SHAK NOWTZ BY "MAD" FRANK - G3ZMF

SHAK NOWTZ No 13

Introduction

Off we go again and as it's Number Thirteen, let's hope that some of what follows is lucky for you. So far in "Shak Nowtz" I've tried to cover some of the basic items on my list of "wanted by others" but from now on, it will be "as it comes."

This Shak Nowtz covers the simple conversion of solid state AM and FM PA strips into usable SSB amplifiers and basic dual voltage PSUs.

Class C to AB Conversion

In Class C the "kick-on" voltage on the base of a transistor is derived from some of the driving power before it starts to amplify the remainder. No good for SSB but okay for CW/FM or AM when the PA is directly modulated.

However, it is possible to modify the PA strips of, for example, PMR equipment to make them useable for SSB.

There are many excellent circuits to be found in various publications, so I'll cover only the basic modification.

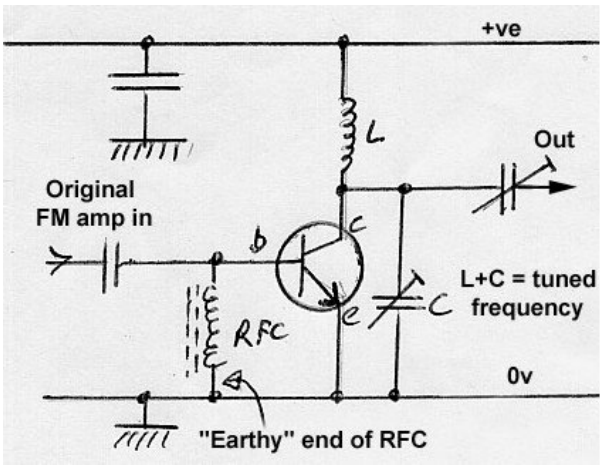

Fig 1.1 The original FM amplifier

To illustrate the basic principle, a typical unmodified FM/AM PA circuit is shown in Figure 1.1.

The modification involves lifting the "earthy" end of the RFC (or RFC plus resistor in parallel) in the base circuit and fitting a low value carbon resistor (R_B) of say 10Ω to 20Ω , ½ to 1 watt rating between the earthy end of the base RFC and ground, decoupled with a 1000 pF to 2200 pF capacitor C_B, and then feeding a bias voltage (eg initially from a variable voltage PSU) so that the base-emitter junction voltage is between 0.8 and 1.5 volts under no-signal conditions The "Bias in" is adjusted to suit the recommended current of the device.

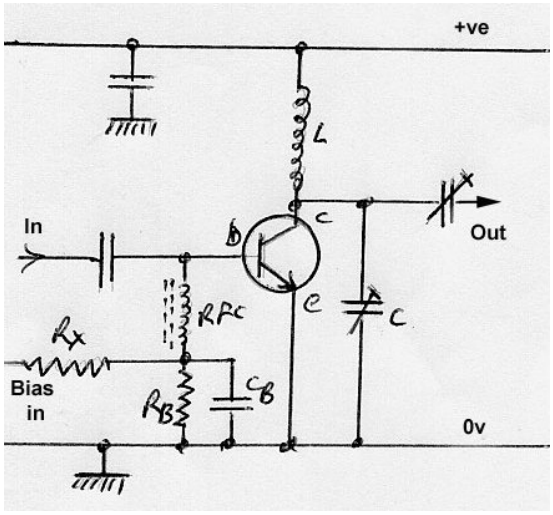

Fig 1.2 Previous circuit modified to work in Class AB
R_B = 10 to 20 Ω
R_X to suit (see text)
C_B = 1nF or 2.2 nF or feedthrough capacitor

Don't forget, if you calculate the value of the fixed resistor R_X from the positive rail in the bias circuitry (see later) to this bias point, you must remember that the base of the transistor also takes current. Also, the decoupling capacitor C_B is ideally a feedthrough device, so keeping the bias supply free from RF.

Biasing Techniques

I recommend using a preset variable voltage feed to each stage that you intend to re-bias using this technique.

To set up the reconfigured stages you could initially use a suitably-rated wirewound potentiometer, or a simple diode circuit, see below:

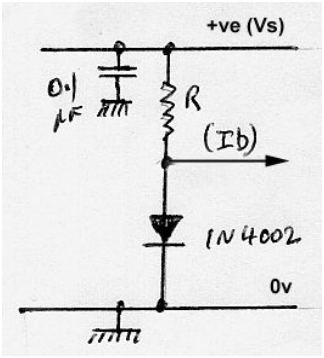

Fig 1.3 Simple Zener diode circuit
R = dropper resistor
I_b = base current
I_c = Collector current
Hfe = current gain of transistor
V_s = supply rail voltage +ve
I_b = Ic/Hfe
Average voltage drop across diode 0.6 volts.

If I_C = 1 amp. Hfe = 10 then I_b = 0.1 A. So R = (V_s-0.6)/0.1. If V_s = 12V then R will be 114 Ω. Two one watt 220 Ω resistors in parallel will be fine. This basic circuit does work but is not always reliable. However, it is useful because of its simplicity and so long as you only use it as a starting point to check out your modification, it will be okay. Then use of the circuits below (see Figs 1.4, 1.5 or 1.6) for a more permanent set-up.

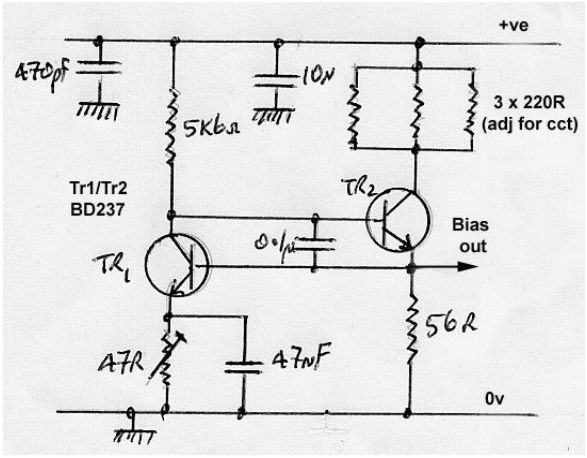

Fig 1.4 Biasing technique as used in G3WZT 50 MHz amplifier, designed for a 48 volt supply [1]

This circuit can provide up to 350 mA of bias current. The 56 Ω resistor should be rated at 2 watts.

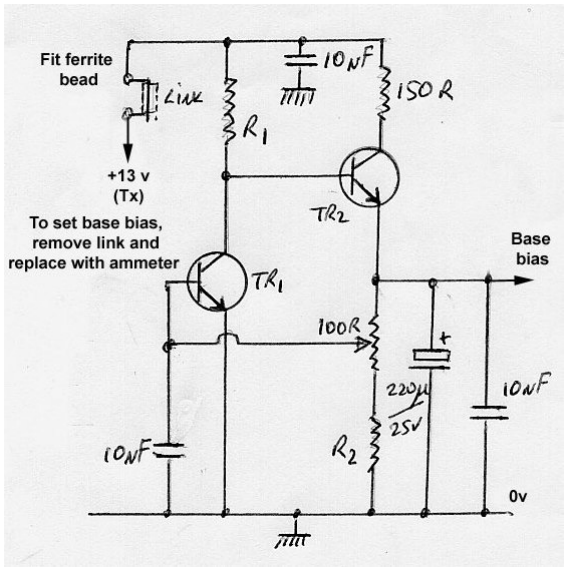

Fig 1.5 Technique as applied to G3TSO's 20 watt amplifier [2]. TR1 = BC108, TR2 = BD139

Resistor values are given in the following table:

	Base Bias Current	
	20 mA	**100 mA**
R1	10 k Ω	6.8 kΩ
R2	330 Ω	220 Ω

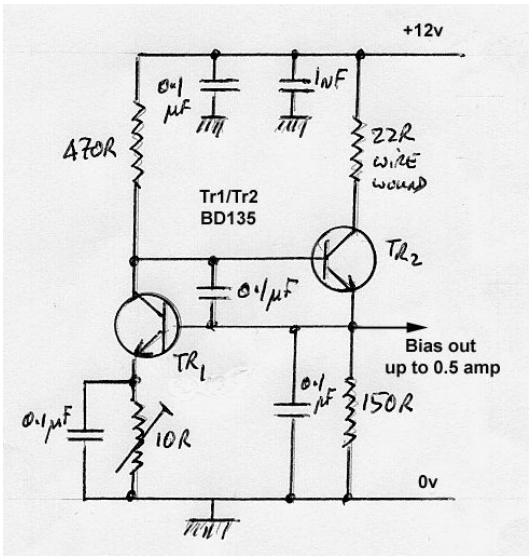

Fig 1.6 Alternative bias circuit [3]
TR1, TR2 = BD135. The 150 Ω resistor should be rated at 2 watts and the 22 Ω resistor at 7 watts (or more)

This circuit can provide a bias current of up to half an amp.

Dual Voltage Power Supplies (PSUs)

Although the following circuit is not regulated, the switch provides two alternative voltage outputs that can subsequently be regulated/ stabilised by the addition of extra components.

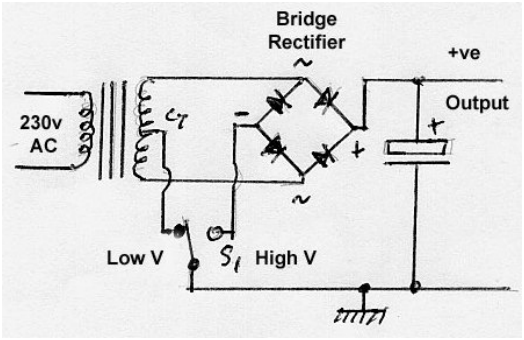

Fig 2.1 Basic Dual Voltage Supply

I recommend that a fuse should be included in the centre tap connection in case the switch doesn't "break before make". Another fuse, suitably rated, could be included in the connection to the negative terminal of the bridge rectifier.

It would also be a good idea to add a bleed resistor across capacitor. This will help stop a high voltage charged capacitor being accidentally connected to low voltage equipment. The rule of thumb to use is 1k Ω per volt, eg a 12 k Ω resistor, suitably rated , where the maximum voltage is for a 12 volts.

In use, the switch either grounds the centre tap of the transformer secondary, thereby using only half the bridge rectifier as a bi-phase rectifier, or else it grounds the negative side of the rectifier bridge and therefore "full wave rectifies" the whole of the transformer secondary.

Taking this one stage further, in fig 2.2, the switch is now 2 pole and the second pole of the switch selects the appropriate regulator going to the individual output terminals . By then adding a third pole to the switch, or by diode isolation of the regulators, then the output could be to a common terminal. BUT beware not to connect the higher voltage to a low voltage load, for obvious reasons!

In Fig 2.3, don't forget to allow 0.6V forward voltage drop when calculating the regulator value. You can of course fit a single diode in the ground leg of the regulators D_{CL} and D_{CH} but you must then isolate the heatsink of the regulators from ground or you will defeat the object of the compensating diodes. Again , this circuit needs break before make switches. The diodes can all be basic 1N4000 series devices with suitable PIV ratings.

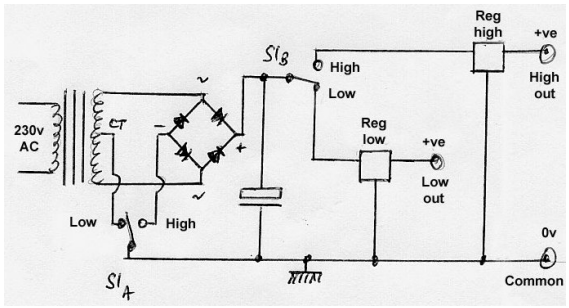

Fig 2.2 Basic Dual Voltage Supply

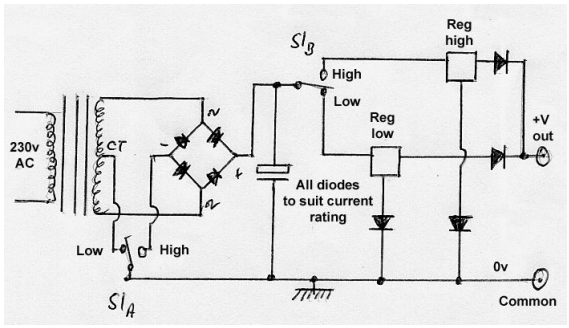

Fig 2.3 Basic Dual Voltage Supply
All diodes to suit current rating

In both of these circuits, fuses and bleed resistors would be added as recommended for Figure 2.1

Well folks, that should keep you busy for another month or so!

The next issue of Shak Nowtz will include feature a mobile whip antenna for 145/ 433/ 1297 MHz and suggestions for remote relay switching where the number of cable cores is limited.

Have fun!

73 de Mad Frank G3ZMF

[1] RSGB Handbook, 4th Ed, page 9.60. ISBN 0 900612 63 0
[2] As above., page 7.57.
[3] RSGB VHF/UHF Handbook, 4th Ed, p5.17