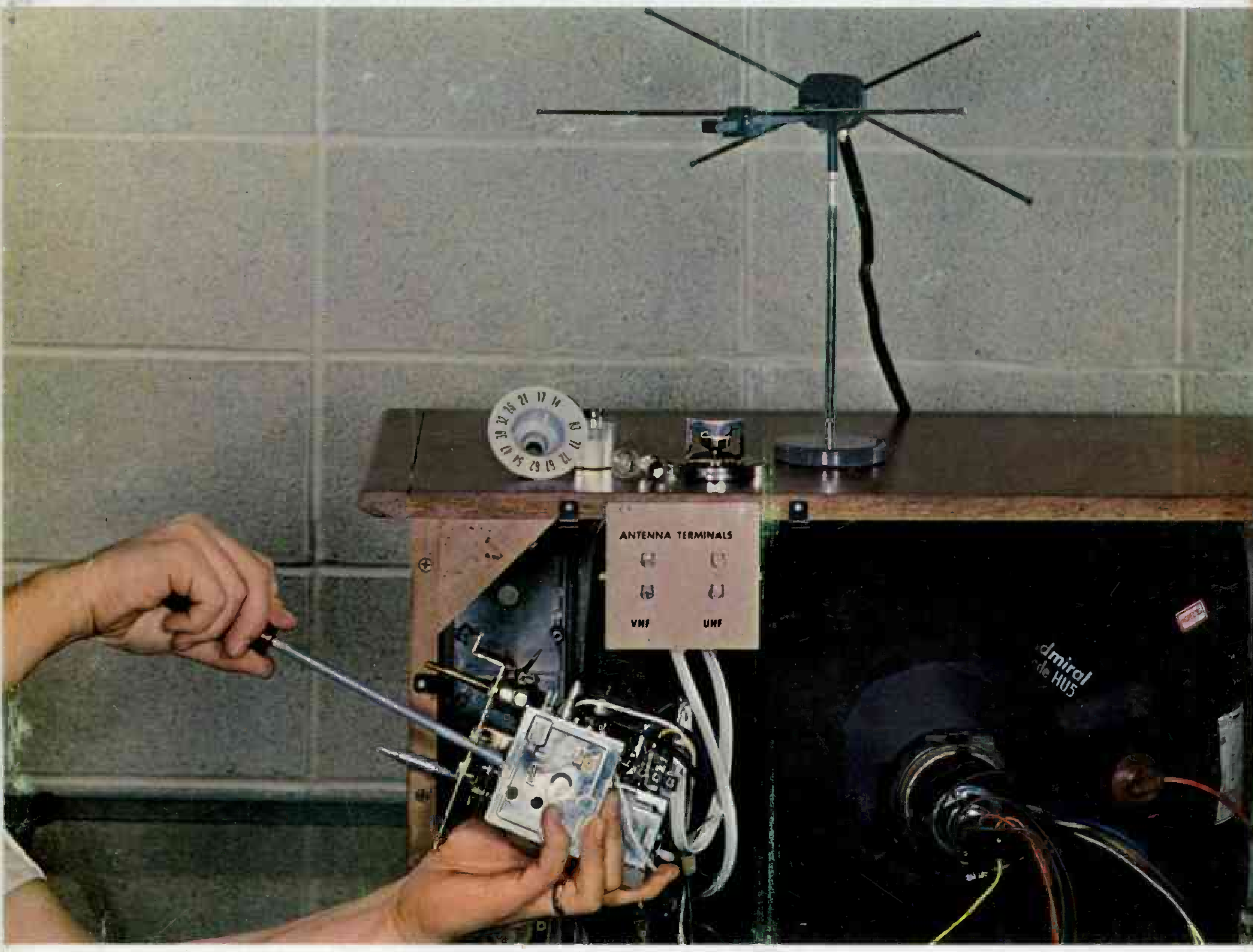
A HOWARD W. SAMS PUBLICATION

DECEMBER 1965/50¢

PF Reporter™

PHOTOFACT

the magazine of electronic servicing



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1965

SUBJECT REFERENCE INDEX

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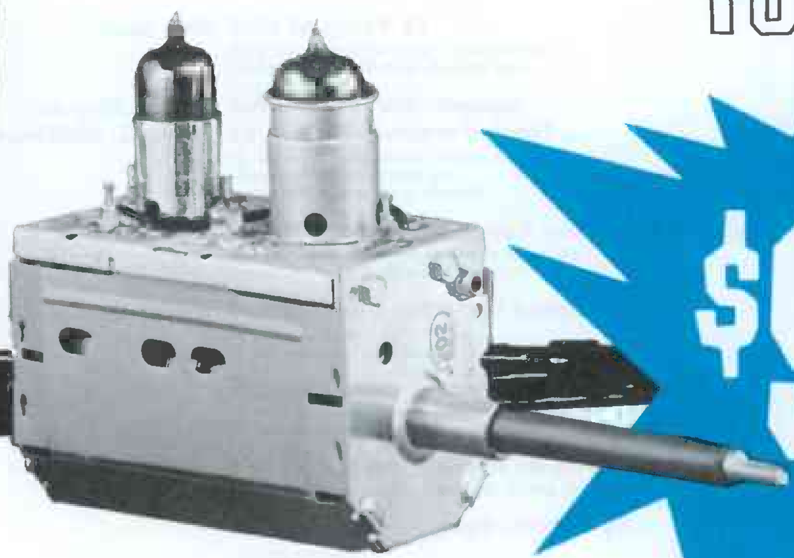

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the magazine of electronic servicing

VOLUME 15, No. 12 DECEMBER, 1965

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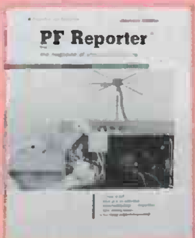
Miniature antennas and tuners are going to become a familiar sight to service technicians as UHF grows. A review of UHF development over the years in one area begins on page 16.



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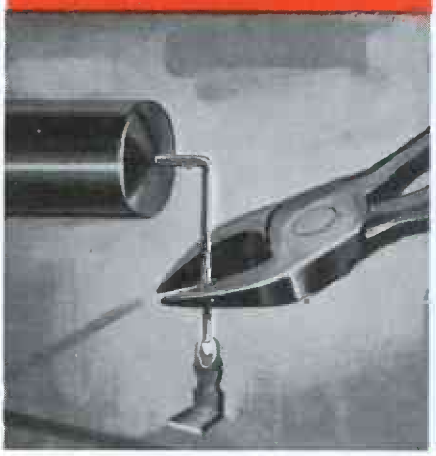
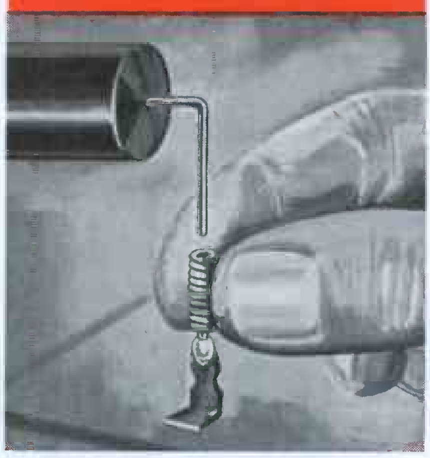
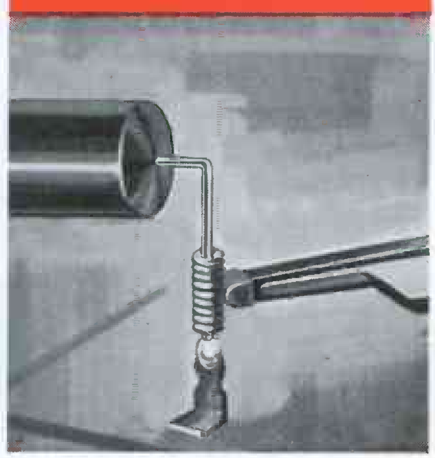


B Slip on KWIKETTE



C Apply Heat, Connection Made!



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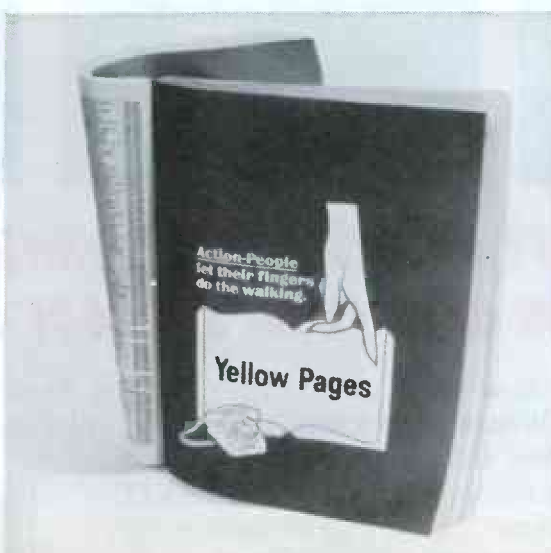

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Letters to the Editor

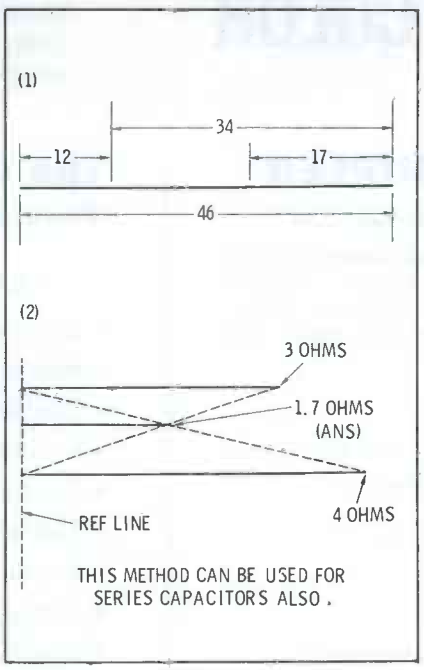
Dear Editor:

I was pleased to see the way you passed along to your readers the safety advice from the booklet "Strange Killer."

In the same issue (October 1965) a "Mr. Name Withheld" gave us readers two easy problems to solve (*Letters to the Editor*, page 14). I say they are easy because they are met and solved daily in the life of the technician:

1. There is an asymmetrical waveform on the face of the scope. The peak-to-peak voltage is 46 volts; the positive swing is 12 volts more than the negative swing. What is the negative voltage amplitude of this waveform?
2. A 3-ohm resistor is connected in parallel with a 4-ohm resistor. What is the total circuit resistance in ohms?

Both of the problems can be solved without the use of algebra. By drawing to some scale:



MELVIN T. HYATT
Prairie Village, Kansas

These graphical solutions can be real timesavers, and they can be shown mathematically to be valid. But to apply them to the solution of our original problems, you first have to recognize the analogies between those problems and the examples given here. And to do that, you have to analyze the problems—which brings us back to our original point, the application of logic. —Ed.

Dear Editor:

In the article "Hybrids on the Auto Bench" (April 1965 PF REPORTER), you stated that a battery can change polarity if the residual voltage has fallen to near zero. I would like to know how this condition can occur in a battery. How low must the voltage be before such a condition takes place, and what can be done to correct this condition?

This is my first issue of the PF REPORTER, and I must say your magazine has all I want and more. Keep up the good work.

MICHEAL MATTHEWS
Corona, N.Y.

In a fully charged lead-acid battery, the active material of the positive plate is lead peroxide, and that of the negative plate is pure sponge lead. All the acid is in the electrolyte, and the specific gravity is maximum. As the battery discharges, some of the acid forms a chemical combination with both plates, changing them to lead sulphate and producing water. If the battery is completely discharged, both plates will have changed to lead sulphate, and it is possible to recharge the battery with the opposite polarity. A condition such as this can only occur with a fully discharged lead-acid battery; also, the charging voltage must be applied with the wrong polarity to change the polarity of the battery. —Ed.

Dear Editor:

Many of your readers may be interested to know that tube charts for Precision tube testers may be obtained from Coletronics Service, Inc., 1744 Rockaway Avenue, Hewlett, L.I., N.Y. 11557.

LARRY'S ELECTRONIC SERVICE
Brooklyn, N.Y.

Dear Editor:

Your article "AGC Filter and Distribution Faults" in the August 1965 PF REPORTER is one of the best I have seen in the 43 years that I have done radio and TV servicing. It was very timely and a big help to me. I had on my bench a set that had the same condition as shown in Fig. 9 of the article and found the cause to be just as you described.

Please keep up the good work.

HENRY W. ALTMAN
Port Charlotte, Florida

Comments like yours are music to our ears, Henry. We're always pleased to learn that our efforts have benefited our readers.—Ed.

The Electronic Scanner

news of the servicing industry

Antenna Improvement Program

Recent studies by KIRO-TV, Seattle, and KSL-TV, Salt Lake City, disclosed that large numbers of television receiving installations are not equipped with proper antennas. A campaign has been launched by the Association of Maximum Service Telecasters, Inc. (MST) and the American Institute for Better Television Reception, to acquaint television dealers and the public with the need for adequate television receiving antenna installations. The necessity for maintaining receiving antennas in proper condition is also being stressed.

The studies at KIRO-TV and KSL-TV convinced them that an unexpectedly high percentage of television viewers did not realize the importance of installing and maintaining adequate receiving antennas, particularly for color reception. Perhaps even more serious, they feel, large numbers of television dealers are either unaware of the problems or haven't had the need made sufficiently clear to them. The present campaign is aimed at educating both the viewer and the dealer, and at encouraging development of receiving antennas that meet the requirements of individual installations.

Communications Leadership

"Only a fundamental change in the policies and regulations governing America's international communications can safeguard our leadership in satellite and global communications." So said Chairman David Sarnoff of the **Radio Corporation of America** in a speech not long ago. "We must look for entirely new procedures, attuned to the realities of the Space Age, if our communications services are to function in harmony with the new technology and if America is to maintain its leadership in this vital field."

Barriers exist between voice and nonvoice communications in the international field and prevent interconnection of international communications with domestic telephone facilities. This outmoded international communication structure could be modernized and strengthened through unification of present international voice and data facilities.

Faced by increased competition from abroad, America cannot, General Sarnoff felt, successfully operate a system of global communications with one company responsible for voice transmission, with five others handling data transmission, and with unresolved jurisdictional lines between the single American satellite entity — Comsat — and all the international communications carriers.

General Sarnoff suggested that a single company in the international voice and data field would be in keeping with the historic tradition of private enterprise. "It would give new cohesion to our entire communications structure and automatically solve the problem of providing interconnection for the flow of international traffic with the established domestic facilities."

Looking beyond the present, the RCA executive asserted that, "within a decade, and possibly less, it will be technically feasible to broadcast directly into the home from synchronous satellites. All of the basic components and technology already exist for radio and television broadcast transmitters to operate in space." This ability of countries to broadcast directly into the homes of other countries will penetrate many barriers, with unpredictable social, political, and economic results. Forms of jurisdiction must be established to prevent the television spaceways from degenerating into a confusion

• *Please turn to page 64*

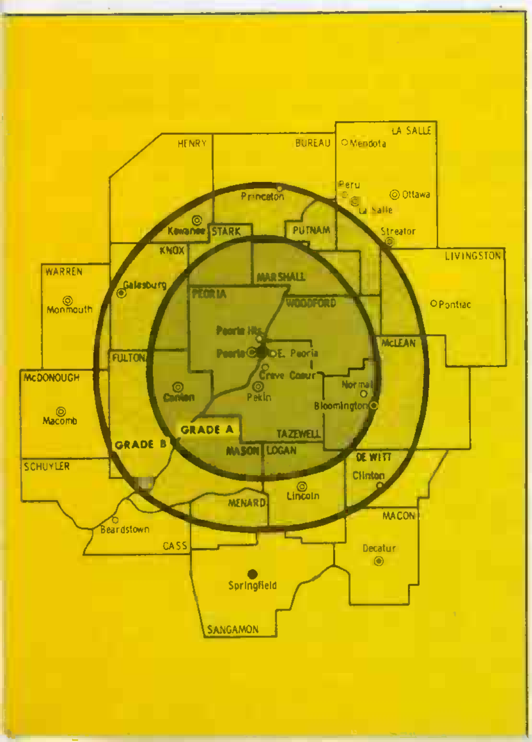
1953 1965 12 YEARS OF UHF

More than a decade of TV progress.

By Alan James

> In areas that expect to get a UHF station sometime, service technicians and viewers alike wonder just how UHF will work. Service-shop owners need to know what servicing problems to expect. The All-Channel Law requires that new sets receive both UHF and VHF, but in any town that gets a UHF station in the next couple of years, there will be many older sets to be converted. There will be new antennas to install, but how and where? Many questions cause uncertainty among those who will be responsible for insuring that viewers receive the new UHF station.
>
> This article looks at this UHF situation through the eyes of one who lived through the very changeover so many dread without knowing exactly why. His story answers questions we've heard from all over the country about UHF. Finally, in talking with technicians who have lived with UHF for 12 years, the author finds how those early problems have been solved and explains the few that remain.
>
> If there's any possibility UHF might come to your town, read this article. It may help you be ready. *—The Editor*

There had been an air of excitement around our store all day. As 7:00 P.M. drew closer, anticipation reached a high pitch in every technician in the shop. None of us had even gone out to eat, for we didn't want to miss any action in case it started early.



The day was February 1, 1953; the place, Peoria, Illinois. For weeks we had been getting ready for this night, because it would put an end (we hoped) to snowy and fading television. We were finally to have our own local station—Channel 43, WEEK-TV, was to sign on at 7:00. The fuzzy and unpredictable pictures from 100 miles or more away, the huge wind-catching antennas mounted with rotators on 40′ to 80′ towers—all that was about to end. Imagine how anxious we were.

Most of the sets we were going to watch at this momentous occasion were equipped with continuous-tuning converters, because the converter strips and single- and dual-channel converters couldn't be adjusted until after sign-on. We'd heard that indoor antennas would work okay at UHF, so we had some strange little antennas sitting around on top of the sets.

At 7:00 sharp, we started twirling dials, searching for the signal. Nothing! We picked up a couple of strange blips we later learned were oscillator interaction, but a TV signal—no! They're late, we decided; so we sent out for more coffee.

Finally, about quarter of 8:00, some knob-twirler sang out, and there on the screen, twinkling at us through dense snow, was a big round circle that said "WEEK-TV, Channel 43, Peoria, Illinois." UHF had come to town!

Low-Power Difficulties

The snow on the TV screen that chilly February night was disappointing. We had expected something better. We tried several sets, but without much luck. A few of the strip conversions wouldn't show enough picture to tune by. By 9:00 that night, we felt we weren't much better off than we had been with VHF from 100 miles away.

WEEK-TV had come on the air with only 100 watts output; they hadn't been able to get the final amplifier installed. To make it worse, their antenna tower was only partially erected, so they had very little height other than the hill they were on. Our troubles (and theirs) were only beginning.

Peoria and East Peoria are situated astride the Illinois River where it narrows at the lower end of Lake Peoria. Part of the town and its suburbs are along the river, about 450′ above sea level; the rest lies on and beyond bluffs and hills that, to the west, reach as high as 900′. On the East Peoria side, toward the transmitter site, hills and hollows spread out like fingers—creating some of the deadest spots you could imagine for receiving a low-power channel 43 at 650 mc.

Next morning, we put a 30′ pipe on top of our shop, with a four-stack bowtie antenna pointed toward the station. When the test pattern came on the air about 10:00, we saw a pretty good picture on the sets we had converted. This blew the story we'd heard that indoor antennas would be okay.

A lot of our customers weren't as lucky as we. Rooftop antenna installations helped in many cases; but there were also those who lived beyond the high terrain west of town, or around the hill up the river, or in those winding hollows on the East Peoria side. UHF shadows in all those places literally shut out the signal.

The station, whose managers were having as much trouble explaining to would-be viewers as we were, began finishing the tower job. With each step, slightly fewer shadows were noticeable, although they were far from eliminated. But then suddenly, just at the tower reached full height and the effective radiated power (ERP) reached 2000 watts, everything got worse! It seems standing waves were developing on the transmission line at the station and causing a lot of problems for everyone. And what do you suppose happened to us? Every bowtie we had installed, which we had painstakingly oriented for best signal, had to be repositioned. We all spent a lot of cold days scurrying around roofs with a converted field-strength meter, hunting for that elusive UHF signal.

In eight weeks we felt we'd been through about everything; the town was quieting down. Signals weren't everything we'd expected, but they were generally better than the old long-distance VHF. At least they didn't fade out. Well . . . not yet, anyway. And then came Spring! One rosy Monday morning, while the air still had a bite in it, the leaves seemed to have popped out all at once on every tree in town. By noon, we were wishing we could disconnect the phone. Calls and more calls. You guessed it—everywhere there was a marginal UHF signal, the leaves were fouling it up. Back to the rooftops went the antenna crews, feeling anything but cheerful those bright Spring days.

After six months at 2000 watts, the station boosted power to 250 kw ERP. We began then to find signals like we had first expected. The hollows and ridges and spots behind the hills were still poor, and some outlying wooded areas had trouble when leaves were wet; but careful probing with a field-strength meter, and sometimes with special antennas, took care of most problem cases.

During the few months WEEK-TV was the only television station in Peoria, we discovered much about high-channel UHF. We learned to carry a dozen 6AF4 tubes when we left in the morning on service calls, for even good ones oscillated poorly at channel 43, and we had to replace many that were only marginally weak by other standards. We found that airplane flutter rarely effected UHF; nor was UHF bothered by ignition interference, diathermy, or signals from two-way or amateur transmitters. Passing autos and large trucks caused mild flutter effects if the antenna was in a weak spot, but nothing to compare with the old weak-signal days of VHF.

More Signals, More Work

On October 20 of that same year, a second station came to Peoria—WTVH on channel 19. This one didn't monkey around long until it was on the air with a half-million watts ERP. But here we were with problems again! Try explaining to a customer why he gets a new station better than he gets the old one; some of ours seemed to feel we'd been fooling them about channel 43. In a few odd locations, the old station could be picked up better than the new one; explain that to someone who knows the new station has double the power.

Back to the rooftops. Antenna crews by this time felt they knew the roofs of Peoria better than they knew the streets. We persevered, however, and found new solutions—always with antennas. In one particularly tough spot, we used a double four-stack antenna with flat-screen reflectors to pick up channel 43, orienting the array to a strong reflection from a hill across the river. Beside that one, we mounted a corner-reflector bowtie to eliminate severe ghosting on 19; we finally aimed the corner-reflector in a generally upriver direction, not knowing from just where we were getting the good signal but assuming that front-lobe and side-lobe pickup were cancelling the unwanted signal—at any rate, we ended up with a single picture of fair quality. Then we found we couldn't feed them both down the same line (as we had done with others), so we ran two lead-ins and installed a low-capacitance knife switch for changing antennas.

That winter, we found that antennas didn't have to be reoriented to allow for the lack of leaves. So, ever after, we rechecked any wintertime installation in the spring when leaves were out. Repositioning wasn't always necessary, but it was needed often enough to justify checking. After that winter, we felt we had relatively smooth sailing.

The Story Today

A few weeks ago, I visited Peoria after an absence of several years. The service technicians and television viewers have had 12 years to evaluate UHF television under just about all conditions. I was curious how they felt about it by this time.

I found a lot of changes: WEEK-TV now operates on channel 25; WTVH is now WIRL-TV, and a third station, WMBD-TV, now operates on channel 31. WEEK-TV has added a satellite near Tonica, Illinois—WEEQ-TV on channel 35.

Operating powers and antenna conditions aren't the same any more, either. WIRL-TV says their channel-19 effective radiated power is 186 kw visual, 18.6 kw aural, and their antenna height is 750′ above average terrain. WEEK-TV lists their new channel-25 ERP at 562 kw visual, 112 kw aural, with antenna 675′ above average terrain. WMBD-TV, on channel 31, boasts 678 kw visual and 339 kw aural, at 670′. Coverage contours of the three stations, as reported in *TV Factbook*, look approximately as shown on the opposite page.

The satellite, WEEQ-TV, at Tonica—operated manually by WEEK-TV for the LaSalle-Peru-Oglesby, Illinois area—reports a grade-A signal contour of slightly more than 10 miles. Their ERP is 15 kw visual, 8.5 kw aural, and antenna height is 440′ above average terrain. WEEQ-TV retransmits telecasts from WEEK-TV, as would be expected of a satellite, but inserts its own identification, has many of its own advertisers, and originates its own news shows.

Viewing radius for the Peoria stations naturally includes grade-B signals, too. For the three, this contour adds another official 15 miles of effective viewing. I asked several servicemen how far away they found usable signals. Every one of them felt the 40-mile radius contained a good signal, with only a few shadow areas behind sharp hills.

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SQUARE-WAVE TESTS

for Three-Terminal NETWORKS

by David I. King and Robert G. Middleton

Preceding articles in our "Advanced Service Techniques" series have introduced you to these basic principles of square-wave testing:

1. *A square wave is made up of a fundamental sine wave plus an infinite number of its odd-order harmonics.*
2. *Square-wave analysis of components and networks will indicate the presence of inductance, capacitance, and resistance.*
3. *RC, or time constant, of a network can be determined by square-wave tests. If either value, resistance or capacitance, is known, the other can be easily calculated. Since RC measurements can test all components within a network, individual component checks need not be performed.*

These basic concepts may seem difficult to learn, but they must be thoroughly understood before more complex techniques are introduced. With this in mind, this review, based upon Robert G. Middleton's previous articles, has been written.

A wideband triggered-sweep scope, such as those described in the March 1965 PF REPORTER *article "Learning About Triggered-Sweep Scopes," was used in obtaining the photos in this article. If you can arrange to use a scope such as this, try to do so. Even if you can't, at present, get to one of these scopes, follow with us. Information here and in coming articles will be invaluable in the future. —The Editor*

Three-terminal networks can usually be classified as *differentiators* or *integrators*. Both are series resistance-capacitance circuits; but the differentiator output is developed across the resistor, while the integrator output is developed across the capacitor. Fig. 1 shows three sets of differentiator-circuit component values and their effects upon a 500-cps square wave. Waveforms indicate that circuit constants determine the shape and p-p amplitude of the output.

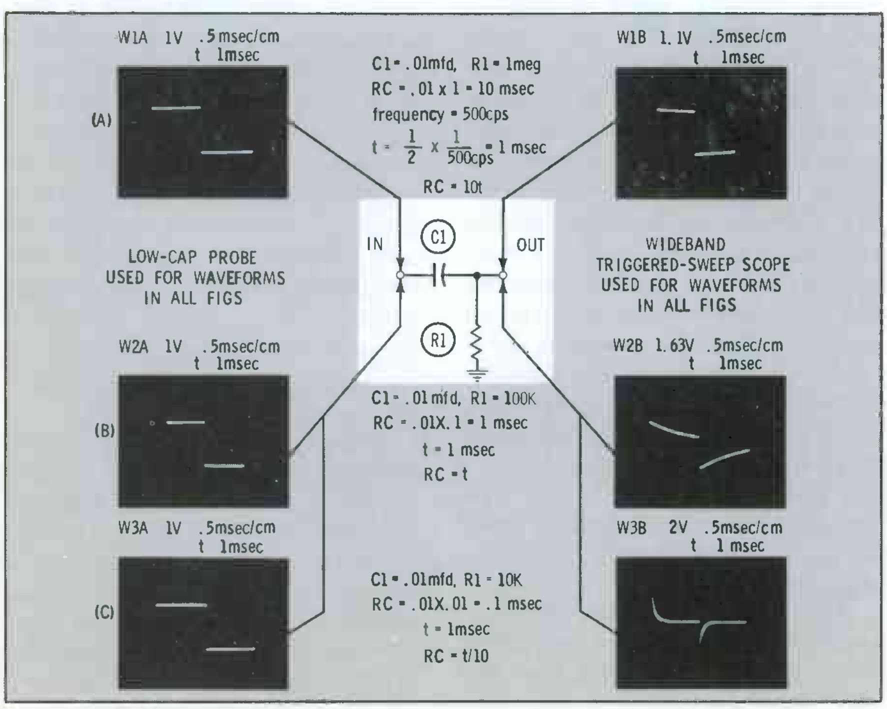

Fig. 1. Relationship between charge time t and RC determines output waveform.

Resistance - capacitance circuit *time constant,* RC, in seconds is the product of resistance in megs and capacitance in mfd:

RC = resistance × capacitance

Charge time t, in seconds, is determined by half the applied square-wave period; period is the reciprocal of frequency;

$$t = \tfrac{1}{2} \times \frac{1}{\text{frequency}}$$

For example, the relationship between t and RC in Fig. 1A is:

RC = 1 meg × .01 mfd
= .01 sec, or 1 msec

$$t = \tfrac{1}{2} \times \frac{1}{500\text{ cps}} = .001\text{ sec, or } 1\text{ msec}$$

RC = 10t

Here, the capacitor charges .1 volt during one half cycle, then charges .1 volt in the opposite direction the next half cycle; its charge is added to the p-p output amplitude. Output amplitude W1B is thus increased .1 volt over that of input W1A; still, the sum of instantaneous voltages across the resistor and capacitor equals the input voltage.

In Fig. 1B, RC = t. Here, the capacitor charges to 63% of the p-p input voltage W2A during t; consequently, p-p amplitude at W2B is 1.63 volts. In the network of Fig. 1C, RC = t/10. During t the capacitor charges to 100% of p-p input voltage W3A. As a result, the p-p amplitude of W3B is twice that of input W3A.

Differentiation means to break up into small parts. Output waveforms in Fig. 1 show that: As RC becomes smaller with respect to t, the square wave is broken into a series of frequencies with maximum amplitude developed for the highest frequency elements. Capacitive reactance attenuates low-frequency elements developed across the resistor — only high-frequency elements remain. If RC is greater than 10t, the differentiator may be used as a coupling circuit—output waveform isn't greatly altered. If RC is less than 10t, the output-waveform leading-edge shape will be similar to that if the input, and lagging-edge shape will depend upon RC.

Differentiator Tests

You can test components in a differentiator by applying a square wave and observing the output. Find the square-wave frequency at which the p-p output voltage equals 1.63 times the input; at this point, t = RC. If the value is above tolerance, resistance is increased; if it's below tolerance, capacitance is decreased. (Capacitors seldom increase, and resistors seldom decrease in value.) Resistance can usually be measured with an ohmmeter; capacitance value can then be rapidly calculated: if t = RC, then t/ = C.

Integrator Circuits

Three time constants are shown for the integrator circuit in Fig. 2; relationships between t and RC are identical to those in Fig. 1. Here, however, output is developed across the capacitor, not the resistor. Note Fig. 2A: RC = 10t. Waveform W1B developed across the capacitor is sawtooth shaped—only low-frequency elements of the square wave remain; also, p-p amplitude is decreased to .1 volt. In Fig. 2B, RC = t. Output amplitude W2B is increased to .63 volt, and the waveform leading edge is sharper. In Fig. 2C, RC = t/10. The output p-p amplitude equals that of input W3A; the amplitude of the high-frequency elements is increased, as the sharper waveform leading edge indicates. These waveforms clearly show that the integrator output depends on the relationship of t to RC. As in the differentiator, the reactance of the capacitor increases for low-frequency elements; but here, high-frequency elements are dropped across the resistor—only low-frequency elements are then developed across the capacitor output. To *integrate* means to unite: As RC becomes greater with respect to t, square-wave elements are summed up, and the output becomes closer to DC.

Testing Integrators

Minimal calculation is needed if you use the rise-time test (Fig. 3) for an integrator. Decrease the square-wave frequency until the top portion of the square wave is flat (Fig. 2C is a good example); next expand the sweep on the scope to ease measurement of time interval between points at 10% and 90% of maximum amplitude (Fig. 3A) —this is rise time. Fig. 3B indicates that a capacitor charges from 10% to 90% of input voltage in 2.2 RC:

$$\text{Rise time} = 2.2\ \text{RC};$$

$$\frac{\text{Rise time}}{2.2} = \text{RC}$$

A change in RC value can be analyzed in the same manner as with differentiators—decreased RC indicates capacitance decrease, and increased RC indicates resistance increase.

You may encounter difficulty with rise-time measurements if RC is greater than 100 msec, since the low scope sweep rate produces flicker which causes inaccuracy. In this case, plot t against RC to determine the relationship of p-p output to input. If t = RC, the p-p output is .63 times the input voltage. If t = RC/10, the p-p output is .1 times the input voltage. Use this second method only if rise-time measurement is impractical.

More Complex Circuits

Fig. 4A shows a more complex integrator circuit, and Fig. 4B shows its equivalent. Thevenin's theorem can be used to show that: (1) the voltage applied to C1 is equal to the voltage across R2, and (2) C1 charges through the equivalent resistance of R1 and R2 in parallel.

In Fig. 4B, a source equal to the voltage across R2 is connected to the equivalent circuit of Fig. 4A:

$$ER_2 = \frac{R_2}{R_1 + R_2} \times \text{Ein}$$

$$= 1 \times \frac{300K}{100K + 300K} = .75 \text{ volt,}$$

R3 is 75K (equivalent to 100K and 300K in parallel). Output amplitude and waveshape are identical to those in Fig. 4A. With the square-wave input frequency set for t = RC, the p-p output is .63 times the input: .75 V × .63 = .47 volt. The generator output impedance limits the accuracy if R_1 isn't more than 10 times the source impedance. The output impedance of the generator used here is 600 ohms; accuracy would be limited if R_1 were less than 6K. If care is taken to avoid inaccuracies, the equivalent

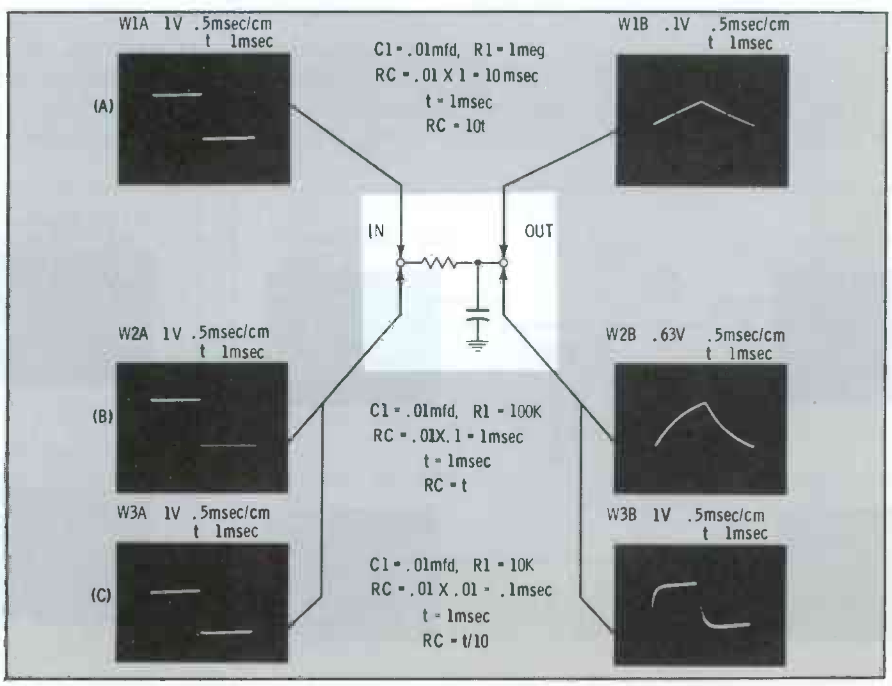

Fig. 2. Integrator output contains low-frequency elements of applied square wave.

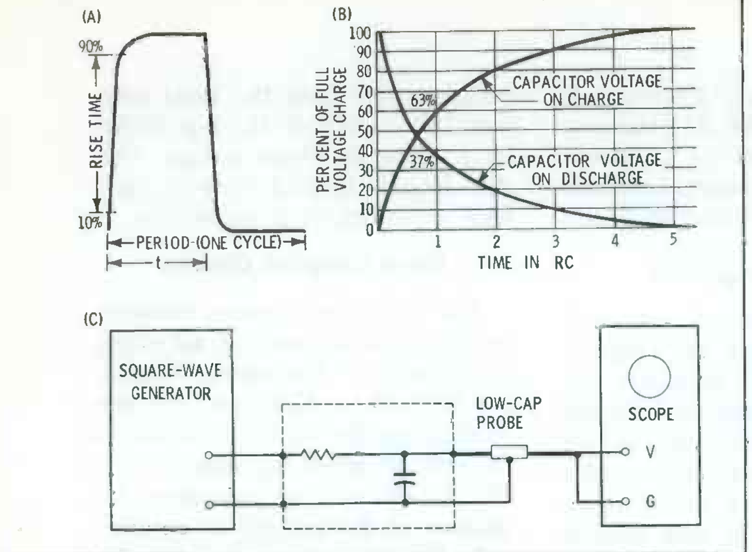

Fig. 3. Find RC by measuring rise time. (Rise time = 2.2 RC.)

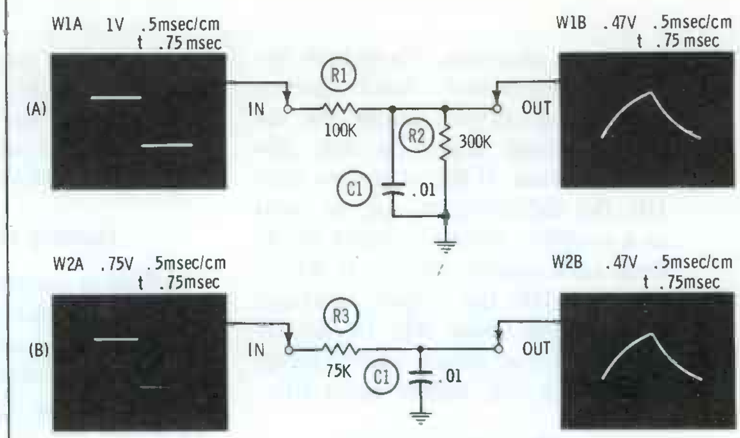

Fig. 4. Output waveforms prove circuit is integrator equivalent.

circuit of Fig. 4B can be tested in the same way as those in Fig. 3.

Impractical Test

A complex differentiator is shown in Fig. 5A. Application of Thevenin's theorem in this case is difficult because the square-wave generator output impedance forms an integrating circuit with C_2. Note the rounded leading edge of input W1A compared to that of W2A. Also, W1B and W2B are not identical. Another method must be used to test complex differentiaors.

Reliable Test for All RC Circuits

In Fig. 6A, the complex differeniator from Fig. 5A has been altered. Across C_1 a 10K resistor has been added to make two networks with equal time constants:

$$R_1C_1 = R_2C_2$$

The rounded leading edge of W1A indicates that this circuit still loads the square-wave generator. Note the change in W1B. The scope sweep speed is increased to 50 usec/cm to measure rise time, but it is still noticeable that the top of W1B is flat (Fig. 6); amplitude is .5 volt. In W1B (Fig. 5) the top begins to tilt downward immediately; in addition, the amplitude is .6 volt. In Fig. 6, the W1A and W1B wave shapes are identical. The amplitude of W1B is determined by the voltage divider formed by the two resistors.

W2B in Fig. 6 shows even greater change from W1A of Fig. 4. Addition of a .03-mfd capacitor across the 100K resistor increases the output amplitude to .75 volt and decreases the rise time to that of the input—7 usec. The output waveform at all frequencies is identical to the input if $R_1C_1 = R_2C_2$. Only at extremely high frequencies will unavoidable stray capacitance and inductance upset this relationship.

Fig. 7 shows a circuit equivalent to that in Fig. 6B. The junction between capacitive and resistive halves of this circuit is opened to show relationships. R_1-R_2 and C_1-C_2 each form voltage dividers. Neither the purely resistive nor the purely capacitive divider changes the input waveform shape—the reactance and resistance *ratios* are the same for all frequencies. If $R_1C_1 = R_2C_2$, the voltages at the capacitive and resistive divider junctions are *equal*. No current flows between the junctions even if they are connected to form a network like those in Fig. 6. The input and output waveforms remain identical.

However, if $R_1C_1 \neq R_2C_2$, the voltages at the divider junctions are unequal. Current will flow between the resistive and capacitive branches if the junctions are connected. The transfer of current between branches means that they no longer behave as purely resistive and reactive paths; the network does not behave

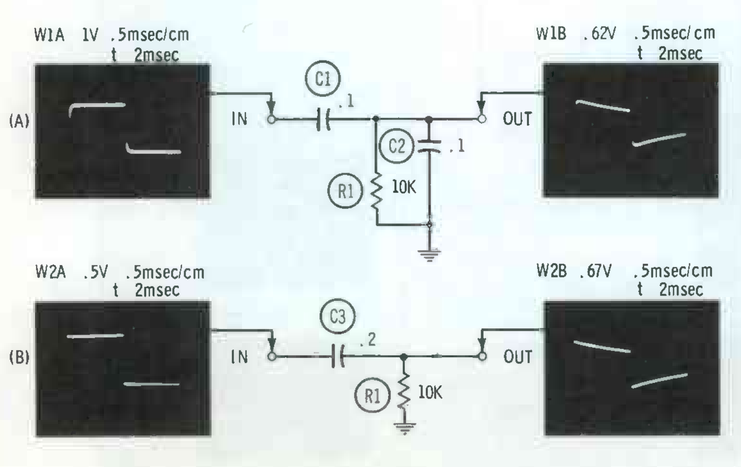

Fig. 5. Generator internal resistance prevents accurate test.

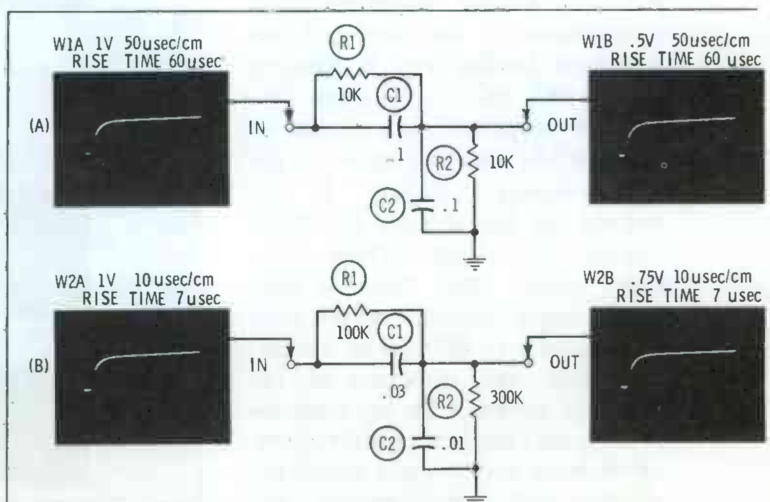

Fig. 6. Input, output are identical: RC series = RC shunt.

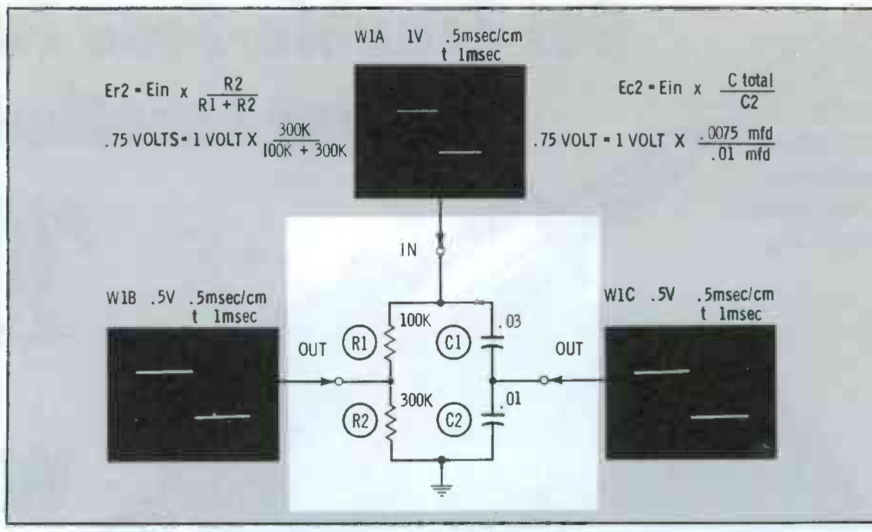

Fig. 7. Circuit equivalent to that in Fig. 6B shows voltage-waveshape relationships.

as the one shown in Fig. 7, and the output waveform is distorted.

RC = RC Test

You can add components to each half of both simple and complex differentiators and integrators as is done in Fig. 6. If $R_1C_1 = R_2C_2$, the output waveform is identical to the input, and the ratio of p-p output to input amplitude is determined by the resistive (or capacitive) divider. You need only calculate the values needed to make both branches have equal RC and the ratio between p-p input and output. Next, sweep the square-wave generator frequency through the range corresponding to t = 10RC to t = RC/10. If the output waveform isn't identical to the input throughout that frequency range, some component value is outside tolerance. Probably you will use substitution boxes for this test; make sure that leads to the substitution capacitor are as short as is possible. (Lead length to the substitution- box resistor isn't as critical—Q is much lower.) Inaccuracies in the test setup can cause ringing, overshoot, or rounded leading edges of the waveform. Usually, components tested will be rated for 20% tolerance; also, tolerance ratings for added components must be considered.

Comparison of rise time, p-p amplitude, or lagging-edge tilt between input and output waveforms should indicate less than 20% variation if components are rated for 20% tolerance.

Applications

In-circuit tests can be used on de-energized equipment. Fig. 8 shows a typical setup for testing an interstage coupling circuit on a PC board. Capacitor C1 can't be tested accurately with a capacitor checker unless it's disconnected, because R3

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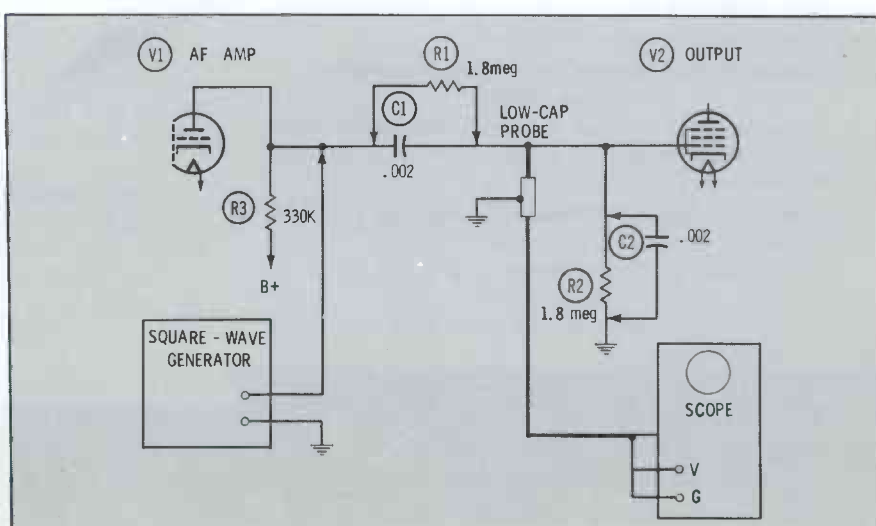

Fig. 8. You needn't unsolder anything to perform square-wave test of C1 and R2.

extend TWO WAY RANGE . . . Reduce Noise

These hints will increase performance.

by Jack Darr

The range of a two-way radio does not depend entirely on how far the RF carrier can be received; it depends on how far the messages can be *understood*. While carrier power is important, *readability* is equally important. The phrase "I read you" means exactly that: the listener has heard and understood the message. Anything that interferes with readability cuts down the range and usefulness of the system.

Since the change to narrow-band FM, range and intelligibility have been more of a problem. The audio recovery is reduced, and more noise is audible, while, at the same time, less audio power is provided in the output. Electrical noise from the vehicle becomes more troublesome. Natural noise is still not a serious problem; the man-made noises, plus certain troubles in the radio sets themselves, are far more annoying. Let's look at some of these annoyances and see what can be done to prevent them.

Installation of the mobile units is a major factor. Every possible electrical noise must be eliminated from the automobile engine and electrical system. Resistor spark plugs, liberal by-passing of all noise sources, plus tight grounding and bonding are a necessity. For units normally working at long ranges, the fully shielded ignition system may be needed. The techniques and materials used are well-known; they're basically the same as those used on BC auto radios. The primary difference is that these techniques are performed to a greater degree of perfection.

Coaxial bypass capacitors are more efficient at VHF frequencies. (Some coaxial types are shown below and to the right in Fig. 1; a standard unit is on the left.) Alternators give less electrical noise than the old generator/voltage-regulator systems. However, when alternators do give trouble, it is harder to cure. The best remedy for alternator noise is a fully shielded two-section LC filter, installed in series with the lead from battery to radio (Fig. 2). These filters are commercially available, or you can make one in the shop. In extreme cases, this filter can be *tuned* to the carrier frequency. However, the standard brute-force filter will normally do a good job.

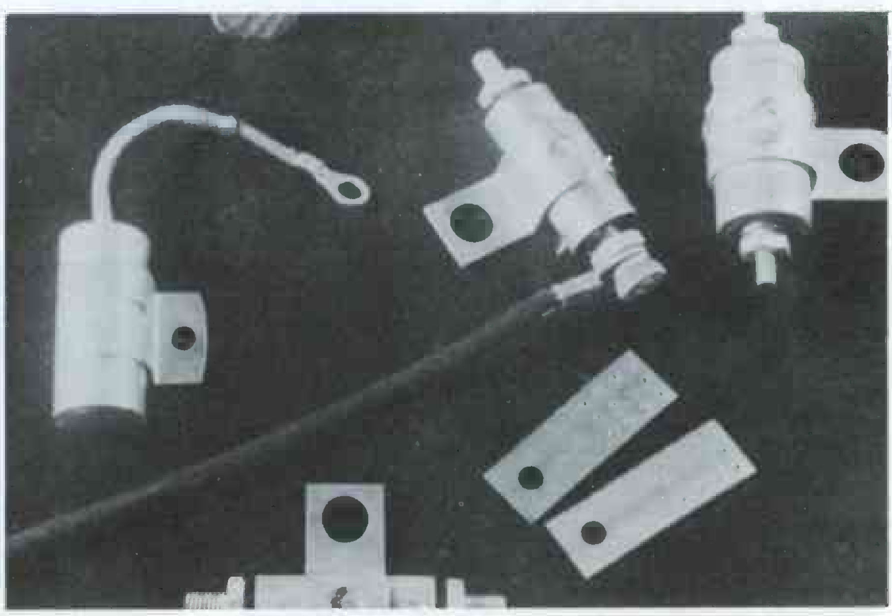

Fig. 1. Coaxial capacitors (shown at right) are more efficient in reducing noise.

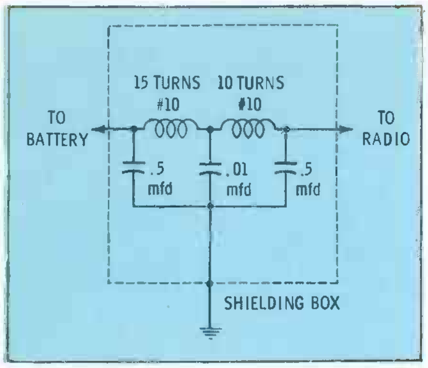

Fig. 2. Filter removes alternator hash.

Antenna connections must be clean and tight—especially the grounding. An intermittent ground on the antenna base is often unsuspected and can cause a lot of difficulty. Be sure it is clean and tight.

When you want to locate noises in a squelch-equipped receiver, run the vehicle into the shop, or at least near enough to the shop that a weak signal from the AM signal generator can be picked up. Set the generator for an unmodulated signal, and use only enough output to operate the squelch circuit of the receiver. This allows you to hear any vehicle noise and also simulates fringe-area operation. Simply opening the squelch control will *not* do the same thing! There must be a signal passing through the receiver before the noise can be heard.

Overmodulation

In narrow-band systems, modulation swing must be set precisely. Even in FM, overmodulation will result in distortion. As you know, this was not a problem with the wideband sets, but it very definitely is now. With only 2.5 kc either side of the carrier, overmodulation of the transmitter can cause the signal to swing outside the receiver passband. Fig. 3 shows what happens: especially at long ranges, the signal will be chopped into bursts and will be nearly unreadable.

Automatic-deviation-control circuits are used in most of the better transmitters. Even so, misadjustment of this circuit will still allow the transmitter to overmodulate. These control circuits prevent overmodulation of the transmitter from such things as the operator shouting into the microphone, etc. But, for best results they must be properly and precisely set with a modulation monitor so that the maximum modulation swing is not exceeded. The transmitter audio circuits must be checked for distortion, proper amplification, and correct clipping action. In most sets, modulation controls are simple diode clippers. However, bad diodes or incorrectly adjusted circuits can cause trouble.

The microphone is also important, especially in mobile units. Microphones of all types suffer from rough handling, moisture, age, and so on. Microphone deterioration often appears as low output or distortion, rather than a complete failure, such as a broken cable or an open switch.

Transistor amplifiers are used with dynamic and variable-reluctance mobile microphones. These must be carefully checked for output and tone quality. Dirty switch contacts in the microphone can reduce the supply voltage or cause chopping of speech. Electrolytic capacitors were a common trouble in the earlier units. In a few cases, the capacitors were defective, but the trouble was caused most often by poor joints in the capacitor mountings. Microphones can be checked most easily by substitution; the absolute output of a cartridge is very low and hard to measure accurately. (Incidentally, some of the diaphragm-type microphones, such as a dynamic, can be checked by feeding an audio signal into them, as you would a speaker, and listening! Any distortion or weakness can be spotted by comparing the audible signal with that from a unit known to be good.)

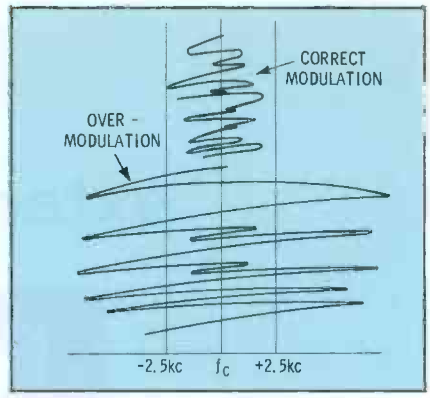

Fig. 3. Overmodulation distorts signal.

Receiver Troubles

Overall RF sensitivity of the receiver is quite important. Check alignment carefully, peaking all stages for maximum quieting. RF tuning should be rechecked *after* the set is reinstalled in the automobile. This will assure you that the vehicle's antenna is properly matched to the receiver input. It's best to use a weak AM signal; too much signal during this test will obscure the correct peak of the antenna-trimmer setting.

Practically all receivers use the Foster-Seeley discriminator because of its simplicity and ease of adjustment. This discriminator must be adjusted correctly to get maximum response from the signal with minimum noise and maximum quieting. The discriminator-circuit center frequency should be checked every time the set is serviced.

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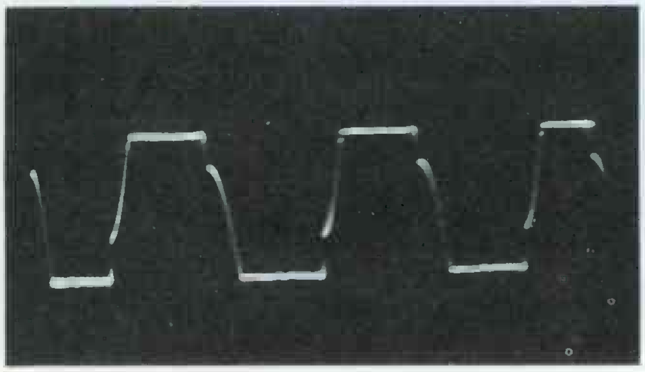

Fig. 4A. A good vibrator gives this square-wave pattern.

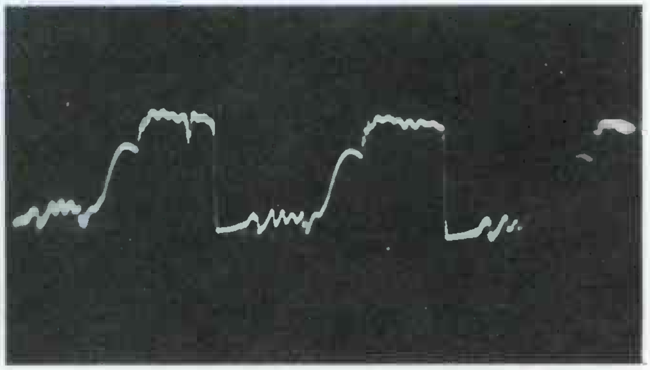

Fig. 4B. Ragged tops indicate poor contacts on vibrator.

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stand up to the INTERMITTENT

Tips for making the trouble occur.

by Wayne Lemons

Since the early days of radio, no one thing has taken more joy out of life for the electronics technician than a stubborn intermittent. Unfortunately, there is no cure-all for this on-again, off-again, unrepentant TV trouble. There are, however, several approaches that work well in a given situation. The first approach we will analyze is a mental one educators sometimes refer to as *mind-set*. Basically, mind-set is simply deciding to take action rather than sidestepping the problem and working on something that promises quicker results. If the technician doesn't believe he can find the trouble, he probably won't. Should he take the attitude that he is more capable of finding the trouble than the circuit is of concealing it, however, he often has the battle more than half won. I imagine every experienced technician has had days when the intermittents were no problem. If he thought back he'd probably discover these were the days when his self-confidence was strongest. So, first decide you can do it, and then get the job done.

Now I'd be the last person in the world to say that just deciding to do a job is all there is to it. As a matter of fact, you are unlikely to develop mind-set until you know as much as possible about the problem and how to use the tools of the trade, whether they be mental or physical. Let's look into some methods for conquering the intermittent that have been proven successful.

First, get as much information as you can from the set owner. This is not as easy as it may sound, because the owner doesn't speak your technical language. You must ask questions that get to the heart of the problem. If you ask what the owner thinks the trouble is, you will probably get a highly original answer, such as "There musbe a short sommers."

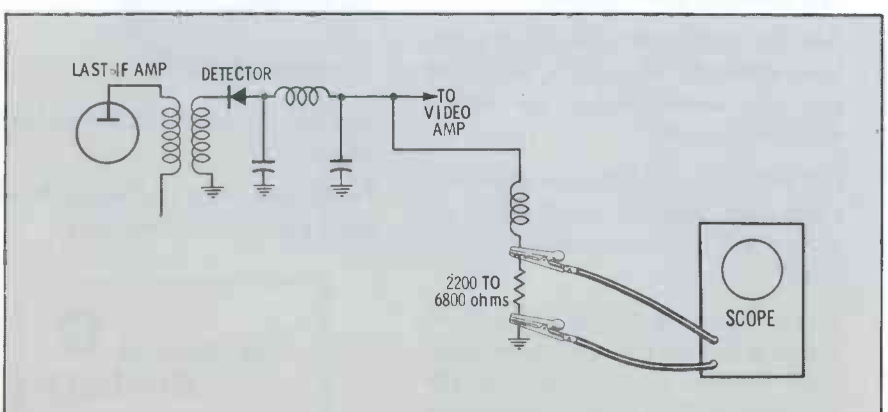


Fig. 1. Video-detector load resistor is ideal place to monitor intermittents.

Ask questions similar to these: Does the picture go off with the sound? Does the picture get narrow before it goes off? Does the picture start moving up or down or get diagonal bars in it before it goes out? Is there any odor when the set acts up? Are there any unusual noises associated with the trouble? Do all stations go off? How long has the set been giving this trouble? Has it gotten worse? Does the trouble occur when the set is first turned on or after it has played several hours? Is there anything you do to make the trouble go away temporarily? Does the trouble occur at some particular time of day or night? Did the trouble start after some new parts had been installed?

Of course, in specific instances there are other questions that should and would be asked, but these give you an idea of how information may be extracted from the customer. By asking questions of this nature, you'll usually get most of the information you need. Quite often the trouble may actually be hidden right in the customer's complaint, and who knows better than he what it is?

Once you have the customer's information, what then? Will you start by immediately pulling the chassis and digging inside? Personally, I think this is a mistake made by too many technicians. As valuable as the customer's information is, it is even more useful when it is coupled with your own interpretation of the trouble. Turn the set on and let it play before you even remove the back. See if the intermittent occurs. Remember, don't spend to much time in the home on an intermittent. Get the set into the shop where you can watch its actions while doing other work. Of course, if you see the trouble occur in the home, then determine if the intermittent is caused by a condition peculiar only to the home environment, such as high power-line voltage, inadequate ventilation, etc.

Explain to the customer that you must take his set to the shop so that it can be monitored with the proper instruments. Also explain that you won't be able to detect any trouble as long as the set is playing well. If the customer is not willing to allow you the necessary time to repair an intermittent, don't take the job. Nothing is more bothersome than an intermittent that seems to be repaired but actually is only hiding until you return the set.

When you see the trouble for yourself, then what? By now you probably know what circuit the trouble is in, but if you don't, at least you know what the symptom looks like, and you're ready to pull the chassis, if that seems necessary. In most cases it is, because even tube replacement may be a mistake at this point. If you do replace a suspected tube, you must then fire up the set and wait to see if the trouble recurs. This is usually the exact time the intermittent goes into hiding. Instead of changing tubes, carefully pull the chassis and, using a scope or whatever instrument is indicated, try to localize the trouble. A good way to start, if the trouble is in the picture, is to connect your scope across the detector load resistor (Fig. 1). When the intermittent occurs, notice if the distortion shows up. In almost every case, this will tell you whether the trouble is before or after the detector. Once you discover which way to look, you are well on the way to pinpointing the intermittent part. Use as many circuit monitors as possible. Tie your VTVM to the AGC or B+ line. If the trouble is in the sound section, place the VTVM across the ratio-detector load resistor. Or in the case of a gated beam detector, put the meter on AC and monitor the audio at the output-tube grid. Where to connect the monitoring instruments is an art that must be developed for each general family of troubles. Sophisticated test equipment is not absolutely necessary; your VTVM or scope will do the job if you use them properly.

Heat

A large percentage of intermittents is caused by temperature changes that normally occur inside the TV receiver. When some part is beginning to deteriorate, it often becomes highly sensitive and maddeningly temperamental when the surrounding temperature changes. The problem is further complicated because removing the chassis from the cabinet gives more air circulation and allows the circuit to seem entirely normal on the bench. There are two or three ways to overcome this obstacle. One is to wrap the set in a blanket (Fig. 2), but you must be sure the blanket doesn't get so close to the high-power tubes that it catches fire. This method entails another problem: when you remove the blanket for making checks, you must work fast because the set will be cooling off again.

Usually, a much more satisfactory way (especially if you are reasonably sure which section of the receiver is causing the trouble) is to use your soldering iron. Move it close to suspected parts, and heat them considerably above room temperature (Fig. 3). The big advantage in this is to locate the heat-sensitive part almost immediately. With the blanket method, all parts are heated, and you still have the job of localization.

As an example of the soldering iron method, let's suppose the set has an intermittent vertical roll. With the chassis out of the cabinet, take a soldering iron and hold it close to each resistor and capacitor in the suspected section for a short

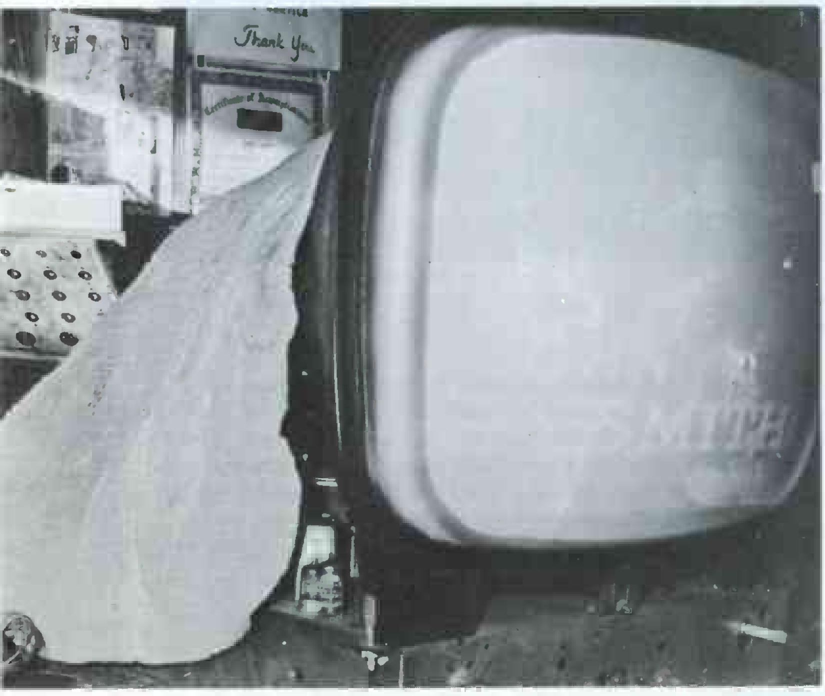


Fig. 2. Covering the set will cause components to heat.

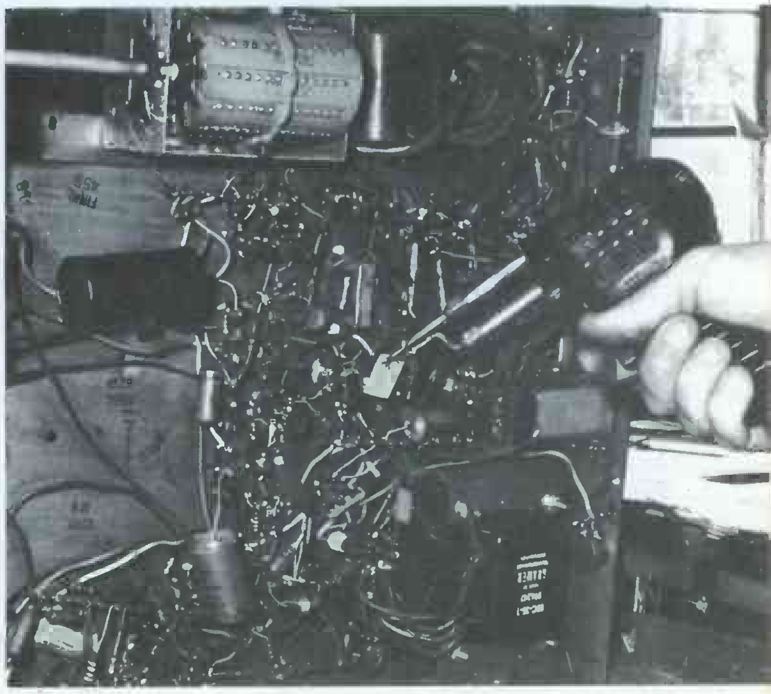


Fig. 3. Heating the defective component causes symptom.

new
8290
Shielded Permohm*
Shown Actual Size

82 Channel TV lead-in

for the strongest, cleanest picture signal and best color... ever!

- Provides 82 channel color reception
- Less installation time and cost
- Eliminates transmission line pick-up of noise and ghost signals
- No expensive matching transformers required
- Can be installed anywhere

Unshielded twin-lead
Severe picture disturbance due to ignition noise.

Coaxial Cable
Ignition noise minimized— but not eliminated.

* Shielded Permohm
Eliminates automobile ignition noise.

New 8290 Shielded Permohm TV Lead-in combines the strong signal strength of twin-lead with the clean signal protection of shielded cable. Because it is a balanced line for 300 Ohm TV antennas and receivers, *costly matching transformers and connectors are eliminated.*

8290 is specifically designed for superior color reception on all 82 channels. The twin-lead is encapsulated in low-loss cellular polyethylene insulation, Beldfoil** shielded against all outside disturbances, and protected with a weatherproof jacket. A drain wire is provided for grounding the shield to the chassis. The need for stand-offs, twisting or routing of lead-in is eliminated. 8290 can be taped directly to a mast or tower, routed through metal pipe, buried underground, or even installed in rain filled gutters to reduce installation time and cost.

Ask your distributor about 8290 Shielded Permohm TV Lead-in cable, today! Or, write P. O. Box 5070-A for complete information.

*Belden Trademark—Reg. U.S. Pat. Off.

**Belden U.S. Patent 2,782,251 and patent pending

8-9-5

BELDEN MANUFACTURING COMPANY **Belden** **P.O. Box 5070-A · Chicago, Illinois 60680**

Circle 11 on literature card

time. When you come to the sensitive one, the picture will start to roll, and you can be pretty sure you have found the trouble. Or perhaps the sync gets critical after the set plays an hour or so. Do the same thing in the sync circuit. You'll find the culprit quite often.

Other Kinds

Other intermittents occur because of high or low power-line voltage. Every technician should have some method of varying the line voltage by about 20%. You must remember, however, that with the chassis out of the cabinet parts will run considerably cooler and the voltage change may not cause the intermittent to happen. In other words, the trouble may be due to heat.

You can use a large pasteboard box, one large enough to cover the set, and leave only the bottom of the chassis exposed for testing. The box and the application of higher or lower voltage will usually make the intermittent come out into the open which will save much time.

There are mechanical intermittents that take place, but these should respond to a mechanical diagnosis. For example, the set may go off or produce distortion in the picture or sound when it is moved. The first things to check in these cases are the antenna lead and other common trouble spots. Nothing is more embarrassing than finding an obvious broken wire (or a "short sommers") after the chassis has been pulled and a good deal of time spent in checking for a more sophisticated defect.

"Don't let him fool you! I've heard about his vacations to Paris, the Caribbean, the Bahamas—"

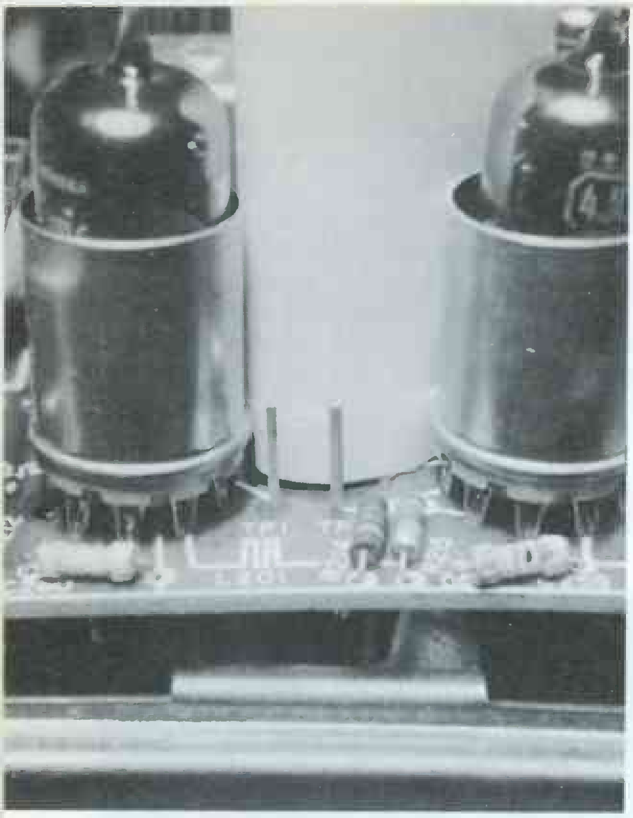
Conclusion

Remember to set your mind to finding the trouble, use the tools at your command, and get busy. Don't put it off! If you start right in and resolve that you can fix any trouble that a circuit can be sneaky enough to hide, you can make the intermittent bite the dust faster than Matt Dillon can pull leather.

One last word of caution: Always make sure, or as sure as you can, that you have actually found the defective parts causing the intermittent. Intermittents, being rather unsavory characters anyhow, often lie low when the law starts after them, coming out only when there isn't much chance of getting caught.

Don't let apparent cures fool you. As has been said before somewhere, if you step on a dog's tail, he yells at the other end. If you push on one part in the chassis it may effect a temporary cure on the other side. Moral: Don't let a sneaky intermittent ruin your reputation. ▲

Circle 12 on literature card



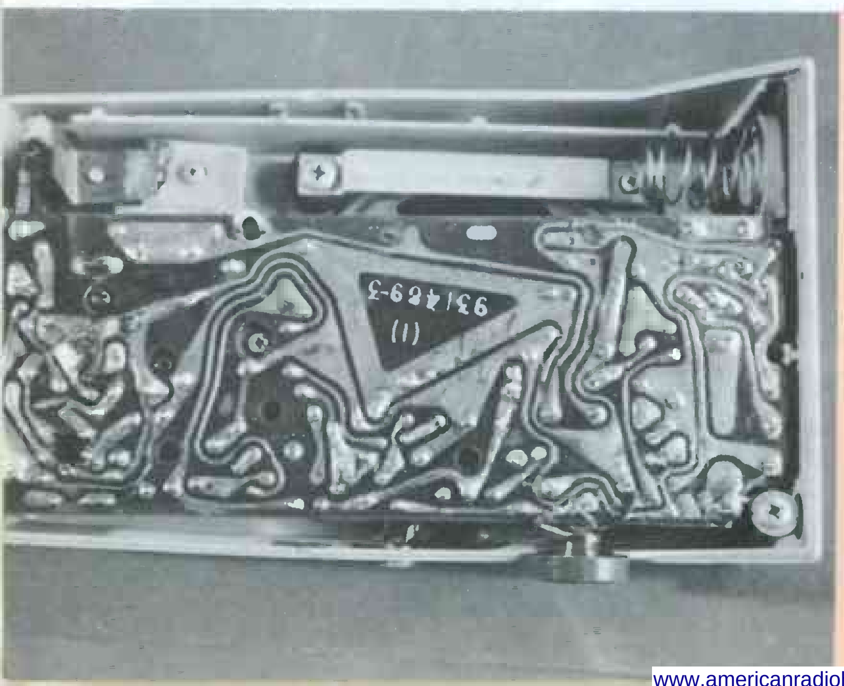
All of us use test points when we troubleshoot radio or television circuits. By making checks at specific points, we can readily determine the operation of an entire section—such as a tuner, video amplifier, or vertical-sweep circuit. After we locate the defective area, we find the exact trouble by conventional tests. Assuming that we know what part of the circuit we want to use for a test point, the next step is to locate it on the chassis. But how do you find a test point on an etched circuit board when the components are on one side and the wiring on the other? These photos show some possibilities.

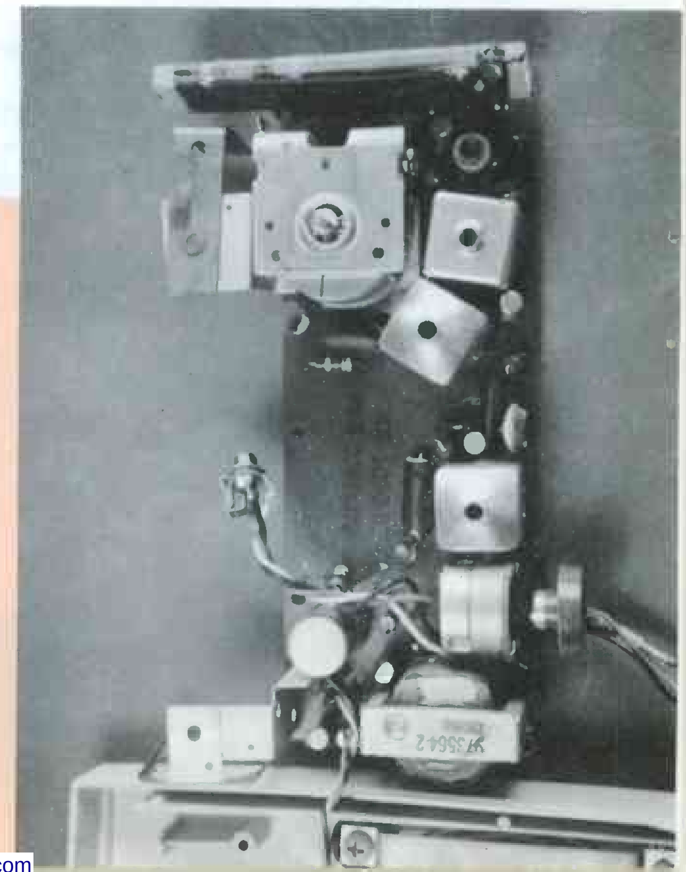
Finding Test Points On Printed Boards

Many large boards have some kind of circuit diagram on the component side to show the path of the wiring on the reverse side. By counting the tube-socket pins, you can identify test points with the elements of a tube.

The service data will usually tell you, but what can you do if a schematic is not available? You can follow the signal path by viewing the reverse side of the radio and observing the positions of IF transformers, detector, etc.

It is more difficult to find test points on a small radio chassis where the size does not permit such a diagram. You can make a visual examination with a magnifier to find bad solder joints or cracks in the board, but the big puzzle is: what components are connected by this wiring?

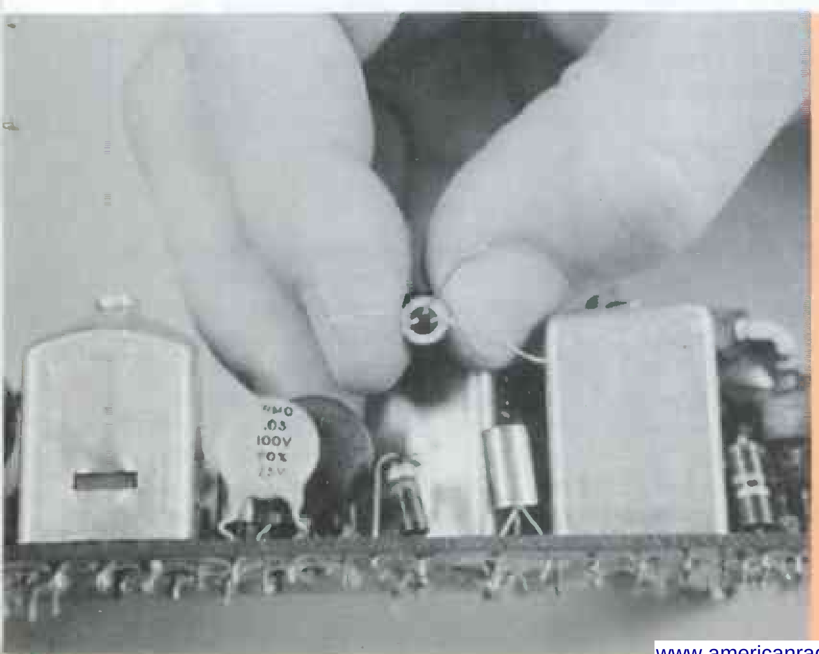




Another helpful method for signal tracing is to make the connection between the components visible. You can do this by viewing the component side of the board and placing a light on the opposite side. A plain light bulb or penlight will do.

The reverse method may also be used; that is, position a light on the component side of the printed board and look at the wiring side. This procedure is sometimes quite helpful, although in most cases it is less satisfactory than lighting the wiring side.

The preceding tests should have localized the trouble spot; now we must concentrate on smaller test points. A dental mirror will help in seeing the under side of the transistors, and an external transistor will help visualize pin connections.



Large components whose functions cannot be mistaken make good landmarks for circuit tracing. These include tuning capacitors, volume controls, transformers, and diodes. The volume control is handy test point for overall check of audio circuit.

can an ACCOUNTANT help you?

These consultants may save you dollars.

by David I. King

One measure of the efficiency of your business operation is the accuracy and completeness of its records. This does not mean you must build a paperwork empire to have an efficient operation; to the contrary, a paperwork empire is a sign of inefficient accounting methods. An efficient, accurate, complete accounting system need not be complex, but it must be well organized.

Many small businessmen do not keep adequate records, and radio-TV repair-shop owners are certainly no exception. Without complete records, a shopowner is never certain of his financial condition. Often an accountant is called in only at year's end (or tax time) to put existing records in order and make an annual statement of total profit or loss. Therefore, information necessary for business decisions throughout the year is available only at this time. Often, it's too late to prevent costly mistakes.

There are many ways that you, the shopowner, can provide yourself with records of your business operation:

1. You can keep your own records—if you have time. The disadvantage is that if business volume increases, you have less time to spend on records, and resulting inefficient management may then destroy profits from increased business.
2. Turn responsibility for your records over to your wife. If she fully understands your business and is a good bookkeeper, then you're most fortunate!
3. If your shop is large enough to need an office girl, keeping records can be made one of her duties. An accountant can then be hired only for annual inventory and tax purposes.
4. You may, if you own a really large shop, decide to hire a full-time accountant. (Radio-TV repair shops this large are few.)
5. If your shop is small or medium-sized, you can use an outside accountant to handle all records, including those for tax purposes.

Why Use An Accountant?

Owners of small shops are often reluctant to hire an accountant. Profit margin is so small that the expenditure for an accountant's services may seem too great. Yet, if the individual owner doesn't keep adequate records, it's probable that he will lose more money through poor management (caused by the lack of complete records) than if he had hired an accountant. Accounting service is not expensive— *NARDA Cost-of-Doing-Business Survey* for 1964 shows that NARDA members spent only .55% of gross sales for accounting and legal services combined. Perhaps you are not familiar with all the services accountants make available; here are the major ones.

Bookkeeping

Before a meaningful record of business transactions can be made, all income and expenses must be recorded. Usually, an accountant collects all bills, invoices, check stubs, receipts, and other transaction statements, then itemizes them to get a full report of profit or loss.

The method used to collect this information varies. Often, a box is left with the shopowner, and he deposits in it all his receipts and bills, etc. These are then collected weekly, biweekly, or monthly.

Profit-Loss Statement

Results from income and expenses are compiled by the accountant and submitted to the shopowner in a report that is usually called a *profit-and-loss statement*. An example is shown in Fig. 1. The top section shows total income. The cost of goods sold is subtracted to give gross profit. Next, total operating expense is subtracted to give gross profit. Finally, total operating expense is subtracted from gross profit to give net gain/loss.

Percentages

To the profit-loss statement the accountant may add *percentages;* here, they are listed in relationship to total income. The center percent column is for the current month, while the percent column to the far right shows percentages from the beginning of the year to date.

These percentages are invaluable for detecting variations in the relationships among net gain, gross profit, cost of goods sold, and operating expense. For example, a sharp increase in the cost-of-goods-sold percentage is an indication of possible inventory problems; or it might indicate a decrease in income from service and labor sales. Although percentages won't always specify the cause of trouble, they are valid indicators of its existence.

Expense Breakdown

Operating expense can be listed in many ways. In the report in Fig. 1, for example, there are no fuel or heating expenses or personal property taxes for this particular month; yet, previous payments are shown in the balance-to-date column, and a percentage is listed showing the relationship to total income since the beginning of the year.

A breakdown of expenses informs the shopowner:

1. Where his money is going.
2. How much is being spent for any item.
3. The relationship in percentage (when given) of any expense to total income.

The shopowner has a monthly report of all expenses. He can then make corrections for any expense that seems excessive. Ideal figures can be determined for expense items, and procedures can be devised for reducing expenses until they approach the ideal. Since net gain can be increased by *decreasing* operating expense as well as *increasing* total income, an accurate account of all expenses is most important to the business owner.

Taxes

Modern-day local, state, and federal tax laws are so complicated that few shopowners have time or incentive to learn them; instead, they usually hire an accountant to compute their taxes. Accountants have to know tax laws—they make their living by performing these services. Still, the very best accountant cannot list exemptions to which the shopowner is entitled if accurate records of all expenses are not available. As a result, the shopowner with an inefficient accounting system can lose money by paying unnecessary taxes.

ACCOUNT DESCRIPTION		CURR PERIOD	PERCENT	BAL TO DATE	PERCENT
INCOME	100				
SERVICE PARTS SOLD	110	1,502.74		11,195.12	
TV & HI FI SALES	111	4,880.10		34,656.88	
APPLIANCE SALES	112	1,488.27		11,246.39	
OTHER SALES	113	533.01		4,395.49	
SERV & LABOR SALES	120	1,427.20		8,982.88	
OTHER INCOME	180	39.75		339.47	
	TOTAL	9,871.07		70,816.23	
COST OF GOODS SOLD	210	5,042.47	51.08	36,896.34	52.10
	TOTAL	5,042.47	51.08	36,896.34	52.10
GROSS PROFIT		4,828.60	48.92	33,919.89	47.90
OPERATING EXPENSE	300				
OUTSIDE LABOR	301	138.39	1.40	391.09	.55
WAGES & SALARIES	305	606.40	6.14	3,967.05	5.60
SOC SECURITY TAXES	314			130.69	.18
PERS PROPERTY TAXES	315			124.68	.18
LICENSES & TAXES	316	5.05	.05	50.95	.07
GROSS INCOME TAXES	318			18.81	.03
FUEL OR HEATING	320			201.23	.28
UTILITIES	330	56.63	.57	326.88	.46
TELEPHONE TELEGRAPH	335	21.87	.22	210.03	.30
IESA SCHOOL	350	4.28	.04	96.12	.14
ADVERTISING	360	502.41	5.09	2,316.28	3.27
AUTO OR TRUCK	361	69.96	.71	262.76	.37
CLEANING & LAUNDRY	363			18.50	.03
TRASH	365			3.00	.00
DUES & SUBSCRIPTIONS	366			110.95	.16
FREIGHT & DELIVERY	368	11.15	.11	121.54	.17
INSURANCE	369	84.46	.86	431.08	.61
INTEREST	370	6.62	.07	340.61	.48
PROFESSIONAL SERVICE	371	30.00	.30	262.50	.37
RENT	372	200.00	2.03	1,600.00	2.26
REPAIRS & MAINT	373	20.00	.20	32.50	.05
SUPPLIES & POSTAGE	375	9.51	.10	465.11	.66
TRAVEL	377			61.08	.09
	TOTAL	1,766.73	17.90	11,543.44	16.30
NET GAIN/LOSS		3,061.87	31.02	22,376.45	31.60

Fig. 1. Profit-loss statement itemizes income vs expense and lists percentages.

The Accountant As A Consultant

In addition to the previously mentioned services, an accountant is a valuable consultant. His experience and knowledge of business procedures are among his most valuable assets. An accountant must be an authority on local, state, and federal tax laws. He can show you ways to avoid unnecessary taxes. He may also be able to help you minimize losses due to depreciation. You can usually call upon your accountant to help set up your inventory. Even if you've had a great deal of experience with inventory procedure, an accountant can probably give you time- and effort-saving hints. Your accountant may have a means of predicting your inventory. By developing a *cost factor* for goods sold, he can estimate your actual inventory. This estimate is valuable if you are in doubt as to whether you should make new orders or continue with present stock.

Summary

Not all accountants offer every service described here; some will offer more, others fewer. All are in business just as you are, and most are very conscientious. One accountant sums up his views like this: "The accountant is the watchdog for the individual client . . . Proper accounting is as important to a businessman as the product he sells."

If you are handling your own records and have any doubts about their accuracy or completeness, definitely consider getting an accountant. You'll probably find that this service will more than pay for itself.

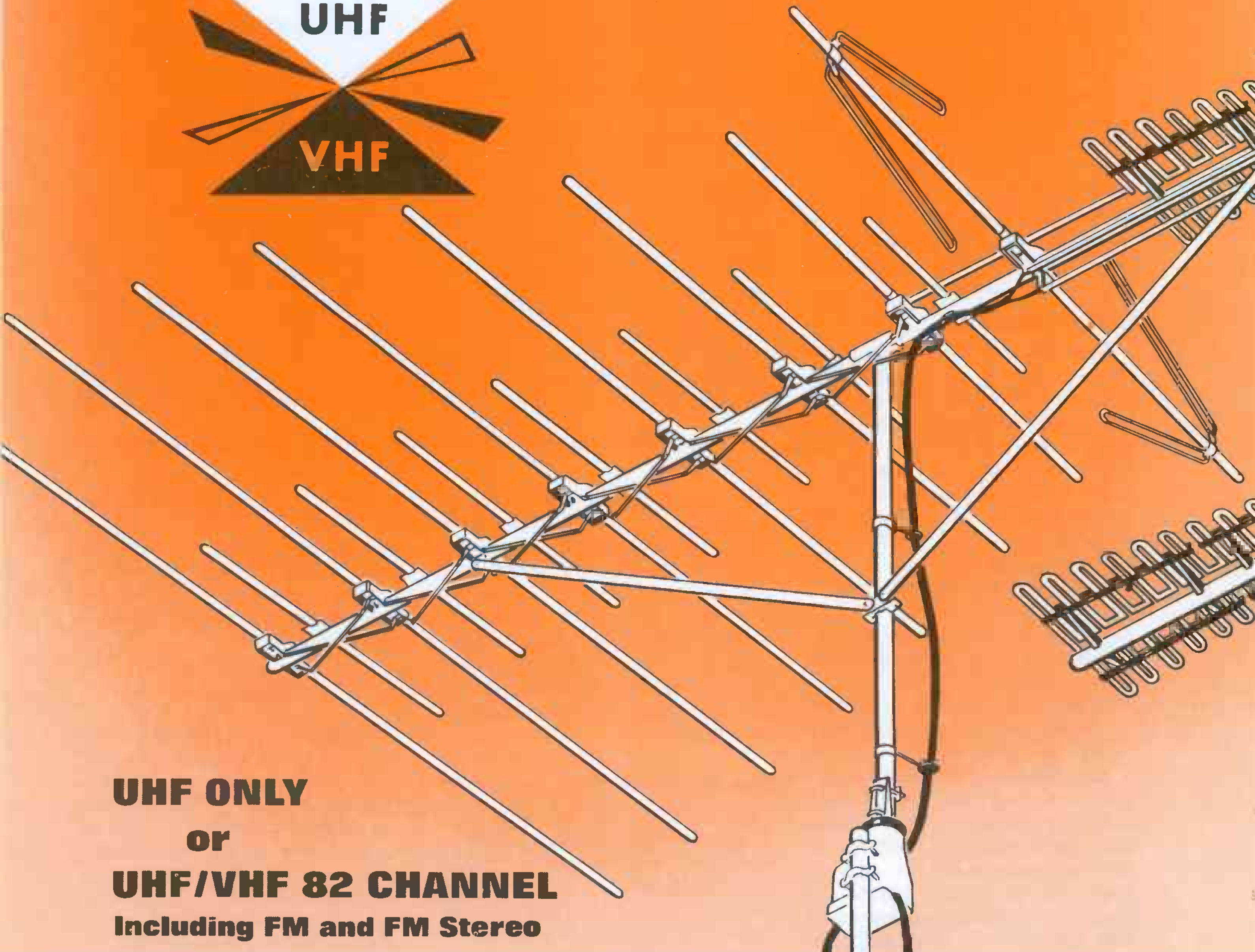
The author wishes to express his gratitude to Dick Glass, president of the National Electronics Association, Walter Akers, and many others for their invaluable aid. ▲

The first completely new antenna concept in years...

Revolutionary CHANNEL ULTRADYNE SERIES

UHF

VHF



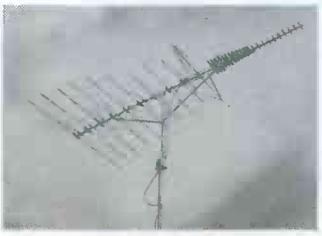
UHF ONLY or UHF/VHF 82 CHANNEL

Including FM and FM Stereo

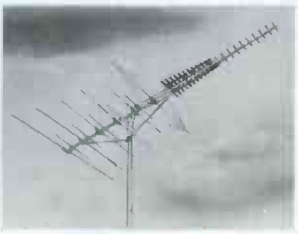
Model 0032 U-V Band Splitter included with all 82 channel antennas.

BREAKTHROUGH!

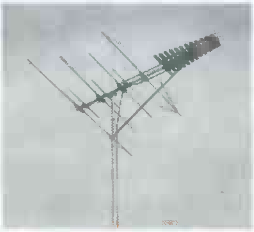
Five new ULTRADYNE CROSS-FIRE antenna models provide the first high gain FM and FM Stereo performance ever attained in an 82 channel TV antenna. Channel Master's exclusive, patented Tri-Band Directors make it possible. All ULTRADYNE series antennas feature the famous EPC golden coating.



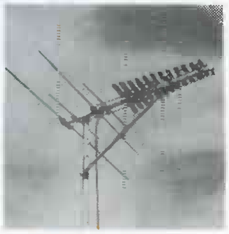
Model 3632G
for deep fringe areas



Model 3634G
for near fringe areas

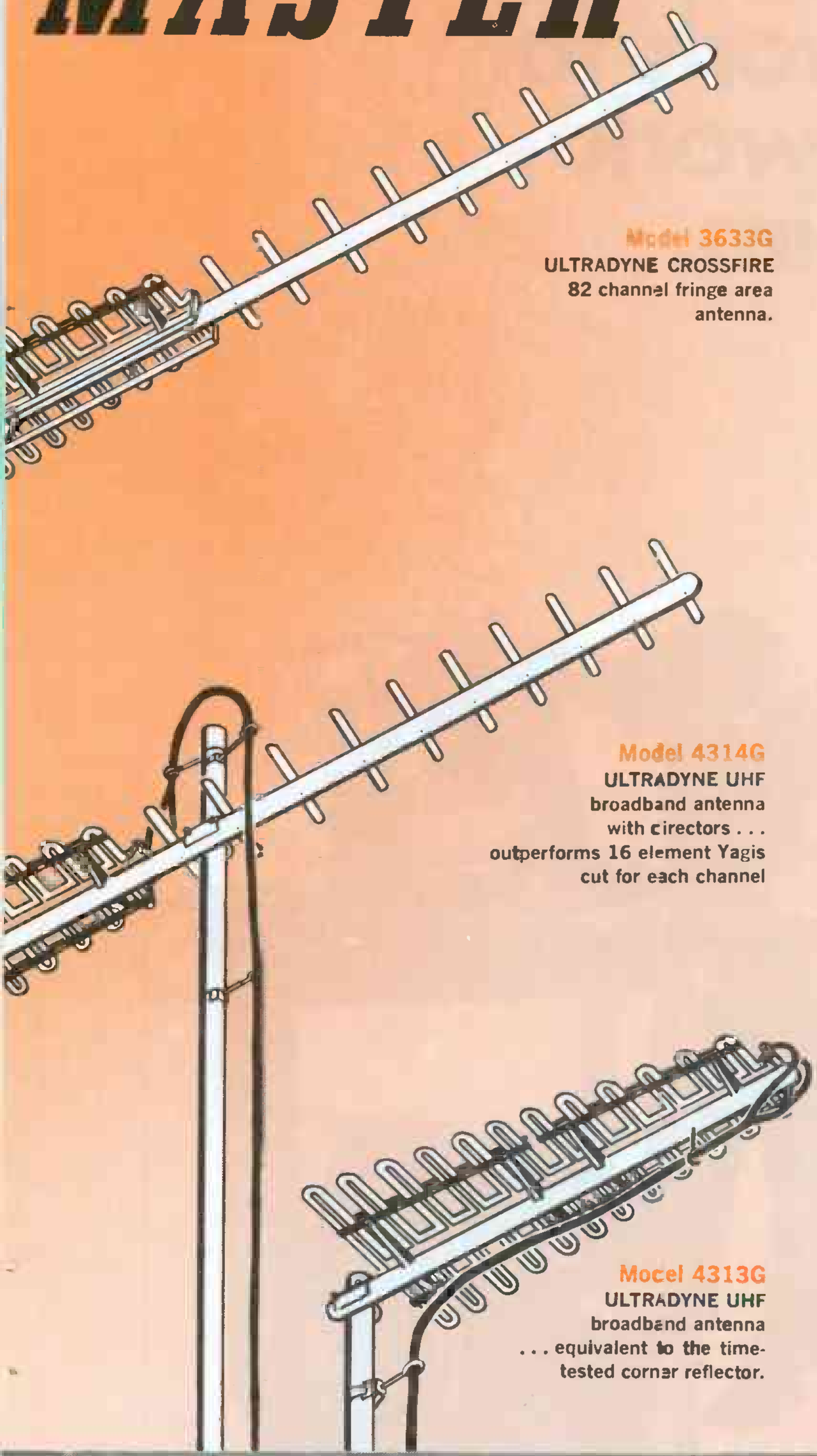


Model 3635G
for suburban areas



Model 3636G
for metropolitan areas

MASTER®



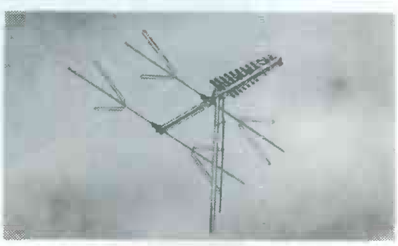
Model 3633G
ULTRADYNE CROSSFIRE
82 channel fringe area antenna.

Model 4314G
ULTRADYNE UHF
broadband antenna with cirectors . . . outperforms 16 element Yagis cut for each channel

Model 4313G
ULTRADYNE UHF
broadband antenna . . . equivalent to the time-tested corner reflector.

BREAKTHROUGH!

The amazing electronic ghost-killing power of Channel Master's famous Coloray antenna is now combined with the ULTRADYNE principle to create an 82 channel antenna for superb color reception as well as FM and FM Stereo in ghost-plagued areas.



Model 3637G
ULTRADYNE COLORAY

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COLOR AGE BREAKTHROUGH!

Model for model, new ULTRADYNE CROSSFIRES are the highest gain, highest front-to-back ratio 82 channel antennas ever developed. Unprecedented acceptance has made Channel Master Color Crossfires the best-selling VHF-FM antennas in TV history. Now, in combination with the ULTRADYNE UHF antenna, new standards of 82 channel performance are achieved.

BREAKTHROUGH!

Obsoletes so-called log periodic antennas. ULTRADYNE antennas, employing an entirely new principle, have higher gain than any log periodic antenna type on the market.

BREAKTHROUGH!

"Built-In" 300 ohm impedence actually makes the ULTRADYNE function as a length of 300 ohm transmission line at VHF. This eliminates the need for an antenna coupler when the ULTRADYNE is used in conjunction with any 300 ohm VHF antenna such as Channel Master's Famous Color Crossfires (models 3617G, 3610G, 3611G, 3612G, 3613G, 3614G, and 3615G).

BREAKTHROUGH!

Fantastic front-to-back ratios . . . over 15:1 across the entire UHF band.

BREAKTHROUGH!

Unique construction. Two stamped aluminum sections make up the entire driven element section of the antenna. This means precise control of dimensions and the elimination of connection and corrosion problems.

BREAKTHROUGH!

Three separate United States patents and two patents pending cover the exclusive design features of Channel Master's new ULTRADYNE series. No other antenna line incorporates such important technical advances. Yes, from the standpoint of gain, front-to-back ratio, impedance, construction simplicity and versatility, no other antenna comes close to the ULTRADYNE series. No wonder the entire industry knows that the truly significant advances in antenna design traditionally come from . . .

CHANNEL MASTER ELLENVILLE, NEW YORK
World's Largest Manufacturer of TV/FM Reception Equipment

Ed Leahy doesn't work for us. We work for him.

Ed Leahy believes in being his own boss. Which is what Ed likes about running his own Philco Qualified Service Center. It means that, with no strings attached, he gets better training, better service and more benefits than any other manufacturer offers.

When he needs a part, he gets it fast. His Philco Parts Distributor has what Ed needs right on hand. But even if Ed gets a job like fixing a 1947 model, he knows the oddball part he needs will be shipped in 24 hours or less through Philco's Lifeline Emergency Service.

Ed keeps up on new products with Philco Tech Data Service. He tried other services and found out that he gets the facts sooner, better and at lower cost from Philco.

Ed likes Philco's "fringe benefits," too. A complete accident insurance program for himself and his men. Advice on business management, found in Philco's popular "Service Businessman" magazine. He gets extra business, too, when his name appears under a Philco listing in the Yellow Pages.

Ed Leahy has it good. You can, too. Talk to your Philco Parts Distributor or contact Parts & Service Department, Philco Corporation, Tioga and "C" Streets, Philadelphia, Pa. 19134.

PARTS & SERVICE DEPARTMENT

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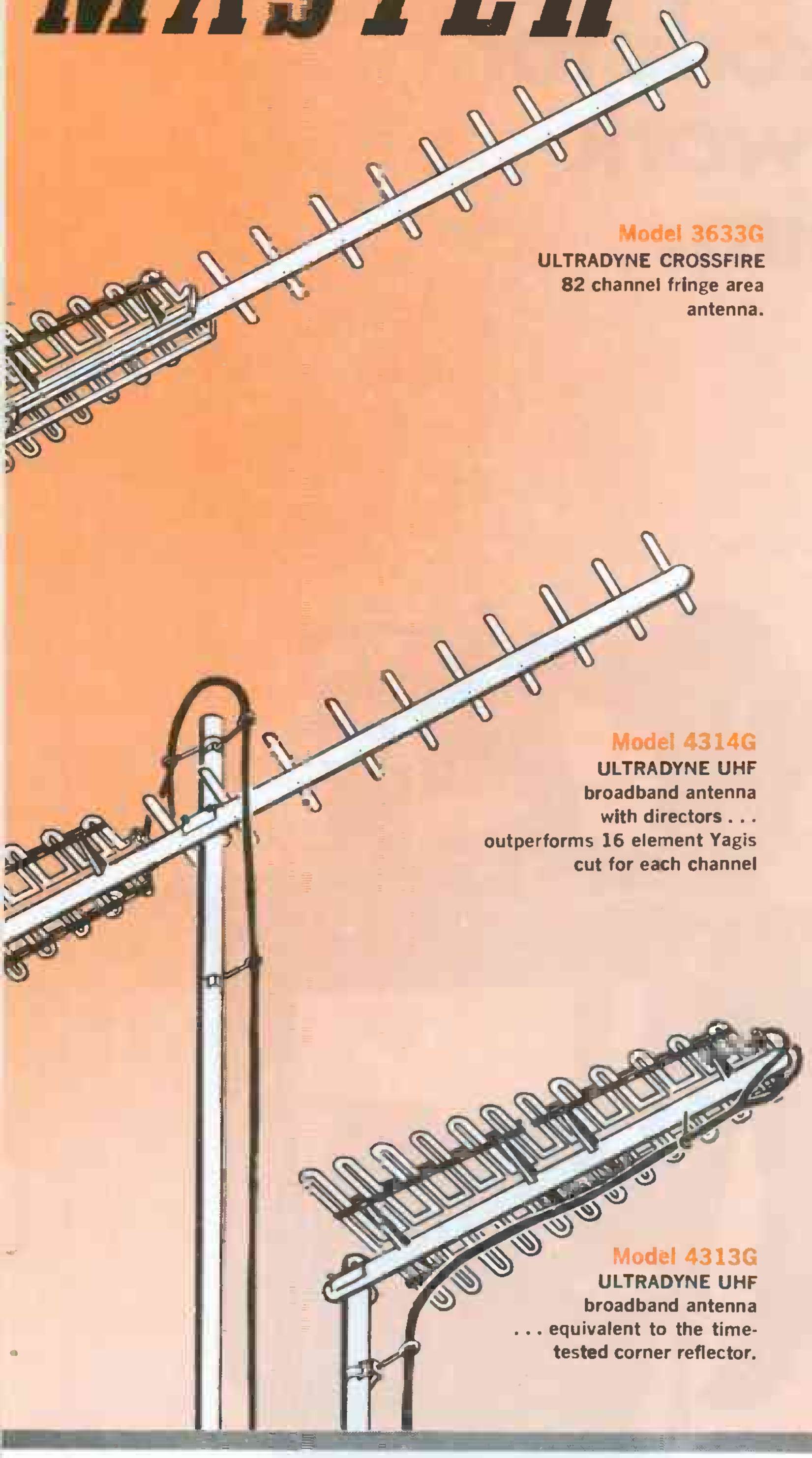
MASTER®



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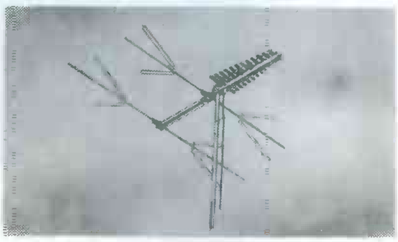

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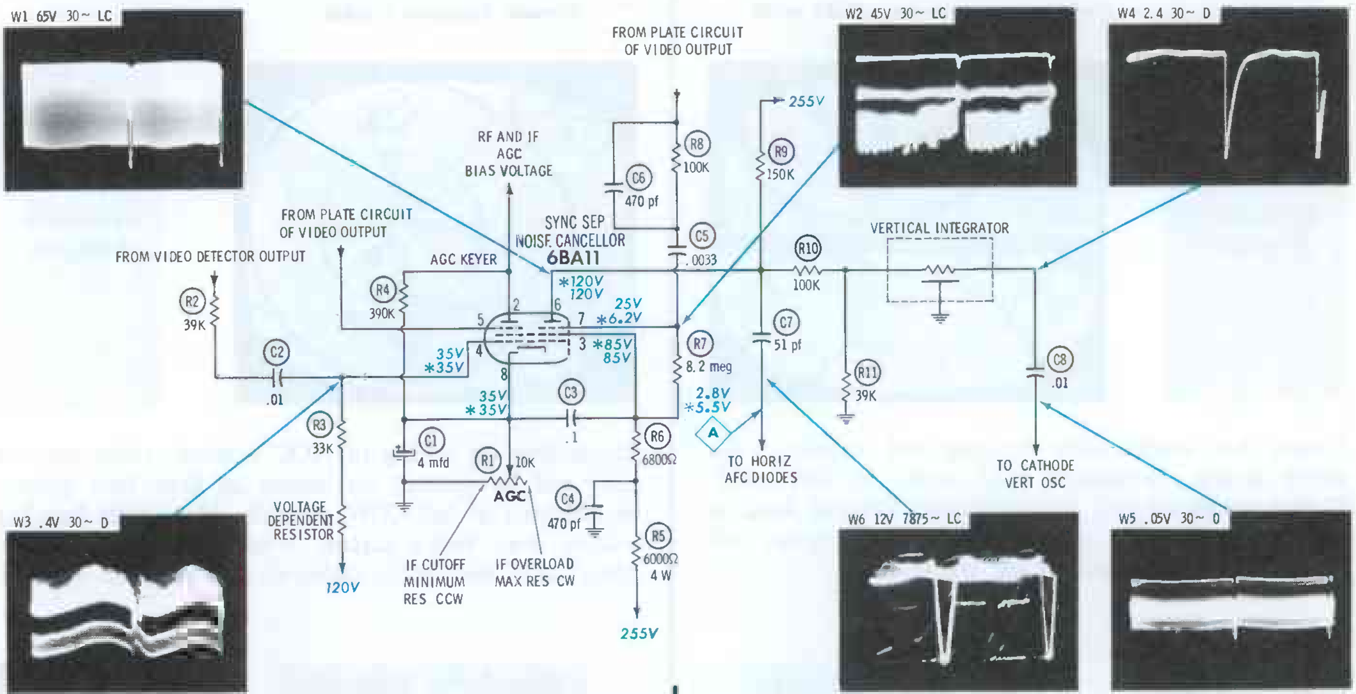
PF REPORTER Symfact®

Sync Separator AGC

Compactron



DC VOLTAGES taken with VTVM, on inactive channel; antenna terminals shorted. *Indicates voltage taken with signal present — see "Operating Variations."

WAVEFORMS taken with wideband scope; TV controls set to produce normal picture and sound. LC (low-cap), D (direct) probes are used where indicated.

Normal Operation

One-third of 6BA11 compactron serves as sync separator in Zenith Chassis 14N26; operates same as BU8 family of tubes. Composite video signal from detector has negative-going sync pulses and is coupled to pin 4 (noise-limiting grid). Normally, this signal (W3) is relatively low in amplitude and, when free of noise, has little effect on tube conduction. However, should interference appear, negative-going noise spikes send tube deeper into cutoff for their duration and prevent distortion of sync pulses (W1) at pin 6. Actual average conduction of sync separator is controlled mainly by screen grid, pin 3; this point is set so that only upper 30% of video signal brings tube out of cutoff, permitting only sync pulses to appear in output (pin 6). Pips at bottom of W1 are vertical-sync tips; white area represents horizontal-sync pulses when scope sweep is at 30 cps. W1 is coupled to integrator circuit, which passes only vertical-sync pulses, and to horizontal AFC circuit. Pins 3, 4, and 8 are all common to AGC section of 6BA11. As control in cathode circuit is set for minimum resistance (CCW rotation), grid bias between pins 4 and 8 goes more positive. Tube conducts more. Thus, AGC voltage at pin 2 (plate) goes more negative and is applied to video-IF grids—causes IF cutoff. When control is rotated CW, adding cathode resistance, bias tends more negative; tube conduction is less. This reduces negative AGC bias on video IF's, and eventually causes IF overloading. During either cutoff or overload of IF's, video is blocked; doesn't reach sync-input grid (pin 7), thus affects operation of sync-separator section.

Operating Variations

Pin 6 Strength of signal has no effect on DC voltage. 95 volts on pin 6 coincides with loss of sync as AGC control is turned and approaches either maximum or minimum position.

Pin 7 When AGC control is rotated CCW, at point where picture just loses sync before blanking out, voltage is 26 volts. In CW direction: 47 volts when picture loses sync prior to overload. Weak signal produces only 13.5 volts.

Pin 3 Adjusting AGC control through entire range has no affect on voltage reading. Variations in signal strength produce no discernible voltage changes.

Pin 4 Reducing resistance on cathode (AGC toward CCW position) causes 10-volt reduction when sync falls out, 20-volt gain with increased resistance (CW) in cathode is to sync-loss point. Voltage doesn't vary with signal.

Pin 8 Voltage varies from 27 volts (AGC CCW to loss-of-sync) to 55 volts (control toward CW rotation until sync is lost). Weak signal doesn't affect voltage at all.

WAVEFORMS All waveforms except W3 show no change in amplitude with different signal strengths. W3 amplitude increases from .2 volts p-p to .25 volts p-p as signal grows weaker.

Horizontal Bending

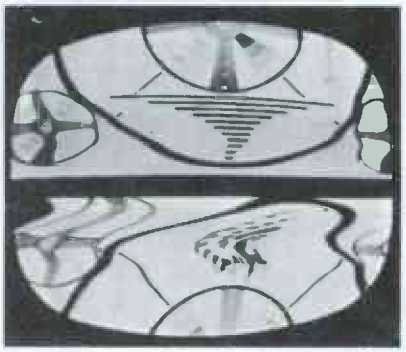
Symptom 1

Vertical Sync Intermittent

C5 Slightly Leaky

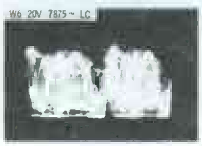
(Sync-input Capacitor—.0033 mfd)

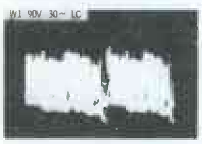
Symptom Analysis



Picture has considerable bending and weaving over entire screen. Horizontal hold seems to lock solid. Picture tends to roll intermittently. Vertical hold is touchy, but locks in strong. Occasionally, picture will lock with vertical blanking bar visible.

Waveform Analysis





W6 amplitude has increased 70% and reveals much video information with horizontal sync pulses at AFC diodes. This explains why changes in picture content affect degree of horizontal bending. W1 shows 30% amplitude increase, which indicates tube gain is excessive; also, observe much video overriding sync pulses (compare with normal W1). This demonstrates tube's failure to separate video from sync pulses.

Voltage and Component Analysis

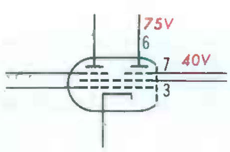


Plate voltage is down 35%, B+ supply is normal. R9 measures okay, so tube must be drawing excessive current. Voltage on screen grid is correct, but voltage on pin 7 has increased from 6.2 volts to 40 volts. Voltage increase on sync-input grid has raised average conduction of tube. Change in tube's conduction level permits amplification of entire composite-video signal. Leaky C5 is allowing part of video-output-plate voltage to appear at pin 7. Disconnect pin-7 end of C5 and check with VTM to verify.

Best Bet: Scope, then VTVM

Horizontal Bending

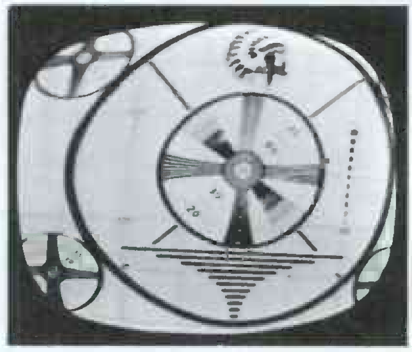
Symptom 2

Vertical Sync Normal

C3 Shorted

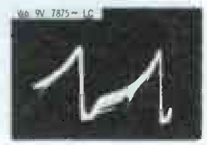
(Screen Bypass—.1 mfd)

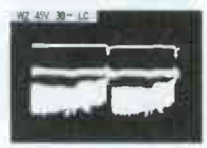
Symptom Analysis



Depending on setting of AGC control, video may or may not be present on screen at first; best picture is obtained at full-CCW position. Horizontal bending occurs over entire screen. Vertical sync is normal. Only AGC and horizontal-sync circuits seem affected.

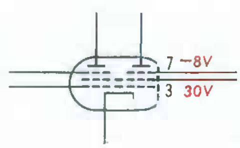
Waveform Analysis





Scope check shows horizontal-sync pulses (W6) are slightly attenuated; also sawtooth appearance denotes they are integrating slightly. W1 amplitude is down 50%; however, horizontal-sync pulses (white area) are attenuated more than vertical, which accounts for normal vertical sync. W2 is normal. Tube gain is low, which also affects AGC section. Circuits of pins 3 and 4 are suspicious since they are common to both AGC and sync separator.

Voltage and Component Analysis



Voltages on pins 4, 6, and 8 are normal. Pin 7 has −8 volts, and screen grid measures 30 volts. Since voltages at pins 3 and 8 are identical, C3 is good suspect. Resistance check discloses C3 has leakage of 220 ohms. Screen voltage leaks through C3 and AGC control to ground. Low screen voltage slows electron flow through tube and permits electrons to collect on pin 7, which accounts for −8 volts on sync-input grid. Since C3 is shorted, large voltage drop across R6 causes its ½-watt rating to be exceeded. Replace it.

Best Bet: VTVM will find trouble

Horizontal Sync Critical

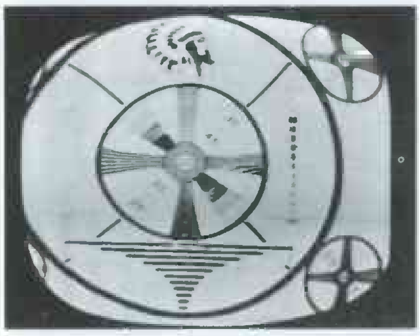
Picture Shifted to Left

Symptom 3

C7 Slightly Leaky

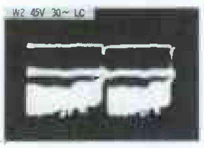
(Horizontal-Sync Coupling Capacitor—51pf)

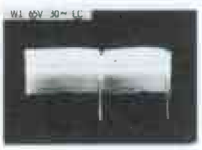
Symptom Analysis



Horizontal hold critical with little range. One-eighth turn either direction from lock-in position throws horzontal out of sync. When locked horizontally, picture is shifted slightly to left side of CRT. Vertical sync normal; attention should be on horizontal sync pulses.

Waveform Analysis





W2 is normal with proper amplitude. W1 reveals healthy vertical and horizontal sync pulses with sufficient gain, verifying separator tube is performing its job and amplifying pulses properly. Scope check of W6 uncovers distorted reduction in peak-to-peak voltage. C7 would seem likely suspect since W1 has normal sync pulses and amplitude. Voltage and resistance checks will give more positive indication of condition of C7.

Voltage and Component Analysis

A 13V

All voltages on sync-separator tube are normal. DC voltage check at common cathodes of horizontal-AFC diodes show voltage increase from 3.5 volts to 13 volts. Suspect horizontal-sync-coupling capacitor is shorted. Resistance measurement confirms C7 has leakage. Leakage voltage through C7, with correction voltage developed by horizontal-AFC diodes, decreases grid bias on horizontal-AFC tube and increases its plate current. This current change is reflected to horizontal-oscillator-grid bias and upsets oscillator operation.

Best Bet: Scope helps, VTVM locates

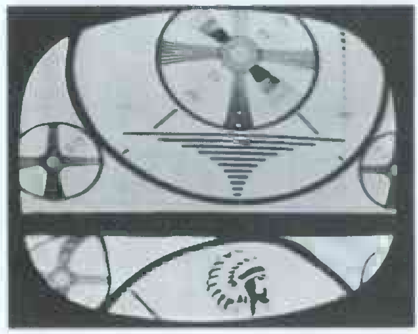
No Vertical Sync

Horizontal Sync Normal

Symptom 4

C8 Open

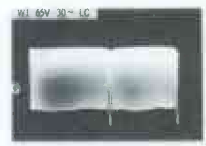
(Vertical-Sync Coupling Capacitor—.01 mfd)

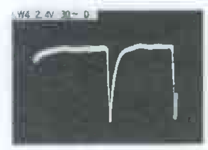


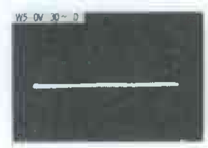
Symptom Analysis

Picture rolls, and vertical hold has no control over sync. Vertical-blanking bar floats either up or down, depending on vertical-hold control setting. Vertical sync is impossible. Horizontal sync locks solid and horizontal-hold control has normal adjustment range.

Waveform Analysis







Scope observation of W1 discloses proper sync pulses available for both oscillator-input circuits. Since horizontal sync is normal, attention is on vertical-sync input circuit. To view vertical-sync pulse without vertical output feedback, vertical oscillator is disabled. W4 shows normal sync pulse is passing through integrator; however, moving scope to look at W5 reveals absence of sync pulse. This suggests that C8 is probably open.

NO VOLTAGE CLUES

Voltage and Component Analysis

All voltages are normal on sync-separator tube. Horizontal oscillator locks in sync properly, and horizontal-hold control has normal range—indicates sync separator is operating and horizontal-sync pulses are present on plate; thus, no reason to believe vertical-sync pulses are absent. Resistance measurements of R10 and R11 are correct. Continuity check reveals vertical-integrator network is not open. Only circuit path remaining for sync pulse to reach vertical oscillator is C8. Substitution of C8 returns vertical sync.

Best Best: Scope is conclusive

Symptom 5

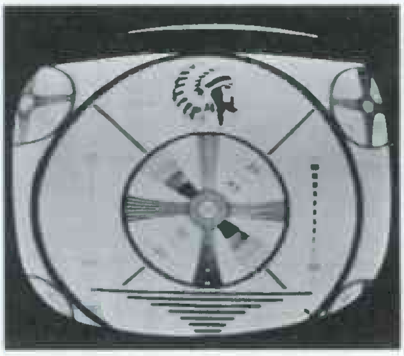
Vertical Sync Weak

Horizontal Hold Normal

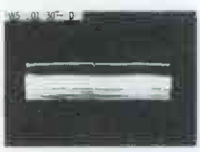
R10 Value Increased

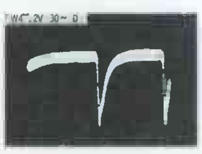
(Voltage Divider and Plate Load Resistor—100K)

Symptom Analysis



Vertical-hold control will hardly sync picture. Slightest signal interference causes picture to roll, and vertical-blanking bar has tendency to float through screen. Horizontal sync appears normal. Would seem vertical-sync pulse is greatly attenuated.

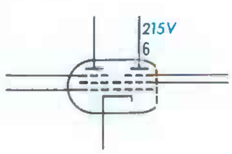




Waveform Analysis

Scoping W1 reveals 160 volts p-p (normal is 65) 60% increase in sync pulses, yet vertical sync is weak. Tube current rise is indicated; however, AGC is normal (cathode is common to both sections of tube, so current increase should effect AGC). W5 uncovers attenuation of vertical-sync pulses (vertical oscillator must be disabled to extinguish feedback pulse). Moving scope to W4 reveals same attenuation. R10, R11 integrator are suspects.

Voltage and Component Analysis



Voltages read correctly on all points except pin 6; voltage here has increased 80%. Since cathode voltage has not changed, tube current must be normal. Vertical-integrator network has continuity and should pass vertical-sync pulses. Plate circuit has voltage divider network consisting of R9, R10, and R11 are also plate-load resistors for separator tube. Should R10 increase in value, voltage-divider action affects DC and plate-load action affects signal. Resistance check shows R10 has increased to 4.7 meg.

Best Bet: Scope first, then VTVM.

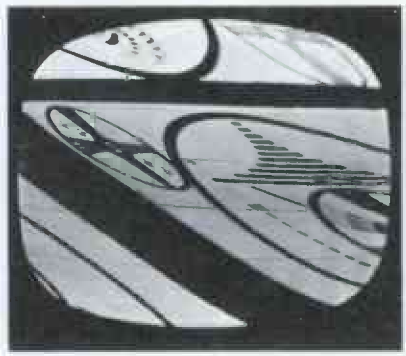
Symptom 6

No Sync

Horizontal and Vertical Both Affected

R9 Value Increased

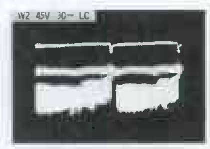
(B+ Supply Resistor for Separator Plate—150K)

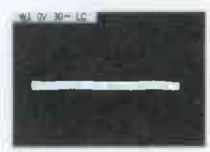


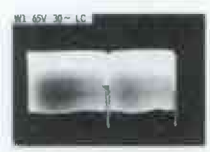
Symptom Analysis

Picture rolls vertically and horizontally at same time. Horizontal and vertical hold controls fail to lock picture. Controls can be set to place picture on CRT, but slightest interference causes rolling or horizontal drift. Defective component affects both sync pulses.

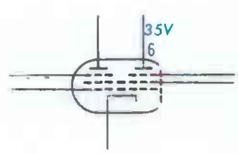
Waveform Analysis







Since both vertical and horizontal sync pulses are affected. first scope check should be at input of sync separator circuit. Pin 7 of sync separator (W2) has normal pulses reaching tube. This eliminates possibility of defects in video output or sync coupling components. Next place to observe sync pulses would be at separator plate. W1 contains neither vertical nor horizontal sync pulses. Logic would point to trouble in plate circuit.



Voltage and Component Analysis

B + voltage on cathode and pin 4 is normal; also, voltages on screen and sync-input grid are correct. This indicates both B + supplies feeding sync-separator stage are normal. Pin 6 measures 35 volts; this significant reduction in voltage points to trouble in plate circuit. Tube could not possibly conduct with such low-plate voltage. Resistance checks are next. R11 measures as it should and R10 has the correct value; however, R9 has increased to 1 meg and is attenuating supply voltage to pin 6.

Best Bet: VTVM pinpoints defect.

U.H.F.

HERE TO STAY

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Circle 16 on literature card

Square-Wave Tests

(Continued from page 22)

and R2 provide a shunt leakage path through the power supply. With square-wave tests you needn't disconnect C1.

Shunt R2 with a .002-mfd capacitor, and shunt C1 with a 1.8-meg resistor:

RC = RC = .002 mfd × 1.8 meg = .0036 sec or 3.6 msec. Sweep the square-wave-generator frequency from 14 cps (t = 10RC) to 1400 cps (t = RC/10); throughout this range, input and output waveforms should be identical, and the p-p output voltage should be .5 times the input:

$$\frac{1.8 \text{ meg}}{1.8 \text{ meg} + 1.8 \text{ meg}} = .5$$

If the output waveform and amplitude is outside 20% tolerance, C1 or R2 is defective. This test will not pinpoint the defective component, but it has allowed you to check both components rapidly without unsoldering them.

Conclusion

You can use square-wave tests to analyze three-terminal networks rapidly. These techniques have many advantages, but remember:

1. Precautions must always be taken to insure that inaccuracies are not introduced by the test—test equipment limitations and substitution-component tolerances must be considered.
2. Accuracy of any test depends upon the equipment used. Sophisticated test equipment needed for square-wave tests is expensive and requires practice and skill for proper use.

In the near future, familiarity with square-wave tests will probably be mandatory for efficient servicing of much home-entertainment equipment. Motorola has displayed microcircuit TV for military use; microcircuit broadcasting equipment is already on the market. Future servicing techniques will certainly involve other methods along with square-wave tests, but basic principles will be similar.

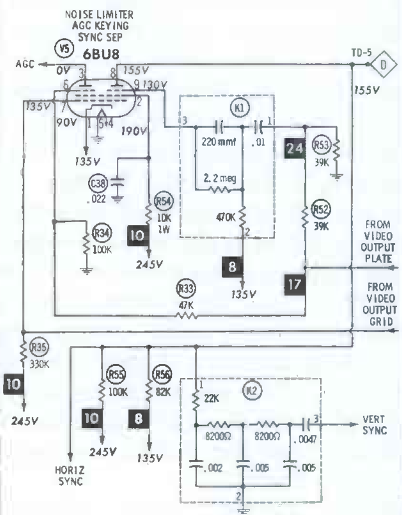
Your ability to service these future devices can depend upon your ability to adopt these advanced techniques; learn them *now*, and you'll be that much ahead. ▲

Sync Trouble

One of our readers has informed us of a sync problem he had in a Model 800 B 148 DuMont television receiver (covered in PHOTOFACT Folder 608-1). We feel this information is worth passing along to the rest of you servicemen.

The problem was critical vertical sync—the picture could be synchronized vertically only for a few seconds. Horizontal sync was also unstable and would tend to lock in out of phase. The waveform at the sync separator plate (pin 8 of V5) showed small horizontal sync pulses and virtually no vertical sync pulses. Voltage checks revealed abnormally low voltage on the plate of the sync separator.

After making rather extensive checks and substitutions, the solution came when pin 1 of K2 was disconnected (vertical integrator



network) from the printed circuit board. This caused horizontal sync to be restored to normal; also, the sync-separator plate voltage returned to normal. Vertical sync was missing because the vertical-sync input path was opened. It was assumed the trouble had been located; replacing K1 proved it had—operation returned to normal.

Apparently, the trouble was caused by leakage in one of the capacitors inside the integrator unit. This leakage was lowering the plate voltage and consequently, greatly reducing the amplitude of both the vertical and horizontal sync pulses.

We would like to thank Mr. Sweeney for providing us with this information, and feel sure that our readers will also be grateful for his thoughtfulness. ▲

Extend Two-Way Range

(Continued from page 24)

If you're servicing a receiver that has been converted to narrow-band, make sure that the discriminator circuit has been modified. These circuits must be changed to alter the slope of the S-curve. Otherwise, you won't get maximum audio recovery from the reduced swing of the signal.

If a vibrator power supply is used, check for noise. Old vibrators, and those with poor contacts, will cause hash not only in the receiver but also in the transmitted carrier. In most of these power supplies, the vibrators work on both transmit and receive. Your scope can serve as a useful preventive-maintenance tester. Any sign of poor contact on either point will be immediately apparent. Connect the scope directly across the primary contacts, and you'll see the characteristic square-wave shape as in Fig. 4A. Bad contacts will show raggedness and distortion as in Fig. 4B. For a definite check, replace the vibrator; if the new one shows a good square wave, the old one was bad. This method will pinpoint those units that would otherwise fail in service.

Defective tubes are a common source of noise. Intermittent shorts, leakage, etc., cause hash and popping noises when the vehicle is moving. Dirty socket contacts are another common cause. Removing all tubes and spraying the sockets with a good contact cleaner during regular maintenance is a good way to avoid future trouble. While feeding a weak signal through the receiver, tap all tubes and crystals and listen for noise.

These same precautions should apply to the multiple-conductor plugs used on trunk-mounted radio sets. Even if the plug is tightly held in place by a large screw, it is entirely possible that some of its many contacts are dirty. Take it out and check the pins; if they are dull or show signs of corrosion, clean the entire assembly. Spray contact cleaner, preferably the type which leaves a residual film of lubricant, into the socket, and insert and remove the plug several times.

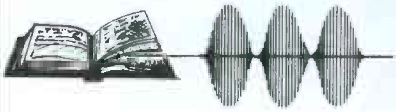
Trunk-mounted sets are subjected to dirt, moisture, and having large objects thrown on them. Make sure the plugs are adequately protected.

On control heads, cables can be kicked loose by the driver's or passenger's feet; keep these cables tied or taped out of the way.

Don't Forget The Speaker

Finally, be sure to check the speakers. Mobile radios use small PM speakers enclosed in heavy metal cases, and many technicians tend to overlook them while servicing the radios since the speaker isn't removed from the vehicle. As an example, this writer once worked hard all afternoon trying to find the cause of a bad case of audio distortion. After checking everything several times, I happened to think of the speaker. Substituting another one cleared up the whole problem! The original was filled with dust and had been wet at some time in the past; the cone looked like a dishrag that had been dragged in the mud. So, don't overlook the obvious or easy things. They are often the right answer to some puzzling service problems. ▲

BOOK REVIEW



Handbook for Electronic Engineers and Technicians; Harry E. Thomas; Prentice-Hall, Inc., Englewood Cliffs, N. J., 1965; 427 pages, 7"x9¾", hard cover, $15.

Although much of the information given in this reference handbook is slanted toward military hardware and its applications, it should be of value for use in nonmilitary applications. EIA, U.L., and NEMA standards are included; for example, the component-parts section and many of the circuits and measurement techniques given are useful for both civilian and military applications.

Mechanical-construction considerations are covered in the first six chapters. Chapters one and two describe tools and techniques used for drafting; chapters three and four list methods and tools used for chassis construction. These first four chapters should be a particularly useful reference for those who, although they have little contact with construction processes, must be familiar with all mechanical requirements and standards. The fifth chapter describes electronic components and their characteristics. Photos, tables, graphs, and drawings provide handy reference data on markings, tolerances, temperature characteristics, and applications. Chassis assembly and wiring is covered in the sixth chapter.

A brief summary of math is given in the seventh chapter; slide-rule use, algebra, standard scientific notation, trigonometry, vectors, and binary numbers are all discussed. The eighth chapter introduces methods of laboratory organization.

Chapters nine through nineteen describe various techniques for measuring individual component characteristics, frequency, waveforms, vacuum-tube and semiconductor characteristics, micro-wave-equipment parameters, transmitter and receiver characteristics, and radar-system characteristics. The twentieth chapter concerns synchro- and servo-system applications and testing. Chapter twenty-one, the last chapter, describes power-supply design methods.

There are six appendices at the back of the book which supplement data contained in the text. Included are schematic symbols, a glossary of electronic terms and abbreviations, receiving-tube characteristics and basing diagrams, a list of JEDEC registered semiconductor characteristics, fuse data, and much other reference information. ▲

Circle 22 on literature card

Circle 21 on literature card

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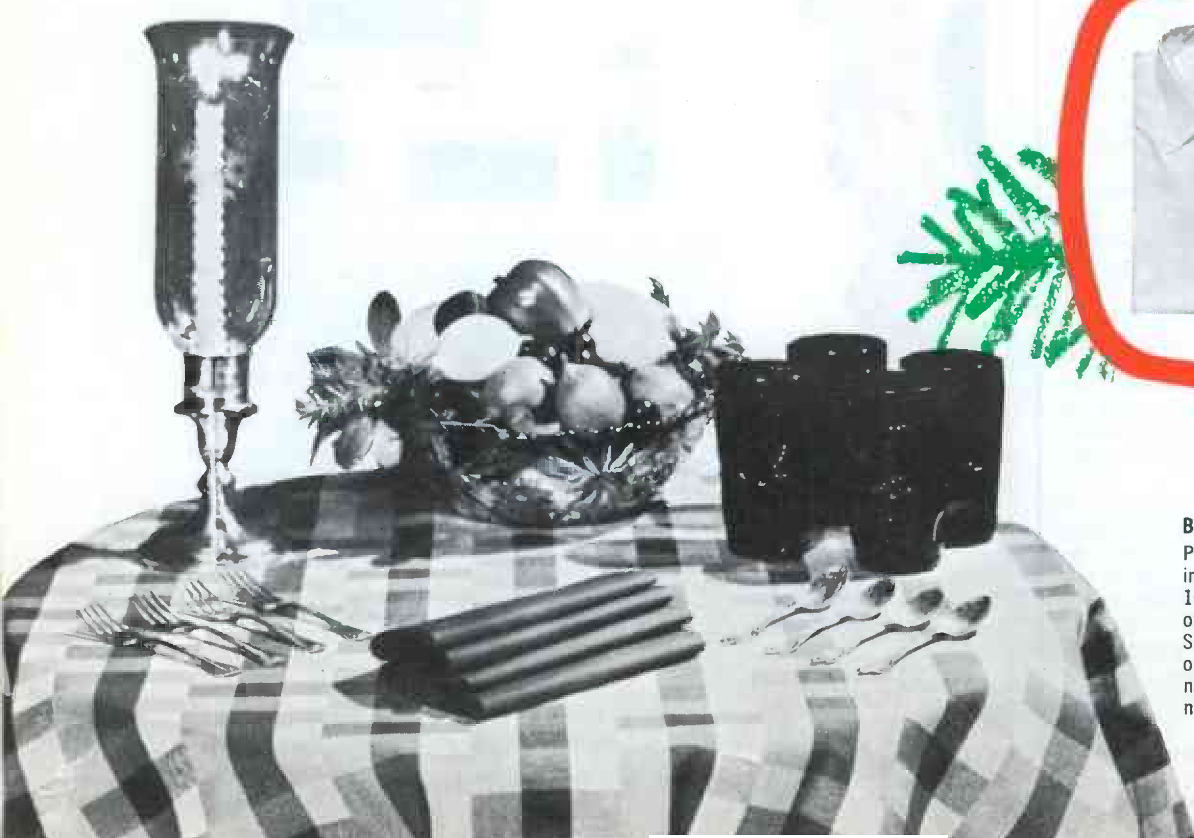
*Premiums available at option of your G-E Tube Distributor.



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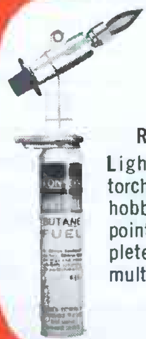
All-metal toy auto transport, multi-colored with two metal cars. Ramp extends for loading. Length 21⅞"

Order ETR-4327



RONSON BUTANE TORCH

Lightweight, easy-to-handle torch has many household and hobby uses. Adjusts from pin-point to blowtorch flame. Complete with large-size Ronson multi-fill fuel container.

Order ETR-4328

D'ORSAY PERFUME SET

What lady wouldn't appreciate this. Set includes 3 oz. Nuage Parfume spray mist plus 1 dram flaconette of Parfum de Bain bath scent. Matched fragrance set comes gift boxed.

Order ETR-4326

TIMEX WATCH

Regular size man's watch with chrome plated bezel, sweep second hand, radio-lite dial. Features Timex unbreakable mainspring; is shock resistant, gift boxed.

Order ETR-4333

G-E CHRISTMAS LIGHT SET

Your choice of either 10-lamp multiple indoor set or 15-lamp outdoor set. Both sets feature all-green, extra-durable sockets and cords. Use season after season.

Order ETR-4334 (Indoor),
ETR-4335 (Outdoor)

KODAK CAMERA OUTFIT

Famous Hawkeye Instamatic F® outfit comes complete with camera with wrist strap, 1 Kodapak cartridge, 4 AG-1 flash-bulbs, 2 AAA-size batteries, flashguard, and instruction book.

Order ETR-4332

PILE LINED JACKET

Stylish year-round Cougar jacket in 100% cotton poplin with 100% Orlon pile lining. Completely wash 'n wear, full zipper front, two slash pockets. Beige only in sizes 36, 38, 40, 42, 44, 46.

Order ETR-4330

MEN'S STRETCH HOSE

Three pairs 100% nylon stretch hose, one each of black, cordovan, and navy. Fits sizes 10-13. Available either Regular or Calf-length.

Order ETR-4325
(Regular)
ETR-4324 (Calf-length)

G-E CLOCK RADIO

Popular G-E AM clock radio features famous Snooz-Alarm® and Muted Slumber Switch. Handsome white cabinet; 4" Dyna-power speaker; built-in ferrite rod antenna; drift compensation and automatic volume control.

Order ETR-4331

GENERAL ELECTRIC

Notes on Test Equipment

analysis of test instruments . . . operation . . . applications

by Arnold E. Cly

MPX Alignment Generator

FM stereo broadcasting has been around since June 1961. Many stations have added this type of transmission to their programming since that date, and one could predict that more will join the trend. This, of course, is brought on by increased FM-stereo receiver sales, and more consumer sales mean additional service business.

Fig. 1. This generator has many signals for multiplex testing and alignment.

The FM-stereo receiver requires perfect alignment of the multiplex stage if the listener is to gain the full enjoyment of stereo broadcasting. The service technician needs to be equipped to perform this alignment job to assure his customers their stereo units are in top-notch operating condition. The EICO Model 342 FM multiplex generator, shown in Fig. 1, can fill this need.

The Model 342 has a stereophonic output signal that may be coupled directly to the multiplex section: also, a frequency-modulated stereophonic RF output is available to be coupled to the antenna input terminals, if desired. The carrier frequency of this RF signal is adjustable from 97 to 103 mc.

A block diagram of the multiplex generator is presented in Fig. 2. A 19-kc (±2 cps) crystal-controlled oscillator drives a 19-kc doubler stage, which in turn feeds a 38-kc amplifier. The output of the 38-kc amplifier is coupled to the modulation section; also, the modulation unit receives, through the SIGNAL switch, a 1-kc signal that represents right- and left-channel information.

The internal L/R audio signal, de-

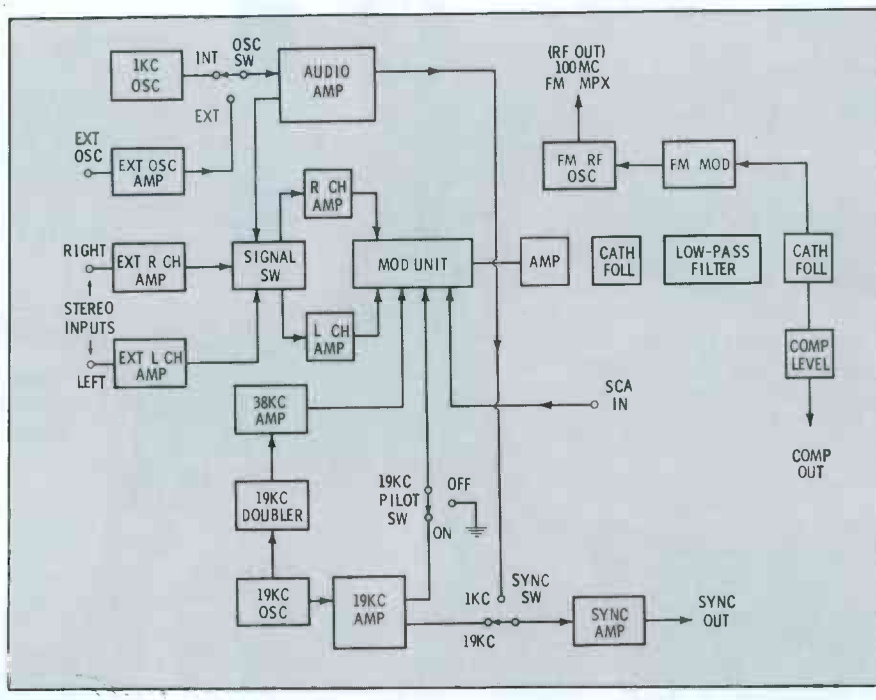
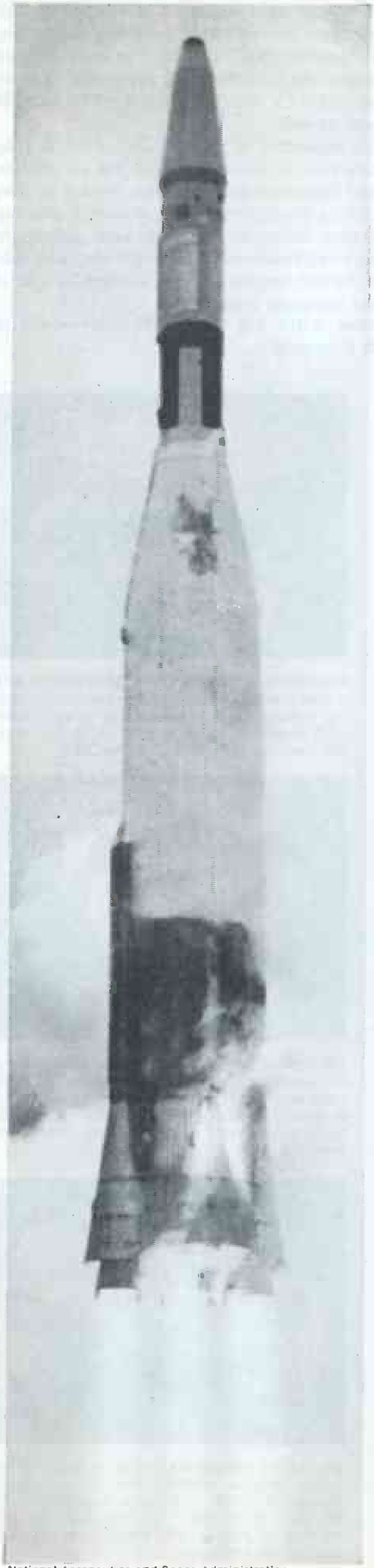


Fig. 2. Block diagram reveals signal paths of the 342 FM multiplex generator.



National Aeronautics and Space Administration

Solid Copper circuit, shown, from RCA Victor Color TV.

The move's on to JERROLD Coloraxial™

best for color and black-&-white ...best for FM...best for business

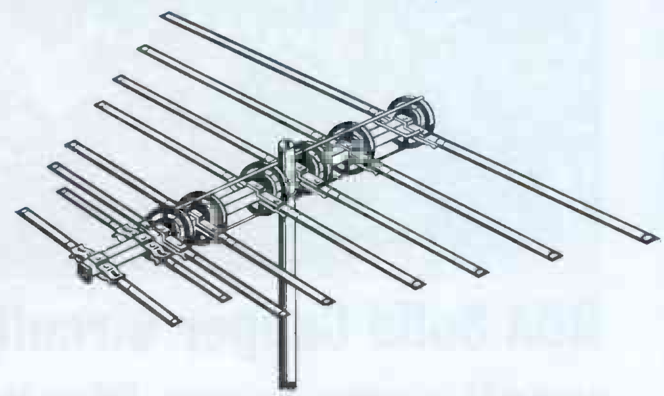
The days of twinlead are numbered. Both the trade and the public are moving unmistakably towards COLORAXIAL, the revolutionary shielded coaxial antenna system—not only for great color TV, but for black-&-white and FM stereo as well.

So important is 75-ohm Coloraxial in your future that Jerrold now offers you a complete line of Coloraxial antennas with 75-ohm output; matching transformers for converting existing 300-ohm antennas for Coloraxial operation; Coloraxial Powermate preamplifiers; and 50- and 75-foot lengths of factory-swept Coloraxial cable complete with fittings.

Now is the big season for color—cash in with Coloraxial.

COLORAXIAL PATHFINDER VHF / UHF / FM ANTENNAS • The first all-channel line featuring 75-ohm output and individual orientation of VHF and UHF sections. Separate-antenna flexibility, without splitter loss. Five models, PXB-30, 45, 50, 70, 90.

COLORAXIAL MATCHING TRANSFORMERS AND KITS • Mast-mounting Model TO-374A converts any existing antenna to 75-ohm Coloraxial output. Model T378 mounts on set to match it to 75-ohm co-ax. Also available as a set in Kit Model CAT-2.



COLORAXIAL PARALOG TV ANTENNAS • The renowned line of seven Paralog VHF antennas now available with 75-ohm output. Models PAX-40, 60, 100, 130, 160, 190, and 220 — for metropolitan to deepest fringe reception areas.

COLORAXIAL SHIELDED CABLE • The heart of every Coloraxial installation — highest-quality RG-59/U cable with fittings already attached. 50 or 75 feet of cable in package. Kit Model K-CAB-50 has 50-ft. cable and one each of the matching transformers described above.

COLORAXIAL COLORGUARD ANTENNAS AND KITS • Three 75-ohm models (CAX-16, 17, and 18), plus kit (Model K-CAX-16) including antenna, 5-foot mast, tri-mount, cable, and set-mounting T378 matching transformer.

COLORAXIAL FM ANTENNAS • Don't forget, FM stereo needs Coloraxial too! Jerrold offers two types, a complete line in each: 75-ohm Paralog (Models FMPX-8, 10, and 16) in log-periodic form; and the five-element Stratophonic FM Yagi (Model FAX-5), also available in kit with mast, tri-mount, cable, and set-mounting matching transformer—everything you need for a complete Coloraxial stereo installation.

COLORAXIAL POWERMATES • Coaxial versions of the famous antenna amplifiers that set an industry standard. Model SPC-103 has two transistors, Model SPC-132 "DE-SNOWER" has five. Both are pre-matched to antenna and receiver — no matching transformers necessary.

JERROLD

JERROLD ELECTRONICS CORPORATION
Distributor Sales Division
15th & Lehigh Avenue, Philadelphia, Pa. 19132

Circle 58 on literature card

EICO Model 342 Specifications

Separation:
40 db minimum from 200 cps to 10 kc; 30 db minimum from 50 cps to 15 kc.

Carrier Suppression:
40 db minimum below maximum composite-signal level.

Composite Signal Output:
0-5 volts p-p, variable; output impedance 1500Ω.

Internal Oscillator:
Approximately 1 kc; total harmonic distortion less than .3%.

External Oscillator Input:
1 volt rms input for maximum composite-signal output; input impedance 10K; input provides ±.5 db response from 20 cps to 20 kc.

Stereo Source Input:
1 volt rms input each channel for maximum composite-signal output; input impedance 1 meg; input amplifier stages provide required FM preemphasis.

FM Multiplex RF Output:
200 mv; output impedance 60Ω; adjustable from 97 to 130 mc.

FM Modulation Frequency Response:
20 cps to 150 kc ±.5 db.

Deviation Control:
To ±75 kc (100% modulation); below .25% distortion at maximum deviation.

Pilot Frequency:
19 kc ±2 cps (crystal controlled); adjustable phase (±30° with respect to carrier), adjustable amplitude (0-15% of maximum composite signal).

SCA Input:
Input impedance 10K

Features:
Signal selection: L+R, L−R, L only, R only, 19-kc pilot only, stereo source. Oscilloscope sync signals: 1-kc internal or external and 19-kc pilot in phase with composite output pilot.

Power Requirement:
117 volts, 60 cps, 36 watts.

Size (HWD):
8½" x 5¾" x 12½"

Weight:
10 lb.

Price:
$149.95 (factory wired only)

veloped by a 1-kc oscillator stage, is fed to the OSC INT/EXT switch; when this switch is set in INT position, the 1-kc signal is coupled to an audio amplifier. The audio amplifier operates as a phase-splitter and provides outputs of the 1-kc signal at its plate and cathode. These outputs are applied to the SIGNAL switch. The two signals, 180° out of phase, are then coupled to the right- and left-channel amplifiers through the SIGNAL switch. The opposing polarity of these two signals permits the 38-kc signal, which is also fed to the modulation unit, to sample the channels alternately at a 38-kc rate. These sampling signals are combined in a resistive adding network in the modulation unit.

The crystal-controlled 19-kc oscillator also feeds an amplifier that couples the 19-kc signal to the modulation unit. This signal path is through the PILOT ON-OFF switch. The 19-kc signal is combined in the resistive adding network of the modulation unit as were the L/R sampling signals mentioned above. The collection of these signals comprises the composite-stereo signal, without the SCA signal (67-kc subcarrier). The SCA signal can be applied to the modulator, via an input jack, from an external signal source. The circuit that connects the 19-kc signal to the PILOT ON-OFF switch incorporates both PILOT PHASE and LEVEL controls. The PHASE control positions the 19-kc signal for proper synchronization with the 38-kc subcarrier; the LEVEL control permits adjusting the level of the 19-kc signal from 8% to 10% of the composite output signal, as specified in the FCC-approved FM-stereo system.

The composite-stereo output signal is coupled from the modulating unit to an amplifier that feeds the composite signal to a cathode follower. The follower passes the signal to a low-pass filter network designed to eliminate harmonics generated in the modulator. The filtered composite signal is then applied to another cathode follower which feeds the signal to two separate circuit paths. One path connects to the COMPOSITE LEVEL control; it in turn couples the signal to the COMPOSITE signal output jack for connection directly to the multiplex stage of the receiver under test. The other signal path leads to the FM modulator and oscillator stages, through the deviation control. This permits signal coupling to the FM antenna terminals and allows the composite signal to pass through the entire FM receiver.

On the front panel is an EXT OSC jack that provides for injection of any desired range of audio frequencies from an external generator. This may be used for evaluation and design of multiplex circuits whenever the 1-kc internal oscillator frequency is not suitable.

Also on the front panel is a SYNC OUTPUT jack which is fed from a cathode follower. This provides a low-impedance output and isolation from external loading effects. Signals applied to this cathode follower are selected by the SYNC switch: the internal 1-kc or external oscillator signal, depending on the position of the OSC switch, or the 19-kc oscillator output. The 19-kc SYNC OUTPUT is used for pilot-phase adjustment; the others are used for scope sync. These uses are fully explained in the maintenance section of the operating manual supplied with the instrument.

On the rear panel are two input jacks marked STEREO RIGHT and LEFT. These inputs permit the output of any stereo source (an example would be a stereo phono or tape recorder) to be fed through the Model 342 and modullated to provide composite FM-stereo program-type material. Coupling this signal to the antenna terminals of an FM-stereo receiver will produce a stereo program output from the receiver. This is useful for demonstration when stereo broadcasts are not available.

The SIGNAL switch on the front panel selects the desired signal for tests or alignment of the multiplex section of a receiver. When this switch is in STER position, the instrument is set up so a stereo source may be coupled to the L and R rear input jacks. The output is then taken from the FM MPX RF cable and applied to the FM receiver's antenna terminals.

The 19-kc position on the SIGNAL switch couples a signal from the 19-kc oscillator to the COMP output jack when the 19-kc PILOT switch is in the ON position. This provides a signal which is injected to the multiplex section to peak the 19-kc and 38-kc coils and transformers. The L − R and L + R positions on the SIGNAL switch select either of these signals for coupling to the COMP output jack. These signals are useful where the multiplex section of a receiver has two separate paths for the L − R and L + R information. Should either circuit be suspected, the corresponding signal can be applied from the Model 342 to determine whether the signal can pass through these circuits.

The settings for the final steps of multiplex alignment are marked L and R on the SIGNAL switch. The 19-kc PILOT switch is set to the ON position, and either the left- or right-channel signal, whichever is selected, is coupled to both the COMP OUTPUT and the FM MPX RF output cable. Switching back and forth between the L and R signals permits precise touchup adjust-

ments in the multiplex section to obtain maximum separation between the L and R channels.

The COMPOSITE LEVEL control affects only the level of signal at the COMP OUTPUT jack. The ON-OFF switch is also located on this control and is actuated when the control is advanced from its maximum counterclockwise position.

A field test verified the accuracy and versatility of the Model 342. The signal from the 100 MC FM MPX output jack was very stable. There was no need to keep retuning the receiver while adjusting the multiplex section. It was found, however, that the AFC circuit of the receiver had to be disabled; interaction between the AFC and the 19-kc pilot signal had a tendency to kill the 19-kc signal.

In our lab we set up the 342 to provide us with a stereo signal at the 100 MC FM MPX output. A stereo phonograph was used as a signal source; its output was coupled to the stereo input jacks at the rear of the multiplex generator. Output from the phono-pickup cartridge itself was insufficient to drive the FM stereo receiver, so the signal was taken from the external speaker jacks of the amplifier associated with the stereo phono. The RF cable from the 100 MC FM MPX output was connected to the FM antenna terminals of the FM stereo receiver we used. The stereo receiver was tuned to 100 mc, and the stereo information from the phono came through loud and clear.

We also aligned the multiplex section of an FM stereo receiver using the 342. The entire job was done without any misfortune or generator problems. Everything performed in a normal manner.

The operating manual supplied with the Model 342 FM multiplex generator is very comprehensive. Instructions are given which cover each test the instrument will perform. A section at the back of the manual is devoted to maintenance procedures; these include alignment and adjustment that may be needed as the instrument ages. The front part of the manual gives a detailed explanation of FM-stereo signal makeup and transmission. ▲

For further information circle 67 on literature card.

Erratum

In the October "Notes on Test Equipment" item describing the Mercury Model 202E (page 54), the price was listed incorrectly. Correct price for the Model 202E is $109.95.

FUSIBLE RESISTOR / CROSS REFERENCE GUIDE

Manufacturer	Part No.	Value Ohms	Value Watts
Admiral	61A19	7.5	5
	61A19-2	7.5	5
	61A28-3	5	5
	61B43-10†	47	1
	61B48-1†	5.5	*
	61C43-5†	47	1
	61C43-7†	11	2
	61C43-8†	1080	2
Airline	E2311†	22	5
	B154089-1-6	7.5	5
	R-1409	5.5	5
	672†	130	4
	V24002	4.7	*
	14135†	47	5
	20E1042	7.5	5
	43X380	7.5	5
	43X397	7.5	15
	43X431	4.7	*
	43X0431-001		
	46M-20681	5.6	5
	46M-22301	9.1	5
	46M-23018	9	5
	259V002H01	7.5	*
	259V004M01	4.7	5
Ambassador	672†	130	4
	24-1073	5	5
Artone	24-1073	5	5
	24B1116	4.7	5
Arvin	47727-3†	11 (cold) 22 (hot)	* TC
	47727-5†	33	*
	47727-6†	16	*
	47727-7†	20 (cold) 45 (hot)	* TC
	47727-8†	22	5
	68504-130	4.7	10
	325-0134-13†	47	5
Bendix	268021-1	5.6	5
Bradford	V24002	4.7	*
	43X0431-001	4.7	5
Buick	7276499	.33	*
	7281027	.51	*
	7281890	.47	*
	7286602	.68	*
CBS	31000472	7.5	6
Cadillac	7270608†	.47	* TC
	7281027	.51	*
	7281890	.47	*
	7286602	.68	*
Capehart	453924B-1	7.5	5
Catalina	V24002	4.7	*
	43X086-001†	22	*
	43X0431-001	4.7	5
Checrolet	7270608†	.47	*
	7276499	.33	*
	7281027	.51	*
	7281890	.47	*
	7287480	.68	1
Coronado	TRP-28	4.7	5
	V24002	4.7	*
	024-201116	4.7	3
	24B1116	4.7	5
	43X0431-001	4.7	5
	46M-23018	9	5
	46M-25577	4.7	5
	816†	22	5
Crosley	154089	7.5	5
Decca	RW10-1†	22	3
DuMont	397148†	22	5
	02310001	7.5	5
Emerson	394158	5	5
	394216	5	7
	397103	1	*
	397118	6	*
	397133	22	5
	397216	62	*
Firestone	24B1116	4.7	5
	43X380	7.5	5
	46M-23018	9	5
GE	ET14X183	3.6	7
	ET14X191	5	5
Hallicrafters	024-201116	4.7	3
	24-1073	5	5
	24-1116	4.7	5
	24B1011	7.2	5
	24B1116	4.7	5
	25B1004	7.5	5
Hoffman	4762	7.5	*
Hyde Park	25B1011	7.2	5
Magnavox	24077-1	5	5
	240074-1	5	*
	240080-19	4.7	*
	240084-2†	22	*
	240084-3†	22	*
	240601-1	7.5	5
Majestic	B-6,326-1	7.5	5
Majorette	not avail.	47	*
Mopar	7281890	.47	*
	7286602	.68	*
Motorola	1K1027	7.5	5
	1K711027	7.5	5
	1K711574	5	5
	17A700149	5	5
	17A711027	7.5	5
	17A711500	7.5	5
	17A791166	7.5	5
	17A791696	5	5
	17C67673A01	5	10
	17K738862	7.5	5
	17K742136	5	5
	65A61832A01†	120	*
Muntz	RW-005-13	5	5
	not avail.	4.7	5
Nordmende	409.030†	1.5K	5
	00038CTZ100†	100	5
	00038CTZ1000†	1K	5
	0038CZT†	1.5K	5
Oldsmobile	7276499	.33	*
	7281027	.51	*
	7281890	.47	*
	7286602	.68	*
Olympic	R-1409	5.5	5
	RE3823	7.5	5
	RE32681†	7.5	5
Opel	7276499	.33	*
Packard-Bell	not avail.	7.5	5
	73500	5.6	*
J. C. Penney	43X431	4.7	*
Philco	33-1334-17†	20	3
	33-1366-2	5.6	5
	33-1366-3	5.6	5
	33-1366-7	5.6	*
	33-1366-9	5.6	*
	76-13605-2	1.45	*
Phonola	14135†	47	*
Pontiac	7276499	.33	*
	7281890	.47	*
	7287480	.68	1
RCA	100117	5.6	5
	100117B	5	*
	103824	4.7	5
	114966	5	10
	942924-4	.35	*
Raytheon	46M-23018	9	5
Sentinel	B154089-1-6	7.5	5
	20E1042	7.5	5
	240074-1	5	*
	240601-1	7.5	5
Silvertone	S43-1007	7.5	5
	T43-1007	7.5	5
	24-1073	5	5
	24-1116	4.7	5
	25B-1011	7.2	5
	43-4-1	22	3.25
	43-1007	7.5	5
	43-1008	7.5	5
	43-1009	5	5
	43-1011	5	*
	61-191-0	4.5	10
	14135†	47	3
	16825†	95	3
Sonora	R1409	5.5	5
Spartan	270074-1	5	5
Sparton	PA4227	7.5	5
Studebaker	7276499	.33	*
	7281890	.47	*
	7287480	.68	1
Sylvania	187-0028	7.5	5
	187-0053	4.7	5
	189-0046	4.7	5

Manufacturer	Part No.	Value Ohms	Watts
Symphonic	A16120†	47	2
	A16121†	22	3
TraVler	E47†	47	*
	F6	5	*
	F6-1	5.6	5
	F8	7.5	5
	F15	5	5
	F23	4.7	*
	TV-F-6	5	5
Truetone	not avail.	7.5	*
	E27†	27	*
	E47†	47	*
	024-201116	4.7	3
	24B1116	4.7	5
	43X380	7.5	5
	43X397	7.5	*
	43X398	7.5	*
	43X0398-001†	4.5	*
	46M-2557	4.7	5
	46M-20681	5.6	5
	46M-23018	9	5
	224-200002	10	10
	816†	22	5
V.M.	12472†	22	*
	17829†	27	*
Wells-Gardner	43X380	7.5	5
Westinghouse	V-16023-1	7.5	5
	25V020H73†	100	3
	251V020H23†	100	3
	251V020H66†	5.6	8
	251V020H73	100	3
	251V035H02	33	*
	251V036H01	5	7
	259V002H01	7.5	5
	259V002M01	7.5	5
	259V004M01	4.7	5
Zenith	WC14132†	47	*
	63-3269	7.5	5
	63-3287	6	5
	63-3644	6	5
	63-4450	6	10
	63-5193†	22	4
	63-5306†	33	*

* Wattage not given by mfr.

† Non-TV Equipment

TC Temperature-Compensating

Use this check list before you install a home TV distribution system

	COAXIAL VHF	TWINLEAD* VHF	COAXIAL UHF/VHF	TWINLEAD* UHF/VHF AND UHF ONLY
Channels received	2-13	2-13	2-83	2-83 (14-83 for UHF only)
Color reception when properly installed	Excellent	Excellent	Excellent	Excellent
Cable loss: @ channel 13 for VHF only @ channel 83 for UHF/VHF	4 db (foam filled) 6 db (solid)	1.8 db/100 ft. @ Channel 13	9 db (foam filled) 13 db (solid)	5.6 db/100 ft. @ Channel 83
Loss increase when wet	Nil	Negligible	Nil	Negligible
Reception when run near or through small metal areas	Excellent	Excellent when properly installed	Excellent	Excellent when properly installed
Reception when run near or through considerable amounts of metal	Excellent	Not recommended	Excellent	Not recommended
Ease of installation	More difficult	Easy	More difficult	Easy
Extra parts required	Connectors, matching transformers	None	Connectors, matching transformers	None
Performance in strong-signal areas	Excellent	Excellent—fair**	Excellent	Excellent—fair**
Performance in weak-signal areas	Excellent	Excellent	Excellent	Excellent
Cable pickup of interference (ignition, appliances, etc.)	None***	None—slight**	None***	None—slight**

*A high quality, low-loss foam encapsulated cable type **Depends upon local conditions ***Poorly designed accessories will pickup interference.

Once you know the facts—there is one best choice for your home system—Blonder-Tongue. Whether you prefer 300 ohm or a 75 ohm coax system, Blonder-Tongue has the products you'll need. There is only one way you can protect your home TV system against obsolescence when new UHF stations come on the air—that's with a Blonder-Tongue all-channel UHF/VHF system.

Blonder-Tongue products designed for all-channel home systems include: All-channel signal amplifiers (V/U-All-2 indoor and U/Vamp-2 mast mounted); all-channel couplers (A-102-U/V two-set and A-104-UV four-set). Rounding out the all-channel concept are UHF/VHF matching transformers (Cablematch U/V set mounted; MT-283 mast-mounted) and the TF-331-U/V flush-mounted feed-thru.

Take your pick. Blonder-Tongue makes them all—and all are "Color Approved". Buy the line with 15 years of quality leadership. Write for free booklet "How to Plan a Color-Approved Home TV System".

BT BLONDER-TONGUE

9 Alling Street, Newark, New Jersey 07102

home TV accessories • closed circuit TV • community TV • UHF converters • master TV

Circle 34 on literature card

12 Years of UHF

(Continued from page 17)

Two servicemen described a shadow effect I remember slightly from the early days—one that television repairmen in the area called "waterfall effect." Essentially, it means that dead spots become much less pronounced at a distance from the transmitter, particularly at high ERP. As a result, behind-the-hill problems upriver from Peoria still exist, as do dead spots in the finger-like hollows in East Peoria; farther out, though, signals seem to slide over the hills more easily, and fewer dead spots are found.

"Beyond 40 miles," one large service operator told me, "our customers put up tall pipes or towers and use high-gain UHF antennas. We've sold several sets 60 miles away." Asked about antenna costs: "Well, we have a real hot model we sell for $15.95, and double-stack it for $24.95 if the customer needs that much gain. We'll put it on a guyed 20′ pipe on the roof for a little over $50. Sometimes the price depends on the lead-in run or mounting problems; and we charge mileage on top of any installation fee."

What about antennas in the local area? Are indoor antennas okay now that the stations are high-powered? "Yes and no," one shop's antenna crew said. "It all depends on what part of town you're talking about. We don't worry much about it. The customer tries an indoor job, and if he doesn't like it we go out and put up a bowtie on a 5′ pipe. At $19.95, the cost is no problem." Another shop foreman added, "Around here, we just include a simple bowtie installation with every new set. Then we have no worry whether an inside antenna is satisfactory."

The Color Picture

How is color on UHF? I've heard different opinions all over the country. In Peoria, however, where they've had color since 1955, everyone I talked to insists it's better than on VHF they've seen in other towns. The field rep of one color-set manufacturer felt the same. "It's hard to put your finger on just what it is that's better," he said, "but, from seeing a lot of both, I've concluded that color on UHF is somehow sharper or crisper than on VHF." He added, "I've no way to prove this; its just an opinion."

One thing is sure: color is okay on UHF.

What is the antenna situation with color sets? Are they necessary? "Yes!" declared every service technician I asked. "I'd bet 99% of the color sets in this town use outside antennas." Asked how this compares with monochrome sets, they agreed that about 80% of black-and-white receivers in Peoria are fed from outdoor antennas. One shop owner suggested, "This may be because of the low cost of a UHF installation. People put one up just to be sure they get a good signal." A new-set salesman for one sizable store said, "We wouldn't even consider installing a color set without an aerial. We'd just be asking for trouble."

Any problem with color out in the fringe beyond 40 miles? Very little, according to the installation man for one company. "We just put up a good antenna . . . but we'd have to do that for a black-and-white set, too," he says, adding, "We put up a few towers with both UHF and VHF antennas—the VHF to bring in channel

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3 from Champaign. Even when these are out on our own fringe, the UHF signal is more consistent for color reception than the VHF signal is. There's more fading on channel 3 than on our stations." I wasn't able to verify this last with other technicians, but it was an interesting observation.

And Other Comments

I heard other miscellaneous comments while I was in this locale of 12-year UHF. Here are a few of them:

"I think we make a lot more money than technicians in VHF areas. We have 6AF4's still giving us trouble. We get more antenna jobs because they're important."

"We still have a lot of tuner trouble. We work on the old tube-type ones, but these little postage-stamp jobs . . . we just send them to the factory. You can get an exchange deal in most cases, so they're not worth bothering with on our own bench."

"I think the All-Channel Law is fine. In fact, I'd like to see the VHF band done away with altogether." I asked this technician why. His reply was lengthly and thought-provoking: "We now have two tuners to worry with, and all the switching and driving junk that go with them. It'd be a lot better to have one tuner with all the stations on one dial. Less trouble and easier to operate. Then we could also have better UHF tuners and they'd cost less. UHF has none of the interference problems VHF has—hams, CB'ers, diathermy, police radios, and all that. Who cares if you can't get it quite as far away? With CATV systems going in all over, the fringe people will be covered anyway. Besides, the government could just assign more of them (UHF stations) closer together; that'd take care of any dead spots. I'll bet the UHF people would be glad to see VHF stations go. Then everyone would have about the same coverage areas; as it is now, the V's have an advantage."

Others voiced various feelings. "Wish we could use more inside antennas" . . . "Hate those areas close in where we have to point antennas in three different directions; nobody wants a rotator" . . . "Sure do like the tiny antennas we use" . . . "No use trying to work on a UHF tuner" . . . "No problems with color" . . . "Glad to see transistor UHF tuners; don't have to replace so many 6AF4's" . . . "Hate to see transistor UHF tuners; don't sell as many 6AF4's" . . . and so on.

Conclusions

Coming away from my trip into the 12-year past, I felt that the problems we had those first few months are largely nonexistent now. Greater power and better frequencies for the stations have helped a lot. I saw better UHF antennas for fringe use than any we had in the early days of 1953.

After 12 years, though, the main difference I noted is in the attitude of the service people themselves. Peoria technicians look on UHF with the same take-it-for-granted attitude a technician anywhere has for the form of TV used in his locality.

Fears expressed around the country that UHF may not be a desirable form of television transmission may be groundless. At least 12 years of experience in Peoria seem to say so. ▲

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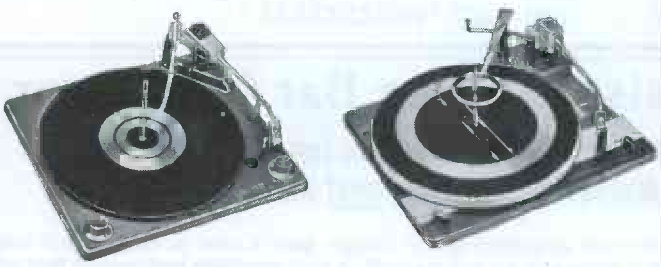

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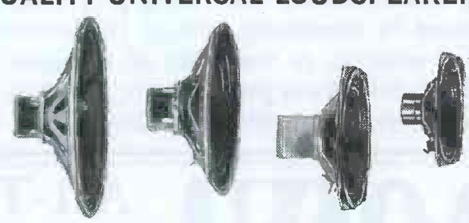

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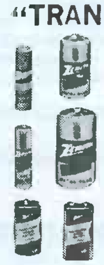

Zenith long-life batteries with "Transistor Blend" electrolyte are designed specifically for transistor radios. Zenith's famous Positive Quality Control assures that all batteries meet Zenith's high standards. Zenith features a complete line of batteries for transistor and portable radios, flashlights and farm packs.

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Circle 38 on literature card

From A to Z about TV

In these days of high-pitched salesmanship, customers expect a lot from their TV serviceman. One thing they expect is that you'll be able to answer their technical questions; this should be easy for you. The tough questions to answer are those about TV programs; on this page, writer Edmund A. Braun has compiled a list of terminology that will help you appear informed on that topic, too.—Editor.

ADULT SHOW—one that parents enjoy and youngsters consider childish.

B-PICTURE—this doesn't mean it's a honey, but the viewer is stung again!

COMEDY—very funny if judged by the dubbed-in laugh track.

COMMERCIAL—the price viewer pays for free TV; the chitter-chatter that follows an announcer's excited words, "Now, a message of great importance for all."

CREDITS—the list of brave people willing to take the blame.

GOOD SHOW—the one that was canceled last week because of low ratings.

HORROR FILM—horribly funny. Earth is invaded by indestructible, man-eating jelly beans; or enslaved by monstrous cabbage heads created by a mad scientist; or variations ad nauseum.

KIDDIE SHOW—a pseudo-uncle, -cowboy, -ranger, or -clown, who encourages small fry to bulldoze their mothers into buying crispy, crunchy, Sloppsie-Woppsies.

LATE, LATE SHOW—movie made in the early, early 1930's.

MUSICAL—lulls viewers to sleep with a boring plot, then terrorizes them awake as the star suddenly screams into song without any reason other than a suspicion the audience may have fallen soundly asleep.

PREMIERE—usually preceded by 17 other premiere showings to be followed by at least 17 more during each of the next 17 years.

RE-RERUN—common cause of see-sickness.

WESTERN—leading man, from the west side of New York City, is dressed in an elaborate costume made in the Bronx, sits astride a horse pacified by tranquilizer pills, strums discordantly on a guitar made in Japan, and sings through his nose about troubles he hasn't got.

WESTERN (High-Budget)—cast drinks real liquor during barroom scenes.

WESTER (Low-Budget)—cowboys and Indians take turns riding the same horse.

WESTERN (Cheap)—doesn't require even a horse because the entire action takes place inside a log cabin completely surrounded by a noisy sound track of wild, bloodthirsty Indians whooping it up.

ZEEZER—watch this type program for 10 minutes and you'll "zzzZZZZZZZZ."

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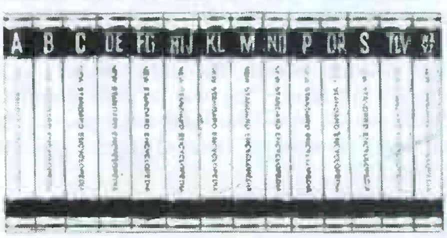

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Electronic Scanner

(Continued from page 15)

of sounds and images. Further, American interests must be preserved and our continued leadership assured in the new era of space communications.

These factors are food for thought among all who make their living in the fields of communication and home entertainment equipment.

Two-Way Radio—Too Big for Its Britches

Time was when people communicated face to face, by smoke signals, or by the written word. Then modern science moved in. People talked to each other miles apart via telephone, listened to others over radio, or saw them on television.

Police departments picked up the idea of two-way radio, which revolutionized their method of operation. Others began to realize that the benefits of two-way radio could be applied to their activities. Fire departments, county sheriff and highway maintenance departments, state and federal governmental agencies, utilities, forestry and conservation organizations, etc. started using it.

The concept soon carried over into the transportation field. One of the most widely known users was the taxicab company, but applications spread to include railroads, trucking companies, and special industrial operations.

Until 1958, the vast business community, made up of thousands of different kinds of companies both large and small, were not eligible to operate two-way radio systems. It was then that the FCC established what is known as the Business Radio Service, allocating a segment of frequencies for businesses. During that first year, some 9000 business-radio stations were licensed, with the users installing 80,000 transmitters. In the seven years since, the number of users across the country has grown to 80,000 operating 150,000 transmitters. The projection for 1970 is 400,000 users with over 1,000,000 transmitters.

Why have so many businesses gotten excited about two-way radio? The reasons are several, but they add up to one big reason: two-way radio makes more money for its users than it costs. The key to it all is immediate contact with the field. The service or delivery truck, the supervisor or salesman, the president of the company — all can be reached in seconds, while they're in motion. The office doesn't have to wait for them to phone in, perhaps too late to be of help.

This flexibility of instant contact pays off in major ways. Everyone benefits. The customer gets good service; the company makes the most of its people and vehicles.

All this has happened in just the seven years since the FCC gave business the go-ahead to use two-way radio. The number of users has been increasing by a greater percentage every year. Greatest growth is in metropolitan areas. With this continued growth, there's also a growing question as to whether many more businessmen will be able to take advantage of two-way radio. The frequencies on which the systems are licensed are getting crowded. This is true not only of the Business Radio Service, which has now grown to be the biggest of them all, but of all the radio services. One frequency in Los Angeles is shared by 62 business-radio users. The average number of users on a single channel in metropolitan areas is something over 20.

Various associations have been studying the frequency-congestion problem, and a number of approaches are being formulated and considered. One is a total redivision of the entire spectrum under which all broadcasting services (television, regular radio, telephone, aviation communications) operate. Another idea calls for making maximum utilization of the spectrum; where frequencies are not being employed for television in a certain area, for example, use them for two-way radio communication.

The answer may not come for awhile, since the problem is complex. But it is one of the most important problems that must be tackled and solved if present users are to continue getting the most from their two-way radio systems and if new users are to have the opportunity to go on the air. ▲

The Troubleshooter

answers your servicing problems

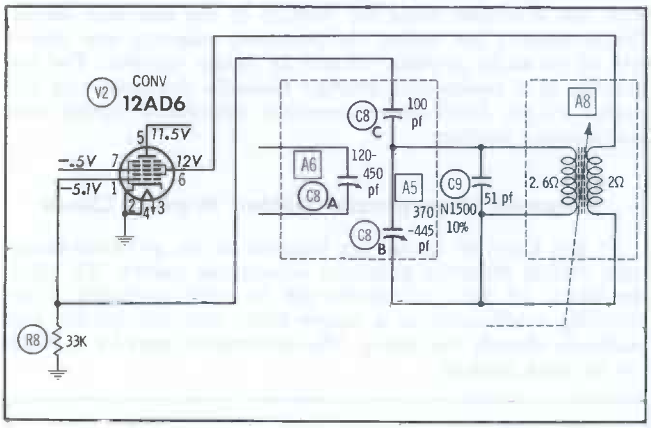
No Signal Above 900 kc

Could you tell me why Ford Model 74BF car radio (covered in PHOTOFACT Folder 399-6) completely blanks out when the dial is turned to 900 kc or above? It operates properly on the low-frequency end of the band. Adjusting the oscillator trimmer (A5) helps a little. I have replaced C9 but the new capacitor didn't help.

JOHN R. ZANATH

Aliquippa, Pa.

The local oscillator in your Ford auto radio is not oscillating above 900 kc. A defective converter tube (V2), low plate supply voltage, or defective grid-leak components (C8C and R8) could cause the oscillator to stop functioning above a certain frequency. Also, it's possible that a tuning slug is shorting its coil windings when the dial is rotated to 900 kc or above.



Alignment Problem

I have a Sonic-Aire Model SA-137 transistor radio which has given me fits in trying to align and get the front end to track. I can't find a listing for this radio in PHOTOFACT Index. I have the schematic that came with the set and will send it along. However, as you can see there aren't any alignment instructions on the schematic, Any help you can give me will surely be appreciated.

W. MALONE, JR.

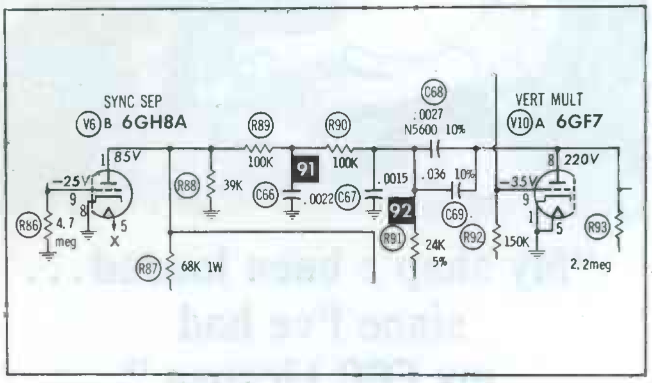
Wilmington, Ohio

Fashion a loop of several turns of insulated wire and connect it to the signal generator output. Set the signal generator for a 400-cps modulated signal. Radiate a signal into the receiver by placing the loop close to its antenna. Connect a VOM across the speaker voice coil, and set the volume control at maximum. In the following procedure, keep the generator output as low as possible, but maintain a suitable meter reading. Set the radio dial and the signal generator to 1600 kc. Adjust the oscillator trimmer for maximum deflection on the meter. Now, set the dial and the generator to 1400 kc and adjust the RF trimmer for maximum reading on the VOM. Next, position the dial and the generator for a 600-kc output, and adjust the oscillator and RF coil slugs for maximum indication on the meter. Go back to the first step (1600-kc adjustment) and repeat the 1600-, 1400-, and 600-kc adjustments until no further improvement can be obtained.

Bends

After spending many hours trying to correct severe bending on a Series 36 Magnavox television receiver, I finally came up with a solution in which I thought your readers might be interested. Several component parts and tubes were checked and substituted in an attempt to correct the trouble, but all efforts were fruitless. I discovered that pin 5 (filament) of the 6CG7 (horizontal-oscillator) had a poor ground connection. By connecting a heavier bond from pin 5 to the chassis in place of the original ground connection to the printed circuit board, I entirely corrected the horizontal bending. Since the original repair, we have corrected several cases of severe bending (some intermittent) in Series 36 receivers by using this same method. We now incorporate this circuit change on all of these particular chassis that happen to be in the shop for repair.

ERNEST C. MOORE



Insufficient Sync

We have serviced several Series 45 Magnavox color television receivers that had weak vertical sync. This problem was solved by shunting R90 (100K resistor) with a short piece of wire and removing capacitor C67 (.0015 mfd) from the circuit. The vertical sync was then solid with no apparent ill effects on set operation.

ERNEST C. MOORE

Rushville, Ind.

Needs A Suitable Load

Recently I have had several high-powered audio amplifiers brought into my shop for repair. My experience with this type equipment is limited. I am never quite sure what the proper load should be across the secondary of the output transformer. The outputs of the units I have worked on recently have varied from 15 to 50 watts per channel.

Could you help me in determining what kind of speakers and loading methods are required to service this type of equipment properly?

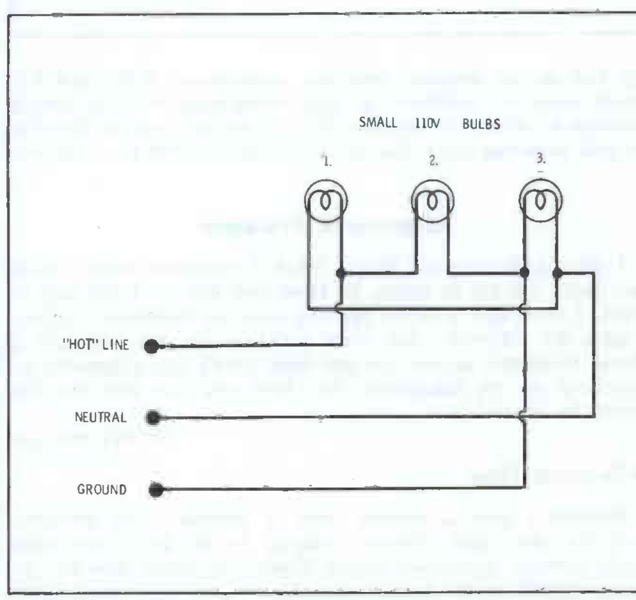
Ellenwood, Ga.

JOHN C. GRAY

Across the output transformer terminals, use a resistor that matches the output impedance. For example, connect a 16-ohm non-inductive 50-watt resistor across the 16-ohm output terminals of a 25-watt amplifier. As a safety precaution, always use a resistor twice the wattage of the amplifier output. Proper loading for testing the frequency response and distortion of an audio amplifier should be purely resistive. The impedance of a loudspeaker changes radically throughout its frequency range; furthermore transients introduced during tests may damage speakers.

Grounded-Receptacle Outlet Wiring Check

As you know all houses are required to use grounded-receptacle outlets wherever grounded objects are nearby. To check the wiring of these receptacles can be quite confusing. I am attaching a schematic of a simple tester that will quickly and positively identify the wiring. This information may be of some use to your readers.



Three 110-volt bulbs are connected to a three-pronged male electrical connector.

As shown in the schematic, when the unit is plugged into a properly wired outlet, lights 1 and 2 will light and 3 will not. If lights 1 and 3 are lit and 2 is off, the line and neutral wires are reversed. If light 1 is on and lights 2 and 3 are only dimly lit, the ground wire is open or disconnected. If light 2 is on and lights 1 and 3 are dim, the neutral wire is open. The conditions can be listed right on the unit for easy reference.

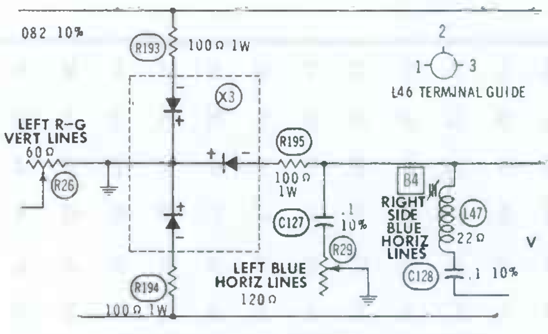
W. W. HENSLER

Indianapolis, Indiana

COLOR COUNTERMEASURES

Symptoms and service tips from actual shop experience

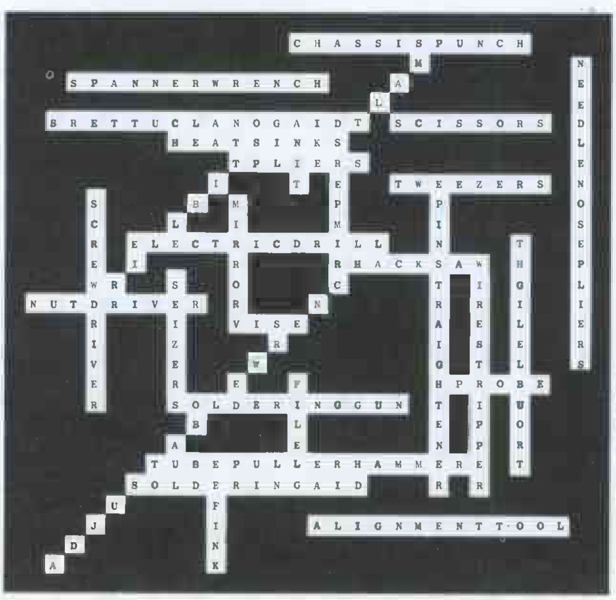
Chassis: Zenith (all chassis)
Symptom: Horizontal and vertical dynamic convergence controls have no effect on display presented on CRT. This condition may appear intermittently.
Tip: Check for defective selenium rectifier X3, located on convergence panel assembly. Replace with Zenith part #212-25 or use the replacement listed in the appropriate PHOTOFACT Folder.



Answer to November's Puzzle.

(See page 68 for December Puzzle.)

Below 20—Don't expect all answers to be obvious.
21-24—Try more approaches for finding the answer.
25-28—You are hesitant to give up, but work a little harder.
29-30—Bravo! You approach problems from all directions.



PFR Puzzler

This month's puzzle contains 30 words relating to semconductors. Some of these words are the actual names of semiconductor devices; others are words associated with the properties of semiconductors. These words are scattered throughout the puzzle, some interlocking with another word. They may be discovered by reading left-to-right, right-to-left, up, down, or diagonally.

See how many of these thirty semiconductor terms you can locate. The answers and a score chart will appear in the January PF REPORTER.

(Answer to last month's puzle is on page 67.)

H	O	M	E	Z	E	N	E	R	R	L	R	P	T	C	O	L	L	E	C	T	O	R	J	I	M	P	T
Z	T	A	R	S	M	L	C	O	C	T	N	D	R	M	A	N	L	P	G	E	R	M	A	N	I	U	M
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A	Q	R	P	C	I	L	Y	H	V	M	J	D	I	O	D	E	F	R	Q	Z	Y	R	A	N	A	L	P
M	Z	I	O	S	C	R	X	C	A	E	F	L	D	F	O	L	D	Y	R	A	F	G	Q	C	Z	N	L
O	N	Z	N	C	X	T	S	U	G	L	I	E	H	T	A	S	E	M	Y	Q	N	R	Z	E	L	Q	C
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A	M	L	C	F	Q	N	M	Z	E	G	I	X	J	Z	E	C	E	I	O	T	P	T	L	U	A	S	P
P	M	A	C	R	M	L	E	D	A	E	T	Q	Y	Z	R	C	R	T	B	O	A	Y	A	E	Z	M	P
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N	O	I	T	C	N	U	J	I	N	U	Z	M	I	T	Q	P	A	L	C	O	R	A	C	E	U	J	R
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B	E	C	K	Y	L	M	T	P	R	O	T	S	I	R	Y	H	T	Z	A	A	B	O	T	U	R	C	Z
X	T	F	O	E	R	A	T	D	C	A	S	R	T	J	M	P	Q	E	A	Z	T	G	T	H	I	L	O
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E	S	A	B	H	E	T	R	O	G	H	J	F	O	O	T	B	A	L	L	Z	B	E	L	B	E	T	A

Product Report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Transistor/Diode Checker

(59)

This instrument can be used to check all types of germanium and silicon junction transistors and diodes, including small-signal and high-power types. The **Workman** "Transitest" gives an indication of transistor or diode condition by means of a tone signal (generated by a self-contained oscillator circuit). The tester is battery operated and cannot damage transistors or diodes even if improperly connected. Each transistor is identified as to PNP or NPN type as part of the test procedure. The unit measures 3¾" x 6¼" x ⅙", and the price is $12.95 (less batteries).

Tape Recorder for Cars

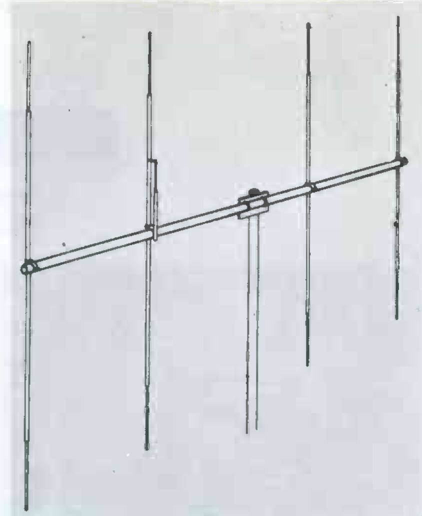
(60)

Illustrated is an automotive tape sound system which can play back through the car radio as well as record. It can be removed easily from the car for use as a completely portable and separate recorder. The **Norelco** "Car-Mount," a two-part unit, comprises a universal mounting and the "Carry-Corder 150." The "Car-Mount" is connected to the auto radio, and the mounting unit is attached below the dashboard with a special adapter inserted into the radio antenna. The "Carry-Corder" is then placed into the mounting's custom-designed tray.

The unit is self-powered, and battery life is extended, since playing the recorder through the car radio instead of its own amplifier reduces the power drain by almost 50%.

Tape cartridges snap into the unit and provide one hour of recording or listening time.

The "Car-Mount" mounting sells for less than $30. The "Carry-Corder" retails for less than $120.



Four-Element Antenna

(61)

This bidirectional base-station antenna operates in the 27-mc Citizens band. The **Scotch-Master** is designed to give a gain of 8.7 db over a ¼ wave dipole (or 11.2 db compared to an isotropic source), a front-to-back ratio of 20 db, and a VSWR of 1.5/1. Wind-load rating is 80-mph, EIA standard. Stacking kits are available for connecting two antennas together for an additional gain of 3 db (11.7 db gain over ¼ wave dipole or 14.2 db compared to isotropic source). **The Mosley** A-411-S is constructed of high-tensile-strength aluminum and has an assembled weight of 15 lb.

Tri-Band SSB/AM/CW

(62)

This three-band SSB/AM/CW Transceiver is for use in the 20-, 40-, and 80-meter amateur radio bands. The **EICO** 753 "Tri-Band" transceiver may be used at fixed locations or as a mobile station, for manual push-to-talk or automatic-voice-controlled (VOX) radio-telephone operating, or for radiotelegraph communication employing grid-block keying.

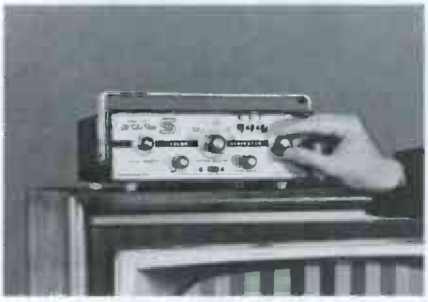
During transmission, power input is 200 watts PEP for SSB or CW, and 100 watts for AM. Power output is rated at 120 watts PEP for both SSB and CW, and 30 watts for AM. The transmitter employs a pi network to enable matching into 40-80 ohm antenna systems.

Receiver sensitivity is better than one microvolt for 10-db signal-to-noise ratio. Selectivity, provided by a crystal-lattice bandpass filter, is 2.7 kc at 6 db. A product dectector is used for SSB and

CW reception, and a triode detector for AM. An external linear amplifier can be used with the transceiver.

The 753 is priced at $179.95 in kit form and at $299.95 factory-wired—less power supplies and speaker. The power requirements are 750 volts DC at 300 ma. 280 volts DC at 170 ma, —100 volts DC at 5 ma, and 12.6 volts at 3.8 amps.

These voltages are provided by the accessory Model 751 AC supply/speaker console, which is priced at $79.95 as a kit and $109.95 wired. The transceiver measures 5 13/16" x 14¼" x 11¼".



Color-Bar Generator

(63)

Solid-state circuitry eliminates the need for warm-up time in **Seco's** Model 900 color-bar generator. Instead of conventional oscillator dividers it employs unijunction-transistor switches as counters for a more uniform square wave. Zener-diode regulation in the power supply and crystal-controlled oscillators are included to provide improved stability. The unit includes a tuner that permits the channel frequency to be varied to match that of the receiver.

Battery Display

(64)

This steel display unit holds flashlights, lanterns, and batteries, including blister-packed transistor batteries. **Union Carbide Corporation's** Cordless Corner, No. 1800, is topped by an illuminated sign, and its entire width beneath the display counter is available as storage space. Each display unit is available free with a suggested order.

Color CRT Test Adapter

(65)

Existing color CRT-test equipment may be converted to test 90° color tubes with this test-adapter socket. The device, manufactured by **Pomona Electronics,** accepts Motorola 23EGP22, RCA 25AP22, and other color CRT's with miniature dihep-tal 14BE basing; it also fits those bases equipped with spark gaps. Net price of the Model 2276 is $5.95.

INDEX TO ADVERTISERS

DECEMBER, 1965

FREE Catalog and Literature Service

**Check "Index to Advertisers" for further information from these companies.*

Please allow 60 to 90 days for delivery.

ANTENNAS & ACCESSORIES

75. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of *Tenna-Rotors*.
76. *ANTENNACRAFT*—Literature featuring 3 new 75-ohm, all-channel TV antennas available in factory-built or kit form.*
77. *BLONDER-TONGUE* — Booklet titled "How to Plan a Home TV System" containing information on required components and cable with diagrams of actual systems. Written for both homeowner and technician.*
78. *FINNEY* — Catalog 20-337 covering U-Vert series UHF converters and catalog 20-338 on Model 65-1 distribution amplifier.*
79. *JERROLD* — Colorful six-page brochure describing and explaining coax, matching transformers, and antenna amplifiers.*
80. *JFD*—Literature on complete line of log-periodic antennas for VHF, UHF, FM, and FM stereo. Brochure showing converters, amplifiers and accessories; also complete '64-'65 dealer catalog plus dealer wall chart of antenna selection by area.
81. *STANDARD KOLLSMAN* — Catalog sheet on Model TA transistorized UHF converter and transistor converter kit.*
82. *TRIO*—Brochure on installation and materials for improving UHF transistor reception.
83. *WINEGARD* — 12-page brochure "Color Spectacular" featuring antenna products designed for color TV use.*
84. *ZENITH*—Information bulletin on antennas, rotators, batteries, tubes, power converters, record changers, picture tubes, wire, and cable.*

AUDIO & HI-FI

85. *ADMIRAL* — Folders describing line of equipment: includes black-and-white TV, color TV, radio, and stereo hi-fi.
86. *CINE SONIC* — Data sheets describing rental service which supplies background music prerecorded on 7", 10½", and 14" reels of tape—stereo or mono.
87. *EUPHONICS* — Jumbo 8-page 4-color brochure introducing *Miniconic* semiconductor stereo phono cartridge. This presentation also covers principles and history of disc recording, stereo theory, cartridge design factors, and characteristics of different cartridges.
88. *JENSEN*—Multicolored 24-page catalog 165-L featuring complete line of headphones, speaker systems, and speaker kits.
89. *NUTONE*—Two full-color booklets illustrating built-in stereo music systems and intercom-radio systems. Includes specifications, installing ideas, and prices.
90. *OAKTRON*—"The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.*
91. *OXFORD TRANSDUCER*—4-page catalog describing three lines of automobile rear-seat speaker kits.
92. *QUAM-NICHOLS* — Catalog 65 listing replacement speakers for public address systems, hi-fi, auto radio, and radio-TV applications.
93. *ROBINS* — Form 851 featuring tape editing workshop and phono-record care kit.

COMMUNICATIONS

94. *EICO*—Data sheet on Model 753 *Triband* transceiver and other ham gear, plus full-line catalog.*
95. *E-Z WAY PRODUCTS*—Information on crank-up, tilt-over towers for amateur radio, Citizens band, and industrial communications.
96. *GENERAL RADIOTELEPHONE* — Operation and instruction manuals on BB-10 and BB-30 business radios, MC-7 and MC-8 CB transceivers, and SB-72 single-sideband receiver.
97. *E. F. JOHNSON*—Information on Citizens band, industrial radio, and radio-paging communications equipment.
98. *MOSLEY ELECTRONICS* — Catalog covering complete 1966 line of Citizens-band equipment.
99. *PEARCE-SIMPSON* — Specification brochure on IBC 301 business-band two-way radio *Companion II, Director, Escort II, Guardian* 23, and *Sentry* Citizens-band transceivers. "The Modern Approach to Business Communications" concerning land mobile radio service for businessman.
100. *SONAR RADIO*—Specification sheet on Model FM-40 business radio.

COMPONENTS

101. *BUSSMANN*—Bulletin SHF-11 on new waterproof in-the-line fuseholder for use on any circuit of 600 volts or less operating in exposed locations. Two fuseholders are available; one for 13/32"x1½" fuses, another for 13/32"x1⅜" fuses.
102. *CENTRALAB*—4-page catalog describing in detail the complete line of miniature electrolytic capacitors.
103. *GC ELECTRONICS* — Cross-reference guide FR-605-G for TV knob replacement; catalog FR-66-TD listing TV antennas and accessories; brochure FR-171-A and catalog FR-66-A covering audio accessories and solid-state modules; also information on test prods, tape and phono drives, and belts.
104. *LITTELFUSE* — New circuit-breaker cross-reference brochure.*
105. *ONEIDA*—New catalog pages listing line of hardware, switches, resistors, and other replacement components.
106. *SONOTONE*—Technical brochure RA-112 describing sealed nickel-cadmium batteries.*
107. *SPRAGUE* — Latest catalog C-616 with complete listing of all stock parts for TV and radio replacement use.*
108. *SWITCHCRAFT*—Product bulletin No. 155 describing a push button that lights without a lamp or power supply. Mounts on any push-button switch plunger with .050"x.187" dimensions.*
109. *TRW*—General catalog No. 166 covers all standard capacitors offered by company. Technical information on tolerance, reliability, and other characteristics of capacitors.

SERVICE AIDS

110. *CASTLE*—How to get fast overhaul service on all makes and models of television tuners is described in leaflets. Shipping instructions, labels, and tags are also included.*
111. *ELECTRONIC CHEMICAL* — Catalog sheet describing aerosol cleaners for electrical contacts, volume controls, and tape heads.
112. *PRECISION TUNER*—Literature supplying information on complete low-cost repair and alignment services for any TV tuner.*
113. *RAWN* — Detailed instruction sheets on TV knob and plastic repairs with *Plas-T-Pair*.
114. *WALLIN-KNIGHT*—Folder on Reflect-O-Scope, a tool for static convergence of color TV receivers.
115. *YEATS*—The new "back-saving" appliance dolly Model 7 is featured in a four-page booklet describing feather-weight aluminum construction.

SPECIAL EQUIPMENT

116. *ATR* — Descriptive literature on selling new all-transistor *Karadio* Model 707, having retail price of $29.95. Other literature on complete line of DC-AC Inverters for operating 117-volt PA systems and other electronics gear.
117. *GREYHOUND* — The complete story of the speed, convenience, and special service provided by the Greyhound Package Express routes.
118. *PERMA-POWER* — Four-page catalog, GB281, illustrating solid-state garage-door operator using pulse tone modulation.

TECHNICAL PUBLICATIONS

119. *CLEVELAND INSTITUTE OF ELECTRONICS*—Free illustrated brochure describes electronic slide rule and four-lesson instruction course and grading service.*
120. *GRANTHAM*—Catalog describing home-study and resident courses in electronics leading to job objectives, FCC license, and ASEE degree.
121. *HOWARD W. SAMS* — Literature describing popular and informative publications on radio and TV servcing, communications, audio, hi-fi, and industrial electronics, including special new 1966 catalog of technical books on every phase of electronics.*
122. *RCA INSTITUTES* — 64-page book, "Your Career in Electronics" detailing home study courses in telecommunications, industrial electronics, TV servicing, solid-state electronics, and drafting. Preparation for FCC license, and courses in mobile communications and computer programming also available.*

TEST EQUIPMENT

123. *B&K*—New 1966 catalog featuring test equipment for color TV, auto-radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.
124. *HICKOK*—New 1965-66 short-form catalog listing test equipment for radio and TV servicing.
125. *JACKSON*—New 8½" x 11" catalog listing full line of test equipment.*
126. *LECTROTECH*—Bulletins on Metergards, Lectrocells, V-6 and V-7 color-bar generators, CRT-100 picture tube analyzer, and Model U-75 UHF translator.*
127. *MERCURY*—Folder supplying information on complete line of test equipment.*
128. *SECO*—Catalog sheet No. 90065 describing Model 900 color-bar generator and Models 88, 98, and 107B tube testers.*
129. *SENCORE*—Latest information on TC-136 tube tester and SS137 sweep-circuit analyzer.*
130. *SIMPSON* —Flyer giving specifications of Model 604 Multicorder for measuring and recording volts, amps, milliamps, and microamps.
131. *TRIPLETT* — Complete information on burnout-proof VOM Model 630-PLK.
132. *WATERMAN*—Technical data on OCA-11B industrial oscilloscope.
133. *WORKMAN*—Information on transistor-diode checker using a transistorized audible signal with self-contained oscillator circuit.*

TOOLS

134. *ARROW*—Catalog sheet describing uses, prices, and construction features for staple guns.
135. *ENTERPRISE DEVELOPMENT* — Time-saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering techniques for speeding and simplifying operations on PC boards.*
136. *XCELITE*—Product bulletin on two new pocket-size screwdriver sets designed to simplify assembly and service work involving Scrulox recess screws.*

TUBES & TRANSISTORS

137. *SEMITRONICS*—8-page semi-conductor replacement and interchangeable guide, featuring exact replacements for almost 5,000 semi-conductors.

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DECEMBER, 1965

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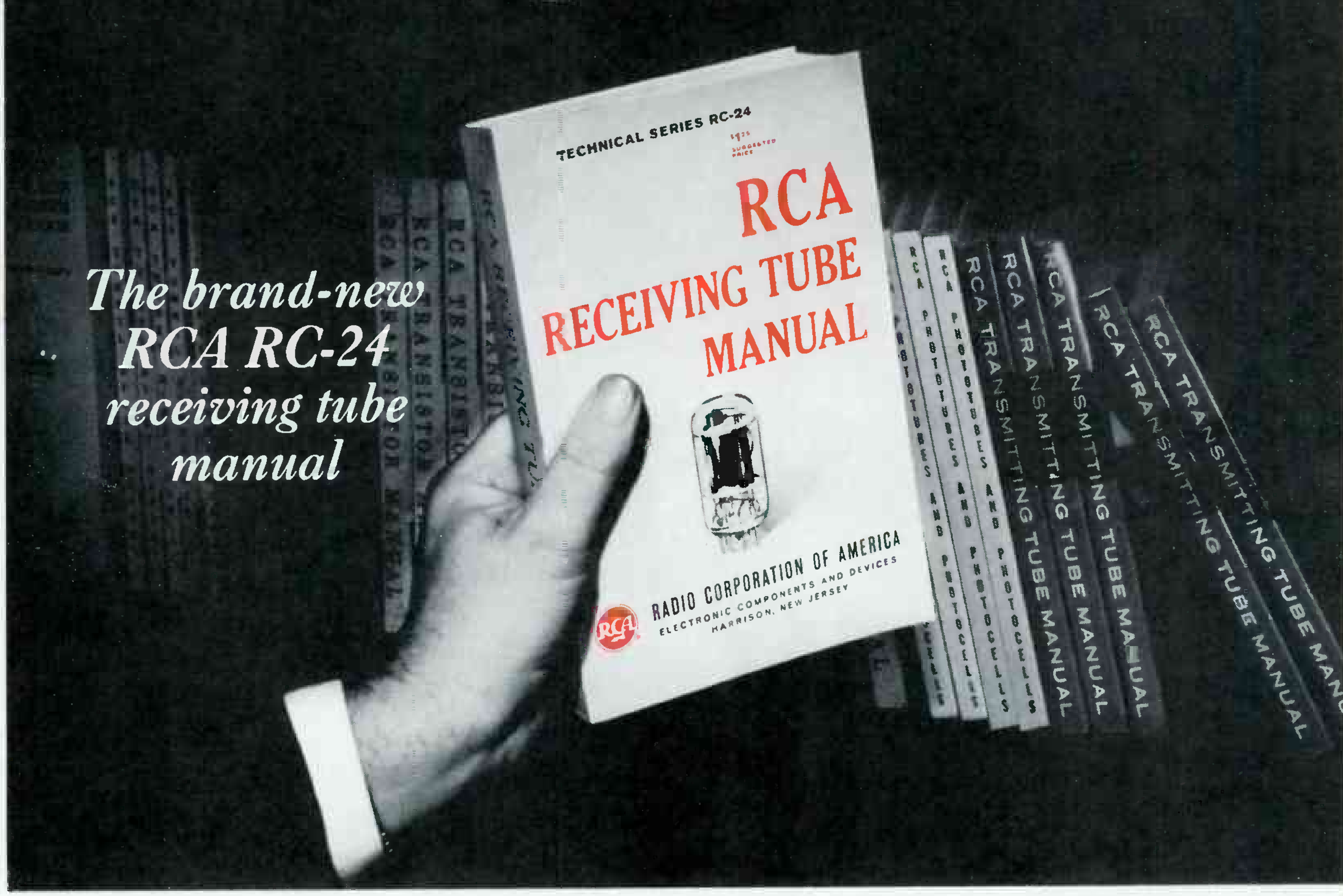

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- ✓ Updated picture tube characteristics chart
- ✓ Revised and updated Applications Guide
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- ✓ Data section on active types only. (Discontinued and replacement types appear in a separate section.)
- ✓ Additional text material on TV in the tube applications section

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