Television Signal Booster
—A 2-Stage Pre-Amplifier

Ricardo Muniz, E.E.

HERE'S a real first! A crying need for a signal boosting amplifier has been felt by many of the men making installations of television receivers in the twilight zone of the service area of the television transmitters. Even in the city—near the transmitter—there are areas which are effectively shadowed. The installation instruction sheet supplied to men installing television sets for one of the very large manufacturers states under the heading Too Weak a Signal, quote: "The signal may be too weak even to ensure stable synchronism as noise pulses may be strong enough to override the signal and go trip the deflection oscillators at the wrong times. The remedy is to install the antenna at greater height or in an unshielded location, provided increased transmission line loss does not offset the increase in signal strength—there may be no alternative except the installation of a special R.F. Amplifier to offset increased transmission line loss...."

The author, wishing to be fully prepared to meet any emergency, diligently sought to locate, on the market, such a "Special R.F. Amplifier" without meeting with any success. The gadget being unavailable, he decided to design and construct one himself. The unit described in this article was the result of these efforts.

PERFORMANCE: This signal booster amplifier was tested in a location where See RCA's "Practical Television." (Continued on page 40)

Wiring diagram of the signal booster—suit the thing for distant receivers.
Television Signal Booster

No picture signal was receivable and brought in a full strength picture perfectly sharp and steady. The sound was heard without the pre-amplifier. The receiver under consideration was a Du Mont 183. The band pass characteristic provided by the pre-amplifier was maintained without any loss of the fine details which are carried by the higher modulation frequencies. The sound channel was also amplified.

FEATURES: There is full equipment for two channels built in and provisions are made for at least one more channel—an additional one might be squeezed in (making total of 3) if desired. The antenna, used for W2XBS 45.25 mc. picture; 49.75 mc. sound; and W2XBE 51.25 mc. picture; 55.75 mc. sound. A self-contained power-pack is built in. A gain control is provided for each of the two R.F. amplifier stages to permit optimum adjustment of each stage without the aid of test equipment. The output is made adjustable by using the same potentiometer for both stages. The antenna switch can change from one channel to the other at a flip. This feature is a real convenience and is very compact so that it will not be an eyesore if it must be installed outside the cabinet and yet will quite probably fit inside.

CHOICE OF CIRCUIT: The circuit published together with this description of the signal booster is the result of a good deal of experimental work. It is the simplest possible circuit which was found to work well. The design of a signal frequency amplifier is a big headache to everyone who has tried it. It is a much easier and much less expensive to design and make something else. Many were tried. Some can be made to give slightly more gain than the one described, but also, much more gain. The circuit was designed to be trouble-free. It is an entirely out of the class of equipment which can be made in the average service shop. It is a laboratory job. The actual advantage of these “laboratory” circuits over the one finally chosen was found to be mostly “on paper.” The circuit used is very stable and will not oscillate at full gain if the described parts placement is adhered to.

DESCRIPTION OF CIRCUIT: The television diode antenna is fed down through the usual transmission line. In locations requiring use of the signal booster it is desirable to use relatively good line-connection. It will be noted that the two ends of the transmission line are connected to taps on the grid coil of the 1st stage. See diagram for details of this coil make-up. As found after complete testing that this was the least troublesome way to match the line impedance into the amplifier input. Several other methods were tried, but this one had a way simpler and much simpler to adjust—as a matter of fact, if you make the coil just as specified no adjustments are required. If you are not of an electronic mind, however, I recommend the lower tap—nearest ground—will permit exact matching. It is necessary to adjust C1, and C5, every time the tap is moved a fraction of a turn. The first stage uses tuned grid, tuned plate. The plate is coupled by a 0.005-m. condenser. The second uses tuned plate. It will be noted that single tuned circuits are used. A ganged switch changes from C1, C2 to C3, C4, C5 for switching the power input to channel No. 2. The output link to the television receiver again must match the impedance of the usual television set line (about 72 ohms) because the input of a standard television receiver is designed to work from an antenna line. This is accomplished by connecting a piece of transmission line (twisted pair may be used) at one end, to the television set at the other end; the two wires are connected to the plate side of the last plate stage, as indicated. Many arrangements were tried here without success—this is only the one that worked at all. Since L1 has B-plus on it, blocking condensers C4, and C5 were necessary.

ADJUSTING THE SIGNAL BOOSTER: It is desirable to adjust the signal booster in a location where the signal strength is sufficient to operate the receiver without the booster. Final trimming of the first and last trimmer may then be made on a location to match up as best can be done.

Connect the antenna transmission line to the INPUT terminals; the television receiver to the OUTPUT terminals. Turn on both the "television" and the signal booster. Adjust the paddlers while observing the transmitted "Test Pattern" on the screen of the telly set. It will be necessary to bring the gain or contrast control down on the telly set as the adjustment proceeds. The adjustment should be made with the gain control turned off and the signal booster both set about 1/4 of the way up. Adjustment of the booster paddles until the picture is the strongest that can be obtained for a given contrast ratio will be obtained. It will be noted that the television sound gets stronger at the same time.

PRECAUTIONS TO BE OBSERVED IN CONSTRUCTION: To one familiar with construction of ultra-short wave receiving equipment no special difficulties will present themselves. To those familiar with experimental work, a few words of advice will not be amiss. The author does not advise anyone without prior radio construction experience to try to build this or any piece of television equipment unless is is willing to devote time necessary to master the fundamental principles of the art. The latter group may find it necessary to re-build the booster after having completed preliminary experiments.

The distributed constants of the wiring and equipment assume primary importance in ultra-high frequency work. A wire is not only a lead, but also a condenser, an inductance and a resistance. The proximity of the various parts introduces into the circuit unexpected capacitances and inductances. Bearing these facts in mind, avoid paralleling any R.F. circuits where a reasonable amount of space between parts without unduly lengthening the wiring. Remember that small changes in wiring location often require changing the number of turns on the tuning coils. The number of turns should be adjusted to such a manner that the NBC channel (48.25 mc.) comes in with the paddle condenser almost all the way in. CBS (51.25 mc. and 55.75 mc.) will then come in with very little or no adjustment, leaving a room for a third set of padders for the third channel. The specified bandwidth switch is to be extended to provide spacing of 2 inches between switches. This is an easy job for the experimenter. Trimming is best accomplished using the special screw-driver specified in the parts list to reduce the effect of body capacitance.

The author will be very glad to hear from builders of this booster and to give them any reasonable amount of advice should they encounter problems. Address him care Radio & Television Magazine. Envelope a specially impressed "stamped" envelope of the actual assembly of the booster.

Paris List
2 Stage Pre-Amplifier
I.R.
1-10,000 ohms, type D1A, R12, R13
1-100,000 ohms, type D1A, R14, R15
1-160 ohms, RF, R2, R5
1-100 ohms, RF, R11, R6
1-60,000 ohms, BT1, R8, R10
1-250,000 ohms, BT2, R9
1-20,000 ohms, BT3, R11
1-60,000 ohms, type 1A10, W1, R12

AMERICAN PHENOLIC CORP.
2-Super Mop sockets No. 2408
1—green reeders, MIP-4

INSULINE CORP. OF AMERICA
1—200,000 ohms, plastic, type 24-4000
1—ground chassis cover, same number
1—ground plate; same No., 4662

CORNISH WIRE CO.
2—25 feet coax Belden radio hookup wire

BUD MFG. CO.
1—Power switch type 1063, SW1

RCA RADIOFONIC CORP.
1—51C7, V5

HARMARLUND MFG. CO.
6—RCA CTC-3304, type APC24, C1, C5, C6, C7, C9, C14

KENYON TRANSFORMER CO., INC.
1—100 ohm, type 1T128, L4

THORDARSON ELEC. MFG. CO.
1—00 mA, choke, type T1527, L4

CORNELL-DUBILIER CORP.
6—01—type 1W3, F3, C1, C3, C6, C10
1—005 mc. type 1W3, IB, C6

AMERICAN RADIO HARDWARE CO., INC.
1—No. 275 300 line, 75 volt, type 785
1—No. 14 round bobber wire
1—No. 68 1 inch bobber wire
1—No. 140 terminal strip
1—No. 120 terminal strip
1—No. 120 terminal strip
1—No. 120 terminal strip
1—No. 429 Archie terminal strip
1—No. 429 Archie terminal strip

R.M. MALLORY & CO., INC. (TAYLOR)
1—240 volt, 8Vac, 5-amp, power transformer, type 1224, SW2

COIL DATA
1—No. 14 copper wire on 1/4" Dia.
2—no. 14 copper wire on 1/4" Dia.
3—no. 14 copper wire on 1/4" Dia.
4—No. 14 copper wire on 1/4" Dia.
5—All turns spaced equal to diameter of wire

Let's Listen In with Joe Miller

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YUGOSLAVIA

YUVE, 11,700 mc., exceeds testing lately from 9000-100 mc. which is probably to ascertain the reliability of production in America at this time. For this frequency, we are certain that equipment is on the market. The frequency is one provided it is not GMRG. YUC, 9,565 mc., conducted by that department, which is in the 17,451 mc. group, is too close to the 16,500 mc. See full listings for Jan. 1940 article.

CHINA

XGQO, 15,159 mc., Shangai, has altered skeds to New America to 8,809-10 and 11,101-93, but not always heard well. Shanghai, XGGZ, 6,556 mc., new operation for America. Reports on China's station are few. XGQO, 11,411 mc., has been heard daily 2 p.m., but XGGZ is too close to the 16,500 mc. See full listings for Jan. 1940 article.

We'd like to get reports from all the boys, and maybe to do a May Summit for sufficient material, so it's up to you! Will you help? Good listening to all YV1J—Joe Miller.