Two Meters the Hard Way

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BC-625 RCVR
Front and Top Views

Nowadays, radio amateurs wishing to operate on 2m have it easy. For basic FM operation, one need only purchase a handheld or mobile, program it on local repeaters and a few simplex channels, and get on the air. The more technically inclined can still pick up a surplus LMR (land-mobile radio) unit and reprogram or convert it.

In the early 1960's, when I was first licensed as ZS1ZG, access to the 2m band was a much more daunting proposition. Virtually all amateur 2m operation was still AM, and the usual station consisted of a crystal-controlled transmitter and a down-converter supplying a 28 MHz IF to the HF station receiver. Very little commercially-manufactured 2m gear was available to ZS hams; the Heathkit "Twoer" (a.k.a. "Lunchbox"), with a crystal-controlled transmitter and super-regenerative receiver, was reasonably priced and quite popular.

LMR equipment was all FM, and was extremely expensive; there was no land-mobile surplus to speak of in South Africa. U.S. and British WW2 military surplus VHF airborne sets were on sale at surplus stores; these were quite well-designed, used top-quality components and lent themselves well to conversion.

The USAAF SCR-522 VHF AM transmitter/receiver covered 100-156 MHz. Large numbers of these sets were installed in USAAF and RAF aircraft, and were released on the surplus market at war's end.

In its original form, the SCR-522 was not very suitable for amateur use. The 8W transmitter had poor modulation quality, and the receiver was very noisy. The crystal-controlled receiver was another obstacle to amateur use.

In 1963, I purchased a 522 in good condition for the equivalent of $5, and decided on two major conversions: increase the transmitter output to 35W, and make the receiver continuously tunable.

Transmitter (BC-625):

The original TX PA and tripler/driver used 832 double-tetrodes. These were quite rare by the 1960s, and were invariably "soft." So I redesigned the PA around a 5894, which would deliver 30W with ease.

As part of the retrofit, I replaced the tank coil and coupling link and reworked the tank capacitor. The new tank coil was a big hairpin of 5mm OD copper tubing. With 500V B+ at 100mA plate current, power out was 35W into 50Ω and grid current was 2mA.

The tripler/driver circuit was re-tubed with a new 832A—a great improvement over the "stock" 832. Coupling to the PA grids was adjusted for a bit more drive to the 5894. In addition, the multiplier chain was redesigned for higher drive. An 8.055 MHz FT-243 crystal put the transmitter on 145 MHz.

"With 500V B+ (ouch!)"

The modulator was totally gutted, and a new one designed and installed. This circuit was a true example of "living on the edge!" It utilized the original modulation transformer and a pair of 6V6GTs in a special high-μ triode connection. Drive was applied to the screens, with each screen tied to its corresponding grid via a 6.8KΩ resistor. The modulator stage was zero-bias Class B. With 500V B+ (ouch!) the standing current was 5mA. Audio output for 90% modulation was 28W into a 5KΩ load. As the modulation-transformer ratio was 1:(1+1), obtaining 90% modulation was no problem.

It was essential to use glass 6V6GT's; metal 6V6's tended to flash over. "Soft" tubes did not do very well in this circuit either! The modulator tubes withstood 500V without distress, and the SCR-522 modulation transformer took the higher power without any heating or saturation. The earlier stages of the modulator were a 12AX7 speech amplifier and a 6V6GT driver. A dynamic microphone with a transistor preamplifier was used.

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New T/R and control relays were installed, as well as a netting (spotting) switch. The original autotune mechanism and crystal switch were removed, and knobs fitted to the tuning shafts. The original metering circuitry and meter switch were retained, with an added "Mod Plate" position. This facility served as an excellent tuning aid, with a VOM plugged into the meter socket.

Tuning was rather critical, but fairly straightforward; the highest meter reading always indicated the correct harmonic.

Receiver (BC-624):

The receiver was not modified as extensively as the transmitter. The original crystal oscillator, autotune mechanism and crystal switch were removed, but the squelch circuit (using a 12J5) was retained. The original 9002 harmonic amplifier was converted into a VHF Colpitts VFO. This tunable local oscillator was remarkably stable; over a period of onr hour, a test signal did not drift by more than a few kHz. I found that high- and low-side LO injection worked equally well.

6AG5's were substituted for the 9003's in the RF amplifier and mixer, resulting in a marked improvement in noise figure. The 12 MHz IF strip was realigned. The audio chain was re-worked; a 12A6 replaced the original 12J5 output stage, to achieve higher audio output.

Tuning was extremely critical; about 10° of shaft rotation covered the entire 144-146 MHz band! As a result, vernier drives were fitted to the tuning shafts.

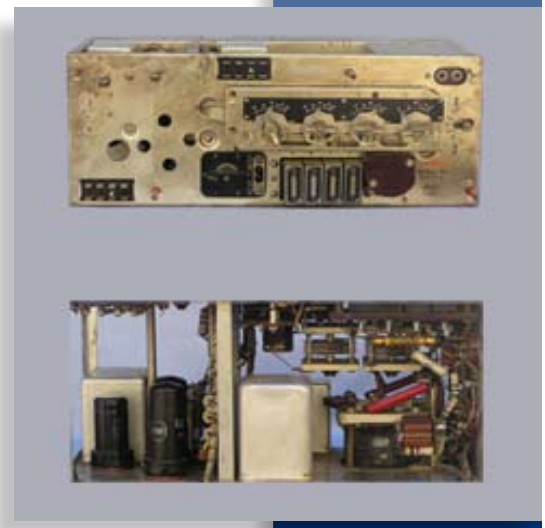
The receiver was tested on a vertical dipole; while no amateur signals were heard, copy was excellent with FM LMR signals on 138 and 152 MHz, by using slope detection.

"Tuning was rather critical…"

Power requirements were 500V/200mA for the PA and modulator, 250V/100mA for early TX stages and RX, 6.3V/0.45A and 12.6V/2.5A for heaters and 24V/0.5A for relays. Heaters were AC-fed.

Later on, the fruit of all this effort was a 2m AM QSO with a friend of mine 5 km away. He was using a Heathkit "Twoer," also feeding a vertical dipole.

Although the re-worked SCR-522 did not see much actual on-air operation, I felt that the design and construction effort that went into it, and the accompanying learning process, fully justified this project. It awakened my interest in VHF and UHF; this led to FM and repeater conversion and building projects in later years.



BC-624 XMTR
Front and Side Views

Acknowledgements:

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Links:

- First Steps in Amateur Radio
- Kurrajong Radio Museum (BC-624, BC-625)

Based on Adam's article, WORK TWO METRES WITH SURPLUS GEAR SCR-522, *Radio ZS*, April 1964 ■

Meet the *K9YA Telegraph* Staff—On-the-Air

Every Wednesday evening, 2400 UTC, members of the *K9YA Telegraph* staff can be found at 7.121 MHz (plus or minus QRM).

Since its inception, the Robert F. Heytow Memorial Radio Club has been conducting code practice nets. The first Wednesday of the month is our fast net and the remaining Wednesdays are slow nets (we QRS to the slowest op).

The purpose of the nets is to practice our Morse skills and to have fun. We don't use net prosigns or complicated procedures—you can't mess up!

So, whether you're a hi-speed, lo-speed or somewhere in between speed op, stop by and say hello. We're fluent in most dialects—straight key, bug, cootie, iambic and banana boat swing. It would be our pleasure. ■

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