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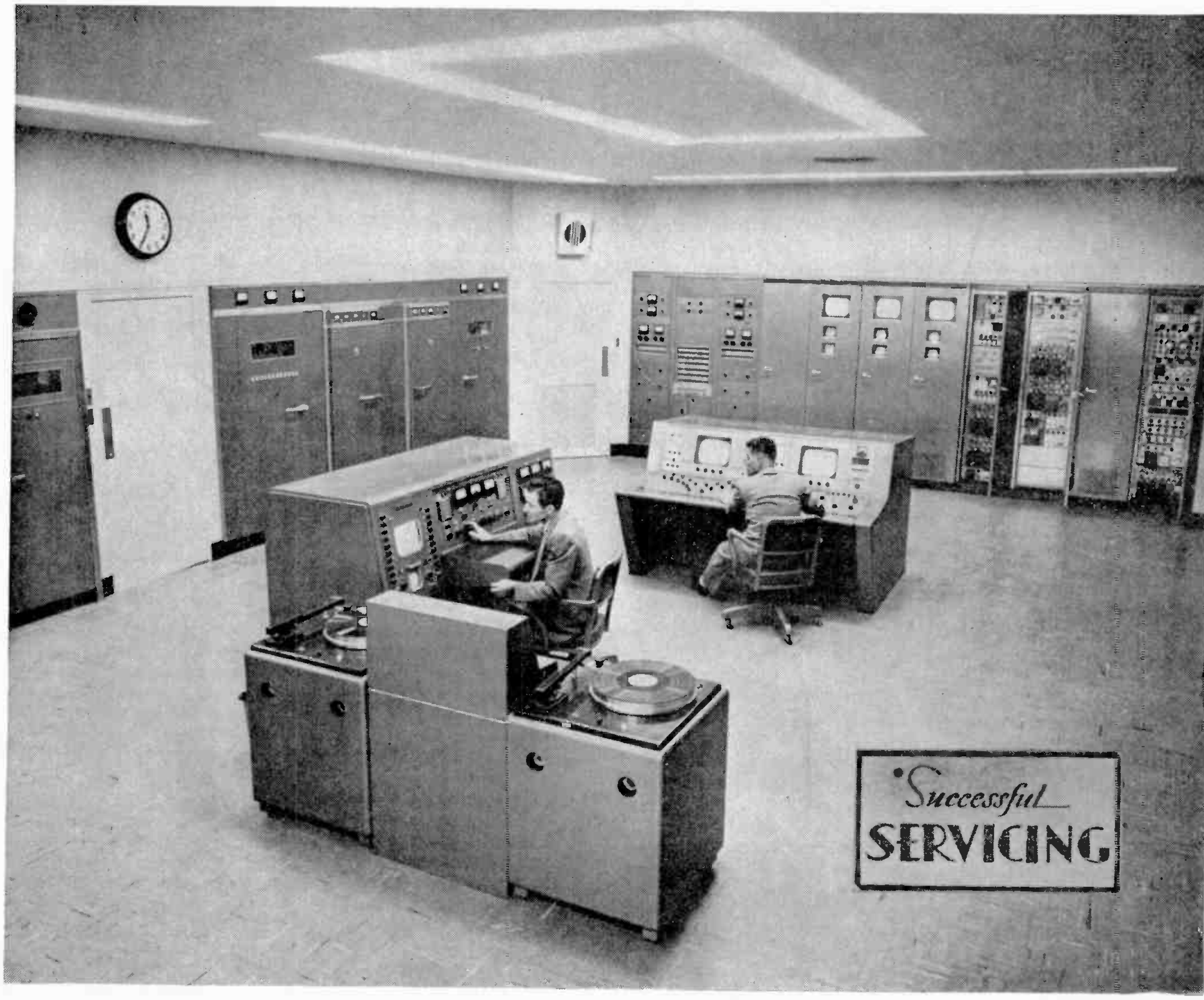


JANUARY, 1950

Courtesy WOR-TV

CIRCUIT LOSS IN SIMPLE CENTER-FED TV ANTENNAS

By ARNOLD B. BAILEY

In television receiving antenna practice, it is imperative to cover a wide band of frequencies far exceeding the normal capabilities of any one simple center-fed antenna. The TV channels when represented on a frequency-ratio basis bring this out clearly. Table 1 shows present channels on the basis of the nominal center frequency and the appropriate limits to be covered by the proposed vhf channels. Even if a separate simple antenna is used for each of the three bands, the problem, although vastly simpler, is still formidable. For the present, we shall consider only the circuit problem, and evaluate the mismatch loss which directly affects the magnitude of the received TV signal, and which will probably be present when one simple center-fed antenna is operated over a wide frequency band. Another distinctly separate factor relates to the directional response changes which occur over a wide frequency band. These directional response changes will be treated later.

> Editors Note: This material is an *abridged* excerpt of the same subject as found in "Theory and Practice of 30—1,000 Mc Receiving Antennas" a forthcoming book which has been written by the author of this article and will soon be published by John F. Rider Publisher, Inc.

The receiving antenna as a circuit element can be considered as a generator. This generator tries to pump power into the antenna load and can only do so when the load is properly matched to the antenna. We can fix the load resistance by proper selection of the TV receiver input circuit constants and choosing a transmission line to correspond to this receiver input resistance. This fixed load resistance can be made the same value for all TV channel frequencies.

The simple antenna, however, has a different value of resistance at each frequency, which will prevent a perfect match at more than one frequency. At its resonance frequencies the antenna is "in tune" and its Q (ratio of reactance to resistance) is zero. At other frequencies, the antenna is out of tune; the Q is finite and will cause further mismatch losses. Thus we see that we can only have a perfect match at one frequency, and this frequency must, for simplicity, be one of the antenna's resonant frequencies.

This brings about at least three possible ways of selecting load values for a simple antenna. One way is to use a low-load resistance value which equals the antenna resistance at the half-wave resonant frequency. Another way is to use a high-load resistance value which equals the antenna resistance at the full-wave resonant frequency. A third possibility is to use an intermediate-load resistance value, the geometric mean of the other two values.

Figs. 1, 2, and 3 show these three cases for four simple center-fed antennas. The

(*Please turn to page 12*)

Television Changes

General Electric 811

The Model 811 chassis is similar to that of the 810, which appears on *pages 2-22 through 2-43 of Rider's TV Manual Volume 2,* except for the changes described in the following paragraphs.

When making video i-f alignment, adjust the signal input to each stage to develop ¾-volt peak at the video detector (junction of L16 and C27), as measured with a calibrated oscilloscope, with a contrast bias of -4 volts.

When making audio i-f alignment, adjust the signal input to each stage to give ¾-volt peak at the limiter grid (junction of R104 and C100), as measured by a calibrated oscilloscope, with a contrast bias of -4 volts.

Two types of ion traps were used on this model. One is a single assembly, the other is a rubber sleeve with two magnet rings. Both types should be adjusted to give maximum brightness on the screen. To adjust the first type, it is necessary to put the trap around the neck of the tube with the arrow pointing toward the face of the tube. The assembly should then be rotated and moved forward or backward to give maximum brightness. If the illuminated area gets too bright, reduce the brightness control and readjust the ion trap for maximum brightness. The second type of ion trap is a rubber sleeve with two magnet rings, one large and one small. The trap should be mounted on the tube neck between the focus coil and the tube base, with the smaller magnet ring toward the focus coil and the larger magnet ring toward the tube base. The approximate adjustment requires that the gaps in the two magnets be lined up with the break in the rubber sleeve.

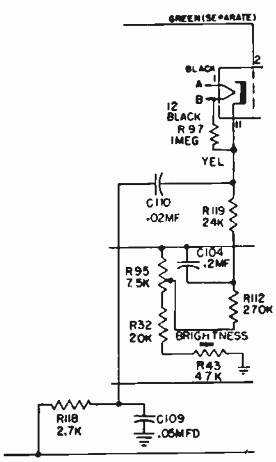
1. With brightness control advanced, turn ion trap assembly so that the gap in the rubber holder is faced up or down and lined up with either pin no. 6 or pin no. 12. Whichever way gives some illumination is the correct approximate orientation of assembly. If the tube, V12, is removed, it will be found much easier to adjust for maximum illumination since the resultant thin line will show illumination even though the magnets are considerably out of adjustment.
2. Move the assembly back and forth, and rotate it while viewing the screen for maximum brightness.
3. If illuminated area gets very bright, reduce brightness control and repeat Step 2. If tube V12 was removed, replace it before proceeding with Step 4.
4. If any shadowing of the tube neck is present after completing Step 3, rotate the small front magnet to correct the shadow, and repeat Steps 2 and 3.

Early production used a ten-inch speaker, while late production uses an eight-inch Alnico PM speaker.

Early production used a coil L5 in the grid circuit of V17. This was changed to a transformer T21 with tap 1 connected to R101 and capacitor C106, 5,000 μμf (which is connected to ground), tap 2 connected to the plate of V22, tap 3 to ground, and tap 4 to grid 1 of V17.

Bias voltage was added to the grid of V2-B converter, by a circuit consisting of R120, 1 megohm, R121, 1 megohm, C113, 5,000 μμf, and R4, to prevent the video carrier from modulating the audio carrier and causing a buzzing sound in the audio. R121 and C113 are connected in parallel to ground and the junction of R4 and R120, which goes to the junction of R8 and C19.

A circuit consisting of R118, C109, C110, and C104 has been added to improve blanking of the vertical retrace. This is shown in the accompanying diagram.



Circuit changes for General Electric 811.

An *R-C* filter, R38 and C46, 20 μf, was added to the primary of the vertical output transformer T15, to remove the vertical sawtooth wave from the B+ line which in some cases caused buzzing in audio.

C111, a 5,000-μμf capacitor has been added to the filament of V10 to remove a buzzing sound in the audio.

Model 811 Replacement Parts List is identical to that listed for Model 810, except for the following changes.

These items listed in the parts list for 810 are not used on 811:

Cat. No.	*Symbol*	*Description*
Cat. No.	*Symbol*	*Description*
UOP-577		Speaker—5¼-inch PM speaker
RAB-077		Back—cabinet back cover
RAV-059		Cabinet—model 810 cabinet
RCE-071	C59,60, 61,63	Capacitor—electrolytic
RDW-010		Safety glass—cabinet glass
RJC-008		Connector—picture tube anode, connector assembly
RJS-119		Socket—picture tube socket
RMM-081		Cushion—rubber cushion for picture tube
RRW-029	R97	Resistor—0.65 ohm, 4 w, ww
RTO-054	T17	Transformer—hor. sweep
RTP-062	T18	Transformer—power transformer, 60 cycles.

These items are used on 811, and are not listed for 810:

UOP-867		Speaker—eight-inch PM speaker, used on late production 811
URF-047	R38	Resistor—820 ohms, 2 w, carbon
RAB-084		Back—cabinet back for 811
RAV-072		Cabinet—for 811, using 10-inch speaker, ROP-018
RAV-084		Cabinet—for 811, using 8-inch speaker, UOP-867
RCE-084	C59,60, 61,63	Capacitor—electrolytic
RCE-093	C46	Capacitor—electrolytic
RDE-041		Escutcheon—knob escutcheon
RDW-017		Safety glass
RET-002		Ion trap
RHX-014		Lead damper and spring
RHX-015		Cable—picture tube mounting ring and spring assembly
RJC-002		Contacts—speaker contact clips
RJC-011		Anode connector assembly—for picture tube
RJC-014		Connector—single female plug to connect yoke assembly to chassis
RJC-015		Connector—single male plug connects yoke assembly to chassis
RJP-027		Plug—eight-prong male plug connects yoke assembly to chassis
RJS-114		Socket—female socket connects to RJP-027 on yoke assembly
RJS-128		Socket—for picture tube
RMM-086		Cushion—for escutcheon
RMM-087		Cushion—for safety glass
RMM-099		Bracket—used with RMM-100 and RMX-126 for mounting yoke assembly
RMM-100		Adjusting plate—with two tapped holes
RMX-126		Bracket—for adjusting and clamping deflection yoke
RMS-165		Spring—for mounting picture tube
ROP-018		Speaker—ten-inch speaker, used on early production
RTL-090	T21	Transformer—1st audio i-f
RTO-067	T17	Transformer—horizontal sweep transformer
RTP-300	T18	Transformer—power transformer.

Sentinel 401, 402, 406

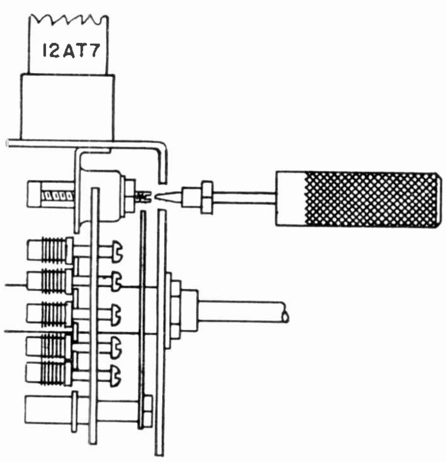
These models appear on *pages 3-8 through 3-17 of Rider's TV Manual Volume 3.* Glass breakage and premature failure of the 6AR5 tube may occur. This happens because the tube shield used over the 6AR5 tube fits very snugly and if there are any minute flaws in the glass envelope, the envelope will break due to the expansion caused by the heat of the tube. When replacing 6AR5 tubes, do not reinstall the tube shield. This shield was used solely to prevent the tube from dropping out of its tube socket during shipment.

Television Changes

Sentinel 400, 401, 402, 405, 406

Models 400 and 405 appear on *pages 2-1 through 2-13 of Rider's TV Manual Volume 2* and on *pages 3-1 through 3-7 of Rider's TV Manual Volume 3.* Models 401, 402, and 406 appear on *pages 3-8 through 3-17 of Rider's TV Manual Volume 3.* If tearing and picture breakup (noise streaks) occur when the set is jarred, on early models 400, 401, 402, 405, and 406 television receivers using a 12AT7 oscillator tube, it is probably due to a loose padder trimmer slug screw in C-11. The loose fit between padder trimmer screw and the threaded sleeve prevent a firm grounding contact and result in a breaking up of the picture, noise streaks, and possible detaining of the received picture. The installation of a locknut bushing, part number PST 500, on the padder trimmer screw will hold the trimmer screw firmly and provide a proper ground.

Slide the locknut bushing on a thin bladed screwdriver with the nut end toward the handle and insert the screwdriver into the trimmer screw slot as shown in the accompanying diagram. While holding the padder trimmer screw so that it will not turn, slide the locknut bushing on the padder trimmer and turn it down by hand until it is tight against the front of the r-f tuner unit chassis.



Adjustment for the Sentinel 400, 401, 402, 405, 406.

Industrial Television IT-35R

This chassis appears on *pages 3-1 through 3-8 of Rider's TV Manual Volume 3.* The following changes are suggested to improve the video response:

Change the value of R42 from 10,000 ohms, ½ w to 3,900 ohms, ½ w.

Add L30, a 470-μh peaking coil, between R42 and the junction of CR1 and C54.

All current production models of the 35R-control chassis will have Standard Coil tuners instead of the G. I. tuners. The phono-jack audio output and four-pin video and control-voltage plug will be replaced by one octal plug.

Muntz M169

This model appears on *page 3-4 of Rider's TV Manual Volume 3.*

The four 30,000-ohm, 2-watt resistors located in the horizontal hold circuit have been replaced by one 20,000-ohm, 10-watt resistor, number RW-2002-210.

●

General Electric 805, 806, 807, 809

These models appear on *pages 3-1 through 3-15 of Rider's TV Manual Volume 3.* Insufficient horizontal sweep width may be caused by a parasitic oscillation in the type 19BG6 horizontal sweep output tube, V13. To correct this, connect a 47-μμf, 500-v, mica capacitor, Stock No. UCU-1020, from pin 7 of the 19BG6 tube to a ground lug of an existing terminal board on the adjacent side apron.

Correction

On *changes page 3-2 of Rider's TV Manual Volume 3,* General Electric 802 is listed as appearing on *pages 1-28 through 1-49,50 of Rider's TV Manual Volume 1.* This should read "This model appears on *pages 1-52 through 1-72 of Rider's TV Manual Volume 1.*"

Sears Service Hint

Since the failure of capacitor, C92, 0.01 μf, 400 volts, in some television chassis has resulted in the destruction of several other parts, it is expedient to replace it with a 600-volt capacitor, before turning the receiver on for its initial test, as shown in the data for Model 9119, which appears on *pages 3-23,24 through 3-32 of Rider's TV Manual Volume 3,* and for Model 9122, which appears on *pages 3-12 through 3-21,22* of the same Volume. This change has been incorporated in all chassis above serial number B09-T51016 for Model 9119, and above serial number B09-T310002 for Model 9122.

It is not necessary to remove the chassis from the cabinet when making this change. Remove the bottom plate from the cabinet on either the console or table models with the cabinet on the side or upside down on protective pads. The capacitor C92 is mounted between pins 3 and 5 on the 7AF7 horizontal oscillator discharge tube. Unsolder the original part and solder in a good 0.01-μf, 600-volt, tubular paper capacitor.

●

General Electric 801

This model appears on *pages 1-28 through 1-51 of Rider's TV Manual Volume 1.* Add a 13-volt, bezel-indicator pilot lamp, catalog number UDL-019, to the replacement parts list.

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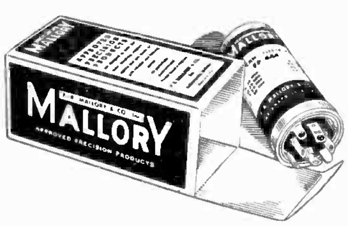

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CURTAIN TIME

TVI And The Serviceman

For the benefit of those servicemen who need the information, TVI means television interference from a ham station. The spread of television poses many problems for the operating amateur. Judging by reports from different parts of the country where both hams and TV receivers are in use, all operating frequencies used by the amateur station may produce interference. The conditions under which such interference develops, and how they may be cured are varied. We shall discuss some of these in this editorial, but the primary purpose of this brief discourse is to bring to the attention of the serviceman that there is more to the solution of TVI than the simple advice to the TV receiver owner, "write to the FCC". The principle involved is: live and let live.

It would be ridiculous to deny that ham interference can prove annoying to the TV serviceman, and it is also true that one cannot expect the television servicing industry to serve as a liason between the set owner and the ham. It is, however, equally true that when a TV antenna is being installed, it does seem silly to locate it within a few feet of a ham beam, especially when there is adequate room elsewhere for the antenna. We recognize that changing a position of a TV antenna laterally on a roof can materially alter the character of the received picture, but we repeat, that such changes will not always destroy received picture clarity. It may mean a slight loss in signal strength, but in many large centers it can be tolerated. Frequently, a very unhappy situation is created, because a ham who is operating his transmitter in accordance with all of the FCC requirements finds it impossible to go on the air during TV hours because the close proximity between his and the TV antenna results in shock excitation of the latter. Sometimes a fundamental frequency (ham) trap at the TV receiver antenna terminals is a great help, but why create a situation if it can be avoided.

We think that it is the responsibility of the television servicing industry to be as familiar with the problems of ham interference as it is for them to be familiar with the various conditions which control proper reception from a TV station — assuming all other detrimental influences absent.

Neglecting for the moment the matter of justice, the rights of the ham cannot be denied. They are not any more or any less than that right of the public to receive a television picture without any interference. The television serviceman should realize that both parties have rights, and that it is the responsibility of the serviceman to give *proper* advice to the complaining receiver owner. It is neither just nor technically correct to dismiss such interference conditions by recommending a letter to the FCC.

Without question, numerous ham transmitters located in TV areas are emitting harmonics which are frequently the cause for TVI. The FCC has decreed that such harmonic emission would be cleaned up; and in many cases, when this was done, TVI ceased. One manufacturer of ham transmitters has designed his equipment with the elimination of TVI in mind, and there is no doubt that others will do likewise. However, it is also very significant to know that in some instances — and these must be recognized — television interference has reappeared; and upon investigation, it was found to be in no way connected with the ham transmitter, nor with the TV receiver itself. The trouble issued from corroded joints or poor contacts in the TV antenna system. In other words, it was not a ham problem, but rather a service problem.

We know only too well that the public at large wishes to get the most for the least — that people are not overanxious to recompense a serviceman for any special precautions which he may take or desire to take to assure good TV reception. Yet it cannot be denied that when the locale is such that a ham transmitter is in the proximity of a TV receiver, it is necessary to take the presence of that

(*Please turn to page 15*)

Television Changes

Sears 9123, 9124, 9126

These models appear on *pages 3-1 through 3-11 of Rider's TV Manual Volume 3.* If one of these sets cannot be made to focus properly, the type of focus coil used should be checked carefully and possibly replaced. In original production, the horizontal output transformer produced an anode potential of approximately 7,500 volts. This same transformer had a tendency toward short horizontal scan which, in many cases, was corrected by the addition of a capacitor across part of the transformer wiring. As soon as it was possible, a horizontal output transformer was incorporated which produced an anode potential of 10,000 volts and developed more than adequate scan. The higher-anode potential made it necessary to adopt a new focus coil since the original focus coil would not produce proper focus with potentials higher than about 8,000 volts. A new focus coil can be identified by the fact that the back aluminum cover is not embossed the same as the front cover. In addition, this focus coil, which is an I.T.E. product, has four rivets holding the two aluminum cover plates in position and has six ears. The original focus coil, manufactured by G.E., has only four ears and the securing rivets are located in the ears. It is important to note that the G.E. coil will focus over a second-anode potential of 7 to 8,000 volts, whereas the I.T.E. focus coil will focus over a second-anode potential range of 8 to 10,000 volts.

General Electric 801, 802, 803

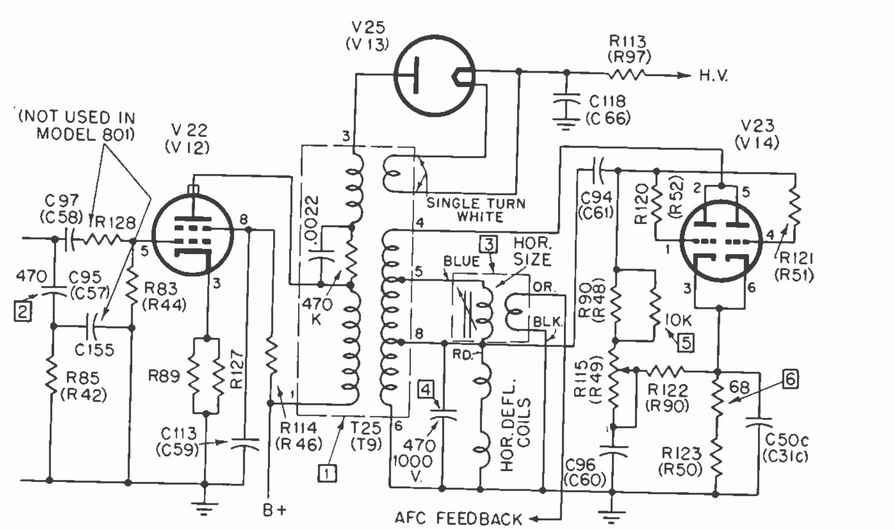
Model 801 appears on *pages 1-28 through 1-51 of Rider's TV Manual Volume 1,* and Model 802 appears on *pages 1-52 through 1-72* of the same Volume. Model 803 appears on *pages 2-1 through 2-21 of Rider's TV Manual Volume 2.* The original molded horizontal sweep output transformer listed for these models has been replaced by a new ceramic core sweep transformer, Stock No. RTO-071. It has several electrical design improvements over the original specified transformer; among them are higher efficiency and better high-voltage insulation. The transformer is equipped with a 470,000-ohm resistor in shunt with a 0.0022-μf capacitor, connected between the primary and hv windings. In order to provide identical electrical characteristics to the original transformer, a few circuit revisions are necessary when the substitution is made. The accompanying diagram shows the six steps required to adapt the circuit for the new transformer. The numbers in the squares correspond to the steps in the procedure. Because the 801 schematic symbol numbers are different from the 802-803, the 801 numbers are shown in brackets.

The procedure is as follows:

1. Disconnect leads of the old sweep output transformer and remove it from the chassis. Remove and discard the following parts: on Model 801—R107 and width control, L7; on Models 802 and 803—R126 and width control, L23. Mount new transformer on the chassis and connect it as shown to existing components. In some Models 802 and 803 a decoupling choke and capacitor, L2 and C154, were used between B+ and primary of transformer T25. Leave these in the circuit.
2. Change C95 (C57) from a 1,000-$\mu\mu f$ capacitor to a 470-$\mu\mu f$, 500-volt mica capacitor. This is in the plate return, pin 5 of V21 (V11).
3. Add new width control and connect as shown. A secondary winding (leads—orange and black) is added to provide the necessary afc feedback voltage for these receivers, which was originally supplied by a tap on the transformer. It is very important to observe color coding when wiring in the control; otherwise the feedback voltage will have improper phase.
4. Add a 470-$\mu\mu f$, 1,000-volt, mica capacitor between terminals 6 and 8 of the sweep transformer. Two 1,000-$\mu\mu f$, 500-volt mica capacitors in series may be substituted.
5. Add a 10,000-ohm, ½-watt, carbon resistor across R90 (R48).
6. Add a 68-ohm, 2-watt, carbon resistor in series with the cathode resistor, R123 (R50) of V23 (V14).
7. Change C93 (C56) from 150 $\mu\mu f$ to 180 $\mu\mu f$. This is to assure that all receivers will sync within horizontal hold-control range.

The new parts required are as follows:

Part No.	*Description*
RTO-071	Ceramic iron horizontal sweep output transformer
RLD-017	Horizontal width control (includes secondary for afc feedback voltage)
UCU-1544	470 $\mu\mu f$, mica-C95 (C57)
URD-073	10,000 ohm, ½ w, carbon
URF-021	68 ohm, 2 w, carbon
(see substitute)	470 $\mu\mu f$, 1,000 v, mica (substitute two 1,000 $\mu\mu f$, 500 v, Stock No. UCU-1052, in series)
UCU-2534	180 $\mu\mu f$.



Circuit changes for General Electric 801, 802, and 803. Circuit symbols in parenthesis denote reference numbers for Model 801. A single resistor R45 replaces the parallel resistor, R89 and R127 in Model 801.

Radio Changes

RCA 8V91

This model appears on *pages 19-16 through 19-25 of Rider's Manual Volume XIX*. The following changes in parts list have been made:

Change:
73753 Pull—
to read:
73753 Pull—Door pull (2 required) for mahogany instruments.
Add:
74626 Pull—Door pull (2 required) for blonde instruments.

●

Philco M-12C

This model appears on *pages RCD. CH. 19-55 through RCD. CH. 19-74 of Rider's Manual Volume XIX*. The three parts referred to below were listed twice in the parts list, and should be deleted as indicated.

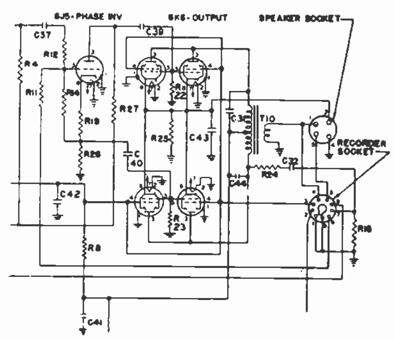
Part No.	*Description*	
56-4647	Retainer spring	Delete
56-5753	Push-off saddle	Delete
76-4008	Base plate assembly	Delete.

●

Hoffman C503 and C513, Ch. 108

These models are identical with Models B503 and B513, which appear on *pages 17-8 through 17-13 of Rider's Manual Volume XVII*, except for the following changes:

1. Push-pull parallel 6K6's are used in the output stage instead of push-pull 6V6's. This is shown in the accompanying diagram.



Circuit changes for Hoffman C503 and C513.

2. On the recorder amplifier the screen dropping resistor R11 has been changed from 0.1 megohm to 2.2 megohms. The cathode resistor, R1, for this stage has been changed from 2,200 ohms to 4,700 ohms. This allows the screen current of the 6SJ7 tube to be self-regulating and to eliminate variations in gain between various 6SJ7's.
3. R31 and C49 have been added in parallel to the S1-sec 2, rear, wafer lead that goes to the phonograph receptacle.
4. Capacitor C30 is now connected to the variable resistor, R20, instead of to ground.

Farnsworth P-10

This a-m—f-m radio chassis used in Model 100-M, is identical to the P-10 chassis which appears on *pages 19-19 through 19-33 of Rider's Manual Volume XIX*, with the exception of the phono-input circuit.

In Model 1001-M, the P-10 chassis employs a 680,000-ohm resistor, from phono-input to chassis ground, instead of a 100,-000-ohm resistor, ref. no. 15.

Following is a list of parts which apply to Model 1001-M. These parts are different from those shown in the Manual for the P-10 chassis.

Part No.	*Description*
650183A-G1	Speaker, 10" PM, output trans. assy.
750114B-1	Glass escutcheon
650189A-G1	Loop antenna assy.
650186A-4	On-off volume knob
650186A-2	Tuning knob
650186A-1	Band switch knob
650186A-3	Tone control knob.

United Motors 984296

Model 984296, Pontiac, appears on *pages 19-60 through 19-64 of Rider's Manual Volume XIX*. The following change has been made in all sets above serial number 691137 and B39-54401:

Illus. No.	*Production Part No.*	*Service Part No.*	*Description*
43	1213220	A 151	150 ohms, ½ w, insulated.

●

General Electric 115, 115W

These models appear on *page 18-13 of Rider's Manual Volume XVIII*. The following changes have been made in the parts list.

Delete catalogue numbers and parts RDK-121 and RDK-122.

Add the following:

RAG-019	Grille, for Model 115 and 115W
RDK-150	Knob and bezel, brown, for Model 115
RDK-151	Knob and bezel, white, for Model 115W.

●

Westinghouse H-203

This model appears on *pages 19-29 through 19-32 of Rider's Manual Volume XIX*. If bass response is objectionable, it can be decreased by changing C29 from 0.05 μf to 0.005 μf.

National Service Hints

The NC-183 appears on *pages 19-11 through 19-35 of Rider's Manual Volume XIX*. Following is a list of troubles and suggestions for correcting them:

1. Oscillation in the E band at twice and three times the i.f.
   a. Look for loose screws on sides of coil compartment.
   b. Be sure second i-f and avc amp. plate leads are down near the chassis.
   c. Be sure the diode leads of the 6H6 are down near the chassis.
   d. Check ground leads on side of coil compartment.
   e. Be sure that the first r-f grid lead is down near the chassis.
   f. Check ground at the end of the shield on the bfo lead near the 6H6 det. tube.
2. Oscillation at low end of the B band.
   a. Check ground on main tuning capacitor and the ground brushes on band-change switch shaft.
   b. Be sure first i-f plate lead is down near the chassis.
3. Pulling of signal with antenna trimmer on the A band.
   a. Check ground on band-change switch shaft.
   b. Check ground from tie rod on tuning capacitor to chassis.
4. Motorboating with both r-f and audio gains at zero.
   a. Check value of inverse feedback resistor R47. This resistor should be 4,700 ohms. A lower value than this will cause the motorboating.
5. Audio oscillation.
   a. Output transformer may be wired wrong.
   b. Connecting leads to the transformer may be reversed.
6. Hum with limiter on.
   a. Change limiter tube.
7. Back lash in main tuning or bandspread dials.
   a. Check end bearings of main tuning and bandspread capacitors.
   b. Check tension of spring on antiback-lash gears.

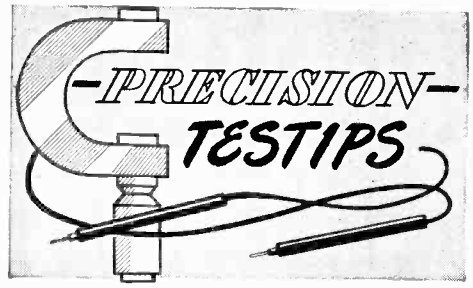
HIWYNI Have It When You Need It

Zenith 8H832, Ch. 8E20

This chassis appears on *pages 19-16 through 19-21 of Rider's Manual Volume XIX*. If replacement of one of the speakers is required, care should be taken when connecting the new speaker in the circuit so that the speakers are properly phased. If the speakers are out of phase, all bass notes will be absent and distortion will be dominant. This condition can be corrected by reversing the voice coil wires on the newly replaced speaker.

RCA 8X71, 8X72, Ch. RC-1070

These models appear on *pages 19-30 through 19-34 of Rider's Manual Volume XIX*. The driver tube (12AU6) cathode resistor, R11, has been changed from 180 ohms to 330 ohms.



CIRCUIT PROBING WITH THE VTVM

Experienced television technicians know that the efficient way to run down sectional defects in a television chassis is to PROBE for the trouble. Such circuit probing is usually done with a vacuum-tube voltmeter, and the measured values are checked against the mfr's. service data.

Circuit probing must frequently be performed under dynamic (signal carrying) conditions and in addition, numerous polarity reversals are also met in modern television circuits. For example, five positive terminals, and six negative terminals appear in the typical sync network shown in Fig. 1.

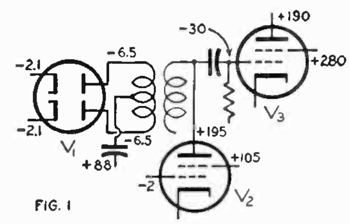


FIG. 1

At first glance, it might be thought that polarity reversals could be taken care of by reversing the test leads of the VTVM. Actually, **this practice can cause incorrect measurements,** because the isolating probe of the VTVM is ineffective when test leads are reversed.

For example, the –30 dc volts of signal-developed bias at the grid of V3 cannot be measured by reversing the test leads. This bias is caused by high-frequency pulses and flow of grid current, – and the pulses are "killed" unless the isolating probe is used at the grid of V3.

The return (ground) test lead of a VTVM does not contain an isolating resistor, but instead is a direct connection to the case of the instrument. It is easy to see that if the instrument case is connected to the grid of V3, the heavy shunt capacitance will "kill" (and/or short) the stage.

Signal-developed bias voltages can be measured if the VTVM has a polarity-reversing switch, because the isolating probe is then always in the "hot" side of the measuring circuit. Such switches, however, are wasteful of both time and tempers. Note that five polarity reversals would be required when probing the network of Fig. 1.

TIME IS MONEY IN THE BUSY SHOP, and it is very important to use the right instruments for the job.

The right answer to the television (as well as general) circuit-probing problems is the **ALL Direct-reading zero-center-scale** as shown in Fig. 2.

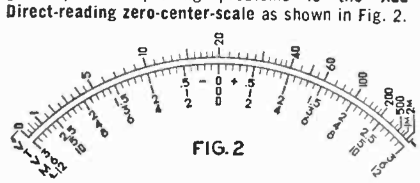


FIG. 2

When the VTVM is provided with such direct-reading zero-center **scales, no polarity switch** is used, and it is **never** necessary to reverse the test leads. Correct measurements will be obtained in all circuits, and no "figuring" is required. **Polarity and magnitude are indicated simultaneously in only one operation.**

The direct-reading zero-center scale puts extra hours into every service day, and is one of the keys to high-speed profitable servicing.

R. G. "Bob" Middleton
Engineering Division

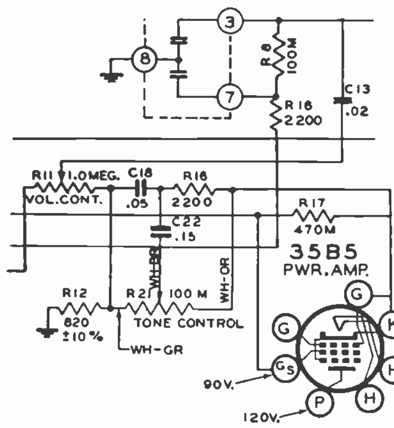
Radio Changes

Zenith 7H822Z, Ch. 7E02Z

Chassis 7E02Z is similar to the 7E02 which appears on *pages 18-21,22 through 18-25 of Rider's Manual Volume XVIII.* On the 7E02Z receiver a tone control has been added and a neon bulb on-off indicator. The accompanying figure shows the tone-control circuit. The following parts list shows the new components included in this receiver:

Part No.	*Description*
12-1546	Indicator socket brkt.
14-857	Model 822Z plastic cab.
22-1025	0.15 μf, 200 v, capacitor
22-1511	50 μμf, ceramic 500 v, capacitor
26-419	Dial scale
46-769	Tuning & vol. con. knob
46-770	Band-switch knob
46-780	Tone-control knob
46-781	Tone-control knob
63-1744	100 ohms, ins. resistor, 20%, ½ w
63-1884	220,000 ohms, ins. resistor, 20%, ½ w
63-2008	Tone control
78-585	Indicator socket
80-402	Dial cord tension spring
83-1593	Felt strip (2 used)
83-1595	Spacer strip
93-961	Ins. shoulder washer
100-105	Neon indicator bulb
199-35	Dial scale
202-687	Instruction book
S-15325	Cab. back & plug cover assy.

The 220,000-ohm resistor, R22, and the neon bulb on-off indicator have been inserted from pin 4 of the 35B5 power amplifier to ground.



Circuit changes for the Zenith 7H822Z, Chassis 7EO2Z.

RIDER MANUALS KEEP UP TO DATE FILL IN THE GAPS

National Service Hints

The NC-57 appears on *pages 18-1 through 18-16 of Rider's Manual Volume XVIII.* Following is a list of troubles common to the NC-57 and suggestions for correcting them:

1. Audio oscillation with automatic noise limiter (ANL) on and a-f gain on full.
   a. Dress the primary leads to the output transformer under the ANL switch. Pull the excess length of leads through the hole to the top of the chassis.
2. Hum with ANL on and a-f gain on full.
   a. Change the 6H6.
3. Oscillation on B and C bands.
   Check C19 h-f osc. grid coupling capacitor. This should be 100 μμf. A higher value than this will produce oscillation. Also change the oscillator grid resistor from 47,000 to 22,000 ohms.
4. Parasitic oscillation on A band above 50 Mc.
   a. Check the ground lead of the r-f amp. screen bypass capacitor. This should be as short as possible and soldered to the lug on the socket mounting ring adjacent to pin 4. The r-f amp cathode bias resistor should be 220 ohms.
5. Noisy band switch.
   a. Poor contacts in the switch, and poor contact between the switch shaft and the ground brushes on ER 210 coils.
   b. Ground brushes on switch shaft rubbing on the coil partition of the ER 210 coils.
   c. Coil partition mounting screws not tightened down.
6. Noisy trimmer control.
   a. Shorted plates.
   b. Poor rotor brush contact or rotor brush not grounded to the mounting bracket.
   c. Rotor shaft grounding spring on front end of chassis is loose or missing.
7. Oscillation on E band at twice the i.f.
   a. Check to see that there is a metal shield mounted on the trimmer control bracket.

Circuit Loss in Simple Center-Fed TV Antennas

(Continued from page 1)

four simple antennas differ from each other only with respect to their thickness (or diameter). The factor P is arbitrarily used to describe this thickness factor and represents the periphery, or circumference, of the antenna rod cross section expressed as a fraction of the free-space wavelength. Table 2 gives a physical picture of what the diameter of the four antennas would be at 200 Mc where, as an example, we will assume the antenna is operating as a half-wave antenna.

Table 2: 200 Mc Half-Wave Antenna

$$P = \frac{\pi D f}{11{,}800} = \frac{D}{18.8}$$

where P is in fraction of wavelength, D is in inches, and f is in megacycles.

P (fraction of wavelength)	Antenna Diameter (inches)
1. 0.00001	0.0002
2. 0.005	0.094
3. 0.04	0.75
4. 0.20	3.76

The first case (Fig. 1) is only of theoretical interest, since its diameter is physically impractical to use.

If we match these four antennas at 200 Mc (the half-wave resonant frequency) the respective load values required will be 72 ohms, 63 ohms, 46 ohms, and 35 ohms. By inspection of Fig. 1, we see this point is labeled $\frac{f_o}{f_x} = 1.0$, where f_o is the standard half-wave frequency and f_x the signal frequency, which we will vary. The loss at this point is 0 db, since we have chosen a perfect match at the half-wave resonant frequency.

Now if we depart from 200 Mc and examine the antenna mismatch loss at any other frequency, we can obtain the frequency ratio with respect to 200 Mc and note the corresponding loss in signal strength in db. It reaches high values at frequencies which are between *odd* resonant frequencies, as we would expect. The losses are higher for thin than for thick antennas.

When we choose to match the same antennas at the full-wave point (Fig. 2), the respective load values become 9,200 ohms, 2,400 ohms, 960 ohms, and 290 ohms. Except for the last case, this precludes the use of normal transmission lines. It is of interest, however, to note the broad simplicity in the results.

The third case, where the load is selected to be the geometric mean of the half-wave and full-wave value (Fig. 3), requires load resistances of 820 ohms, 370 ohms, 220 ohms, and 110 ohms. By choosing these mean values, the mismatch loss curve is quite constant with frequency ratios above unity. It must be admitted, however, that this third case does not fully match at any frequency and we can expect that this will give rise to the possibility of assisting some reflections (line ghosts) at all frequencies. These reflections in the first and second case were completely eliminated at the matched frequency points, but became very serious at most other frequencies. The following approximations in Figs. 1, 2, and 3 have been made:

a. Frequency ratios are plotted as if resonances occurred at integral frequency ratios. (In practice, even resonances may be lowered due to the "physical mismatch"; odd resonances may be modified by smaller amounts. "Physical mismatches" at even resonances where the wave energy is not highly localized are due to the inability of this energy on the antenna to be "funneled" ef-

TABLE 1. CHANNEL-TO-CHANNEL FREQUENCY RATIO

Channel Number		2	3	4	5	6	7	8	9	10	11	12	13	VHF*				
	Freq. Mc	57.5	63.5	69.5	79.5	85.5	177.5	183.5	139.5	195.5	201.5	207.5	213.5	500	600	700	800	900
2	57.5	1.0	1.1	1.2	1.4	1.5	3.1	3.2	3.3	3.4	3.5	3.6	3.7	8.8	10.5	12.3	14.0	15.8
3	63.5	0.9	1.0	1.1	1.25	1.35	2.8	2.9	3.0	3.1	3.2	3.3	3.4	8.0	9.5	11.1	12.7	14.3
4	69.5	0.83	0.92	1.0	1.15	1.23	2.6	2.66	2.74	2.8	2.9	3.0	3.1	7.3	8.7	10.1	11.6	13.0
5	79.5	0.72	0.8	0.88	1.0	1.08	2.24	2.32	2.4	2.47	2.54	2.62	2.7	6.35	7.6	8.9	10.3	11.4
6	85.5	0.67	0.74	0.81	0.93	1.0	2.08	2.15	2.22	2.3	2.36	2.43	2.5	5.9	7.1	8.2	9.4	10.6
7	177.5	0.32	0.36	0.39	0.45	0.48	1.0	1.04	1.07	1.10	1.14	1.17	1.21	2.8	3.4	4.0	4.5	5.1
8	183.5	0.31	0.34	0.38	0.43	0.47	0.97	1.0	1.03	1.06	1.10	1.13	1.16	2.7	3.3	3.8	4.4	4.9
9	139.5	0.30	0.33	0.36	0.42	0.45	0.94	0.97	1.0	1.03	1.06	1.09	1.13	2.6	3.2	3.7	4.2	4.8
10	195.5	0.29	0.32	0.35	0.41	0.44	0.91	0.94	0.97	1.0	1.03	1.06	1.09	2.6	3.1	3.6	4.1	4.6
11	201.5	0.28	0.31	0.34	0.39	0.42	0.88	0.91	0.94	0.97	1.0	1.03	1.06	2.5	3.0	3.5	4.0	4.5
12	207.5	0.28	0.30	0.33	0.38	0.41	0.86	0.89	0.91	0.94	0.97	1.0	1.03	2.4	2.9	3.4	3.9	4.4
13	213.5	0.27	0.30	0.32	0.37	0.40	0.83	0.86	0.89	0.92	0.95	0.97	1.0	2.3	2.8	3.3	3.8	4.2
VHF*	500	0.11	0.13	0.14	0.16	0.17	0.35	0.37	0.38	0.39	0.40	0.42	0.43	1.0	1.2	1.4	1.6	1.8
	600	0.10	0.11	0.12	0.13	0.14	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.83	1.0	1.2	1.3	1.5
	700	0.08	0.09	0.10	0.11	0.12	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.72	0.86	1.0	1.1	1.3
	800	0.07	0.08	0.09	0.10	0.11	0.22	0.23	0.24	0.24	0.25	0.26	0.27	0.63	0.75	0.88	1.0	1.1
	900	0.06	0.07	0.08	0.09	0.10	0.20	0.20	0.21	0.22	0.22	0.23	0.24	0.56	0.67	0.78	0.89	1.0

* Individual channels not shown.

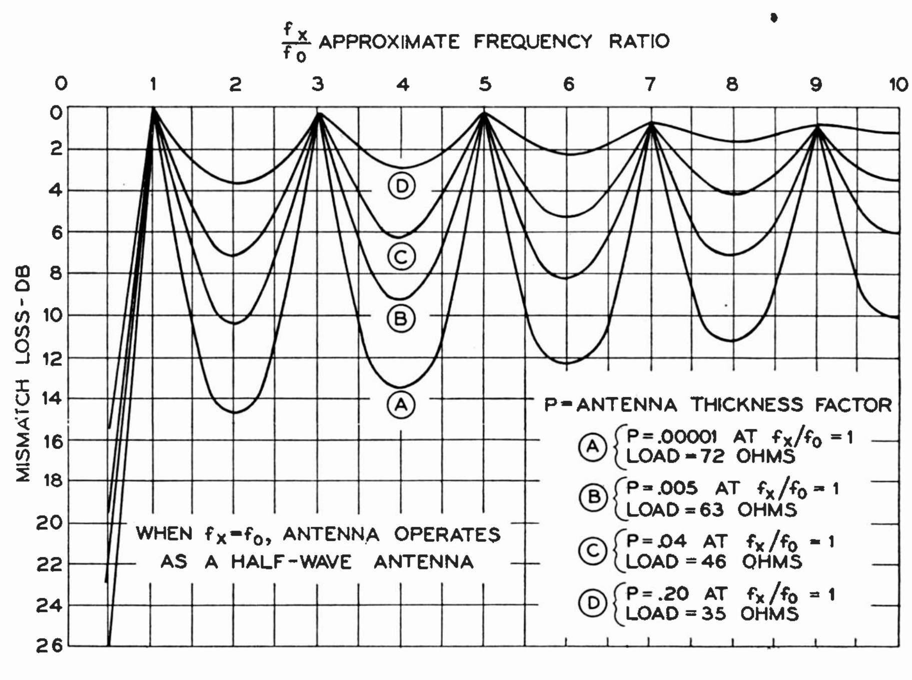


Fig. 1. The mismatch loss of a center-fed antenna over a frequency band is shown for the case where the load is selected to match the antenna resistance at the half-wave point.

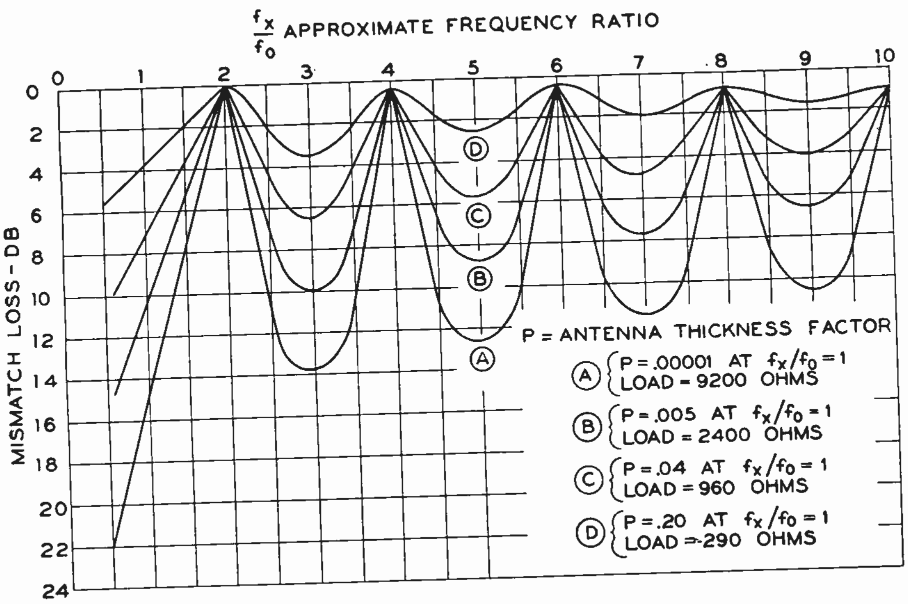


Fig. 2. The mismatch loss is shown for the case where the load is selected to match the antenna resistance at the full-wave point.

ficiently into the physically small transmission line over the right-angle bend between antenna conductor and line. The voltage maximum occuring for even resonances at the load terminals will tend to exaggerate stray capacitance effects in the presence of "physical mismatches".

b. Minor variations in Fig. 3, which may occur in practice, are not shown. These may cause the flat portion of the graph to exhibit cyclic dips of 1 db to 2 db between integral frequency ratios.

c. The antenna feed point is assumed to be free of stray capacitance effects due to "physical mismatch".

These approximations do not impair the utility of the graphs. The losses indicated may be considered as minimum values, which may be *exceeded* in practice, but are rarely less than indicated. There will, however, be slight shifts to lower frequencies at the higher orders of resonance. Figs. 1, 2, and 3 may then be considered to be about the best possible simple approximation to the actual situation.

Let us note some important conclusions from these graphs. If we match an antenna at any resonance point, we find that the maximum loss at other frequencies may be relatively high. If we permit a small constant mismatch, the third case (Fig. 3), we get a loss at all frequencies, but it is much less than the maximum loss for the first case (Fig. 1), or the second case (Fig. 2). Furthermore, the maximum losses of the first case and the second case are approximately equal.

A further precaution is in order. The loss figures of Figs. 1, 2, and 3 take into account only losses produced by *circuit conditions* at the antenna load, as the frequency is changed. We will see presently that we must also evaluate the signal loss (or gain) due to the variation in *directional response* of the antenna with frequency.

This completes the determination of the *amount of power* absorbed by the antenna load for various types of center-fed antennas having uniform cross section, when operated close to the half-wave point or over a band of frequencies.

The practical necessity of considering antenna loads which are not a pure resistance, as may be the case when the antenna is connected to the transmission line, will be considered later. When the far end of the transmission line (at the radio receiver) is terminated in a matching resistance equal to the characteristic impedance of the line, the antenna itself will also see a resistance load equal at all frequencies to the transmission-line surge or characteristic impedance. When the line is not properly terminated, the antenna will see a load consisting of a resistance and a reactance, each varying with frequency. This case may give rise to different loss values, some higher, some lower than those shown on Figs. 1, 2, and 3, but in no case will the over-all trend of these graphs be improved. Essentially, the loss graphs will be modified by substantial "wiggles" or variations around the values indicated. The *number* of wiggles per unit change in frequency will be small if the line is short in terms of wavelengths. If the line is long, the number of wiggles per unit frequency change will be great. The *amplitude* of the wiggles will depend on the line loss and the degree of mismatch at the receiver end of the line. This condition will be treated later as attributable to the line and receiver, and should not be considered as a defect of the antenna.

By proper realization of the values of mismatch loss for simple TV antennas, we shall better appreciate the action for the more complicated forms of TV antennas. It is important to note that what has been said about the mismatch loss for the simple center-fed antenna does *not* directly apply to the conventional simple *folded-type* dipole. The two differ substantially from each other.

Thus it is evident that the choice of antenna diameter and the choice of antenna load resistance both serve either to accentuate or to smooth out the matching losses of an antenna over a wide frequency band. It is not surprising, therefore, that the present TV channels are not all equally well received by TV receiving antennas. It is well to note that optimum results for one particular channel may preclude obtaining a good signal at some other channels, solely because of the circuit losses between the antenna proper and the antenna load.

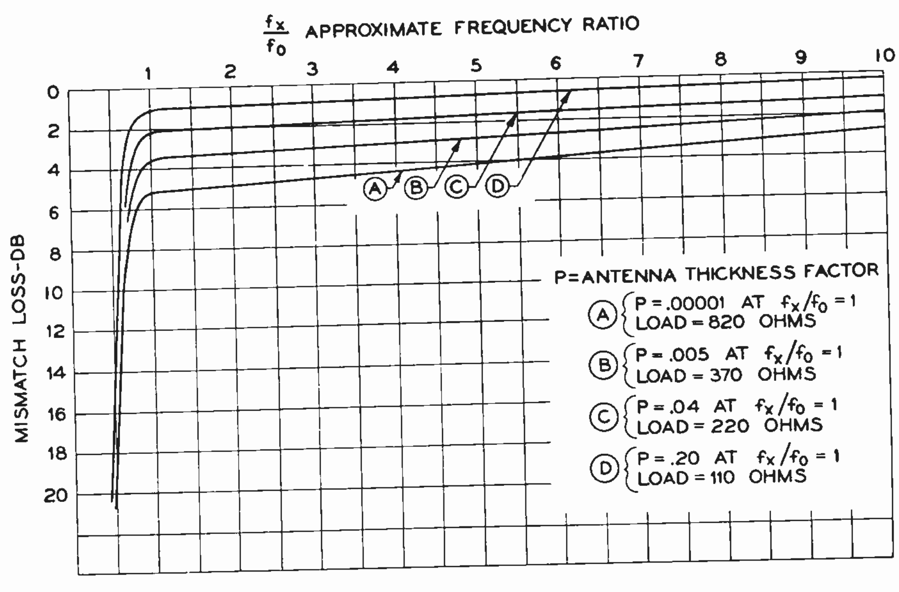


Fig. 3. The mismatch loss is shown for an intermediate case where the load matches neither the full- or half-wave point, but is equal to

$$\sqrt{R_{max} \cdot R_{min}} = 0.59\ Z_A.$$

Curtain Time

(*Continued from page 5*)

installation into account when installing the receiver. It would not do the servicing industry any harm to contact such hams and to ascertain their operating frequencies, and even go so far as to add a filter, which is comparatively inexpensive, across the antenna terminals of the TV receiver, or to recommend to the set owner that it be done. Who can tell how many more TV receivers will be installed in the same area? It may be the easier path to ignore the existence of the ham transmitter, and to simply say that it is the interference which issues from the ham station, and let it go at that, but that is not the soundest business practice. The only trouble with that line of thinking is that quite frequently the ham, in his defense — knowing that he is operating his transmitter in accordance with the regulations — will malign the service organization and may even go so far as to place the service organization in a bad light by adding such a filter. In making these comments, we are not expecting the servicing industry to bear every burden, but it is not stretching the imagination too far to visualize an installation service organization doing everything in their power — naturally, everything within reason — to satisfy a customer.

Despite many expressions to the contrary, hams in the United States are not willfully interfering with TV reception; they are cognizant of their responsibility to the public and to the rights of the public, which is why in many parts of this nation, hams are conspicuous by their absence during TV hours. Every day more and more hams are spending money to eliminate harmonic radiation and thus clean up TVI. This does not call for thanks on the part of anyone, but does call for a little more consideration on the part of the TV serviceman. In saying this, we are not whitewashing the entire ham field because there are many who are flagrant in their violations, and unfortunately, the FCC neither has the man power nor the funds to spot these stations as rapidly as all might desire. Eventually they are caught up with, but in the meantime, the servicing industry cannot indict the entire ham activity because of a few un-co-operative individuals.

Considering the legal status of the ham field, there is much to be said for the approach toward accomplishing an end. There is no harm in telling a TV set owner that his picture is being destroyed by a ham, and that as a servicing facility, little if anything, can be done by that facility to remedy the situation. This, of course, presupposes that corroded joints and poor contacts are absent in the antenna system. However, it is wrong, no matter how you look at it, to arouse the ire of the set owner by condemning the ham. It is just as easy to explain the situation and if possible, to ask the set owner to get in touch with the ham. Nine times out of ten, they will arrive at an amicable solution, and no one's prestige or reputation will be hurt.

What we are leading up to is that it behooves the TV servicing industry to become more familiar with a ham transmitter, the manner in which harmonic radiation affects a TV receiver, and the means of recognizing ham interference in contrast to other types of interference. It would do no harm if servicing organizations contacted hams so as to learn more about them, especially the various means of correcting TVI at the receiver end. It is important for the servicing industry to understand that the FCC, when responding to a complaint, invariably advises the complainant to communicate with the offending ham, and the recommendation is also made that the receiver owner call his serviceman to apply whatever corrective remedies are possible at the receiver site. The ham is called upon to clean up his transmitter but he is not ordered by the FCC to take any corrective steps at the receiving end. Some hams, in their desire to co-operate, do install filters on receivers, but have been discouraged from so doing because in altogether too many cases, a *subsequent failure in the receiver was wrongly attributed to the addition of such a simple thing as a trap across the antenna terminals.*

These remarks do not imply that simple intercourse between people leads to an understanding and a resolution of all problems. Personalities frequently conflict, and where suspicion abounds or where some previous experience may have proved

(*Please turn to next page*)

Curtain Time

(Continued from page 15)

distasteful, the attainment of co-operation is difficult. Be that as it may, it does not deny the continuation of attempts to co-operate. Such co-operation between a ham activity and the servicing activity is most important. Since the serviceman is in much more intimate contact with the TV receiver, it seems only logical that the suggestion for greater co-operation be aimed at him. Ham activity is not apart from the radio industry — it is part and parcel of that activity and it must be recognized as such by the servicing group. It can be a headache at times, especially, when a ham refuses to co-operate. Such instances, however, are infrequent rather than frequent, because every ham is anxious to do whatever he can to enable him to be on the air whenever he so desires.

It is silly for the serviceman to malign him — to disparage his usefulness or his hobby. While it is not our desire to laud the ham on the basis of his best accomplishments, the fact remains that much scientific knowledge is still being acquired from ham activities. Maybe all the hams do not contribute to it, but many do. Their unselfish efforts during emergencies cannot pass unnoticed — their service as a communication link between military personnel all over the world and their families here in the United States merits approbation — in other words, the activity as a whole serves a purpose.

Hams and servicemen have been at loggerheads for a long time, exclusive of those who perform both roles. The possibility of ham activity being legally banned as a result of TV receiver pressure is very remote. The possibility of television channels being changed or the ham bands being changed is likewise remote, at least for quite a few years to come. The possibility of TV receivers being designed in such manner as to preclude completely the possibility of ham interference is likewise a comparatively long way off. In other words, the ham, the serviceman, and the public will have to learn to live together. It can be done and it is being done. It may not be achieved successfully in every single instance, but by and large, all can work together.

Admittedly, the magnitude of the television receiver industry overwhelms ham activity, but we cannot ignore the fact that the majority of ham installations in the country represent investments from five hundred to many thousands of dollars. It is not inconceivable that servicemen might be invited to attend ham club meetings and become acquainted, or that recognized hams be invited to address servicemens' associations so that they can hear about the ways and means of curing television interference from ham stations.

To bring these comments to an end, let it be said that these two branches of the radio industry might do well to co-operate with each other and cease fighting each other. Day by day, the hams are trying to do more and more to lick TVI. Day by day, the servicemen should learn more about TVI. In the end, everybody, including the public, will be happier.

JOHN F. RIDER

Cover

The photograph on the cover shows two WOR-TV engineers seated in WOR-TV's North Bergen transmitter building at the equipment that enables them to control the picture and sound transmitted by WOR-TV on Channel 9. The engineer at the left is making an adjustment to the picture quality at the operating transmitter control console. The engineer at the right is stationed at the "mixing desk", which synchronizes picture and sound transmission. In the foreground is a sound desk for playing records or making announcements from the transmitter. Wall units in the background house transmitting equipment.

Additions

York Radio and Refrigeration Parts, York, Pa., Almo Radio Company, Wilmington, Del., and Belmont Radio Supply, Chicago, Ill., should have been included in the Jobber List that was published in the December, 1949, issue of SUCCESSFUL SERVICING.

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