent indicating normal load operations.
- Using the ADP500 check and record Aural power readings. This is normally set at 10% of P-Sync. Expect this to vary only a few percent from reading to reading.
- Carefully inspect RF Output coax and coaxial fittings for excessive heating or discoloration

### **FACILITIES**

- Clean all air inlet filters and exhaust outlets to insure that the transmitter is getting clean unobstructed air flow.
- Perform recommended service on air condition systems
- Rodent traps or baits should be renewed to keep the facilities clear of these pests which can damage to the transmitter



## **VIII — ADJUSTMENTS AND TUNING**

The VTX2KWA is basically a broadband transmitter with a few frequency selective sub-assemblies which comply with FCC Type Certification requirements. A list of these sub-assemblies are listed below and followed by general instructions where applicable:

- A. MODULATOR Instructions for making adjustments to the modulator are included in the Manufacturer's Instruction Manual
- B. BPV2KW Band Pass filter comes adjusted to the channel as purchased. To change frequency would require a tuning adjustment to the filter. To perform this adjustment it is necessary to use a NETWORK ANALYZER and a signal generator with necessary I/O Adaptors to connect to the filter. The Technician performing this adjustment should be skilled in tuning Band Pass Filters. If the target frequency is outside of the tuning range of the filter, it becomes necessary to purchase a new filter. Replacement filters and service is available from Pineapple Technology Inc.
- C. V600LDV2 POWER AMPLIFIER MODULE: The V600LDV2 has three areas where adjustments may be necessary over time or in the event of a frequency change. These areas are:
  - 1. Bias adjustments: The LDMOS FET devices used in these pallet amplifiers are set to 500ma/device side or a total of 1 amp/device. This adjustment can be made on the bench by first terminating the input and output with 50 ohm terminations. Apply 31 volts DC to the PA using a power supply that can provide a minimum of 15 amps. Note: a cooling fan will be necessary to cool the amplifier during this adjustment.

To adjust biases it is best to turn all the bias adjust resistors CCW or to minimum on the pallet being adjusted. Using a clamp on DC AMP Meter connected to the DC Feed terminal located on the DC ISOLATION AND CURRENT MONITOR BOARD measure the current levels. The first resistor is increased to 500ma indicated on the Amp meter. Repeat this adjustment for each additional resistor for reading of 1.0 A, 1.5 A, and 2.0 A. This will indicate that each device half is set to 500 ma.

This concludes the bias adjustment procedure. This adjustment should be made at all time when a device has to be replaced. Normal bias ranges from 1.5 amps to 2.3 amps per pallet as indicated on the ADP500/1000. DO NOT USE THE ADP500/1000 CURRENT READINGS FOR MAKING BIAS ADJUSTMENTS.

- 2. PA PALLET RF circuit tuning: These circuits are Broadband and Fixed tuned providing no adjustments. Any turning at this level is performed by the factory.
- 3. GAIN & PHASE MATCHING: Each V600LDV2 must be gain and phase matched to each unit in the system. This is accomplished by maintaining tight manufacturing tolerances on devices, cables, and component selection. No adjustment are required at this level and should not be attempted in the field



- D. **PHASE MATCHED CABLES:** The cables used to connect the splitter to the PA Amplifier inputs and those provided to connect the PA Amplifiers to the combiner are phase matched. If a cable is damaged and needs to be replaced, additional cables are available from Pineapple Technology Inc. The customer may manufacture additional cables, however the same coax type, connector, and lengths must be used.
- E. **ADP500/1000 WATT METER:** This unit comes calibrated from the factory for the rated power level of the transmitter. Adjustments are not recommended in the field.



## **IX — PROBLEM SOLVING**

The VTX2KWA is a complex assembly of Digital and Analog circuits and in many cases it is advisable to contact Pineapple Technology Inc for assistance. If it is necessary to perform field service on the transmitter, most parts are available from Pineapple Technology Inc for next day shipment.

The failure analyzes of the transmitter starts off with the following assumptions:

- A. The transmitter is connected to an AC Source which is within the specified voltage range and has ample power to run the transmitter. This would normally be 208-240 V AC SINGLE PHASE with a minimum of 60 Amps available.
- B. The antenna has been checked out and verified to have a VSWR of 1.2:1 or better.
- C. The room temperature is < 35 degrees Celsius.
- D. There are no restrictions on the air flow in or out of the building
- E. The video and aural signals, to the Modulator, comply with stated specifications.

### **CHECKING THE WARNING LIGHTS**

MFA1KW: This unit has dual performance indicator lights located above the air inlets. One set of lights for each PA Assembly located inside the unit.

|              |       |        |
|--------------|-------|--------|
| HS OVER TEMP | GREEN | NORMAL |
|              | RED   | FAULT  |
| +28 VDC      | GREEN | NORMAL |
|              | RED   | FAULT  |
| FAN SUPPLY   | GREEN | NORMAL |
|              | RED   | FAULT  |

HS OVER TEMP FAULT could indicate one of the following problems:

- a. Room temperature too high and the HS are over heating
- b. High VSWR on PA output port will cause to Dump Load sensor to Fault.
- c. Air filters are dirty and need to be cleaned
- d. Exhaust fan failure. (located in the top of the rack)

+28 VDC FAULT could indicate a power supply failure. Check the ADP500 & PAS10 for PA voltage and current readings. The power supply modules will also indicate a loss of power.

FAN FAULT indications could mean that the PA blower has failed or there has been a loss of AC power



to the fan. There is also a fuse located just inside of the front panel in case there is a locked rotor failure condition. To access the fuse, the MFA1KW must be removed for the rack and the top cover removed. The fuse is located just behind the front panel.

ADP500: There are a number of fault indicator lights on this unit that can be used for trouble shooting possible problems with the transmitter.

With normal operating conditions, all the LEDs located on the front panel should be green. Red lights could indicate a fault in normal operations of the transmitter. Fault indicators are listed below:

- a. ANT VSWR HIGH light is RED. This indicated that the antenna reflected power exceeds the set point in the equipment which is normally set to 10 %. When this LED is on, the transmitter shutdown line is pull down to ZERO and the transmitter RF PWR OFF LED will also light RED indicated that the transmitter has been shutdown at the driver level. This condition will automatically reset when the problem is corrected. CHECK THE ANTENNA FOR POSSIBLE FAULTS.
- b. RF PWR OFF light is RED. This will occur anytime the “SHUTDOWN LINE” is pulled to ZERO. This control line is pulled to ZERO with any of the following faults:
- c. ANT VSWR HIGH

PA INHIBIT SWITCH IN THE INHIBIT MODE

NOTICE: ONLY THE PA INHIBIT SWITCH OR THE ANT VSWR HIGH WILL SHUTDOWN THE TRANSMITTER DRIVE CAUSING THE RF OUTPUT TO FALL TO NEAR ZERO.

- d. PA1 THRU PA5 LEDs RED would indicate that the PA Pallet current level has fallen below the set point and could indicate a transistor failure.

### **RR6000 (AC2008) POWER SUPPLY MODULES**

The Power Supply module has two warning lights located on the front panel. Normally these lights are GREEN indicating that the AC Line voltage and the Over Voltage circuits are within their normal range. Should either go out of range, the lights will turn RED and the power supply module will shutdown. This will reduce the available power to the RF Stages and could result in lower RF Output Power from the transmitter. If this happens, turn off the transmitter for about 1 minute and then turn it back on. If this warning continues, the module should be removed from the rack and returned for service and a spare module should be installed to maintain normal operations.

NOTICE: The VTX2KWA transmitter has 4 each 2 KW power modules. Under normal conditions, this is enough head room to allow the removal of one power supply module with little or no reduction in output power. In the event it becomes necessary to remove a module and the RF Output power drops, the RF Drive level from the Modulator can be reduced to a point where the DC Volt meter on the ACDIS2 reads 31 volts. This is the maximum output level obtainable with one power supply module removed. On this transmitter that could be a reduction of less than 500 watts in operational output power. This will keep the station on the air till the new power supply module arrives. DON'T FORGET TO TURN THE DRIVE LEVEL UP AFTER INSTALLING THE NEW SUPPLY TO RETURN TO 100% OPERATION.



## **X — WARRANTY**

The WARRANTY provided by Pineapple Technology, Inc. (PTI) on this transmitter is detailed below. It should be noted that some of the equipment sub-systems have warranty coverage by the original manufacture that differs from the standard warranty provided by PTI. Warranty details on equipment falling into this category may be found in the Manufacturer's instruction manual provided with the transmitter. In all cases, replacement units of this equipment are normally in stock at PTI for quick turn service support to our customers during the PTI Standard Warranty period.

### **STANDARD WARRANTY**

Seller warrants that each Product sold by it is free of defects in materials and workmanship. Seller's obligation under said warranty continues for a period of one (1) year from date of shipment. Repairs or replacement of defective parts shall be the sole and exclusive remedy under warranty, at Seller option, provided that Seller may, as an alternative, elect to refund an equitable portion of the purchase price of the product. THIS WARRANTY IS EXPRESSLY IN LIEU OF AND EXCLUDES ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE, USE, OR APPLICATION, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF THE SELLER, UNLESS SUCH OTHER WARRANTIES, OBLIGATIONS OR LIABILITIES ARE EXPRESSLY AGREED TO IN WRITING BY SELLER.

### **WARRANTY REPLACEMENT AND REPAIRS**

All claims under warranty must be made promptly after occurrence of circumstances giving rise to thereto and must be received within the applicable warranty period by seller or its authorized representative. Such claims must be documented on a PTI \*Field Failure Report with a full description of the circumstances giving rise to the claim. Before any products are returned for repair and/or adjustment, written authorization from seller or its authorized representative for the return and instructions as to how and where these products should be shipped must be obtained — This is to include a Return Authorization (RA) number provided by the seller or authorized representative, this must accompany ALL returns. Any product returned to seller for examination shall be sent prepaid via the means of transportation indicated as acceptable by seller. Seller reserves the right to reject any warranty claim not promptly reported and any claim on any item that has been altered, i.e. circuit modifications, components removed, or has been shipped by non acceptable means of transportation. When a product has been returned for examination and inspection, or for any other reason, customer shall be responsible for all damage resulting from improper packaging or handling, and for loss in transit, notwithstanding any defect or nonconformity in the product. In all cases the seller has sole responsibility for determining the cause and nature of the failure, and the Seller's determination with regard thereto shall be final. If it is found that Seller's Product has been returned without cause and is still serviceable, customer will be notified and the Product returned at its expense, in addition, a charge for testing and examination may, in Seller's sole discretion be made on Products so returned.

*\*A Field Failure Report is included at the end of this manual — Additional Field Failure Reports can be obtained by calling Pineapple Technology, Inc. at (916) 315-8338 or you may download one from our web site at [www.ptibroadcast.com](http://www.ptibroadcast.com) in the Warranty section.*



## **XI — OPTIONAL EXTENDED WARRANTY**

Pineapple Technology, Inc. transmitters come with the option of extending the standard warranty for up to 5 years. To exercise this option, the purchaser must buy and pay for the option at the time the transmitter is purchased. The cost of the EXTENDED WARRANTY OPTION is in accordance with the following schedule:

|          |                                   |
|----------|-----------------------------------|
| 1st year | NO CHARGE                         |
| 2nd year | 10% of transmitter purchase price |
| 3rd year | 10% of transmitter purchase price |
| 4th year | 10% of transmitter purchase price |
| 5th year | 10% of transmitter purchase price |

A five year EXTENDED WARRANTY would cost 40% of the original selling price of the transmitter. The purchaser may exercise all or part of the EXTENDED WARRANTY as needed.