AN RF MODULATION MONITOR:
Modified RCA WO-33A 3-Inch Oscilloscope

By R. A. Rainboth, WV2LNQ, and J. F. Sterner, W2GQK

RCA's new WO-33A 3-Inch Oscilloscope, which is available both as an easy-to-assemble kit and as a completely-wired, factory-calibrated instrument, has proved excellent for amateur radio use. Because of its plate coupling network (L-2 and R-33 in Figure 4), and the high sensitivity of the 3AQP1 cathode-ray oscillograph tube, the WO-33A is ideally suited for the application of rf signals to its vertical-deflection plates. The sensitivity of the 3AQP1 alone is such that 15 volts rms of rf signal provides at least one inch of deflection on the screen.

Frequencies below 4 Mc can be applied directly to the vertical input terminal of the WO-33A. A simple modification procedure permits monitoring of rf signals from 4 Mc to more than 150 Mc.

Essentially, as shown in Figure 2, this modification consists of adding a 0.01-µf ceramic disc capacitor (C-101) as a high-frequency bypass from cathode to ground, and a 0.005-µf ceramic disc capacitor (C-102) as a safety device to insure against excessive voltage being applied to the 3AQP1. A 4- to 40-µf ceramic trimmer capacitor (C-103) is mounted on the rear of the WO-33A case for use as a gain control to provide fine adjustment of the rf carrier applied to the 3AQP1 vertical-deflection plates.

Specifically, the modification of the WO-33A as an rf modulation monitor consists of 14 steps, as follows:

1. Carefully remove instrument from case.
2. Install the two-lug terminal strip, TS-101, under the left-hand screw (as viewed from rear) holding the 3AQP1 support bracket. Position as shown in Figure 1.
3. Connect C-101, the 0.01-µf disc capacitor, between lug #3 of the 3AQP1 and the grounded lug of TS-101 (attached to chassis). Solder the connection to lug #3 of the 3AQP1.
4. Connect C-102, the 0.005-µf disc capacitor, between lug #6 of the 3AQP1 and the insulated lug of TS-101. Solder the connection to lug #6 of the 3AQP1.
5. Connect one end of a 12-inch length of hookup wire to the grounded lug of TS-101. Solder.
6. Connect one end of the other 12-inch length of hookup wire to the insulated lug of TS-101. Solder.

These six steps complete the modification to the chassis. As noted, all connections made...
C
to the grounded lug of TS-102 (lug #1).

(14) Connect the other hookup wire to lug #4 of TS-102. Solder lugs #1, #2, and #4 of TS-102. Be sure that good solder connections are made at the two lugs of the trimmer capacitor.

Coaxial cable or 300-ohm TV twinlead may be connected directly from an rf source to lugs #1 (ground) and #2 of terminal strip TS-102 on the rear of the WO-33A case. If coaxial cable is used, connect the braided shielding to lug #1, and the center conductor to lug #2 of TS-102.

When rf signals are applied directly to the vertical plates of the 3AQP1, the vertical input cable should be shorted out and the "Ver-

To modify RCA’s WO-33A 3-Inch Oscilloscope for use in monitoring rf signals from 4 Mc to more than 150 Mc, only a few parts are needed, as follows:

- One C-101 (capacitor, ceramic disc, 0.01 µf, 1 kv)
- One C-102 (capacitor, ceramic disc, 0.005 µf, 1 kv)
- One C-103 (trimmer capacitor, ceramic, 4-40 µf)
- One TS-101 (terminal strip, two lugs—with one grounded)
- One TS-102 (terminal strip, four lugs—with one grounded lug at end)
- One screw (6-32 x 1/4", pan head)
- One #6 internal tooth lockwasher
- One #6 hex nut
- Two insulated hookup wires (12" length)

It is suggested that these two 12-inch lengths of hookup wire be of different color for identification purposes.
tical Range" switch set to position "60". The horizontal amplifier and sweep circuits may be adjusted in the normal manner to obtain modulation patterns as desired.

Normal operation of the WO-33A should not be affected by this modification. However, cables or leads connected to the terminal strip on the rear of the case must be removed before normal operation is resumed; otherwise, performance is affected by the added capacitance of these cables in the V-2 plate circuit.

For information concerning connections to the transmitter, interpretation of the 'scope pattern, and additional RF applications, radio amateurs should consult the ARRL Handbook or similar publications.
HALF-KILOVOLT RF PROBE

By Joseph Talavage
RCA Semiconductor and Materials Division, Somerville, N. J.

A 500-volt rf probe, useful for obtaining the resonance point of transmitter tank circuits, grid circuits, and other high voltage rf circuits, can be easily constructed with readily available components and two silicon rectifiers. Figure 5 shows the simple schematic diagram for the probe.

RCA-1N1764 silicon rectifiers are used in the probe. Because these rectifiers have a peak inverse voltage of 500 volts each, the two connected in series permit the probe to be useful to peak voltages of 500 volts, or about 350 volts rms. The addition of more rectifiers raises the peak-voltage rating of the probe by 250 volts for each additional rectifier, a decided advantage over a typical crystal-diode rf probe which has a maximum operating voltage of about 28 volts peak.

Circuit operation is such that the dc output of the probe is proportional to the peak value of the input wave. For this reason, and because of the value selected for R1, best accuracy is obtained when the input wave is sinusoidal.

An increase in the value of C1 will extend the low-frequency response, but will also affect the accuracy of the reading. However, if C1 is increased in value, the accuracy of the probe can be adjusted to an optimum value by means of compensating changes in the value of R1.

The probe circuit can be constructed to fit easily inside a discarded low-capacitance probe case. It was connected directly to an RCA WV-98A Senior VoltOhmyst®, through a shielded cable, and tested over a frequency range from 5 kilocycles to 50 megacycles, and a voltage range from 0.4 to 50 volts rms. Figures 6 and 7 show that for frequencies to 50 Mc, the greatest accuracy is obtained at voltages greater than 3 volts. The loading effect of the probe on resonant tank circuits was found to be negligible to at least 10 Mc.

Although all the tests were made with only one rectifier in the probe, the accuracy above 3 volts is relatively unaffected by the addition of the second rectifier.

Use of the probe involves a few simple steps: (1) place the selector switch of the VTVM in the "—DC" position; (2) apply the probe tip and ground wire to the correct points; and (3) read the rms value of the rf voltage on the appropriate dc scale.

Figures 6 (top) and 7, as noted in text, show that for frequencies to 50 Mc, the greatest accuracy is obtained at voltages over 3 volts.
... with RCA Beam Power Tubes

You are looking at the Heathkit "Cheyenne". That's the popular RCA 5146 beam power tube in the final, and an RCA 5753 drives it on "all bands" from 10 to 80.

Why do smart designers choose beam power tubes?

More compact size. Beam power tubes banish "three-omer" operation to the job with fewer stages, less expensive components, and fewer controls. Beam power rigs keep more of your transmitter dollars where you want them— in your pocket.

RCA is proud of the originator of beam power tube design. RCA is your local RCA distributor, Harrison, N.J. It is available free of charge from RCA distributors.

Information furnished by the Radio Corporation of America is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.