TIME-TESTED FAVORITES

. . . WITH EXTRA DATA

TVR HI-PASS FILTER

EMERGENCY-PORTABLE RIG

MOBILE MODULATOR

HARMONIKER

By popular demand, this issue contains additional design data on four widely used G-E HAM NEWS items, plus a digest of the original articles, that will help you tailor and construct this equipment to fit your individual needs.

—Lighthouse Larry

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THE HARMONIKER

The Harmoniker (See G-E HAM NEWS, November-December, 1949, Vol. 4, No. 0) is a band-pass type filter to attenuate signals both higher and lower in frequency than the amateur band for which it is designed. Properly constructed and installed in a transmitter between the final amplifier output circuit and the antenna feed line, it is highly effective in reducing harmonic-type interference on nearby television receivers.

However, it will not attenuate harmonics being radiated from an unshielded transmitter, or by unshielded wiring that runs out of the transmitter enclosure. The Harmoniker also will help prevent radiation of other spurious signals, particularly when a transmitter is fed into one of the increasingly popular all-band antenna systems. These signals include "pink-ticket" harmonics that fall outside an assigned amateur band, and signals that leak through a final amplifier from an exciter operating at a sub-multiple of the output frequency. The latter spurious signal frequency usually varies with the output level, and may be driven by a frequency tripler stage from 7 megacycles.

This half-wave filter circuit is quite tolerant of impedance mismatch. The attenuation of harmonics is virtually unaffected by mismatch and the very low insertion loss at the fundamental frequency increases but very little with mismatch ratio. A serious mismatch is apt to harm the filter only at high power levels where the maximum current and voltage ratings of the elements may be exceeded. Normally, the Harmoniker should only be inserted in a feed line having a standing wave ratio lower than 2 to 1.

The loss through the filter is only about 0.1 db—thatis, 1/0 dB of an "A" unit. The attenuation of harmonics is as follows: second, 31 db; third, 48 db; fourth, 59 db. For higher order harmonics, the attenuation is about 30 db greater each time the frequency is doubled. The attenuation at half the design frequency is about 20 db.

HARMONIKER CIRCUIT

The limitation on standing-wave ratio makes it desirable to design two different Harmonikers—a low and a high impedance unit—for each band. The circuit diagram, shown in Fig. 1A, is the same for both units, the main difference being that the high-impedance unit requires higher inductance and lower capacitance for a given amateur band.

The input and output terminals are A—B and A—'B', respectively, for balanced transmitted and open-circuit conditions. The high-impedance unit when the line is between 150 and 150 ohms, the components listed in Table 1 for the 100-ohm Harmoniker. Similarly, the 300-ohm components apply for transmission line impedances between 150 and 400 ohms.

The connections for unbalanced feed lines, such as coaxial cable, are A—-G and A—'G' for input and output, respectively. Because only half of the Harmoniker

TABLE I—HARMONIKER CIRCUIT CONSTANT DATA

<table>
<thead>
<tr>
<th>Band</th>
<th>Impedance Class</th>
<th>Cx</th>
<th>Lx</th>
<th>Minimiser No.</th>
<th>Air-Out No.</th>
<th>Turns</th>
<th>Wire Size</th>
<th>Diameter</th>
<th>Length</th>
<th>Turns per In</th>
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<td>1000</td>
<td>450</td>
<td>1.1</td>
<td>3006</td>
<td>508</td>
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<td>12</td>
<td>5/8</td>
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<td>8</td>
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<tr>
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<td>220</td>
<td>0.65</td>
<td>3003</td>
<td>408</td>
<td>10</td>
<td>12</td>
<td>3/16</td>
<td>1 1/2</td>
<td>8</td>
</tr>
<tr>
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<td>130</td>
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<td>3005</td>
<td>304</td>
<td>7</td>
<td>12</td>
<td>5/8</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>35</td>
<td>1000</td>
<td>113</td>
<td>0.39</td>
<td>3001</td>
<td>454</td>
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<td>12</td>
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<td>5/7</td>
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<td>3001</td>
<td>404</td>
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<td>280</td>
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<td>3015</td>
<td>816</td>
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<td>1 1/4</td>
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<tr>
<td>14</td>
<td>3000</td>
<td>73</td>
<td>1.65</td>
<td>3010</td>
<td>608</td>
<td>13</td>
<td>12</td>
<td>1 1/4</td>
<td>1 1/2</td>
<td>8</td>
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<td>111</td>
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<td>3005</td>
<td>500</td>
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<td>3002</td>
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<td>3/16</td>
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<td>8</td>
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<td>456</td>
<td>9</td>
<td>12</td>
<td>5/8</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

Fig. 1A. Schematic diagram of the balanced type Harmoniker. Only the portion of the circuit from the ground box up is required for an unbalanced type Harmoniker for coastal cable.

Fig. 1B. Sketch of correct and incorrect layout and connections at the inter-section shield as noted in the text.
is utilized for unbalanced line, the 100-ohm unit then closely matches the popular 50-ohm coaxial cables. These circuit constants also are suitable for use with 75-ohm coaxial cables. Only the upper half of the coil need be constructed for unbalanced feed lines.

**SELECTION OF COMPONENTS**

Good quality mica capacitors are necessary at all points marked "C." Disc ceramic capacitors usually are not sufficiently stable for this application. The values specified in Table I should be closely duplicated, either by paralleling two capacitors, or by measurement against a capacitor within 5 percent of the specified value. The power levels at which capacitors of various voltage ratings may be operated in the Harmoniker are given in Table II.

A Harmoniker designed to operate at power levels for which 500- or 1000-ohm capacitors are adequate can use the plastic-insulated coils specified in Table I without excessive heating. A unit for a high-power AM transmitter usually will require the heavier coils made from No. 14 or No. 12 wire. Coils having more than 1 microhenry of inductance should be wound on ceramic forms, such as Centralab pillar insulators. The smaller coils are self-supporting when wound from No. 21 or No. 22 wire. The recommended values for Table I include connections to the center wires. (Surely you already must have shunted your rig! If the transmitter is designed to operate on several bands, a separate Harmoniker must be constructed for each band. Some type of plug in connectors should be used to switch in the desired Harmoniker. A selector switch is not recommended, or else harmonic signals may leak around the Harmoniker.

Generally, it will be unnecessary to change the transmitter output stage with the shortest possible length of feed line, plus a heavy conductor to terminal G or G'. Otherwise, harmonics may be radiated from these connections before they can be attenuated by the Harmoniker. Better still, attach the Harmoniker directly to the transmitter shielding. (Surely you already must have shunted your rig! If the transmitter is designed to operate on several bands, a separate Harmoniker must be constructed for each band. Some type of plug in connectors should be used to switch in the desired Harmoniker. A selector switch is not recommended, or else harmonic signals may leak around the Harmoniker.

**HARMONIKER CONSTRUCTION**

A 3-4 x 5-inch Minibox or utility box is large enough to house all Harmonikers except the 300-ohm balanced unit for 80 meters. This unit will require a 4 x 5 x 6-inch box. The parts layout shown in Fig. 3 should be followed closely, including the placement of the intersection shield. This shield may be fashioned from any hard metal sheet or it should be the maximum size that can be fitted into the box. Paint should be removed from the box joints and places where the intersection shield, and terminals G and G' are attached.

Connections to the center capacitors on both sides of the intersection shield should be made as shown in the upper diagram of Fig. 1B. Note that separate leads are run from each coil to the capacitors at points P and Q, and not a common lead, as in W to X. The leads between center capacitors may be run through a 3/8-inch diameter hole in the shield, or by means of small feed-through insulators. Connect the other end of each coil to a capacitor at point B, and not directly to the input or output terminals, as shown at Z. For minimum lead inductance, use heavy wire or copper strap for connections wherever possible.

**INSTALLATION AND OPERATION**

The Harmoniker should be connected to the transmitter output stage with the shortest possible length of feed line, plus a heavy conductor to terminal G or G'. Otherwise, harmonics may be radiated from these connections before they can be attenuated by the Harmoniker. Better still, attach the Harmoniker directly to the transmitter shielding. (Surely you already must have shunted your rig! If the transmitter is designed to operate on several bands, a separate Harmoniker must be constructed for each band. Some type of plug-in connectors should be used to switch in the desired Harmoniker. A selector switch is not recommended, or else harmonic signals may leak around the Harmoniker.

Generally, it will be necessary to change the transmitter output stage with the shortest possible length of feed line, plus a heavy conductor to terminal G or G'. Otherwise, harmonics may be radiated from these connections before they can be attenuated by the Harmoniker. The balanced type Harmoniker will balance the feed line to ground automatically far better than a ground on the coaxial coupling. Opposite terminals on the box will be reversed, if it is designed. Otherwise, at least 93 percent of the transmitter power will be dissipated in the Harmoniker—very disastrous for the Harmoniker when connected to a high-power rig—and likewise for your signal reports with a low-power rig.

Other notes and ideas described in similar half-wave filters have been published as follows:

The Emergency-Portable Rig for 3.5 megacycles originally described in the March, 1955 issue of QST HAM NEWS (Vol. V, No. 2), the Mobile Modulator discussed on page 6 and the Mobile Portable Power Supply (See QST HAM NEWS, March-April, 1953, Vol. V, No. 2) are all versatile companion units. In addition to the portable, emergency and mobile service for which they were designed, this gear will make a good stand-by transmitter for the home station.

CIRCUIT DETAILS

Several mandatory features of any portable rig are, small size, low current drain, self-contained variable frequency oscillator, simple circuit using few low-cost parts, and as high a power output as is consistent with the primary source, a 200-volt, 100-watt vibrato-type supply. The circuit diagram, Fig. 3, shows the final result, a GL-2E26 electron-coupled oscillator, GL-2E26 final amplifier and an OA23 voltage-regulator tube for the oscillator and an amplifier screen voltage. Adequate oscillator isolation is achieved by operating the oscillator grid tank on 1.75 megacycles, thus allowing the plate circuit to 3.5 megacycles, plus selecting a well-shielded pentode tube with a separate suppressor-grid connection. Space and mechanical rigidity limitations ruled out the series-tuned Colpitts oscillator circuit, with its necessary large inductance.

The oscillator may be adapted to crystal control by either of two modifications, shown in Fig. 4. At the left, a crystal socket is substituted for C2, which is then fitted with pins and plugged into the socket for VFO operation. Crystals in the 3.3-megacycle range, when plugged into the socket, may be varied in frequency slightly by tuning C2. The alternate crystal oscillator circuit, at the right, may be substituted only when crystal-controlled operation is desired.

Construction Details

The transmitter is housed in a 4 x 5 1/2-inch utility box, with one removable side serving as a front panel. Bend a 3 1/2-inch chassis from 1/8-inch thick sheet aluminum with a 1/4-inch high flange, and a 1/2-inch front flange. Mount all major components in the locations pictured in the rear view, Fig. 3. Holes must be drilled in the box top and rear plate for tuning the coils. The connections between the ungrounded end of L1, and the stator of C1, is made with small coaxial cable, with the shield grounded at the point which passes through the chassis. Other wiring and small parts locations can be seen in the bottom view, Fig. 6. Silvered mini capacitors are recommended for C1, C2, C3, C4, and C5. Disc ceramic or silvered mica types will suffice for all other capacitors. The 38 turns of

EMERGENCY-PORTABLE RIG

Fig. 4. Alternate oscillator grid circuits for (A) both crystal controlled and VFO operation, and (B) crystal controlled operation only, elevating Cc1, Cc2, Cc3, and L4.

PARTS LIST, E-P RIG

C1 0.05-mfd electrolytic
C2... 100-mfd variable (Remanent MK-100)
C3... 100-mfd electrolytic
C4... 0.002-mfd disc ceramic or disc ceramic
C5... 0.005-mfd disc or disc ceramic
C6... 0.005-mfd disc or disc ceramic
C7... 10-mfd mica
L1... 38 turns No. 26 enameled wire on Norton X-50 coil form; tapped 9 turns from bottom
L2... 3.5 mihercyle of choke
R1... 0.1 megohm 1/2 watt
R2... 22,000 ohm; 1/2 watt
R3... 5,000 ohm; 1/2 watt
R4... 3000 ohm; 5 watt (See Text)

Fig. 3. Schematic diagram of the Emergency-Portable Rig. Jack J is for measuring the GL-2E26 plate current.
TUNE-UP ADJUSTMENTS

Insert the 6AK6 and OA3 tubes, apply heater and plate voltage and adjust L2 until the oscillator covers either 3.5-3.9 megacycles for CW, or 3.55 to 4.0 megacycles for phone operation. Plug a 0-100 ma DC meter into J3, insert the GL-2E26, and short the coaxial output connectors. Tune L2 for maximum brilliance of a neon lamp held close to pin 5 on the GL-2E26, then tune L4 for a dip in plate current on the meter. These adjustments usually will hold over a 100-kilocycle range on the VFO. Remove the meter from J3 and measure the current through the OA3 tube, which should not exceed 30 ma. With the keying jack shorted, the OA3 current should be at least 5 ma and a glow should still be present within the tube.

Remove the short from the coaxial cable connector and connect a 50-ohm dummy load—or a real, live antenna having this impedance—to the transmitter. Total current drain, as measured in the keying jack, should be about 60 to 80 ma with the GL-2E26 working into a load.

TVR HI-PASS FILTER

Can TVI be eliminated from a television receiver for less than half a dollar? The answer is very likely yes, if the TVR Hi-Pass Filter, originally described in the March-April, 1951 issue of G-E HAM NEWS, is installed at the antenna terminals of the TV set. The TVR filter is merely a balanced constant-k high-pass filter, designed for 300-ohm transmission line, with a cutoff frequency of 44 megacycles. It is capable of greatly attenuating signals below this frequency, and passing all higher frequencies, including the television channels. A single TVR filter will cure most TV receiver overload problems, but tough cases may require two filters in series. A schematic diagram is shown in Fig. 7.

TVR FILTER CONSTRUCTION

The "chassis" for the TVR filter is simply a piece of %4\text{in}. thick bakelite, lucite, etc. Insulating board 1 x 1\frac{1}{8}\text{in}. in size. Drill five holes, four of which should be %1\text{in}. in from each corner, and the fifth in the center. Drill and tap each hole for a 4-40 brass screw, which are then assembled with washers and nuts under the heads. Solder the capacitors in place as shown in Fig. 8, at the same time bonding the soldering lug to the machine screw heads.

Cut two 15-inch lengths of No. 30 enamelled copper wire for the coils and fold each double. Remove about 1 inch of insulation at the 56d, solder the wires to-gether and bend the soldered portion at right angles. Measure out 6\frac{1}{4}\text{in}. inches from the bend, cut the wire and tin %1\text{in}. inch at the ends. Wind the coil, starting at one end of the wire, on a rod exactly %1\text{in}. in diameter. Place the completed coil in position, trim the center tap until it just overlaps the center screw and solder in place. Then bend all coil ends with tweezers to such that they can be soldered to the corner screws. Run brass hex nuts on the machine screws and the TVR filter is complete. Keep the coils so small that direct pickup is negligible eliminates the need for shielding the TVR filter.

Even though the radio amateur is not required to install high-pass filters on neighboring television receivers, the TVR filter, under public relations, usually will solve most TVI problems.

Fig. 5. Each view of the 6-P7ig Cells L (right) and L\left(\text{left}) are threaded holes in the cabinet rear plate. The GL-2E26 plate coil, L4, mounts directly behind this tube.

wire specified for L4, L5 and L6 should just fill the coil form in a single layer. Select a resistance value for R1, which limits the OA1 regulator tube current to 30 ma with the key jack, J1, open.

Capacitors in filters over load problems, passing higher frequencies, such as the TVI oscillator, to the receive side. The filter, originally described in the March-April, 1951 issue of G-E HAM NEWS, is installed at the antenna terminals of the TV set. The TVR filter is merely a balanced constant-k high-pass filter, designed for 300-ohm transmission line, with a cutoff frequency of 44 megacycles. It is capable of greatly attenuating signals below this frequency, and passing all higher frequencies, including the television channels. A single TVR filter will cure most TV receiver overload problems, but tough cases may require two filters in series. A schematic diagram is shown in Fig. 7.

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Fig. 6. Under-choke view of the Emergency-Portable Rig. Midget phone jacks can be substituted for the larger jacks.

at the exact center. Drill and tap each hole for a 4-40 brass screw, which are then assembled with washers and nuts under the heads. Solder the capacitors in place as shown in Fig. 8, at the same time bonding the soldering lug to the machine screw heads.

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Even though the radio amateur is not required to install high-pass filters on neighboring television receivers, the TVR filter, under public relations, usually will solve most TVI problems.

Fig. 7. Schematic diagram for the TVR High-Pass Filter. Capacitors C are 12-mfd general-purpose ceramic. Cells L are 1.28 k, 25 turns, No. 30 enamelled wire on a %1\text{in}. diameter form. (See text for coil winding details.)
The companion modulator (originally published in G-E HAM NEWS, July-August, 1930, Vol. 3, Nos. 4) for the Emergency-Portable Rig has a total static current drain of only 30 ma. rising to about 50 ma on voice audio peaks. Thus, the 60-ma current drain of the E.P. Rig, plus the modulator drain, is easily supplied by a 30-volt, 100-ma vibrator type power supply. Bulb distortion level and current drain are lower than with most other modulators having comparable power output.

In the 12AT7 class B push-pull vacuum tube audio amplifier, the modulator operates from the cathode to the plate of the transformer, three twin-triode tubes are used as push-pull voltage amplifiers, cathode-coupled driver, and class B amplifier stages respectively. Only three capacitors and eight resistors are required for the entire circuit, shown in Fig. 9. Note that the cathode current for the 12AT7 driver stage flows through the 37-volt bias battery. The bias is thus divided between the driver and class B stages, 1 to 8 volts, and 15 volts, respectively. Potentiometer R1 serves as a gain control by varying the DC microphonic voltage a limited amount.

Although the 12AT7 class B stage will deliver more than 10 watts peak voice output, the 12BH7A twin triode has a higher plate dissipation per section (3.5 watts, as against 3.75 watts) which might be substituted when maximum power output is required.

Since small modulation transformers can vary greatly in efficiency, a loss of 3 decibels (one half the audio power) is not unusual. The transformer specified for T1 is a component made especially for this modulator, although any transformer having the proper impedances and power rating will serve. (Panther A-383, Thorlarson T-311SM and UTC S-18B).

CONSTRUCTION DETAILS

All components except the phone-CW switch are mounted on a 4 x 1/2 x 7/8-in inch aluminum plate, as pictured in Fig. 10. Matching holes for this switch, control shaft, microphone plug and power cables are then drilled in the front panel of a 4 x 5 x 6-inch utility box in which the modulator is housed. The chassis plate is fastened to the inside of the front panel with 1/4-inch long metal spacers at the four corners.

TESTING

After applying heater, bias and plate voltages, check the bias on the driver and modulator tubes, as previously mentioned. The no-signal modulator plate current should be about 15 ma.Temporarily connect a 5000-ohm-10-watt resistor across the secondary of T1 before applying an audio signal to the modulator input.

Though designed primarily for operation from a storage battery, the Mobile Modulator may be run from an AC power source by disconnecting wire "B" from the battery lead and connecting it instead to a 5.3-volt flat plate transformer. From 4 to 6 volts DC for the microphone is fed into the battery lead. Regardless of the purpose for which it is built, this high quality little modulator should find many users around the ham shack.

**PARTS LIST**

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<tr>
<th>Part</th>
<th>Description</th>
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</tr>
<tr>
<td>C2</td>
<td>1000-µF, 350-volt ceramic</td>
</tr>
<tr>
<td>C3</td>
<td>250-µF, 630-volt paper</td>
</tr>
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Boy! What would we have to do for rag-chewing topics if new technical developments were not constantly coming along for us to hash over! Lately, one of the most popular topics for discussion—on the air, at club meetings, or wherever a group of amateurs congregates—is a double-sideband, suppressed-carrier transmitter for short-wave operation (DSB). Undoubtedly the big advantage of both SSB and DSB signals over the AM is that absence of that old heterodyne-producing carrier. Spacewise, the two sidebands of AM and DSB signals normally will make these signals twice as broad as that from a properly-adjusted transmitter having adequate un-wanted sideband suppression (30 db or greater). Overdriving a linear amplifier following either a SSB or DSB exciters usually results in a much too-broad signal con- tinuing an absence of distortion products. We've heard this condition for too far, too lately, so watch out! To many amateurs the big decision seems to be, "Should I convert my present AM rig to SSB or DSB?" and, which system offers the best results, plus the least complicated conversion? The "best results" question is highly controversial; but two simple methods have been suggested for converting an AM transmitter to DSB, both of which utilize a greater portion of an existing AM rig than a similar conversion to SSB. The same basic type of balanced modulator circuit is used in both DSB systems, but the DSB signal may be generated in either the final amplifier stage, or a low- est exciter stage. The low-level DSB signal is then amplified by operating succeeding stages as linear amplifiers, as in SSB transmitters. In contrast, in a low-power, all-band SSB exciter is quite complex, and the amateur who has built his own presently deserves a pat on the back! The abundance of commercially-built SSB exciters on the air verifies this fact. However, a one-band SSB exciter can be quite simple (see SSB Jr., G.E. HAM NEWS, November-December, 1936, Vol. 3, No. 6) without the extra frequency con- version and spurious signals that usually arise when detection is performed for several bands. This is an easy way for the build-it-yourself radio amateur to get DSB, which is quite satisfactory if he can limit his SSB Jr., can later be incorporated into a heterodyne- type. The reception of DSB signals on a garden-variety communications receiver may be more difficult than one might think, however; the carrier that you re-insert with your rig's receiver's battery connection is often used as the DSB transmitter carrier for best readability. Mis-timing of the DSB signals on the receiver often will make a receiver results in greatly reduced audio intelligibility. This problem can be avoided by means of a good receiver adapter that has a complex carrier phase synchron- izing feed-through mechanism. Communications," Proc. IRE, December, 1935, page 172. "QST," January, 1937, page 296. "QST," October, 1937, page 187. C. J. Grammer, "Suppressed-Carrier AM," QST, March, 1937, page 22. C. J. Grammer, "Suppressed-Carrier AM," QST, March, 1937, page 31.

--SWEEPING the SPECTRUM--

Boy! What would we have to do for rag-chewing topics if new technical developments were not constantly coming along for us to hash over! Lately, one of the most popular topics for discussion—on the air, at club meetings, or wherever a group of amateurs congregate—is a double-sideband, suppressed-carrier transmitter for short-wave operation (DSB)....

Thus, a DSB signal usually is as simple to generate as a conventional AM signal, and somewhat easier than generating an SSB signal. Conversely, DSB signals are more difficult to receive properly than AM or SSB signals without a special adapter on your receiver.

Now that we've briefly outlined the relative simplicity of the equipment required for SSB and DSB opera- tion, let's talk a bit about what happens when you put either type of rig on the air. A lot of the SSB boys con- tact each other on round-table QRO's, some of which collect staggering numbers of participants! The sending conversations often greatly resemble the old-fashioned party-line telephone circuits! Operating thrilly practically requires all stations to be equipped for voice-controlled break-in operation.

After listening to—or operating in—one of these round tables, the advantage over the old system of long-winded alternate transmissions are obvious (and of course may be exaggerated), since the SSB signal-and the other fellow instantly when some QRM lands on the channel is much easier than struggling to maintain solid copy through heterodynes and other hash. It also elim- inates note-taking—or relying on your memory—to be sure of commenting on all subjects the other fellow has covered. And how many times have you patiently listened out loud to a transmission without being able to break in right after the XYL has told you that the steaks are on the table—if I had better get there fast before everything gets cold! Need I say more?

Of course, most boys using DSB transmitters also will want to equip their stations with voice-controlled break-in so that they can jump right into the round- table's conversation when the voice-controlled break-in signal is heard enough to provide any other break-in which the other rig is not equipped to handle. This is usually done with one of three types of stations—AM, SSB and DSB—or participating. For this, it is simply desirable that all stations be within a few cycles of the same carrier frequency, and that voice-controlled break-in be employed. This could and should be a good way to make new acquaintances—as well as renew old ones—among amateurs using other modulation methods, and simi- larly increase your enjoyment of amateur radio as a hobby. Finally, let's coin an appropriate slogan, which will be a useful reminder when you put your rig back on the air.
NEW HANDBOOKS

RECEIVING TUBE ESSENTIAL CHARACTERISTICS

Here's a newly revised and enlarged seventh edition of the G-E Receiving Tube Essential Characteristics handbook. Its 228 pages are packed with technical data on 1593 receiving, special-purpose and cathode-ray tubes, including 299 newly listed types. A saw cuts give maximum plate dissipation ratings has been added—a feature of special interest to most radio amateurs.

Essential characteristics also contain tube classification charts, tube envelope outline drawings and dimensions, characteristic curves, plus 25 pages of typical circuits.

WHERE TO GET THEM

Both Essential Characteristics (left) and the Transistor Manual (right) should be in the library of every ham shack and experimenter's test bench. They are available through your local authorized G-E Tube distributor—please see him for your copies soon!

-Eighthouse Barry

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