23 cm Xvtr and SSPA

User Manual

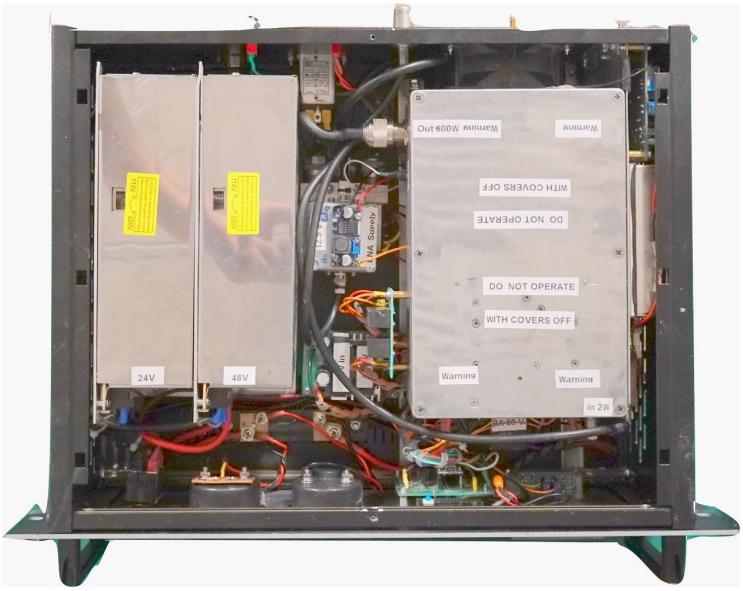
Rev 1.0

Introduction

The unit combines a SG Labs V2.3 transverter with a W6PQL 23 cm Very High-Power Amplifier to provide up to 600W on 23cm from a 144MHz 5W transmitter and provides a low noise receiver to the 144MHz receiver.

Power Supply

Two 24V 20A switching supply operating from 240Vac mains 48V to the power amplifier and 24 V to coax change-over relays. A DC-DC down converters operating from 24V provides 12V for the transverter, driver amplifier, power amplifier bias, power supply relays, temperature meter, and the SSPA controller module.



A second DC-DC down-converter operating from 24V provides 12V current limited to 1A for a masthead low noise amplifier (MH LNA) via a bias-T between the output antenna changeover relay and the rear RF output connector. A rear panel switch enables the MH LNA and isolates the bias-T supply for testing and when a MH LNA is not used.

Controller / Sequencer

The SSPA Controller, an Arduino Nano microprocessor with custom shield provides control, sequencing, and protection for the amplifier. Sequencing is applied to antenna changeover, power supply switching, and LNA supply switching. Protection monitors SWR, drive, 48V supply, temperature, and PTT time.

Transverter

An SG Labs 23cm transverter V2.3 (see Appendix for detail), with 144MHz IF, is mounted under the left-hand side panel. The transverter and 10MHz reference module are mounted on an aluminium L-bracket. The transverter is fitted with top and bottom shields fixed with 3mm screws. EMC polymer gasket is fitted to both covers. EMC absorbing foam is fitted to each section under the top cover. These are precautions to maintain the transverter stability in the high RF field in the power amplifier case. NOTE: The SSPA must not be operated without the cover screwed down on the PA diecast enclosure.

The transverter is modified to sustain over 20W of 144MHz drive. Only 10 W is required to drive the amplifier to 600W output (limited by power supply current limit).

The transverter is configured for an external 10MHz reference. A Brisbane VHF Group OCXO module (see Appendix), less distribution amplifier is used. A 10MHz reference output at +4dBm is also provided via SMA female jack on the rear panel.

As the modified transverter had inadequate receive gain and relatively poor noise figure the receiver input is supplemented with a RF Amplifier V2 (PGA-103).

For single 23cm coaxial cable feed to the antenna, the RF receive signal is switched by high power coaxial relay. For separate receive coax cable feed from a mast head low noise amplifier a SMA – SMA link on the rear panel. This link is normally fitted.

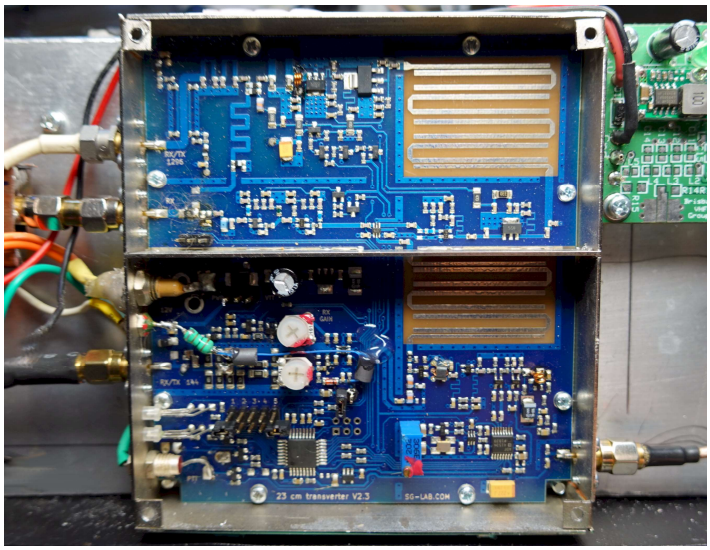
As the transverter includes IF receive transmit switching the IF input/output is provided to a BNC female connector on the rear panel.

The internal receive gain and transmit gain controls have been set for optimum performance and should remain as set.

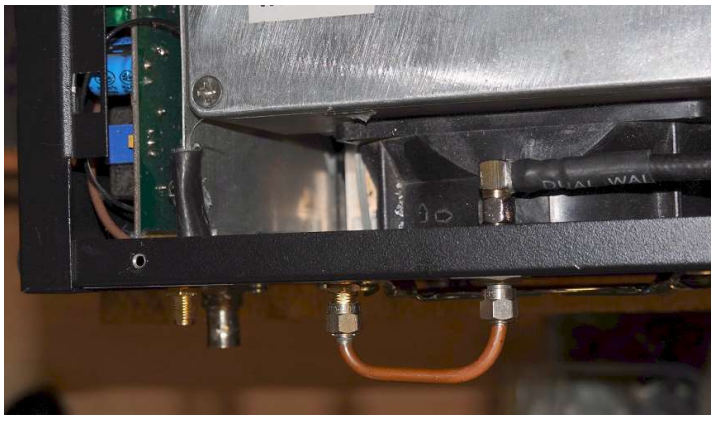
Power supply 12Vdc at 800mA max is provided continuously by a DC-DC converter off the 24V supply.

The transverter is configured for hard PTT (not RF detect). The PTT line is wired through a feed through capacitor and directly connected to the rear panel 5 pin 180° DIN connector. The PTT line is also feed to the SSPA controller for operation of the sequencer.

The internal RF detector output is feed through a feed through capacitor to the SSPA controller for transverter, driver, and PA fault monitoring.

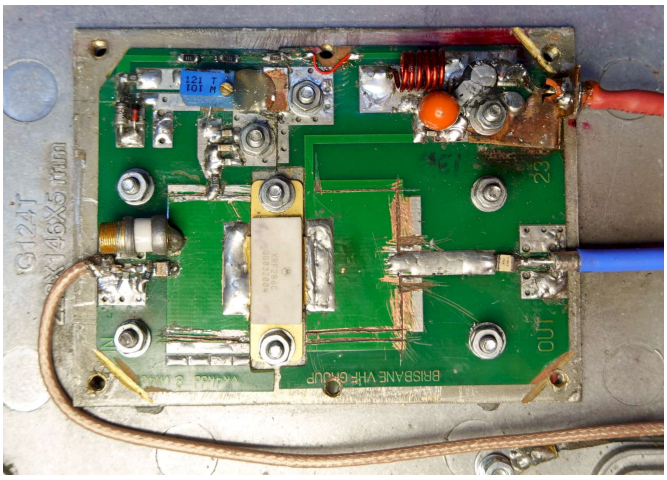


The output of the transverter is 1 W approx. for 5W IF drive.



Driver

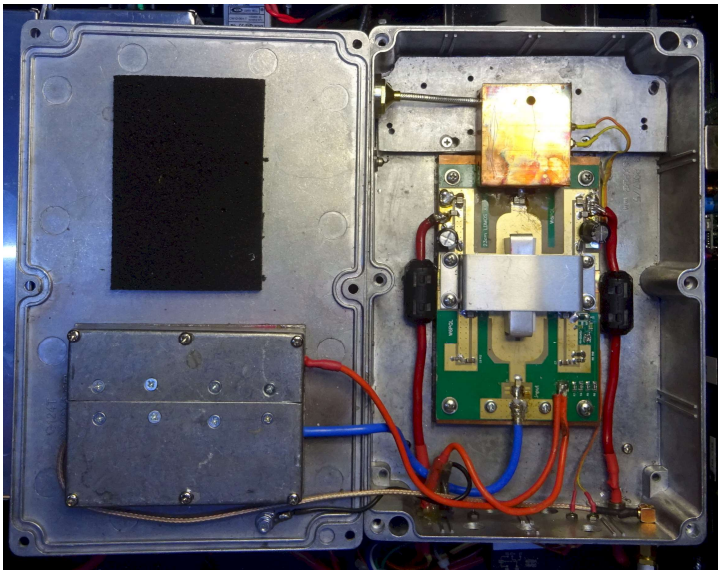
A single XRF286 on a Brisbane VHF Group PCB is mounted in a diecast enclosure under the lid of the PA enclosure. The supply is connected through a feed through capacitor.



The driver, with a supply of 12Vdc, produces over 5W to drive for the final power amplifier. The supply voltage is limited to ensure the driver cannot damage the power amplifier input. The driver may draw up to 1A.

Power Amplifier

The final power amplifier, a dual MRF13750 operating in parallel from 50V, is capable of 600W output. Detail description of the W6PQL “Very High Power 50v LDMOS Amplifier for 1296MHz” is provided in the Appendix.

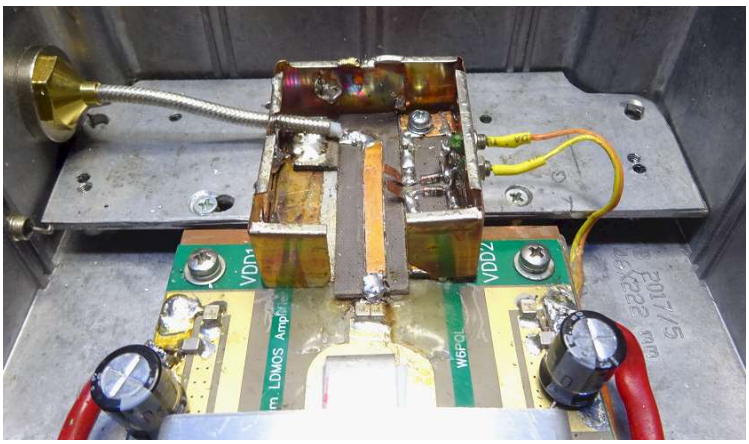


The RF deck is mounted on a large air cooled heatsink and shielded in a diecast aluminium enclosure. The enclosure also contains the driver and the output reflectometer. RF input is via a SMA female flange jack and the output through a N female flange jack. Power supply feeds and SWR monitoring signals are connected through feed through capacitors.

A rectangle of EMC foam is included in the enclosure to assist overall driver and power amplifier stability.

Reflectometer

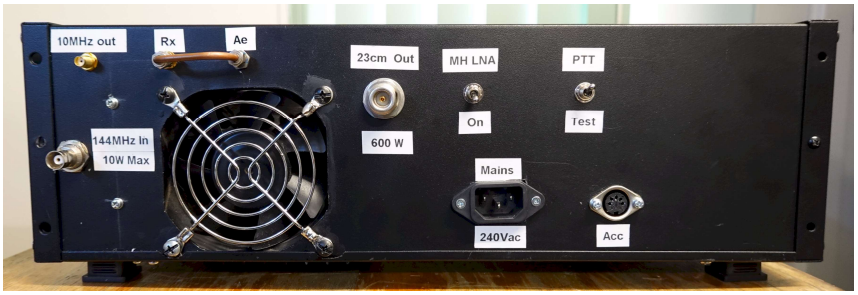
A PCB microstrip transmission line is connected directly to the output of the power amplifier. Two microstrip sections terminated in 75 ohms provide forward and reflected voltage for the front panel meter and the SSPA controller for SWR protection. The reflectometer is enclosed in a copper sheet box.



Metering

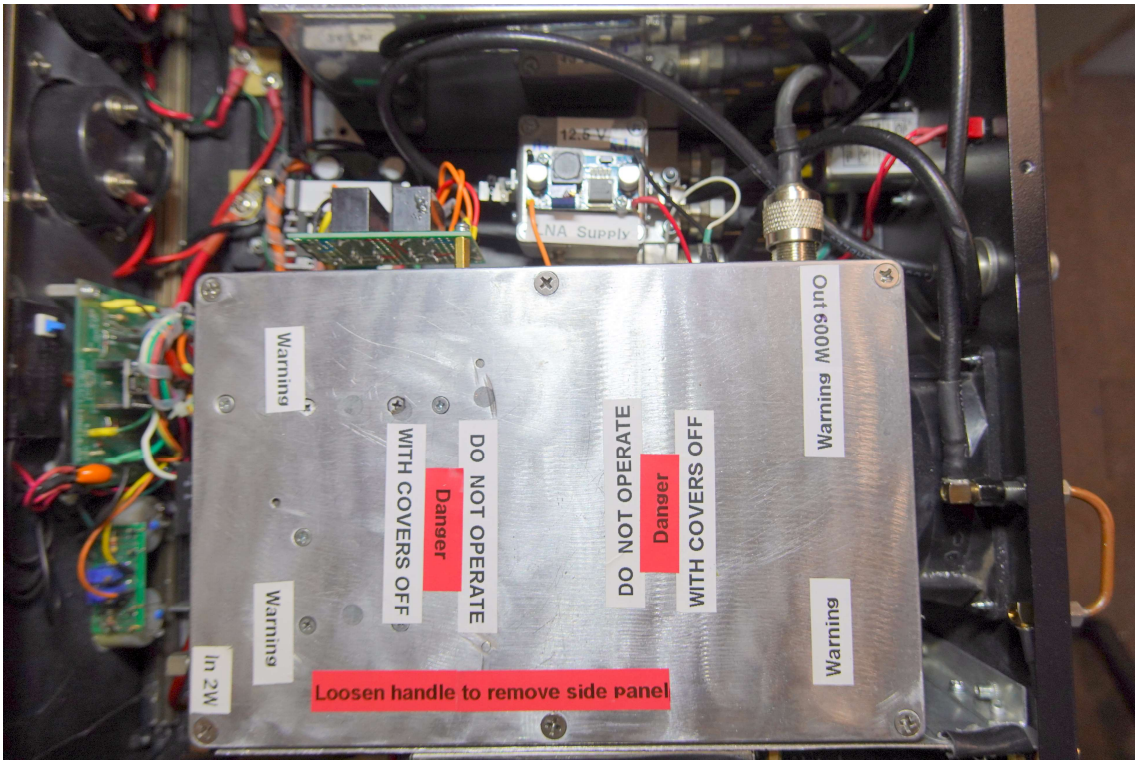
Analog meters monitor 48V voltage and current. A cross-needle meter monitors forward and reflected power and indicates SWR. A digital temperature meter with coloured analogue temperature bar monitors the power amplifier heatsink.

Back Panel /Connections



A 3U high 19” rack case enclosure the assemblies. The front panel is painted in Battleship Grey.


DO NOT OPERATE
WITH COVERS OFF
Warning
Warning M009 Out
10MHz Out
+8dBm
23cm Out
MH LNA
PTT
144MHz In
15W Max
Mains
Acc


Warning
WITH COVERS OFF
Danger
DO NOT OPERATE
DO NOT OPERATE
Danger
WITH COVERS OFF
Warning M009 Out
Warning
Warning
In 2W
Loosen handle to remove side panel