PACKAGED SELECTIVITY

455-KC MECHANICAL FILTER RECEIVER ADAPTER

Enjoy 1957-style selectivity and performance from your present receiver by plugging in this simple mechanical filter adapter that replaces the first IF amplifier tube.

—Lighthouse Larry

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PACKAGED SELECTIVITY

GENERAL INFORMATION

There are clear channels on today's crowded amateur bands even though you may not be aware of them easily with your present communications receiver. Picture tuning one of the new high-selectivity communications receivers. The band and several clear channels usually will be found by bypassing your present receiver—whichever may be operating at that time—to your present receiver—which otherwise may be operating on any channel. The result is that you can connect the adapter to your present receiver, then tune for a channel, and insert two short coaxial cables into the tube socket, as shown in Figure 1. These cables carry the RF signal to and from the adapter. An adapter that plugs directly onto the tube socket could be constructed, but the available space is very restricted in many receivers.

The primary design and construction consideration of this adapter is to completely isolate the input and output circuits. Any stray coupling can cause signal distortion around the filter unit, thus impairing its effectiveness. For this reason, we recommend that the adapter be constructed as described.

Modern medium-priced and older high-priced communications receivers now in general use are convenient to operate, have good frequency stability and sensitivity, but lack the necessary "shirt" selectivity to sufficiently reject strong signals that are only a few kilocycles higher or lower in frequency from a desired signal. The shaded area of curve "A" in Figure 2 shows the typical selectivity characteristic of several popular medium-priced communications receivers. Although the peak, or "tone," of this curve is usually only a few kilocycles wide, the "shirt" selectivity 60 degrees down from the peak may be from 15 to 30 kilocycles broad. Small wonder that strong local signals a few kilocycles up or down from a station you are trying to copy may dominate and prevent any copy at all.

Incidentally, the curves at "A" are the bandwidth figures of typical new communications receivers. The only curve that is used for the sharpest bandwidth that does not utilize the crystal filter is the one at "B", which represents the characteristic of the filter. Reducing the width of the "shirt" of a filter will greatly sharpen the "tone" of the selectivity curve but the width of the "shirt" may not be materially reduced.

When the "PACKAGED SELECTIVITY" adapter is installed in a receiver of this type, the crystal filter can then be utilized to reject, or "catch out" any heterodyne type interference that may fall within the bandwidth of the mechanical filter. Or, a Q multiplier may be connected into the receiver for this purpose. The mechanical filter has noise of the characteristic "ringing" sound that sometimes results when a crystal filter is adjusted to produce an extremely sharp selectivity peak response curve. And lastly, the random noise output from the receiver will be reduced.

SELECTIVITY SYSTEMS

There are two systems generally used to obtain a bandwidth characteristic that approaches the "ideal" communications receiver selectivity curve for voice- modulated signals, shown at "B" in Figure 2. One system is the "packaged filter," including the mechanical filter as used in this adapter circuit, the crystal lattice filter, and certain toroidally-wound inductive filters. A good crystal lattice filter usually must be assembled from carefully matched torus-surplus quartz crystals in this frequency range, while the toroidal filter operates at a lower frequency and requires a more complete frequency conversion adapter circuit. The second method is to utilize a string of high Q circuits in the receiver's IF amplifier that are tuned to achieve the desired bandwidth. This system requires considerable space consuming, difficult to adjust and liable to excessive "ringing" if quality components are employed. Of the two systems, the "packaged filter" has certain advantages. It is very compact, readily available in a variety of bandwidths, and provides excellent selectivity curves, and is roughly equivalent to "B" of the other systems having comparable selectivity. Curve "C" in Figure 2 illustrates the selectivity of the 3.5-kilo-
cycle mechanical filter bandwidth suitable for AM and SSB reception. Compare this curve with "A," which is drawn to the same scale.

A mechanical filter is of the same implications, a series of vibrating, mechanically resonant, disks tied together with small rods that transmit the vibrations from one disk to disk. Small inducances coupled to the disks at both ends convert the electrical energy passing through them into mechanical vibrations at the input end and back into electrical energy at the output end. Each disk has a "Q" 20 times as high as an ordinary tuned circuit, so that several disks of slightly different resonant frequencies must be coupled together to achieve a nearly rectangular bandwidth response curve. Since the filter characteristics determine the overall intermediate frequency bandwidth, any other tuned circuits in the intermediate-frequency amplifier may utilize a low-cost, readily available coil, such as the vari-lyticonv, instead of more expensive IF coupling transformers.

The adapter model pictured on the cover was assembled from parts that cost about five dollars (plus $45.00 for the Collins F-452.31 filter). W2FZV, designer of the adapter, was so pleased with his station receiver's new-band selectivity (formerly about 30 kilocycles broad at the 40-meter band) after testing the adapter that he promptly added "A" to the receiver's model number! 1A.

The adapter includes an intermediate-frequency amplifier on 465 kilocycles (nearly found in pre-War World II receivers) which is to be aligned to the 465-kilocycle center frequency of the mechanical filter, otherwise very little signal will be heard when the adapter is added. This change in the intermediate frequency will render the crystal filter practically insensitive unless a 465-kilocycle filter crystal is substituted for the original.

**Electrical Details**

The adapter picks up the signal from the control grid of the receiver's first IF tube and amplifies it through coupling capacitor C1, then feeds it to the grid of a second IF tube, V1, in the adapter itself. The schematic diagram, Fig. 2, and the following text should explain the manner in which this is done. The adapter is designed so that the mechanical filter output terminals are connected directly to the control grid of V1 and the chassis, so that no grid current will flow in this stage. The output signal from V1, again, is coupled back into the plate terminal of the receiver's IF tube socket. The tuned circuits connected to the plates of both V1 and V2 are composed of vari-lyticonv coils, L1 and L2, mounted by fixed capacitors C1 and C2.

The input and output coaxial cables are 16-inch lengths of RG-11/U. This cable forms the 40-millimeter ground of a capacitive voltage divider, C1, being the other leg, that reduces the signal voltage applied to V1, to about 1/4 of the voltage across the secondary of the receiver's first IF transformer.

The over-all signal amplification of the adapter has been held down to a few decibels more than the 16-in-16 through the filter through use of small input and output coupling capacitors and fairly large cathode bias resistors in both amplifier stages. This is suitable for receivers having two or more intermediate-frequency amplifier stages, but additional gain from the adapter may be obtained by reducing the value of one or both cathode resistors to 370 ohms. This may be desirable when the adapter is operated with a receiver having only one intermediate frequency amplifier stage. The capacity ratio in the input voltage divider may be reduced by shortening the input cable, or increasing C1 to 22 to 33 microfarads, for a given basic (Collins 459-31) the adapter may then have to be recalculated to achieve maximum signal strength. Power was brought in through the adapter chassis plug, but three- or four-wire cable may be substituted. The mechanical filter is shown in Fig. 1 as an adjustable stub for IF Radios; Tavish, 1932, page 27. Proceeding with the IF design, 1932, page 27, and in Audio Engineering, 1932, page 285.}

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**Fig. 3. Schematic diagram of the mechanical filter adapter.**

**Fig. 4. Alternate output coupling and optional AVC connections in the adapter.**

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**PARTS LIST**

- Ci—600-mf, ceramic, 250- and 330-volt type.
- Ci—120-mf, ceramic.
- C2—10-mf, film capacitor (Kearney Type 452-5 or Roentgen Type 515).
- Fl—459-kilocycle mechanical filter with 2.1-kilocycle bandwidth and 0.1 milli-ampere current rating.
- L1—200-uH slug-tuned coil (Graybee or Sperus Type 459-lyticonv Model V1 or Miller No. 6300).
- M—inductive slug with retarding ring (American 86 FM, 86-PM).
- V1—6BE3 or 86-PM tube.
little more than was drawn by the IF tube replaced by the adapter. A single plate and screen voltage lead will suffice when the supply voltage is 130 or less. A single 350-volt DC source will require that an 18,000- ohm, 12-watt screen voltage dropping resistor be connected between pins 4 and 8 on the power plug.

An alternate output coupling circuit, and a method of applying 4VDC voltage from the receiver to the second amplifier stage in the adapter are shown in Fig. 4. This circuit is mainly useful when the adapter is con-

ected to a receiver that has few AVC-controlled stages. The AVC voltage is taken from the control grid connection on the IF tube socket and is applied to the grid of V1, through the output coupling coil of the mechanical filter. The lead from the plate of V1 to the IF tube socket should be the shortest possible length of RG-58/U coaxial cable. The primary of the receiver's second IF transformer should be returned after plugging in this cable.

MECHANICAL DETAILS

This adapter unit was constructed in a 2½ x 3½ x 4-inch Minibox (Radio-Craft 3600), a good compromise that is compact, yet not too small for easy wiring. A larger box may be required if a "B" or "C" type ret-

angular mechanical face filter designed for horizontal mounting is used instead of the "J" model. A somewhat smaller Minibox will suffice if the circuit in Fig. 4, eliminating L6, is used.

For maximum isolation between input and output circuits, a parts layout similar to that shown in the drilling diagram, Fig. 5, should be followed. After drilling and punching all holes, the tube and me-

chanical filter sockets, power plug, and rubber grom-

nets may be assembled. Solder lugs were placed on all socket screws for ground connections. Then, a 3 x 3-inch piece of perforated sheet aluminum is formed into the shield shown in the bottom left oblique view, Figs. 6 and 7, respectively. A 3-inch-wide flange is formed along all edges of this shield except where it crosses the center of the 9-pin socket. A small notch is cut in the shield next to the socket for heater and plate power leads to V1. The shield passes between the lugs for pins 3 and 4, and 8 and 9, then it is bolted to a soldering lug that has been soldered to pin 2 on the socket. The upper flange on the shield box is bolted to the box directly above L6, and two self-tapping screws are driven into the shield's wide flange where the other half of the box is assembled.

Assembling the two IF tube socket probes, takes little more time than is required to explain it. First, cut two lengths of RG-58/U coaxial cable 17 inches long and remove 1½ inches of the vinyl cover on one end of each piece. Slide the braided shield back over the outer cover, then trim the center conductor and insulation so that 1½ inches protrudes beyond the shield. Next, skin the insulation to expose ½ inch of the center conductor, trim one lead of the 10-mfd capacitor, C4, and solder it to the center conductor with a 1/2 of an inch overlap. Cut narrow strips of plastic insulating tape and wrap them around this joint up to the body diameter of the capacitor as shown in Fig. 8. Slide the braided shield over the capacitor, pull it
Fig. 7. Oblique view of the adapter.

The shield is held in place by the hexagonal nut, which is tightened with a screwdriver. The shield also serves as a ground connection for the signal leads. The adapter is connected to the communication receiver by means of a 3-pole, 3-wire connector, which is plugged into the rear of the receiver. The shield is connected to the ground lead of the connector, and the signal leads are connected to the signal output terminals of the receiver. The shield is also connected to the ground lead of the receiver, which is connected to the ground of the communication receiver. The shield is connected to the ground lead of the receiver, which is connected to the ground of the communication receiver.

Fig. 8. Cross-sectional assembly view of signal cables.

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carrier strength on the meter. On a receiver that has no "S" meter, Ls and Lc are best adjusted by turning the RF gain down, the audio gain up, and tuning both coils for maximum audio output from a modulated sig.

Fig. 10. TYPICAL TECHNICAL DATA.

A somewhat different technique should be used for tuning a receiver when the signal source is a CW transmitter. The installation of "PACKAGED SELECTIVITY." If any of the above techniques are used, a receiver with built-in mech.

tional signal, you may wish to have him brief you on this subject. And it's also a good opportunity to compare the selectivity improvement you can expect from this adapter.

Modulated signals with carrier should be tuned in so that the carrier is placed on one edge, rather than the center of the IF passband shown in Fig. 1C. If you tune a bit too far, the carrier will drop off the edge and will be suppressed, and the modulation will sound like an "SSB" signal—spectrally unintelligible. Since only one sideband of a double-sideband signal will be heard at a time, the receiver tuning may be shifted so that the sideband on which a heterodyne is present may be "pushed off" the edge of the IF bandpass.

When receiving single-sideband, suppressed carrier signals—or for single-sideband CW reception—the receiver's best frequency oscillator is turned on and the "FITCH CONTROL" is adjusted so that the IF block is on a sideband that is just above the signal frequency, thus tuning to an amplitude and by using a receiver with a "BFO" frequency control and a second sidetone control, the receiver is not affected by the modulation. A wide range of SSB signal strengths can be handled by the receiver, and the receiver is capable of tuning the RF gain control up and down. (See "CC" magazine, November, 1939, page 19, and the ARRL's "Rifleman for the Radio Amateur," page 86, for additional details on product design.)

In addition to the 3.1-kilowatt bandwidth filter previously mentioned, 455-kilowatt wide filters may be obtained in the following bandwidths: 0.5, 1.5, 2.1, 6.0, 12.0, and 24.0 kilowatts. The 3.1-kilowatt bandwidth model is ideal for reception of SSB, and receiver with the same bandwidth is also available. The 0.5-kilowatt bandwidth model provides the same bandwidth as the maximum bandwidth, but is limited to practical use for CW reception. Devoted brass pounders may prefer the 1.5-kilowatt, especially when using "OK" and other signals. Samples of the 0.5- and 3.1-kilowatt filters will be supplied by plugging them into the adapter. The same shunt capacitors, C1 and C2, may be used as filters.

If you still have a soft spot in your heart for that old CW QSO, or if you want a selective receiver with "PACKAGED SELECTIVITY" that meets your bandwidth needs.
Mrs. Mary D. Burke
W3CUL

JUDGED

E. HOLLAND HARRELL, Chair-
man, American National Red
Cross

HERBERT HOOVER, JR., The
Under Secretary, U.S. De-
partment of State

COMMISSIONER, Federal Communications Com-
mission

GOODWIN L. DOGLAND, President, American Radio
Relay League

From his efficient station layout (top), Mary (Mrs.) Burke, W3CUL, tops out another of the more than 3000 messages per month she averages while operating about eight hours daily in six traffic networks. Miss soldier handled messages are "phase." 

"It's no idle assumption"—pioneering a better than 20-word-per-minute rate on CW. Her longest stretch of operating without missing a schedule was 1823 days—five years without taking a vacation or a single day off.

Mrs.'s husband, Al, operates as W3VJR, and their 13-year-old pet, "Buck," listen audibly to another hobby, playing her church method Hammond electric organ (lower left). A third hobby is gardening and growing violas (lower right).

All on the-air fun is quite limited by a busy schedule as a maintenance supervisor of electric equipment on oil tankers, and keeping the almost continually running transmitters and receivers in peak operating condition.

W3CUL received the Edison Award trophy and a $500 check at the presentation ceremony in Washington, D. C., on February 28, 1956.
SWEEPING THE SPECTRUM

From the Edison Radio Amateur Award committee—heartiest congratulations to the eight Special Citation winners, also the twenty-two recipients of Civil Defense Campaigns. The 1956 Award judges in addition to the official winner.

The Special Citation winners include: W5DE and W2KJ, cited for outstanding technical and organizational efforts; W2RP, W5IQ and W2DVL for emergency communications work; plus two individuals and a club committee who provided well-organized communication for the U.S. Navy's "OPERATION DEEPFREEZE" in the Antarctic (see story on page 8).

Many readers will remember newspaper accounts of W2RP's role in arranging and expediting shipment by air of a rare drug needed to save a two-year-old boy's life in the Belgian Congo in July, 1952. This was in addition to his usual operations, devoted mostly to handling messages and special requests.

The Civil Defense Commission was initiated by the Award judges to honor those 1956 candidates who were nominated for outstanding organizational efforts in local or state Civil Defense amateur radio communications groups. These amateurs received unanimous high praise from Civil Defense officials in nominating letters, and the Award judges.

It's sad, but true! The supply of G-E HAM NEWS SECOND ROUND VOLUMES probably will be exhausted by the time you read this item. It was possible to assemble only a limited quantity of this book, and it is now the last of its kind. In addition, the 1956 edition has been completely consumed by the print run, and it is not expected to be available in 1961.

In answer to many requests, the DX LOG issue is published every three years in the January-February issue, and not yearly. However, the 1956 DX LOG is still available simply by writing for it. This year, we concentrated less on a two-element beam for the 20-meter DX chasers.

HOW TO GET G-E HAM NEWS

G-E HAM NEWS may be obtained free of charge from your local G-E Sales Office, or from any G-E jobber. G.E. will mail it directly to your home. Write to G-E HAM NEWS, Electrical Conductors Division, General Electric Co., Schenectady, N. Y. This subscription plan is available only to persons in the United States, Alaska and Hawaii. For a overseas address, contact your nearest foreign distributor.

To the DXer, this is the magazine that provides an instant check on stations worked on each band. Most top-scoring stations on Field Day are using these, in addition to closely guarded secrets.

Here's another item from the Edison Radio Amateur Award committee, saying that for the 1956 Award, one candidate was nominated by amateur radio clubs than ever before. It certainly is an excellent way to honor a local radio amateur who has been doing an outstanding public service job.

There is a very special committee, a special secretary, or a special committee, draft a nominating letter giving complete credit to the candidate's public service work. This letter is then signed by the club members and sent to the Award committee. Booster members even submitted individual letters giving additional details that were of great help in the Award judging process.
Edison Award Special Citation winners Navei Krause, WISBE (drawn with his Rorax, Adavac, above left), 11-year old Jahnia Halley, KDQEL (right), together with the 14 members of the Radio Amateurs of Greater Seattle "OPERATION DEEPFREEZE" committee, all have faithfully maintained nightly message-handling and 'phone patch schedules with the Antarctic expedition during most of 1956. The KE4 stations are on the air from about 7 p.m. to 6 a.m. (PST), meaning either lost sleep or an involved swing schedule for these public-spirited amateurs who jointly have delivered several thousand individual messages.

Some even greater number of persons will be in the Antarctic during No testing! How enthusiastic! Anyone clubs in all areas of the United States should consider setting up an operation similar to the KE4G committee, in which each member operates a three-hour schedule once a week. It's a great public relations job if you have your next meeting!