Eclipse Series

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November, 2001

PA50 Amplifier

Operation and Maintenance Manual

This manual is produced by RF Technology Pty Ltd
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Contents

WARNING

Changes or modifications not expressly approved by RF Technology could void your authority to operate this equipment. Specifications may vary from those given in this document in accordance with requirements of local authorities. RF Technology equipment is subject to continual improvement and RF Technology reserves the right to change performance and specification without further notice.

1 Operating Instructions

The PA50 is part of the Eclipse range of modular base station equipment. It is a power amplifier capable of delivering 120 Watts in the VHF frequency range. It is designed to complement the T50 transmitter, and mounts in a standard Eclipse sub-rack.

1.2 Front Panel Indicators

PWR LED Power LED indicates that the PA50 is connected to a DC power source.

RFO LED RF Output LED indicates that the PA50 is being driven by the exciter and RF Output is available at the antenna socket.

TEMP LED Temperature LED indicates that the output transistors are above 90 degrees. This is only an indication and not an alarm condition as the exciter monitors the PA50 temperature at all times in order to keep within safe operating limits.

2 Internal Adjustments

All internal adjustments are factory set and should not need to be changed under normal conditions.

R238	Driver bias adjustment
R239	O/P Q101 bias adjustment
R240	O/P Q100 bias adjustment
R227	Forward power meter adjustment
R228	Reverse power meter adjustment
C209	Reflectometer balance adjustment

3 Test Points

These test points are provided on the PCB and the DB9 front panel connector for use by maintenance personnel

TP100 and TP101 Driver drain current measurement. A multimeter placed across these pins will indicate 1 volt for 1 amp of Q102 drain current

TP102 and TP103 O/P stage drain current measurement. A multimeter placed across these pins will indicate 1 volt for 10 amps of Q100 and Q101 drain current

TP200 PA Temperature reading. 1 volt indicates a temperature of 40 degrees. This reading deviates by 10mV per degree of change

TP203 Reverse voltage output from the reflectometer

TP204 Forward voltage output from the reflectometer

DB9 pin 1	GND
DB9 pin 2	O/P drain current
DB9 pin 3	
DB9 pin 4	Reverse voltage
DB9 pin 5	+28V
DB9 pin 6	Driver drain current
DB9 pin 7	
DB9 pin 8	Forward voltage
DB9 pin 9	

4 I/O Connections

There are 3 I/O connectors on the rear panel with the following functions

25 pin connector	DC power and exciter logic interface
Pin 1,2,3,4,14,15,16,17	GND
Pin 10,11,12,13,22,23,24,15	+28V
Pin 7	DATA-IO
Pin 19	CLK
Pin 20	CS
Pin 18	VREFB
Pin 6	Forward Volts
Pin 8	Reverse Volts
Pin 9	Temperature

BNC Connector: RF Input from exciter, approximately1 Watt

N Connector: RF Output to antenna, up to 150 Watts

5 Circuit Description

The following descriptions should be read as an aid to understanding the block and schematic diagrams.

5.1 Driver Stage

The function of the driver stage is to transform the RF input signal from the exciter to the appropriate levels and impedance required by the output stage. The RF input signal is applied to the high pass filter (C121, C130, C131, C132, C133, L102 and L106). This filter suppresses any residual low frequency spurious that may be present at the exciter output. T100 is used to transform the nominal 50 ohm output from the exciter to match the input of Q102. A negative feedback network (C120, R130, R132, R131, R133, R125, R129, L107 and R124) is used to achieve a reasonably flat gain across the frequency of operation and to match the drive level requirements of the PA50 to the output level provided by the exciter. DC bias is applied to the gate of Q102 via R120 and R121 and is decoupled by C106 and C116. The DC feed for Q102 drain is decoupled by L100, C112, C102, C100 and C118. T101 is used for impedance matching between the driver and output stage and to provide a balanced feed for the push-pull output stage

5.2 Output Stage

The output stage amplifies the 5 – 10 W from the driver to in excess of 150 W for final delivery into the low pass filter. Q100 and 101 are driven in push-pull configuration by the outputs of T101. L105, R126, C126 and L104, R127, C127 form negative feedback paths in order to achieve a reasonably flat frequency response across the frequency of operation. T102 is used to provide the DC feed via the centre tap in the primary winding to Q100 and Q101. T102 also combines the balanced output of the transistors into a single ended output as well as provide the necessary impedance transformation from the transistors into a nominal 50 ohms. A small DC bias is applied to the gates of Q100 and Q102 via R118, 119, 122 and 123 and decoupled by C103, 113, 107 and 117. The DC feed to the transformer is decoupled by L103, L101, C101, 119, 104, 114, 105, 115 and 128.

5.3 Low Pass Filter

The low pass filter attenuates spurious emissions to less than –86dBc.

5.4 Bias Supply

The function of the bias supplies is to provide a temperature compensated bias voltage to the gates of Q100, Q101 and Q102 for adjustment to their quiescent currents. U205 and R213, R214 and R215 provide the bias voltages. U200D provides a decreasing output voltage with increasing temperature. The resistive dividers R214, R229 and

R213, R230 and R208, R215 provide the bias voltage to the transistors so that quiescent current is maintained across the operating temperature range.

5.5 Reflectometer

The reflectometer provides an indication of load mismatch. A200 is a current transformer with a single turn primary being passed through the centre of a toroid. The multiturn secondary has an output voltage that is proportional to the current flowing in the primary. The voltages appearing at the anodes of D205 and D206 are of equal amplitude and opposite phase. A sample of the line voltage is applied to the junction of the divider resistors R218 and R220. C209 is adjusted for equal amplitude with the transformer. Since the transformer has 180 degree phase shifted outputs, the application of the line voltage will cause cancellation at D205 and addition at D206. This phase relationship will change when a mismatch occurs resulting in an increase in the voltage at D205. D205 and D206 rectify these voltages so that a DC level proportional to the forward and reflected voltages are available for the metering circuits. L200 provides a DC reference point for the diodes.

5.6 Metering Circuits

These circuits are included so that the exciter can interrogate the PA and read all the vital operating levels. U203 is an A to D converter with the following inputs:

Reverse voltage
Forward voltage
Temperature
DC Input volts
O/P drain current
Driver drain current
Q100 bias voltage
Q101 bias voltage
Model identification jumpers

Forward and reverse voltages are supplied from the reflectometer outputs and factory set to the correct levels by R227 and R228. U204 (temperature sensor) is mounted on the same pad as the source lead of Q101 to provide a temperature reading of the O/P transistor cases. DC Power Input voltage is provided by a resistive divider (R3 and R4). The O/P drain current is provided by measuring the small voltage drop across R113 and R128. Driver drain current is provided by measuring the small voltage drop across R112 and R138. The bias voltages are read directly from the bias supplies. The model identification is determined by the jumper settings of J203, 204 and 205.

PA50A	25 – 32 MHz	J203 on, J204 and J205 off
PA50B	30 – 40 MHz	J204 on, J203 and J205 off
PA50C	38 – 50 MHz	J205 on, J203 and J204 off

U202 and associated components provide a 3 wire serial interface to allow the exciter to interrogate the A to D converter. U200C is a comparator that switches the fan on when the temperature rises above 40 degrees C. U201D is a comparator that switches the

TEMP LED on when the temperature rises above 90 degrees C. Q203 samples the line output RF voltage to turn on the RFO LED.

6 Specifications

The PA50 is designed for use with the T50 exciter to provide 20 to 150 Watts output. Output power regulation is performed by the exciter as it continually monitors PA performance. The exciter also monitors important levels such as temperature, reverse power and drain currents to keep them within operating limits.

6.1 Physical Configuration

The PA50 is designed to fit into a 19 inch rack mounted frame. The installed height is 4RU or 178mm and the depth is 350mm The amplifier is 125mm wide. An extruded aluminium heatsink with vertical fins and an enclosed fan is used. The temperature rise can be as high as 50 degrees depending on output power.

6.2 Indicators and Test Points

Power On	Green LED
RF Power	Yellow LED
Temperature 60 degrees +	Red LED
Forward Power	DB9 pin 8 and GND
Reverse Power	DB9 pin 4 and GND
O/P Drain Current	DB9 pins 2 and 5
Driver Drain Current	DB9 pins 6 and 5
+28V	DB9 pin 5
GND	DB9 pin 1

6.3 Electrical Specifications

6.3.1 Power Requirements

Operating Voltage	26 to 30VDC (available O/P power reduced below 26V)
Current Drain	Approx 10A at 28V and 100W O/P
Polarity	Negative Ground
Frequency Range	PA50A25 to 32MHz
	PA50B30 to 40MHz
	PA50C38 to 50MHz

Nominal Antenna Impedance	50 ohms	
Output Power	20 to 100 Watts	
Transmit Duty Cycle	100W Continuous up to 60 degrees C ambient	
Spurious Emissions	less than 0.25uW	
Maximum Heatsink Temperature	110 degrees C	
Mismatch Protection	Protected from damage by control from the exciter	
Connectors	Antenna connector	N type female on rear panel
	Power and exciter interface	DB25 Female on rear panel
	RF Input	BNC female on rear panel
	Test connector	DB9 female on front panel