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Product Review

Conducted By Paul K. Pagel,* N1FB

Yaesu FRG-7700 Communications Receiver

The general-coverage communications receiver has always been a welcome addition to the ham shack. Depending on your operating habits and interests, such an addition might be looked on as a luxury or necessity. Though many of the older receivers are still performing "yeoman service" today, you might admit they are large, power-hogging heavyweights with faces only a radio enthusiast could love. In contrast, today's general-coverage receiver is compact, lightweight and perhaps attractive enough to occupy a place in the family living room. The Yaesu FRG-7700 fits the latter description.

General Description

Yaesu's '7700 is an ac-operated, dual-conversion, PLL frequency-synthesized receiver, that permits reception over the range of 150 kHz to 30 MHz in thirty 1-MHz bands. Ten 1-MHz bands on one sector of the BAND switch are assigned specifically for coverage of the hf amateur frequencies, while another sector of the switch has all 30 positions. This feature eliminates needless stepping of the BAND switch should the operator be interested in listening only to the amateur frequencies at a given time.

The optional 12-channel memory unit (MU-7700) was supplied with the review unit. This option easily and quickly installs on the rear panel of the receiver; it is a useful accessory. Particular frequencies on any band of operation may be stored and recalled by the push of a button without the need to index the BAND switch no matter what the frequency difference is between that to which the receiver is tuned and the memorized frequency. A ±1 kHz FINE tuning control permits the memorized frequency to be "rubbered." Unfortunately, no fine tuning or BFO control exists for VFO operation. A readily accessible three-cell battery clip (batteries not supplied) provides memory-unit backup when the receiver power is turned off or disconnected from the line.

Controls and Features

Front panel layout is attractive and the controls are well placed. Two pairs of concentric controls exist: AF GAIN/TONE and Memory FINE/SQUELCH. Square and rectangular brushed aluminum push buttons are used for many other functions.

A 12-hour clock with A.M. and P.M. indicators and a 59-minute sleep timer is built in. The clock may be programmed and set from the front panel push-button switches and used to turn the '7700 on and off. The FUNCTION switch determines whether the digital readout displays the received frequency or one of the several clock functions. A DIM push button reduces the illumination of the S meter and both the analog and digital dials. Beneath the front-panel-mounted speaker and adjacent to the POWER switch are a 1/4-inch (6.4-mm) PHONES jack and a miniature RECord jack (used

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Yaesu FRG-7700 Communications Receiver Serial No. OMO314224

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 150 kHz-30 MHz.	As specified plus 50-kHz overlap at high and low band edges.
Modes of reception: A-m, ssb, cw, fm.	As specified.
Frequency readout: Analog and digital; 5-digit, orange LED digital display.	0.3-in. (8-mm) digits.
Resolution: Analog, 10 kHz; digital, 1 kHz.	As specified.
KHz/turn of knob: Not specified.	38
Backlash: Not specified.	Nil
RIT range: ±1 kHz with optional memory unit.	As specified.
Attenuators: Rear panel, switchable 20 dB; front panel, continuously variable.	Rear panel, 26 dB; front panel, as specified.
S-meter sensitivity (μV/S9): Not specified.	2000 m, 1500; 160 m, 660; 80 m, 24; 40 m, 27; 30 m, 37; 20 m, 40; 17 m, 49; 15 m 66; 12 m, 66; 12 m, 68; 11 m 80; 10 m 100.
DB/S unit: Not specified.	Variable from 1 to 6 dB from S1 to S9; each 20-dB step above S9 measured 10 dB.
Receiver sensitivity (μV/50Ω), 2-30 MHz: A-m, 5; ssb/cw, 0.5; fm, 1.	Receiver dynamics measured with 2.7-kHz ssb/cw filter. No narrow bandwidth cw filter available.

	80 M	*20 M*
Noise floor (MDS) dBm:	−126	−114
Blocking DR (dB):	noise limited	noise limited
Two-tone 3rd order IMD DR (dB):	75	82
Third-order input intercept (dB):	−13.5	9

Audio power output (8-ohm load): 1.5 W.
Frequency stability: < ±1 kHz from 1-30 min. after power applied; < ±300 Hz after 30 min. warm-up. 600 Hz from a cold start to one hour later.
Power requirements: 100/120/220/240 V ac, 50/60 Hz, 39 VA with memory unit.
Size (HWD): 5 × 13 × 8.9 inches (129 × 334 × 225 mm).
Weight: 13.2 lb (6 kg).
Color: Gold-brown.

for tape recording received stations). The output level of the RECord jack is fixed and unaffected by the position of the AF GAIN control.

The rear panel supports a 3-prong male ac socket (the line cord is detachable), ac operating voltage selection switch, fuse holder and EXTernal SPeaker jack (miniature type). Two phono jacks provide access to a set of internal relay contacts. An SO-239 coaxial antenna connector; the fixed, switchable ATTenuator (also labeled DX/LOCAL); a 5-pin DIN jack for ACCessory connections (two for antenna attachment, one for a ground wire and another connected to the receiver muting line) are also on the rear deck.

Circuit Description

Incoming signals are either routed around or through the fixed, switchable front-end attenuator. It then passes through an L-C low-pass filter and through one of six diode-switched band-pass filters before reaching the rf amplifier. Up-conversion to 48 MHz takes place in the first mixer. The signal is then passed to the first i-f crystal filter, which has a 20-kHz bandwidth. The signal proceeds to the second mixer for conversion to the second i-f of 455 kHz. A 20-kHz-wide ceramic i-f filter, noise blanker circuitry and switch-selected ceramic filters for the different modes are next in line. A-m selectivity positions of 12, 6 and 2.7 kHz are provided with 2.7 kHz being used for ssb and cw reception. For fm signals, a 15-kHz-wide filter is used. The signal is then demodulated, amplified and passed on to the audio chain.

Operational Comments

While the 38-kHz-per-turn tuning rate of the VFO is somewhat rapid, it is manageable. I found the analog dial to be somewhat superfluous with its 10-kHz increments, and noted the skirt could easily be knocked out of calibration by a hasty hand on the tuning knob. The addition of a BFO or fine-tuning control would be an asset. Since the BFO frequency is not counted in the mixing scheme, a frequency readout error of 1 kHz on usb and 2 kHz on lsb (as read from the display) exists when zero beating a particular frequency.

A number of "birdies" were noted, primarily on 10 meters. Most of them were weak, and none was strong enough to cause deflection of the S meter. I also heard quite a few weak RTTY "signals" (images), which appeared to populate the 10- and 12-meter bands during operation from a suburban location. A trap tribander and 40-meter, half-wave sloping dipole were used for antennas.

The agc time constant may be switched between FAST and SLOW, but no OFF position is provided. Some agc popping occurs, but I did not find it to be annoying. Noise-blanker action appeared to be ineffective against most types of noise encountered.

Overall mechanical and electrical stability is very good. There's lots of audio power available, and the quality of the recovered audio while using the built-in speaker did not leave me wanting. It's too bad the manufacturers of general-coverage receivers haven't recognized the desire many prospective buyers have for owning a receiver that has a 24-hour clock instead of the 12-hour types being supplied presently.

A capacitively coupled antenna input circuit is used. Thus, there is no dc discharge path to ground for antenna static build up.

The fm reception capabilities of the '7700 should be an attraction to many who might like to copy the ever-growing number of fm stations on 10 meters. Also, by placing a converter ahead of the '7700, you can extend your listening range into the vhf spectrum. The SQUELCH control operates only in the fm mode.

The rear panel has a rectangular plug fitted over a hole, above which a DC label appears. Though the manual makes no mention of this and the plug and label cannot be seen in the rear-panel photograph, a 12-V dc option is available from Yaesu. Many prospective purchasers, I'm sure, will want to add this low-cost feature. The unit certainly is designed for going places, with the built-in carrying handle and feet mounted on opposite ends of the cabinet.

I'm sure a number of amateurs and SWLers will be adding the FRG-7700 to their "desirables" list. The FRG-7700 is manufactured by the Yaesu Electronics Corp., 6851 Walthall Way, Paramount, CA 90723. Price class: $550; dc kit, $6; MU-7700, $150. — *Paul K. Pagel, N1FB*

THE RADIO SHACK DX-302

☐ This synthesized, triple-conversion, general-coverage receiver is designed to receive cw, a-m and ssb signals at frequencies from 10 kHz to 30 MHz. The '302 will operate from 117-volt house current or from a 12-volt supply. An external 12-volt supply may be used or eight C-size batteries may be installed internally. Should the ac power fail, the internal battery supply will be switched in automatically.

Front panel controls include: PRESELECTOR BAND, PRESELECTOR TUNE, BFO PITCH, RF GAIN, VOLUME, MODE, WIDE/NARROW SELECTIVITY, 0-20-40 dB ATTENUATOR, LIGHT/BATTERY TEST and MAIN TUNING. A PRESELECTOR tuning dial, signal strength and battery meter, phones jack and five-digit frequency display complete the layout. At the rear of the receiver is the access door for the battery compartment, an EXTERNAL SPEAKER jack, a TAPE OUT jack for interconnection with a tape recorder, and a KEY jack. With the proper control setting, the receiver may be used as a Morse code practice oscillator! An SO-239 connector is provided for use with antennas exhibiting a 50- to 75-ohm impedance. A terminal strip is used for mute, ground and single-wire antenna connections. The ac line cord, fuse holder and 12-volt external dc supply jack are also mounted on the rear panel.

"Kenwood R-1000 General Coverage Receiver," Product Review, *QST*, Dec. 1980, pp. 46-47.

Frequency Selection and Display

Tuning in a station with the '302 is different from most receivers — except for its predecessor, the DX-300. The PRESELECTOR BAND switch is first to set to the band of interest. Then, the PRESELECTOR TUNE is adjusted to the approximate frequency of the desired signal (it never gave a very definite peak). Next, the main tuning control comes into play. It consists of two concentric knobs, an outer MHZ knob and an inner KHZ knob. By means of the outer knob, the synthesizer is incremented in 1-MHz steps, and the inner knob tunes the receiver within the 1-MHz block you have chosen. The tuning rate of the inner knob is approximately 65 kHz per revolution. The outer knob does not have a positive detent, and the adjustment is critical. Sometimes the proper position was found at a point just on the edge of synthesizer lock.

The BFO is not accounted for in the frequency-mixing scheme. When it is used, the displayed frequency differs from the actual received frequency by 2 kHz. Therefore, when receiving lsb signals, 2 kHz must be added to the displayed frequency and subtracted when receiving usb signals.

Operational Notes

The nonswitchable agc time constant is fast, but "comfortable." Received audio was found to be somewhat unpleasant because of distortion, but not unduly so. The '302 overloads in the presence of strong signals. While using the receiver coupled to a 5-foot (1.5-m) long indoor antenna (five blocks away from W1AW), the station made its presence known even when it was not tuned in. On the 10-meter band, W1AW was heard as far as 200 kHz away from its actual operating frequency. Interestingly enough, the tuned-in signal registered only 25 dB over S9, which indicated the meter to be somewhat unresponsive.

Receiver "birdies" were found throughout the range of the '302. Usually a "birdie" could be eliminated by careful tweaking of the MHZ knob. Two exceptions worth noting occurred at 910 and 1000 kHz. The instruction manual mentions these responses and states that they are normal because of the Wadley Loop synthesizer circuit used in the receiver.

Use of the high-impedance antenna input is recommended by the manufacturer for long-

Radio Shack DX-302 Receiver Serial No. 000281

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 10 kHz-30 MHz, continuous.	As specified.
Modes of operation: Ssb/cw/a-m.	As specified.
Readout: Digital, five 7-segment LEDs.	Red 0.5-inch (12.8-mm) digits.
Resolution: 1 kHz	As specified.
KHz/turn of knob: Not specified.	65
Backlash: Not specified.	Nil.
Agc auto/man. selected: Not specified.	No.
BFO range: ±1 kHz.	As specified.
Receiver attenuator: 0-20-40 dB.	As specified.
S-meter sensitivity (μV/S9): Not specified.	80 m, 50; 40 m, 50; 20 m, 50; 15 m, 110; 10 m, 175.
Receiver birdies/spurs: Not specified.	Multiple, each segment: None registers on meter.

Receiver sensitivity: Ssb, 0.03 μV for 10-dB S/N.	*80 M*	*20 M*
Noise floor (MDS) dBm:	−129	−127
Blocking DR (dB):	Not measurable.	
Two-tone third-order IMD DR (dB):	37	52
Third-order input intercept (dB):	−71.5	−49

Audio power output (8-ohm load): 0.8 watts.	As specified.
Audio quality: Not specified.	Fair.
Power requirements: Ac — 120 volts 60 Hz, (220/240 volts 50 Hz for European/Australian models).	
Dc — 8 "C" cells or external 12-V supply, negative ground only.	As specified.
Power consumption: 120 V, 15 W; 12 V dc, 8 W.	
Frequency stability: Within 1 kHz during the first hour after 60 min. of warm-up; within 2 kHz during 10 min. after initial turn-on.	Within 4.55 kHz from cold start to one hour later.

Size (HWD): 6 × 14.5 × 10 in. (146 × 362 × 254 mm).
Weight: 13.2 lb (6 kg).
Color: Black.

wave reception. Some beacons were heard in that range, but local QRN ruled out the possibility of any DXing.

The DX-302 is suitable for *casual* listening on the amateur bands. It comes supplied with a telescoping whip antenna and a 30-foot (9-m) wire antenna. While not technically oriented, the instruction manual adequately introduces the owner to the operation of the receiver and the wonders of shortwave listening and Amateur Radio. The DX-302 is manufactured by Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102. Price class: $400. — *Bruce Kampe, WA1POI*

THE AEA MORSE MEMORY KEYER MODEL CK-1

☐ It is difficult not to use words like "amazing" and "impressive" in describing this compact electronic keyer. A few minutes spent with it will just begin to uncover its unusual flexibility. It takes some familiarity to tease the most out of the nearly shirt-pocket-size device, but the excellent instruction manual does a fine job of making you feel right at home with it.

Many features of the CK-1 have been designed for the dedicated cw operator. They include an extremely versatile memory-load and edit capability, automatic serial numbering, rapid cw speed changes and full weighting control.

The front panel of the CK-1 is little larger than the key pad that is used to call up each of the features. There are two other controls: a top-mounted power ON/VOLUME (sidetone) control and a memory-load switch on the left side.

Speed Change and Adjustment

At turn-on, the keyer has set into it two speeds, 20 and 30 wpm. Either of these speeds may be called up by pressing two buttons for each speed. If these speeds are not desired, any speed from 1 to 99 wpm may be inserted in the two preset speed positions. A variable speed feature provides speed selection within the above range of speeds. Alternating dots and dashes are automatically sent during the change to advise the operator of the increasing or decreasing speed.

Sidetone Change

The starting sidetone frequency is set at 500 Hz. The pitch may be lowered or raised through a range of approximately 50 tones. It would be difficult not to find a tone to please the most finicky operator.

Automatic, Semiautomatic and Iambic Operation

Here I had a little fun. When first turned on, the keyer is set for automatic, iambic operation. The keyer may be set for "bug" operation by pressing three keys. The exclusive use of a keyer for more than 20 years has reduced me to a "fumble fingers" when attempting to use a "bug." However, the instruction manual says one may set up for "bug" operation and put a message in memory. The keyer will revert to automatic operation when the message is sent from that memory. Deciding that a real test was in the making, I keyed in a message, very poorly. When it was sent by the memory, out came perfect cw, in no way resembling the poor job done in storing the message. Ah, there's hope for all! More about the message memories in a moment.

Iambic keying fans haven't been forgotten either. A dash may be inserted in a string of dots, and similarly, a dot may be inserted in a string of dashes. If one chooses, these memories may be disabled.

Dot-Space, Dash-Space Ratios

Though it might not be apparent from listening to some of the signals on the bands, good cw is supposed to be formed by making a dot equal to the space between parts of characters, and a dash equal to three dots. Therefore, a dash is equal to three intra-character spaces. In the CK-1 these dot-space and dash-space ratios may be tailored to suit individual preferences, though why anyone would wish to use any spacing other than the perfect (and *correct*) 1 to 3 ratio is difficult to understand. The dot-space ratio (normally at 1.0) is adjustable from 0.5 to 1.5. The dash-space ratio, initially at 3.0, may be adjusted between 2.0 and 4.0. In other words, one may select short or long dots, and short or long dashes.

Transmitter Tuning and Message Memories

The * and 5 keys place the CK-1 in a key-down condition that may be used to turn one's transmitter on for tuning. Touching any key pad or the paddle terminates the tune procedure.

The CK-1 has an approximately 500-character memory, which may be divided up into 10 random-length memories. This is known as "soft partitioning." Actual memory length depends upon the length of stored characters, the number of pauses and the length of each pause. The memory length of each message location is adjusted automatically during loading.

Real-time memory loading or automatic character and word-space loading may be selected. In real-time loading, all pauses will be recorded. The keyer powers up in automatic memory mode. In this mode a pause longer than two space lengths records a character space. A pause longer than five space lengths records a word space. At this point, loading stops until the next character is sent.

Maintenance of the memories requires constant application of the 12-volt power source.

If power is removed, or momentarily interrupted, all memories will be dumped. In testing the CK1 at W1SE it was found that just turning the VOLUME control to its lowest point was sufficient to dump the memories. The manufacturer offered the explanation that the power switch actually starts to open at the point of lowest volume, well before the "click" of the switch is audible. He suggested wiring across the switch. This was done with a 1/2-inch (13-mm) length of wire. Now, no more inadvertent memory dumps. Actually, the CK-1 is designed to be left on continuously, and has been for many months at W1SE. To erase one of the memory locations requires only that one switch to MEMORY LOAD, press the number of that memory and the pound sign, #. Random characters appear in each memory when the keyer is first turned on. These should be erased by the technique mentioned above, before loading is begun.

Automatic Serial Numbering

Tailor-made for the contester, the automatic serial-number function alone is probably worth the price of the keyer. The keyer will automatically increment from 01 to 9999, or it can be started at any number one may choose. The serial number may be inserted anywhere in a message, to appear as many times as one selects, and it also may be repeated upon demand. Once the memories are loaded, the touch of only one button at the desired memory location is required to send a message from a memory containing a serial number. This remarkable keyer has even more features, including editing, extra word and character spaces, and a "memory full" warning.

In the past several months of operation at W1SE, only one problem arose, and the manufacturer advises that this problem has been solved. He had been supplied about 50 faulty 0.01 μF capacitors. Most never made it out of the plant, but one of them was in the keyer reviewed. The capacitor was replaced with a new one supplied by the manufacturer. He tells me that all keyers that fail as a result of this capacitor will be repaired free of charge.

The capacitor is located on the bottom-right side of the circuit board. It is across the paddle dash input line. Failure of the capacitor is evidenced by continuous dashes from the keyer.

The CK-1 is manufactured by Advanced Electronic Applications, Inc., P.O. Box 2160, Lynnwood, WA 98036. Price class: $130; AC-2 power supply, $10. — *Lee Aurick, W1SE*

HAL MESSAGE STORAGE OPTION

☐ The folks at HAL have come up with a new addition to their line of sophisticated gear, aimed primarily at the RTTY/ASCII gang. The MSO-3100 Message Storage Option, a factory installed accessory for their DS-3100 ASR terminal,[2] will provide more than 32,000 characters (approximately 450 lines) of additional memory. The MSO-3100 was designed with Electronic Mailbox operation in mind.

Messages may be stored in the MSO in variable-length files with passwords for security if desired. The contents of a file may be accessed locally or remotely, read on the DS-3100 screen, or printed out on an external printer. A directory is available that gives a complete listing of all your files and the level of security for each, and lets you know how much file space has been used and how much is still available. When a file is deleted, the remaining files are compressed so that all the remaining space is in one block.

Once the MSO is activated, a valid command in the receive buffer of the DS-3100 will be obeyed. Thus, it may be inserted by typing it on the DS-3100 keyboard and transferring it to the receive buffer, from another keyboard or tape locally, or by a signal received from a remote station. Just a few commands are necessary to operate the MSO, and a couple of hours of experimentation will show just how simple and versatile it is. First, the DS-3100 is set in the "MSO Enable" mode. Now, a simple letter-group command, such as MSOWPR, indexed to the left margin in the receive buffer, will activate the MSO. The DS-3100 has a real-time clock, so the correct time and date should be entered. Each file will carry both the time and date it was originated and that it is read. A valid command must be indexed to the left margin and consists of a period (.) followed by the command and file name and "Newline" symbol. For example, to store your brag tape into the file, simply type ".Write Brag" and hit the "Newline". Then copy your tape into the buffer and at its conclusion type "Newline" followed by "Endfile" and "Newline" again. Your brag tape is now in the file and the terminal will tell you how many bytes were used and how many remain. If you want to see your file, ".Read Brag" will show it on the receive portion of the screen. ".Send Brag" will transfer it to the transmit buffer ready to be sent on the air. ".Delete Brag" will delete the file and the terminal will again tell you how much space is left. ".Exit" will return the MSO to ENABLE status. Other commands allow you to control relays, read the full directory or a shortened version of it, print a couple lines of RY,*U (the ASCII equivalent of RY), or "The Quick Brown Fox." ".Help" and ".Filehelp" commands will bring assistance if you run into a problem.

The basis of Electronic Mailbox operation is that you leave your receiver and copying equipment on while the station is otherwise unattended. With the use of the AUTOSTART and SELCAL features of your terminal unit and DS-3100, stations knowing your MSO Enable code may activate your MSO and store messages in your files. Later, when you (or another control operator) are present, stations may call in and access whatever files they are interested in. Since you, as control operator, are responsible for the proper operation of your station, you want to be able to screen the files to prevent transmission of any illegal files. These could be in the form of "commercial" messages or messages involving third parties with countries with which we do not have third-party agreements. Thus the file security provisions of the MSO are very important. The "Brag" file we entered was an "Open" file. It could be copied by anyone or deleted by anyone having access to the MSO. The second level of security is the "Read" status. "Brag/Bill" could be copied by anyone, but only a person knowing the password "Bill" would be able to delete the file. Two passwords give a file "Private" status. Thus, "Brag/Bill/Mike" could be copied only by someone using either password and deleted only by someone using the first. If someone attempts to copy or delete a file without the proper password, the MSO merely prints out "File is protected". A directory listing is available in a full form listing all the files, the length of each, its password status, and date and time of origin; or in a short form listing just the file names and password status.

A couple of questions come to mind. What happens if another station enters a file with passwords without telling me what they are? The MSO has thought of this! When you enter the directory from the DS-3100 keyboard all the files are listed, along with their passwords. Well, then, what's to keep somebody from accessing the directory and finding the passwords and copying or deleting a file against my wishes? Again, the MSO is a jump ahead. When a remote input activates the directory, the passwords are omitted. There is another possibility. Suppose you find a "Private" message listed in your directory but with no passwords listed? This is the result of using a string of spaces as the password, and the file may be copied or deleted as appropriate by a similar string, or by "Brag//".

While transmission to and from another station on the air must be carried on at the data rate of the mode being used, usually 45-baud RTTY or 110-baud ASCII on the hf bands, local operations such as accessing the directory or reading a file may be done at computer speed. The MSO may also be used for cw operation by using the symbol $\overline{\text{BT}}$ in place of "Newline".

The MSO-3100 is available only as a factory installed option. Price class: $600. Manufacturer: HAL Communications Corp., Box 365, Urbana, IL 61801. — *Charles R. Bender, W1WPR*

K5SMG CODE PRACTICE TAPES

☐ The prospective Amateur Radio operator of today frequently asks how licensed amateurs learned the Morse code. Many attended classes and had Elmers to help them or they might have found assistance within the few home study courses available to them. The latter area is where the K5SMG code tapes enter the picture.

If you are in the market for beginner code practice cassettes, you might want to focus your attention on John Tarvin's course. This set of two 90-minute cassettes introduces the alphabet and numbers in Morse code at a rate of 2.5 wpm. This speed sounds slow (and it is). Tarvin uses what he calls the HI/LOW system to emphasize character sound recognition, however. The dots and dashes of each character are sent at the rate of 15 wpm, but each letter or number is equally spaced to the 2.5-wpm speed.

The teaching method can cause confusion to beginners at times, since they would try to group similar sounding letters together and the randomly sent code practice sometimes goes on seemingly indefinitely, with few breaks to review what was just learned.

Outside of that, there are a lot of pluses. Since the code is randomly sent, one cannot memorize the text. A check list, as well as an introductory sheet that briefly explains the purpose of the course and provides helpful studying tips, accompanies the course. All the cassettes are first-generation duplicates for the best signal-to-noise performance, and the code is computer generated.

Once you learn the code and want to increase your speed of reception, K5SMG offers a complete line of upgrading practice cassettes with speeds to 50 wpm. Each is priced at $5.95. A free catalog can be obtained by writing to John Tarvin, K5SMG, 14480 Shadowlane Ct., Morgan Hill, CA 95037. — *Maureen Thompson, KA1DYZ* QST

[2]"Product Review," *QST*, April 1980, p. 49.