



# **DTXPRO-1.2KU INSTRUCTION MANUAL**

PINEAPPLE TECHNOLOGY, INC  
*PRELIMINARY DRAFT*

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# **SECTION I**

## **SAFETY NOTICES**

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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.

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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.

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BEFORE CONNECTING THIS EQUIPMENT TO ANY AC ELECTRICAL SOURCE READ THE SECTION ON INSTALLATION. ALL ELECTRICAL WIRING FOR THIS EQUIPMENT MUST BE PERFORMED 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.

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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.***

# Section II

## Transmitter Specifications



**II – TRANSMITTER SPECIFICATIONS**

**OPERATING**

|   |  |
|---|--|
| Input Connector.....                    | ASI or SMPTE310M                                     |
| Transport Stream Data Rate.....         | 75 Ohm BNC   |
| External GPS Clock Input.....           | 19,390 kbps  |
| Power Output.....                       | Optional   |
| RF Output Impedance.....                | 800 to 1.2 KW AVG POWER                              |
| RF Output Connector.....                | 50 ohms  |
| Frequency Range .....                   | 1 5/8" EIA Standard (7-16 DIN and 7/8" EIA Optional) |
| Frequency Stability.....                | 470 – 806 MHz (Channel 14 to Channel 69)             |
| Modulation.....                         | < ±10 kHz  |
| Channel Bandwidth.....                  | 8VSB   |
| Peak to Peak Group Delay.....           | 6 MHz  |
| Conducted Spurious & Harmonics.....     | < 20 ns  |
| Radiated Spurious & Harmonics.....      | FCC 74.794 Compliant                                 |
| MER.....                                | FCC 2.1053 Compliant                                 |
| IMD shoulders for upper or lower SB.... | 35 dB Typical  |
| Digital Emissions.....                  | -50dB Typical  |
| AC Power Consumption.....               | FCC 74.794 Compliant                                 |
| AC Line Voltage.....                    | 6.3 kW maximum                                       |
| AC Line Frequency.....                  | 208 – 240 VAC Single Phase                           |
| Input Transport Stream.....             | 60 Hertz   |

**GENERAL**

|                             |  |
|-----------------------------|--|
| Operating Temperature ..... | -10 to +35 Degrees Celsius Ambient<br>+14 to +95 Degrees Fahrenheit Ambient                |
| Altitude.....               | 5,000 ft without additional cooling. High altitude package available for up to 12,000 feet |
| Cooling Requirement.....    | Self contained with un-obstructed air inlets and exits                                     |
| Weight.....                 | 690 lbs  |
| Dimensions Overall.....     | 23" x 89" x 32" (W x H x D) Standard   |

**THESE SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

## **Section III**

# **Transmitter Installation**



### III. TRANSMITTER INSTALLATION

To ensure long and reliable trouble-free service from the DTXPRO-1.2KU transmitter the following steps for installation are recommended:

1. **MECHANICAL INSTALLATION:** The DTXPRO-1.2KU 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 earthquake 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 above to allow the air to exhaust from the transmitter. Air flow thru the transmitter is approximately 2,000 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° Celsius (95° F), 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 ensure the installing crews have proper insurance coverage.

2. **GROUNDING:** Transmitter grounding is **VERY IMPORTANT** and must be done correctly for safety and operational reasons. The single point grounding technique can be effective to protect multiple pieces of equipment installed inside an equipment rack cabinet. Treat the rack the same as you would a building, a copper bus bar has been mounted inside the cabinet to act as both an entrance panel and reference ground for all conductors entering and leaving the rack. It is recommended the customer install an AC surge protector at this point in shunt to ground, and install a series impedance between the panel and the equipment. The chassis of each piece of equipment has been bonded to this buss bar with a single copper braid or strap. Redundant ground connections by means of the AC cable and the shields of audio cables should be avoided when possible. Finally, connect the rack's access panel to the building reference ground using a heavy gauge wire such as #2 AWG stranded copper or solid copper buss one (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 be 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:** Wiring to the house electrical sub-panel will use the supplied 4-wire cable already connected to the ACDIS2 Panel inside the transmitter cabinet. Connections to the AC Main should be made as follows:

- RED and BLACK are connected to the 220 VAC.
- WHITE WIRE is connected to NEUTRAL.
- GREEN WIRE is connected to 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 ensure that the proper breaker size is selected for the main circuit.





### III. TRANSMITTER INSTALLATION (Continued)

4. **ANTENNA CONNECTION:** The transmitter is equipped with a 1 5/8" EIA flange connector located at the top of the rack. The RF ATSC Compliant Mask Filter and output Directional Coupler(s) are provided with the transmitter and are to be located and mounted at the customer discretion. Pineapple Technology recommends the filter be securely mounted above the transmitter cabinet but not in a position that could inhibit air circulation from the top of the cabinet. The customer is responsible for the procurement and placement of the RF cable connection between the cabinet 1 5/8" output flange and the 1 5/8 input flange to the mask filter. The directional coupler is usually mounted on the output of the mask filter convenient for connection to the station antenna transmission line. Two cables have been provided for connection between the output directional coupler monitor ports and the DXDPRO-10U Modulator. Conditions vary from site to site so some engineering may be required to ensure that the antenna is receiving the correct amount of power to comply with FCC licenses and to ensure safety from lightning, etc.

# **SECTION IV**

## **Transmitter Turn-On Procedure**



## 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 switched to ensure that they are all in the OFF position.
5. Turn-on the Main AC breaker located in the house service sub-panel.
6. Turn-on the Main AC Breaker on the front of the transmitter cabinet located on the front of the ACDIS3 Power Distribution sub-assembly. 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 RACK TOP FAN and AMP FANS breaker located on the ACDIS2 front panel. The PA fans and rack exhaust fans should come on.
9. Turn-on the AC power supply breakers located on the front panel of the ACDIS2. Check the power supply modules, one (1) each, to see if the green light is lit indicating normal operation.
10. Using the ADP500, check the idling currents on each PA to ensure that the currents are in the correct range. Typical range is 0.5 to 2.5 amps. See ADP500 Operating Section for details.

***NOTICE: The modulator has been set at the factory for optimum output power and should not need adjustment. The DXDPRO-10U output power reading, upon initial turn-on, will show approximately 10% to 20%. The following steps are used to bring the transmitter up to full output power.***

11. Turn-on the power switch for the DXDPRO-10U exciter. **Note: The exciter will take several minutes to ramp up. Do not make any adjustments during this ramp up period.**
12. The power control and ALC functions are located on the front panel of the DXDPRO-10U. Select the power display feature located to the right of the power control switches by toggling the switch next to the LCD display. Power reading is in percent of license requirements as specified on purchase order. **FULL POWER IS SHOWN AS 100%** and is a factory setting.



#### IV --- TRANSMITTER TURN-ON PROCEDURE (Continued)

13. Using the power control switches increase power to 50%. **Do not exceed this level till the reflected power from the load or antenna is checked.** This can be done by selecting the REFLECTED POWER DISPLAY (RFLD). Reflected power should not exceed 5%.
14. If the power reflected (RFLD) exceeds 5% the load or antenna, coaxial cables, and fittings must be check for possible faults. This must be corrected before increasing power over 50%.
15. With <5% (RFLD) power record the current levels on the ADP500 for each amplifier stage and compare this to the test data recorded at the factory during transmitter setup. If current levels are approximately the same as factory readings it is ok to increase power to 100% (FWRD).
16. Return to the PA current readings on the ADP500 to verify that all the currents are approximately the same.
17. Record these measurements in station maintenance log for future reference.

**Note: This transmitter is FCC Type Certified to operate between 800 and 1200 watts average power. This transmitter is calibrated to read 100% at the output power level stated on the purchase order. It is assumed that this is the level stated on the owner's license. The FCC requires that the output power level of the transmitter be set to 100% indicated output power. Any variation to this may cause the transmitter to perform out of specification and not be compliant with manufacture's or FCC rules**

# **SECTION V**

## **Theory of Operation**



## V. THEORY OF OPERATION

### A. INTRODUCTION

The DTXPRO-1.2KU 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 DTXPRO-1.2KU is BASIC and MODULAR with most subassemblies field replaceable. Special emphasis was placed on "KEEPING IT SIMPLE" and returning to more traditional transmitter layouts and instrumentation. Refer to the DTXPRO-1.2KU block diagram for an overview of the transmitter architecture. This will give the technician basic information needed to understand the operation of the transmitter and the function of each subassembly.

**SEE SECTION (VI) FOR SUBASSEMBLIES AND BLOCK DIAGRAM.**

### B. ACDIS2 AC AND DC DISTRIBUTION

The ACDIS2 is the primary AC power inlet module. The DTXPRO-1.2KU transmitter was designed to accept 208 to 240 VAC Single Phase using a four (4) wire connection. The four wires are:

- 2 wires for 208 -240 VAC 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 TRANSMITTER INSTALLATION Section III.3. If not followed, severe damage to the transmitter and, or, electrical shock could result.

The ACDIS2 performs the following functions:

1. Provides a primary AC power breaker point to shutdown the transmitter
2. Provides 208-240 VAC power to each of the 2 KWDC power supplies with individual breaker points for added safety.
3. Provides 110 VAC circuits for DXDPRO-10U, ADP500, ABS (as necessary) 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.



## V -- THEORY OF OPERATION (Continued)

### **C. PS6KW 6 KW POWER SUPPLY ASSEMBLY FOR 50 VDC OPERATION**

The DTXPRO-1.2KU transmitter is designed with over 6 KW of DC power. To achieve this level, the power supply in each transmitter rack is made up of three (3) AC2050 power modules mounted into one (1) main frame assembly, AC2009, which is capable of managing all three (3) 2 KW modules.

The power modules are "HOT PLUGGABLE" and can be removed or installed without turning off the transmitter. A third power supply module can be purchased for added redundancy.

Each power supply module 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 FOR THE RRSI SERIES POWER SUPPLY PROVIDED WITH THIS DTXPRO-1.2KU USERS MANUAL.

### **D. ADP500 PERFORMANCE MONITOR AND PAS SELECTOR SWITCH**

The ADP500 Performance Monitor provides the following functions:

1. Provides device current monitoring of all the pallets used in the three (3) PA1K-50 power amplifier assemblies. The current levels can be read directly from the multi-meter on the front panel. Individual PA's and pallets are selectable on the ADP500 and PAS. In normal operation, a PA FAULT is indicated when the LED goes from green to red. RED indicates that the current level is below 500 mA and a transistor device may have failed. To read the actual current, select the appropriate Power Amplifier (i.e.: PA1, PA2 or PA3) using the rotary switch on the PAS. Then, using the rotary switch on the ADP500, rotate through the 5 PA positions to measure the drain current on each transistor device for the selected power amplifier module. The multi-meter will read the actual current.
2. 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 were recorded at the factory and are found on the Transmitter Test Report, DC Test Report Section. This is the best way to troubleshoot 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 TTL 0 state and the output power has been reduced to near zero.



V -- THEORY OF OPERATION (Continued)

**D. ADP500 PERFORMANCE MONITOR AND PAS SELECTOR SWITCH (Continued)**

3. An RF MONITOR port (BNC) is available to connect a spectrum analyzer for monitoring the output signal.
4. METER SELECTION SWITCHES – The rotary switches on the PAS are used to select the appropriate PA module (PA1K) for performance display on the ADP500. The PA designations on the ADP500 are PA5, the driver transistor device then PA1 and PA2, indicating the devices on the left side DX500U Pallet. PA3 and PA4 indicate the current through the devices on the right side DX500U Pallet.

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

|                 |  |
|-----------------|--|
| PA5             | Reads PA Driver device currents as selected<br>Typical reading in INHIBIT MODE 1.5 to 2.5 A.<br>Typical reading in normal transmitter operation approximately 1 to 2 amps.   |
| PA1 to 4        | Reads the individual drain currents on each device located on the pallets located on the left and right side of the Power Amp selected.<br>Typical reading in normal transmitter operation is approximately 7 to14 amps. |
| PA6             | Not used   |
| PS VOLTS        | Reads DC voltage applied to PA stages Typical reading for 50 VDC would be the center of the meter, in the green zone.  |
| *P FWRD         | Reads PA output power from the mask filter in RMS percentage of rating. 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. Typical reading would be < 5% indicated.  |
| AUX 1 AND AUX 2 | Not used in this configuration.  |

\*This feature is disabled on units used in the DTXPRO-1.2KU. This feature is displayed on the DXDPRO-10U Modulator/Exciter front panel.





## V. THEORY OF OPERATION (Continued)

### **E. DXDPRO-10U DIGITAL MODULATOR AND EXCITER**

The heart of any TV Transmitter is the Modulator. This equipment receives the ASI or SMPTE digital stream from the program source. The modulator generates the ATSC/8VSB signal and up converts it to the desired Television Channel.

The modulator performs several additional important function as listed below;

1. Manages the linear and non linear correction of the output signal.
2. Provides a platform for all alarms and monitoring functions via Ethernet.
3. Manages TS inputs

**REFER TO INSTRUCTION MANUAL PROVIDED WITH THIS PACKAGE FOR MORE DETAILS ON OPERATING AND USING THE DXDPRO-10U MODULATOR..**

### **F. PA1KU-50 FINAL AMPLIFIER**

The DTXPRO-1.2KU transmitter uses three (3) PA1KU-50 integrated power amplifiers. See section VI PA1KU-50 for block diagram and parts list. This integrated final amplifier assembly is built using 50 VDC power transistors and includes a full power isolator with an 800 watt dump load

### **G. DRIVER AND ALC CIRCUITS ARE INCLUDED IN THE DXDPRO-10U MODULATOR/DRIVER.**

1. The ALC and output power level adjustments are integrated into the DXDPRO-10U modulator. These controls perform the same as the previous driver with ALC (DR50U). Additional information is also available in the DTXPRO-10U MODULATOR MANUAL.

The ALC function when active is designed to keep the transmitter output power at a predetermined level, typically 100%. The output power is sampled with a directional coupler located after the digital mask filter. The power sampled is detected in the modulator and a DC voltage proportional to the power level is provided to the processor for display on the front panel and on the Ethernet Web Page.

2.0 VDC = 120% Output Power

1.8 VDC = 100% Output Power

1.3 VDC = 50% Output Power

**Note: % FWD Power =  $30V^2$**

**% RFLD Power =  $12.5V^2$**

The ALC is adjusted to maintain the output power you have selected at a constant level.



## V -- THEORY OF OPERATION (Continued)

### **G. DRIVER AND ALC CIRCUITS ARE INCLUDED IN THE DXDPRO-10U Modulator/Driver (Continued)**

2. Command Functions - The three front panel “NO” (momentary) push buttons – POWER UP, POWER DOWN, SET/RESET – can be remotely operated by a momentary relay closure to ground. Each operation is internally pulled up to 5 VDC through a 10K resistor. The SET/RESET push button toggles the DR50UD between manual and track modes. In manual mode the transmitter power may be raised or lowered by use of the POWER UP or POWER DOWN buttons until the desired transmitter output power is obtained. Momentarily pressing the SET/RESET push button toggles the DR50UD into TRACK mode where the ALC board maintains that power level.

### **H. USH3C 3-WAY SPLITTER**

The USH3C 3-Way Phased Splitter receives the output from the DXDPRO-10U and splits it into 3 parts. Two outputs are at 0 degrees phase and the third output is shifted 90 degrees. This unit is an isolated phased splitter and will provide some isolation in the event one PA fails.

### **I. UCH2KU-3 MULTICOUPLER COMBINER**

The UCH2KU-3 is a 3-Way Phased Multicoupler Combiner. This multicoupler accepts the phased output power from each of the three (3) PA1K-50 Power Amplifiers and combines them into an output power level slightly higher than the rated transmitter output power in order to compensate for the filter insertion loss. This is a closed unit and cannot be serviced.

### **J. DC5KC-1 DIRECTIONAL COUPLER**

The DC5KC-1 Directional Coupler provides for insertion monitoring of forward (FWD) and reflected (RFLD) RF power after the mask. These monitor signals are sent to the ADP500 for display, operation of the ALC feature and adaptive pre-correction when the DXD100AU exciter is installed. These directional couplers also provide sample power to the modulator Adaptive correction circuits.

### **K. BPUD2.5K ATSC COMPLIANT MASK FILTER**

This mask filter was designed to meet FCC Certification requirements with minimum loss of RF Power. The BPUD2.5k comes tuned and tested to the operating frequency of the transmitter and should not be adjusted without proper equipment and experience. It is recommended that, should adjustment become necessary, the filter be returned to the factory.



## V -- THEORY OF OPERATION (Continued)

### L. BPL5KU-KK HARMONIC FILTER

This harmonic (also sometimes called Low Pass) filter is inserted at the output of the ATSC mask filter and before the transmission line to the antenna to provide necessary filtering of channel harmonics to meet FCC Rules.

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# **SECTION VI**

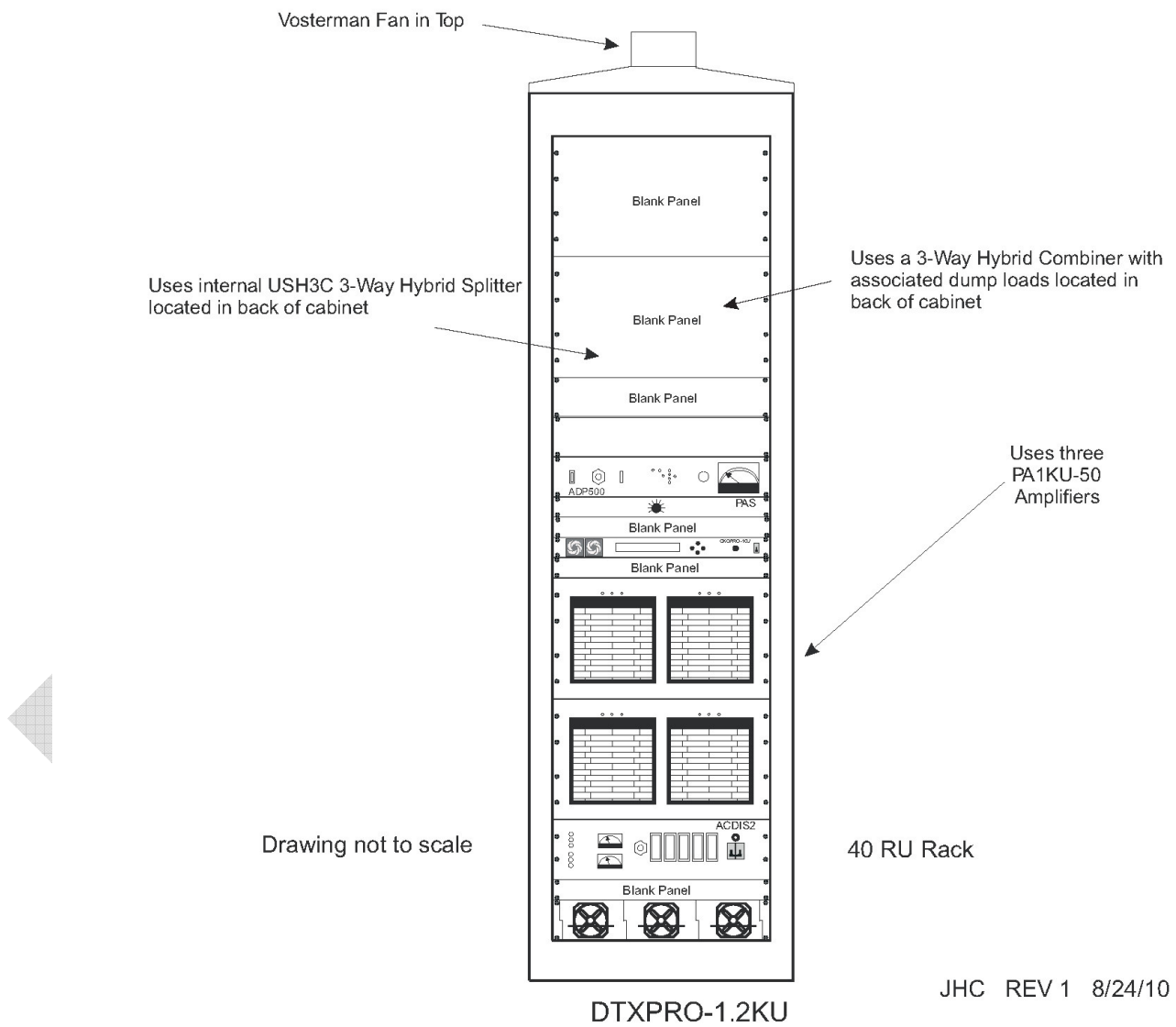
**Block Diagrams  
Photos  
And  
Parts List**

## VII. BLOCK DIAGRAMS AND PARTS LISTS

*Section VI includes a DTXPRO-1.2KU block diagram and block diagrams, parts lists, and/or photos of many of the components in the DXTPRO-1.2KU.*

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# VI. -DTXPRO-1.2KU RACK LAYOUT





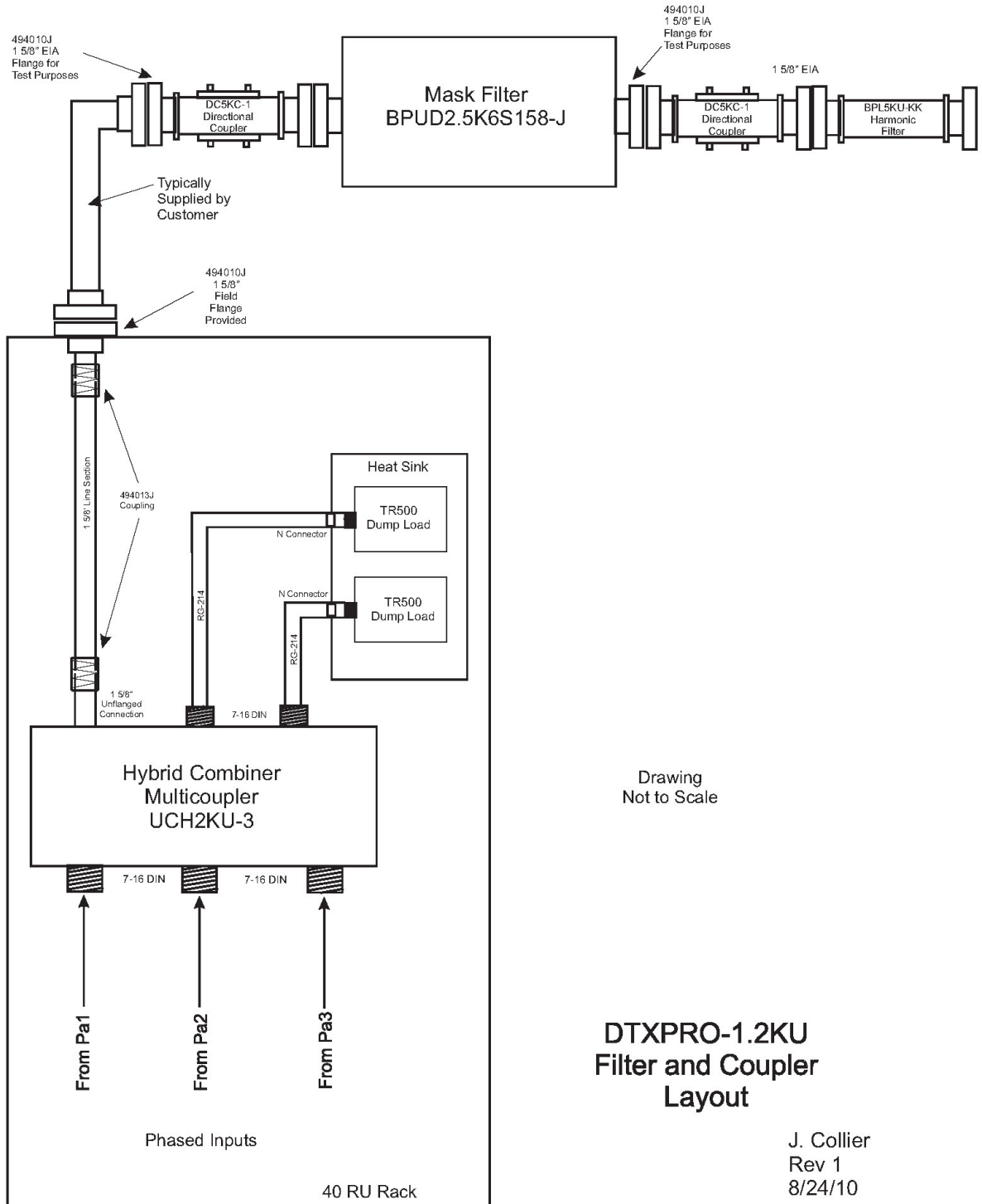
## **VI - BLOCK DIAGRAMS AND PARTS LIST**

**The following subassemblies make up the DTXPRO-1.2KU:**

1. DC5KC-1 DIRECTIONAL COUPLER
2. BLP5KU-KK HARMONIC FILTER
3. BPUD2.5K6S158-J MASK FILTER
4. TR-500 TERMINATION
5. UCH2KU-3 HYBRID COMBINER MULTICOUPLER
6. MFA2PA
  - 6A. PA1KU-50
  - 6B. 1A0035
6. ADP500 MONITOR
7. PAS6 PA SELECTOR
8. USH3C SPLITTER
9. DXDPRO-10U MODULATOR
10. ACDIS2
11. PAS6KW
12. PA FANS
13. RACK FAN
14. DUST FILTERS



**VI. DTXPRO-1.2KU FILTER AND COUPLER LAYOUT** (Includes: DC5KC-1 Directional Coupler, BLP5KU-KK Harmonic Filter, BPUD2.5K6S158-J Mask Filter, TR-500 Termination and UCH2KU-3 Hybrid Combiner Multicoupler)



**VI. DC5KC-1 DIRECTIONAL COUPLER**

