

• Recent Equipment —

Squires-Sanders SS-1R Receiver

MANY of the specifications and features of the SS-1R receiver will already be familiar to the reader, because the receiver has been widely advertised and sections of it have been the basis for technical articles.^{1,2} However, in the interests of completeness, we will have to act as though the receiver were a complete surprise and this was the first description.

Although the SS-1R is essentially an amateur-bands-only receiver, it can be made to receive most of the 3.5- to 30-Mc. spectrum, with only a few exceptions. As an amateur receiver, it covers the amateur bands within this range in 500-ke. segments, and WWV can be received at 5, 10 and 15 Mc. Optional 500-ke. segments between 7.5 and 11.0 Mc., and 16.5 and 20.5 Mc., are available for use with a v.h.f. converter.

A general idea of the frequency sequence through the receiver can be obtained from Fig. 1. The first mixer is a 7360 beam-deflection tube, with the local oscillator signal applied to the deflection plates and the incoming signal to the No. 1 grid. The output plates are connected push-pull. Used in this application, the tube has a low noise figure and the ability to handle strong signals without cross-modulation.¹ The output coupling of the first mixer is a band-pass filter, 5.0 to 5.5 Mc. In the 6BH6 oscillator stage, the 9-Mc. crystal is used for 80 or 20, the second harmonic of the 8-Mc. crystal is used for 15 meters, and the second harmonics of 11.5 Mc. or higher are used for 10 meters. When harmonics are used, they are selected by tuned circuits. On 40 meters, the first mixer is bypassed and the antenna circuits feed the No. 1 grid of the second mixer.

The second mixer is also a 7360 balanced mixer, with the tunable (6.0 to 6.5 Mc.) oscillator signal fed to the deflection plates. The tunable oscillator uses a triode section of a 6BK7B in a Hartley circuit, and the other triode section serves as a cathode follower. The oscillator cannot be lightly dismissed, and we will spend a paragraph or two on it later on.

Three degrees of selectivity are available in the 1-Mc. i.f. amplifier. A 5-ke. (at -6 db.) channel is obtained from the transformers alone. With a -60 db. bandwidth of 25 ke., it is used for a.m. reception. A 2.5-ke. bandwidth crystal-lattice filter (5 ke. at -60 db.) is used for sideband and c.w., and a sharp two-crystal filter (0.35 and 2.0 ke. at -6 and -60 db.) is there when the going gets rough on c.w.

Following the selectivity in the i.f. amplifier there are two gain-controlled 6BA6 stages, a fixed-gain 6AX8 pentode stage, and a 6AL5 automatic noise limiter.³ The limiter level is adjustable by a panel control; the limiter is used primarily on c.w., where it does a nice job of protecting one's eardrums.

The a.g.c. rectifier at the end of the i.f. amplifier has a threshold level set by the manual gain control, so that as the gain is reduced manually the a.g.c. can take over on a loud signal. Slow and fast time constants, as well as an "AGC OFF" condition can be selected with a panel switch. In addition, extremely strong signals will apply a.g.c. voltage to the signal grids of the 7360 mixers.

For a.m. reception a germanium diode serves as the detector. For sideband and c.w. reception, a 6BE6 product detector is used. The 6AU6

¹ Squires, "New Approach to Receiver Front-End Design," *QST*, Sept., 1963.

² Squires, "A Pre-I.F. Noise Silencer," *QST*, Oct., 1963.

³ "Bishop's Noise Limiter," *Electronics*, June, 1953. Also see Stiles, *QST*, page 16, June, 1960.

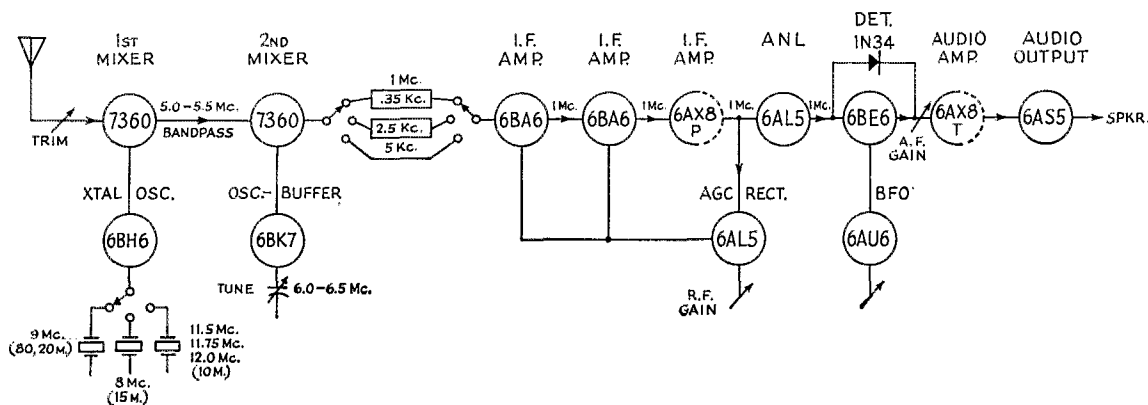


Fig. 1—Simplified block diagram of the SS-1R receiver.

b.f.o. is preset for sideband reception, but on switching to c.w. the b.f.o. panel control becomes operative. Not suggested in Fig. 1 is the circuitry that switches capacitors in and out of the preset b.f.o. so that a panel switch marked "USB" and "LSB" does indeed give upper and lower sideband reception, regardless of the band. Also not shown is similar circuitry across the 6BK7 oscillator circuit that shifts the oscillator just enough to make the tuning dial always read the frequency of the (suppressed) carrier. It is a highly refined extension of the principle first described by Bob Ehrlich.⁴

The audio section of the receiver utilizes the triode portion of the 6AX8 and a 6AS5 pentode to deliver a maximum of two watts of audio.

The Oscillator

We promised a paragraph on the oscillator, and here it is. It is tuned by a variable capacitor (see photograph) at a tuning rate of 10 kc. per knob revolution. That of course is great for sideband or high-selectivity c.w., but it is a lot of knob twisting if you are at 3.5 Mc. and want to check 4.0 Mc. So don't twist the knob — push a button! Immediately a small motor picks up the chore and whizzes you to the other end of the band, at a speed of $62\frac{1}{2}$ kc. per second. Although this doesn't approach escape velocity, it sure beats turning a knob 50 times. Actually the motor tuning also provides a convenient check on a "dead" band. One sets the selectivity at 2.5 or 5 kc., with the b.f.o. on, and the "dead" band can be checked in a few seconds by pushing the proper button, since there is no electrical noise from the motor.

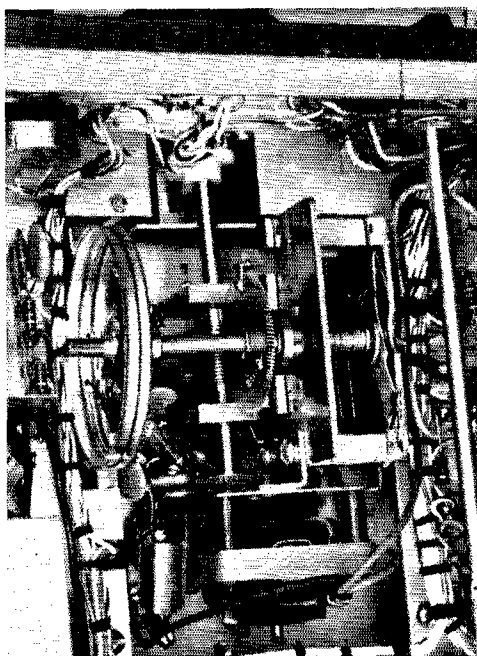
The slide-rule dial of the receiver marks 100-kc. intervals. The receiver frequency is read to the nearest kilocycle through a small window. This is not the usual scale-and-pointer device; it is a counter that displays the numbers 0 through 99, one at a time. A glance at the slide rule tells what 100 kc. section you're in, and the digital indicator does the rest. On 80 meters the slide-rule scale reverses (high frequency at left-hand end), but the usual window closes and a new window opens, disclosing another counter that reads correctly and saves the day. Anyone even remotely connected with the construction of radio receivers will appreciate that it takes quite a capacitor to be used with a digital readout like this.

Sharp observers may have noted the lack of voltage regulation in the block diagram. There is none. The line voltage can be varied over 15 volts or so, and all you can notice is a change in *gain*! We have been told that the oscillator was designed to compensate for voltage changes; there is nothing magical apparent in the schematic, so it must be a trade secret or something. In any event, it is quite impressive.

The Noise Silencer

A companion unit to the SS-1R is the SS-1S Noise Silencer. It is housed in the speaker cabinet

⁴ Ehrlich, "Notes on a Specialized Phone Receiver," *QST*, April, 1953.

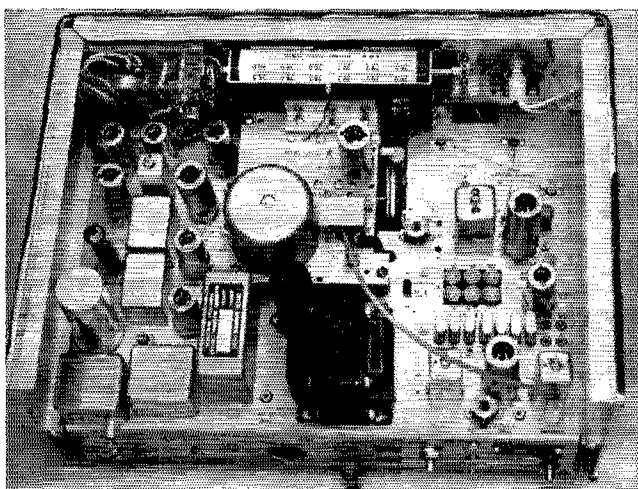


The tuning capacitor for the oscillator is a rugged unit manually operated from the panel through the panel shaft, a worm and spring-loaded gears. The small nylon gears near the panel (top of photograph) drive the digital frequency indicators (counters) and the drum drives the pointer on the slide-rule segment indicator. The small motor is normally disconnected from the panel shaft but engages on demand to drive the tuning capacitor. Small coil to left of motor is part of a low-pass filter in the oscillator output; the special inductor for the oscillator is housed in a shield dome visible in the other photograph.

and is an accessory (doesn't come with the receiver). Its basic principles were described earlier.² The output of the 5-Mc. band-pass first i.f. of the receiver is sampled by the noise silencer, and a noise-blanking pulse is developed. This keys a gate in the silencer. The 1-Mc. output of the second mixer is fed through the gate and back to the selective circuits in the receiver. Switches and threshold controls for the silencer are provided on the panel of the receiver. Having heard most of the noise silencers since Jim Lamb's original, this reviewer is willing to state that this seems to be the most effective of them all. It is not affected by adjacent-channel signals, as were some of the old versions. But before anyone gets the wrong idea, it will not remove all types of noise. It is at its best with high-amplitude pulses of short duration, such as automobile ignition. In common with all such systems, the larger the duty cycle of the noise, the less effective the silencer because it has less time to let the non-interfered-with signal through. The big feature of this silencer is that it accomplishes the silencing without introducing a little noise itself.

The Right Antenna

Unless the amateur radio world is changed overnight, someone is going to connect an SS-1R



Top view of the SS-1R receiver. The front panel and sides are formed from a single piece of extruded aluminum, bent to the proper shape. The chassis slides in or out of grooves formed during the extrusion process.

Platform at top center supports the oscillator section.

to an antenna without reading the instruction book. If the antenna is a random wire, the new receiver owner may be sadly disappointed. He may even think his receiver isn't very good. But if, instead of calling the dealer or the manufacturer, he reads the instruction book, he will find the statement that the receiver is tailored for 50-ohm transmission-line installations. In other words, if your antenna is a dipole or beam fed with and properly matched to 50-ohm line, the input circuits of the receiver will work as they were intended to. If you use an antenna coupler, so much the better, because now you can present 50 ohms to the receiver with any antenna system.

All this is not conjecture on our part. After a large dose of stupid pills we first connected the SS-1R to a long wire. The antenna trimmer didn't peak correctly, and we found a few non-amateur signals. Shifting over to a properly matched beam at W1AW, the receiver became a different box. It was a hard lesson to take, but after preaching the use of receiver antenna couplers for years we should have known better. In a receiver with an r.f. stage, the input circuit can be effective or not, depending upon its design and the antenna in use. But the tuned circuit between r.f. stage and mixer is *always* effective, because it is isolated from the antenna by the r.f. stage. In the SS-1R there is no protection like this, so the antenna *must* look like the 50 ohms the receiver was designed around. Acknowledging this requirement, one then has himself a receiver in the SS-1R.

General

Some day a manufacturer may take the giant step and try to sell a receiver without the "traditional" S meter. (The "traditional" S meter is calibrated in "db. above an extremely strong signal," a very exact measure indeed.) The SS-1R almost made it, but the manufacturer chickened out. The SS-1R S meter has two scales. The top one is the familiar marking, partially in S units and then in db. "over S9." (S9 is obtained with

Squires-Sanders SS-1R Receiver

Height: 7 $\frac{3}{4}$ inches.

Width: 16 $\frac{1}{4}$ inches.

Depth: 13 inches.

Weight: 25 pounds.

Power Requirements: 105-125 v.a.c., 60 cycles; 55 watts.

Price Class: Under \$900 (silencer extra).

Manufacturer: Squires-Sanders, Inc.
475 Watchung Avenue, Watchung,
New Jersey

50 μ v. input at the calibration frequency of 21 Mc.) A lower scale is calibrated in db. above 1 μ v. and runs to 100. It shouldn't take long for shrewd observers to note that S9 on the upper scale coincides with 33 db. on the lower scale. Since "33 db." sounds like a lot more than "S9", it would be no surprise to see the lower scale become very popular, especially on the weaker signals and rarer countries.

The workmanship and quality of the SS-1R is in every way what one has a right to expect from a receiver carrying the price tag it does. The instruction book, packed with the receiver, is well organized and complete, except for page 6. (Here the unpacking instructions for the receiver are given, and we must confess that the SS-1R had been unpacked and enjoyed for several hours before we learned the factory method for removing it from its shipping carton.) — B. G.

Strays

W6IAB has a wallful of BPL cards, but still needs some QSLs for WAS. Do you owe him a card?

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S.s.b. 100 years old? Lord Tennyson began one of his poems "Break, break, break." — WØRA

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