New Equipment

ACITRON SSB-400

We believe this unit (photograph is on the front cover), known as the SSB-400 and is designed specifically for Amateurs, is the first Australian designed and made product of this type.

The transceiver is basically a 400 watt p.e.p. transceiver covering the Amateurs bands 160 through to 10 metres and including also two metres at a lower power level of 20 watts p.e.p. out.

The receiver front end uses dual gate zener protected Mosfets for improved cross-modulation and intermodulation performance. This in turn feeds into an integrated circuit balanced mixer which in turn goes through an eight-pole 9 MHz. crystal filter with a bandpass of aproximately 2.3 KHz. The i.f. system also uses dual gate zener protected Mosfets for greatly improved a.g.c. action, followed by the product detector and finally the audio system which delivers 3 watts of audio output at less than five per cent. distortion.

The local oscillator system starts with a 5-6 MHz. v.f.o. which is heterodyned with high frequency carrier crystals in an integrated circuit balanced mixer. The output of this feeds through bandpass filters before it goes into the transmit and receiver mixers, thus greatly reducing the possibiilty of spots.

The frequency readout incorporates aproximately twenty integrated circuits in a complete frequency counter which in turn drives a set of gallium arsenide seven-segment display indicators. These of course have the advantage of greatly reduced size and greatly increased life over the more conventional nixie type display.

The clock oscillator for the frequency counter is a 100 KHz. crystal, this gives approximately 50 cycle accuracy on the readout itself. The readout system is designed to readout to the nearest 1 KHz.,but has a built-in scaling switch which enables the final decimal place to indicate 100 cycle steps.

The unit tunes directly both 7.5 and 15 MHz. which enables the digital readout clock oscillator to be accurately set up without any sophisticated test equipment.

The transmitter consists of a 9 MHz. balanced modulator, once again an integrated circuit, which gives greatly improved carrier suppression. This in turn feeds through the 9 MHz. filter and into the transmitter mixer. The output of the transmitter mixer feeds through the receiver front end which is band switched to obtain the required spurious rejection, the output of this feeds through a broad-band transistor amplifier and finally into the p.a. valve. Apart from the final p.a. valve, which is a v.h.f. dual tetrode, the unit is fully solid state.

For two metre operation an in-built conversion system enables the 28 MHz. band to act as an i.f. for the two metre converter. Two MHz. coverage is given on ten and consequently also on two metres. The front end on two metres consists also of dual gate zener protected Mosfets and the transmitter output on two metres consists of strip lined v.h.f. transistors.

The transceiver comes complete with a matching power supply and extension speaker and has all the normal features such as v.o.x., a.l.c., c.w. both upper and lower sideband, noise blanker, etc.

The SSB-400 is currently in production and should be available to the general public during the month of September.

ZONE 29 AWARD

The Zone 29 Award is issued by the West Australian Division of the Wireless Institute of Australia to licensed Amateurs and S.w.l's throughout the world. To qualify for this award, the following conditions must be satisfied:—

1. Establishment of two-way communication with any twenty-five different Amateur stations situated in Zone 29. Communication to be made after 0001 W.A.S.T. January 1952.
2. The total of 25 different stations may be obtained by operation on one or more of the Amateur bands.
3. Any types of emission which are permitted by the local licensing authority may be used.

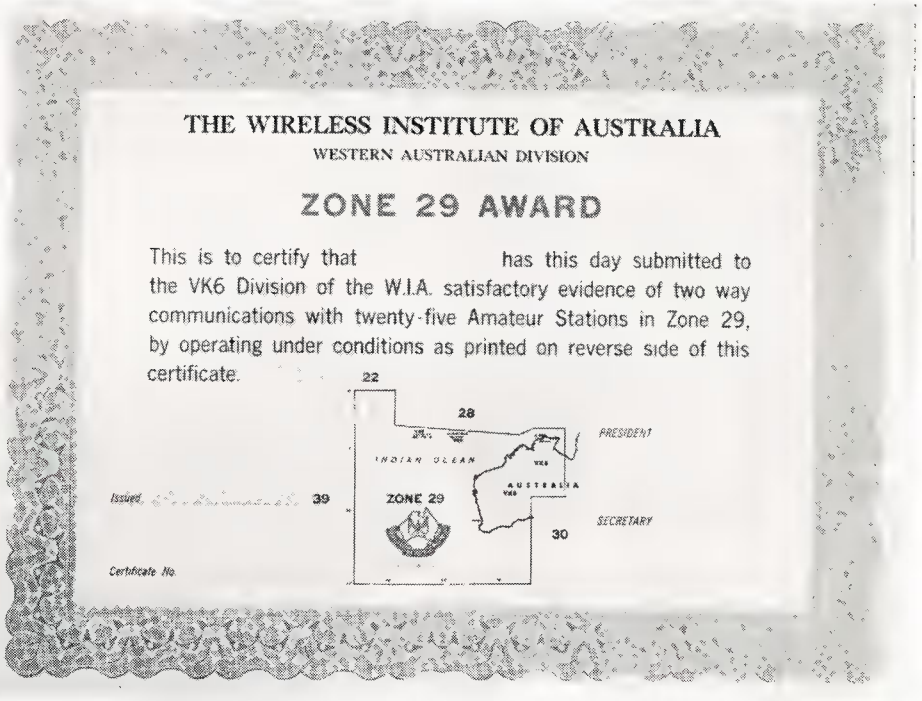
The Certificate will be endorsed when issued as confirmation of fulfilment of the following special conditions:—

(a) All 25 stations obtained from operation on one band only. (Open)
(b) All 25 stations obtained from operation of phone transmission (s.s.b., a.m., f.m., etc.).
(c) All 25 stations obtained from operation of c.w. transmission.
(d) All 25 stations obtained by one band operation and phone only.
(e) All 25 stations obtained by one band operation and c.w. only.
(f) 25 stations heard by S.w. Listener in (a) to (e) of above.

Confirmation in writing of all contacts must be submitted to:—

The Secretary,
W.I.A. (W.A. Division),
Box N1002, G.P.O.,
Perth, W.A., 6001,

together with $1(A) or 10 I.R.C.



ACITRON SSB-400 TRANSCEIVER

GENERAL DESCRIPTION

The Acitron SSB-400 Transceiver consists of the following modules:

1. **Band Switched R.F. Section**
   This is a large double-sided circuit board housing:
   Injection crystal oscillator,
   Injection balanced mixer,
   R.f. amplifier,
   Transmitter balanced mixer.
   This complete section is readily removable for maintenance purposes.
2. **I.F. Modem**
   A second relatively large printed circuit board houses:
   Receive balanced mixer,
   Transmit balanced modulator,
   9 MHz. filter and associated matching networks,
   Two i.f. amplifiers,
   A.m. and sideband detector,
   A.g.c. system.
3. **10-Watt Broad-band Driver**
4. **Frequency Counter and Digital Display.**
5. **6-5 MHz. VFO.**

The remaining modules are contained on separate plug-in boards. These are:

6. **10 Volt Power Regulator,**
7. **Audio Amplifier,**
8. **9 MHz. Carrier Oscillator,**
9. **Microphone Amp., Vox/Anti-Vox.**
10. **Digital Oscillator and Balanced Mixer,**
11. **100 KHz. Clock Oscillator and Logic Generator.**

All circuit boards are plated fibreglass using gold plated edge connectors, where applicable.

A.L.C.

The a.l.c. system uses the grid current of the final tube to generate a negative voltage which is applied to the first i.f. amplifier. Whilst the main function of the a.l.c. system is to prevent overdrive of the transmitter, it also performs the function of a speech compressor owing to its very fast time constant, thus allowing approximately 15 to 20 dB. compression to be incorporated on transmit, if desired.

TRANSMIT BALANCED MIXER

A hot carrier diode ring mixer is used to ensure a minimal radiation of spurious emissions. This is a broad-band device using toroidal transformers, therefore, no tuning is required.

MICROPHONE AMPLIFIER, VOX/ANTI-VOX SYSTEM

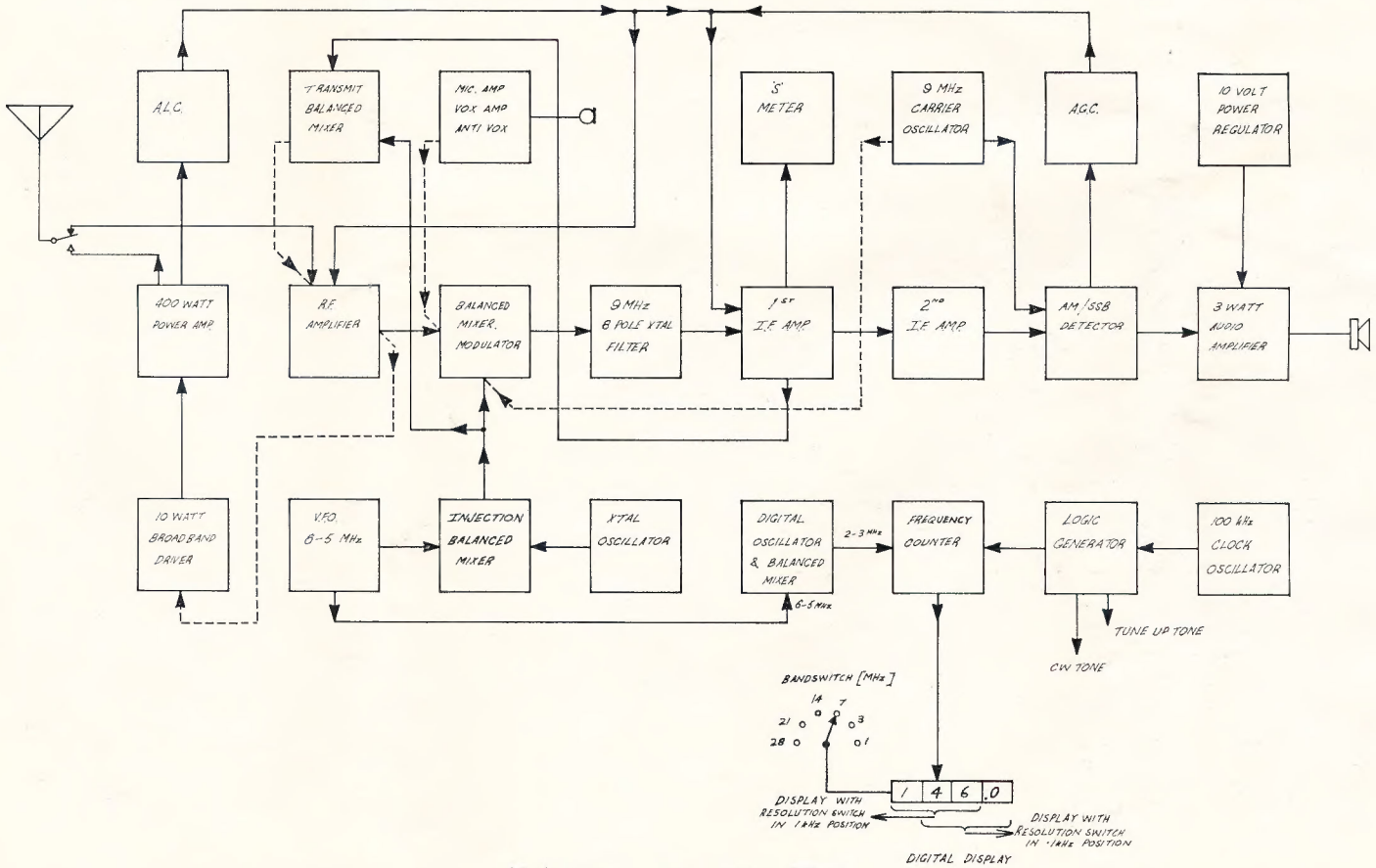
The microphone amplifier consists of a source follower driving an integrated circuit. The source follower input enables high impedance crystal to low impedance dynamic microphones to be used. The terminating resistor to suit the microphone is the only change required. There is adequate gain in the microphone amplifier to accommodate most dynamic, crystal and rocking armature microphones.

The vox amplifier consists of two transistors and a fast-acting voltage doubler deriving its input via the vox gain control from the output of the first stage of the microphone amplifier. The output of the voltage doubler is combined with the output of a second voltage doubler connected by the anti-vox control to the loudspeaker. These two voltages are out of phase and cancel prior to passing through a digital gating system and thus operating the vox relay. The vox delay is incorporated after the digital gating system which means it has no affect on the anti-vox operation. The system of vox/anti-vox gating used allows the vox to override the anti-vox, even when there is only a slight pause in the anti-vox signal, i.e. the pause between word syllables.

Four transistors, two integrated circuits, one FET and six diodes are used in this system which is self-contained on a single plug-in circuit board.

"S" METER

The "S" meter forms the dual function of "S" meter and transmit power monitor. On receive, the "S" meter is connected by a bridge circuit to the combined source voltages of the r.f. and first i.f. amplifiers. Both of these are a.g.c. controlled, giving a dynamic range on the "S" meter of approximately one microvolt to one volt. On transmit, the "S" meter is connected to a diode monitor on the transmitter r.f.



Block Diagram of the Acitron SSB-400.

output. A separate meter is used to indicate plate current of the power amplifier.

9 MHz. CARRIER OSCILLATOR

This unit consists of a series mode transistor oscillator and FET source follower. Diode switching allows the correct crystal to be selected when changing from normal to reverse sideband.

A.G.C.

The a.g.c. system uses a negative voltage derived from a voltage doubler and feeds in turn to the r.f. and first i.f. amplifiers, both units being dual gate FETs. This allows a large dynamic range prior to receiver overload and in actual practice the receiver will accept a signal from noise level to almost one volt before overload occurs.

10 VOLT POWER REGULATOR

The 10 volt power regulator supplies power to all stages of the transceiver with the exception of the audio output stage, transmitter p.a. and broad-band driver.

The supply consists of a two-stage emitter follower with short circuit protection supplied from a zener referenced voltage.

400 WATT POWER AMPLIFIER

The power amplifier consists of a YL1060 u.h.f. dual tetrode transmitting tube. This stage has a broad-band input and pi-coupler output. The valve is running approximately 800 watts p.e.p. in and delivering 400 watts p.e.p. out.

The power is slightly less on 10 metres. Approximately 1,800 volt (p.a.) and 400 volt (screen) supplies are used.

R.F. AMPLIFIER

This is a band switched r.f. amplifier consisting of a dual gate FET followed by an emitter follower. Tuning is electronically accomplished using diodes. The r.f. amplifier is used both on transmit and receive.

BALANCED MIXER -MODULATOR

One of the most interesting blocks in the transceiver is an integrated circuit balanced mixer which performs the dual function of receive balanced mixer and transmitter balanced modulator. While receiving, the input ports are connected to the r.f. amplifier and the injection balanced mixer. The output of the balanced mixer is fed via an emitter follower to the 9 MHz. crystal filter. On transmit, the input ports are changed over and the transmitter audio is fed to one port and the 9 MHz. carrier to the other. The unit then functions as a balanced modulator. The carrier suppression of the balanced modulator and filter combined is in the vicinity of 60 dB.

9 MHz. 8-POLE CRYSTAL FILTER

A 9 MHz. 8-pole crystal filter is used with a bandwidth of approximately 2.5 KHz. at the 6 dB. points, rising to only 4.1 KHz. at the 60 dB. points.

I.F. AMPLIFIERS

The first i.f. amplifier is used both on transmit and receive and consists of a dual gate FET. It has a.g.c. applied on receive and a.l.c. on transmit.

The second i.f. amplifier also consists of a dual gate FET.

A.M./S.S.B. DETECTOR

The product detector used is a diode bridge detector and one leg of the bridge is opened when operating in the a.m. mode. A source follower connected to the output reduces the impedance to drive the audio amplifier, via the volume control.

THREE-WATT AUDIO AMPLIFIER

The three-watt amplifier consists of a pair of TO3 transistors, transformer coupled to the loudspeaker and driven by two small signal transistors.

TEN-WATT BROAD-BAND DRIVER

The 10-watt broad-band driver consists of a transformer coupled pair of v.h.f. strip-line transistors. These are driven by a single v.h.f. strip-line transistor. The complete unit is broad-band, from input to output, delivering approximately ten watts of drive to the power amplifier. This unit is contained on a separate circuit board mounted on a heat sink and does not require tuning.

V.F.O. 6-5 MHz.

The v.f.o. consists of a permeability tuned FET Vacker oscillator followed by suitable buffering stages. The unit is completely enclosed in a metal box and is substantially free from vibration, making it particularly suitable for mobile use.

INJECTION BALANCED MIXER

The injection balanced mixer is once again an integrated circuit similar to the type used in the balance modulator. The input ports are connected to the 6-5 MHz. v.f.o. and the band-set crystal oscillator. The output of this is fed via broad-band tuned circuits (to reduce the possibility of spots on receive) to an emitter follower driving both the receive and transmit mixers.

CRYSTAL OSCILLATOR

This unit is a series overtone crystal oscillator followed by a FET source follower. The appropriate crystals being switched in when changing from band to band.

DIGITAL SYSTEM

As the v.f.o. is reverse tuning from 6 to 5 MHz., a balanced mixer is used to convert this to the 2 to 3 MHz. range. This is then applied to a conventional frequency counter. The 8 MHz. crystal used in the digital oscillator is diode switched when changing from upper to lower sideband and in some cases when changing from band to band (depending on whether additive or subtractive mixing is used). This is achieved automatically due to the logic system, enabling the digital readout to display the exact carrier frequency, rather than the centre pass band frequency.

FREQUENCY COUNTER

The frequency counter consists of eleven dual in line integrated circuits comprising complete count and memory facilities and it drives a three-digit seven-segment gallium arsenide display. It has the facility to scale down and read to one extra digit (100 Hz.).

LOGIC GENERATOR

The logic generator performs the functions necessary to generate the various gate, set and re-set pulses, etc., for the frequency counter. It also generates tones for c.w. transmission and tuning purposes. Eight dual in line integrated circuits and two transistors are used in this section.

100 KHz. CLOCK OSCILLATOR

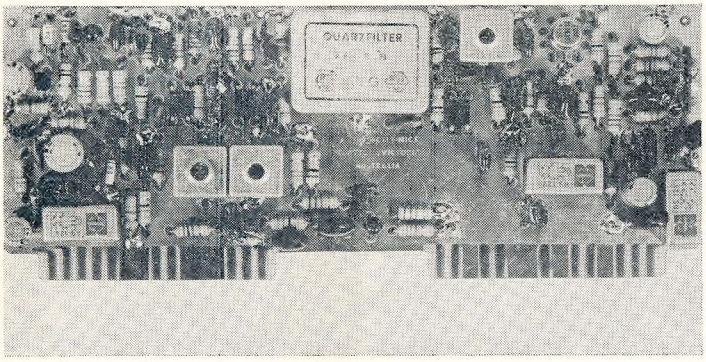
The 100 KHz. clock oscillator consists of a parallel mode 100 KHz. crystal. Twenty-one integrated circuits, five transistors and one FET are used in the complete digital readout system.

P.A. TUNING

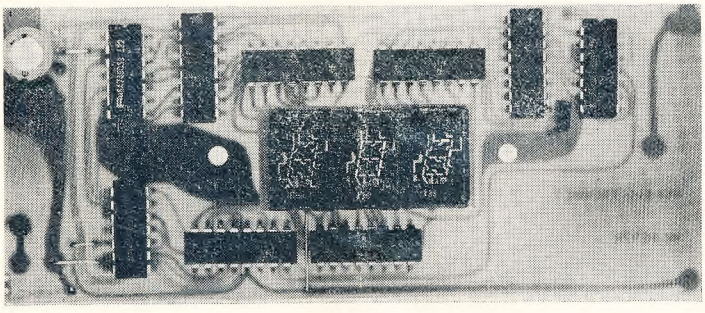
Before describing the tune-up system employed in the SSB-400, some comments are necessary on the tuning of s.s.b. transmitters in general.

It is a well known fact that an s.s.b. transmitter must be tuned at the full rated (p.e.p. value) input that it will be operating at on voice peaks in order

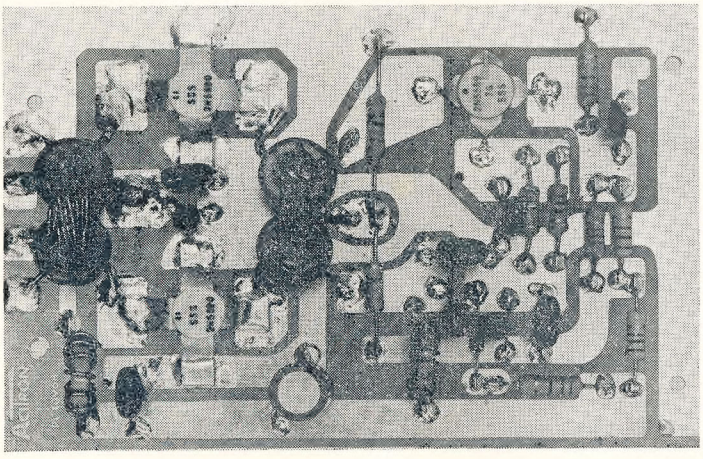
(Continued on Page 9)



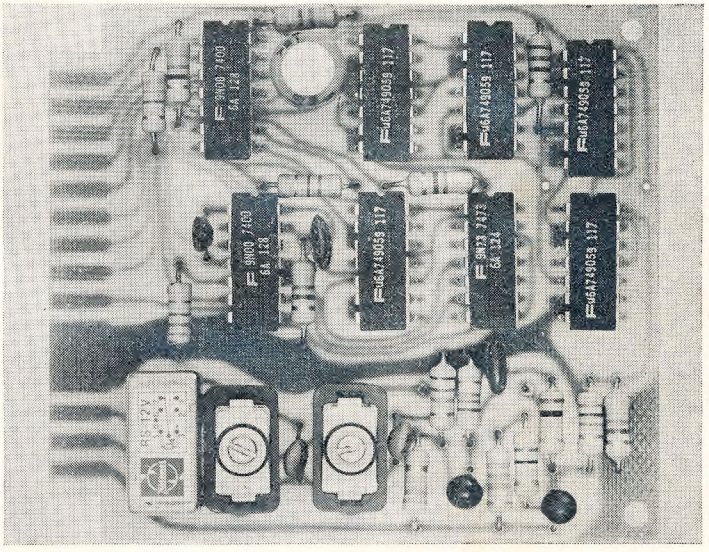
I.F. Modem.



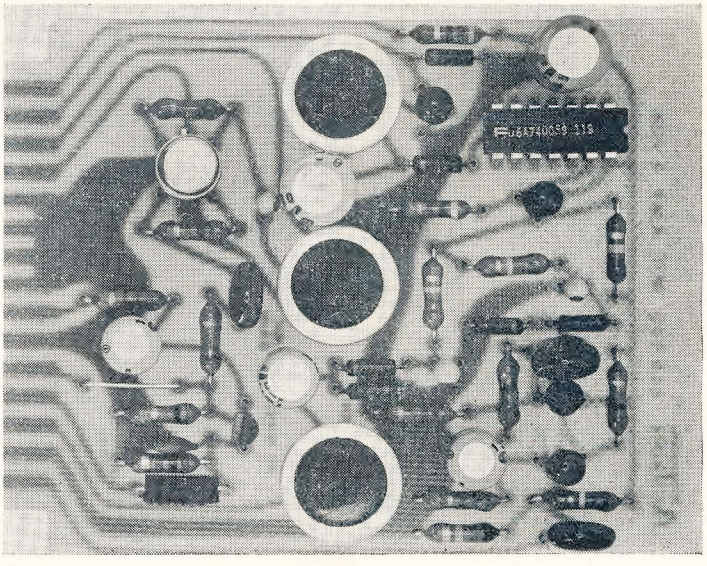
Frequency Counter and Digital Display Module.



10 Watt Broad-band Driver Module.



100 KHz. Clock Oscillator and Logic Generator module.



Microphone Amplifier, Vox/Anti-Vox Module.

transformer was an ex-radio speaker output transformer for 15 ohm output. The 500 μF. capacitor is mainly to allow peak voltage to build up. Fig. 5 shows the voltage drop against current taken for this p.s.u., and is included as a matter of interest for those contemplating a similar type of p.s.u.

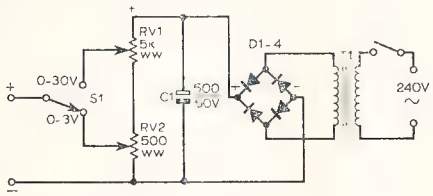


Fig. 4.—0-30v. p.s.u. circuit diagram.

C1—500 uF.
RV1—5K ohm wire wound potentiometer.
RV2—500 ohm wire wound potentiometer.
S1—Single-pole, 2-way.
D1-4—75v. p.i.v. silicon rectifier diodes.
T1—20v. miniature mains (Radio Spares).
Terminals or sockets—2 off.

CONSTRUCTION

The tester shown is constructed in a $\frac{1}{2}$" wall wooden box with an $\frac{1}{8}$" thick paxoline panel. After marking out and drilling, a sheet of substantial plain white paper is placed over the finished drilled panel and all holes rubbed in. Hole centres are easily found to allow the paper to be marked up, using a suitable pair of compasses and pen for all necessary inscriptions. The panel is then lightly gummed and the paper placed in position. After allowing a period for drying out, the author used 2" wide Sellotape to cover the papered panel and wrap a little around the edges. The large holes can be cut radially before folding inwards and the small holes pierced with pen or pencil.

Assembly of the switches, variable resistors, etc., can then take place, the Sellotape protecting the panel while wiring and soldering takes place. RV1 is a linear wire wound potentiometer and the panel can be pre-marked 0 to 6v. as the input resistance is constant. It is advisable to subdivide the 0 to 1 division into either 10 or 5 further divisions.

It is not possible to divide out the sweep of RV2 and RV3 as the load here is not constant, as can be seen by Fig. 5, which, in a way, simulates the varying load presented by the FET drain current. The station multimeter across B2 input to the tester when in use shows this up as widely varying voltages at identical positions of RV3.

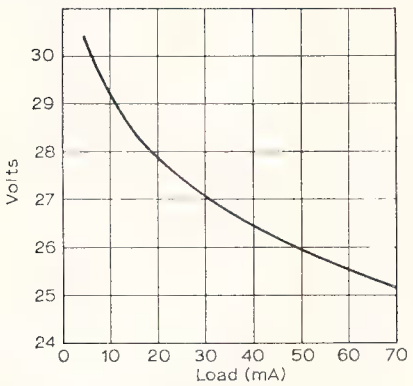


Fig. 5.—P.s.u. voltage drop against load in mA.

DRAKE 2-B RECEIVER

(Continued from Page 3)

The receiver bandswitch is set to 160 metres (band "A") and the pre-selector control to mid-scale. The main tuning control is set to the frequency that corresponds to 1.9 MHz. and the trimmers CT1A and CT2A carefully adjusted for maximum received noise without an aerial connected. If the receiver is fitted with the optional 100 KHz. calibrator, this can be switched on and the trimmers adjusted for maximum S meter reading.

Correct adjustment of the trimmers can be checked by retuning to 1.8 MHz. and the pre-selector control adjusted for a noise peak (or maximum S meter reading on the calibrator signal). This peak should occur with the pre-selector at near maximum capacity (pre-selector dial near 3.5). A similar check at 2.0 MHz. should provide a pre-selector peak at near minimum capacity (28 MHz. on the dial). Provided that the trimmers have been correctly set, tracking over the band will be satisfactory and the aerial can be connected. If it is found that the pre-selector will not peak at the band edges, or if there is an obvious difference in sensitivity over the band, this is a sure indication that the trimmers were not set correctly at 1.9 MHz. and further adjustment is required.

PERFORMANCE

A number of Drake 2-B receivers have been similarly modified for 160 metres, using the arrangement described. In every case the sensitivity throughout the band has compared favourably with that attainable on 80 metres. The G6LX receiver has been used extensively for Top Band DX working and by the Croydon N.F.D. Group, with excellent results.

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OVERSEAS MAGAZINE INDEX

This month five magazines were available to us: 1, "Break-In," July; 2, "CQ," Sept.; 3, "QST," July; 4, "Radio Communication, August; 5, "Short-Wave Magazine, July (all 1971 issues). Material available varied, as usual, with the accent upon antennas.

Antennas: An optimum performance array for 160, 40 and 20 metres; A half-Wave DDRR Antenna; An Antenna for 75 metre WAS; The K7GCO Modified HT-18 Hy-Tower; A Rotatable Dipole for 20, 40 and 80 metres: A Cheap 10 metre Vertical, see key 1; The Ground Image Vertical Antenna (3); "Two-Toter" Lightweight Portable Beam for 2 metres (3); Development of an All-Band Vertical (4).

Accessories: A Simple IC Keyer with weight control (3); Katsumi CW Monitor and Electronic Keyer, review (5).

General: A Second Look at Linear Integrated Circuits (3); A 20 MHz. Digital Frequency Meter using TTL ICs, Part 2 (4); Microwave Diodes (4); Modern Filter Design for the Radio Amateur (4); The Solar Link (Amateur Radio Astronomy) (4).

Receiving: A Solid State Noise Blanker (3); A Tunable 440 MHz. FM Receiver (3); Heath Model SB-303 Receiver, review (3); An RF Noise Bridge and its uses (5); More about Satellite Reception, Part 3 (5).

Transmitting: A Power Bridge and SWR Indicator for 2 metres (3).

Other: Standard Frequency and Time Transmissions (1); Space Conference Interim Report (2).

—VK3ASC.

ACITRON SSB-400

(Continued from Page 7)

to obtain the maximum output consistent with the best linearity. For example, if a transmitter is operated at 400 watts p.e.p. r.f. output it can only be correctly adjusted when running at this level. If it is tuned up at a value below this level and the drive is then increased to full input, it will be substantially maltuned and most certainly not optimised for best linearity.

In order to meet the above, the following requirements have to be met:

(a) A power supply capable of running with a continual two-tone input at the full p.e.p. rating, with little or no voltage drop;
(b) A p.a. tube or tubes capable of standing the full p.e.p. rating for some time.

However, in practice allowing for 50% transmit/50% receive time, the actual duty cycle on speech wave forms is as little as 15% to 20%.

In summarising, it is sufficient to say that for normal operation of s.s.b. equipment, i.e. voice, we require valve and power supply capabilities far in excess of what is necessary simply to enable the transmitter to be correctly tuned.

The novel (patented) tune-up system employed in the SSB-400 overcomes this problem using a different technique. The system of tuning is accomplished by feeding a low-duty cycle wave form into the transmitter audio input. In practice, this consists of a tone burst, with a one to ten mark to space ratio, meaning that the transmitter is running during these bursts to its full rated input, but is only running an average power in the order of 10% of its maximum rating

This in effect means that although the transmitter is running to its full rated p.e.p. input there is only one-tenth of the drain on both power supply and p.a. tube. This enables the operator to be relatively slow in carrying out the tune-up procedure and still have little possibility of damaging the final valve.

The price of the SSB-400 transceiver is $750.

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HY-Q ELECTRONICS TO MANUFACTURE IN SINGAPORE

Hy-Q Electronics Pty. Ltd., the Melbourne based quartz crystal manufacturers whose Frankston, Vic., plant is now operating at capacity, are to start manufacturing in Singapore.

Mr. T. A. Dineen, marketing director of Hy-Q, stated on his return from Singapore that the new operation Hy-Q Electronics Internatinal Pty. Ltd. will be in production early in 1972 and that a new air-cnditioned factory is already under construction.

Hy-Q Electronics will be joined in this venture by O'Connors Pty. Ltd., a Singapore based organisation with a 30% holding in the new company.

Mr. Dineen recently carried out a survey of East Asian markets, and with Mr. P. E. Cooper, chairman of Hy-Q Electronics, and Mr. R. C. Richards, managing director, concluded the negotiations with O'Connors and the Singapore Government.

BEWARE OF . . . CHAIN LETTERS

Another batch are in circulation.
If you get one, tear it up!