

ADC

TELECOMMUNICATIONS

TECHNICAL MANUAL

EXHIBIT II

(PRELIMINARY)

5721

**DIGITAL ITFS/MDS/MMDS
TRANSMITTER**

REV: 0

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5721

SYSTEM DESCRIPTION

The 5721 is a complete MDS/MMDS/ITFS transmitter capable of operating as a television transmitter at a nominal power of 2.5 watts average output power. The 5721 incorporates Automatic Level Control (ALC) to maintain a constant output power level.

Combining the latest in GaAs FET amplifier technology, the 5721 delivers an output power of 2.5 watts (average).

The unit's circuitry is enclosed in a tray assembly designed for mounting in a standard 19" equipment rack. The unit comes complete with slide rail mounting hardware to allow the tray to move in and out of the rack for ease of service. The outside dimensions of the tray assembly are 19" x 21" x 8.75" (WxDxH).

The 5721 is factory calibrated for a front panel LCD display power meter reading of 100%, which represents the rated output power of the unit (unless otherwise specified).



WARNING!!!

◀ HIGH VOLTAGE ▶

DO NOT ATTEMPT TO REPAIR OR TROUBLESHOOT THIS EQUIPMENT UNLESS YOU ARE FAMILIAR WITH ITS OPERATION AND EXPERIENCED IN SERVICING HIGH VOLTAGE EQUIPMENT. LETHAL VOLTAGES ARE PRESENT WHEN POWER IS APPLIED TO THIS SYSTEM. IF POSSIBLE, TURN OFF POWER BEFORE MAKING ADJUSTMENTS TO THE SYSTEM.

★ RADIO FREQUENCY RADIATION HAZARD ★

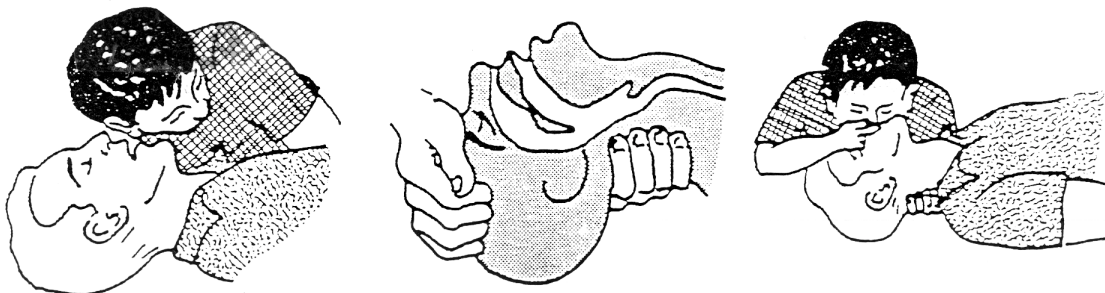
MICROWAVE AMPLIFIERS AND TUBES GENERATE HAZARDOUS RF RADIATION WHICH CAN CAUSE SEVERE INJURY INCLUDING CATARACTS, WHICH CAN RESULT IN BLINDNESS. SOME CARDIAC PACEMAKERS MAY BE AFFECTED BY THE RF ENERGY EMITTED BY MICROWAVE AMPLIFIERS. NEVER OPERATE A MICROWAVE SYSTEM WITHOUT A PROPERLY MATCHED RF ENERGY ABSORBING LOAD ATTACHED. KEEP PERSONNEL AWAY FROM OPEN WAVEGUIDES AND ANTENNAS. NEVER LOOK INTO AN OPEN WAVEGUIDE OR ANTENNA. MONITOR ALL PARTS OF THE RF SYSTEM FOR RADIATION LEAKAGE AT REGULAR INTERVALS.

WARNING!!!

DO NOT ATTEMPT TO REPAIR OR TROUBLESHOOT THIS EQUIPMENT UNLESS YOU ARE FAMILIAR WITH ITS OPERATION AND EXPERIENCED IN SERVICING HIGH VOLTAGE EQUIPMENT. LETHAL VOLTAGES ARE PRESENT WHEN POWER IS APPLIED TO THIS SYSTEM. IF POSSIBLE, TURN OFF POWER BEFORE MAKING ADJUSTMENTS TO THE SYSTEM.

EMERGENCY FIRST AID INSTRUCTIONS

Personnel engaged in the installation, operation, or maintenance of this equipment are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.



RESCUE BREATHING

1. Find out if the person is breathing.

You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing you can feel the air on your cheek. You can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.

2. If he is not, open the airway by tilting his head backwards.

Lift up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself. If it does not, begin rescue breathing.

3. If he is still not breathing, begin rescue breathing.

-Keep his head tilted backward. Pinch nose shut.

-Put your mouth tightly over his mouth.

-Blow into his mouth once every five seconds

-DO NOT stop rescue breathing until help comes.

LOOSEN CLOTHING - KEEP WARM

Do this when the victim is breathing by himself or help is available. Keep him as quiet as possible and from becoming chilled. Otherwise treat him for shock.

BURNS

SKIN REDDENED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with clean sheet or cloth to keep away air. Consult a physician.

SKIN BLISTERED OR FLESH CHARRED: Apply ice cold water to burned area to prevent burn from going deeper into skin

tissue. Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

EXTENSIVE BURN - SKIN BROKEN: Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

MATERIAL RETURN PROCEDURE

In order to efficiently handle equipment or components returned for repair or sent out on loan, ADC requests that each returned item be accompanied by a Material Return Authorization Number (MRA#).

To obtain an MRA follow the procedures below:

- ☐ Call ADC Customer Service at (800) 215-2614
or FAX (724) 941-4603
- ☐ A Service Engineer will provide you with an MRA#
- ☐ Write the MRA# on the packing list or in the case of repairs, a note describing the reason for return. Also, be sure to include contact information.
- ☐ Send ALL MRA items to the following address

ADC CORPORATION
102 RAHWAY ROAD
McMURRAY PA 15317

TELEPHONE TECHNICAL SUPPORT

ADC currently provides free telephone technical support. When calling, be prepared to provide the following information:

- ☐ Transmitter model # AND Serial #
- ☐ Status of front panel LED's (are any red LED's on ?)
- ☐ Have a copy of your operation manual ready prior to calling

From 8:00 AM - 5:00 PM EST call (800) 215-2614 for technical support

PROPER PACKING OF MATERIALS

When returning materials to ADC, it is extremely important to pack them properly. Due to the delicate nature of components contained within the equipment, major damage can occur without proper packing. Please adhere to the following guidelines when returning materials.

☐ Save the boxes that the transmitter is shipped in. Each tray is sent double boxed and enclosed in foam padding. Use the same packing method when returning materials.

☐ In the event original packing materials are not available call ADC at (800) 215-2614 to request proper shipping materials. A fee of \$25.00 will be charged for each shipping box required.

Failure to properly pack any returned materials may result in damage to the equipment. ADC is not responsible for damaged equipment under these circumstances. Many freight companies will not compensate for damages when items are not packed properly. Please pack items properly!

LIMITED WARRANTY TWO YEAR

Seller warrants each new product manufactured and sold by Seller against defects in material and workmanship under normal use and service, for a period of two (2) years from the date of shipment from Seller's plant, when operated in accordance with Seller's operating instructions. This warranty shall not apply to tubes, fuses, batteries, or bulbs.

Warranties are valid only when and if (a) Seller receives prompt written notice of breach within the period of warranty, (b) the defective product is properly packed and returned by the Buyer (transportation and insurance prepaid), and (c) Seller determines, in its sole judgment, that the product is defective and not subject to any misuse, neglect, improper installation, negligence, accident, or (unless authorized in writing by Seller) repair or alteration. Seller's exclusive liability for any personal and/or property damage (including direct, consequential or incidental) caused by the breach of any or all warranties, shall be limited to the following: (a) repairing or replacing (in Seller's sole discretion) any defective parts free of charge (F.O.B. Seller's plant), and/or (b) crediting (in Seller's sole discretion) all or a portion of the purchase price to the Buyer.

Equipment furnished by Seller, but not bearing its trade name, shall bear no warranties other than the special hours-of-use or other warranties extended by or enforceable against the manufacturer at the time of delivery to the buyer. **NO WARRANTIES, WHETHER STATUTORY, EXPRESSED OR IMPLIED, AND NO WARRANTIES OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR FREEDOM FROM INFRINGEMENT, OR THE LIKE, OTHER THAN AS SPECIFIED IN PATENT LIABILITY ARTICLES, AND IN THIS ARTICLE, SHALL APPLY TO THE EQUIPMENT FURNISHED HEREUNDER.**

dBm, dBw, dBmV, dB μ V, AND VOLTAGE EXPRESSED IN WATTS

50 ohm system

WATTS	PREFIX	dBm	dBw	dBmV	dBμV	VOLTAGE
1,000,000,000,000	1 TERAWATT	+150	+120			
100,000,000,000	100 GIGAWATTS	+140	+110			
10,000,000,000	10 GIGAWATTS	+130	+100			
1,000,000,000	1 GIGAWATT	+120	+ 99			
100,000,000	100 MEGAWATTS	+110	+ 80			
10,000,000	10 MEGAWATTS	+100	+ 70			
1,000,000	1 MEGAWATT	+ 90	+ 60			
100,000	100 KILOWATTS	+ 80	+ 50			
10,000	10 KILOWATTS	+ 70	+ 40			
1,000	1 KILOWATT	+ 60	+ 30			
100	1 HECTROWATT	+ 50	+ 20			
50		+ 47	+ 17			
20		+ 43	+ 13			
10	1 DECAWATT	+ 40	+ 10			
1	1 WATT	+ 30	0	+ 77	+137	7.07V
0.1	1 DECIWATT	+ 20	- 10	+ 67	+127	2.24V
0.01	1 CENTIWATT	+ 10	- 20	+ 57	+117	0.707V
0.001	1 MILLIWATT	0	- 30	+ 47	+107	224mV
0.0001	100 MICROWATTS	- 10	- 40			
0.00001	10 MICROWATTS	- 20	- 50			
0.000001	1 MICROWATT	- 30	- 60			
0.0000001	100 NANOWATTS	- 40	- 70			
0.00000001	10 NANOWATTS	- 50	- 80			
0.000000001	1 NANOWATT	- 60	- 90			
0.0000000001	100 PICOWATTS	- 70	-100			
0.00000000001	10 PICOWATTS	- 80	-110			
0.000000000001	1 PICOWATT	- 90	-120			

TEMPERATURE CONVERSION

$$^{\circ}\text{F} = 32 + [(9/5) ^{\circ}\text{C}]$$

$$^{\circ}\text{C} = [(5/9) (^{\circ}\text{F} - 32)]$$

USEFUL CONVERSION FACTORS

TO CONVERT FROM	TO	MULTIPLY BY
mile (US statute)	kilometer (km)	1.609347
inch (in)	millimeter (mm)	25.4
inch (in)	centimeter (cm)	2.54
inch (in)	meter (m)	0.0254
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.9144
mile per hour (mph)	kilometer per hour(km/hr)	1.60934
mile per hour (mph)	meter per second (m/s)	0.44704
pound (lb)	kilogram (kg)	0.4535924
gallon (gal)	liter	3.7854118
U.S. liquid (One U.S. gallon equals 0.8327 Canadian gallon)		
fluid ounce (fl oz)	milliliters (ml)	29.57353
British Thermal Unit per hour (Btu/hr)	watt (W)	0.2930711
horsepower (hp)	watt (W)	746

NOMENCLATURE OF FREQUENCY BANDS

FREQUENCY RANGE	DESIGNATION
3 to 30 kHz	VLF - Very Low Frequency
30 to 300 kHz	LF - Low Frequency
300 to 3000 kHz	MF - Medium Frequency
3 to 30 MHz	HF - High Frequency
30 to 300 MHz	VHF - Very High Frequency
300 to 3000 MHz	UHF - Ultrahigh Frequency
3 to 30 GHz	SHF - Superhigh Frequency
30 to 300 GHz	EHF - Extremely High Frequency

LETTER DESIGNATIONS FOR UPPER FREQUENCY BANDS

LETTER	FREQ. BAND
L	1000 - 2000 MHz
S	2000 - 4000 MHz
C	4000 - 8000 MHz
X	8000 - 12000 MHz
Ku	12 - 18 GHz
K	18 - 27 GHz
Ka	27 - 40 GHz
V	40 - 75 GHz
W	75 - 110 GHz

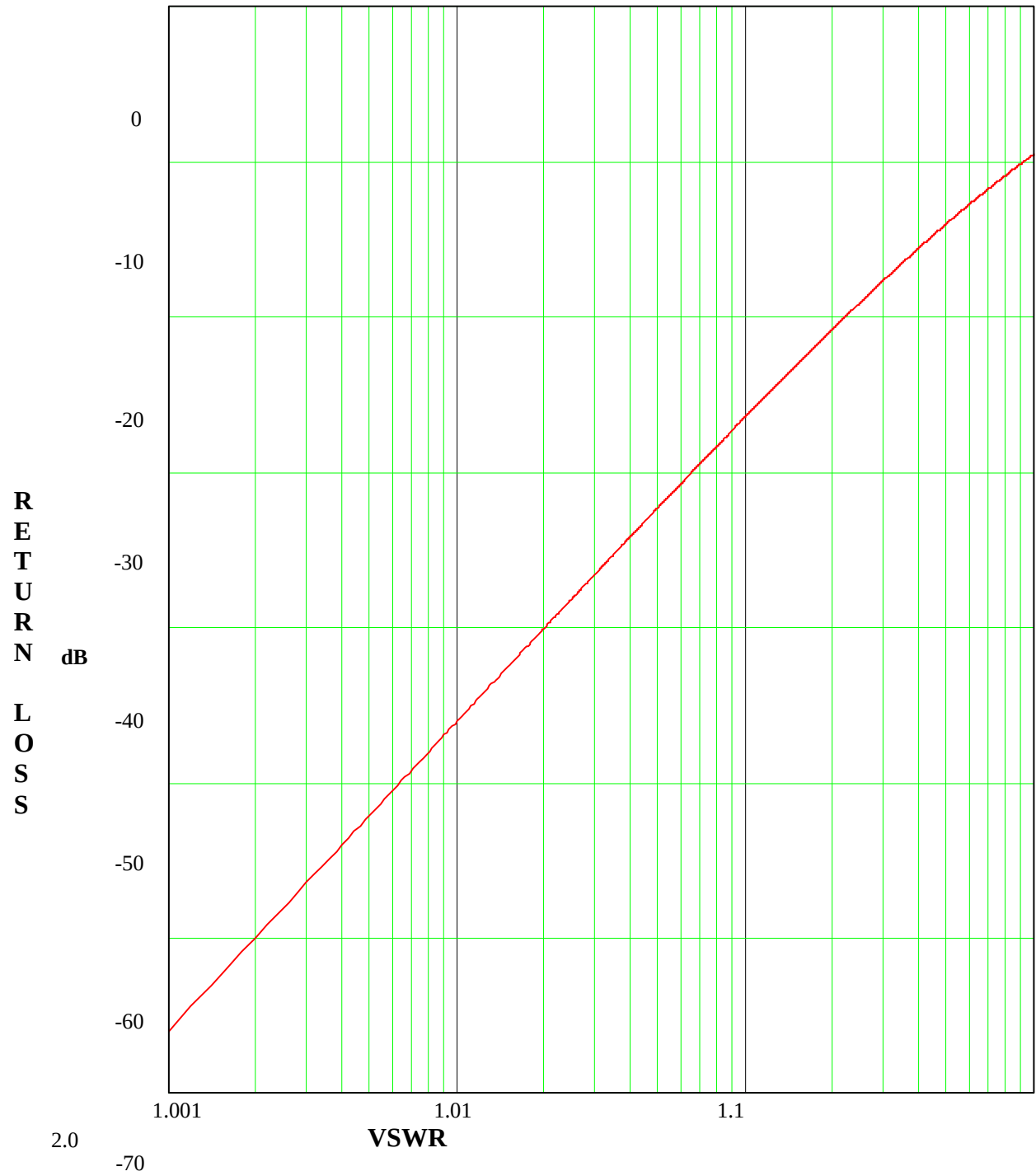
ABBREVIATIONS/ACRONYMS

QAM

Quadrature Amplitude Modulation

AC	Alternating Current
AFC	Automatic Frequency Control
ALC	Automatic Level Control
AM	Amplitude modulation
AGC	Automatic Gain Control
AWG	American wire gauge
BER	Bit Error Rate
BW	Bandwidth
DC	Direct Current
D/A	Digital to analog
dB	Decibel
dBm	Decibel referenced to 1 milliwatt
dBmV	Decibel referenced to 1 millivolt
dBw	Decibel referenced to 1 watt
FEC	Forward Error Correction
FM	Frequency modulation
Hz	Hertz
ICPM	Incidental Carrier Phase Modulation
I/P	Input
IF	Intermediate Frequency
LED	Light emitting diode
LSB	Lower Sideband
MPEG	Motion Pictures Expert Group
O/P	Output
PLL	Phase Locked Loop
PCB	Printed circuit board

RETURN LOSS VS. VSWR



SPECIFICATIONS

Technical Specifications

Type of Emissions 6M00D7W
Frequency Range.....2150 to 2162 and 2500 to 2686 Mhz (any 6 MHz channel)
Output Power Rating:.....2.5 watts peak envelope
DC voltage and total current of final amplifier stage 10 volts DC at 6.86 amps
(Class A - Not RF power dependent)

Performance Specifications

Operating Frequency Range..... 2150 to 2162 and 2500 to 2686 MHz
RF output - Nominal:
Power 2.5 watts average
Impedance.....50 ohms
Connector Type N

Input (Modulator): QAM, MPEG-2 Transport Stream
Impedance..... 75 Ω (BNC)

Out-of-Band Power Per FCC Rules
-25 dB max (at band edges)
-40 dB max (250.00 KHz above and 250.00 KHz below band edges)
-60 dB max (3.00 MHz above and 3.00 MHz below band edges)

Electrical Requirements

Power Line Voltage:
Modulator90 to 264 VAC, 47 to 63 Hz
Upconverter/Amplifier 117 VAC $\pm$ 10%, 60 Hz or
220 VAC $\pm$ 10%, 50 Hz

Power Consumption:
Modulator 50 watts
Upconverter/Amplifier 250 watts

Environmental

Maximum Altitude:
Modulator 10,000 feet (3,048m)
Upconverter/Amplifier 12,000 feet (3,660m)

Ambient Temperature:
Modulator 0° to 50°C
Upconverter/Amplifier 0° to 50°C

Mechanical

Dimensions (WxDxH):

Modulator	19" x 21" x 8.75" (48.3cm x 53.3cm x 22.24cm)
Upconverter/Amplifier	19" x 18" x 1.75" (48.3cm x 45.7cm x 4.45cm)

Weight::

Modulator	12 lbs. (5.45 kgs)
Upconverter/Amplifier	45 lbs. (22.0 kgs)

INITIAL TURN ON

Once all connection have been made and the unit has been installed, the process of turning on the equipment can begin. First verify that AC power is present and connected to the transmitter. Verify all cables are properly connected and the correct type. Once verified, the unit is ready to be turned on following the process below.

Turn on the main AC circuit breaker (CB1) on the back of the unit.

Verify that the front panel display is as follows:

ADC		V2.5	
TELECOMMUNICATIONS			

When the transmitter is in the operate mode, the standby (STB) menu appears. Press the NXT key after each menu to continue through the sequence that follows.

Description

MODEL: 5721			
RF CHANNEL: A1			
STB	STS	PRV	NXT

Model number of transmitter
Selected RF channel

VERSION: 2.5			
SCADA ADDRESS: 32			
STB	STS	PRV	NXT

Version of microcontroller software
Device address (network mgmt sys)

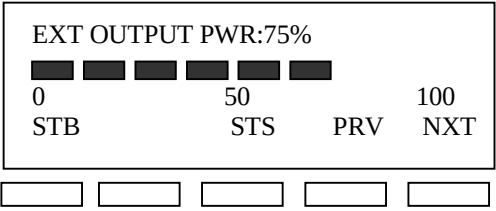
OUTPUT POWER:75%			
<div><div></div><div></div><div></div><div></div><div></div><div></div></div>			
0	50	100	
STB	STS	PRV	NXT

Percent of rated output power
Bar scale indicator

REFLECTED POWER:10%			
<div><div></div><div></div><div></div><div></div><div></div><div></div></div>			
0	50	100	
STB	STS	PRV	NXT

Reflected Power as percent of rated
Bar scale indicator

INITIAL TURN ON - continued



Percent of Rated Output Power of extenal
amp (if external amp is used)
Bar scale indicator

NORMAL OPERATION

After the Initial Turn on has been completed, the transmitter will be in Normal Operation. During Normal Operation the front panel displays a series of health status messages with corresponding fault condition messages. Any fault condition messages will be flashing. Example status messages and fault messages are shown below.

Status Message	Description
<div>TRANSMITTER STATUS IF PRESENT</div> <div>STB SYS PRV NXT</div> <div><div></div><div></div><div></div><div></div><div></div></div>	IF input signal is present
<div>TRANSMITTER STATUS IF INPUT FAULT</div> <div>STB SYS PRV NXT</div> <div><div></div><div></div><div></div><div></div><div></div></div>	IF signal not present

Additional Status Messages are as follows:

OUTPUT POWER OK
PLL LOCKED
EXT REF PRESENT
AMP MODULE OK
TEMP OK
POWER SUPPLY OK
PEAK VS. AVG OK
MODULATOR VIDEO PRSNT
MODULATOR PLL LOCKED
MODULATOR INPUT OK

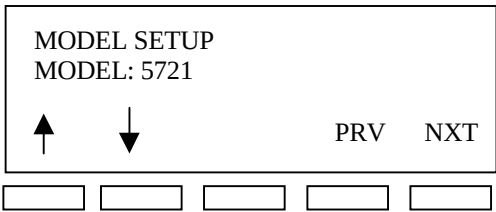
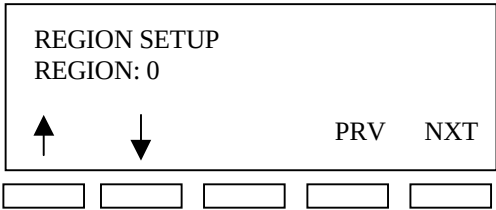
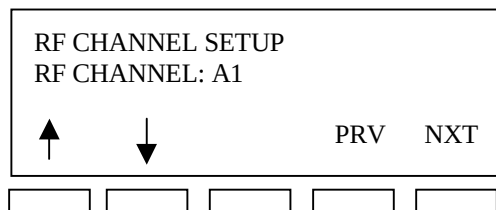
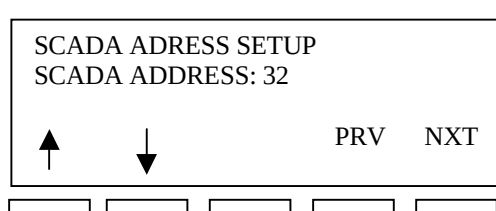
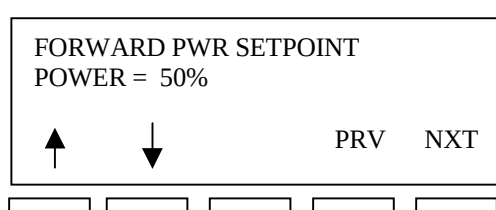
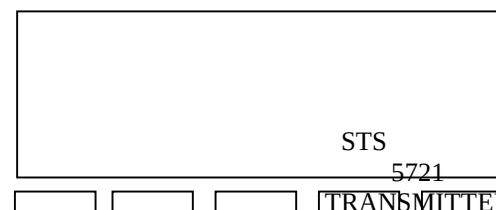
NORMAL OPERATION - continued

Additional Fault Messages are as follows:

OUTPUT POWER FAULT
PLL FAULT
EXT REF FAULT
AMP MODULE FAULT
TEMP FAULT
POWER SUPPLY FAULT
PK VS. AVG FAULT
MODULATOR VIDEO LOSS
MODULATOR PLL FAULT
MODULATOR INPUT FAULT

SETUP

The Set-up menus are used to set such things as RF Chnnel, SCADA Address, and Region of Operation. The Set-up menus are accessed by holding down the second button from the left for 5 seconds. The arrow keys are used to cycle through the selections. The Set-up menus are shown below.

Set-up Menus	Description
	Select model number of transmitter
	Select region of operation
	Select RF Channel of operation
	Select Scada address for transmitter
	Set low output power fault threshold
	Press Status button to exit Set-up menu

Note: The following drawings were uploaded as individual schematic attachments.

DRAWING LIST

20 Watt PEP Power Amplifier Module	
Block Diagram	1585-3236
Interconnect	1585-8236

The 20 Watt PEP Amplifier Module consist of the following boards/modules:

20 Watt PEP Power Amplifier Board	1585-1194
Schematic.....	1585-3194
Dual Power Detector Board.....	1585-1125
Schematic.....	1585-3125
1 Section Bias Protection Board	1585-1270
Schematic.....	1585-3270

Power Supply Module.....	1585-1248
Interconnect	1585-8248
Transmitter Control Monitoring Board.....	1585-1130
Schematic.....	1585-3130

Local Oscillator/Upconverter Module	1585-1145
Block Diagram.....	1585-3145
Interconnect	1585-8145

The Local Oscillator/Upconverter Module consist of the following boards:

Single Stage Amplifier Board.....	1585-1101
Schematic.....	1585-3101
Local Oscillator/Upconverter Board.....	1585-1117
Schematic.....	1585-3117
4 Section Bandpass Filter.....	2140-1006
Schematic.....	2140-5006

5721
TRANSMITTER

DRAWING LIST

IF Processing Module	1585-1127
Block Diagram.....	1585-3127

The IF Processing Module consist of the following boards:

IF Processing Board.....	1585-1198
Schematic.....	1585-3198

Back Plane Board	1585-1113
Schematic.....	1585-3113

