Sherwood Model SEL 300
Digital Readout Stereo FM Tuner

MANUFACTURER'S SPECIFICATIONS
IHF Sensitivity: 1.5 μV. **FM Quieting:** 0.9 μV for —20 dB; 3.0 μV for —50 dB. **Alternate Channel Selectivity:** —85 dB. **S/N Ratio:** —70 dB. **AM Suppression:** —65 dB. **THD:** 0.15% at 100% modulation (mono). **Spurious Response Rejection:** —100 dB. **Image Rejection:** —80 dB. **IF Rejection:** —110 dB. **Stereo Separation:** —40 dB @ 1 kHz. **Frequency Response:** (mono) 20 to 20 kHz ±1 dB; (stereo) 20 to 15 kHz ±1 dB. **Size:** 5¼ in. H. × 16¼ in. W. × 14 in. D. **Shipping Weight:** 25 lbs. **Retail Price:** $579.00.

The new Sherwood SEL 300 Tuner is truly the embodiment of "an idea whose time has come." While not the first high fidelity component to utilize "digital readout tuning," it is the first such unit which we have had an opportunity to analyze and measure and, as such, provided us with a whole new series of performance features which cannot, for the moment, be compared with any other similar units. In one sense, it is almost a pity that the "digital readout" features predominate in all of Sherwood's promotional material and advertising, for in point of fact this new tuner has so very much to commend it from a performance standpoint. More about that in a moment.

As can be seen in the front panel view, the tuner has no familiar dial scale. Instead, the upper left portion of the gold and black panel has four readout tubes mounted behind it. The tubes themselves are normally not visible since this portion of the panel is constructed of smoked plastic. Only the incandescent-illuminated digits themselves are visible when the tuner is powered. Sherwood indicates in its instruction manual that the life expectancy of these display tubes is 100,000 hours. Even if you're a 12-hour-per day FM buff, that works out to about 25 years! Alongside the digital readout area are two meters—one for center-of-channel tuning, the other for indicating relative signal strength and for aiding in antenna orientation. There follows a good sized tuning knob, coupled to an effective flywheel (and we must confess that it takes a bit of

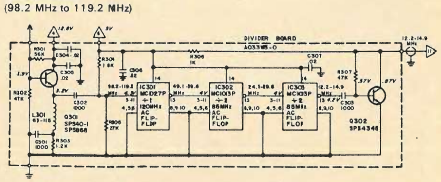

Fig. 1—First logic module in digital read-out circuitry divides local oscillator frequency by eight.

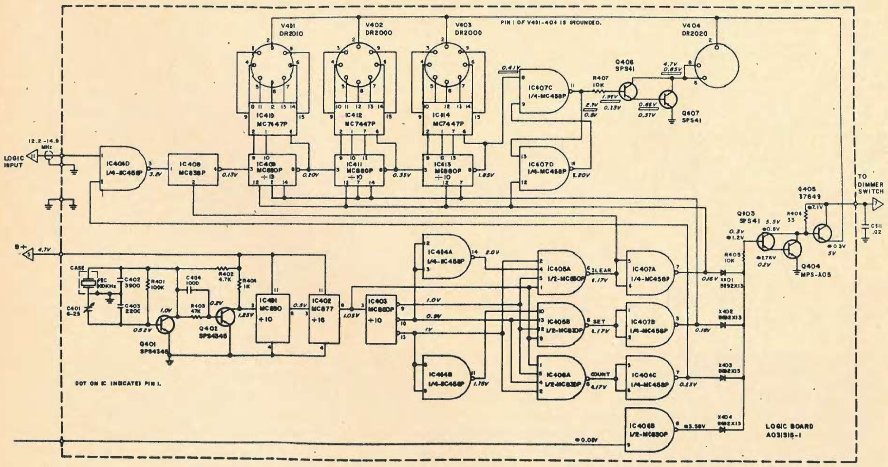

Fig. 2—Major logic module contains 100 kHz reference, or "clock" frequency crystal oscillator, further divides IC's and the necessary logic "gates" to drive the segments of the numeric read-out tubes.

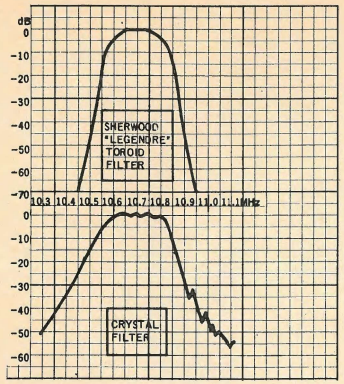

Fig. 3—Sherwood's published comparison between its i.f. bandpass response using multipole filters and "inferior" crystal filters. I.f. systems using conventional tuned interstage transformers would probably suffer even more by comparison.

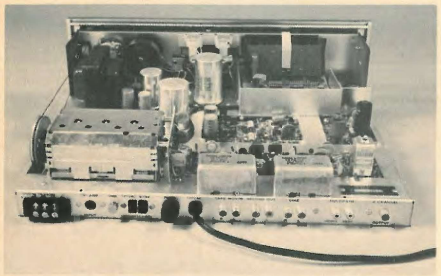

Fig. 4—Rear view of the SEL 300 chassis.

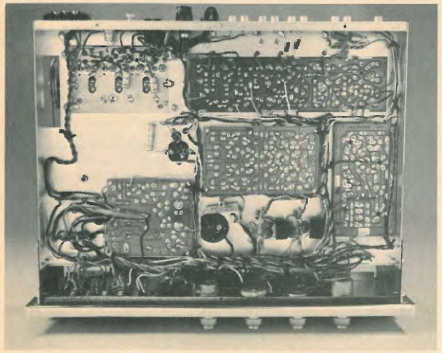

Fig. 5—Bottom view of the SEL 300 chassis.

getting used to, to spin the tuning knob and see only rapidly changing digits instead of the usual travelling dial pointer). A step-switch attenuator offers precise settings of output from +4 VU to −63 VU and an OFF position in ten discrete settings. Along the bottom half of the panel are a power ON-OFF switch, a HUSH control (Sherwood's name for its muting circuit), a BRIGHTNESS control for the readout tubes (they can be extinguished entirely or set to three levels of brightness), a VOLUME control for the adjacent stereo phone jack (yes, the phones can be directly powered from a built-in low powered pair of audio amplifier channels), a tape dubbing jack and a series of six push-push button switches. These switches take care of the tape monitor function, the mute on/off action, FM-mono/stereo switching (used only when a stereo station is too noisy and distant to be received satisfactorily in the stereo mode), a high frequency noise filter (for reducing background noise with only moderate reduction in frequency response and high frequency stereo separation) and two more buttons which require a bit of explanation.

A stereo-only button, when depressed, acts to "mute" all monophonic stations, allowing only stereo programming to reach the various output jacks. The last button is identified as interstation readout blankout and, as the name implies, it causes the readout tubes to light *only* when a station is received. It should be noted that all readouts are in increments of 200 kHz, corresponding to actual FM station frequency allocations. Thus, the digit beyond the decimal point reads only 1, 3, 5, 7 or 9. Thus, in tuning for a given station, say 96.3, the reading will remain constant from 96.200 MHz all the way to 96.399 MHz. This suggests that based upon the digital readout only, a user might be mistuned by as much as 100 kHz and still get a "correct" digital readout. It is for this reason that the center-of-channel tuning meter is still a "must" in this system.

The rear panel has terminals for connection of either a 75-ohm or 300-ohm transmission line. There is also a 75-ohm antenna jack which accommodates a standard Motorola-type coaxial plug. Pairs of outputs are available for tape monitor, record output and line output. In addition, there are a pair of outputs intended for connection to the horizontal and vertical deflection plates of an oscilloscope and a "4-channel output" jack. The latter jack is a takeoff point at the discriminator (detector) of the tuner i.f. system and anticipates the future possibility of FCC approval of a discrete system of "four-channel" broadcasting. Talk about "non-obsolescence"! The rear panel layout also includes a ground terminal, a line fuse and an unswitched convenience a.c. receptacle.

Naturally, the most intriguing part of the circuitry of the SEL 300 tuner has to do with the digital read-outs, and the two portions of the schematic diagram relating to this function are shown in Figs. 1 and 2. Essentially, the circuit operates much like any commercially available frequency counter. What is "counted" in this instance is the frequency of the local oscillator, which is always 10.7 MHz higher than the incoming frequency. Figure 1 shows a series of "divide by two" logic IC's which reduce the oscillator frequency to a range of 12.2 to 14.9 MHz (a total division by eight). In Fig. 2 a 100 kHz reference crystal acts as a "clock" frequency against which the further divided incoming oscillator frequency is compared in a series of logic IC's which ultimately trigger and fire the various segments of the four read-out tubes. Readers familiar with digital electronic techniques will have no trouble following the "logic" of these circuits. Those readers who can think only in "analog" terms will have to take our word for it—the circuit works, and works very well indeed.

Of equal (or perhaps greater) interest to us was the rest of the circuitry—that part of the tuner which enables us to *hear* clean, noise free, undistorted FM at its best. A *pair* of FET r.f. amplifiers in cascade, followed by an FET converter

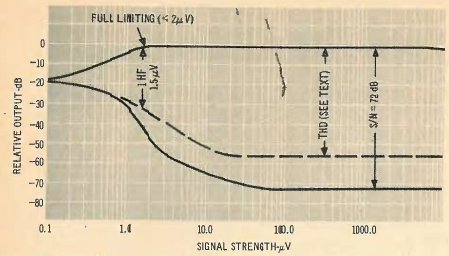

Fig. 6—FM characteristics.

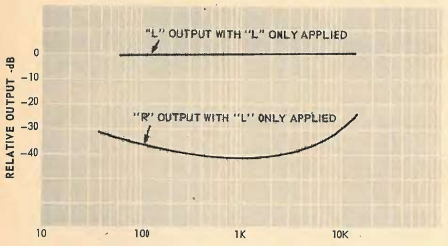

Fig. 7—Stereo FM separation characteristics.

stage and a 3-IC i.f. system which remains in perfect alignment thanks to a pair of multi-pole "Le Gendre" type toroidal filters as well as a *real* Foster-Seeley discriminator circuit, yield sensitivity figures that are unequivocally the *best* we have checked to date and selectivity characteristics which were so good that we were able to tune in *several* channels which were only 200 kHz removed from strong, local stations. It goes without saying that alternate channels (400 kHz apart) were the rule, all over the band, rather than the exception. As a matter of interest, Fig. 3 (taken from Sherwood's instruction manual) shows the excellent i.f. bandpass characteristic of the SEL 300 as compared with crystal filter arrangements which Sherwood obviously feels are inferior to the multi-pole filter approach—and we tend to agree.

Multiplex circuitry is fairly conventional and is the usual "bridge demodulator" automatic switching type. We found this portion of the circuitry to be in perfect alignment, giving the separation results claimed by the manufacturer. Views of the internal construction of the chassis are shown in Figs. 4 and 5.

Measurements

We have, in the past, stressed the importance of early limiting and "steep" quieting characteristics in a good FM tuner. While the Sherwood SEL 300's IHF sensitivity of 1.5 μV is impressive enough in itself, Fig. 6 discloses the fact that full limiting is actually achieved at an input level of less than 2 μV, while 50 dB of signal-to-noise ratio is attained with an input of 3 μV. (Actually, we measured S/N of 53 dB at this low input level). Ultimate S/N reached 72 dB as opposed to the 70 dB claimed by the manufacturer. As for THD, very frankly we have to take the manufacturer's word at 0.15%. Our FM generator itself is *known* to produce about 0.25% THD and that is exactly what we read when trying to measure the mono THD of the SEL 300. (Anyone want to buy a slightly used FM generator in excellent condition?)

The stereo separation characteristics of the SEL 300 are shown in Fig. 7 and are seen to be every bit as good as FCC *transmitter* requirements (at least 30 dB from 50 Hz to 15 kHz). At mid-frequencies we read 40 dB, as claimed, though the tuner may well be doing a bit better since, again, that is about the reliable limit of our stereo generator's separation capability. (Anyone want to buy a slightly used stereo generator in excellent condition?)

Other pertinent facts we learned about the SEL 300 are that the hush control may be set as low as a 2.5 μV threshhold and all interstation noise will be eliminated. We wonder, in fact, why Sherwood offers so much front-panel range for this control. If, as is the case, 3 microvolt signals are perfectly listenable, why would anyone want to block signals of, say, less than 10 μV? The station read-out sensitivity is just under 4 μV, which means that it is possible to listen to a few very weak signals which are not strong enough to trigger the readout tubes when the INTERSTATION READOUT BLANKING button is depressed. Of course, if such a situation exists in your area you have but to release this button to read the received frequency. With this button released, all frequencies are read, regardless of whether a station is being received at the particular frequency or not.

Listening Tests

Without using our antenna rotator (and allowing the antenna to face due west, towards New York City, some 20 miles from our location), we did not miss a single alternate channel from 92.3 MHz to 107.9 MHz. That is, every 400 kHz we heard a listenable signal. Below 92.3 we received only four additional stations (this is the "non-commercial" or educational segment of the FM band) and that was simply because some of the lesser educational stations are not on the air all the time. Thus, with no antenna reorientation we received 45 usable signals, of which 28 were broadcasting in stereo. Reorientation of our antenna by means of our rotator brought in an additional 15 stations from the north and northeast, for a grand total of *60* different signals. More importantly, this last experimentation enabled us to really check the aural significance of a selectivity specification in excess of 80 dB. It is, indeed, highly significant, for we were dealing with *adjacent* channels (only 200 kHz apart) in this last phase of our tests—and some of the adjacent channels involved were adjacent to local signals with measured signal strengths at our antenna of more than 10,000 μV!

We also utilized the "multipath" 'scope jacks on the rear of the tuner to orient our antenna properly for those signals which did exhibit significant amounts of multipath interference and were able to clean up all but about three. Invariably, the least multipath interference occurred when we directed the antenna to points *other* than the "maximum signal strength" point, as indicated on the meter alone. Anyone fortunate enough to own this tuner will not be doing it justice unless he avails himself (even if on a borrowed basis) of an oscilloscope with which to record the "least multipath" antenna positions for his favorite stations. We realize that the SEL 300 might have cost considerably more had it been provided with a built in 'scope tube, such as is supplied by some of the high-priced competition, but it just might have been worth it.

As for our reaction to the digital readout feature, in a word, it's "comforting"—comforting to know that we really *have* tuned to the station of our choice without having to wait for a station identification. If that were the biggest selling point of this "over $500 tuner" we would seriously question its merit. But, confronted with a tuner that *performs* like the Sherwood SEL 300 we can only wish that the digital readout innovation helps Sherwood sell a lot of them, so that discriminating FM listeners will have an opportunity to judge it as an FM tuner—not as an eye-catching "gimmick." *Leonard Feldman*

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