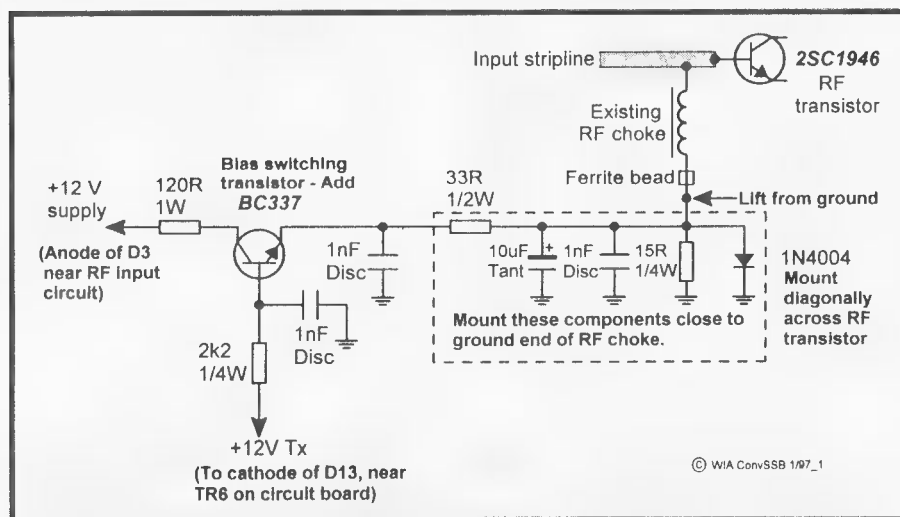


■ Transmitting

Converting the PV-35R and PV-85R 2 m Power Amplifiers for SSB Operation

Chas Gnaccarini VK3BRZ describes how experienced amateurs can convert these bargain amplifiers for SSB operation.*



Schematic of the bias modifications to the PV-35R amplifier for use on SSB.

Can They Be Used For SSB?

In ascertaining whether these 2 m FM power amplifiers are suitable for SSB operation, there are three important questions to be answered:

- Are the amplifier stages biased for linear operation?
- What is the maximum drive power which can be applied without driving the amplifier into distortion? and
- How is the transmit/receive switching accomplished?

I'll address each question in order.

Biasing

For FM operation, there is no requirement for the amplifiers to be biased into conduction. However, an SSB signal must have its modulation envelope preserved, without distortion. Without appropriate bias current,

“crossover” distortion will result, manifesting itself as “splatter”.

Unfortunately, these amplifiers are not biased, so on this count they are *not* suitable for SSB. It is possible for an experienced constructor to modify them and add the necessary biasing circuitry. However, some “surgery” is required, particularly in the case of the 80 watt unit, which has not one, but two stages to be modified.

Circuits of the modifications are shown in the accompanying diagrams. I respectfully suggest that, if you need more detailed information than is provided, you probably shouldn't attempt the job. You should also appreciate that the warranty will most likely be voided by the modifications.

Drive Power

The question of maximum driving

power is rather less well defined. The output power available from any “linear” power amplifier (which includes audio amplifiers as well as RF amplifiers) depends on how much distortion you (or someone else!) are prepared to tolerate. With linear RF power amplifiers, this distortion takes the form of “splatter” into adjacent channels, which is intolerable to other band users.

So, it is vitally important to set the drive power correctly. For example, if you refer to the test results for these amplifiers, you will see that the PV-85R produced 65 W with only half a watt of drive. If it were truly linear, then one watt of drive should produce 130 W output, but you can see that, even with three watts drive, the amplifier delivered only 90 W. This is because the amplifier reaches saturation at around one watt of drive. From that point, any more drive does not result in more output.

This is of no concern for FM use, but it would result in severe distortion (again, splatter) if an SSB signal were being amplified. For SSB use, the drive power should be adjusted to a point well below saturation. I suggest that the PV-35R be driven to no more than 30 W output and the PV-85R to no more than 80 W when used for SSB.

After modification to add the biasing circuitry, the power gain of both amplifiers increases noticeably. The drive required by the PV-35R will only be about 500 mW, and the PV-85R, being a two-stage amplifier, will require no more than 200 mW to produce full output.

For use with the FT-290R transceivers, an easy way to set the drive properly is to select the low power mode and adjust its level accordingly. Refer to the rig's manual for the adjustment pot location. Be sure to remember to always select low power for SSB use, otherwise you will produce a horrendously wide signal!

Alternatively, a resistive attenuator can be placed at the base of the power transistor (not at the input socket, otherwise you attenuate the received signals too). Place a DC blocking capacitor (1000 pF disc ceramic) after the attenuator otherwise it will affect the bias. Refer to the ARRL Handbook for attenuator resistor values. The PV-35R will need about 6-7 dB of attenuation, and the PV-85R around 10-12 dB.

Transmit/Receive Switching

Finally, we come to the matter of transmit/receive switching. Modern practice with VHF power amplifiers is to include circuitry to detect the presence of the RF driving signal and use it to switch the power amplifier into the transmit mode. This is simply for convenience, as few rigs have any connection for switching a PA these days.

This is precisely how it's done in these two amplifiers, and for FM use, where the RF drive is always present during transmission, it works fine.

SSB is another matter though. The driving waveform's amplitude is continually varying according to the speech and, during pauses between words, there is no RF present at all. This would cause the changeover relays to "chatter" as you speak. Amplifiers intended for SSB operation usually have a switch which allows you to select a delayed release, thus holding the relays in for a second or so, just enough until the next syllable. These two amplifiers are *not* equipped with this feature.

The PV-85R has provisions on the circuit board for an electrolytic capacitor to add the necessary time constant for this purpose, and it is a simple matter to add the delayed release feature. This is not the case with the PV-35R, but one can be soldered in as shown in the accompanying diagrams. If you feel confident that you understand the purpose of the modifications, and have some experience working on modern equipment, you may wish to attempt them. **Be aware, though, that such**

modifications generally void manufacturer's warranties. Also, you are responsible for any disasters you might precipitate!

Modifying the Units

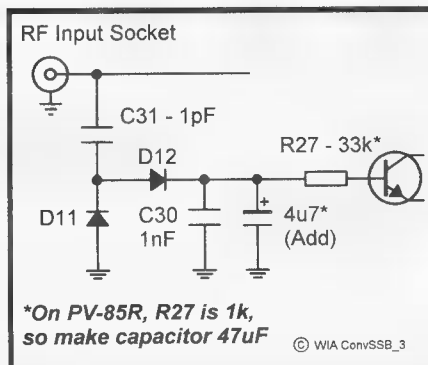
Both amplifiers were modified for SSB use, and the accompanying circuits show how this was done. The circuit board of the PV-35R is clearly marked with the component identities, so the appropriate connection points should be easily to locate.

However, this is not the case with the PV-85R, making it difficult to explain the locations of the appropriate connection points. The best bet is to locate them with a multimeter.

The additional components can be soldered in "dead bug" style. The only really critical construction is the bypassing of the ground-end of the base chokes, which should be done right at the choke, keeping the capacitor leads short. All wiring should be kept well clear of the strip-lines, to avoid the possibility of RF feedback. The diode should be mounted diagonally across the transistor case, with the body of the diode in thermal contact with the transistor's ceramic cap. Apply a little thermal-transfer compound between them.

The quiescent current for the PV-35R should be 50 to 80 mA. For the PV-85R, the driver stage should be biased to about 50 to 80 mA, and the final to about 100 to 150 mA.

Modify each stage one at a time, and measure the quiescent current, adjusting the value of the bias resistor if necessary. The bias current can easily be measured.



Schematic of the delayed VOX release modifications to both the PV-35R and PV-85R amplifiers for use on SSB.

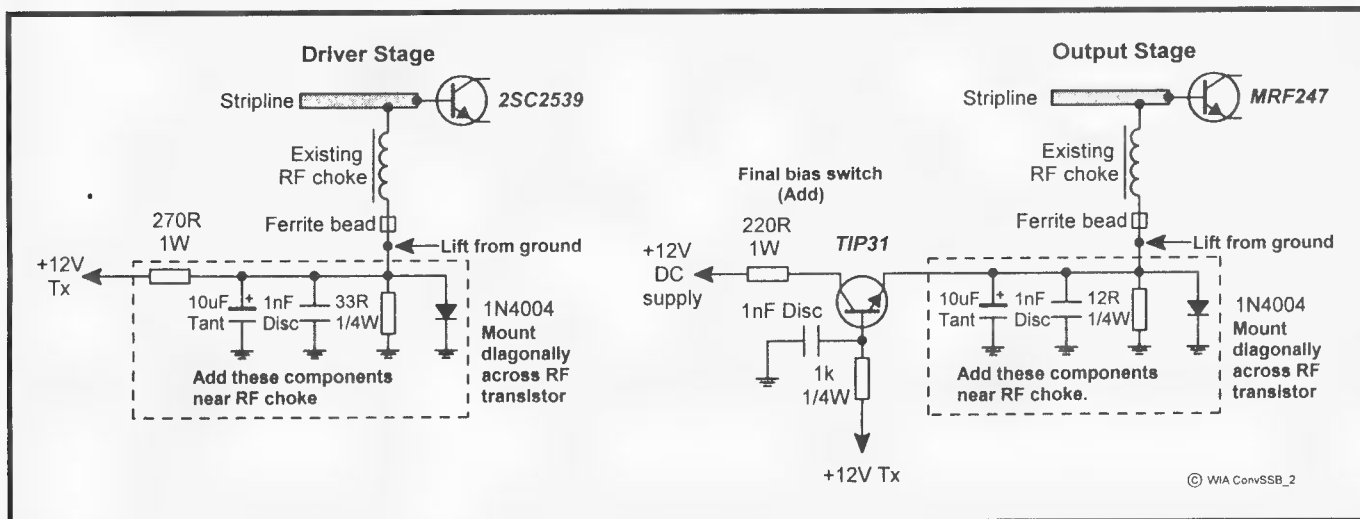
Simply connect a milli-ammeter in series with the power supply, switch the amplifier into transmit mode (do not apply any drive!) and measure the total current. Momentarily short the base of the transistor to ground, and note the reduction in total current. This is the bias current of that transistor. It's a good idea to leave a dummy load connected during this test in the unlikely event that the amplifier goes into oscillation.

After successfully adding the biasing circuits, connect a rig and dummy load to the amplifier, and tweak the input trimmer of the amplifier for maximum output. Finally, re-assemble the amplifier case, and the job is finished.

Many thanks to David VK3XLD, who assisted in developing the modifications and performing the tests, and to Dick Smith Electronics for allowing us to experiment with the amplifiers.

**66 Smeaton Close, Lara VIC 3212*

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Schematic of the bias modification to the two amplifier stages in the PV-85R amplifier for use on SSB.