TECHNICAL NOTES FOR MODIFYING THE AN/PRC-5

The following information is published to give Headquarters Command MARS members, in possession of AN/PRC-5's, the opportunity to modify the portable radio set, AN/PRC-5, for use on MARS and "Ham" frequencies.

This information was extracted from Headquarters Command Newsletter, Volume II, Issue II, dated 31 August 1956:

Notes on AN/PRC-5 - By Commander Sturkey, W4DAZ

Ref: (a). QST Oct 55 - Page 36
(b). QST Jan 56 - Page 37
(c). QST Dec 54 - Page 34
(d). CQ Oct 55 - Page 33
(e). CQ May 54 - Page 48
(f). CQ Oct 55 - Page 27

1. The AN/PRC-5 unit is about the most useful piece of equipment which has been available from MARS. The unit as issued is ready to operate at 40 and 20 meters CW. The transmitter is very tricky to adjust as the crystal oscillator (6V6) is poor and the PA (6L6) is very prone to self oscillation. The receiver having no RF gain control is too sensitive on 40 and it was found that it was necessary to leave the "Send-Receive" switch in the "Send" position in order to copy signals. In this position the antenna is only a short piece of wire going to the switch. The receiver will operate properly with the antenna connected on 20 as the sensitivity is low on this band, but it is nearly impossible to tune in a CW signal because of the back lash in the original dial.

2. The minimum modifications suggested for the transmitter are:

a. Change the oscillator tube to a 6AG7 which can be done by merely changing the connections to the socket. The 6AG7 is a much better oscillator and is not so critical to adjust. In order to work on the underside of the transmitter chassis, it is recommended that the receiver chassis be dismounted to provide access.

b. Provide some method to neutralize the 6L6. The method used in figure 1 which is discussed in reference (a) should do the job.

3. The minimum modifications suggested for the receiver are:

a. Provide a method for vernier tuning. Surprisingly enough, this is quite easy to do by adding a small variable capacitor across the local oscillator. C2 on figure 2, which is in series with a small fixed capacitor of approximately 5 mmfd, accomplishes this very nicely. There is a space between the present volume control and the shield over the band switch which provides an ideal location for this control. This vernier permits tuning about 30Kc on 20 meters and about 15Kc on 40 meters.

b. Install an RF gain control to permit reducing sensitivity of the receiver, particularly on 40 meters. The method used in figure 2 may be used although this may be accomplished more easily by using a 10K potentiometer between the cathode and ground of the RF stage with a .01 mfd by-pass. This control can be located in almost any convenient place as the length of the leads are not critical.

4. Having discussed the minimum suggested modifications, the maximum possible modifications will be covered next. Something between the maximum and the minimum depending on the individual will be the most practical approach.

5. The Transmitter - The rebuilt transmitter will operate on all bands 10 through 80 with an input of 35 watts CW and 25 watts phone. The neutralized 6BQ6 operates as a straight amplifier on all bands since the 6AG7 will give between 2 and 3 mills grid drive even when quadrupling. An RCA 6BQ6GTB/6CU6 was used instead of the 6BQ6 as this is a better tube, though a GE 6BQ6-GA should be equal.

a. Neutralizing Circuit - It was found that the 6BQ6 amplifier would operate nicely on 11mc and below without being neutralized. But on 21 and 28 mc, tuning was extremely critical. After being neutralized, the PA behaves correctly on all bands. The circuit used here is a slight modification of the one used in reference (a).

b. Crystal Oscillator - The 6AG7 crystal oscillator used in figure 1 will operate straight through, double, triple, and, if you are lucky, quadruple. The original tuning capacitor is used but instead of the plug-in coils, a band switch arrangement is employed. The 10 meter coil is air-wound with #14 wire approximately 5/8 inches in diameter, approximately 1 inch long, and 8 turns space wound. The remainder of the coil is a BW miniductor #3008. For 15-tap 5 turns from the end; for 20-tap 15 turns from the end; for 40-tap the center of the coil; and for 80-the entire coil is in use. The location of the crystal oscillator and the rectifier were reversed to give shorter leads.

c. Meter Switch - The information on the meter switch circuit may be found in reference (b). It was found by removing the shunt in the meter that the basic movement was approximately 15 mills. This makes it possible to use the meter without the shunt for reading final amp grid current. The resistor marked SR, in figure 1, is the shunt resistor which has been removed from the meter. In the normal position, the meter reads cathod current of the 6BQ6. In the other position, the plate voltage of the oscillator comes from the receiver and the meter reads the grid current of the 6BQ6. This makes it possible to spot the crystal frequencies on the receiver and to peak up the oscillator before switching to transmit.

d. Antenna Current Indicator - The pilot bulb originally supplied (#49) is rated at only 60 mills and will be burned out when the transmitter is re-built unless an antenna is fed at a low current point. By using pilot bulbs having a higher current rating, this antenna current indicator can be made to operate. The following pilot bulbs may be useful: #1490-160 mills, #45-350 mills and #43-500 mills.

a. Antenna Loading - With the 140 mmfd condenser in the out-put of the pi network, loading will be found to be excessive when using a low impedence feedpoint. A very simple method to overcome this problem was found. A small crystal socket was installed next to the antenna switch and additional capacitors, as necessary, are plugged into the crystal socket, 150, 250 and 500 mmfd were found to provide for most cases. The small mica condensers used were connected across the terminals of crystal holders after removing the crystals.

6. Power Supply - No major changes were made in the power supply. The filter condensers were relocated on the transmitter chassis to provide room for the modulator on the receiver chassis. A 500 ohm resistor was put ahead of the filter choke which is in the circuit on "receive" and "test" and is cut out on "transmit". This means that the voltage increase from condenser input is not realized except when in the "transmit" position. Providing a separate filament transformer is very important especially if high level modulation is to be used on phone. The voltage of the original transmitter under load was 350 volts and as modified, under full load, on CW the voltage was 425 and phone 405.

7. Receiver - The original receiver covered only 2 amateur bands 40 and 20. But by realigning it was possible to cover from 3.7 to 7.4 mc on Band one. In order to do this, the 75 meter band is aligned with the local oscillator on the high side and 40 meters with the local oscillator on the low side. Because on this band 5 to 7 mc was to be used to tune 10 meters by using a broad band converter, in aligning the high end of the band was favored, which resulted in somewhat reduced sensitivity on 75 meters. Band two was made to cover 20 and 15 meters by shorting out 5 turns on the coils. To make it possible to tune 10 meters, a converter was built using the circuit from reference (c). The converter was built in a mini box and was fitted in the space over the power transformer. The crystal used in the converter was 7550 Kc.

a. Vernier Tuning - The method of providing vernier tuning is discussed in paragraph 3 above.

b. RF Gain - The RF gain control used controls the gain of the RF and IF stages simultaneously as shown in figure 2.

c. RF Stages - A considerable improvement in sensitivity was obtained by modifying the RF stage to use a 6AB7. Reference (d) will supply more details on this modification.

d. IF Stage - The 6SK7 was retained in the IF stage but the circuit was modified. It was found that by choosing the value of the cathode resister so that the IF goes into regerneration just before the RF gain potentiometer is set for minimum resistance, a considerable improvement in gain and selectivity resulted. The 300 ohm resistor shown in figure 2 may not be correct in all cases. Careful realignment of the mixer and IF stage is desirable.

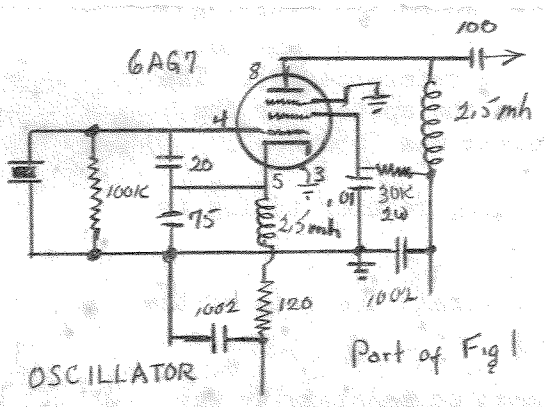
e. Antenna Trimmer - Adding an antenna trimmer can be easily accomplished by replacing the original trimmer with an APC which has had a shaft soldered on.

f. Pitch Control for BFO - A pitch control may be added across the BFO coil as shown in figure 2 but will require realigning the BFO with the IF frequency.

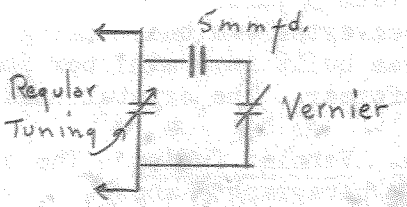
g. TNS - A TNS noise limitor-squelch was added using information from reference (e). The squelch is on the luxury side but the noise limitor is considered a must, particularly if the rig is to be used on 10 meters. There are a number of simpler ways of adding a noise limitor and one of these was used by AF4IAE which involved only adding a crystal diode and a few condensers and resistors.

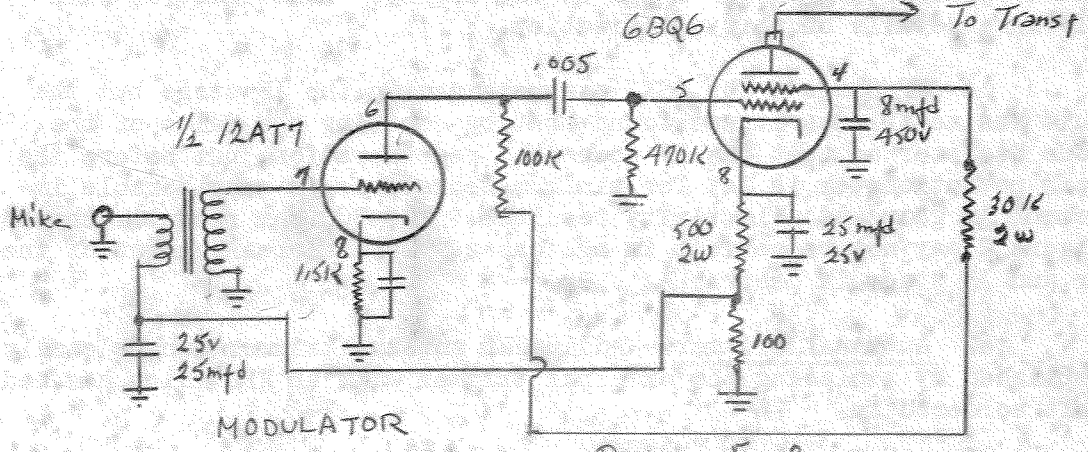
8. Modulator - On a low power rig, a good high percentage of modulation is very important. After searching literature, the modulator shown in figure 2 was decided upon. The 6BQ6 draws approximately 65 mills. When checked with an oscilloscope it was shown that with 25 watts input a full 100% modulation is possible. The key to this performance is the Triad M-42 modulation choke. Information on using this modulation choke is given in reference (f). The circuit otherwise is conventional. It will be noted that the microphone voltage is obtained from the voltage drop across the cathode resistor of the 6BQ6. It was found that a gain control was not necessary. The phone CW switch shorts the modulation choke and removes the filament voltage from the modulator when operating CW.

9. On the air performance of the little rig, has been good on both phone and CW.



Part of Fig 1





Part of Fig. 2.