CRT Monitor Unit

FOR PHONE MODULATION CONTROL

D. PRATT (G3KEP) and
D. NOBLE (G3MAW)

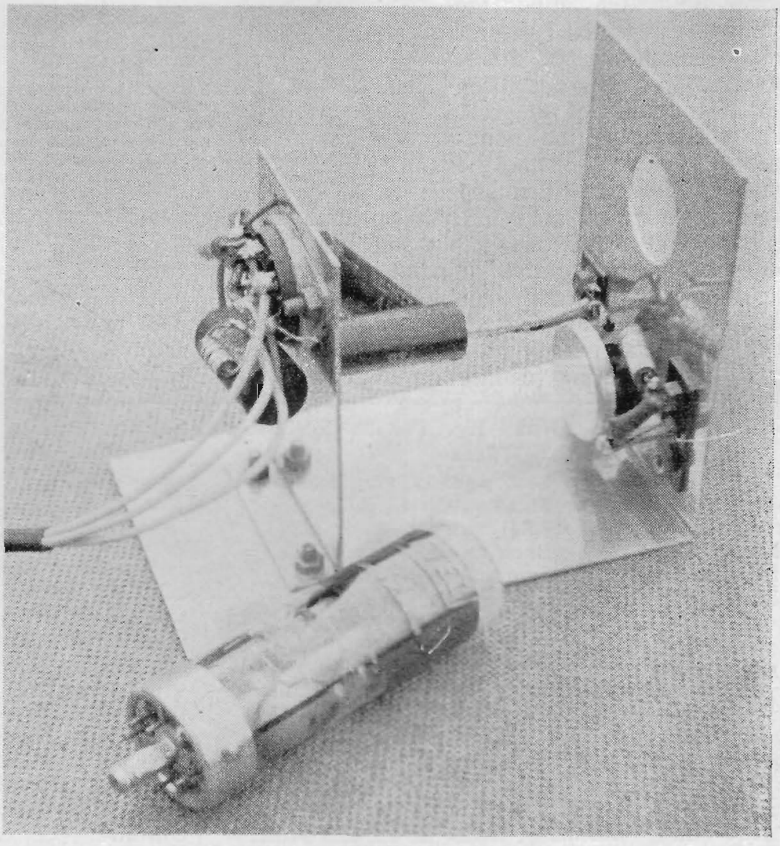
WITH the ever increasing number of stations on the amateur bands, it is necessary to take every possible precaution to avoid excessive interference to stations on adjacent frequencies. Common causes of interference include over-modulation and sideband splatter. Sidebands can be attenuated by inserting a low-pass filter in the modulator, or by a suitable modulator pre-amplifier circuit designed to eliminate the modulation frequencies above, say, 5 kc. Splatter, however, is caused by the modulation waveform cutting off on the peaks. This may be due to over-modulation, but it may also be caused by insufficient filtering after a speech clipper, or by a clamper valve conducting due to insufficient bias from the grid drive. Modulation approaching, yet not exceeding, 100 per cent is desirable for good communication efficiency. It is, therefore, very useful to be able to keep an eye on the modulation level with a suitable monitor.

Only a very simple monitor is required, and can be built quite easily. The suggested circuit is shown in Fig. 1. While surplus tubes, *e.g.* VCR97, 3BP1, etc., can be used, a much higher EHT is required. Also, a focus control would be needed, and this would tend to complicate the device. However, the Cossor 1CP1 (and equivalents) as used here is self-focusing. This tube is only 1 inch in diameter, which makes for a very compact little unit; it can be run off any readily available power supply. In fact, in many rigs there will, no doubt, be sufficient space internally for the monitor — although for experimenting, it may be advantageous if the unit is built on a small sub-chassis as shown in the photograph. Chassis details of the model can be deduced from the photograph below.

The Circuit

The 1CP1 is self-focusing, and the brilliance is controlled by the value of the cathode bias resistor, R3. It could be replaced by a variable potentiometer but this was not considered necessary. The anode is connected to the HT line, as are also the returns of the deflector-plate load resistors, R1, R2. The RF input to the Y-plate is taken to the harmonic check point of the transmitter, *i.e.* through the condenser C1 to the aerial socket. The audio from the modulator is applied to the X-plates. Its connection to the unit requires a lot of attention as the audio voltages are much greater than the 75-ohm RF voltage on the Y-plate.

The total value of the voltage divider circuit (R) should be 250,000 ohms per 150 volts of audio. The isolating condenser C should be at least equal to ·004/R in Farads.



The cathode ray Modulation Monitor can be built up on a simple chassis, with the only variable control — the potentiometer R in the circuit of Fig. 1 — on the front panel to the right, below the tube, a Cossor 1CP1 with one-inch face.

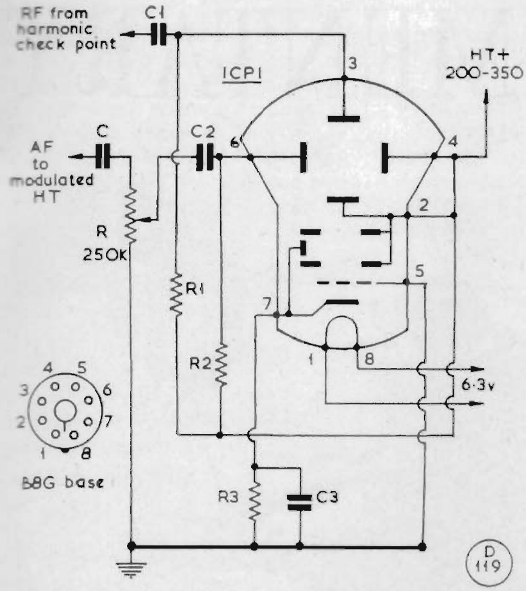


Fig. 1. Circuit of the CRT Modulation Monitor Unit, values for which are: C1, C2, 0.1 μF; C3, 1.0 μF; C, see text; R, 250K; R1, R2, 2.2 megohm; R3, 470K. The tube is a Cossor 1CP1, having a one-inch diameter face.

Example: Assume PA stage has an input of 10 watts, and the modulating impedance is 18,000 ohms. The approximate audio power required for 100 per cent modulation would be 5 watts.

$$W = \frac{V^2}{R}$$

$$\therefore \quad V = \sqrt{W \times R}$$

$$= \sqrt{5 \times 18{,}000}$$

$$= \sqrt{90{,}000}$$

$$\therefore \quad V = 300 \text{ volts}$$

$$\therefore \quad R = 250{,}000 \times 2. = \mathit{500{,}000\ ohms.}$$

$$C = \frac{0{\cdot}004}{500{,}000} \text{ Farads} = \mathit{{\cdot}008\ \mu F.}$$

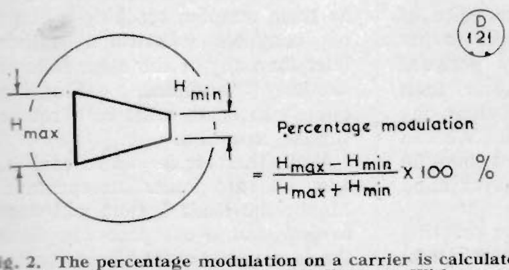


Fig. 2. The percentage modulation on a carrier is calculated from the measurements shown in this diagram. With a steady tone — such as a VFO/Rx heterodyne beat picked up from the speaker acoustically by the microphone — it is possible to get a "steady picture" to enable measurements to be made. These are facilitated by having a transparent scale on the face of the tube.

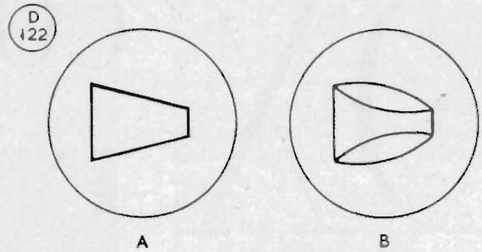


Fig. 3. For modulation levels of the order of 60%, the trace should be much as the left-hand sketch. If the coupling between the RF source — PA tank or aerial tuner — is incorrect, a "bellied-out" pattern similar to the sketch on the right will be obtained. The coupling adjustment through capacity C should be such as to give a pattern with straight sides.

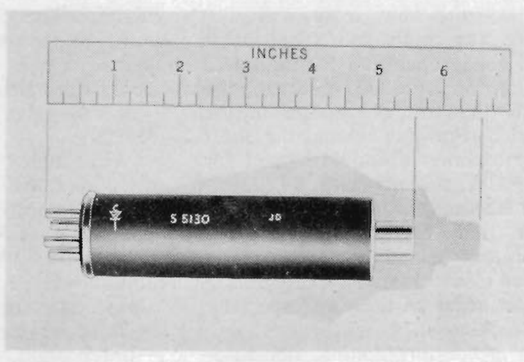
The display given by this unit is of the trapezoidal type. This is shown in Fig. 3A. Phase shift in the modulated amplifier is shown in Fig. 3B; this was actually induced due to capacity in the connecting leads so these must be kept separate.

Non-linearity in the modulated amplifier gives curved sides, and over-modulation causes the shortest side of the trapezium to close up completely.

The unit described has been used at the writers' station for some time, and it has been found to be indispensable for monitoring the speech transmission as it is radiated.

THE "NEW QTH" PAGE

Readers are reminded that all new-issue call-signs, or changes of call-sign address, should be notified to us for publication under "New QTH's" and subsequently in the U.K. section of the *Radio Amateur Call Book*. This ensures appearance in the only directory to the radio amateurs of the whole world.



For many years, the 866 and its equivalents have been regarded as the standard for high-voltage rectifiers. But it can now be replaced by the S.5130 silicon rectifier, which not only requires no heater current or warm-up period but is physically smaller than the 866. The S.5130, handled by the New York factors Ad. Auriema, Inc., is capable of giving 300 mA continuously under a peak inverse voltage of 10,400v. It fits comfortably in the palm of your hand!