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Issue #270

73®

Amateur Radio's Technical Journal

A Wayne Green Publication

8 New And Useful Projects!

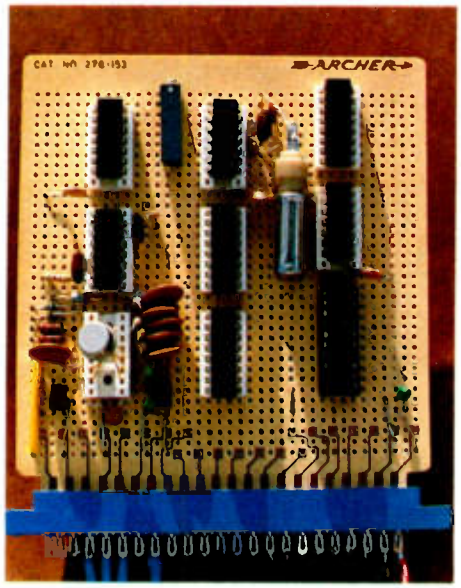
Home-Brew II Contest Winner
Page 10

Tearing Into Ten-Tec's Corsair
Page 105

Coffee-Can Cavity Filter
Page 74

OSCAR Gear From Junk
Page 18

More Simple Circuits
Page 110



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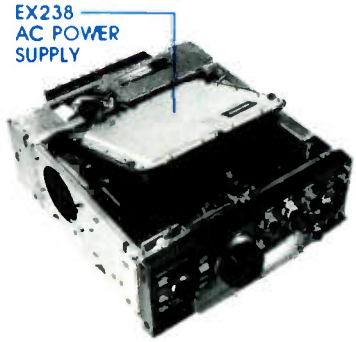

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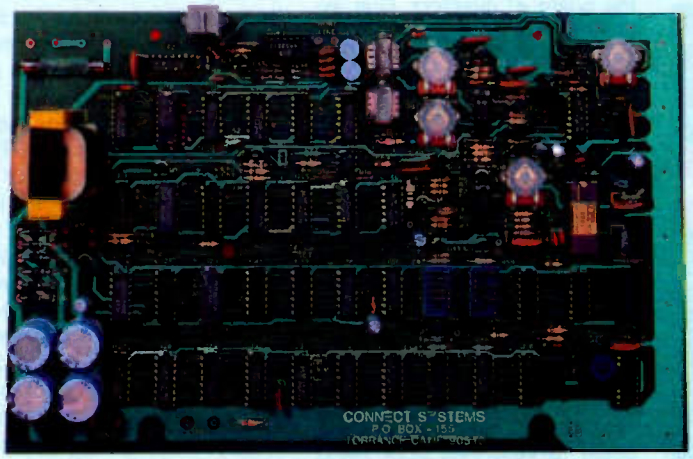

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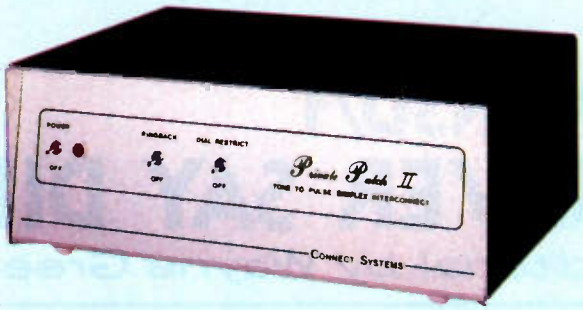

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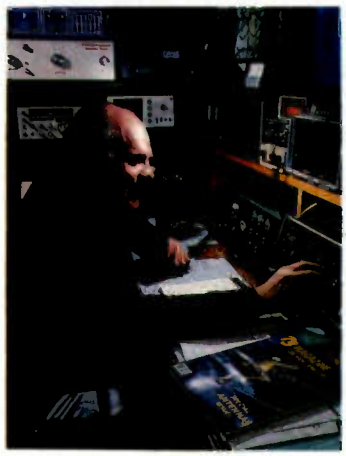


W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

THE CONNECTICUT CONTEST, CERTIFICATE, AND CHOWDERHEAD CLUB

There are three items on my agenda which may be of less than great importance to you. One has to do with some wondrous changes wrought by the International Amateur Radio Union, wherein, I was told by several of the assembled at the recent Bangkok hamfest, the ARRL was finally dumped out of the driver's seat. There was an unseemly amount of rejoicing among our supposed friends overseas.

While the League has graciously permitted foreign amateur radio societies to belong to this illustrious organization, HQ always insisted that they have complete control of it. Unrest has been brewing for quite a few years over this, with a growing number of malcontents fomenting revolution over the high-handed, low-action management by the League.

Oh, there goes that miserably crotchety old Wayne Green, griping about the League again... right? Well, you probably believe in the Tooth Fairy, too, so who am I to suggest you take off your smoked glasses and see what your bumbling voting record at ARRL elections has cost you. But, if you even have a shred of question about how our beloved League is perceived overseas, then for heaven's sake try to find your old rig up there in the attic and get on the air for a day or two... make some DX contacts ...and, after you've gone through all the usual drivel ...probably mercifully covered up by QRM... ask 'em what they think. You'll get an earful from a bunch of 'em.

At any rate, there was general rejoicing at Bangkok over the freeing of the slaves as news of the vote to move IARU headquarters from some almost totally unknown town in Connecticut to Geneva was spread. Who knows, perhaps the IARU will now be able to develop some clout!

Item two has to do with the recent director election wherein Mary Lewis eked out a win by less than ten votes...raising hell with the morale of the entrenched chauvinists at HQ. They'd said for years that, dammit, this was a man's hobby and they didn't need any women on the board of directors. One ex-president of the outfit said that hell would freeze over before they'd let a woman get on the board. I wondered about that, so while in Bangkok I made a visit to Hell (a well-known Bangkok restaurant) and found that it had not, in fact, frozen over. Well, so much for ex-presidential predictions. No wonder they dumped him.

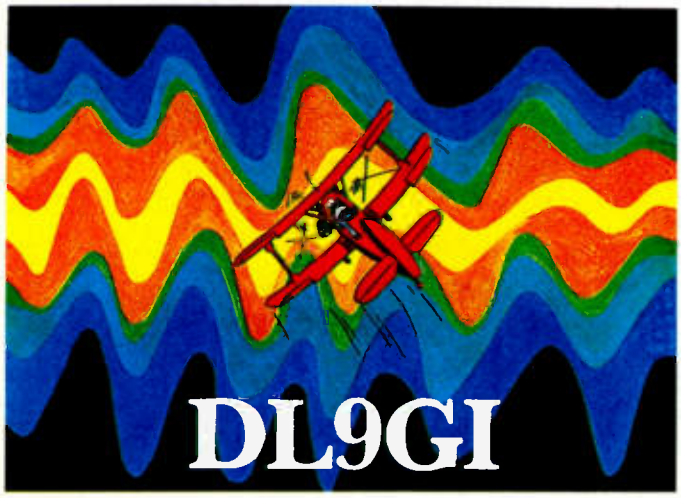
Then there was the defeat of poor Don Miller out in Indiana. Don has had a rough time of it. First the HQ gang did all they could to keep him from being elected the first time. Then they trumped up a bunch of baloney and scared him into resigning, threatening to put on the pressure to get him fired from his job. Knowing that HQ had been able to get Mary's job, he panicked. With Dannals and Baldwin out of the driver's seat at HQ, Don apparently thought he might be able to make it back into the director's chair again. Well, one thing no one at HQ wants to have to live with is a director who starts asking questions and shows any initiative at really directing. They have their short yearly meeting, vote on everything unanimously, and go home. Do not rock the boat, please. Remember that we here at ARRL are all one happy family and that Wayne Green is a kook. Close, but no cigar...actually I'm a cook...love to cook.

So Metzger is your Midwest Director and those who voted for this chap are welcome to him. Some of the other directors like him, others sneer and call him a toadying turkey. That sort of talk is ill-becoming of directors, even if it might be true. I try to look at the bright side...the more all this politics screws up the League, the more interesting things I can write about.

Since most of the older timers at the League have bailed out, the attitude has improved a bit. The old-timers' perception of the membership was as a bunch of nitwits who could easily be led into anything they wanted. Unfortunately, there was more truth in this perception at times than was comfortable. For every thinking ARRL member, there was a counterbalancing group of blind followers, eager to buy whatever the latest party line demanded.

The laughter was uncontrolled at HQ when they came out with incentive licensing. This was their plan to disenfranchise 85% of the hams from the phone bands, returning us to the pre-WWII licensing system of two classes, one with phone bands and the other without. Would you believe that almost 50% of the ARRL members bought the idea ...mostly on the basis of the nice name they'd given it. Who could be against *incentive* licensing? Only those who bothered to read the fine print, which turned out to be a minority. And a lot of those opposing it were fighting it because they didn't want to have to go down and retake the test all over again rather than because the whole idea was ridiculous.

The few firms still left in the amateur radio industry are waiting to see some positive moves by the new management of the League. There's not much left of the industry any more. 95% of the manufacturers are long gone...and 95% of the dealers are gone. We used to



QSL OF THE MONTH

This month's winning QSL is from Lutz Hannig DL9GI of Berlin, West Germany. Lutz's unique design depicts a confused-looking Red Baron flying into the center of a multi-colored radio wave. The card cleverly focuses your attention to the center by moving from the black background to the bright yellow and red of the middle. The rapid shift in hue lends depth to the scene, making it appear as if the aviator were flying into the maw of some great creature. Lutz's callsign, emblazoned in white at the bottom, ensures that the viewer knows where this card is from.

If you would like to enter our QSL card contest, put your QSL in an envelope with your choice of a book from *73*'s Radio Bookshop and send it to *73*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries which do not use an envelope or do not specify a book will not be considered.

NEW

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Big LCD, Big 45 W, Big 21 memories, compact.

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Outstanding features providing maximum ease of operation include a large, easy-to-read (direct sunlight or dark) LCD display, 21 multi-function memories, automatic offset, programmable priority channel, memory and band scans, built-in lithium battery memory back-up, built-in 16-key autopatch encoder, and a choice of a hefty 45 watts output (TR-7950), or 25 watts output (TR-7930).

TR-7950/TR-7930 FEATURES:

- **NEW, large, easy-to-read LCD digital display**
  Easy to read in direct sunlight or dark (back-lighted). Displays transmit/receive frequencies, memory channel, repeater offset, (+,S,−), sub-tone number (F-0, 1, 2, 3), tone, scan, and memory scan lock-out. Includes LED S/RF bar meter, and LED indicators for REVERSE, CENTER TUNING, PRIORITY, and ON AIR.
- **21 NEW, multi-function memory channels**
  Stores frequency, repeater offset, and optional sub-tone channels. Memories 1 through 15 for simplex or ± 600 kHz offset. Memory pairs 16/17, and 18/19 are paired for non-standard repeater offset. Memories "A" and "B" set upper and lower scan limits, or for simplex or ± 600 kHz offset. In MEMORY mode, a circle of light appears around the memory selector knob. When the memory selector knob is rotated in either direction to channel 1, an audible "beep" will sound.
- **Choice of 45 or 25 watts output**
  The TR-7950 provides a hefty 45 watts output, while the TR-7930 features a more modest 25 watts. A HI/LOW power switch allows power reduction to approx. 5 watts.
- **Long-life lithium battery memory back-up**
  Built-in lithium battery has an estimated 5 year life.
- **Automatic offset**
  The microprocessor is pre-programmed for simplex or ± 600 kHz offset, in accordance with the 2 meter band plan. "OS" key allows manual change in offset.
- **Programmable priority alert**
  The PRIORITY channel may be programmed in any of the 21 memories. With ALERT switch "ON," a dual "beep" sounds when a signal is present on the PRIORITY channel. An OPER switch allows an easy move to the PRIORITY channel.
- **Programmable memory scan lock-out**
  "LO" key for programming scan to skip selected memory channels, without erasing the memory.
- **Programmable band-scan width**
  The lower limit may be programmed into memory "A," and the upper limit into memory "B."
- **Center stop during band-scan, with indicator**
  Stops in center of channel during band-scan, with center tuning indicator.
- **Scan resume selectable**
  Scan stops on busy channel. Selectable automatic time resume-scan (approx. 5 sec., adjustable), or carrier operated resume-scan. A scan delay of approx. 1.5 seconds built-in.
- **Scan control using up/down microphone**
  Momentarily pressing UP or DOWN button on microphone tunes one step in the selected direction, on memory or on 5-kHz step tuning. Holding the button for about 2 seconds starts UP or DOWN automatic scan action. Scan start also possible using "SC" key on keyboard. Scan may be cancelled by momentarily pressing the PTT switch, or by pressing both UP/DOWN buttons simultaneously.
- **Programmable sub-tone channels**
  Optional TU-79 3 frequency sub-tone unit provides keyboard selectable sub-tone channels, which may be stored in memory.
- **Built-in 16-key autopatch, with monitor**
  The keyboard functions as a 16-key autopatch encoder during transmit. DTMF tones appear in the speaker output when a key is pressed during transmit.
- **Front panel keyboard control**
  Used for selecting frequency, offset, programming memories, controlling scan, and autopatch encode. Keyboard lighting is provided.
- **Extended frequency coverage**
  Covers 142.000-148.995 MHz, in 5-kHz steps.
- **Repeater reverse switch**
  Locking-type switch, with indicator.
- **"Beeper" amplified through speaker**
- **Compact, lightweight design**
- **Easy-to-install adjustable-angle mobile mounting bracket**

Optional accessories:

- TU-79 three frequency tone unit.
- KPS-12 fixed-station power supply for TR-7950.
- KPS-7A fixed-station power supply for TR-7930.
- SP-40 compact mobile speaker.

More information on the TR-7950 and TR-7930 is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

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...pacesetter in amateur radio

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have nearly a thousand ham dealers around the country selling *73* over their counters! Now there's a few score. You know this when you look around for some place to go to see a new rig. A few years ago, ham stores were almost everywhere... today they aren't. There's just one or two left in all of New England, for example.

THE CODE

Which really brings us to a discussion of the Morse code. Just what you really wanted, eh? Yes, I know the League is dedicated to preserving the code. And, believe me, I have heard all the old saws about the code being the only thing protecting us from the hordes of CBers and keeping the ham bands from being like the CB bands. What a crock of...er...stuff. Frankly, I'm not at all convinced that if we set up booths on the street and gave away ham tickets to any passerby, we could attract anyone to our hobby.

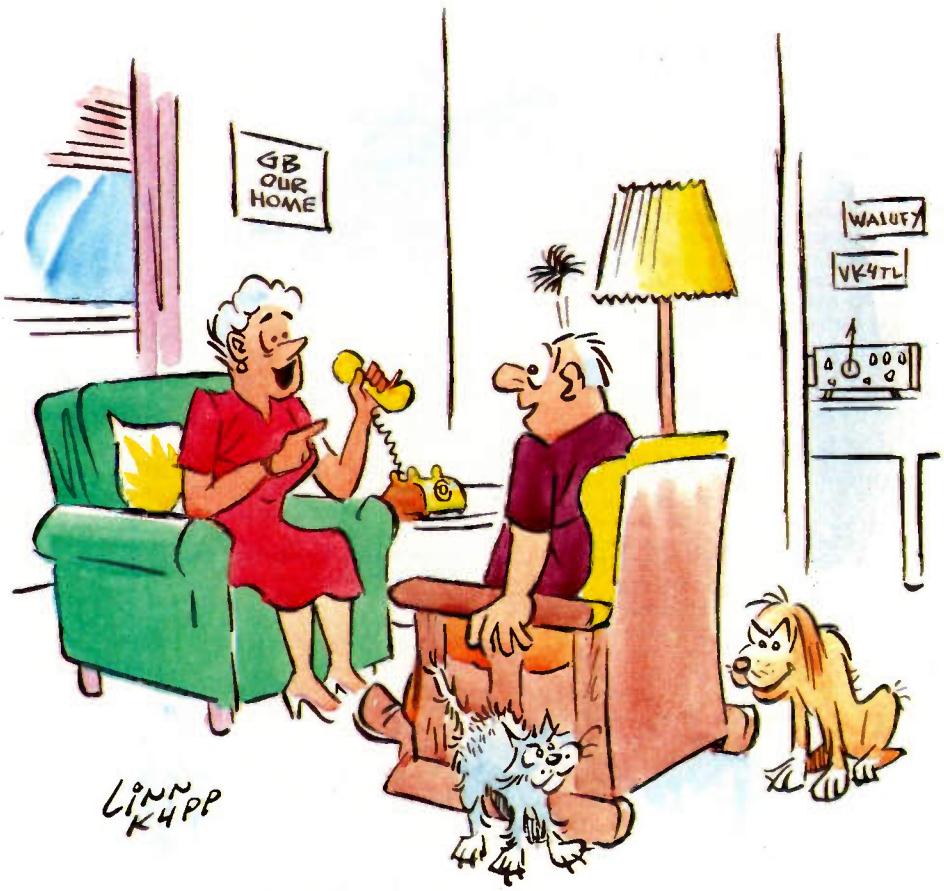
There is now a rising call for getting older people into amateur radio, our having failed to interest kids any longer. Just what we need. Sure, the hobby is great for oldsters. It would keep them from getting lonely. It would give them something to do in their twilight years...kerchunking repeaters and jamming nets. Why save all that fun for just the Extra-class hams, eh? Of course, we aren't going to provide our country with much in the way of technicians, engineers, and scientists this way...or electronic fodder for our war machine, should we decide to save the world for capitalism again. But we would be able to sell some rigs, thereby enriching the lives of the Japanese manufacturers. I say let's get at it. Let's get into the old folks homes and set up club stations...give licensing classes ...and call in Bash so faltering memories won't even have to learn any theory.

Word from the underground has reached me that the outfit selling the FCC Morse-code exams at Dayton was run by none other than a very well-known California ham. We really have to see that those tapes get better distribution so that old people, who have more trouble than kids with the code, are not discriminated against. Why should we penalize old people just because they can't learn the code?

As a matter of fact, if we are going to go along with the modern morality, we should set up a system whereby anyone who has shown proof that he has seriously tried to learn the code, yet failed, would get a license. In today's world, it is not the answer to the question

Continued on page 101

Well...I Can Dream, Can't I? **by Bandel Linn K4PP**



"It's the FCC! They're not just renewing your license—they're also giving you a Caribbean cruise!"

John Langner WB2OSZ
115 Stedman Street
Chelmsford MA 01824

RTTY Tuning: The New Solution

This simple tuning indicator whipped the competition and took first place in 73's Home-Brew II Contest.

What is your favorite method to tune in a radioteletype (RTTY) signal quickly and accurately on an SSB receiver? A dual ellipse on an oscilloscope? Light-emitting diodes (LEDs) activated by mark and space filters? A signal-strength meter? By ear? Here is a new one that might make you change your mind.

Background/The Problem

When Teletype® signals are sent through audio channels, they are usually conveyed by switching between two tones with a different timing pattern for each of the characters. During periods when no characters are being sent, a steady tone, called the "mark" tone, is present. The other tone is called the "space" tone. A device called a "terminal unit" (TU) extracts these two particular tones from any background noise and produces a digital signal suitable for a printer or computer.

If this audio signal is coming across a telephone line or an FM radio link, the frequencies of the tones at the receiving end will be the same as at the origin. However, there can be a problem when using an SSB receiver, because a slight mistuning will change the frequencies of the tones heard and the terminal unit will not work. Over the years, various methods have been devised to indicate when the proper tones are detected. Here is a new one.

Photo by Mark Hood

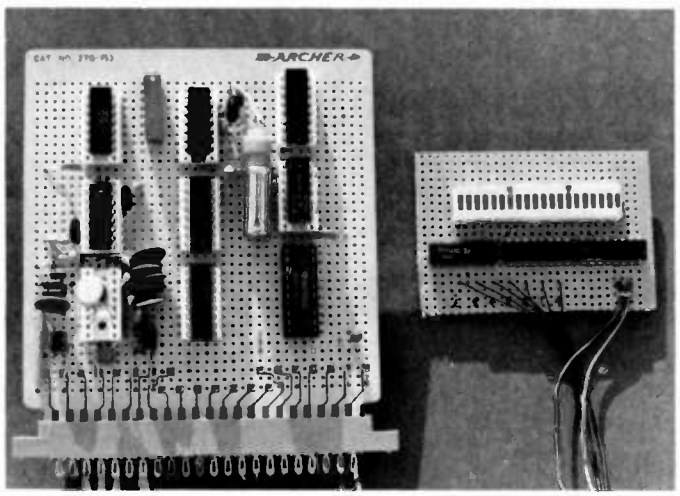


Photo A. Appearance of the display for a correctly tuned signal.

A New Solution

As shown in Photo A, the circuit displays its output with a row of 20 LEDs. Each one will light up when the strongest audio frequency present is within its particular range. The two with the pointers over them correspond to the mark and space tones. A constant mark signal is tuned properly when the LED under the left marker is lit. When characters are being received, the LEDs under both markers will be lit. If the tones are low in frequency, LEDs to the left of these positions will be lit. Higher frequencies activate LEDs farther to the right. It's as easy as tuning an FM broadcast receiver with a tuning meter!

Theory of Operation

The simplified block diagram in Fig. 1 illustrates the basic principle involved. Each time the input signal completes a cycle, the current content of the counter is captured in the latch. After a brief delay, the counter is reset and resumes counting for another cycle of the input signal. Meanwhile, a decoder is looking at the output of the latch and selects one of the LEDs based upon it.

For example, let's suppose we had a clock of 200 kHz and an input signal of 2 kHz. During each cycle of the input signal there would be 100 clock pulses, so the counter would contain 100 when the latch grabs the counter's output. If there was an LED corresponding to a count of 100, the decoder would cause it to light up until a different count was obtained from the counter. A higher frequency input would result in a shorter period, a smaller count, and a different LED.

Keeping this simplified model in mind, let's look at the actual circuit (Figs. 2 and

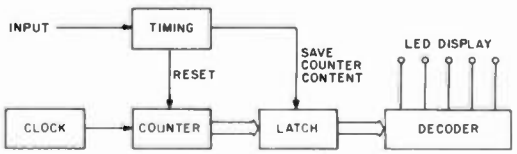


Fig. 1. Simplified block diagram.

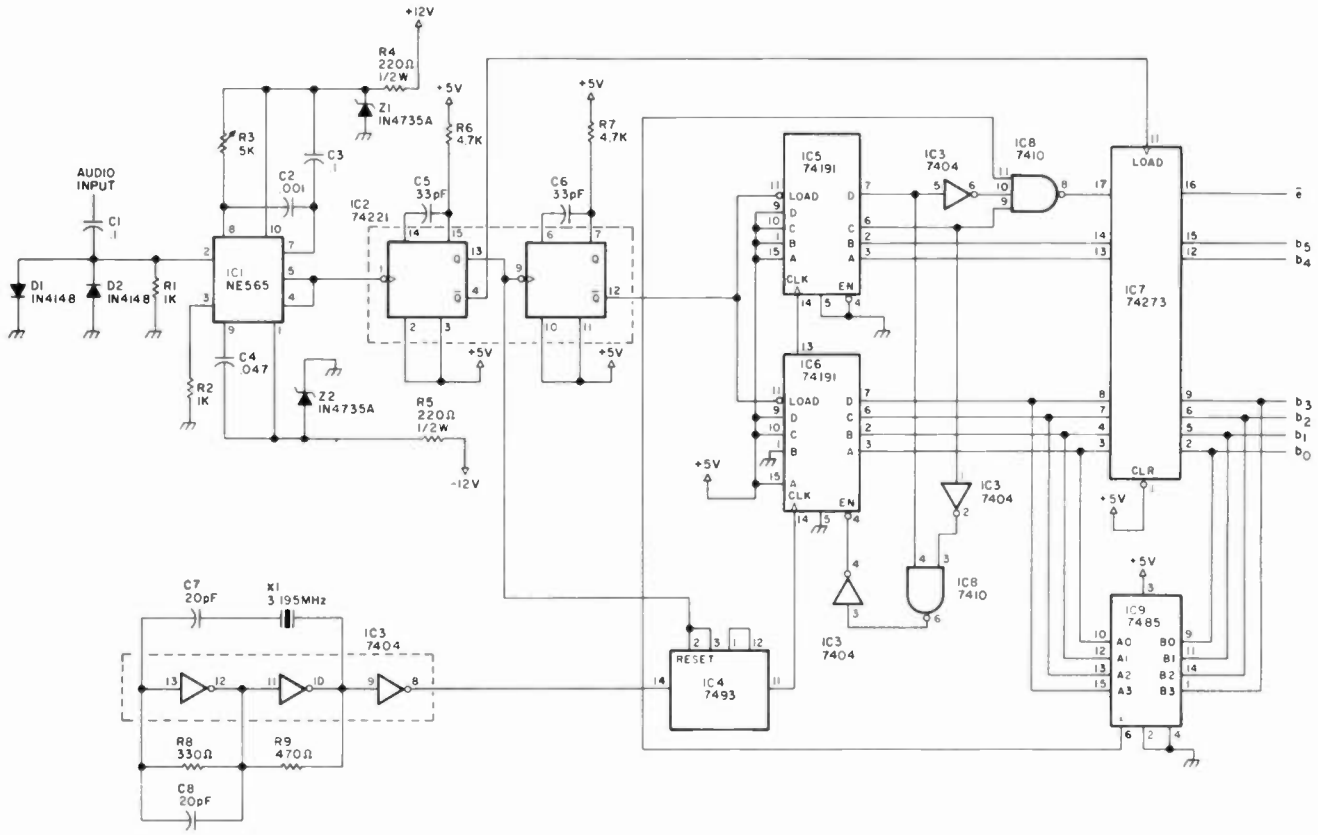


Fig. 2. Main circuit for tuning indicator.

3) and see how it differs. Starting from the audio input on the left, the first thing you will notice is the 565 phase-locked loop. I initially tried some experiments with bandpass filters and a Schmidt trigger. This worked great with a nice clean waveform from a signal generator, but was pretty useless with a noisy signal from a sideband receiver. The phase-locked loop does a good job of following a signal through the noise and providing a nice clean square wave of the same frequency for later logic circuits. The two diodes before it provide protection against large signals that could damage the IC.

Next we have a couple of one-shots (IC2) to generate timing pulses at the end of each cycle. Four separate steps are involved: (1) Stop the clock so the count isn't changing during latching. (2) Capture the contents of the counter in the latch. (3) Reset the counter. (4) Restart the clock.

When the counter is reset, it is set to −3 rather than zero as you would probably expect. (See pins 9, 10, 1, and 15 of the counters.) This is to make the mark and space tones fall in the middle of the frequency ranges for the corresponding LEDs.

When the most significant bit of the count (IC5, pin 7) is 0 and the next bit (pin 6) is 1, the count is in the range of 64-127. This is the region where the display is enabled. If the counter content reaches 128, IC6 is disabled through pin 4 and counting stops. This prevents overflowing and a false display for a very low frequency input.

Under the latch (IC7), you will notice a 7485 magnitude comparator. Each time the latch is clocked, it compares the counts for the current and preceding cycles. When the low-order four bits are the same, the display is enabled for the next cycle. This blanks the display during changes, resulting in a much cleaner appearance and dimming with only noise present. High-order bits could also be compared with another chip but I doubt it would have much effect because counts for consecutive cycles differing by a multiple of 16 are probably quite rare.

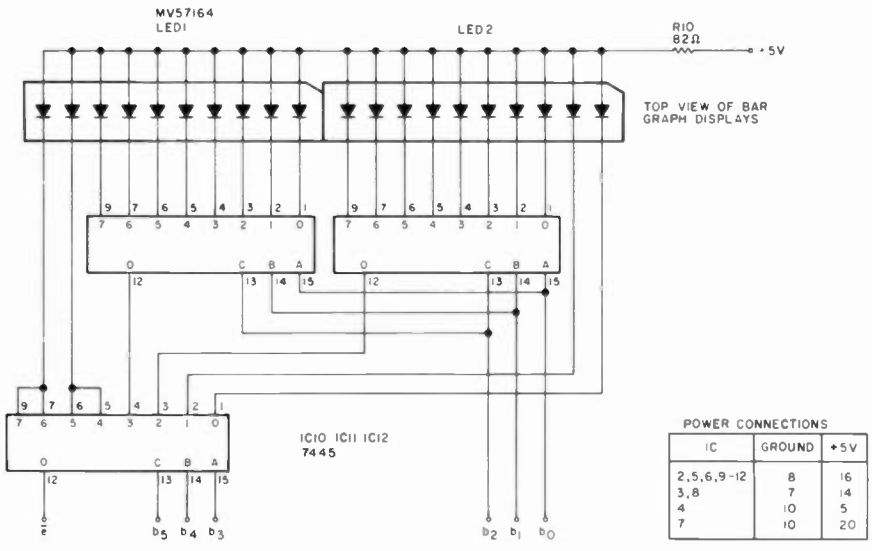


Fig. 3. Display portion of tuning indicator.

```
10 REM-- RTTY TUNING INDICATOR DESIGN PROGRAM.
20 REM--
30 REM-- WB2OSZ, APRIL 1982
40 REM--
50 REM-- M9 AND S9 ARE DESIRED COUNTS FOR MARK & SPACE LEDS.
60 REM--
70 M9=91
80 S9=84
90 REM--
100 PRINT "WHAT IS MARK (LOWER) FREQUENCY";
110 INPUT M
120 PRINT "WHAT IS SPACE (HIGHER) FREQUENCY";
130 INPUT S
140 IF M>=S THEN PRINT "MARK MUST BE LOWER FREQUENCY." \ STOP
150 REM--
160 REM-- CALCULATE COUNTER PRESET VALUE.
170 REM--
180 P=INT((M9*M-S9*S)/(M-S)+.5)
190 IF ABS(P)>63 THEN PRINT "INVALID PRESET COUNT." \ STOP
200 REM--
210 REM-- CALCULATE THE CRYSTAL FREQUENCY.
220 REM--
230 X=((M9-P)*M+(S9-P)*S)*8
240 REM--
250 REM-- PRINT CALCULATED VALUES FOR CIRCUIT AND
260 REM-- PRODUCE CHART OF FREQUENCY RANGES FOR EACH LED.
270 REM--
280 PRINT "WHERE WOULD YOU LIKE THE OUTPUT (TERMINAL IS
 DEFAULT)";
290 INPUT O$
300 IF O$="" THEN O$="TT:"
310 OPEN O$ FOR OUTPUT AS FILE #1
320 PRINT #1,"MARK FREQUENCY =";M;"HZ, SPACE FREQUENCY =";S;"HZ"
330 PRINT #1
340 REM--
350 PRINT #1
360 PRINT #1,"COUNTER PRESET = ";P;" (BINARY ";
370 N=128
380 P2=P
390 IF P2<0 THEN P2=P2+256
400 IF P2<N THEN 440
410 PRINT #1,"1";
420 P2=P2-N
430 GO TO 450
440 PRINT #1,"0";
450 N=N/2
460 IF N>=1 THEN 400
470 PRINT #1,")"
480 PRINT #1,"CRYSTAL FREQUENCY =";X/1.00000E+06;"MHZ"
490 PRINT #1
500 PRINT #1
510 PRINT #1
530 B=127.5 \ GOSUB 620 \ GOSUB 680
540 B=111.5 \ GOSUB 620 \ GOSUB 680
550 FOR B=95.5 TO 79.5 STEP -1
560 GOSUB 620 \ GOSUB 680
570 NEXT B
580 B=71.5 \ GOSUB 620 \ GOSUB 680
590 B=63.5 \ GOSUB 620
600 CLOSE #1
610 STOP
620 REM--
630 REM-- PRINT AUDIO FREQUENCY BOUNDARY.
640 REM--
650 F=INT(X/16/(B-P)+.5)
660 PRINT #1,,,"---";F
670 RETURN
680 REM--
690 REM-- PRINT '**' REPESENTING A LED.
700 REM-- APPEND 'M' OR 'S' FOR MARK AND SPACE TONES.
710 REM--
720 C$="**"
730 IF B-.5=M9 THEN C$=C$+" M"
740 IF B-.5=S9 THEN C$=C$+" S"
750 PRINT #1,,C$
760 RETURN
```

Fig. 4. Basic program to compute crystal frequency and counter preset for given mark and space tones.

Construction and Adjustment

As shown in Photo A, the LED displays and three decoder chips are mounted on a small piece of perfboard which can be installed on the front panel of a terminal unit. The rest of the prototype was constructed with wire wrapping for ease of modification during development. You can reduce the cost by using solder-tail sockets with point-to-point wiring or making a PC board.

With no input applied to the circuit, adjust R3 so that the LED just to the left of the center line is lit.

Power requirements are + and −12 volts at about 25 milliamps and 5 volts at about 350 milliamps.

Modifications

The crystal frequency and counter preset value shown in the schematic are for the standard RTTY tones of 2125 and 2295 but can easily be changed for a different pair of tones in the same neighborhood. The Basic program in Fig. 4 computes these values from

Parts List

Semiconductors			
IC1	NE565		$ 1.00
IC2	74221		1.25
IC3	7404		.22
IC4	7493		.52
IC5, 6	74191	2×	.85
IC7	74273		1.25
IC8	7410		.19
IC9	7485		.65
IC10-12	7445	3×	.69
D1, 2	1N4148 or 1N914 diode	2×	.20
Z1, 2	1N4735A 6.2-V, 1-Watt zener	2×	.30
LED1, 2	MV57164 10-segment bar-graph display (Radio Shack part number 276-081)	2×	3.79
Resistors (¼-Watt unless noted)			
R1, 2	1k	2×	.07
R3	5k 15-turn trimmer		1.25
R4, 5	220-Ohm, ½-Watt	2×	.07
R6, 7	4.7k	2×	.07
R8	330-Ohm		.07
R9	470-Ohm		.07
R10	82-Ohm		.07
Capacitors			
C1, 3	.1-uF, disc ceramic	2×	.15
C2	.001-uF, disc ceramic		.10
C4	.047-uF, mylar™		.15
C5, 6	33-pF, mica	2×	.26
C7, 8	20-pF, mica	2×	.26
—	.01-uF, disc ceramic (to bypass +5 volts to ground)	5×	.10
Other			
X1	3.195-MHz crystal, FT-243 holder, .01% tolerance, 32-pF load capacity (available from Jan Crystals)		3.00
	solder-tail IC sockets, 14-pin	7×	.14
	16-pin	4×	.16
	20-pin		.29
	perfboard		1.59
	total about		$28.00

Obtaining Parts

The only unusual components in this device are the 10-segment LED bar-graph displays. As indicated in the parts list, these are available at your local Radio Shack store. If there is not a Radio Shack in your part of the world, use 20 separate LEDs instead.

I happened to use a crystal in an HC6/U holder. If you don't mind the size and appearance of an FT-243 holder (like Novices used in the old days) you can save a couple of bucks by getting a crystal with only .01% tolerance which is still more than adequate.

Everything else is quite ordinary and available from various dealers who advertise in the back of *73*. The circuit is not at all critical and minor substitutions should not affect performance.

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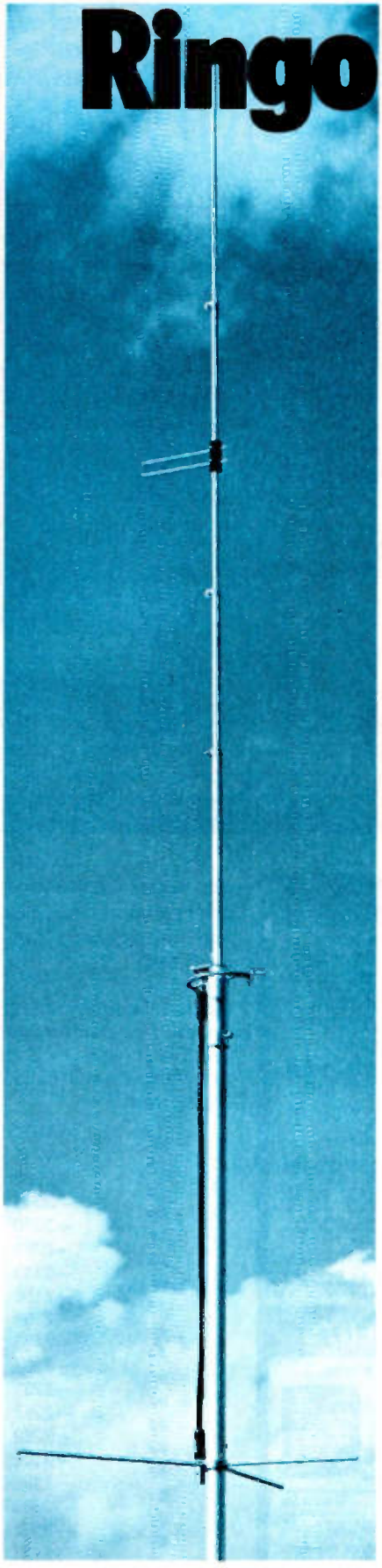

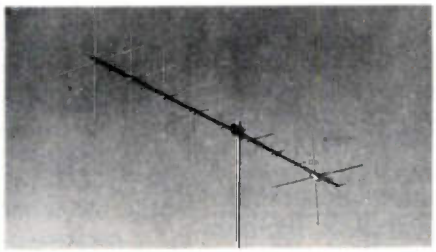

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ARX-220B	220-225 MHz
ARX-450B	435-450 MHz

RINGO RANGER

ARX-2	134-164 MHz

RINGO

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AR-2	135-175 MHz
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AR-220	220-225 MHz
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A147-11	145.5-148 MHz	11 Element
A147-22	145.5-148 MHz	22 Element
214-FB	145.5-148 MHz	14 Element
A220-7	220-225 MHz	7 Element
A449-6	440-450 MHz	6 Element
A449-11	440-450 MHz	11 Element

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the tone frequencies and prints a chart (Fig. 5) indicating the frequency range for each LED.

Mark frequency = 2125 Hz, Space frequency = 2295 Hz, Counter preset = −3 (binary 11111101), Crystal frequency = 3.19532 MHz

```
##      —1530
##      —1744
##      —2027
##      —2048
##      —2070
##      —2091
##      —2113
## M    —2136
##      —2159
##      —2183
##      —2207
##      —2231
##      —2257
##      —2282
## S    —2309
##      —2336
##      —2363
##      —2392
##      —2421
##      —2681
##      —3003
```

Fig. 5. Output of program in Fig. 4 for standard tones of 2125 and 2295.

Use and Conclusion

The circuit requires a minimum of 10 millivolts peak-to-peak for good tracking of the input signal. Acceptable results can be obtained by connecting the tuning indicator directly to the receiver's speaker, but a cleaner signal will produce a more pleasant display. If your terminal unit has a bandpass filter, connect this circuit after the filter, but before the limiter. If you don't have a bandpass filter, I suggest that you build one (see *73*, September, 1977, page 38) or buy one such as the Flesher PS-170. It's simple, inexpensive, and makes a big difference when trying to copy RTTY under noisy conditions.

For a couple decades, most people agreed that a dual ellipse pattern on a CRT was the best way to see when a RTTY signal was tuned in properly. Try this circuit and you might not be one of them anymore. ■

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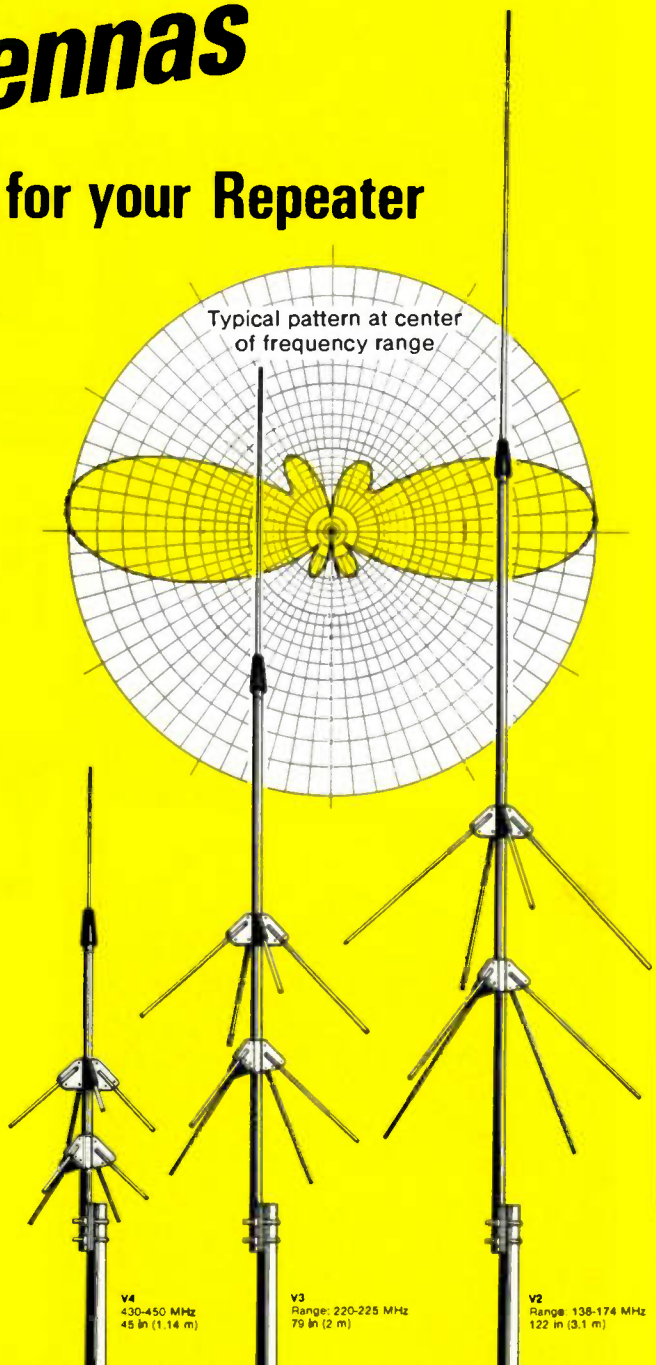
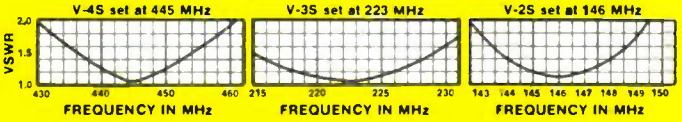
For unbiased information ask any of several thousand V2 users or read the product review in QST May '82 or Amateur Radio Profiles Vol. 2, No. 3.





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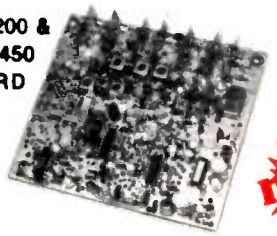

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This article is for the amateur who wants to get on OSCAR Phase III inexpensively. This can be done by converting a surplus GE UHF transmitter strip to a 435-MHz SSB mixer.

With the upcoming launch of OSCAR Phase III, I was looking for a way to get on the 435-MHz input inexpensively when I found some old GE Progress-line UHF transmitter strips at a ham flea market. I asked a friend who had a GE data file to send me a copy of the schematic, which he did.

After reviewing all the material he sent me, I found that I had a 450-to-470-MHz transmitter, model 4ET24A2. It could be modified to be a mixer for 435 MHz, but it would be upconverting in frequency with the local oscillator frequency on the high side of the wanted output-signal frequency. Thus, the sideband signal would be inverted and when I wanted to change frequency in an upward direction on 435 MHz, I would have to go down in frequency with the 28-MHz exciter.

This was too confusing to try to handle while tracking a satellite, so I looked further and found in the data my friend sent me a schematic on a unit, model 4ET24A1 or A11, which covered 406 to 420 MHz. This was perfect. When you want 435 out and you are putting 28 MHz into a mixer, you need a 407-MHz local oscillator to make the mixer work correctly. This 4ET24A1 was in the right frequency range. I started looking around at the swap meets and asking my friends who were into old FM equipment to keep an eye out for this model for me. I found out later that GE did not make too many of these A1-type strips as compared with the A2-type strips. I finally found a 4ET24A1 strip at an FM-equipment auction and paid $20 for it, complete with all the tubes.

After cleaning the dirt off the unit and making sure it had not been modified or robbed for parts, I started the conversion. My first task was to order a crystal from the ICM crystal company in

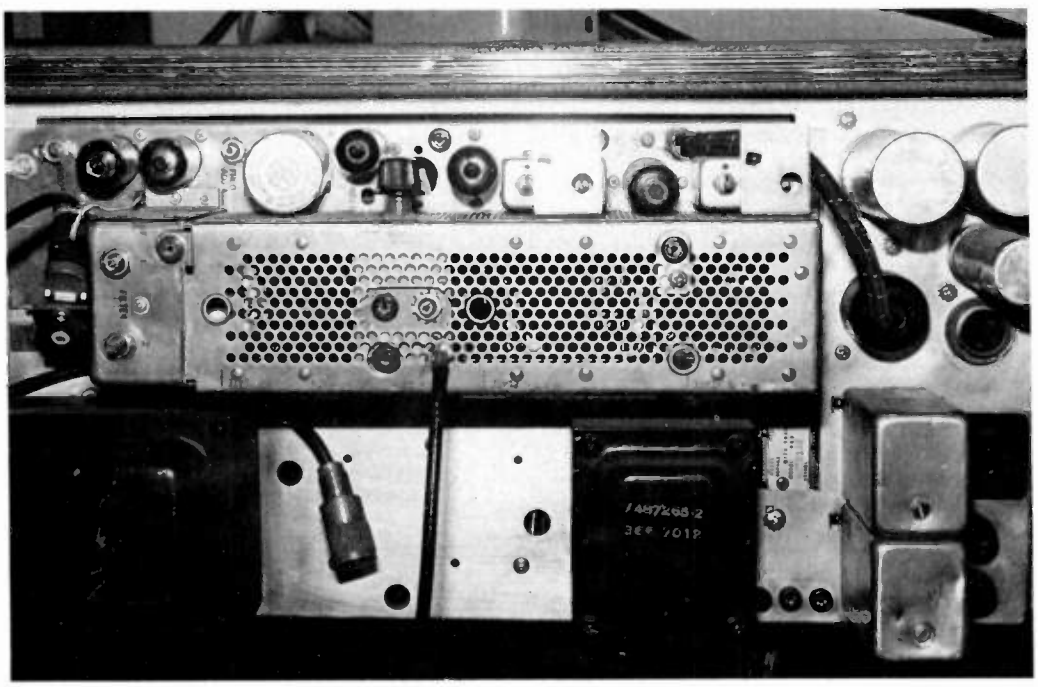

Photo A. Overall view. Notice orientation of the crystal oven.

Oklahoma City. Since we need a 407-MHz local oscillator and the transmitter strip has a multiplier of 36, the crystal frequency needed is 11.3055 MHz. When ordering the crystal, tell ICM that the crystal is for a GE model 4ET24A1. If your strip has a crystal oven or if you can get a GE crystal oven, tell ICM that the crystal will be used in a GE oven.

Modification

The modification of the transmitter strip is very easy. First, remove the cover over the three large tubes in the caged-in area. This is done by removing one screw next to the MULT-4 test point (see Photo A). Next, pull off the cover, starting with the end over the 2E26. The far end of the cover fits under a notch in the output filter. Then, find C171, the PA grid-tuning capacitor of the last tube, a 6907. Drill a 3/16" hole in the plate that C171 is mounted on, halfway between C171 and the edge of the plate closest to the red test point, PA CATH (see Photo A). Next, using a small pair of wire cutters, cut off the capacitor and wire going to pin 4 of the 6907 tube. Pin 4 is right under C171.

Prepare a three-foot length of RG-58-type coax by stripping off 2 inches of the outside rubber jacket, followed by one and one half inches of the coax braid. Next, remove ¼ inch of the inner insulation from one end of the coax. Prepare the other end of the coax to accept a PL-259 coax fitting with the adapter ring for the RG-58 coax. Push the center conductor of the coax through the 3/16" hole in the plate and then wrap and solder the center conductor to pin 4 of the 6907 tube under C171. Push the coax braid down around the 3/16" hole and solder the braid to the plate.

Find the cover and, using a reamer or a set of drill bits, enlarge the vent hole in the cover that is closest to being right over where the 3/16-inch hole is in the plate when the cover is replaced. Enlarge this hole to about ¼ inch, which is big enough to allow the coax to pass through it. Feed the coax through the hole and replace the cover on the cage.

Solder a PL-259 with the adapter to the end of the coax cable you prepared earlier. Find a 28-MHz rf choke coil such as a Miller RFC28 or Ohmite Z28. Solder this rf choke inside another PL-259 coax fitting. One end of the rf choke goes to the center pin of the PL-259 and the other end goes to the outside rear edge of the PL-259. Using a UHF coax T-fitting, connect the new cable from the mixer unit and the coax fitting with the rf choke inside it to the T-fitting. Later, the coax from the 28-MHz exciter will connect here also.

Caution: The rf choke must be connected or damage could result to your exciter. Check the rf choke with a VOM to be sure it is good, after soldering to the PL-259.

Locate the socket the crystal oven plugs into and cut off the ground wires going to pin 5. If there are any other wires going to pin 5, cut them off pin 5 also and solder them to ground points. Next, remove V108, a 12AU7/6680 tube. It will not be used. If any other tubes are missing, replace them per the following list:

V101	6BH6/6661
V102	6U8
V103	6CL6
V104	2E26
V105, 106	6907/6252
V107	12AU7/6680

Install the crystal in the GE oven between pins 4 and 8; then plug the GE oven into the 8-pin socket on the mixer. If an oven is not used, plug the crystal into pins 4 and 6 on the 8-pin socket.

Power Supply

Power supply connections are as follows:

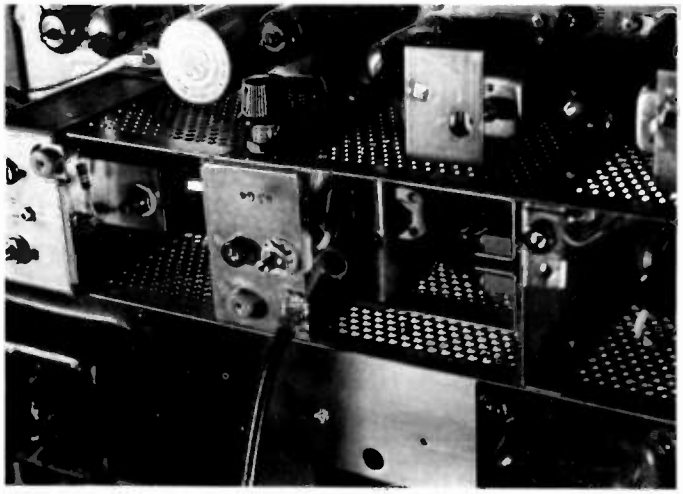

Photo B. The coax from the 28-MHz exciter is soldered to pin 4 of the last 6907 tube right under the variable capacitor, C171.

- Pins 1 and 2 are not used. Audio input for FM.
- Pin 3 to ground. Oscillator-select channel 1 on A11 model.
- Pin 4 is not used. Oscillator-select channel 2 on A11 model.
- Pin 5 to +6 volts dc keyed on transmit, if antenna relay is used.
- Pin 6 to 6 volts ac or dc filament supply (not used if 12-volt filament supply is used).
- Pin 7 to ground (filament-return lead for 6-volt filament). (To 12 volts ac or dc if 12-volt filament supply is used.)
- Pin 8 bias supply, −22 volts dc, adjustable.
- Pin 9 B+ final, 450 volts dc, keyed on transmit.
- Pin 10 B+ multiplier, 300 volts dc, keyed on transmit.
- Pin 11 B+ oscillator, 200 volts dc.

This transmitter strip is normally used with a GE model 4EP4A power supply. This is the same supply that is used on GE Progress-line repeater stations. Since many older 2-meter and 440-MHz repeaters are going to solid-state equipment, some of these power supplies are showing up at auctions and flea markets now. The 4EP4A power supply is selling for about $30 to $40 in working condition. See the photos of the completed mixer mounted on the power supply to help you recognize the power supply at the flea markets.

When using the 4EP4A power supply, the bias-supply section will need to be modified to a voltage-multiplier-type power supply in order to get the required −22-volts-dc bias. See the *ARRL Handbook* under power supplies for circuits. This requires only the addition of two capacitors and two diodes.

Here are the terminal-strip connections on the 4EP4A power supply:

- Terminals 1, 2, and 4: not used. Audio lines.
- Terminal 3: key to ground on transmit PTT line.
- Terminal 5: 250 volts dc "caution."
- Terminal 6: to ground channel A select on model A11.
- Terminal 7: ground.
- Terminal 8: 6.3 ac filament line.
- Terminal 9: one side of 110-V-ac input.
- Terminals 10 and 11: other side of 110-V-ac input.
- Terminal 12: not used. Channel B select on model A11.
- Terminal 13: not used. Transmit light line.
- Terminal 14: not used. Rec mute line.
- Terminals 15 and 16: not used. Spares.

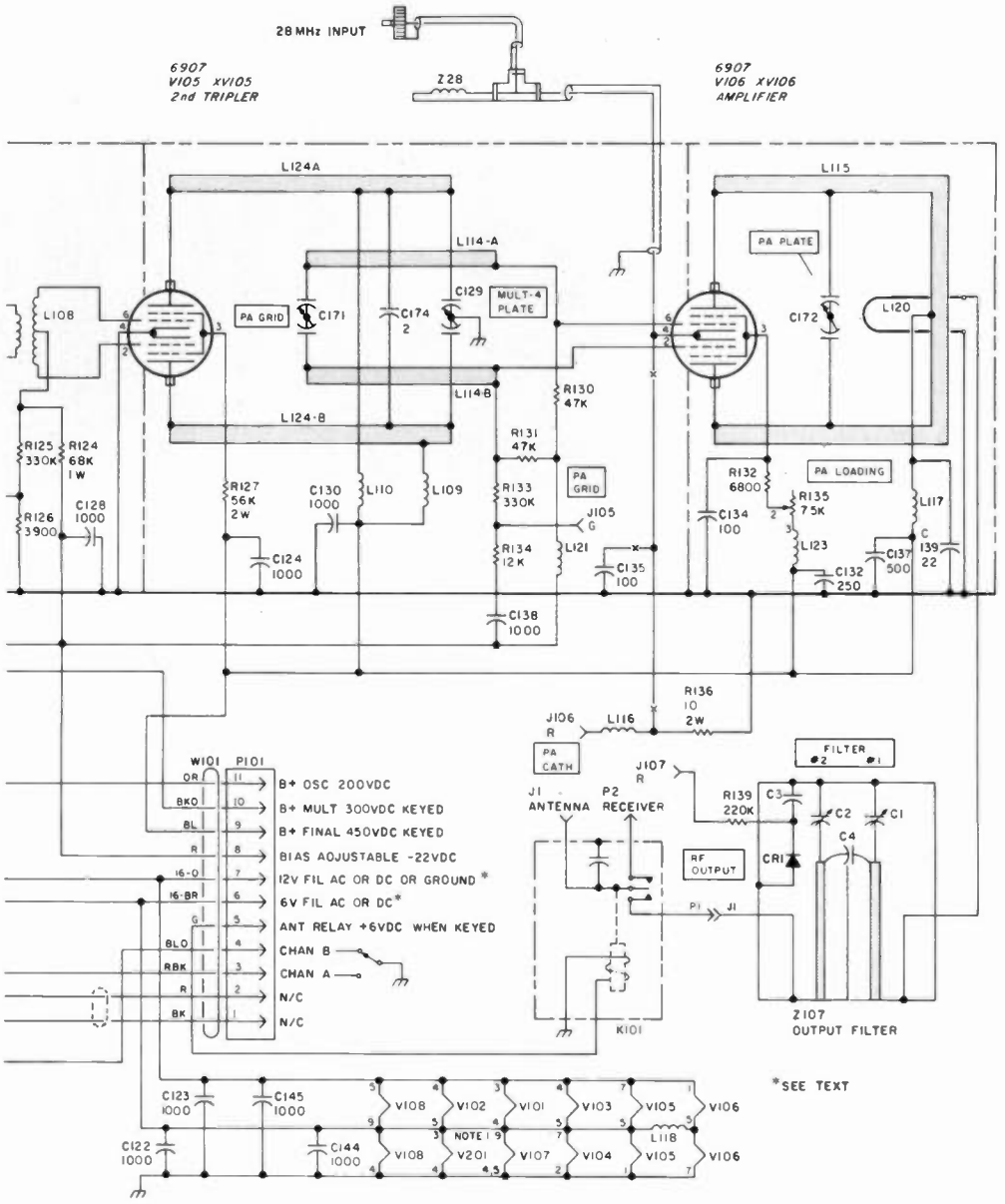

Fig. 1. Schematic.

If you have a model A1 unit and want to modify it to be an A11-type unit so you can switch between 432 and 435 MHz at the flip of a switch, send me an SASE for a schematic.

Install a 10-Ohm, 2-Watt resistor in another PL-259. This will replace the PL-259 with the rf choke for the bias setting in the alignment procedure only.

Alignment

Replace the PL-259 with the rf choke in it with the PL-259 with the 10-Ohm resistor in it on the T-fitting. Connect a voltmeter (2.5-volt scale) to where the exciter should connect on the T-fitting. Turn on the power supply and, after a few minutes warm-up, turn on the B+ voltages. Adjust the bias supply until you just start to get a reading on the voltmeter. This indicates that the mixer tube is just starting to draw cathode current. Remove the B+ voltages and replace the PL-259 with the rf choke in it. Do not connect the exciter yet. Turn the variable resistor on the side of the cage to fully counterclockwise.

Caution: Do not key the transmitter for more than 30 seconds at a time during the entire alignment procedure.

Connect the negative lead of the voltmeter to the MULT-1 test point and the positive lead to ground. Key the B+ voltage and you should see a reading of about 1 volt. This shows the oscillator is working. Move the negative lead to the MULT-2 test point and adjust the two transformers between the 6U8 and 6CL6 tubes for maximum voltage on the voltmeter (approximately .75 volts).

Move the negative lead to the MULT-3 test point and adjust the two transformers between the 6CL6 tube and the end of the transmitter strip for the maximum voltage (approximately 1.5 volts). Move the negative lead to the MULT-4 test point on the top of the cage next to the 2E26 tube. Using a nonconductive screwdriver, adjust C126, the 2E26 plate-tuning capacitor, for maximum voltage on the meter (approximately 2 volts).

Move the negative lead to the test point marked PA GRID. This is near where the new coax cable is coming out of the cage and the test point is green in color. Using a nonconductive screwdriver, adjust C129, the plate-tuning capacitor of the first 6907 tube, for maximum voltage by putting the screwdriver through the hole in the cage cover and down about an inch to engage the plate-tuning capacitor. This is a very sensitive adjustment. With the negative lead in the same place, adjust C171, the grid-tuning capacitor of the mixer tube, for maximum voltage on the meter. C171 is the capacitor right next to where the new coax cable comes out of the cage cover. You should repeak C129 again.

Connect a load to the output of the transmitter and connect the exciter to the coax T-fitting. You may want to connect a good UHF wattmeter between the transmitter and the load. I suggest a Bird wattmeter with a 25-Watt 200-500-MHz element. Connect the voltmeter with the negative lead going to ground and the positive lead going to the test point marked RF at the end of the cage area. Remember, do not key the transmitter for more than 30 seconds at a time in CW mode or you could burn out R132, a 6.8k ½-W resistor connected to the screen pin of the mixer tube.

Apply about 10 Watts of 28-MHz energy from your exciter and turn the B+ voltages on. Tune C172, the mixer-tube plate-tuning capacitor, for maximum voltage on the meter. Be sure you use a nonconductive screwdriver and place it down through

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the hole in the cover of the cage to engage with C172. This is a very sensitive adjustment. Adjust the two controls on the output filter at the end of the cage area, by the antenna relay, for maximum voltage on the voltmeter or maximum output on the wattmeter. Go back and readjust C172 again for maximum output. I suggest that you take the output power right from the filter output connector without going through the antenna relay. You should go back and adjust C171 (PA GRID) again for maximum output.

Turn R135, the variable resistor on the side of the cage, fully clockwise again. Increase the 28-MHz input power up to 20 to 25 Watts and you should get between 8 and 12 Watts out of the mixer at 435 MHz. This completes the alignment procedure.

Operation

You may connect the mixer directly to the antenna or run the output of the mixer into an amplifier. I have used this mixer on 432 MHz with a 4CX250B amplifier to win many ARRL VHF contests in the Pacific Division. I have also used its predecessor, the A2 version of the transmitter strip, to make over 500 contacts on OSCAR 7, mode B.

As you can see, this is an inexpensive way to get a 435-MHz SSB signal on the air to input OSCAR Phase III. If you would like to use this same unit on 432 SSB, substitute a crystal with a frequency of 11.2222 MHz and follow the same alignment procedure as before. I hope this article will help many more stations get on OSCAR that would not have because of the high cost of new equipment. ■

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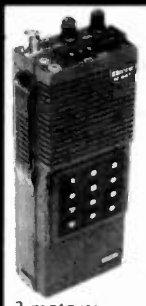

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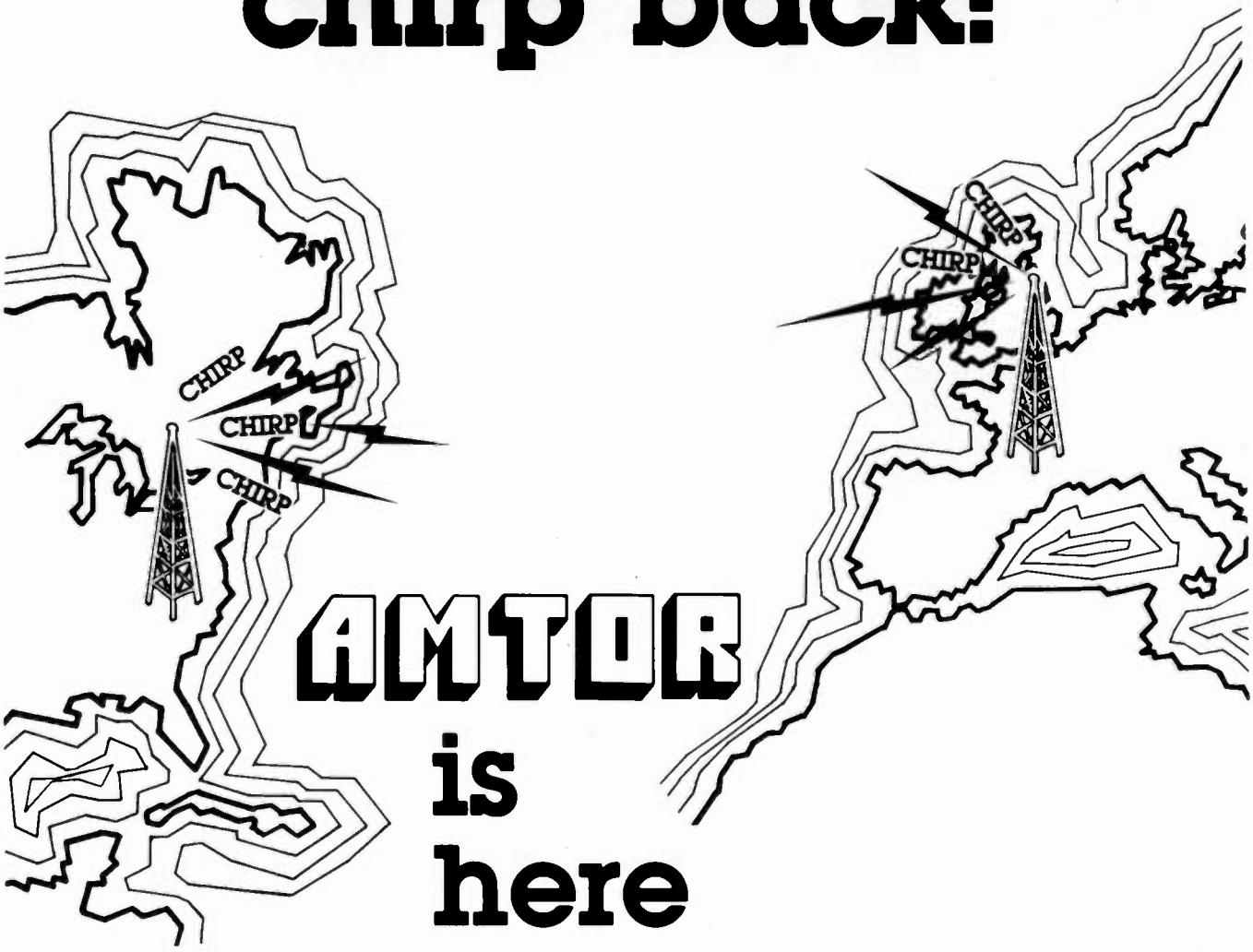

AMTOR is here

Been wondering what those "chirp-chirp" signals were around 14075? They're AMTOR, AMateur Teleprinting Over Radio. European hams have been enjoying the benefits of error free RTTY for sometime. (It's a must for commercial Maritime traffic.) Now, U.S. Amateurs are on the threshold of a new era of RTTY.

Old problems of QRM, QRN, & QSB are gone! If a propagation path exists, AMTOR will get the message thru — with no "hits" — "newspaper" perfect copy!

Two modes are available; AMTOR mode A transmits a three character block specially coded so that the receiving station can recognize an error. The three character block is repeated until the receiving station confirms reception by replying with the proper control code signal. Flawless print is possible with this "hand-shake" style operation.

Mode B, "FEC" or Forward Error Correction, is actually a time diversity mode where text is repeated and intermixed in the transmission. The receiving station unscrambles it and prints the clear text. This "broadcast" mode allows more than two stations to communicate. It's more effective than conventional Baudot or ASCII, but not as reliable as AMTOR mode A.

The actual DATA transfer in either AMTOR mode is nominally equivalent to conventional RTTY at 50 baud, or 66 WPM.

A receive only "Listen" mode is also available for reception of mode A data by a station not directly involved in the "hand-shake" communication.

Start with a new AMTOR ACT-1, ATR-6800, or update your present system.

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AMTOR, WHAT IS IT?

AMTOR, AMateur Teleprinting Over Radio will change the way you communicate. AMTOR is both a code and a method. This radically different RTTY system can provide virtually error-free copy under conditions that you wouldn't even attempt with conventional Baudot or ASCII. It is, in fact, the most well thought-out communication code since Sam Morse pounded brass. Every facet is designed to overcome the real-world problems of fading, noise and interference.

THE METHOD:

There are two variations, namely modes A & B (clever names eh?). In describing mode A, imagine the time wasted with lengthy repeats of whole messages just to correct a few errors, or the uncertainty of whether your traffic got through. How many times has one of your long dissertations been lost when the band folds? AMTOR mode A shortens each "message" to only three characters. The sending station (Tx) transmits this "block" of three then goes to receive so that reception can be confirmed by the receiving station (Rx). This is accomplished by the Rx transmitting a short "control signal" back to the Tx. Upon confirmation, Tx sends the next three character block. If not confirmed, the same block is repeated again, and again until it's perfect, or the computer decides it's not possible. As you can guess, this eliminates the necessity to type out repeats such as name, call etc. Signal reports are also redundant because you can tell by the number of repeats requested how well you're being copied! Even deep fades just slow down the traffic a bit until the signal recovers and copy resumes. All without the usual "garbage" print typical of poor conditions. A special "over" sequence reverses Rx and Tx roles.

THE AMTOR CODE:

Your next logical question will be "How does the Rx know it got a good block or not?" The answer lies in the code itself. The AMTOR code is neither Baudot nor ASCII. On the contrary, it is a "synchronous" code without start or stop bits. (Makes the computer work a little harder!) There are seven "BITS" per character, and always a constant 3 to 4 ratio of mark / space. This fixed ratio allows the Rx to determine good or bad data. (It *is* possible for *two* bits to reverse, 0 to 1, and 1 to 0, but the probability is extremely low !) This "double parity" limits the number of combinations to 35, which is directly compatible with the current Baudot character set.

Tx/Rx TIMING:

The continuous switching from receive to transmit makes some critical demands on the radio, because each three character block is sent in 210 MSec., (21 bits at 100 baud). The confirming control signal falls in the next 240 MSec., usually after a 10 to 20 MSec. delay for a total time of 450 MSec. (This explains the familiar "chirp-chirp" signal of about 2 per second that you hear.) The radio must fully recover from transmit to receive in less than 10 MSec. Generally, QSK rigs and most of the current crop of radios can handle it. Some might require an AGC tweak etc. A simple method is to use a separate receiver. That's the way a lot of commercial ships do it. Information on individual rigs will be made available as we go.

PROPAGATION TIMING:

The timing requirement also limits the total distance that can be traversed due to propagation delays out and back. Simply put, "long-path" is out! But direct short path up to one-half the earth's circumference is easily accomplished within the 240 MSec. time frame.

MODE B, FEC:

So far we've been discussing AMTOR mode A. The second, mode B, or Forward Error Correction mode is useful for bulletins or round tables. The same 7 bit synchronous code is used, but each character is transmitted twice, separated in time and inter-mixed. Hence the term "Time Diversity " is applicable. The transmission is continuous, with no hand-shake just as standard Baudot or ASCII is sent. (FEC sounds more rhythmically flowing than Baudot with its periodic start/stop bits.) The receiving stations recompile the data and display only the clear text. The same 3:4 mark/space ratio determines valid characters.

COMPUTER TRICKS:

By definition, in mode A, an entire block of 3, 7-bit characters, or 21 synchronous bits must be received, all with the proper 3:4 ratio to be considered valid. In our system, if *any* characters are valid, we save them and ask for a repeat. Chances are, the missing characters will be recovered in the next block. By accumulating characters, the "thruput" (computer jargon!) is significantly increased under poor operating conditions. Also, if signals do drop out entirely, we repeat for 32 tries before we discontinue.

See List of Advertisers on page 114

Up and Coming: Direct-Broadcast Satellites

Part II looks at the technical problems with communications at 12 GHz, which may be offset by the advantages.

Timothy Daniel N8RK
7 Peabody Drive
Oxford OH 45056

Hams love a challenge. Why else would they erect 200-foot towers, endure cold mountaintops, or spend hours designing and building the ultimate receiver? The current generation of satellite television was a natural attraction for hams. Dedicated to doing more with less, electronics hobbyists took on the TVRO challenge and ended up creating a new home-entertainment industry.

Will the 1980s version of spacecasting, Direct-Broadcast Satellites (DBS), offer the same kind of opportunity that beckoned TVRO pioneers like W5KHT, W6HD, K4AWB, and N6TX? The first part of this article, in last month's *73*, concluded that DBS holds a different kind of promise. The presence of large, technically-advanced companies is likely to discourage garage-style entrepreneurs. But what about the basement tinkerer? For him, DBS could be a challenge par excellence.

This is not a "how to" article. With DBS service planned to begin in the mid to late 1980s, it would be premature to start manufacturing circuit boards. But if you have already mastered the reception of present-day 4-GHz satellite signals, then consider taking on the challenge of receiving 12-GHz signals from one of the "communications" satellites already in orbit or soon to be launched. Though no hobbyist has publicly announced such an accomplishment, an examination of the technical parameters will show that it is doable.

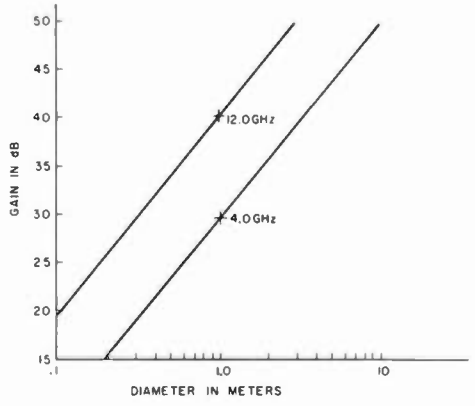

Fig. 1. The gain of a dish antenna depends on the frequency of operation and its efficiency. A one-meter dish has 10 dB more gain at 12 GHz than it has at 4 GHz, provided efficiency remains the same.

Why 12 GHz?

The choice of 12 GHz for DBS is not as baffling as it may first appear. Perhaps the most important reason behind 12 GHz is the need for small, inexpensive receive antennas. Fig. 1 shows that a dish, one meter in diameter, has roughly 30 dB of gain at 4 GHz, making it far too small for catching satellite TV signals on that band. The same dish has about 40 dB of gain at 12 GHz. A dish antenna's gain at a particular frequency is proportional to the reciprocal of the wavelength squared, hence the increase of 10 dB.

A second argument for 12 GHz centers on the ability to use larger bandwidths. DBS proponents have suggested using signals with bandwidths as wide as 400 MHz. The tenfold increase over 4-GHz signal bandwidths holds some exciting possibilities. We might be treated to high resolution video and have our choice of several different audio channels!

The technical attractions of the 12-GHz Ku-band are accompanied by some substantial drawbacks. While much of the theory that works at 4 GHz holds true at 12 GHz, actual Ku-band components require another magnitude of precision. Consider that a Ku-band signal has a freespace wavelength that is less than one inch long. At these frequencies, hardline gives way to waveguide and suitable microwave transistors, when available, cost in the hundreds rather than the tens of dollars.

The Satellites

DBS planners have laid the groundwork for a multi-satellite network. Depending on the proposal, there will be either three or four geosynchronous spacecraft, each one beaming to a separate region of the US. The multi-satellite approach offers two advantages over

the current system of using a single satellite to blanket the country.

First, by concentrating the satellite's signal on a smaller area, the cost and complexity of receivers can be lessened. When the antenna-size limitation, receiver-noise performance, and the substantial path loss (approximately 205 dB) are weighed against the need for snow-free pictures, it becomes clear that the new satellites must have an effective radiated power far greater than the 30- to 35-dBW signals emanating from the 4-GHz satellite-TV birds. Ku-band DBS signals will probably exceed 50 dBW and may even approach 65 dBW. A satellite capable of covering the continental US with that kind of signal would need close to 1000 Watts of output power, severely taxing the weight and power-supply limitations for spacecraft.

How do spacecasting transmitters generate high-powered microwave signals? The answer is, very carefully. Traveling-wave tube amplifiers (TWTAs) are used, often in groups of two or more since the largest single unit can generate no more than a couple of hundred Watts. TWTAs, like amplifiers for ham radio, can fail at the worst time. The world's first direct-broadcast satellite, a Japanese experimental spacecraft, had a shortened life due to TWTA problems. The push is now on to build higher power TWTAs and improve satellite power generation and cooling systems.

A second drawback to the single-satellite approach stems from biannual eclipses where the Earth prevents the sun's rays from reaching a satellite's solar cells. The satellite must cease transmitting or rely on heavy and expensive storage batteries. Rejecting the second alternative, it may be possible to place the satellite in an orbital location that causes the blackout to occur at an hour when few people expect television service. But, as Harley Radin pointed out in the August, 1982, issue of *Satellite Communications*, such a location would be over the Pacific Ocean and impractical for east coast reception.

With the single-satellite approach presenting problems at every turn, planners have suggested a multi-satellite system where each craft would serve either one-fourth or one-third of the continental US. In arguing for the three-satellite approach, Radin questions the need to match program times with the national time zones, a feature of the four-bird proposal. Instead, he suggests that using only three satellites will reduce the overall cost (satellites are expected to cost in the $100-million range) and make better use of the frequency spectrum and orbital space.

Should DBS become a money-maker, two additional problems may develop. First, there is a limited number of ways to launch a satellite. Companies that counted on the European Space Agency's Ariane launcher are beginning to have second thoughts, and the best alternative, the US Space Shuttle, is almost completely booked through the mid-1980s.

If a large number of satellites do end up in orbit, it could present problems on the receiving end. Dish antennas are limited to a very narrow beamwidth—about 3 degrees—and may need to be rotated to receive signals from different satellites. If motorized antennas prove too costly, an electronically-steered "flat" array could be introduced.

Receiver Performance

The plight of satellite-receiver designers is best expressed by the old saying, "He robs Peter to pay Paul."

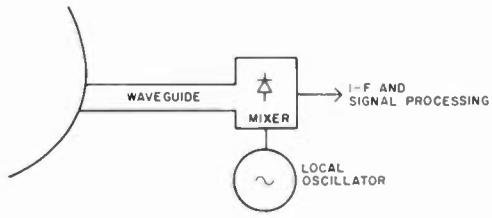

Fig. 2. The NHK Corporation of Japan receiver, described in the January/February, 1982, issue of High Technology, *uses direct conversion for low cost and a reasonably good noise figure.*

The tradeoff is between receiver-noise performance and antenna size. It boils down to getting acceptable performance at a reasonable cost. Acceptable performance is usually equated with a carrier-to-noise ratio (C/N) of at least 10 dB. While 10-dB C/N may not be studio quality, it does ensure reasonably snow- or sparklie-free pictures. DBS backers realize that their signals must compete favorably with conventional broadcasting and cable TV if they are to stand a ghost of a chance.

For an in-depth look at the "rob Peter, pay Paul" dilemma, read Stephen Gibson's "How Big a Dish?" in the November, 1981, *73*. The culprit, as Gibson points out, is noise.

In his article, "Direct Satellite TV: The 12-GHz Challenge" (*High Technology*, January/February, 1982), James Fawcette outlined three approaches to building receivers. The first and perhaps most startling method (shown in Fig. 2) is direct conversion, developed by the Japanese broadcasting giant, NHK. Akin to the simplest of ham receivers, the NHK design features a very low manufacturing cost. The signal goes from the antenna to a diode mixer via waveguide. There is no low-noise preamplifier stage. Fawcette cites an NHK claim of a 3.4-dB noise figure and 300-MHz bandwidth!

A more traditional approach to receiver design centers on a low-noise preamplifier circuit operating at 12 GHz. Like the current 4-GHz gear, several gallium arsenide (GaAs) field-effect transistors (FETs) are chosen because of their minimal noise contribution to form a preamplifier before the mixer stage. GaAsFETs are, however, expensive and difficult to use. Designers must pay close attention to the transition from waveguide to printed circuitry and use isolators to insulate the FETs from high swr. These additions can add to the receiver noise level and require a lot of individualized alignment. The result, while expensive, should be better than that which is achieved with the direct-conversion approach.

Hobbyists who want to roll their own 12-GHz low-noise amplifier might want to consider the Mitsubishi MGF-1403. This GaAsFET, offered by at least one *73* advertiser, has a Ku-band noise figure of less than 2 dB. If your pocketbook permits, you might want to try for an even better noise figure.

Manufacturers hope to avoid the cost of discrete GaAsFET front ends by fabricating GaAs integrated circuits. It is conceivable that the entire receiver could be on one chip. But until GaAs technology is refined and yield levels are boosted, receivers probably will employ hybrid circuitry using discrete front ends and integrated circuits for intermediate frequencies and signal processing. Siemans A.G., a European

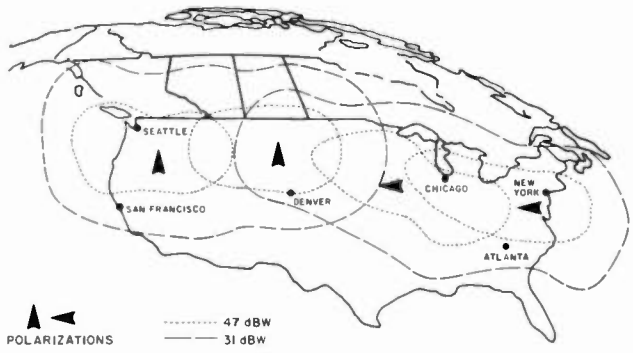

Fig. 3. ANIK C3, a Canadian satellite, may be the first source of North American 12-GHz television broadcasting. Its footprint will favor the northern United States. (Illustration from Satellite Communications, *July, 1982.)*

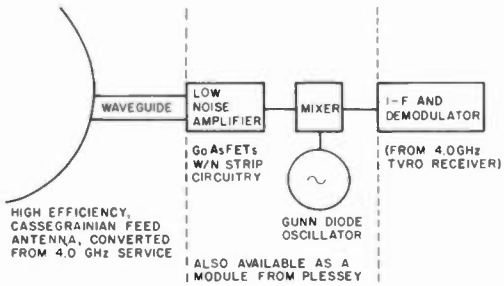

Fig. 4. By using a 4-GHz TVRO dish, front-end module from Plessey Corp. and integrated circuits for the i-f and signal-processing stages, a 12-GHz receiver could be within the reach of many hobbyists. For dyed-in-the-wool do-it-yourselfers, there are suitable GaAsFETs for building a 12-GHz low-noise amplifier, and a Gunn-diode oscillator could be used with a passive mixer for the downconverter stage.

corporation, already has introduced GaAs ICs that would follow the mixer stage in a DBS receiver.

A number of companies have finished prototype receivers and are laying the groundwork for manufacturing them in 100,000 quantity levels. European and Japanese companies like Plessey, Philips, Sony, NHK, and Siemans seem to be in the forefront. The late entry by American firms may be due to the lengthy FCC-approval process and lack of 12-GHz satellites for testing. Just who will dominate the US market remains to be seen. The ability to keep costs to a minimum could be the deciding factor.

Getting Started

If you have read this far and like a challenge, then consider getting in on the ground floor. In late 1980 a satellite built by Hughes Aircraft was put in a geosynchronous orbit of 106 degrees west. Operated by Satellite Business Systems (SBS), the spacecraft has ten-Ku-band transponders and is used by large corporations for high-speed data communication.

The all digital-time division multiple-access data format will make it difficult for hobbyists to receive any meaningful data from the SBS signals, but what the satellite does offer is a steady source for testing antennas and receivers. The transmitter footprint is said to be in the 43-dBW range, favoring the east central and western United States. SBS recommends that users have a 5.5- or 7.5-meter dish.

The first North American satellite to carry 12-GHz video on a regular basis will probably be ANIK C3, which was launched from the Space Shuttle last November. (See Fig. 3.) Built by Hughes Aircraft for Telesat Canada, ANIK C3 has 16 12-GHz transponders that can accommodate data traffic or two FM TV channels each. Telesat Canada plans to lease most of the transponder space to US companies, including several interested in experimenting with direct broadcasting. Although ANIK C3 transmissions aren't as strong as future DBS signals, they should be easier to receive than those from the SBS satellite, especially if you live in the northern US.

Finding suitable 12-GHz hardware will be the biggest problem facing pioneer tinkerers. One logical starting point is the dish antennas for 4-GHz TVRO reception. Some manufacturers even claim that their antenna will work just as well at the higher frequency. Whether you build or buy, remember that any dish antenna's performance is severely degraded if flaws in the surface accuracy exceed .1 times the wavelength of operation. For 12-GHz work, this means a tolerance of less than a tenth of an inch!

When choosing an antenna, pay close attention to the feed since it plays a big role in determining an antenna's efficiency. Remember, the feedhorn designed for a 4-GHz satellite system is *not* what is best for 12-GHz experimentation.

Choosing receiver components could be tough. If you have the necessary experience and test gear, you can roll your own 12-GHz LNA. Otherwise, you'll have to scour the surplus markets or save up enough money for a commercial-grade unit. Engineering evaluation models are starting to become available; Plessey Corp., for example, offers a complete receiver front-end module.

Hams who have experimented with Gunn-diode-based oscillators may want to try building their own local oscillator and diode mixer. The secret seems to be keeping the local oscillator's frequency stable and reducing unwanted sideband noise. Once you have perfected the preamplifier, local oscillator, and mixer stages, you can rely on proven intermediate-frequency and signal-processing designs. Fig. 4 shows one possible approach at assembling a working 12-GHz terminal.

Does all this sound like too much—an impossible feat? Then think about the not-so-distant past when Bob Coleman K4AWB built a 4-GHz satellite terminal using a few hundred dollars worth of surplus "junk" and a VTVM. For him, satellite TV was an opportunity rather than a roadblock and there was no need to wait for someone else to lead the way.

Who will be the first to master the 12-GHz DBS challenge?

Author's Note

Since the legality of unauthorized reception of satellite signals has not been decided, readers are urged to use discretion in decoding or disseminating any information they might receive. ■

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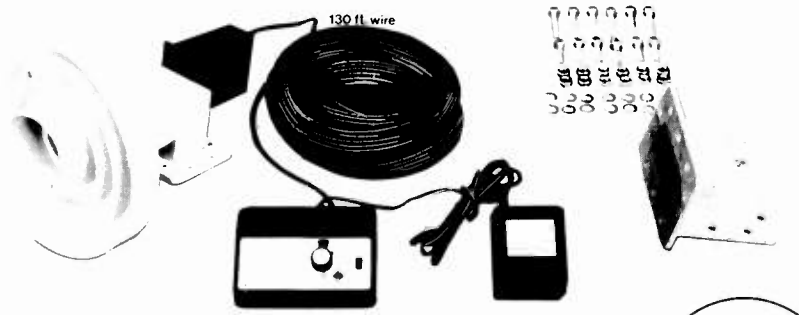

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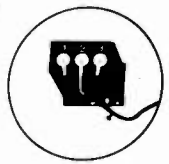

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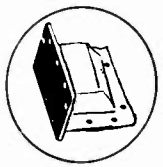

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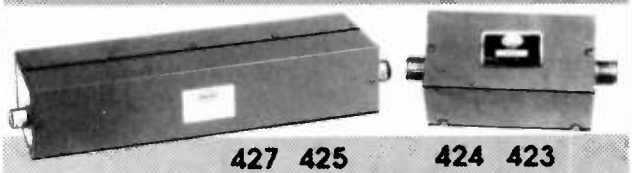

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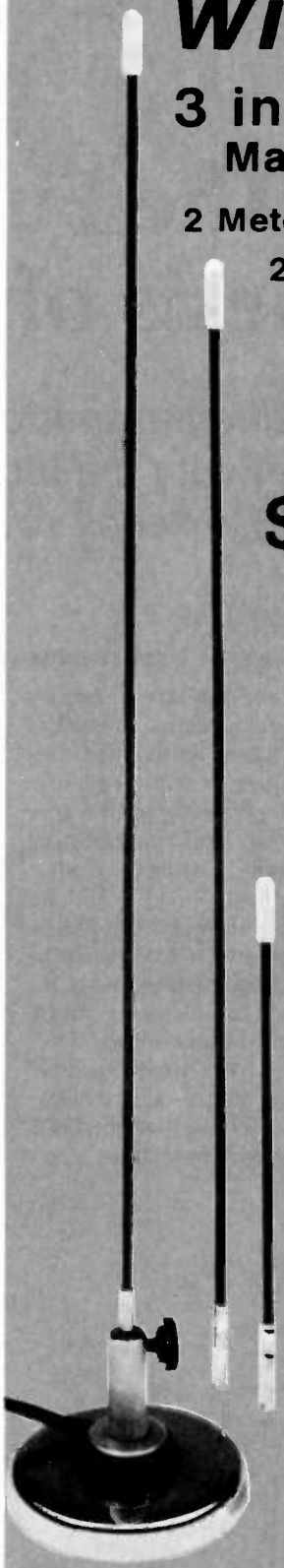

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The Fun-Vac: A Synthesis of Old and New

This one-tube transmitter combines the circuits of the fifties with the technology of the eighties. It also keeps your coffee warm.

Ed. Note: PC boards for this project are available from the author for $7.00 ppd.

The response to my series of articles on Fun home-brew gear has indicated that there is a diverse group of people building gear today. Without question, the one central and overwhelming theme of the response has been about *simplicity*!

The emphasis in home-brew products has changed dramatically over the years. Nearly everyone has as his main rig a factory-built transceiver which is good on today's crowded bands. However, the lure of home-built gear seems to entice even more hams than before, quite possibly because they are building for fun and challenge and not because of necessity or lower cost.

The "Fun-Vac," the 2-to-5-Watt 40-meter CW transmitter described here, is in response to requests from both old-timers and newcomers for a different kind of transmitter—a *tube* transmitter. Believe it or not, I did say *tube* (hence the "Vac" for vacuum). What a challenge it was to design and build a tube transmitter based on the Fun-gear principles of no adjustments and all parts coming from Radio Shack! It really *was* fun to return to the early days of my ham career (mid-sixties) and work with vacuum tubes. However, modern construction practices and the 1980s philosophy of home-brew gear were used in designing this very simple, very reliable, one-tube, 40-meter transmitter.

Why use a tube?

First, it is nostalgic for the many who entered the ham-radio field before the seventies.

Second, many older hams have stopped building due to the extinction of tube circuits. This project hopefully will bridge the gap for them between current transistorized gear and the older, massive, point-to-point construction-type tube rigs which required hours and hours of wiring, sheet-metal work, and critical adjustments.

Third, many new hams have virtually no experience or education regarding tubes, and a simple one-tube project is a good way of discovering our tube heritage (which may help in understanding transistor circuits).

Fourth, it is just plain fun to integrate the fifties and sixties home-brew ideas with the home-brew philosophy of the eighties!

I firmly remain, however, a proponent of state-of-the-art gear. Transistors are much more efficient with their use of power, and 12 V

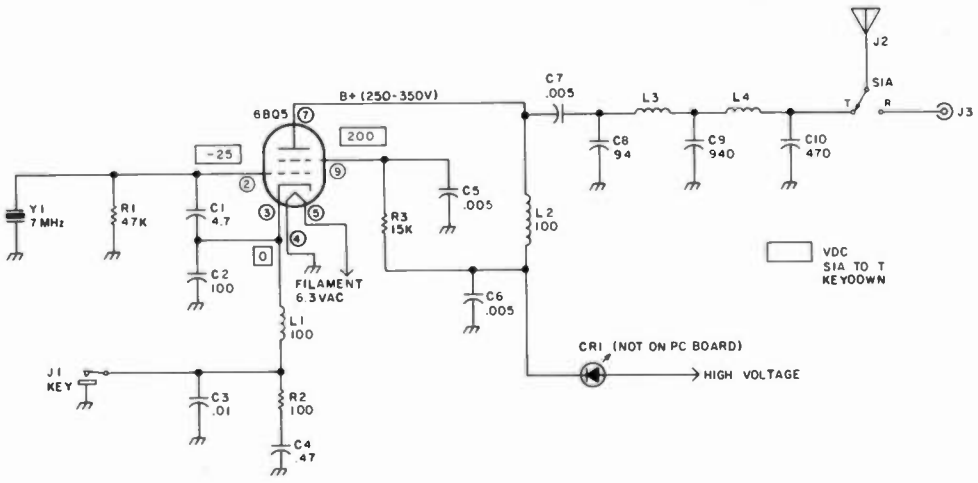

Fig. 1. Fun-Vac schematic.

to 24 V is much, much safer to work with than 300 V!

Objectives

My main objective with this rig was to design a tube transmitter that fit in with the entire Fun series of simple, low-cost gear. It would be worthwhile to review the entire series, particularly the article on the Fun-Mitter (*73 Magazine*, February, 1981; see also "Fun-Equipment Revisited" in the January, 1983, issue). The Fun-Mitter is a 5-Watt, 80- through 15-meter solid-state transmitter. The characteristics of the Fun gear are: small size, simple construction, no adjustments, and all parts available from Radio Shack.

The objectives of the Fun-Vac were, in addition:

- PC board construction with the same size board as other Fun gear (2¼" × 3")
- a cost less than $25
- easy assembly
- 2 to 5 Watts output

All of these objectives were met. Even a 300-volt power-supply design is included here.

Circuit

The basis of the transmitter is a 6BQ5, a 9-pin miniature beam-power pentode available from Radio Shack. The 6BQ5 is a rugged device capable of dissipating 10 to 15 Watts under a 50% CW duty cycle.

The 6BQ5 functions as both oscillator and amplifier. The oscillator uses FT243 fundamental crystals in a Pierce configuration. C1 and C2 provide feedback between the control grid and cathode. The oscillator is keyed by breaking the cathode-to-ground connection. L1, R2, C3, and C4 comprise a wave-shaping circuit to eliminate clicks and sluggish starting of the oscillator.

The big power-waster of this circuit (as with all tube circuits) is the filament. A tube works by heating the cathode to jar electrons loose from its specially-coated surface. This is the function of the filament (or heater) which actually glows orange, warming the cathode. The 6BQ5 requires 6.3 V at .75 Amps applied to the filament. (This is about 4½ Watts, or as much as the total output power of the tube!)

The plate operating voltage (250 to 300 V) is applied through plate choke L2. In order to meet the objective of using Radio Shack parts, L2 was required to be 100 uH. This is somewhat less inductance than the normal value of plate choke, but absolutely no problems were encountered. Rf output is taken from the plate through C7 and applied to the matching network, L3, L4, C8-C10. This network serves two purposes and is different from the norm in tube circuits.

Its first purpose is to match the impedance of the plate (about 2500Ω) to a 50Ω antenna load. This is accomplished by C8, C9, and L3. The second purpose is harmonic filtering, which is accomplished by both sections. The matching network is actually two pi networks combined. One matches 2500Ω to 50Ω and the other is a 50Ω-to-50Ω match.

Although the pi network is a standard method of matching impedances in a plate circuit, this network is different in one aspect: it is fixed-tuned. Normally, a variable-load capacitor would be used at C10 to adjust for an antenna load of between 30Ω and 70Ω. All of today's equipment is fixed-tuned for a 50Ω antenna load, and with antenna transmatches in abundance, the necessity for a variable load control no longer exists. Another norm in tube circuits is to use a variable-tune-control capacitor at C8. By designing for a somewhat lower Q, this capacitor was made fixed. No tuning adjustments are required! The entire transmitter can be built on a small PC board just like today's solid-state rigs, with no bulky front-panel variable capacitors!

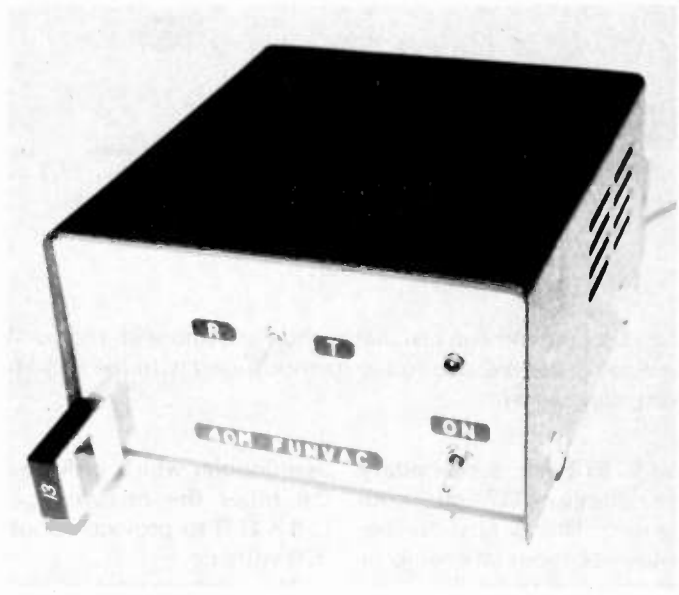

Photo A. Front view of the Fun-Vac.

The matching inductors, L3 and L4, are made from Radio Shack 10-uH chokes as has been done with all previous Fun gear. By removing the required amount of turns, the needed inductance is easily obtained. These chokes make for small and easy-to-make inductors—again, something quite unusual in a tube circuit.

The LED, CR1, was included to provide a method of monitoring plate current. The LED is wired in series with the plate voltage and lights brightly when the plate current passes through it. Because of the very low voltage drop across the LED, no power is lost in it. (It also is fun to use a modern solid-state device to monitor current in a tube rig!)

Power-Supply Circuit

The Fun-Vac operates from two power-supply voltages, 6.3 volts ac and approximately 300 volts dc. The 6.3-V-ac filament voltage is somewhat critical in value, but the high voltage can vary between 200 and 350 volts. These voltages can be obtained from an existing supply or a supply can easily be built and incorporated into the same box with the Fun-Vac PC board. I chose to include power supply and Fun-Vac in one box, as shown in Photo B. However, the voltages can easily be "stolen" from a tube-transceiver supply or a similar supply by using the appropriate connector on the Fun-Vac chassis.

A simple circuit to obtain the needed voltages is shown in Fig. 2. An attempt was made to design a supply that also met the Fun gear objective of obtaining all parts from Radio Shack. The design shown meets that objective although it represents a rather unorthodox approach. By using two step-down transformers

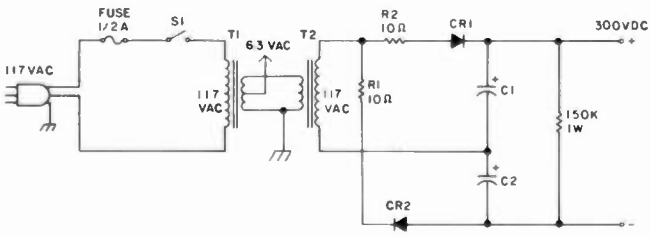

Fig. 2. Fun-Vac power-supply schematic.

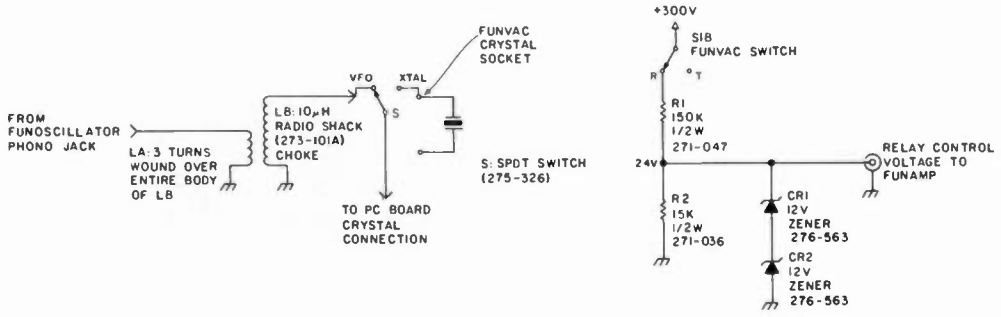

Fig. 3. Using the Fun-Oscillator and Fun-Amp with the Fun-Vac. The Fun-Amp relay-control voltage is needed due to the methods used with the Fun-Mitter. Mount resistors R1 and R2 very close to S1.

back to back, a secondary ac voltage of 117 volts is obtained. This is possible because of the relationship of the turns ratio of the transformer. (It is an old trick, used in the past to obtain a negative bias voltage for tube rigs.) The 117 volts ac is applied to a full-wave voltage doubler which provides 2.8 times the rms voltage (2.8 × 117) to provide about 320 volts dc.

This arrangement is not extremely efficient and the parts shown do not provide a very "stiff" high-voltage supply. This results in less power output than the tube is actually capable of, but the parts are easy to obtain and the circuit is easy to build. The transformer windings must be connected in phase in order to add voltages. If, after the supply is wired, no ac output occurs at T2 secondary, then reverse the connections at T1 secondary.

Using the Radio Shack parts shown does make the power-supply portion of the Fun-Vac nearly as expensive as the rf circuitry. It may be possible to substitute for the filter capacitors by using the junk box or buying from a local TV repair shop. A value of 50 to 100 uF will work fine, and even less capacitance can be used at the expense of less filtering and regulation. Also, the transformers can be replaced by any transformer that can supply the needed voltages.

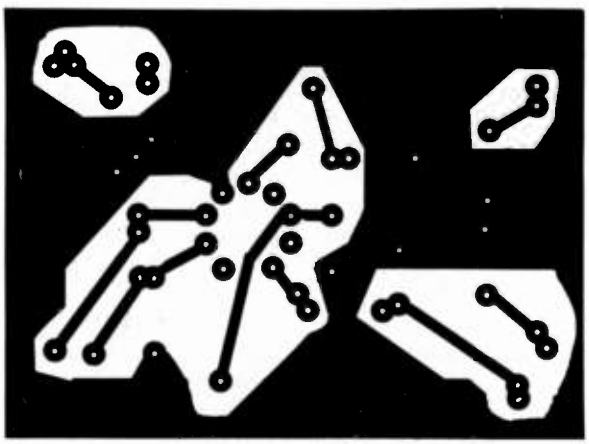

Fig. 4. PC board.

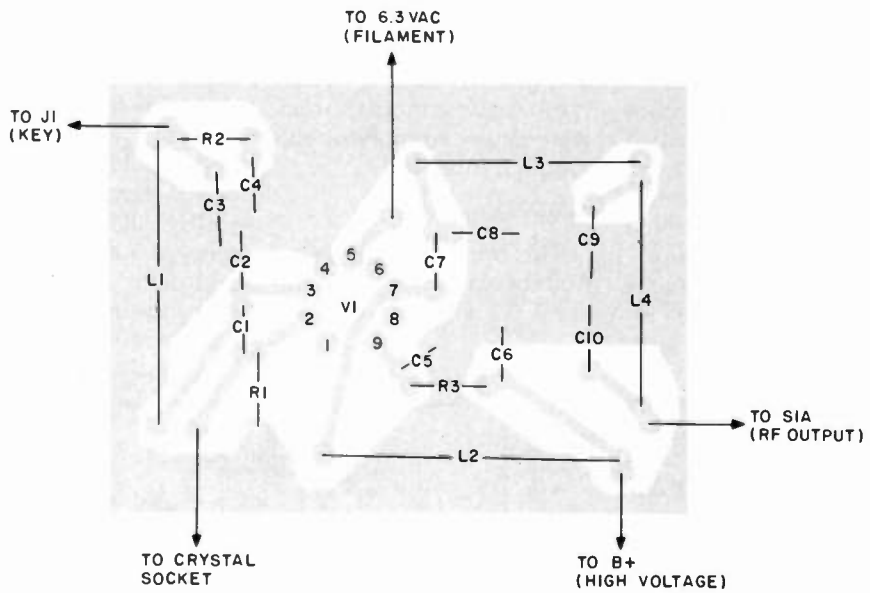

Fig. 5. Component layout.

Construction

Before beginning the actual construction of the Fun-Vac, a review of safety practices with high voltages is necessary. *The high voltage used in this circuit can be lethal!* When voltage is applied, never touch anything on the PC board or in the box. Always keep one hand away when making any measurements.

Using PC board construction for the Fun-Vac greatly simplifies building the rig and makes it as simple to build as solid-state gear. PC board use also eliminates wiring errors. All of the parts except the jacks, switches, and the plate-current LED are mounted on the board.

The 6BQ5 tube can be soldered directly to the PC board without a tube socket. This makes the loaded board shorter, which is important in mounting. If you purchase a new 6BQ5 from Radio Shack, there should not be a need to replace the tube, rendering the usual practice of using a tube socket unnecessary.

FT243 crystals and sockets can be obtained from a number of sources and are quite inexpensive. Mount the socket on the front panel to facilitate easy changing during operation.

The plate-current LED should be mounted in a hole on the front panel and glued in place. Route the wires to the LED carefully since these wires carry the high voltage. If possible, don't leave bare wire exposed anywhere in the high-voltage circuit.

The sheet-metal work necessary with the Fun-Vac is much simpler than it was in a comparable tube transmitter from fifteen years ago. Before, heavy metal was used, often even steel, and it had to be punched for tube sockets, variable capacitors, and large coils. Using the Radio Shack cabinet makes sheet-metal work easy. The light-gauge alumi-

IC-740

Internally Mounted Options

Internal options are provided for the IC-740 to increase its flexibility.

The internal power supply, the EX238, gives the IC-740 portability and also makes a clean looking shack.

With an installation time of under 30 minutes and clear instructions, the IC-EX238 can be installed easily. The EX238 works from either 110 or 220 VAC 50/60 Hz.

The EX242 FM unit allows transmission and reception of FM signals on 10 meters.

A marker unit, EX241, gives clear frequency marking signals at 25 or 100 KHz, selectable by top panel switches.

With the installation of the **EX243 electronic keyer and optional filters,** the IC-740 becomes a compact, complete CW station.

Filtering
Control in Center Position

	Modes Of Use	6dB Bandwidth	60dB Bandwidth
Standard Filtering IF Shift Mode	CW/RTTY/SSB	2.4	4.5
Standard Filtering PBT Mode	CW/RTTY/SSB	2.2	3.6
Optional FL44 with Standard PBT Filter	CW/RTTY/SSB	2.2	3.0

Optional Filters

	Use	Center Frequency	6dB Bandwidth	60dB Bandwidth
FL44	SSB/CW/RTTY	455.0KHz	2.4KHz	4.2KHz
FL45	CW/RTTY	9.0115MHz	500Hz	1.6KHz
FL54	CW/RTTY	9.0115MHz	270Hz	1.1KHz
FL52	CW/RTTY	455.0KHz	500Hz	820Hz
FL53	CW/RTTY	455.0KHz	250Hz	480Hz

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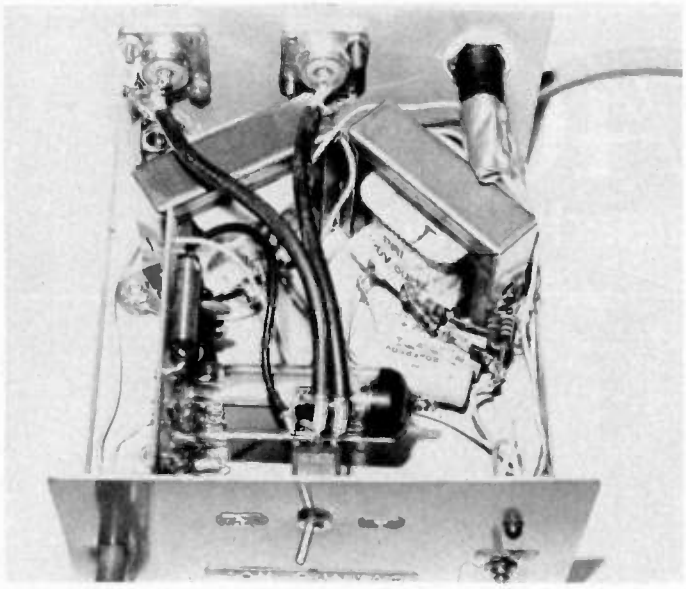

Photo B. Inside view of the Fun-Vac.

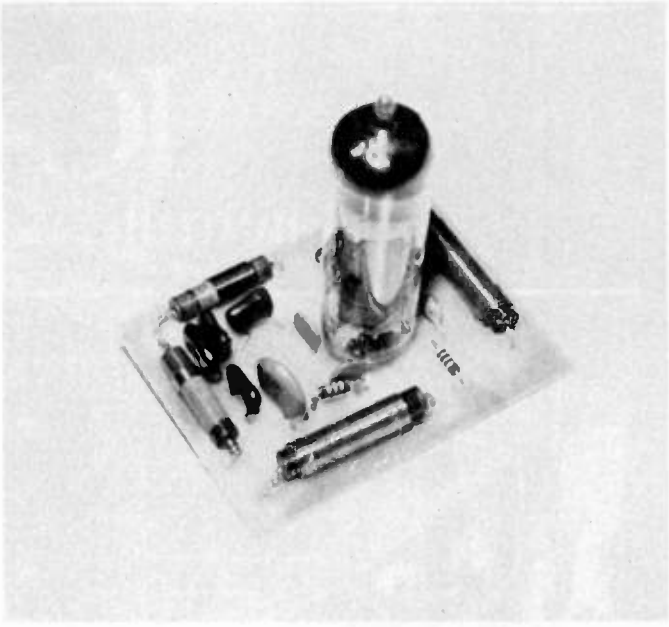

Photo C. PC board for the Fun-Vac.

num is easily worked using a hand drill and a knife.

Mounting of the PC board in the cabinet should be done with care. If the Radio Shack cabinet is used, it will be necessary to mount the board at right angles to the case, as shown in Photo B. If desired, the bottom of the board can be covered with electrician's tape to keep fingers from accidentally touching the high voltage.

The wiring used is not particularly critical. The filament wire should be at least 22 gauge. All rf wiring should be with coax, and RG-58 will work fine.

After the power-supply section is completed, do not connect the voltages to the Fun-Vac PC board. This will be done after proper operation of the supply is verified.

Vfo and Amplifier Use

The Fun-Vfo (2/82) and Fun-Amp (5/82) can be used with the Fun-Vac easily. Using the Fun-Vfo requires the addition of a step-up transformer to match the output impedance of the Fun-Vfo to the high impedance of the control grid of the Fun-Vac. The vfo signal is applied to the crystal socket. A switch can be used to switch between vfo and crystal. Details of the impedance transformer and possible switching arrangement are shown in Fig. 3.

The Fun-Amp is easily added to the Fun-Vac. It requires a control signal to control the Fun-Amp relay; this can be brought out of the Fun-Vac through a phono jack. The Fun-Amp will provide around 20 Watts of output power from the Fun-Vac. Details of the Fun-Amp use are given in Fig. 3.

Fun-Vac Parts List
(with Radio Shack numbers)

C1	4.7 pF	272-120	
C2	100 pF	272-123	
C3	.01 μF	272-131	
C4	.47 μF	272-1071	
C5	.005 350 V	272-1051	(Two in series)
C6	.005 350 V	272-1051	(Two in series)
C7	.005 350 V	272-1051	(Two in series)
C8	94 pF 100 V	272-121	(Two 47 pF in parallel)
C9	940 pF	272-125	(Two 470 pF in parallel)
C10	470 pF	272-125	
CR1	LED	276-041	
J1	Phone jack	274-252	
J2	SO-239 ant. jack	278-201	
J3	SO-239 ant. jack	278-201	
L1	100 uH choke	273-102	
L2	100 uH choke	273-102	
L3	Remove 7 turns from 273-101A choke		
L4	Remove 17 turns from 273-101A choke		
R1	47k, 1/4 W	271-1342	
R2	100, 1/4 W	271-1311	
R3	15k, 1 W	271-040	(Two in parallel)
S1	DPDT	275-1546	
V1	6BQ5		
Y1	7-MHz FT243 crystal		
Case		270-253	

Adjustment

The safety factor cannot be overemphasized. During adjustment, with the case open, it is very easy to accidentally touch the high voltage. Whenever the cover is off, always be aware of where the high-potential voltage points are.

The only adjustments of the Fun-Vac are really not adjustments at all; they are checks to ensure proper operation. If possible, obtain a voltmeter capable of measuring ac and dc voltage of greater than 300 V. At this time the two power-supply voltages should not be hooked up to the Fun-Vac. With the power on, carefully measure the high voltage. The reading should be between +250 volts and +350 volts.

Next, connect the filament-voltage wire to the PC board. Switch the voltmeter to the ac range and measure the filament voltage. It should be around 6.3 V. If it reads more than 7 volts ac, a filament-voltage dropping resistor may need to be added—$R=(V-6.3)/.75$. At this time, with 6.3 V ac on the filament, there should be an orange glow from the tube, indicating that the tube filament is working.

Next, with power off, connect the high voltage to the circuit board through the front-panel plate-current LED. Also, hook up a dummy load to the antenna connector and insert a key into J1.

Turn the power switch on and wait at least 30 seconds for the filament to warm up.

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Fun-Vac Power Supply Parts List (with Radio Shack numbers)

C1	Each capacitor should be about 25 μF at a	
C2	voltage rating of at least 200 volts. This can be done by wiring four 272-1044 100-μF 50-volt caps in series for each.	
CR1	400-V, 1-Amp diode	276-1103
CR2	400-V, 1-Amp diode	276-1103
R1	10Ω ½ W	271-001
R2	10Ω ½ W	271-001
S1	SPDT switch	275-324
T1	Transformer, 12.6 V ac, 1.2 Amps	273-1505
T2	Transformer, 12.6 V ac, 1.2 Amps	273-1505
	Fuseholder	270-365
	1/2-Amp fuse	270-1271
	Line cord	278-1255

With a 40-meter crystal installed and the receive/transmit switch set to transmit, close the key. The front-panel plate-current LED should light, indicating the plate current of around 30 to 50 mA. This indicates proper operation. If a wattmeter is connected between the antenna jack and the dummy load, a power output of between 2 and 5 Watts should be observed, with the key closed.

For vfo operation, merely substitute the Fun-Oscillator for the FT243 crystal and proceed as above.

If problems are encountered, a logical analysis should reveal the trouble. If power-supply voltages are correct, then the problem can be isolated to the Fun-Vac PC board. Measure the voltages at the various points around the board corresponding to the indicated voltages on the schematic. If your voltages vary significantly from those given, then check and re-check for improperly soldered connections, miswiring, or faulty components.

Operation

Using the Fun-Vac for contacts is almost as much fun as building it! As with the Fun-Mitter, a 50Ω resonant antenna must be used. This usually will provide an swr of 1 to 1, which is a good method of monitoring load conditions. With today's stations, the necessary 50Ω-load antenna probably already exists due to the prevalent use of transmatches.

Allow the Fun-Vac to warm up for at least 30 seconds before use. In some ways, the soft warm glow of the tube as you operate is a reassuring feeling—reminiscent of days gone by. Incidentally, the heat generated by the soft, warm glow of the tube literally will keep your coffee warm—a side benefit of the Fun-Vac.

To operate, merely select the correct operating frequency, switch S1 to transmit, and begin keying. The receiver is connected to the receive antenna jack on the rear panel of the Fun-Vac. The low power of the Fun-Vac eliminates the necessity of a sidetone or receiver mute control since the actual signal can be listened to on the receiver without overloading.

Conclusion

The Fun-Vac provides a means of experimenting with tubes using modern methods. (If other band coverage is desired, refer to the Fun-Mitter articles.) It's amazing how simple those massive old rigs can be. Happy nostalgia! ■

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Adventure in Sarawak

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The three 9M8s; left to right, Jim 9M8JS, Paul 9M8PW, and Kirsti 9M8NL.

Jim at the rig.

Sarawak—the land of the Hornbills, in Northwest Borneo: It is a country of rain forests, rivers, and unexplored areas. It is also a country of culture, arts, and handcrafts. Once the domain of headhunters, Sarawak is now the largest of Malaysia's 13 states.

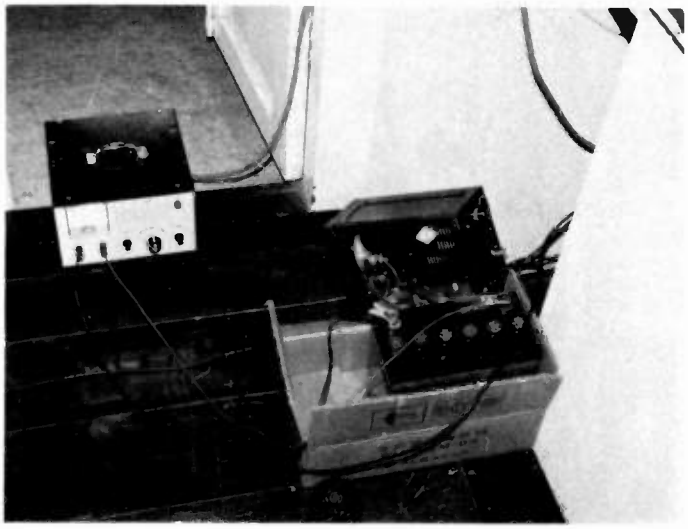
So reads the caption on our QSL card from this operation. The idea of visiting Sarawak during our holidays came to us early in the year. It did not seem to appear on any of the guided-tour brochures which came our way, and as we are not very tourist-minded, this made us look into the possibility of visiting and also doing some operating from there.

There were no problems regarding travel and visas. Modern jet-liners connect with Kuching daily, and for us it was a matter of traveling Norfolk Island—Sydney—Singapore—Kuching. We had contacted Paul 9M8PW beforehand and he was most helpful in arranging accommodations for us in the Anglican Church hostel. Here we were able to rent a small flat and thus be independent.

This is necessary in this sort of venture since not everyone appreciates their houseguests staying up through the night making cups of coffee and shouting into a mike. And hotel accommodations—apart from being expensive—present a problem in that hotel mealtimes do not coincide with the times of the day when band conditions are down to nothing and it is most suitable for the operators to take a meal. In fact, they have a way of serving dinner and breakfast at peak operating times. So the hostel was ideal in many ways. It also was central and close to shops and restaurants.

We had applied for our licenses months before, and on arrival in Kuching were informed that these would be issued for the period of time we were visiting the country. This was good news indeed, as we were well aware of the reluctance to issue guest-licenses in Malaysia.

It now was a matter of proceeding to set up our operating quarters and station. Jim got busy with the multiband dipole which we eventually were able to hang from under the roof of the building across the yard and make fast in a suitable tree. Paul had a beam he was not using which he lent us. It needed some repairs and handiwork done to it, and Jim got busy with this chore. At the same time, we were making enquiries as to where we might be able to obtain a steel water pipe to mount the beam on. We were met with a strange re-



The battery setup after the lightning strike.

Our water-pipe antenna, overlooking Kuching.

luctance which we did not get to understand until over a week later, but we decided to find pipe for ourselves.

Nowhere did we see such an item, but after making our way through nooks and crannies in the shopping center, we finally found a shop where they said that they could help. So across the street we went; a large storage room was unlocked, and there within were literally hundreds of pipes. We selected a 20-foot piece and asked if it could be brought home to us.

"No, no...(with an apologetic smile)!" Well, by this time we thought we had wasted enough time on the project, and the main thing was that we had the pipe within our reach. So resolutely we picked it up between us and paraded home through the streets to the vast enjoyment of the locals. Once home, there were no more difficulties. The caretaker and one of the gardeners came along, offered to help us put it up, and the job was done in minutes.

Later on, visiting the police museum at Fort Marguerita, we realized why we had experienced some reluctance in "operation water pipe." There on display were several guns and mortars homemade from water pipes which had been confiscated from terrorists. We hasten to say that Sarawak is a well-ordered and safe state at present, but obviously they have learned from history and are not taking any chances.

We were now in business. We had decided to concentrate on CW contacts as this mode was more needed from East Malaysia. We did not have a thundering success that first day. We had the dipole only up to the first floor and there was a CW contest on that weekend. So, unless people were looking for us, we could not break through on the busy bands. We also found that propagation was not the best to America and Europe, but was excellent to Asian countries and the Pacific. It took a couple of days to get the antennas erected to their full potential, but gradually we worked our way into the rest of the world.

Openings to America and Europe continued to be a bit tricky, but with cooperation from the people calling, we were able to work pileups giving such reports as 529 and even 429. This is not possible unless there is some restraint on behalf on the ones awaiting their turn. The bands usually opened properly for a few hours from midnight on and the path would be open to the USA and Europe, which created some tremendous pileups. The Europeans are not known for their patience and restraint in these circumstances, so it was plain hard work. It was, on the other hand, a pleasure to work a pileup of JA-boys. Their operating manner is above reproach.

Anyway, we continued in this manner for the first week and were looking forward to the weekend when lots of people who have only weekends available for their hobby would be around. On Saturday afternoon, however, there was a tremendous flash of lightning simultaneous with a deafening crash of thunder. Jim was outside making improvements to the antennas and was holding the 40-meter dipole in his hand at the time. It was lucky that he escaped being sizzled. That the power supply to the rig died instantly is really of minor importance in comparison. However, we were effectively shut down for 24 hours while we tried to repair the power supply.

We were able to buy some of the components we knew had blown, but after struggling until 2:00 am Sunday replacing these and still not making it work, we realized we were going nowhere unless we could gain access to a good ham shop. With one resident ham in the country, the shops did not stock ham gear. We finally arranged to hire a battery and charger which gave us 25 Watts, and by borrowing Paul's linear, we could bring this up to 100-150 Watts and continue operation.

The second week was mostly a continuation of the first week. The number of QSOs crept upwards, and it was nice to meet old friends in the pileups. We had realized by now that checking into nets we usually checked into from Norfolk Island was virtually impossible due to lack of propagation at those specific times. So, we carried on with the pileups, still concentrating on CW, Jim with his fancy electronic keyer and I with my old faithful straight key. (I want to go down in history as the only DXpeditioner stubbornly sticking to a 1940-model straight key in 1982, hi.)

We had by now been in Sarawak long enough to have spent time sightseeing and getting the feel of the place. Kuching is a fascinating city with all its old-world charm intact. There are the old narrow streets lined with shops absolutely spilling goods of every description out onto the footpaths. There were the handmade souvenirs made from local materials, and there were

The author stayed at the rig when the aerial fogging to kill mosquitoes began.

A typical shop in Kuching.

the friendly people, hard-working and cheerful. We spent many hours in the museum, learning a lot about the culture and history of the country.

And not far out of town was the jungle, practically undisturbed. We also were aware now that the dreaded dengue fever was around. We swallowed anti-malaria tablets against malaria and kept our fingers crossed against cholera, but as far as dengue was concerned, we just did our best to keep the mosquitos at bay by spraying the rooms and burning mosquito-coils through the night. We still became covered with bites and just hoped it was not the dengue-carrying kind of mosquito that had feasted on us.

The authorities had an ongoing eradication scheme against this particular beast, and one rule was that if someone contracted dengue, every house in the neighborhood was treated with a sort of spray. So it was that on one fine evening there was a whirring sort of noise outside, and the next thing we knew the flat started filling up with a dense fog. (See photo of the author at the rig at the beginning of the fogging process.)

It got so thick that we could not see at all at a distance of 2-3 meters. We could not breathe, either, so we agreed there was a limit to how devoted one can be, hi, and we would not be much use to our fellow amateurs if we suffocated. There was also the fact that we did not know exactly what the fog contained and just how harmful it might be to humans. So it was a matter of QRT and escape downtown for a meal. (The frogs were particularly noisy that night. We think they were kicking up a row because their favorite food had been done away with!)

All things come to an end, and so also did our stay in Kuching. We had settled in properly and were most reluctant to leave. We took one last look out the window at the view of tile-covered roofs, charcoal smoke rising amongst them, and one last admiring look at the orchids growing in a hedge along the footpath. Then a quick good-bye and *au revoir* to Paul's family and Paul drove us to the airport.

We really had not wanted to go, but we had received the good news that we had been successful in chartering a vessel, the *Cheynes II*, for our January, 1983, Heard Island DXpedition. So, although we had an unforgettable holiday and made 10,500 QSOs in Sarawak, we knew that loads of work regarding our Heard Island trip would be waiting for us at home and we just had to move on.

Afterthought: It was very hot in Kuching. There never seemed to be any breeze to relieve the heat of the day. And as the bands closed in the middle of the day, this was when we emerged outside for sightseeing and shopping. Strange how that old tune kept coming into my mind all the time: Mad dogs and Englishmen go out in the midday sun . . . It could just as well read: Mad dogs and ham-band-fans go out . . . etc.! ■

✓See List of Advertisers on page 114

Put 2 Meters in Your Shirt Pocket

Radio Shack's Pocket Weatheradio makes a dandy 2-meter receiver. A few quick modifications will get it right on target.

Lester Kolb K3PIC
PO Box 161
Lebanon OR 97355

Quality, simplicity, and low price make this shirt-pocket two-meter receiver surpass anything on the market, if indeed such a compact gadget with these features is available.

The heart of the FM monitor is a "Pocket Weatheradio" which is listed in Radio Shack's 1982 catalog for $12.95 and measures less than 4 × 3 × 1¼ inches. Originally covering the 162.40-162.55-MHz weatherband, the state-of-the-art circuit features of the Weatheradio make it an ideal choice for conversion to two-meter FM. The frequency modification consists of simply adding three 5-pF capacitors across three inductors. This modification alone makes a dandy monitor, but the addition of a simple squelch circuit puts icing on the cake.

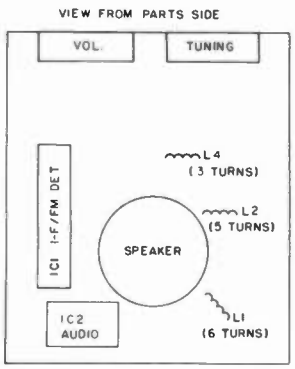


Fig. 1. Weatheradio component layout.

Weatheradio Circuit

The schematic included with the radio shows a simple, well-designed circuit consisting of a zener-regulated, three-transistor front end followed by a 4.5-MHz ceramic filter and a total of two ICs for i-f amp/FM detector and audio amp. The local oscillator is tuned by a varicap diode, and a 10k pot serves as a tuning control. The rf amp is not variably tuned since the small frequency range does not require it. Selectivity and frequency stability are excellent for a tunable VHF receiver, but don't expect top sensitivity.

Disassembly

Snap the plastic cover off the Weatheradio case. A cardboard insert over the circuit board is firmly glued to one of the electrolytic caps. Carefully remove this insert from the cap to have a look at the board. The cardboard insert can be cut off permanently except for the nine-volt-battery area. With a miniature phillips screwdriver, remove the two screws holding the volume and tuning knobs to their shafts. Also remove the two screws from the circuit board and the one anchoring the whip antenna. Remove the whip through the top of the case and take out the circuit board. Unsolder the leads from the speaker itself to avoid errors when reconnecting. Use small clip leads to the speaker while testing.

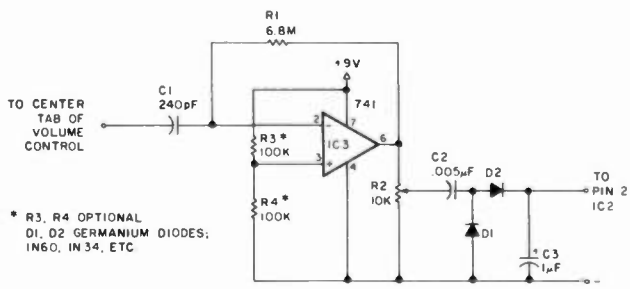
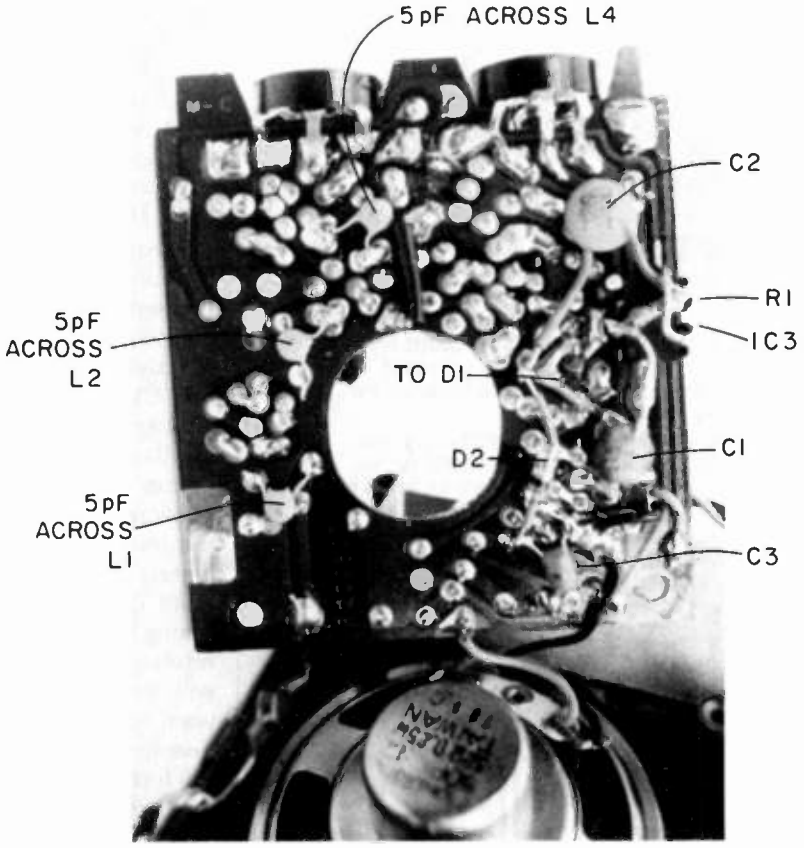


Fig. 2. Hybrid squelch circuit.

Frequency Modification

All that is required to cover two meters is the addition of a 5-pF capacitor (parallel) directly across inductors L1, L2, and L4. The locations of these coils are shown in Fig. 1. No existing parts are removed. After soldering these caps into place on the foil side of the board, reconnect the speaker, slip the board back into the case, and install the knobs and

whip for final testing. Reconnect the battery, set the tuning knob to mid-position, and with a toothpick or pointed nonmetallic tool, spread or compress L4 (local oscillator) until you hear a local repeater signal or desired center frequency from a signal generator. L2 and L1 (rf amp) should be spread or compressed in the same manner for maximum quieting, which can be accomplished only with a weak signal, preferably from a signal generator. Even though coupling between the local oscillator and the rf amp is very light, peaking of L2 for maximum sensitivity will shift the receive frequency slightly, so keep retuning onto frequency as L2 is being peaked; an increase in noise may be a shift off frequency rather than a decrease in sensitivity. Strong signals can be received even without adjustment of L2 and L1, but peaking (especially L2) is recommended for best sensitivity.



Circuit modifications.

Hybrid Squelch

Drilling holes or adding controls and switches to an otherwise attractive custom case is both difficult and unsightly. With this in mind, I came up with a novel idea which I call a hybrid squelch; the volume control doubles as a squelch control. The squelch engages at (and remains engaged above) any preset volume level suited to preference by varying the squelch sensitivity setting of R2 (Fig. 2). Once this R2 level is set, it needs no further adjustment. Although the most sensitive volume/squelch setting is just at threshold, a moderately strong signal will open squelch even if set at full volume. The use of the volume control as a squelch control is accomplished by coupling the input of the 741 op amp directly to the center tab of the Weatheradio volume control with a 240-pF capacitor. Thus, the input level to the noise amp/squelch switch varies with the volume setting.

Fig. 2 shows the complete squelch circuit. The 741 (DIP) op amp serves as a high-gain noise amplifier. Germanium diodes D1 and D2 provide a dc voltage which mutes the Weatheradio audio amp (IC2) at pin 2 when no signal is present. The 240-pF coupling capacitor helps eliminate passage of voice frequencies. However, if you find that, at high-volume settings, heavy modulation activates the sensitive squelch during voice peaks, reduce squelch sensitivity R2 until a compromise position is reached. To save space and eliminate the need for a subminiature pot, I adjusted R2 to the desired level, measured the resistance on each side, and substituted fixed resistors as a divider. An alternative would be to substitute a fixed 10k resistor for the R2 pot (connecting C2 to the junction of R2 and pin 6 of IC3) and to lower the gain of IC3 by reducing R1 to anywhere between 6.8 and 2.2 megohms. For this approach, I found the optimum value to be somewhere between 2.2 and 4.7 megohms. R3 and R4 on pin 3 of the 741 are standard practice, but optional; mine functions perfectly without them.

Construction Notes

Store all tiny screws and the knobs in a cup; they have a tendency to wander off. All parts for these modifications were soldered directly to the foil side of the Weatheradio board, each supported by its own leads or short lengths of thin but rigid wire. Space is limited, requiring ¼-Watt resistors and other parts of miniature variety. The 741 DIP was mounted against the foil side of the board, leads up, between IC1 and the immediate side edge of the board, with leads trimmed short. Keep parts placement near the board edges, as the speaker magnet area has the least room for clearance. The protective coating on the foil can be scraped away at points needing the solder connections. Watch battery polarities and note that the Weatheradio schematic chassis symbol designates nine volts *positive*. Be sure to connect the positive lead of the squelch circuit to a point *after* the on/off switch so it does not draw current when the radio is turned off. A circuit modification or error on the Weatheradio schematic has pins 2 and 3 of audio amp IC2 reversed. Squelch output (from D2 and C3 of Fig. 2) goes to actual pin 2 of IC2. As each part is added to the board, it is a good idea to seat the board into position in the plastic case to check for parts clearance and to avoid shorting leads to the metal speaker. Care and patience cannot be overemphasized. It is quite easy to make optical reversals while looking at both sides of the board for circuit points of inductors and IC pin numbers. Triple check. Insert a milliam-

meter in series with one of the battery leads after the completed unit is in the case. If it draws more than 25-30 mA, recheck for shorts or solder bridges.

Final Touches

Frequency coverage of the tuning range can be increased or decreased by increasing or decreasing (respectively), by a few picofarads, C18 which couples the varicap tuning to the local oscillator. I made no modification here, as frequency coverage was adequate for the repeater portion of two meters. A tiny dot of white paint or nail polish on the tuning knob, with frequency-reference dots on the case, will prove useful. If you want to turn this into a deluxe model, drill a tiny hole on top of the plastic case and install a subminiature LED for an on/off indicator. At the expense of a slight increase in current drain, this feature will remind you to turn the radio off at night and might save you a battery. If space can be found to neatly install a small battery cut-off jack for an external nine-volt supply, it would do wonders for your budget; nine-volt batteries are not noted for their longevity. With a little ingenuity, the local oscillator could even be converted to single-channel crystal control.

My FM monitor keeps me in touch with what's going on without my having to pull my rig out of the car every evening. For a while, it also kept me from jumping in on every QSO. Eventually, I broke down and built a 50-mW companion FM transmitter which easily hits the local repeater. It measures only 1½ × 1 × 1 inches. So now I have a $25 hand-held, but—you guessed it—no matter how hard I tried, I couldn't squeeze it into the Weatheradio case. ■

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↙See List of Advertisers on page 114

The Secret Telemetry of OSCAR 8

Do those numbers from the sky mean anything? You bet.

Joe Magee K5OM
3928 Tacoma
Irving TX 75062

Do these numbers mean anything to you: 101, 245, 376, 449, 549, 601? Well, this is the data I received from OSCAR 8. Since first learning about amateur satellites with signals I could hear on my Kenwood R-599, I have often copied this type of data.

The above sequence, when decoded, says that the total solar-cell current was 0 mA, the battery current was −285 mA, the battery voltage was 15.85 volts, the base-plate and battery temperatures were 23.28° C, and the Mode J power output was 0 mW. The math is pretty simple, so the numbers are easy to calculate. A pocket calculator does the job in no time.

The data comes from OSCAR encoded into six different number groups. These groups are assembled into a certain order by OSCAR before transmission. Each number group is called a channel and the assembly is called a frame. Thus, the numbers above are considered as one frame. Each frame is separated from the rest by "HI." So, the frame above was actually copied as "101 245 376 449 549 601 HI."

Notice that each channel is composed of a three-digit number. The first digit tells what channel is being sent and the next two digits are the data for that channel. Each frame will always have all six channels.

The data is encoded in each channel. Since two digits can have only 100 different values, equations must be used to decode the data into something useful (see illustrations). In addition to the equations, graphs are presented so that you can get approximate values. You can locate the received values on

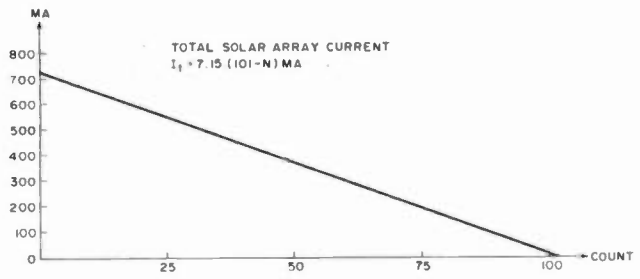

Fig. 1(a). Channel 1.

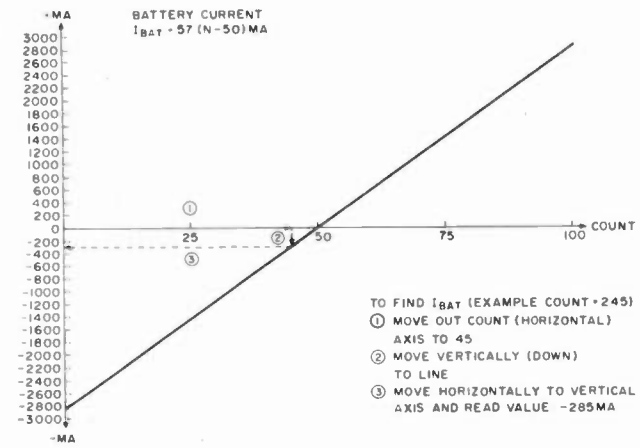

Fig. 1(b). Channel 2.

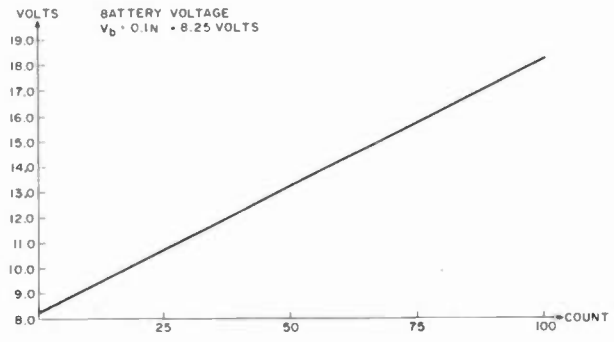

Fig. 1(c). Channel 3.

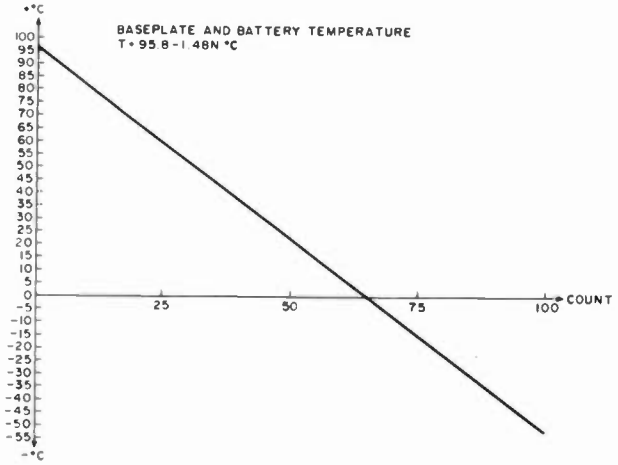

Fig. 1(d). Channels 4 and 5.

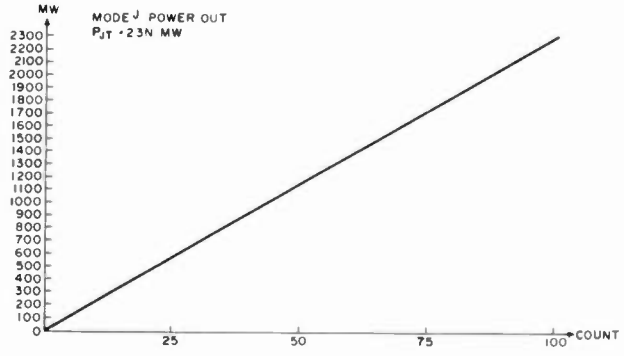

Fig. 1(e). Channel 6.

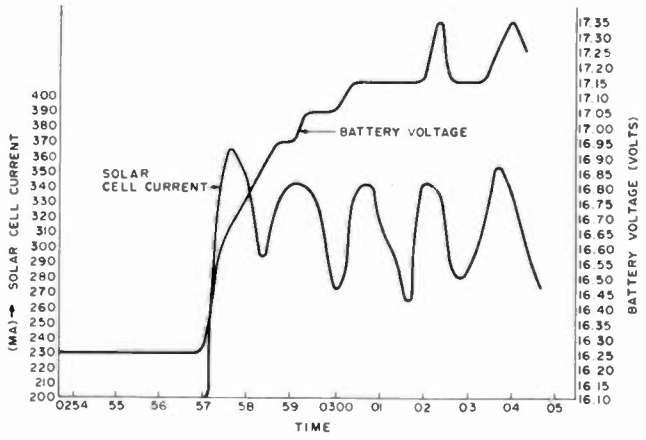

Fig. 2.

the horizontal axis and find the decoded values on the vertical axis—as is shown in Fig. 1(b).

Knowing the numbers still doesn't tell you what they mean. For instance, the 1xx sequence gives solar-cell current. Above, it was 0, but sometimes you may copy several sequences and the 1xx may change. This happens when OSCAR goes from light to dark or dark to light. Since this happens rather quickly, one should notice a dramatic change.

Once OSCAR is in the sunlight, a more subtle change should be noticed. The solar cells that are used to charge the batteries are mounted on the faces of the satellite. Thus, as it turns, the solar-cell output current will vary correspondingly. On April 17, 1979, during orbit 5683 (for example), I monitored the telemetry. I plotted the solar-array current (Fig. 2). The passage into the sun is clearly evident. Before passing into the sun, the 1xx data should be 00, 01, or 02. The 01 or 02 results from voltage offsets and counting errors. (Each channel is subject to a 1-count error.) Also, note any changes in the current resulting from the spin. As the sun shines on a corner, two sides are lighted, resulting in more current than if only one side were illuminated. Also, since there are four corners, there will be four current peaks per revolution. By looking at the graph in Fig. 2, we can see that OSCAR 8 was rotating once about every four or five minutes.

Channel 2 is a measure of the battery current. It tells how much current is flowing into the battery. When in the dark, with no solar-cell current, it will show how much current is being used by the satellite. This value, in conjunction with Channel 3 (battery voltage), can be used to determine the Mode A power output. Simply determine how many Watts the battery is delivering and then subtract 3 (the power consumed by the rest of the satellite except the Mode A transmitter). In my original example, the Mode A power is about 1.52 Watts (15.85 V times .285 A minus 3 Watts).

As mentioned, Channel 3 is the battery voltage. Out of curiosity, I plotted it along with the solar-cell current in Fig. 2. The rises in battery voltage corresponded to the peak current from the solar array, as one would expect.

Channels 4 and 5 measure temperature. Channel 4 is the base-plate temperature and 5 is battery temperature. The base-plate temperature will stay fairly constant when OSCAR is in the dark and will become warm in the sun. This warming will occur at various rates, depending on the angle of the sun in relation to the satellite.

The battery temperature can vary much more rapidly. As nicads are overcharged, their temperature rises. When in the sun, OSCAR will warm up from the sunshine and perhaps from battery heating as well. Battery temperature is important because high temperatures will cause cell damage. In space, there is no shade; thus, if the batteries start to overheat, something must be done to reduce charging current. This is most easily accomplished by putting the satellite into a high-power mode, such as Mode J, which draws more current from the battery.

Finally, Channel 6 is a measure of the Mode J power output. Naturally, it will show 00 (or 01 or 02 as does Channel 1) when in Mode A.

Working with the numbers once you have them isn't half as much fun as getting them. You must listen to OSCAR 8 as it makes a pass within range of your QTH. This procedure is covered well in other places, but if you are in the US, any evening Sunday through Thursday (except Tuesday) will be a Mode A night. Now, turn to the Table of Contents of your *73 Magazine* and find the page number for Satellites. By turning to that page you will find a listing of reference orbits for each day of the month (remember that

```
INPUT PARAMETERS

   101.
   245.
   376.
   449.
   549.
   601.

COMPUTED RESULTS

     0.      ITMA
  -285.      IBAT
 15.85       VBAT
 23.28       TBP
 23.28       TBAT
     0.      PJT
```

Fig. 3. Output of program.

these dates and times are GMT). In general, you can hear two or three passes in any one evening. On Mode A, the telemetry is on 29.40 MHz. (The actual received frequency may vary a few kHz due to Doppler shift.) As OSCAR is approaching, the frequency will be high; it will be low as it is departing.

If your QTH is close enough to a particular orbit to hear OSCAR 8, you should hear some activity within one to five minutes after the predicted crossing time. The length of time that OSCAR is within range will vary, from less than five minutes to nearly twenty minutes.

One big problem with OSCAR is that it is addictive! I am torn between listening to either the telemetry or to QSOs. To help make the telemetry more fun, I wrote a program for my TI-59 calculator to perform the math needed to decode the data. For added interest and experience, the program that I wrote used the PC-100A print cradle with its 20-column thermal printer, providing an informative and permanent printout. The printout of the data in the first paragraph of this article is shown in Fig. 3.

Fig. 4 is a listing of the program. It is made up of three sections. Section 1, lines 000 through 029, is used to enter the data into the calculator memory for later use. In Section 2, lines 030 through 164, the OSCAR data is converted to the proper value. Lines 375 through 390 are a subroutine and are used to determine if the 1xx and 6xx values are very small, in which case they really should be 0.*

The last part, lines 165 through 374, is used to print out the answers. This is where the alphanumeric capabilities of the TI-59 are used. When printing out the

*Glassmeyer and Harris, *QST*, July, 1978.

Fig. 4. TI-59 program listing.

```
000  76 LBL
001  11  A
002  42 STO
003  11  11
004  91 R/S
005  76 LBL
006  12  B
007  42 STO
008  12  12
009  91 R/S
010  76 LBL
011  13  C
012  42 STO
013  13  13
014  91 R/S
015  76 LBL
016  14  D
017  42 STO
018  14  14
019  91 R/S
020  76 LBL
021  15  E
022  42 STO
023  15  15
024  91 R/S
025  76 LBL
026  16 A'
027  42 STO
028  16  16
029  91 R/S
030  76 LBL
031  10 E'
032  69 OP
033  00  00
034  43 RCL
035  11  11
036  75  -
037  01  1
038  00  0
039  00  0
040  95  =
041  71 SBR
042  34 FX
043  77  GE
044  45 YX
045  00  0
046  42 STO
047  21  21
048  61 GTO
049  33 X2
050  76 LBL
051  45 YX
052  07  7
053  93  .
054  01  1
055  05  5
056  65  X
057  53  (
058  01  1
059  00  0
060  01  1
061  75  -
062  43 RCL
063  17  17
064  54  )
065  95  =
066  42 STO
067  21  21
068  76 LBL
069  33 X2
070  05  5
071  07  7
072  65  X
073  53  (
074  43 RCL
075  12  12
076  75  -
077  05  5
078  00  0
079  75  -
080  02  2
081  00  0
082  00  0
083  54  )
084  95  =
085  42 STO
086  22  22
087  93  .
088  01  1
089  65  X
090  53  (
091  43 RCL
092  13  13
093  75  -
094  03  3
095  00  0
096  00  0
097  54  )
098  85  +
099  08  8
100  93  .

101  02  2
102  05  5
103  95  =
104  42 STO
105  23  23
106  09  9
107  05  5
108  93  .
109  08  8
110  75  -
111  01  1
112  93  .
113  04  4
114  08  8
115  65  X
116  53  (
117  43 RCL
118  14  14
119  75  -
120  04  4
121  00  0
122  00  0
123  54  )
124  95  =
125  42 STO
126  24  24
127  09  9
128  05  5
129  93  .
130  08  8
131  75  -
132  01  1
133  93  .
134  04  4
135  08  8
136  65  X
137  53  (
138  43 RCL
139  15  15
140  75  -
141  05  5
142  00  0
143  00  0
144  54  )
145  95  =
146  42 STO
147  25  25
148  43 RCL
149  16  16
150  75  -
151  06  6
152  00  0
153  00  0
154  95  =
155  71 SBR
156  34 FX
157  02  2
158  03  3
159  65  X
160  43 RCL
161  17  17
162  95  =
163  42 STO
164  26  26
165  98 ADV
166  00  0
167  00  0
168  00  0
169  00  0
170  02  2
171  04  4
172  03  3
173  01  1
174  03  3
175  03  3
176  69 OP
177  01  01
178  04  4
179  01  1
180  03  3
181  07  7
182  00  0
183  00  0
184  03  3
185  03  3
186  01  1
187  03  3
188  69 OP
189  02  02
190  03  3
191  05  5
192  01  1
193  03  3
194  03  3
195  00  0
196  01  1
197  07  7
198  03  3
199  07  7
200  69 OP

201  03  03
202  01  1
203  07  7
204  03  3
205  05  5
206  03  3
207  06  6
208  00  0
209  00  0
210  00  0
211  00  0
212  69 OP
213  04  04
214  69 OP
215  05  05
216  98 ADV
217  43 RCL
218  11  11
219  99 PRT
220  43 RCL
221  12  12
222  99 PRT
223  43 RCL
224  13  13
225  99 PRT
226  43 RCL
227  14  14
228  99 PRT
229  43 RCL
230  15  15
231  99 PRT
232  43 RCL
233  16  16
234  99 PRT
235  98 ADV
236  00  0
237  00  0
238  00  0
239  00  0
240  01  1
241  05  5
242  03  3
243  02  2
244  03  3
245  00  0
246  69 OP
247  01  01
248  03  3
249  03  3
250  04  4
251  01  1
252  03  3
253  07  7
254  01  1
255  07  7
256  01  1
257  06  6
258  69 OP
```

input data, a header is printed. This is accomplished by filling the print buffer with 40 numbers that correspond with the 20 characters that are to be printed (two numbers per character; sorry, not ASCII) and then issuing a print command (lines 166 through 215). In lines 217 through 234, the values are recalled and printed.

Another handy feature of the TI-59/PC-100A is the ability to print 4-character subscripts. The calculated data is output this way in lines 287 through 373 (236 to 285 are used to print the output header). This is done by putting the eight numbers which correspond to the characters in the subscript into the right-most segment of the print buffer, recalling the data from memory, and then printing the line.

I am glad that I had to tell the TI-59 how to do all this only once! From now on, I will just read the program in on a mag card.■

```
259  02  02
260  00  0
261  00  0
262  03  3
263  05  5
264  01  1
265  07  7
266  03  3
267  06  6
268  04  4
269  01  1
270  69 DP
271  03  03
272  02  2
273  07  7
274  03  3
275  07  7
276  03  3
277  06  6
278  00  0
279  00  0
280  00  0
281  00  0
282  69 DP
283  04  04
284  69 DP
285  05  05
286  98 RDV
287  02  2
288  04  4
289  03  3
290  07  7
291  03  3
292  00  0
293  01  1
294  03  3
295  69 DP
296  04  04
297  43 RCL
298  21  21
299  69 DP
300  06  06
301  02  2
302  04  4
303  01  1
304  04  4
305  01  1
306  03  3
307  03  3
308  07  7
309  69 DP
310  04  04
311  43 RCL
312  22  22
313  69 DP
314  06  06
315  04  4
316  02  2
317  01  1
318  04  4
319  01  1
320  03  3
321  03  3
322  07  7
323  69 DP
324  04  04
325  43 RCL
326  23  23
327  69 DP
328  06  06
329  03  3
330  07  7
331  01  1
332  04  4
333  03  3
334  03  3
335  00  0
336  00  0
337  69 DP
338  04  04
339  43 RCL
340  24  24
341  69 DP
342  06  06
343  03  3
344  07  7
345  01  1
346  04  4
347  01  1
348  03  3
349  03  3
350  07  7
351  69 DP
352  04  04
353  43 RCL
354  25  25
355  69 DP
356  06  06
357  03  3
358  03  3
359  02  2
360  05  5
361  03  3
362  07  7
363  00  0
364  00  0
365  69 DP
366  04  04
367  43 RCL
368  26  26
369  69 DP
370  06  06
371  98 RDV
372  98 RDV
373  98 RDV
374  92 RTN
375  76 LBL
376  34 fX
377  42 STO
378  17  17
379  03  3
380  32 X:T
381  43 RCL
382  17  17
383  77  GE
384  35 1/X
385  00  0
386  42 STO
387  17  17
388  76 LBL
389  35 1/X
390  92 RTN
```

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Beverly Hills CA 90212

Scandinavia: The 2-Meter Dream Vacation

Licensing, frequencies, and procedures—it's all here. All you need is a plane ticket.

Pack your bags for a great Scandinavian vacation! The land of the midnight sun beckons and it's more fun with 2 meters. If you want to take that rig with you, plan in advance.

Getting Your Licenses

You need sufficient time for processing through the FCC, the Scandinavian authorities, and for any international mail delays. Allow 6 months if possible. Send the ARRL (225 Main Street, Newington, Connecticut 06111, Attn: International Affairs) an 8½" by 11" SASE and they will send you application forms for each country. If time is short, Fig. 1 is a form which includes all of the necessary information for each country. The address for each licensing authority is also given.

For each country (except Finland, where the form is sent directly to SRAL), send the completed form to the FCC requesting endorsement and forwarding. Enclose a stamped airmail envelope addressed to the proper foreign authority. If you furnish an SASE, the FCC will confirm the date on which your papers were mailed. Send to: FCC, PO Box 441, Gettysburg, Pennsylvania 17325.

Denmark. Application should be filed at least a month before the requested license period. Attach a photocopy of your license. Within a few weeks you will receive the license and a payment form. When you arrive in Denmark, go to the nearest post office, pay the fee (only 20 kroner for a short stay), and your license is then valid. A temporary license will be issued for up to three months.

In Copenhagen, there is 24-hour service at the post office in the Central Railroad Station. This is right in the center of the city, next to Tivoli Gardens.

When applying for your license in any country, if you do not know the exact dates of your arrival and departure, allow a few extra days on each end. If you have no references in the country, enter "none" on the reference line.

Norway. In addition to a copy of your license, Nor-

TO: (See Below for Addressee)

APPLICATION FOR PERMISSION TO OPERATE AN AMATEUR RADIO STATION IN _____(Country)

I, the undersigned, hereby respectfully apply for a temporary permit or license to operate an amateur radio transmitter in _____

License period requested:_____
Name in full:_____Occupation _____
Address in my own country:_____
_____
Date and place of birth:_____
Nationality:_____
Call Sign:_____License Class:_____Expires:_____
Address in _____:_____
Vehicle Registration Number:_____
Mailing Address of Fixed Station:_____
_____
Object of stay:_____
_____
References in _____:_____
_____
Member of following amateur organization:_____
_____
Place and date:_____
Signature:_____

Opinion of applicant and comments or endorsement by licensing authority of home country:

General Directorate of Post and Telegraphs
1st Technical Office
17, Farvergade, 1st Floor
DK-1007 Copenhagen K
DENMARK

Norwegian Telecommunications Administration
Postboks 6701 St. Olavs pl.
Oslo 1, NORWAY

Swedish Telecommunications Administration
Radio Department, Stockholm
Licensing Section
S-123 86 FARSTA
SWEDEN

SRAL
P.O. Box 306
SF-00101 Helsinki 10
FINLAND

Fig. 1. Sample form for requesting license to operate in a foreign country.

Look for me on 2m as I drive around Scandinavia in April. I'm open for ham talks in Copenhagen 3-5th April; Oslo, 6-9th; and Stockholm, 10-13th. If there is any interest, please get in touch.—Wayne Green W2NSD/1.

REPEATER CHANNELS

Channel #	Receive Frequency*
R0	145.600
R1	145.625
R2	145.650
R3	145.675
R4	145.700
R5	145.725
R6	145.750
R7	145.775
R8	145.800
R9	145.825

*Transmit 600 kHz down

SIMPLEX CHANNELS

145.250 to 145.575 at 25-kHz spacings
145.500 used as calling frequency
145.550 mobile channel
145.525 and 145.575 probably most used simplex channels other than 145.500

Fig. 2. Two-meter repeater and simplex channels most frequently used.

STANDARD

	Receive*
R1	434.600
R2	434.625
R3	434.650
R4	434.675
R5	434.700
R6	434.725
R7	434.750
R8	434.775
R9	434.800
R10	434.825

*Transmit 1.6 MHz lower

SWEDISH

	Receive**
RU0	437.600
RU1	437.625
RU2	437.650
RU3	437.675
RU4	437.700
RU5	437.725
RU6	437.750
RU7	437.775
RU8	437.800
RU9	437.825
RU10	437.850
RU11	437.875
RU12	437.900
RU13	437.925
RU14	437.950
RU15	437.975

**Transmit 4.6 MHz lower

Fig. 3. UHF repeater channels.

way requires a "certificate of good conduct" from your local police department. This can be a letter on police department stationery stating that you are of good character and reputation and that the police know of no reason why you should not be issued an amateur license in Norway. Your application should be on file at least a month before the operating period requested. A temporary license will be issued for up to three months.

The fee of 50 Norwegian kroner must be sent with your application. Buy an international draft or money order payable in Norwegian currency. If you send a personal check or dollar instrument, you may cause substantial delay or return of your application. I suggest that you staple all of the documents together.

Sweden. A police good-conduct letter is required for Sweden just as in Norway. Your application should be filed at least two months prior to the requested license period. The Swedish authorities will send you a license with a request for any fees. Fees can be paid by mail or upon arrival in Sweden at a post office. The fee will vary with the length of the requested license period.

Finland. The amateur society, SRAL, handles all license applications. SRAL tells you to allow at least 4 to 8 weeks, more in summer, for issuance. It took me considerably longer than 8 weeks. If your license is for less than one month, a fee of 58 markka must be paid with your application. This includes the processing charge by SRAL. For a license for more than a month, you must join SRAL and the fee is higher. The maximum temporary license period is three months, subject to renewal. Your mailing address in Finland must be given exactly. This may be the address of your hotel.

You must furnish a copy of those pages of your passport containing personal data and of your amateur license certified by two signatures. I photocopied my amateur license and the pages of my passport with my name, date of birth, etc., and my picture onto a single sheet. At the bottom I typed this certification: "Each of the undersigned certifies that he has examined original passport No. _____ and the amateur radio license of Charles R. Perelman and that the above are true and correct copies. Executed on_____, 1981, at Beverly Hills, California, under penalty of perjury." Two signatures followed.

Each country will send you a translated copy of rules and regulations. Your license will bear your home call with the appropriate country designation, for example: WA6OGW/OZ. Low-band and UHF privileges will depend upon the class of license you hold in your home country. In Denmark, Norway, and Sweden, you

QTH	Channel
DENMARK	
Verhoj	R0
Ringsted	R1
Esbjerg	R2
Alborg	R2
Bornholm	R2
Hvidovre	R3
Yding Skovhoj	R3
Odense	R4
Copenhagen	R4
Thy	R4
Kvinsbjerg	R5
Vejby	R5
Ostervold	R6
Lysnet	R6
Lindeballe	R7
Herning	R8
Arhus	R9
Fredrikshavn	R9
Sakskobing	R9
NORWAY	
Oslo	R0
Horten	R1
Rinsaker	R1
Flekkefjord	R1
Grenland	R2
Kongsvinger	R2
Oslo stad	R2
Harstad	R2
Hallingdal	R2
Trondelag	R3
Ringkollen	R3
Sandnes	R3
Arendal	R4
Kongsberg	R4
Drammen	R5
Egersund	R5
Gudbrandsdal	R5
Bergen	R6
Oslo, Enebakk	R6
Bodo	R6
Kristiansand	R6
Tromso	R6
Vardo	R6
Trondheim	R6
Sondeled	R7
Stavanger	R7
Sandefjord	R8
Vestland, Stord	R8
Tromso Fjellheisen	R8
Telemark	R9
Follo S. Oslo	R9
FINLAND	
Turku	R0
Helsinki	R1
Pietarsaari	R1
Kotka	R2
Antari	R2
Mariehamn	R3
Lahti	R3
Seinajoki	R3
Jyvaskyla	R4
Salo	R4
Pori	R5
Kuusankoski	R5
Espoo	R6
Tampere	R6
Vaasa	R6
Lappeenranta	R7
Turku	R7
Hameenlinna	R8
Kuopio	R8
SWEDEN	
Bjorna	R3
Bollnas	R2
Boras	R8
Bracke	R4
Backefors	R4
Edsbyn	R0
Falkenberg	R1
Falkoping	R5
Falun	R8
Gladsaxe	R0
Glommerstr.	R6
Gallivare	R2
Goteborg	R2
Hagfors	R0
Halmstad	R9
Helsingborg	R2
Hudiksvall	R7
Hallnas	R2
Harnosand	R1
Jonkoping	R6
Kalix	R5
Kalmar	R8
Karlskoga	R6
Karlskrona	R6
Karlstad	R3
Katrineholm	R3
Kiruna	R8
Kramfors	R0
Kristineberg	R3
Kungsbacka	R7
Kyrktasjo	R5
Linkoping	R8
Ludvika	R5
Lulea	R8
Lycksele	R7
Lysekil	R0
Mariefred	R9
Motala	R1
Malmo	R7
Norberg	R3
Norrkoping	R0
Nykoping	R4
Nassjo	R2
Olofstrom	R1
Orsa	R6
Oskarshamn	R5
Pitea	R0
Sanviken	R4
Skelleftea	R4
Skovde	R9
Solleftea	R2
Solna	R5
Sorsele	R0
Stockholm	R1
Stockholm	R8
Storuman	R5
Sundsvall	R8
Sunne	R7
Tanumshede	R3
Tranas	R7
Tarnaby	R2
Ulricehamn	R3
Umea	R8
Uppsala	R6
Vetlanda	R9
Vilhelmina	R4
Visby	R6
Vimmerby	R1
Vargarda	R1
Varnamo	R0
Varobacka	R4
Vastervik	R3
Vasteras	R7
Vaxjo	R4
Vannas	R5
Ystad	R8
Orebro	R2
Ornskoldsvik	R7
Ostersund	R6

Note: Above are in alphabetical order. In Swedish, the letters a and o with special phonetic marks come at the end of the alphabet. I could not print these marks.

Fig. 4. Two-meter repeaters in Scandinavia.

are permitted to work mobile. Although local amateurs have been working diligently to obtain this privilege for visiting amateurs in Finland, at this time non-residents are not permitted to operate mobile in Finland.

Gear to Pack

If you are traveling other than by car, a synthesized handie-talkie would certainly be the most versatile rig. In the older crystal-controlled radios, the Kenwood TR-2200 (same as the Drake TR-22) with sockets for 12 channels will permit you to crystal up for the 10 repeater channels and two popular simplex channels. However, unless you already have some of the crystals on hand, the cost of all those rocks will probably convince you to buy a synthesized rig.

Scanning is useful, particularly if you will be operating mobile. Even though you may have looked up the local repeater frequencies, changes do occur; you may not know exactly where some of the repeater sites are located or the extent of coverage of some repeaters, or you may desire to check simplex channels.

I suggest that you take the following in addition to your 2-meter rig:

- Mag mount and cigarette-lighter power-supply cord for mobile use.
- Quarter-wave or 5/8-wave telescoping antenna for HT. You may be in a poor location or want to extend the range beyond that feasible with a rubber ducky.
- Shortened or flex-type rubber ducky. If you carry the HT on your belt, both the rig and antenna are less likely to be damaged if either of these types of antennas are substituted for the regular rubber ducky.
- Battery charger and transformer or solid-state converter for 220 volts to 110 with sufficient wattage rating. Conversion plug with large round prongs. Some hotels furnish a 110 outlet for shavers which can be used to charge HT batteries. Ordinary wall outlets are 220 volts, 50 cycles requireing the round prongs and converter or transformer.
- 1750 tone burst with duration of at least 1 second. Some repeaters are carrier-operated. Most require the 1750 tone burst. Length of burst required appears to be longer than typical in some other parts of Europe. You may be able to obtain a whistle from a friend in Scandinavia which will produce the 1750 tone. It looks like a single pitch pipe.

If you are a good whistler, unless your musical talents are sufficient to approximate 2 octaves higher than A (440 Hertz) above middle C, the technique is to start high and slowly descend in pitch to be sure you've covered the right frequency. This sounds something like the second part of the whistle when you gaze approvingly at one of the local beautiful blonde blue-eyed YLs. If all else fails, you can still get into the repeater after a local ham has accessed it with the tone burst.

- Earphone. There are times when people on a bus, the street, or elsewhere may not take too kindly to the sounds of the QSO you may be holding with a local amateur. This is particularly true if there is a lot of noise coming in with his signal. The earphone solves these problems.

To avoid possible customs questions, either upon entry into one of the Scandinavian countries or when returning to the US, it is a good idea to register your radio gear (and cameras as well) with US customs. Call your local customs office to find the location for this service. It only takes a couple of minutes to fill out the form which will be stamped and inserted into your passport. In Los Angeles this can be done at a little cubicle on the second floor of Los Angeles International Airport.

Repeater Frequencies

Fig. 2 lists the repeater frequencies and most-often-used simplex frequencies for 2 meters. Fig. 3 contains information on UHF repeaters. Most of these are located in Sweden and follow the Swedish band plan with a 4.6-MHz separation rather than the typical 1.6-MHz separation used elsewhere. With my Kenwood 2400, I found it most convenient to program the 10 repeater channels into memories 0 through 9. Scanning the memory channels would then locate an active repeater. As in the United States, the repeaters are busier in the morning just before working hours and in the evening than they are during the working day. However, the level of activity appears to be considerably less than on a busy repeater in one of our metropolitan areas.

During the summer months, working hours often begin at 7 or 8 am and end by 4 pm. The first three weeks in July are usually an "industrial holiday," vacation for much of the work force. This often means deserting the city for a cottage in the country or at the coast. If you want to be sure to make contact with a particular ham, by all means arrange your meeting in advance. Use the low bands or a letter before your trip to be sure of his or her location when you will be in his country.

Fig. 4 contains information on the location of 2-meter repeaters in each of the Scandinavian countries. With the harsh winters, antennas are often damaged so that some of the stations may be off the air at times. Fig. 5 shows locations of UHF repeaters.

Enjoying Your Fellow Hams

For information on everything from directions to a Chinese restaurant (yes, there are some in Scandinavia) to an interesting art exhibit, try your friendly local repeater. As elsewhere in Europe, many of the hams save pins, banners, or patches from radio societies of other countries. This kind of item makes a nice token

QTH	Channel
DENMARK	
Lindeballe	RU0
Copenhagen	RU0
Ringsted	RU1
Alborg	RU2
Esbjerg	RU2
Copenhagen	RU3
Fredericia	RU3
Se nedan	RU4
Knjvsbjerg	RU5
Arhus	RU5
Yding Skovhoj	RU6
Purhoj, Horsens	RU7
Hillerod	RU7
Randers	RU8
Copenhagen	RU8
Sakshobing	RU8
Abenra	RU8
Nord-Fyn	RU9
Copenhagen	RU9
NORWAY	
Kongsvinger	RU1
Horten	RU2
Bergen	RU4
Gjovik	RU6
Oslo	RU7
FINLAND	
Salo	RU4
SWEDEN	
Bollnas	SRU2
Eskilstuna	SRU10
Falun	SRU8
Halmstad	SRU9
Helsingborg	SRU2
Hudiksvall	SRU7
Hono	SRU10
Karlstad	SRU7
Kungsbacka	SRU4
Linkoping	SRU8
Lund	RU5
Mariefred	SRU9
Sandviken	SRU4
Solna	SRU5
Stockholm	SRU1
Stockholm	SRU2
Stockholm	SRU8
Vasteras	SRU7
Orebro	SRU2

Fig. 5. UHF repeaters in Scandinavia.

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Each one of these easy to use converters will turn an average 2-meter, fully synthesized H.T. into an extended coverage receiver. Choose either UHF or VHF PUBLIC SERVICE coverage, or 220Mhz AMATEUR coverage.

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Model No.	HC-V	HC-V220	HC-U2	HC-U2L *
Nominal Coverage (MHZ)	154-158 (PSB) 159-163 (MB)	221-225	460-464 480-484	470-474 506-510
Type (summary)	Police, fire, other public service. Marine telephone, N.O.A. weather	Amateur	Police, etc.	Police, etc.
			NOTE: other frequency groups are available. Contact factory.	
Price	$39.95	$54.95	$59.95	$59.95

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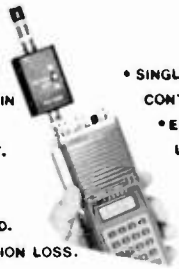

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- Visa and Master Charge

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  Ultimate Rejection better than 100dB.
  Works wonders on SSB; improves CW.
- Compensates for Filter insertion loss.
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- No RX audio Impairment, TX unaffected.
- Includes Filter and all needed parts.
- Fits all models of Series - any letter.
- All Filters 8-pole - Guaranteed One Year.

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YAESU FT101 $75; FT101ZD $70; FT107 $75; FT901/2 $65; FR101 $55 (filter only). KENWOOD TS520/R599 $70; TS820 $70; TS830/RB20 $150 (Two Filters). HEATH SB104A $60.

Shipping $3 (Air $5). FL Sales Tax 5%

In addition to the above, FOX-TANGO stocks a wide line of $55 SSB, CW, and AM 8-pole filters for Yaesu, Kenwood, Drake R4C and 7-line, and Heathkit. Also, special filters made to order. Send specs for quote.

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$39.95 DUAL 24 HOUR LCD MFJ-104

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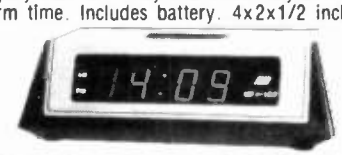
Alarm plays 4 selectable melodies. Alarm "ON" indicator. Snooze button.
Quartz timing. Synchronizable to WWV.
Flip-top cover serves as stand.
Night light. Forward/reverse, fast/slow set buttons. Lock function prevents mis-setting. Display main time only, main/auxiliary or main/alarm time. Includes battery. 4x2x1/2 inches.



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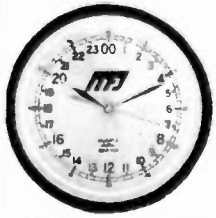
Switchable 24 hour GMT or 12 hour format. ID timer sounds every 9 minutes after reset. **Switchable seconds readout.**
Observed timer. Just start clock from zero and note time of event up to 24 hours.
Bright blue 0.6" vacuum fluorescent digits.
Alarm with snooze function. Synchronizable with WWV. Fast/slow set buttons. Lock function prevents mis-setting. Power out, alarm "ON" indicators. 110 VAC, 60 Hz (50 Hz with simple modification). UL approved.
Black, brushed aluminum top/front. 6x2x3".



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gift. Yaesu and Kenwood rigs are widely used and you make a friend for life by obtaining a needed service manual for a Scandinavian ham. If a radio friend is contemplating a trip to the US, he may appreciate a repeater directory or road maps. An auto club is the best source for maps.

I think the most enjoyable contact in a foreign country is with a ham with whom you've talked on the low bands. When your itinerary is firm, set up a definite rendezvous. You will probably learn more about life in that country in an evening than during the rest of your trip.

Chance contacts resulting in bending elbows together at one of the local pubs can make new friends and be a lot of fun as well. However, alcohol and driving definitely don't mix in Scandinavia. Penalties for driving with even a very small quantity of alcohol in the blood are severe. Therefore, expect your friend to pass up the beer for a soft drink if he is driving.

In Copenhagen, don't be surprised to have Swedish stations from Malmo, Falkenberg, or some of the other southern towns come back to you through the local repeaters. In Finland, the repeaters in the less populous parts of the country, north of Hameenlinna, Tampere, and Lahti, may not be operational from time to time. You should check this out through low-band QSOs if you are planning to travel in the more northerly areas.

Two meters can be your key to opening up better paths of understanding of the beautiful countries and people of Scandinavia. Plan ahead, make new friends on the low bands, and have the fun of eyeball QSOs far from home. You will learn more, have more fun, and have some unforgettable memories through the power of amateur radio. ■

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Dennis Pharr WD5JWY
3521 SE. 45th St.
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Twisted Remote Control

This circuit is easy to build and easy to use.
The twist is that you probably own the most important part.

Described here is a simple and inexpensive remote-control system, the major component of which you probably already have on hand: an AM-FM receiver, either portable or table model. As with any remote-control system, it has many uses. It may be used as a television commercial killer, to turn on or off a distant light, etc.

If you have tried to build any of the light-operated-relay type of remote-control devices in the past, you must surely have noted two distinct disadvantages of that type of system: 1) They are usually very sensitive to ambient light levels and therefore difficult to adjust, and 2) You must be able to see the device in order to control it. Since this system uses radio waves as the controlling medium, these drawbacks are readily overcome.

Receiver-Transmitter

It is certainly not difficult to generate a low-power rf signal that can be used for remote control, but the difficulty begins when trying to design and build a receiver with sufficient gain to amplify the low-power signal to a usable level. To circumvent this problem, a conventional table model or portable-type AM-FM receiver can be used along with a tone-modulated FM wireless microphone to generate the control signal.

Switching Circuit

With the problem of the receiver-transmitter solved, all that is needed is a switching circuit that can be operated by an audio tone taken from the receiver. The circuit shown in Fig. 1 does this job very nicely.

The heart of the switching circuit is U2, the CMOS 4027 J-K flip-flop. This particular type of flip-flop has the unique characteristic that if both the J and K inputs are held in a high state and a clock pulse is applied to the clock input, the output will toggle to a high or low depending on its previous state. The output will continue to toggle back and forth as long as clock pulses are applied to the clock input.

Referring to Fig. 1, assume that the output of U2 is in a low state and Q2 is off. Also assume that the primary of T1 is plugged into the earphone jack of an FM receiver tuned to the operating frequency of the wireless microphone. When the transmitter (wireless microphone) is momentarily turned on, an audio pulse is applied to the primary of T1. This audio pulse is then rectified and used to forward bias Q1. With Q1 momentarily turned on, a negative-going trigger pulse is seen at the trigger input of U1 (used here as a one-shot).

This trigger pulse causes the output of U1 to switch to a high state where it will remain for a period of time determined by the series combination of R1 and C2 (in this case about 1 second). This positive-going

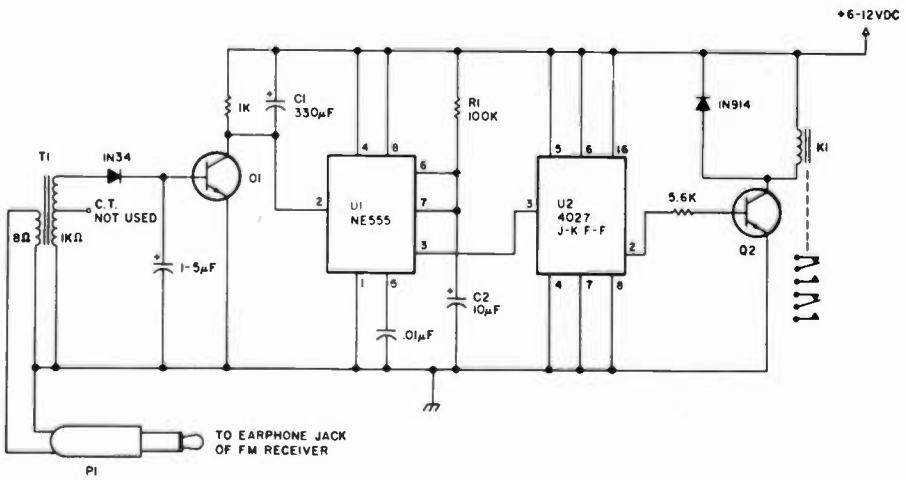

Fig. 1. Schematic diagram of the switching circuit. The transistors and transformers used in both circuits are 2N2222 or Radio Shack 2009 and Radio Shack 273-1380, respectively.

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pulse at the output of U1 is applied to the clock input of U2, causing the output of U2 to toggle to a high state which turns on Q2 and energizes relay K1. The output of U2 will remain high until another pulse is applied to the clock input, at which time it will toggle back to its original low state.

Since the limiting action of most inexpensive FM receivers is not what it should be, C1 (connected across the Q1 collector resistor) is included to prevent possible false triggering caused by noise spikes from the output of the receiver.

No power supply is shown in Fig. 1, since these have been extensively covered elsewhere in the ham literature. As shown, any voltage from 6 to 12 volts will work. The amount of supply voltage you decide to use will depend upon the voltage rating of the relay you purchase, or that of one you may have on hand.

It should be mentioned here that the receiver you use must have some type of external antenna, and an earphone jack. If your receiver has no earphone jack, one must be added, which is simple to do using a three-conductor phone jack.

Transmitter Circuit

The FM wireless microphone circuit shown in Fig. 2 was originally published in the April, 1969, issue of *Popular Electronics*. The circuit, as shown in that issue, used an RCA KD-2114 linear IC for the active device but discrete transistors were used here since they were more readily available. The circuit is shown here with one modification; the microphone input network has been replaced with a simple tone-generating circuit composed of R1, C1, Q1, and T1. It has an output of about 800 Hz and provides the necessary control signal.

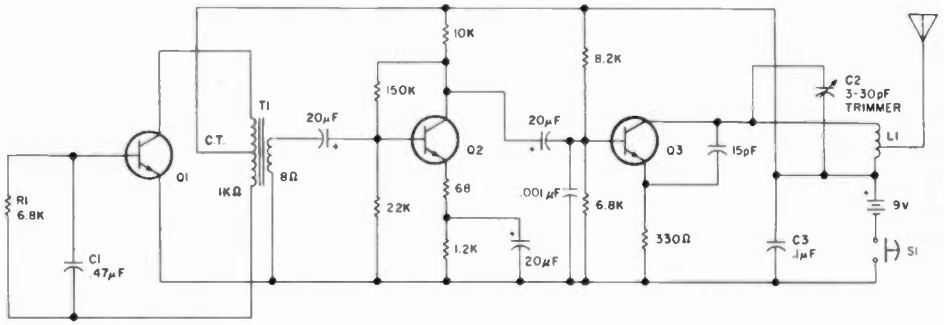

Fig. 2. Schematic diagram of the transmitter. See text for L1 dimensions.

Switching Unit and Transmitter Construction

The switching unit can be built most easily using perfboard construction, and sockets should be used for both U1 and U2, in case replacement becomes necessary. The unit may be enclosed in any type of case you may have on hand.

Perfboard construction also may be used for the transmitter, although I have used the PC board square block method with good success. This means using a hacksaw to cut the foil side of a piece of PC board into squares and mounting the components on the squares. Placement of parts in the transmitter is not too critical, but an orderly in-line layout ought to be used. The connections in the rf portion of the circuit should be kept as short and as direct as possible.

Coil L1 consists of 6 turns of #12 tinned copper wire with an inside diameter of 5/16 inches and spread to 3/4 inches in length. The antenna tap is made one and one-half turns from the cold, C3, side, and tuning capacitor C2 is soldered directly to the top and side of the first and last turns of the coil. Coil L1 should be mounted as firmly to the board as possible to enhance frequency stability. The antenna can be fashioned from a piece of heavy-gauge copper wire, and can be anywhere from 3 to 12 inches in length. A plastic case similar to those sold by Radio Shack can be used for housing the transmitter.

Test and Adjustment

First, the transmitter should be tested and adjusted to a clear operating frequency. To do so, turn on your FM receiver and tune for a clear spot on the dial. The afc should be turned off, if possible, to prevent the receiver from tuning automatically to a strong adjacent channel. Once a clear spot is found, apply power to the transmitter and adjust tuning capacitor C2 until an audio tone is heard from the receiver. Now, either continue adjusting C2 or vary the tuning of the receiver until the purest tone possible is obtained.

The switching unit may now be tested for proper operation. Plug P1 into the earphone jack of your FM receiver and apply power to the switching unit. At this point, the volume control of the receiver should be set at some low level. Each time the transmitter is momentarily activated, the relay on the switching unit should energize and stay energized until a second pulse is transmitted, at which time it will return to its normally-closed position. The volume control may have to be increased a small amount to ensure reliable operation at a distance.

If the switching unit does not operate as just described, then either a wiring error has been made or one of the active devices is defective.

The range of the transmitter will vary with operating conditions and depends to a certain extent upon the orientation of both the transmitting and receiving antennas. It has been my experience that reliable operation can be had with distances up to 75 feet.

Summary

The uses that may be found for this simple system are many and are limited only by your imagination. If you happen to own a video tape recorder and like to record movies *without* the commercials, then this remote-control system can be used to pause the recorder and to cut them out. It could also be used as a commercial killer for the television itself. To use it this way, one of the television's speaker leads is broken and connected to a set of the relay's normally-closed contacts. In fact, you might even connect your ham-band receiver's mute terminals to the relay's other set of contacts, and that way be able to listen to it while the television sound is off.

There are, undoubtedly, many other applications that can be thought of, but whatever you may use it for, always be careful to observe the relay's contact power rating, otherwise an expensive relay may be ruined. ■

Reader Service for facing page ↙15 →

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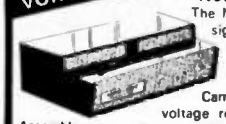

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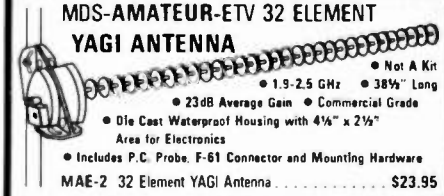

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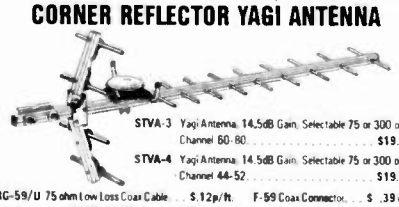

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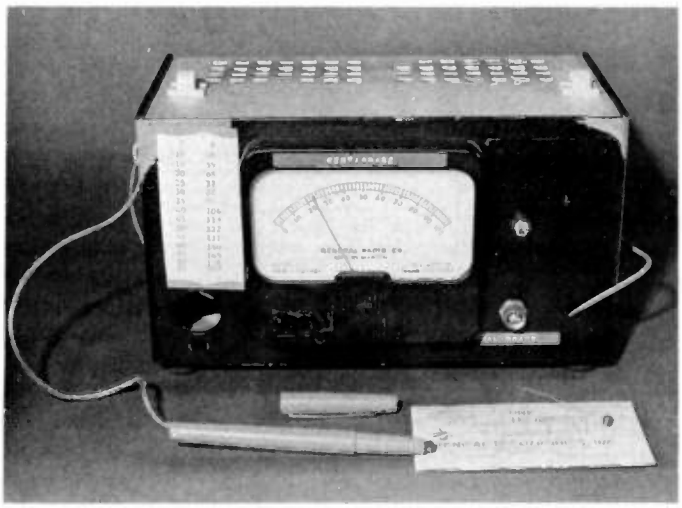
Digital Research of Garland, Texas, has advertised "Thermistors . . . 5000 Ohms at 25 degrees centigrade," four for a buck. Upon arrival they proved to be Fenwal KA35J3 thermistors.

A quick trip to Herbach and Rademan in Philadelphia produced a surplus cabinet and a nice 200-microampere meter with a scale calibrated from 0 to 100. With the addition of very few parts, this collection was turned into a solid-state centigrade thermometer that allows me to answer "How hot is my IC?" very adequately.

The schematic in Fig. 1 shows the simplicity of the electrical hookup. Resistors R1 and R2 of the bridge should be as closely matched in value as possible. They can range from 4700 to 5000 Ohms; the important part of the matter is that they be as alike in value as possible.

Photo by Ira Joffe WA3PTC



Completed meter with probe attached.

Resistor R3 should be as close to the indicated 15k as you can get. The significance of R3 lies in the fact that at zero degrees centigrade the thermistor resistance will be rather close to this value. My four samples checked out this way as indicated by a fairly good digital meter. Thus, at zero degrees, the bridge will be balanced and the meter should read zero. Taking this route eliminates the need for a low-end calibrating element in the circuit. I used a fresh D-cell to drive the bridge; since the current drain is very low, the useful life of the battery should approach its shelf life.

My meter is 200 microamperes full scale, which is about the practical limit of usable sensitivity in the upward direction. That is to say, if you have a more sensitive meter, then use it, but avoid using a less sensitive meter. The reason for this is that even small currents flowing through the thermistor tend to produce "self heat" which changes its ohmic value just as much as heat from a device being measured. If you use a 50-microampere movement, you may have to increase the value of the variable resistor in series with the meter movement. This resistor is used as the sole calibrating element for the thermometer.

The photo shows the finished meter with its probe and also an unmounted thermistor which gives an indication of the size of this circuit element.

Now for some notes on the probe construction. The body of the probe was made from a discarded fiber-tipped type of marker such as a Flair or other brand. The point was pulled off and the residual ink was carefully wiped out of the barrel. I say carefully as there is enough ink left to ruin several sets of clothes, soil your hands, and provide some interesting comments from the family if care is not used in this regard.

The sides of the thermistor are painted with clear nail polish where the leads are attached. The same treatment is given to the first half inch of lead length near the body of the thermistor after a suitable length of cable

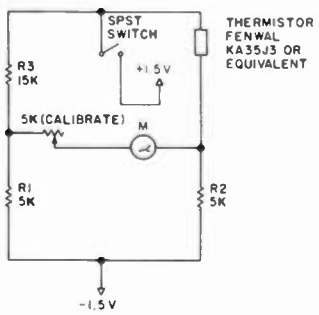


Fig. 1. Schematic diagram of meter.

has been soldered to the extreme ends of the leads.

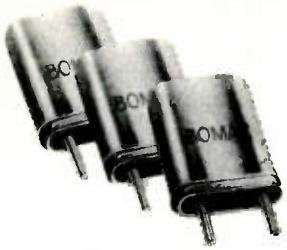
The cable is then threaded through the empty pen body and the thermistor is checked for a good snug fit in the open end as shown in the photo. If you have to ream out the end a bit to achieve a snug fit, by all means do so. When this has been done, pull the thermistor and cable out an inch or so and work some artificial rubber compound like GE silicone seal into the end of the probe barrel. Pull the thermistor back in, seat it nicely, and put the assembly aside to dry. You may also want to use the silicone seal in the end of the probe from which the cable exits to provide a bit of strain relief. That is all there is to the probe.

When the construction of the probe and associated circuitry is finished, turn on the switch and the meter should be reading somewhere about 20 to 25 degrees on the meter face. Turning the calibration control should allow a meter variation of about eight to ten degrees total.

It may pay to make a "big deal" out of the initial calibration so you can see that it works. The big deal is as follows. Obtain a reliable thermometer such as a unit used to check the temperature of photographic solutions. Fill a jar with hot water from the kitchen tap. Check its temperature with your known good thermometer. Add a bit of cold water if necessary to get the water to about 120 to 125 degrees Fahrenheit. After this thermometer reading has stabilized for about one minute, gently place your thermistor probe into the water so that it just dimples the surface of the water. Give the meter a chance to settle to a reading, which may take as much as thirty seconds to ensure that a maximum has been reached. Multiply your meter reading by 1.8 and add 32 to the result to convert the meter reading to Fahrenheit degrees as shown on your comparison thermometer. If it is high or low, make an adjustment with the calibrating pot so that the two readings coincide.

If you do not want to go through the "big deal" version of calibration, then use one of the best thermal standards around. That standard is you and the normal temperature of your body, which is just about 98.6 degrees Fahrenheit or 37 degrees centigrade. Touch the tip of the probe to your tongue and hold it there until the meter reading stabilizes. Set the calibration control for a reading of 37 degrees on the meter and you are done. This is one instrument where you will never lose the source of calibration.

Do not use this thermistor thermometer to take the temperature of hot liquids. Use it for its intended purpose of measuring the temperature of ICs and discrete semiconductors. When you do this, I suggest that you take a small bit of thermal compound such as you would use on a power transistor to make sure that it is in good thermal contact with a heat sink. Place this on the semiconductor or IC of interest and then apply the probe tip to it so that you have good thermal contact with the subject at hand. This should give you reliable comparative readings. You can easily see the effect of different sizes and materials of heat sinks in terms of getting rid of heat from the power devices. Please note the use of the phrase "reliable comparative" readings. This simple device will not put the National Bureau of Standards out of work, but it is a nice adjunct to aid any ham working with power semiconductor devices. ■



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A few months ago, some experimental work I was doing with a low-power, home-brew repeater system required a sharp filter to restrict the bandwidth of the signal presented to the antenna terminals of the receiver section, particularly at the transmitter frequency. Since the cost and availability of commercially-produced cavities were prohibitive, I decided to research the problem and see if I could make my own.

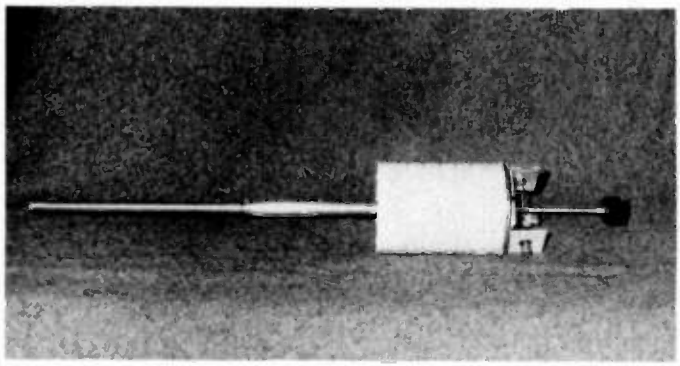
Several of the amateur publications, engineering texts, and reference books in my library discussed the subject (see reference list at end of article); some even gave dimensions and bills of materials. Since I live in a somewhat remote part of the Pacific Northwest, availability of many of the materials specified and machining services required was a problem. I decided that I should tackle the problem with the idea of using only readily-available parts and home-brew construction techniques and see what could be done. This is the story of that effort.

First, it was necessary for me to determine just how a cavity operates and what the critical conditions were. Research showed that the cavity is merely a tuned circuit, consisting of a quarter-wave stub centered in an enclosure. The combination results in a well-shielded, high-Q filter when inserted in series with the transmission line. As with any tuned circuit, the circulating currents are quite high at resonance, so losses must be kept low to ensure high Q. The losses are generally the result of the resistance of the materials from which the cavity is made. For this reason, most commercial units are made of brass or copper and silver-plated.

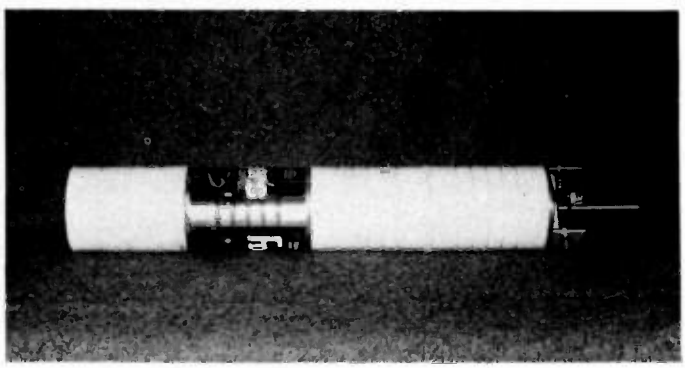
Coupling into and out of the cavity can be accomplished by any of several means, but the most common is inductive coupling, whereby small loops are positioned near the inner stub and act as transformer windings in relation to it. The loops are mounted on opposite sides of the stub so that there is minimum direct coupling between them. Thus, the input loop induces the signal into the stub (which is, remember, part of a resonant circuit), and the stub in turn induces the signal into the output loop. Since the response of the resonant circuit is appreciable only at or near the resonant frequency, appreciable coupling between the input and output loops occurs only in that range, and we have a band-pass filter.

Fig. 1 shows the low-frequency equivalent of the cavity filter, using discrete coils and a capacitor, and may help the reader to understand the operation of the circuit.

In order to build the device with a reasonable chance of success, it is necessary to identify the critical areas first. Obviously, the length of the center stub is critical. It must be an electrical quarter wave-



First coffee can soldered to the top plate. Note the telescoping tuning stub.



Overall view of the two-meter coffee filter. One can was left unpainted for effect.

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length long and, since this dimension is influenced by conducting materials near it, we must make it adjustable so that we can tune it precisely to the desired frequency.

Also, we must minimize the losses to maintain high Q and the sharpness of the filter. Silver-plating was out—for economic as well as practical reasons. Previous research showed that silver-plating at two-meter frequencies yields only marginal improvement—unless the plating is very heavy, the signal still penetrates beyond it to the base metal. Several articles on homemade cavities reported using brass or copper with apparently satisfactory results.

Another way to reduce the losses when the housing of the device is a relatively high resistance material is to increase the spacing between the stub and the housing, thus reducing the magnitude of the induced currents and hence the losses; however, the impedance of the circuit is also dependent upon these dimensions. The question, then, was how to ensure a proper impedance match into and out of the completed cavity filter. None of the references available covered this point; they only gave dimensions that had been used and worked, but did not back them up with theory so that the effects of variations could be determined.

A little more thought provided the answer, though. If the input and output coupling loops were made identical and mounted so that the relationship of each to the stub was identical to the other, the problem would be solved without even knowing what the stub/cavity combination impedance was. It would be like two identical transformers connected back to back—the load impedance would be transformed to

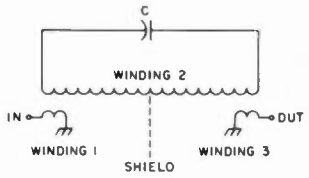

Fig. 1. Equivalent circuit of cavity filter.

whatever the stub/cavity combination required and then back down to the same impedance level in the other coupling loop.

With this encouraging reasoning, construction was begun. A source of brass tubing, of thin wall but quite rigid, was found at the local hobby shop. It comes in varying diameters and 12" (30.48-cm) lengths and is not expensive in the quantities required. I used a 1"(2.54-cm)-diameter length for the upper section of the stub, and a ¾"(1.91-cm)-diameter length for the lower section, so that they could telescope together, allowing the length of the completed stub to be varied as required.

Since circulating currents in any resonant circuit can be quite high, as mentioned earlier, it appeared essential that the two sections be in very good electrical contact at all times. I used some finger stock from the junk box for this purpose, soldering it to the bottom of the upper tube and another piece to the top of the lower one. In this manner, when the two were telescoped together, we not only had good electrical connection, but also the smaller tube was held centered in the larger. The brass tubing used, however, is sufficiently "springy" that the finger stock is not necessary. You can simply saw a number of narrow slits in the ends of the tubing and form the fingers from the resulting tabs. It is a good idea to deburr the fingers thus formed with steel wool and to form slight "hooks" in them so that the contact is not made by sharp corners that

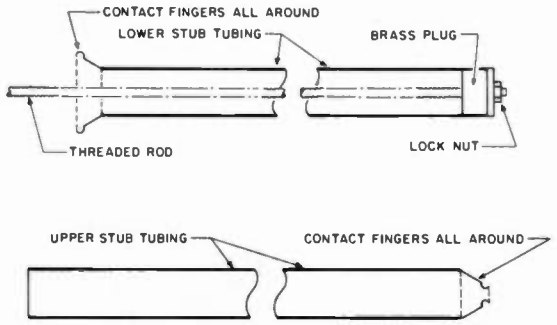

Fig. 2. Details of tuning stub construction.

might bind and hinder adjustment. Fig. 2 shows both the upper and lower stub assemblies in greater detail, including the homemade finger contacts.

Adjustment of the length of the assembled stub is accomplished by means of a threaded rod from the local hardware store. I chose a ¼-20 size. It is secured to the bottom of the inner stub section by means of a brass plumbing fitting. I chose one just slightly larger than the inside diameter of the stub tubing; I ground and filed it down to a snug fit and used it as the plug shown in the drawing. It is soldered to the stub and a nut, threaded over the end of the shaft, is soldered to it, thus ensuring that the threaded shaft is fairly well centered in the stub for smooth operation when tuning. Any of several standard brass plumbing fittings, such as adaptors to couple one size of pipe to another, will be satisfactory. Note that the threaded rod is soldered to the plug and the nut so that it may turn in relation to them.

A top plate for the cavity was made from some 1/16" (0.64-cm)-thick copper plate I had on hand. Any material could be used that is a good conductor, but brass, copper, or aluminum would be best. The latter, however, would require different (and probably difficult) methods for making mechanical and electrical connections to it; the copper or brass stock allows soldering them directly to it.

A clearance hole for the threaded rod was drilled in the center of the top plate and a suitably-sized nut soldered over it. The two sections of the stub were assembled and the threaded rod screwed into that nut. The upper tube of the stub assembly was then soldered to the top plate, centered as closely as I could manage.

A note here about soldering these pieces together: Trying to accomplish this task with a torch or large soldering iron proved difficult. Either I couldn't heat the entire assembly enough to get a good solder connection or it was heated so much that previously sol-

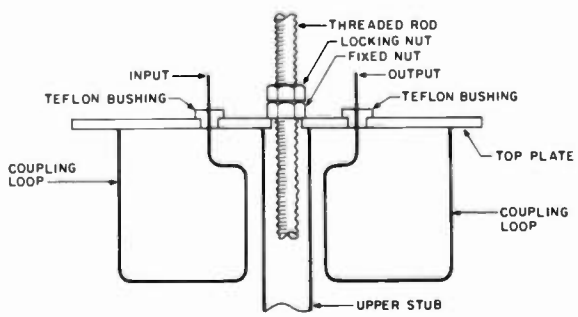

Fig. 3. Top plate assembly.

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dered parts came loose. The solution was to preheat the material in the kitchen oven to some temperature below the softening point of the solder; then a relatively small iron could be used to attach new pieces, without heating the surrounding area sufficiently to loosen previously-made joints.

The coupling loops were formed from 1/16" (0.64-cm) brass tubing from the same hobby shop source. They are formed to be 1¼" (3.18 cm) wide overall by 1½" (3.81 cm) high, with extra material on the inner leg to protrude through the top plate, allowing for connection to the outside world. The offset shown in the accompanying drawings was used to provide clearance between the loop and stub adjustment screw as they came through the top plate and is ½" (1.27 cm) in size. I used a Teflon™ bushing, as shown in Fig. 3, to insulate the inner end of each loop where it passed through the top plate, but if not available, one could be fashioned from almost any scrap plastic. Be very careful that each loop is identical to the other and that both are mounted in an identical manner so that the impedance transformation for each is correct, as mentioned earlier.

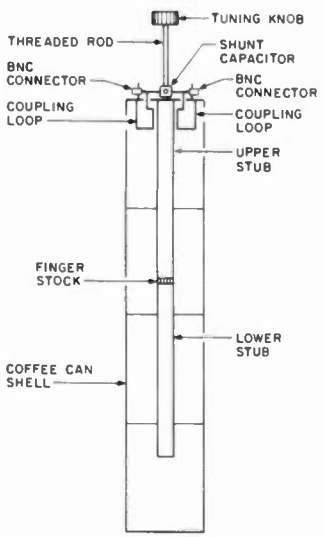
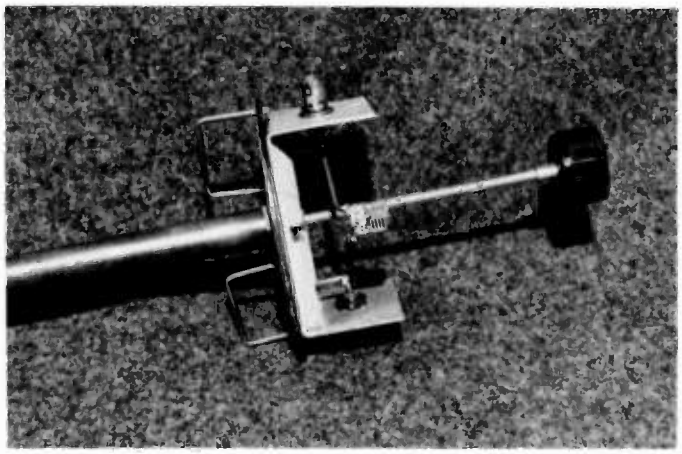


Fig. 4. Cutaway view, assembled cavity filter. The trimmer capacitor used to insert a notch in the response curve is included.



Close-up of the tuning stub, coupling loops, and shunt capacitor.

The two loops were soldered to the top plate, positioned so that their inner side cleared the stub by ¼" (0.64 cm), as shown in Fig. 3. It will be easier to position them accurately if a hole is drilled in the top plate where the outer leg of the loops should go and then the loops are soldered in these holes.

Next, I was faced with the problem of finding a suitable outer housing for the cavity. The construction articles in the references available included one calling for a 4"(10.16-cm)-diameter copper pipe for this material, 22½" (57.15 cm) long. Such pipe is not readily available in my area and has to be ordered from some distance away. Also, it is available only in much greater lengths than required and is relatively expensive. I decided to find an alternative.

A search of the local hardware stores yielded nothing that would be adequate. Then, one day while doing my grocery shopping, I noticed that some brands of coffee came in one-pound cans that appeared to be about the desired diameter! Eureka! Remember the "beer-can" antennas of some years back? I had found my source of material for the cavity. The only question was if the tin-plated steel cans would have too much loss to be usable. I decided to try and see.

I wanted new cans that weren't corroded or dented; this meant stocking up on quite a bit of coffee. I decided to try four cans, giving an overall length of 22" (55.88 cm). After storing the fresh coffee in everything I could find in the kitchen, I proceeded to cut both ends out of three of the cans and leave the bottom in the other. They were soldered end-to-end, and then the open end was soldered to the underside of the top plate, centered on the stub.

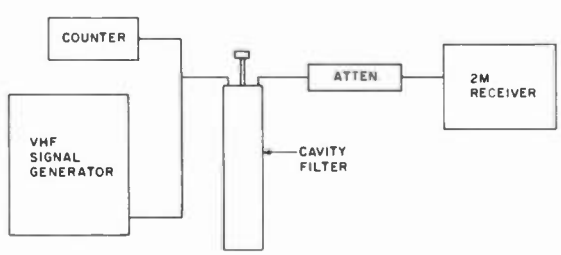


Fig. 5. Test setup for tuning and evaluating the cavity filter.

The addition of a small aluminum box to the outside of the top plate and mounting two BNC connectors on its ends allowed connection to be made to the ends of the coupling loops. Adding a second nut to the threaded shaft to allow it to be locked in place after tuning and a knob to the top of the threaded shaft to make it easier to adjust completed the job. I had a cavity filter, but would it work?

Fig. 4 shows a cutaway view of the entire assembly and may be of use to those desiring to build their own cavity filter.

Tuning the filter and evaluating its performance showed promise of being a problem without the availability of a well-equipped laboratory. I had an old VHF signal generator and a frequency counter available; that combination would serve as an adequate source with precise frequency calibration. The signal generator had an output meter so I could keep the input signal constant, and valid measurements could thus be made. But I needed a detector to permit measurement of the output of the filter. If the attenuation of the filter was anywhere near as great as it should be, I would be trying to measure signal levels far below those readable on a VTVM with an rf probe.

Finally, I borrowed a technique used by hidden transmitter hunters—I used a two-meter receiver with an S-meter and a calibrated step attenuator between it and the filter to keep the signal out of the limiting range of the receiver. Fig. 5 shows the test setup. With this arrangement, I was able to make measurements of sufficient accuracy to tune the filter and to gain a reasonable feel for how it worked.

Actual tuning proved unexpectedly easy. Adjust the threaded rod for maximum

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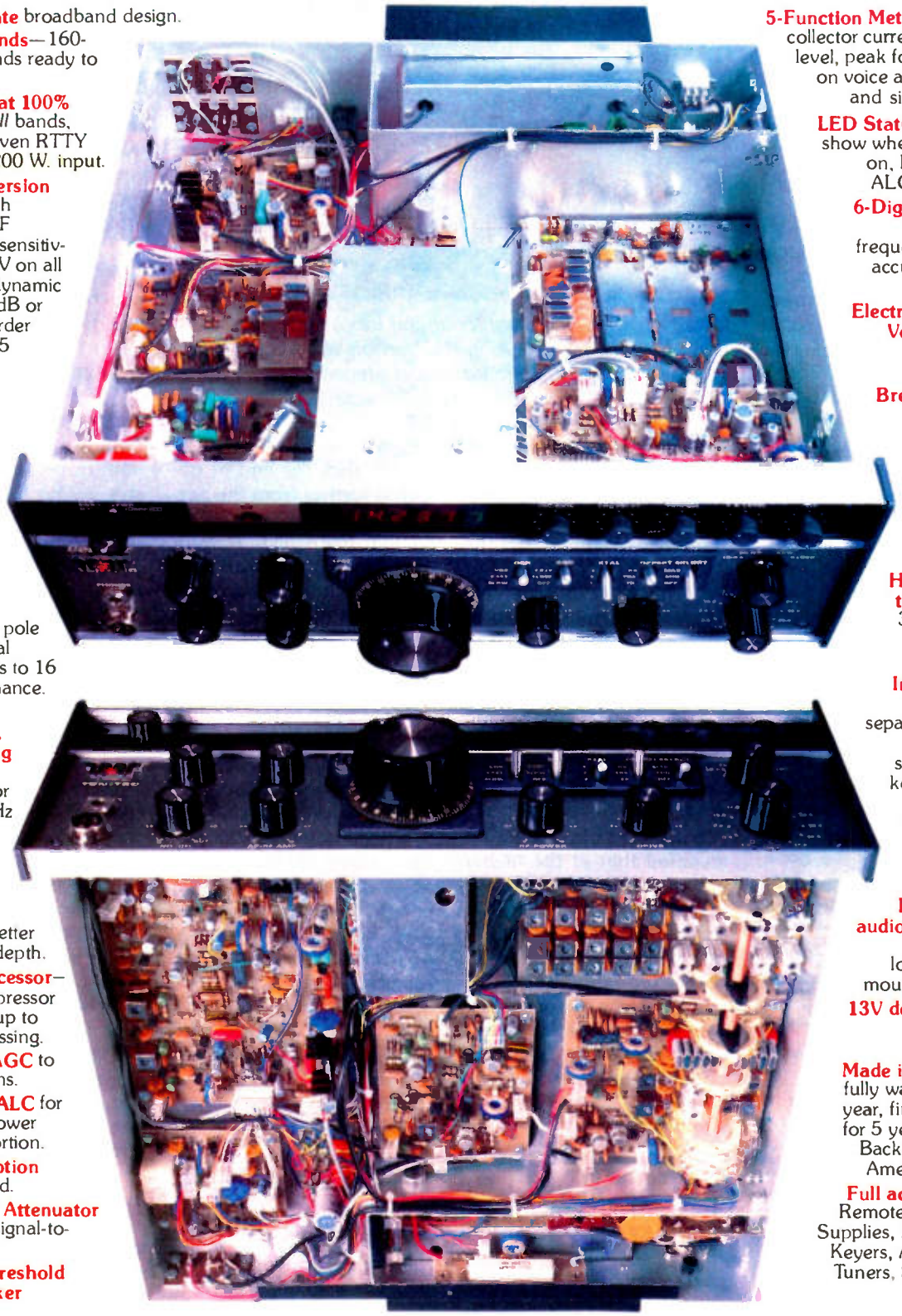

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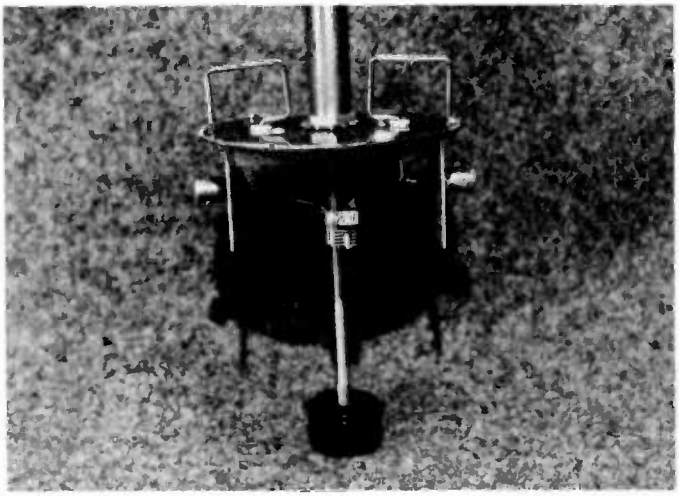
output at the frequency desired. Results indicated that the response was similar to that shown in Fig. 6; I had a filter. But it wasn't sharp enough for my needs—I needed (or at least wanted) additional attenuation at the repeater's transmitter frequency, 600 kHz above the receiver's frequency. Something else was needed.

Let's go back to theory for a minute. At resonance, the inductive reactance is exactly equal to the capacitive reactance of the circuit and each cancels out the other; that's the very definition of resonance. At frequencies below resonance, the inductive reactance is smaller than the capacitive reactance; hence, the overall result is a circuit that looks like a capacitor. Above resonance, the reverse is true, and the circuit appears to be an inductor. Since my transmitter frequency was above the receiver (filter) frequency, the filter would look like a small inductor there. If I put a small value of capacitance in parallel with the filter, it should be possible to make it resonate with this apparent inductance, hopefully at the frequency of the (undesired) transmitter output. This would, in effect, form a parallel resonant trap in series with the receiver input, just as the traps in many multiband antennas are formed. The results should be similar.

I used a 2-15-pF air trimmer. By alternately tuning the threaded rod for maximum output at the receiver frequency and the trimmer for minimum output at the transmitter frequency, I was able to achieve results similar to those shown in Fig. 7. The peak of the response fell at the desired receiver input frequency, while the notch in the response curve fell at the transmitter output frequency. The difference between the two measured on the order of 16 to 18 dB and, because of suspected leakage around the cavity, is probably greater. Since some references claimed that the maximum rejection for such a cavity is about 20 dB, I wasn't doing too badly. I couldn't measure the insertion loss accurately, but it appears to be about 1.5 dB, which is entirely satisfactory and near the values quoted for commercially available cavities.



Detail showing top plate, coupling loops, and upper portion of tuning stub. Stub in this version was soldered to a threaded fitting which in turn was fastened in a hole in the top plate.

Subsequent investigation revealed that at the higher end of the tuning range, the Q appeared to be substantially higher, as evidenced by a sharper filter response. This is probably due to the fact that the distance between the center stub and the inside of the cavity is larger (in terms of a wavelength), so losses are reduced; also, the end of the stub is further from the bottom of the cavity, also reducing losses. If I were planning to build another of these filters, I would try the larger 2-pound coffee cans and use five rather than four of them.

It has been many months since I built this filter. Rechecking its tuning and response curve indicates no change, even though I live in a high humidity area and some corrosion was expected; apparently it is tight enough that this will be no problem. I have detected no noticeable shift in its parameters due to temperature excursions, although I have not subjected it to wide extremes.

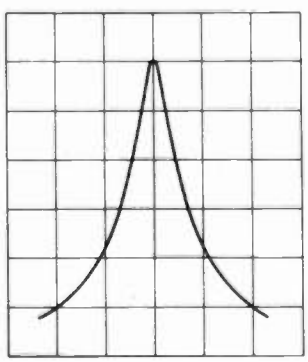


Fig. 6. Shape of the response curve of the cavity filter without shunt trimmer.

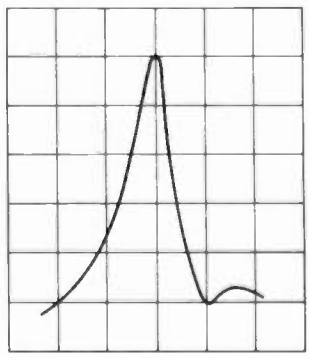


Fig. 7. Shape of the response curve of the cavity filter with shunt capacitor included.

The proof of the pudding is in the eating, they say, and the proof of this filter is in the system it was intended for. Without the filter, the very poor receiver I had responded to a 10-Watt signal anywhere in the two-meter band when the source was a few feet away from it; with the filter inserted between the antenna and receiver, an 80-Watt signal, at the same distance, has no effect until it is within about 30 kHz of the receiver frequency—the bandwidth of the filter included in the receiver's first i-f.

So what have we learned? It is possible, even easy, to make a cavity for your own use. It isn't expensive. Home tools and building techniques are more than adequate. Readily-available components can be used, and most dimensions are not at all critical. It is not difficult to tune up, and readily-available equipment can be used.

We don't have to pay a fortune for commercial cavity filters or duplexers for low-power use. While it may be advisable to do so for wide-coverage, heavily-used machines, we can quite easily use these for low-power, local-coverage machines. By substituting a small inductor for the trimmer capacitor, the notch can be moved to the low side of the response curve so several cavities can be connected together to form a duplexer; although adjusting the inductor would be more difficult than the trimmer, it can be done. Maybe now we can see more of these low-power, local-coverage machines, reducing the load on the wide-coverage systems. ■

References:

The Radio Amateur's VHF Manual, 3rd Edition, ARRL.
VHF-UHF Manual, 3rd Edition, RSGB.
Electronics Engineers' Handbook, 2nd Edition, Fink and Christiansen, McGraw-Hill.

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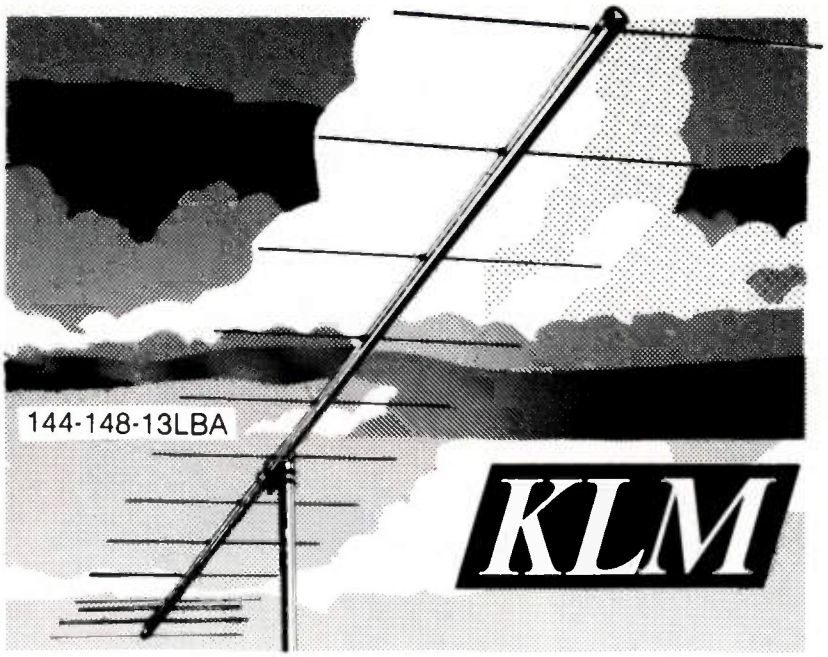

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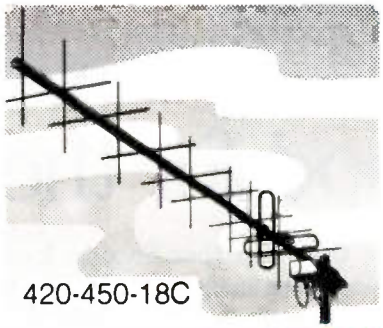

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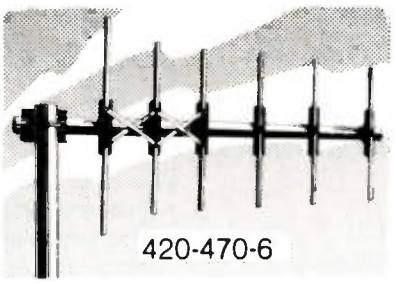

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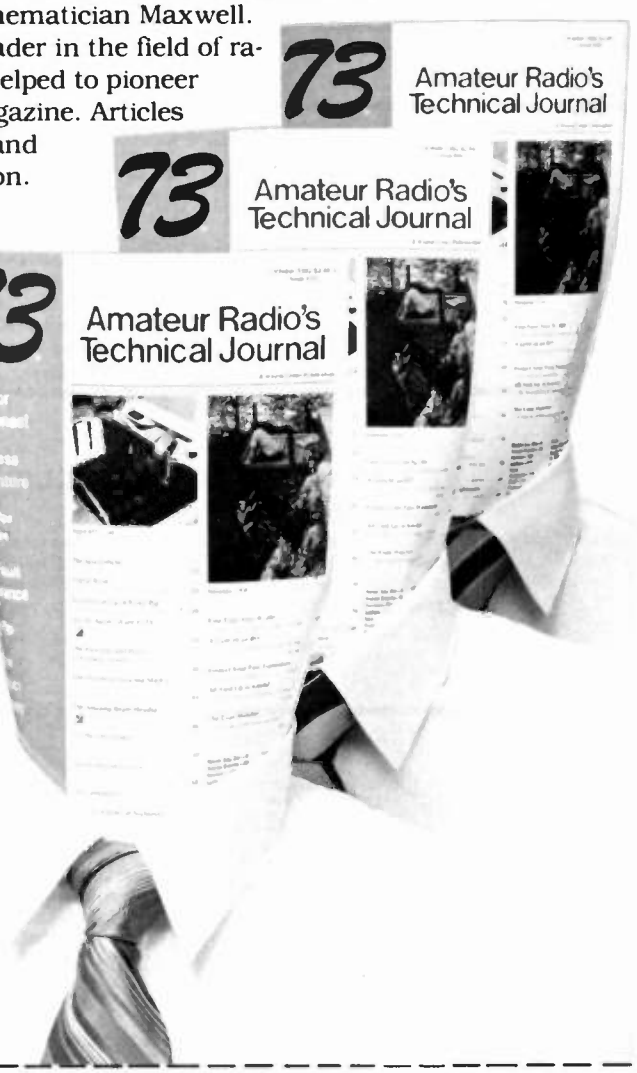

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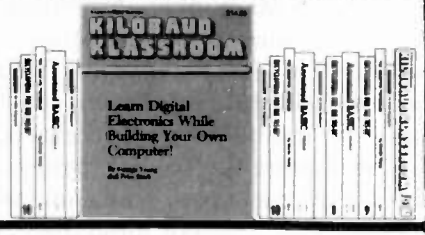

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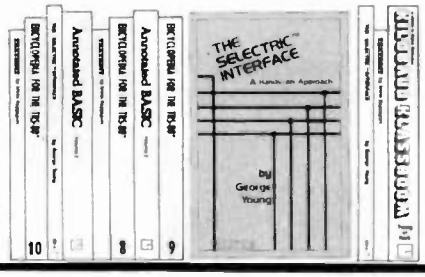

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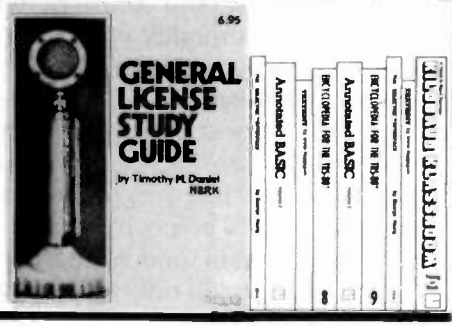

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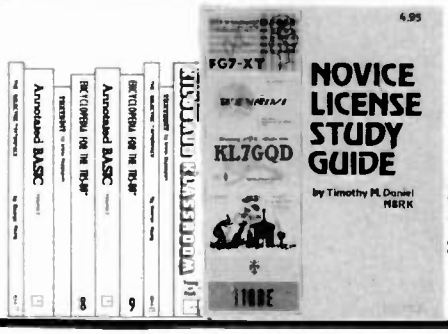

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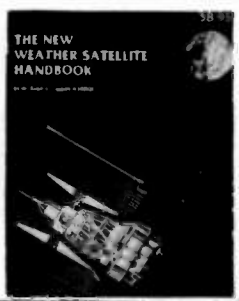

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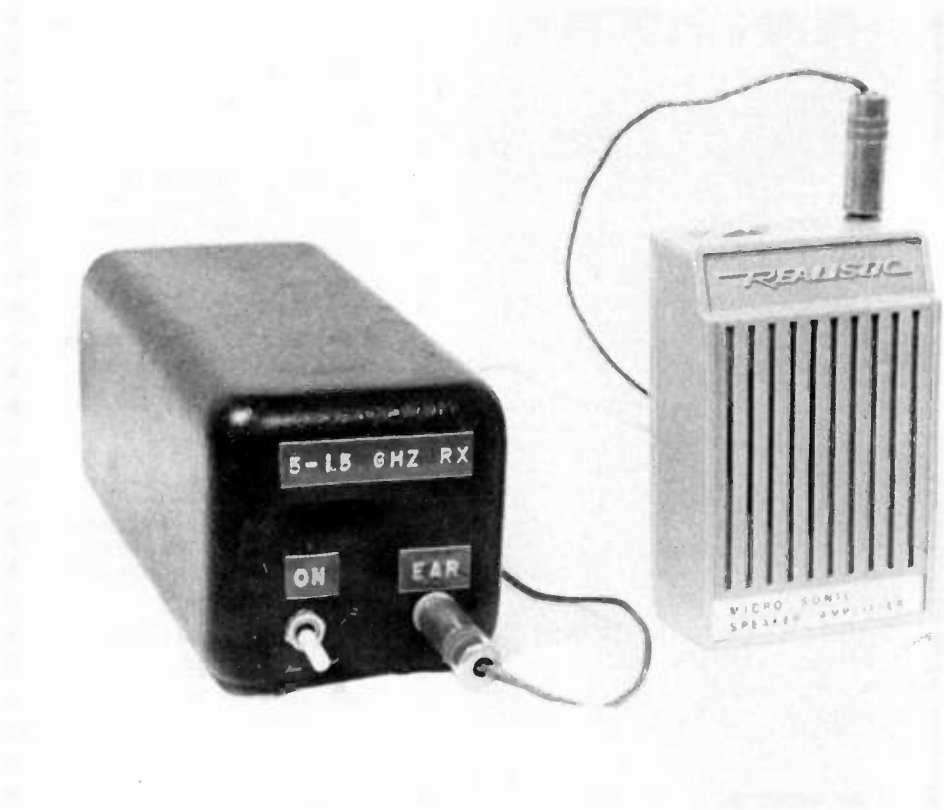
Push Your Radar Detector to the Limit

Without this simple modification, you won't know what you are missing—until it's too late.

The use of speed-detection radar devices by law-enforcement agencies as a means of enforcing speed-limit laws is becoming very controversial in the United States. A court in Miami, Florida (Dade County) already throws out radar speeding cases if there is no other data presented. The State of Kentucky has a court case pending to determine the validity of radar as a speed-law enforcement tool. If the courts later rule that radar cannot be used as a means of enforcing the speed laws of the country, radar sets will probably not be used by enforcement agencies. The auto radar detector thus would no longer have an operational requirement. What will you do with your radar detector which has accompanied you so faithfully in your auto all these past years?



The author's radar detector modified to receive signals from 5 to 15 GHz. Both receiver and audio amplifier operate off 9-volt batteries and are self-contained.

Extend Its Usefulness

Until such time that auto radar detectors become "useless," in the sense that they may not be needed to provide an alerting function for you, a simple modification to almost any detector will let you extend your use and interest in a radar detector. Before we go into how the simple modification works, let's review how the speed radar works so we will better understand our radar detection operation.

Law enforcement agencies use the familiar Doppler shift principle (named after Johann Doppler, 1803–1853) to determine the speed of a vehicle. A hand-held radar transmitter emits about 100 milliwatts of continuous microwave energy

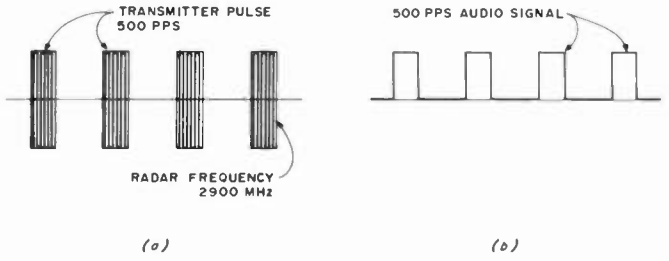


Fig. 1. Pulse radar signal (a) and audio signal (500 pps) when detected at a distance (b).

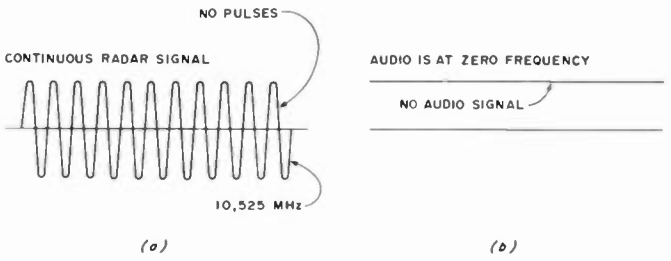


Fig. 2. Continuous-wave (CW) radar signal (a) produces no audio signal when detected at a distance (b).

at 10,525 MHz (X-band) or 24,100 MHz (K-band). The radar signal is concentrated in a narrow beam by a horn-type antenna so that the target vehicle is illuminated with the maximum amount of energy. Because of the movement of the vehicle, the 10,525-MHz signal is Doppler-shifted up in frequency about 940 Hz for an auto traveling at 60 mph. This upward Doppler shift is obtained for the emitter stationary (but vehicle moving) and is arrived at by the expression: Emitter stationary: $f_{D1} = f_1[(V + V_0)/V]$, where f_{D1} is the Doppler shift frequency in Hz, f_1 is the operating frequency (10,525 MHz), V is the velocity of light, and V_0 is the velocity of the vehicle in same units as V.

However, the transmitted signal must now be returned (reflected) to the radar receiver. So now the vehicle acts like a transmitter and originates (reflects) a signal (emitter moving) which also is Doppler-shifted up in frequency when it arrives at the radar receiver. The returning signal is shifted up in frequency according to the expression: Emitter moving (vehicle): $f_{D2} = f_2[V/(V - V_S)]$, where f_{D2} is the Doppler shift frequency in Hz, f_2 is the reflected frequency (vehicle) (10,525 MHz + f_D), V is the velocity of light, and V_S is the velocity of source (vehicle) in the same units as V.

We thus find that the total Doppler-shifted frequency is equal to $f_{D1} + f_{D2}$. For a vehicle traveling at 60 mph toward a radar, the total Doppler-shifted frequency is equal to 950 Hz + 950 Hz for a total shift of 1900 Hz. We arrive at this frequency after accounting for the original frequency of 10,525 MHz. This is about 31 Hz per mile for a radar operating at a frequency of 10,525 MHz. The total Doppler shift for a K-band radar would be about 2.3 times greater, or 72.5 Hz per mile.

The speed radar receiver must now process the Doppler-shifted frequency into miles per hour and then display and store it for record until the display is reset, awaiting another vehicle. The speed radar has to be triggered on for only a few seconds in order to lock on and obtain a good speed reading on a vehicle, although older units may be left on all the time. The time available to "hear" the radar transmitter, therefore, isn't very long.

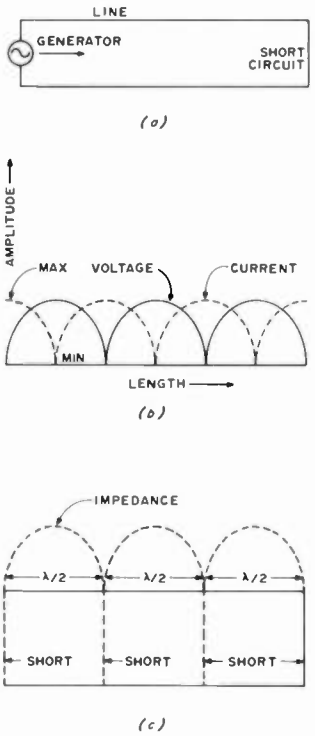


Fig. 3. Standing waves on a shorted transmission line. In (c) we see that a short is reflected every half wavelength.

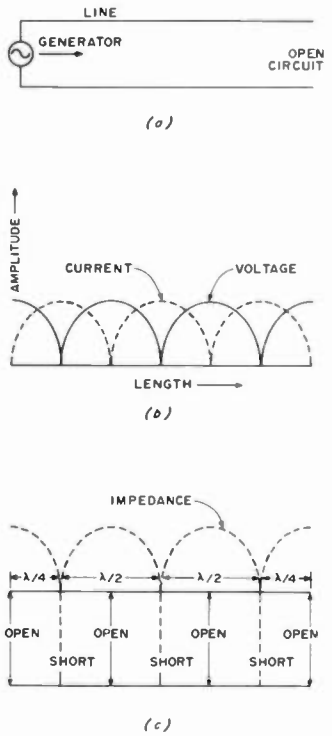


Fig. 4. Standing waves on an open transmission line. In (c) we see that an open is reflected every half wavelength.

How the Auto Radar Detector Works

Pulse Radar. Before the auto radar detector came along, there was only the radar speed detector. But with the advent of the auto-equipped radar detector, the *detector* became the *detectee*! (Or the *chaser* became the *chasee*.) And so the hunt has continued for about 30 years.

Old speed radar sets used the pulse principle as was used during World War II. Fig. 1 shows a series of radar pulses used to determine range to a target and the audio (500 pulses per second) produced by a diode detector receiver when listening to the radar. The rapid turning on and off of the radar carrier produces a music-like audio tone when the radar signal is detected and amplified.

Doppler Radar. Speed radar sets for the past 20 years or so have employed a continuous-wave transmitter, that is, one not modulated with any type of signal. It depends on the rapid Doppler shift in frequency (up in frequency when approaching and down when receding) to produce a shift in frequency which can be equated to *velocity* of a target rather than *distance* to a target as in the pulse-radar case. However, as we see in Fig. 2, the continuous carrier signal does not produce an audible signal when you detect and *listen* to it. Since there is no modulation on the signal at the transmitting end, we must do something to it at the receiving end so that we can detect its presence. And, of course, we must do this as inexpensively as possible as many consumer units will be bought.

Chopping the Radar Signal. You have no doubt driven or walked down a tree-studded roadway when the

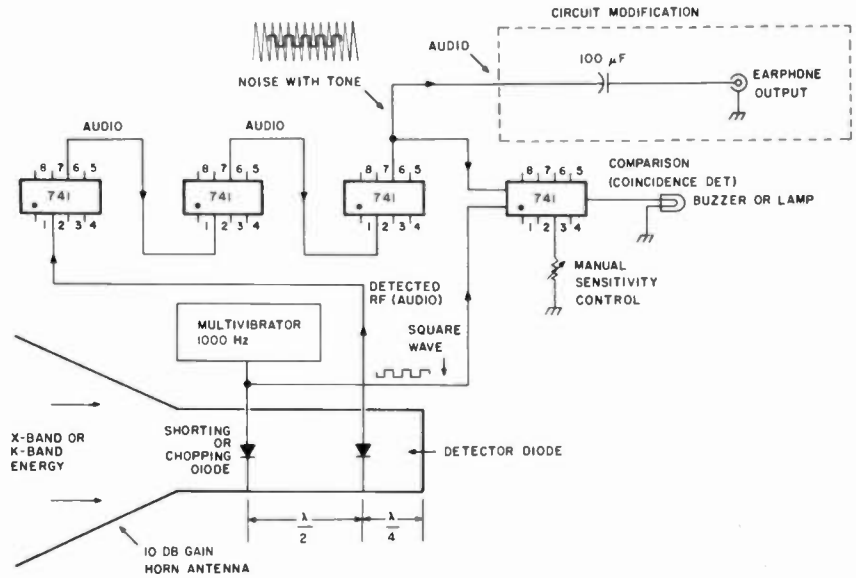


Fig. 5. Auto radar detector diagram showing chopping diode, detector diode, audio amplifiers, comparison circuit, and alerting buzzer or sounder.

sun is shining brightly. As you move along, bursts of sunshine are seen to stream through the foliage between patches of shadows. We are observing the modulation of the sun's steady rays of light where they are rapidly "turned on and off" by the foliage. In much the same manner, we will interrupt, or chop, the radar signal we receive so that we can process it to turn on an audio-altering device or a visual indicator.

In order to fully appreciate the uniqueness of the technique used to "chop" the radar signal, let's take a look at some fundamentals as they relate to antenna transmission lines.

The Shorted Transmission Line. When you take a transmission line such as an open-wire line or coax line as used in your amateur radio or CB mobile installation and short it at the antenna end, you will have zero volts across the end (as shown in Fig. 3). We see a generator sending a signal down the lines with a short at the right-hand end (a). In (b) we see that on a line terminated in a short, the voltage is zero at the end and maximum one-quarter wavelength back from the end. We see, also, that the short is repeated every half wave at the operating frequency (c). No voltage exists at the short, although the current is maximum. This can be likened to placing a screwdriver (zero Ohms) across an ac outlet of 115 volts. There will be a lot of current flowing till the fuse blows or the circuit breaker trips out, but there won't be any voltage! (Don't try this at home!)

The Open Transmission Line. Now let's look at an open terminated transmission line. In Fig. 4, we see a generator driving a signal down the line (a). In (b) we see that there is maximum voltage at the open end of the line and every half wave back toward the generator. In (c) we also see that the open circuit becomes a short circuit just one-fourth wavelength back from the open end.

What we have here is a means of chopping the radar signal as it comes down the waveguide transmission line from the horn antenna used in most radar detectors. What we do is to cause a diode placed across the transmission line to act as an open and a short, alternately, at an audio rate between 1000 and 3000 times per second. When a diode conducts in the forward direction, it acts like a short circuit (very low resistance) but when it does not conduct, it acts as an open circuit (very high resistance).

The Radar Diode Detector. An abbreviated circuit and block diagram of my Snooper (Autotronics, Inc.) radar detector is shown in Fig. 5. The shorting, or chopping, diode is turned on and off by the multivibrator circuit which puts out a square-wave signal at an audio rate of 1000 to 3000 pulses per second. Note that when the shorting diode is conducting (anode positive), it acts as a short in the waveguide. A half wave away, a short is also reflected so that the detector diode is shorted. The detector diode is one-fourth wavelength away from the short in the end of the waveguide so that it always appears as an open, free to detect and rectify any microwave energy coming down the waveguide from the 10-dB gain horn antenna that is chopped up by the shorting diode.

The Comparison Circuit. The detected audio from the detector diode is amplified in several IC chips (type 741) and then routed to a comparison or coherent detector where it is compared to an audio signal arriving from the 1000-Hz multivibrator. A manual sensitivity control is used to set a level at which the audio alarm buzzer or lamp is turned on. The comparison circuit is activated when the signal arriving from the detected audio channel (outside signal) is stronger than the signal from the multivibrator (inside signal). This means a radar signal is being received and the alarm is activated.

The Case of the False Alarm. There are a number of signals, however, that can activate the detector, other than a real speed radar signal. We will look at the signals in greater detail further on, but let's examine what happens when you receive a signal. The first thing you do is to look for the speed radar vehicle. Not seeing one, but the audio alarm is still sounding off, you turn the manual sensitivity control down until the sounder stops. However, what you have done is to make your detector less sensitive to outside signals. You are now very likely to get "pinged" by a real speed radar and not know it (till the bubble machine starts!).

Modify Your Detector to Receive Other Signals. What we will do at this time is to make a slight modification to your detector—to add an audio output capability. We then run this audio output to a small self-contained packaged audio amplifier so that we can listen to *all* signals that are detected by your receiver. We will let your ear become trained so that it can tell the difference between a pulse radar from an airplane, an airport radar, a strong TV station, or a real bubble-machine emitter!

Referring to Fig. 5, we see a dotted area which shows the added circuitry to provide the audio output capability. Any battery-operated audio amplifier will do the job, and one readily-available is the speaker/amplifier from Radio Shack No. 277-1008 for under $12.00. The

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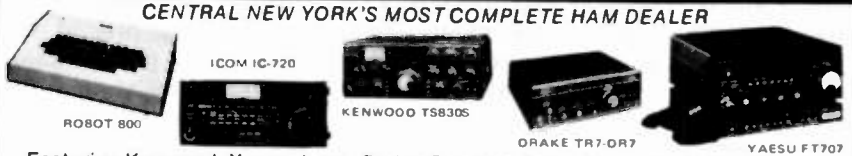

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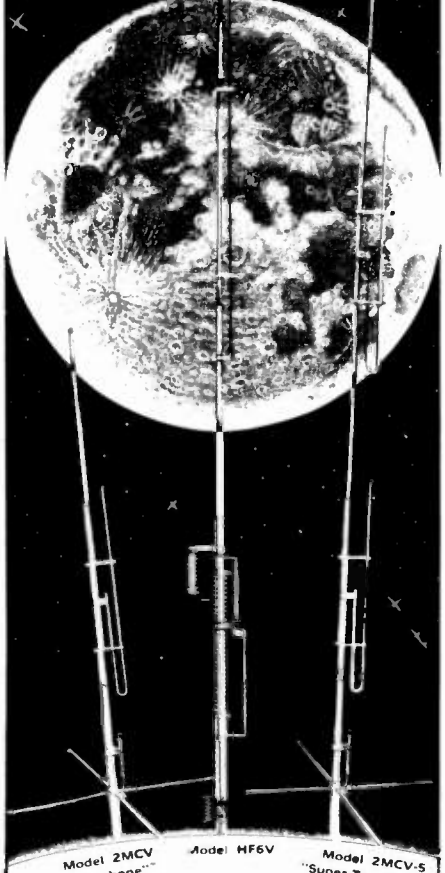

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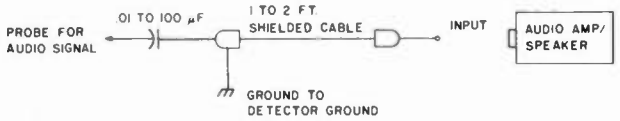

Fig. 6. Arrangement to probe for detector audio circuit. A hiss shows you have located a suitable point to connect the audio output.

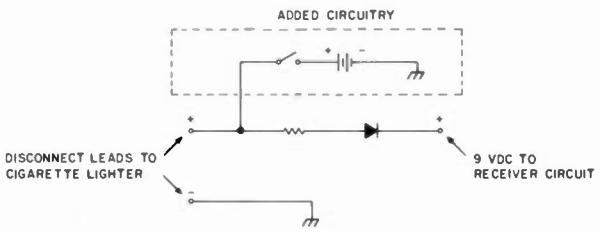

Fig. 7. Radar receiver modified to operate off a 9-volt battery for hand-carry operation.

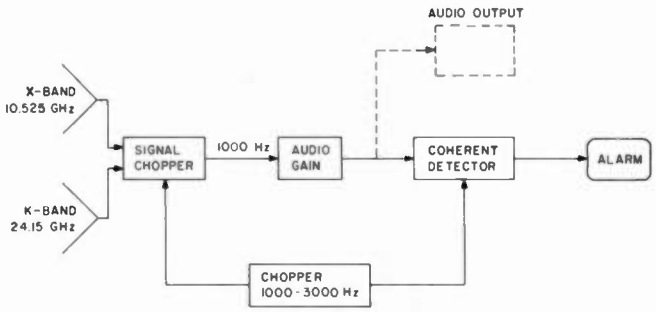

Fig. 8. Block diagram of typical X- and K-band radar detectors. Audio output modification covers both hands.

photo shows my Snooper detector modified for earphone output and an audio amplifier connected by a short piece of shielded audio cable which has male miniature audio connectors on each end.

In order to locate a circuit connection point in your detector which has sufficient audio voltage to drive the amplifier, use the arrangement shown in Fig. 6. Remove your detector from its housing, and with power applied to both units, probe the circuit board near where the manual sensitivity control is wired. There will be several points in the circuit where you will hear white noise, or hiss. This tells you that you have located an audio tone present of 1000 to 3000 Hz. This is the chopping or switching rate that you are hearing and it tells you that the unit is operating properly. When you shut off the radar detector (but leave the audio amplifier on), you may hear the tone become very clear as the white noise disappears before the switching tone. This may not occur in all modified units.

I have added a 9-volt transistor battery and switch to the detector/receiver so that the unit is entirely self-contained and can be hand-carried anyplace. It can be used on aircraft, boats, bicycles, and the like. Connect the battery to the same circuit point as the auto cigarette lighter as shown in Fig. 7. A battery will operate the radar receiver for a number of months with several hours use each day.

Connect the audio circuit as shown in Fig. 5 using a capacitor of 0.01 to 100 μF. To help you make the simple modification to your detector, ask a radio amateur or CB repair shop for assistance. You need not alter the appearance of your detector if you run a pair of small size wires outside your unit where the audio pair can connect to the amplifier.

Radio Signals You Can Receive

Now that you have modified your radar detector, you will be able to receive other radio signals. So that you will now know *what* signals you are receiving, leave your unit operating at its maximum sensitivity while you *ignore* those signals, keeping an alert ear open for the pure tone of a speed radar as it grows slowly out of the noise level. Remember, your detector is a fairly inexpensive device which is called upon to do a rather scientific task—receiving weak continuous-wave radar signals. As such, it is also subject to receiving and detecting any radio energy which is able to enter its detection circuits. You will use your ear to reduce the false alarm rate, and at the same time greatly increase your interest in your electronic surroundings. Let's look at some of the radar signals you may receive on your converted radar detector.

Speed Radar. Two bands are authorized by the FCC: X-band—10.525 GHz (10.5-10.55 GHz), and K-band—24.15 GHz (24.05-24.15 GHz). Power output—100 milliwatts (times antenna gain).

Stationary hand-held units are usually detected at about a half-mile away. If the transmitting unit is on continuously, you will hear the signal begin weakly as a pure tone of 1000 Hz or so, growing out of the white noise hiss. This hiss will not disturb you as it will be masked by road and car noise. But when that pure tone signal jumps up at you, you'll know you have a live one! Remember—the signal you hear out of your detector (1000 Hz or so) is the switching frequency of the chopping diode. It has nothing to do with any Doppler frequency shift associated with vehicle velocity. You will hear the signal with both vehicles stationary if the radar is transmitting. The longest distance over which I have detected signals, over several hills and dales, is 8 miles. But you must be line-of-sight to the radar to hear him and hope he "pings" someone else so you will be able to hear him.

My modified Snooper covers only the X-band, so you may be pinged on K-band and not know it unless your unit has both X- and K-bands. There is presently little operation in K-band, but its use is increasing. In Fig. 8 we see the block diagram of typical X- and K-band detectors, with one modification covering both bands since there is a common audio channel.

Many law-enforcement vehicles will drive around with the radar switched on and transmitting all the time. The hand-held unit, aimed like a spot light, is temporarily placed face down on the front passenger seat. However, enough radio energy is scattered out of the vehicle so that you can detect it several blocks away, be it moving or stationary. You will also be able to detect a radar vehicle passing in the opposite lane of a divided highway from several blocks away. When you receive these signals on your receiver, you will know that you have achieved a good sensitivity level as the radar unit does not have its antenna beam aimed out of the car.

Aircraft Radar. These radars operate in the range of 9300-9500 MHz and usually are heard during inclement weather when the radar is used to navigate around bad weather. You'll hear a "zip-zip" as the airborne antenna sweeps back and forth. You'll be able to track it for many miles as you aim your

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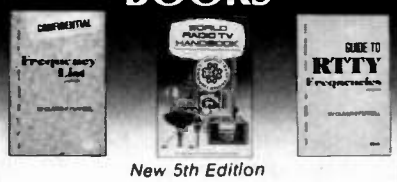

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detector in azimuth and in elevation to the aircarft. Remember, these are pulse radars with high-power output and you can hear them for about ten miles from your location.

Ship and Coastal Radar. These radars operate in the 2900-3100-, 5350-5650-, and 9300-9500-MHz bands. Rotate your detector around slowly as you look for them near the coast as they will have an antenna rotation rate of 5-10 rpm. Large ships will move slowly as you track them while small vessels will move more rapidly and you may soon lose them. While driving along, you'll hear them for 5 to 10 miles before they fade out.

Weather Radar. These radars operate around the clock from a number of locations in the country as part of the NOAA weather service, in a band of frequencies from 2900-3100 MHz. These signals are heard on occasion from as far away as 40 miles when the sky is filled with clouds of rain or heavy moisture. The radars have a low antenna-rotation rate as well as a low pulse-recurrence frequency (prf) which sounds like "burt, burt." On occasion, you may find these signals being reflected off large thunder clouds that are 10 to 20 miles away.

Microwave Communications. These signals will fool you the most as they sound like a real Doppler (continuous-wave) radar. As you drive around in the city or country, you may pass into their beam and hear the pure tone increase in intensity. You'll look around for a bubble-machine car but not see anything. Then, as you drive further, the signal may disappear as you get closer to, and pass under, the beam from the antenna (probably a 3′ to 5′ dish) mounted on the side of a building or on a tower.

These signals usually lie in the frequency range of 12.985-13 GHz. Other users might lie in the 7-9-GHz band. These systems usually operate with just a few Watts of power to the antenna but with a high-gain beam. Once you locate the position of such a signal, you can use it to check the proper operation of your receiver each time you drive by. In the event a real Doppler radar were to begin operation in that same area, your trained ear will still be able to discern a difference between the two.

CB Transmitters and Mobile Radiotelephones. On occasion, you will hear a brief whistle of a signal as you pass other vehicles on the highway. The signal might last for just a few seconds and you'll think you've been pinged. What you have done is pass very close to a CB or mobile radiotelephone in operation. If you glance quickly at the passing autos, you may observe someone talking into a telephone handset. These transmitters usually operate in the 150-170-MHz or 450-MHz range and you are hearing a harmonic due to the closeness of your receiver to them.

Television Stations. Depending upon the TV channels in your location, you may or may not hear false alarms. UHF stations which operate on channels 14-83 (470-890 MHz) at power levels up to 1 million Watts may be received up to 20 miles away, causing you to turn down your manual sensitivity to quiet the alarm. While driving in a strange city, you'll need the discerning power of your ears to tell you what sounds are a TV channel and what sounds are the pure tone of your friendly gendarme radar. These TV signals are so strong that they plainly drive through the X-band antenna and are detected (chopped) and you hear them as real "fake" signals.

Aircraft Runway Landing Aids. As you drive by or near some airports, you may hear all sorts of signals being picked up by your 5-15-GHz receiver. Some of the approach-control radars are at 2800 MHz and you'll hear their prf buzz each time the antenna rotates by your auto as you drive by. You may also hear reflections off buildings by aiming your receiver antenna at the buildings. You may also hear sidelobes from the radar as it sweeps in azimuth.

One very interesting airport radar operates at a frequency of 9080 MHz with prf of 5500 Hz as it sweeps in azimuth and elevation, looking down the runway at approaching aircraft. As you drive by, you will hear its signal. It goes "cheep, cheep" as it scans its pattern across your vehicle. You might hear this one as far as three miles from the end of the runway.

Other Signals You May Receive. There are now a number of microwave burglar alarm systems that operate throughout the country at X-band. As a consequence, depending on the sensitivity of your receiver, you may detect them when driving in residential areas, shopping centers, and industrial areas. Again, you will be able to recognize their sound and identify the area of the city where you receive them.

Other Receiving Considerations

Inverse Square Law ($1/R^2$). A radio signal undergoes a loss as it propagates through space; this is called the inverse square law. Double the distance, and the power received is one-fourth strength. For the radar receiver case, the signal suffers a $1/R^2$ power loss in reaching the target and a $1/R^2$ loss in the signal returning from the target to the radar receiver. For the radar case, therefore, the total power loss is figured by $1/R^4$. However, for the radar detector case, the power loss is only $1/R^2$, not $1/R^4$, as it does not have to look at reflected (bounced) radar energy. Thus, the *detector* can see the *detectee* twice as far away. All things being equal, you should hear him at twice the distance that he can see you. That provides a beep to the wise.

X-Band Radars. There are over 70,000 speed radar sets in operation in the US—about 95% in X-band.

K-Band Radars. About 5% of the radars operate in this band, and this number is increasing as equipment-design technology for this band improves.

Radar Detectors. It is estimated by manufacturers that there are approximately 2 million radar detectors in use in the US. Their use probably will increase as federal laws are enforced additionally by state authorities.

The Superheterodyne Radar Detector. The superheterodyne receiver is the best type of circuit that you can buy. They are just now becoming available in quantity on the radar-detector market and range in price from about $150 to $300. The circuit is the same as that employed in most AM, FM, and TV receivers and is very selective in frequency. Because of this feature, the receiver is able to reject almost all the signals that can be found in the outside world of the present-day radar speed detectors.

Use of the 5-15-GHz Receivers. The modified receiver you are using covers about 5-15 GHz. You'll hear many different kinds of signals in this frequency band, some of interest, some of no interest, and some a bother. Whatever the reason for you to use it, remember—the FCC under Title 47 of the Communications Act of 1934 states that no radio receiver can be licensed, restricted, or banned. And that includes any government agency or state. Happy listening! ■

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Personalize the M800 RTTY Program

Now you can design and save your own version of this popular software package. All it takes is a POKE or two.

Since the introduction of the low-priced microcomputer for the home market, radio amateurs have quickly taken advantage of the fact to modernize their ham shacks. These individuals very quickly realized that not only was the machine capable of doing housekeeping chores, but also it could be used on the air. The first software for the TRS-80's use on CW and RTTY was the Macrotronics M80 written by Dr. Ron Lodewick N6EE. This program was a fantastic learning experience for all users and the enthusiasm generated was sufficient to convince Ron to create the M800. As the FCC opened the door for the use of ASCII in the USA, shortcomings were found in that portion of the program. It was not long at all before Ron issued FREE a corrected version called the M800 1.1.

Now come the shortcomings of any software that is mass-produced. Being mass-produced, one must organize the program to suit his or her operating circumstances. I do not fault Macrotronics for this because to maintain a viable operation, one soon has to lose the personal touch. If the software was to be constructed tailor-made for the individual, the cost would be astronomical, as you can well appreciate.

To get started, simply load and run the M800 as usual (make sure you have the hardware turned on). Once you have entered your name and callsign, you can proceed to set the program as you would for operating, such as CW shift, ignore returns, fast diddle, etc. Now that you are satisfied, run through the operating steps until you are sure you have it the way you want. Proceed to program the three message memories and try them out as well just to be sure that they function correctly. Once satisfied, go to the receive mode and enter the name of the station that you work most often. This is an added touch that saves time.

Now that the program is running properly, break the out by resetting (don't forget to use the break key if you have the expansion interface) and POKE the number of diddles and lines of CQ, RY, and QBF. You can now load TBUGHI and punch a new tape with the P command as follows:

P 43FO 6652 4575 M800 <ENTER>

This will give you a permanent copy. It would be advisable to make a few backups prior to trying out the tape as TBUG does not verify. I have made several different copies, for normal operating, contesting, DXing, and other operations.

The information that I have to pass on to you is very simple and should make the software a dream to use. The program will come up running in the receive mode with all of your information stored as an integral part of the program. The only other software that you require to accomplish the task is TBUG, but this must be relocated out of the way of the M800. If you have trouble with the relocation, an excellent article is available in *80 Microcomputing*, issue #1, January, 1980, page 118.

Disk users will also benefit as the program can be auto-loaded. Using the Apparat 40 Track Newdos+, it takes less than five seconds to receive. Also using Newdos SUPERZAP, you can change the CQ, RY, and QBF messages to suit the operation. I have changed the CQ message from

CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ

to

CQ TEST CQ TEST CQ TEST DE VE4AFO CQ TEST CQ TEST CQ TEST DE VE4AFO.

This is only a simple example of program manipulation; you are limited only by your own imagination.

An added feature is one that should make people very happy: The troublesome keybounce can be overcome using the utility DBNC found in *80 Microcomputing*, issue #1, January, 1980. If you have more than 16K, it is very simple to relocate by changing the ORG statement.

I hope this will help your operating; your comments would be appreciated. Special thanks go to my father, Jim Bowman, and to Bert Anderson VE4AP. Without their help, this article would not have been possible. ■

HAM HELP

I need an audio frequency counter which will work with a Swan 350. I am blind and need some way of determining the exact frequency I am working.

Norm Fettig K9GIR
309 E. Yorkshire Dr.
Stockton CA 95207

I need information on the US Navy's WWII MBM transceiver. I am also looking for technical information and parts for the General Dynamics AM/PRC-70 (XE 2) or a similar model.

Tony Grogan WA4MRR
5 Rollingwood Dr.
Taylors SC 29687

I am looking for schematics and technical manuals for the Exam-eter solar capacitor checker, model CF, type 1.60; Graetz 2000 long-wave, medium-wave and broadcast radio, nr. 87(267)x53, series 171/7, 586828; US Navy model RBB-1 CRV46147 receiver; Hanimex model TDP 850 calculator; and Collins ART-13 transmitter.

Roger Moe N7KGG
Route 1, Box 1140
Wapato WA 98951

I would like to start an Alcoholics Anonymous net. Any recovering alcoholics or others interested in such a net, please contact me.

Raymond W. Guenther N2CWB
20-47 33rd St.
New York NY 11105

I am still looking for a manual for the Globe Scout 680-A. I will pay for all costs.

Dennis Comell WD4HRO
7835 Captain St.
Millington TN 38053

✓See List of Advertisers on page 114

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

MORRIS PLAINS NJ
MAR 4

The Split Rock Amateur Radio Association will hold its sixth annual electronics auction on Friday, March 4, 1983, at VFW Post #3401, State Route 53, Morris Plains NJ. The Morris Plains VFW hall is located a short distance from US 202 and NJ 10 and is easily reached via I-80, I-287, and US 46. Admission is $1.00. Doors will open at 7:00 pm for unloading and inspecting equipment and the auction will commence at 8:00 pm sharp. Items to be sold must be working equipment and loose parts must be bagged in the largest quantity possible. A commission of 10% will be taken on the first $50.00 of each sale. Commissions are payable in cash only. Refreshments will be available. Talk-in on 146.385/146.985 (WR2ADB) and 146.52. For more information, please write to SARA, PO Box 3, Whippany NJ 07981.

OLD BRIDGE NJ
MAR 6

The Old Bridge Radio Association will holds its third annual auction on March 6, 1983, at the K of C Hall, Pine Street (just off Route 18), Old Bridge NJ. Doors will open for registration and inspection at 9:00 am and the sale will begin at 10:00 am. Admission is $2.50. On successful sales, there will be a club commission of 10% on the first $100 and 5% on the remainder. Food and drink will be available. Talk-in on .72/.12, .34/.94, and .52. For more information, contact Fred Goldberg WA2BJZ, 29 Clearview Road, East Brunswick NJ 08816, or phone (201)-257-8753.

SOUTH ST. LOUIS MO
MAR 11

The Jefferson Barracks Amateur Radio Club will hold its annual auction and hamfest on March 11, 1983, at the Carondelet Sunday Morning Athletic Club in South St. Louis MO.

EGG HARBOR CITY NJ
MAR 12

The Shore Points Amateur Radio Club will hold Springfest '83 on Saturday, March 12, 1983, from 9:00 am to 3:00 pm, at the Atlantic County 4-H Center, Route 50, Egg Harbor City NJ (near Atlantic City). Admission is $3.00 at the gate and $2.50 in advance; XYLs and children will be admitted free. Sellers' space is $5.00 and sellers must bring their own tables. There will be a large, heated building with commercial power, as well as outside covered tailgating spaces. Refreshments will be available. Talk-in on 146.985 and .52. For more information and reservations, write SPARC, PO Box 142, Absecon NJ 08201.

LAFAYETTE LA
MAR 12-13

The Acadiana Amateur Radio Association will sponsor the ARRL-approved 23rd annual Lafayette Amateur Radio Hamfest on Saturday and Sunday, March 12-13, 1983, at the Carencro High School, Highway 182 North, 2½ miles north of I-10, Lafayette LA.

FORT WALTON BEACH FL
MAR 12-13

The Playground Amateur Radio Club will hold its 13th annual North Florida Swapfest on Saturday, March 12, 1983, from 8:00 am to 4:00 pm, and on Sunday, March 13, 1983, from 8:00 am to 3:00 pm, at the Okaloosa County Fairgrounds, Fort Walton Beach FL.

MARTINSVILLE IN
MAR 13

The Morgan County Amateur Radio Club will sponsor the Martinsville Hamfest on March 13, 1983, beginning at 8:00 am, at the Morgan County 4-H Building and Fairgrounds. Admission is $3.00 in advance and $4.00 at the door; children 11 and under will be admitted free. Flea-market space with a table is $5.00 and flea-market space without a table is $3.00. Premium tables are $20.00. Tables will be available on a first-come basis and the best spaces will be assigned first. Vendor setups will start at 5:00 am and parking will be free. Talk-in on 147.66/.06. For tickets, table reservations, and information, send an SASE to Aileen Scales KA9MBK, 3142 Market Place, Bloomington IN 47401.

TRENTON NJ
MAR 13

The Delaware Valley Radio Association will hold its 11th annual flea market on Sunday, March 13, 1983, from 8:00 am to 4:00 pm, at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, Lawrence Township. Registration is $2.50 in advance and $3.00 at the door. There will be an indoor and outdoor flea-market area and refreshments, including breakfast at 7:00 am. Sellers must bring their own tables. Talk-in on 146.52 and 146.07/.67. For further information, send an SASE to DVRA, PO Box 7024, West Trenton NJ 08628.

WINCHESTER IN
MAR 13

The Randolph Amateur Radio Association will hold its 4th hamfest on Sunday, March 13, 1983, from 8:00 am to 5:00 pm, in the National Guard Armory, Winchester IN. Ticket donation is $3.00 and children under 12 years old will be admitted free. Table space (by reservation only) is $5.00 with a table and $2.50 without. There will be a flea market, dealers, programs, food, and drink. Setups will be on Saturday from 6:00 pm to 8:00 pm and on Sunday from 6:00 am to 8:00 am. Talk-in on 147.90/.30, 224.90/223.30, and 146.50. For reservations and more information, contact RARA, Box 203, Winchester IN 47394, or phone Jake Life W9VJX at (317)-584-9361.

ERIE PA
MAR 19

The Radio Association of Erie PA will hold The RAE Eyeball QSO Party on Saturday, March 19, 1983, at the Perry Highway Hall, 8/10 of a mile south of I-90 on the west side of Route 19. Admission is $2.00 per person. Tables (8-foot) are $3.00 each and are by reservation only. Food will be available. There will be FCC testing for applicants that mail Form 610 to the Buffalo office by February 22nd. Talk-in on .01/.61 and .22/.82.

MARSHALL MI
MAR 19

The Southern Michigan ARS and the Calhoun County Repeater Association will hold the 21st annual Michigan Crossroads Hamfest on March 19, 1983, beginning at 8:00 am, at the Marshall High School, Marshall MI. Tickets are $2.00 at the door and $1.50 in advance. Table space is $.50 a foot. Doors will be open at 7:00 am for exhibitors and there will be plenty of carry-in help and free parking. Food service will be available in the cafeteria. For tables or tickets, contact SMARS, PO Box 934, Battle Creek MI 49016, or phone Chuck Williams at (616)-964-3197.

SAN FRANCISCO CA
MAR 19

The ARRL will sponsor the second Amateur Radio Computer Networking Conference on March 19, 1983, in San Francisco CA. The conference will be in cooperation with the 8th West Coast Computer Faire being held March 18-20, 1983. This event will be hosted by the Amateur Radio Research and Development Corporation (AMRAD) and the Pacific Packet Radio Society (PPRS). For more information, contact Paul L. Rinaldo W4RI, 1524 Springvale Avenue, McLean VA 22101, or phone (703)-734-0878.

UPPER SADDLE RIVER NJ
MAR 19

The Chestnut Ridge Radio Club will hold a ham radio flea market on Saturday, March 19, 1983, in the Education Building, Saddle River Reformed Church, East Saddle River Road at Weiss Road, Upper Saddle River NJ. Admission is free. Tables are $10.00 for the first and $5.00 for each additional one. Tailgating is $5.00. Food and soda will be available. For further information, phone Jack Meagher W2EHD at (201)-768-8360 or Roger Soderman KW2U at (201)-666-2430.

MIDLAND TX
MAR 19-20

The Midland Amateur Radio Club will hold its annual St. Patrick's Swapfest on March 19-20, 1983, from 8:00 am to 6:00 pm on Saturday and from 8:00 am to 3:00 pm on Sunday, at the Midland County Exhibit Building, east of Midland on Highway 80 on the north side. Pre-registration is $5.00 (at the door, $6.00). Tables are $4.00 each. Refreshments will be available. Talk-in on .16/.76 and .01/.61. For further information and reservations, please contact Midland Amateur Radio Club, PO Box 4401, Midland TX 79704.

JEFFERSON WI
MAR 20

The Tri-County Amateur Radio Club will hold its annual hamfest on March 20, 1983, from 8:00 am to 3:00 pm at the Jefferson County Fairgrounds, Jefferson WI. Tickets are $2.50 in advance and $3.00 at the door. Tables are $2.50 in advance and $3.50 at the door. Parking is free and there will be plenty of food available. Talk-in on 146.52, 146.22/.82, and 144.89/145.49. For more information, advance tickets, and tables, send an SASE to Horace Hilker K9LJM, PO Box 204, 261 E. High Street, Milton WI 53563.

MAUMEE OH
MAR 20

The Toledo Mobile Radio Association, Inc., will hold its 28th annual auction and hamfest on Sunday, March 20, 1983, from 8:00 am to 5:00 pm, at the Lucas County Recreation Center, Key Street, Maumee OH. Tickets are $2.50 in advance and $3.00 at the door. The auction is free and starts at 10:00 am. Ample free parking will be available all day and overnight. Flea-market tables will be available and displays will be limited to electronics and ham gear only. There will also be commercial exhibits, special programs for the ladies, and refreshments. Talk-in on 146.01/.61, .19/.79, .34/.94, 147.87/.27, .975/.375, and 146.52/.52. For more information, send an SASE to J. Honisko KB8YD, 1733 Parkway Drive N., Maumee OH 43537.

MAUMEE OH
MAR 20

The annual meeting of the American Signaling Society is scheduled for March 20, 1983. The meeting will begin promptly at 0100 hours UTC. Members and guests will convene in the Main Exhibit Hall of the Lucas County Recreation Center, 2901 Key Street, Maumee OH. In addition to the election of officers, the ever-popular forum on the latest signaling techniques will be offered. A Century Club confab will also be held. For additional information, please send an SASE to The American Signaling Society, 4015 Windermere Road, Columbus OH 43220.

CIRCLEVILLE OH
MAR 20

The Teays Amateur Radio Club will hold its sixth annual King of the Pumpkin Hamfest on Sunday, March 20, 1983, from 8:00 am to 4:00 pm, at the Pickaway County Fairgrounds Coliseum. Tickets are $2.00 in advance and $3.00 at the door. Tables (8-foot) are $4.00 in advance and $5.00 at the door. Doors will be open for setups on Saturday at 4:00 pm and overnight security will be provided. A large parking area and food will be available. Talk-in on 147.78/.18 and .52/.52. For additional information, please send an SASE to Dan Grant W8UCF, 22150 Hulse Road, Circleville OH 43113, or phone (614)-474-6305.

STERLING IL
MAR 20

The Sterling/Rock Falls Amateur Radio Society will hold its 23rd annual hamfest on March 20, 1983, beginning at 7:30 am, at the Sterling High School Field House, 1608 4th Avenue, Sterling IL. Tickets are $2.00 in advance and $2.50 at the door. Commercial tables and flea-market tables requiring electricity are $5.00; all others are $3.00. A concession stand, free parking, and overnight space for self-contained campers will be available. There will be commercial distributors, dealers, and a large flea market. Talk-in on 146.25/.85 (W9MEP). For advance tickets, tables, and information, contact Sue Peters, 511 8th Avenue, Sterling IL 61081, or call (815)-625-9262.

BLACKSBURG VA
MAR 21-24

The Virginia Polytechnic Institute and State University will hold a Personal Microcomputer Interfacing and Scientific Instrumentation Automation Workshop on March 21-24, 1983, on the Virginia Tech campus in Blacksburg VA. The workshop, directed by Drs. Paul Field, Chris Titus, Jon Titus, and Mr. David Larsen, is hands-on, with the participant designing and testing concepts with actual hardware.

The charge is $595.00. For more information, write Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061, or call (703)-961-4848.

CANTON OH
MAR 26

The Canton Amateur Radio Club will hold an auction on March 26, 1983, beginning at 5:00 pm, at the Nimishillen Grange, Easton Street NE, Canton OH. Admission is $2.00; flea-market table space is $2.00. Free parking will be available. Talk-in on 147.12/.72. For general information, phone Herb Bushong WD8IPE at (216)-488-2920.

JOHNSTOWN PA
MAR 27

The Conemaugh Valley Amateur Radio Club will hold its sixth annual hamfest on Sunday, March 27, 1983, from 8:00 am to 4:00 pm, at the East Taylor Fire Hall, which is located on Route 271, 5 miles south of Route 22 (4 miles north of Johnstown). There will be plenty of food and refreshments available. Talk-in on 146.34/.94.

GRAYSLAKE IL
MAR 27

The Libertyville and Mundelein Amateur Radio Society will hold LAMARSFEST 1983 on Sunday, March 27, 1983, beginning at 8:00 am, at the Lake County Fairgrounds, Routes 45 and 120, Grayslake IL. Tickets are $2.00 in advance or $3.00 at the door. Tables (9-foot) are $5.00 each. Reservations are encouraged because choice locations will be assigned first. Commercial setups will begin at 6:30 am and other setups will begin at 7:00 am. There will be free parking, and breakfast and lunch will be available. Talk-in on 147.63/.03 and 146.94. For tickets, table reservations, or exhibitor information, send an SASE to LAMARS, PO Box 751, Libertyville IL 60048.

MADISON OH
MAR 27

The Lake County Amateur Radio Association will hold their fifth annual Lake County Hamfest and Computer Fest on Sunday, March 27, 1983, from 8:00 am to 4:00 pm, at Madison High School, Madison OH (40 miles east of Cleveland). Admission is $2.50 in advance and $3.50 at the door. Table and display space (all indoors) is $5.00 for a 6-foot table and $6.50 for an 8-foot table. There will be plenty of free parking. Doors will open for exhibitors at 5:30 am. Talk-in on 147.81/.21. For reservations and more information, send an SASE to Lake County Hamfest Committee, 37778 Lake Shore Boulevard, Eastlake OH 44094, or phone (216)-953-9784.

BALTIMORE MD
MAR 27

The Baltimore Amateur Radio Club, Inc. (BARC), will hold the 1983 Greater Baltimore Hamboree and Computerfest on March 27, 1983, beginning at 8:00 am, at the Maryland State Fairgrounds Exhibition Complex (located east of I-83 exit 17, three miles north of I-695, north of Baltimore), Timonium MD. Admission is $3.00; children under 12 will be admitted free. Overnight accommodations are available in the immediate area. Amateur-radio, personal-computer, and small-business-computer dealers will be present. There will be an indoor flea market, a large hard-surfaced outdoor tailgate area, food service, free parking, and guest speakers throughout the day. For additional information and table reservations, contact GBH&C, PO Box 95, Timonium MD 21093-0095, or phone (301)-561-1282. For a recorded announcement, dial (301)-HAM-TALK.

SOMERSWORTH NH
APR 9

The Great Bay Radio Association will hold its 3rd annual hamfest-flea market on Saturday, April 9, 1983, from 9:00 am to 3:00 pm, at the Somersworth Armory, Somersworth NH. The entrance fee is $1.00 per person. Food, refreshments, and free parking will be available. For advance registrations and further information, write Great Bay Radio Associations, PO Box 911, Dover NH 03820.

MADISON WI
APR 10

The Madison Area Repeater Association, Inc. (MARA), will hold its eleventh annual Madison Swapfest on Sunday, April 10, 1983, at the Dane County Exposition Center Forum Building, Madison WI. Doors will open at 8:00 am for commercial exhibitors and flea-market sellers, and at 9:00 am for the general public. Admission is $2.50 per person in advance and $3.00 at the door. Children twelve and under will be admitted free. Flea-market tables are $4.00 each in advance and $5.00 at the door. Features will include commercial exhibitors, a flea market, an all-you-can-eat pancake breakfast, and a barbecue lunch. Plenty of parking space and nearby hotel accommodations are available. Talk-in on 146.16/.76 (WR9ABT). For reservations (early ones are advised) or more information, write to MARA, PO Box 3403, Madison WI 53704.

FRAMINGHAM MA
APR 10

The Framingham Amateur Radio Association, Inc., will hold its 8th annual spring flea market on Sunday, April 10, 1983, at the Framingham Civic League Building, 214 Concord Street (Route 126), downtown Framingham MA. Admission is $2.00 and doors will be open at 10:00 am. Tables are $10.00 (pre-registration required) and sellers may set up beginning at 8:30 am. Radio equipment, computer gear, and food will be available. Talk-in on .75/.15 and .52. For more information, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701.

SOUTH SIOUX CITY NE
APR 15-17

The 39 Hundred Club will hold the 1983 Midwest ARRL Convention on Friday, Saturday, and Sunday, April 15-17, 1983, at the Marina Inn, South Sioux City NE, directly across the river from Sioux City. On Saturday, features will include a QCWA breakfast, a 3900 Club luncheon, an all-day ladies' program, and an evening banquet with entertainment. There will be seminars, displays, commercial exhibits, and a 66-table flea market, all indoors in the same building. Tables (8 ft. x 30 in.) are $5.00 for the 3 days, $4.00 for Friday night and Saturday. For table reservations, contact Al Smith W0PEX, 3529 Douglas Street, Sioux City IA 51104. Exhibitors should contact Jim Boise KA0GZY, 22 LaSalle Street, Sioux City IA 51104. Setup time is Friday afternoon, April 15th. Convention fees are $6.00 for the 3 days; advance banquet reservations are $10.00 (at the door, $12.00). For advance banquet tickets and motel reservations, write to Jerry Smith W0DUN, Akron IA 51001. For general information, contact Dick Pitner W0FZO, General Chairman, 2931 Pierce Street, Sioux City IA 51104.

DAYTON OH
APR 23

The Washington University Amateur Radio Club will hold a reunion dinner on Saturday, April 23, 1983, at the Dayton Hamfest. All past members of the club are invited. For more information, contact Washington University ARC W0QEV, Box 1128, St. Louis MO 63130.

PARAMUS NJ
MAY 1

The Bergen ARA will hold a Ham Swap 'n' Sell on May 1, 1983, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. Admission for sellers is $3.00; buyers will be admitted free. There will be thousands of spaces but tailgating only. Sellers must bring their own tables. Talk-in on .79/.19 and .52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

DULUTH MN
MAY 7

The Arrowhead Radio Amateur Club will hold its annual swapfest on Saturday, May 7, 1983, from 10:00 am to 3:00 pm, at the Holiday Inn, 207 West Superior Street, downtown Duluth MN. Admission will be $2.50 in advance or $3.00 at the door. Tables (4-foot) are $3.50 in advance or $4.00 at the door. There will be plenty of food, free parking in the ramp, and an enclosed shopping mall for the XYLs. Talk-in on .34/.94. For advanced reservations, room discount rates, or more information, send an SASE to Jerry Frederick N0BNG, 1127 104th Avenue West, Duluth MN 55808.

CEDARBURG WI
MAY 7

The Ozaukee Radio Club will sponsor its 5th annual swapfest on Saturday, May 7, 1983, from 8:00 am to 1:00 pm, at the Circle B Recreation Center, Highway 60, Cedarburg WI (located 20 miles north of Milwaukee). Admission is $2.00 in advance and $3.00 at the door. All 8-foot tables are $3.00. Sellers will be admitted at 7:00 am for table setups. Food and refreshments will be available. For tickets, tables, maps, or more information, send an SASE to 1983 Ozaukee Radio Club Swapfest, PO Box 13, Port Washington WI 53074.

ROCHESTER NY
MAY 20-21

The Rochester Hamfest, in conjunction with the ARRL New York State and Atlantic Division Conventions, will be held on May 20-21, 1983, at the Marriott Thruway Hotel and the Monroe County Fairgrounds. Tickets are $4.00 in advance and $5.00 at the gate. Flea-market tickets are $2.00 per space. The banquet will be held at 6:30 pm on Friday and be followed by the annual Funfest at 8:00 pm. The flea market will open at 6:00 am on Saturday; the commercial exhibits, at 8:30 am. The hamfest will close at 6:00 pm. There will be FCC exams given at the Rochester Hamfest for those who have sent Form 610 to FCC, 1307 Federal Building, 111 W. Huron Street, Buffalo NY 14202, by May 1st. A ladies' program will be available. Talk-in on 146.28/.88 and 144.51/145.11. For advance tickets, contact K2MP, 737 Latta Road, Rochester NY 14612. For more information, write Rochester Hamfest, 300 White Spruce Boulevard, Rochester NY 14623.

MUNCIE IN
MAY 22

The fourth annual MAARC Hamfest will be held on Sunday, May 22, 1983, in the Memorial Building located on the grounds of the Delaware County Fairgrounds. Advance admission tickets are $2.00 and tables are $5.00 each. Two new features are computer displays and the first annual Middletown USA QSO Party which will be run during this weekend. The MAARC club station will be in operation from the hamfest site. Electrical hookups and security will be provided during the entire show in a clean and fully enclosed building. For additional information, write Walt Robbins, Jr. WA9ZES, Publicity Chairman, RR 2, Box 340E, Muncie IN 47302.

CUMBERLAND ME
JUL 30

The Blackstrap Repeater Association will hold the second annual Greater New England Hamfest on Saturday, July 30, 1983, from 8:00 am to 5:00 pm, at Cumberland Fairgrounds, Cumberland ME. Tickets are $1.00 in advance and $2.00 at the gate. There will be forums, exhibits, meetings, speakers, dealers, and a giant flea market. Food and free camping will be available. Talk-in on 147.69/.09, 146.52, 3.940, and 146.13/.73. For more information, call Ed Williams KA1FZD at (207)-846-3509.

TRUMANSBURG NY
AUG 27

The annual Finger Lakes Hamfest will be held on August 27, 1983, from 8:00 am to 5:00 pm, at the Trumansburg Fairgrounds, Rt. 96, 12 miles NW of Ithaca NY. Admission is $2.00 at the gate. There will be a flea market, commercial exhibitors, a boat anchor auction, refreshments, and a craft show for the ladies. Talk-in on .37/.97 and .52. For further details, write Dave W2CFP, 866 Ridge Road, Lansing NY 14882.

HAM HELP

I have the following equipment available for cost of postage or free pickup; the Heathkit GR-88, which shorts the ac power supply, and the Heathkit GR-98, which drifts slightly.

Steve Clifton WA2TYF
800 W. End Ave.
New York NY 10025

I need frequency-determining networks with 2125-Hz and 2295-Hz center frequencies for use with a Northern Radio Company dual-frequency-shift tone converter, type 152, model 2.

Bob Workman WA4ZZN
PO Box 942
Atlantic Beach NC 28512

I would like to find a Knight KG687 sweep generator and the schematics for a Sony MX-12 microphone mixer and the Scott 299-T audio amplifier.

Dave Overton
1709 W. 30
Austin TX 78703

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

QCWA QSO PARTY—PHONE

Starts: 0001 GMT March 12
Ends: 2000 GMT March 13

This is the second part of the 26th annual QCWA QSO party. You can work the same station more than once providing it is on another band. Only the bands listed under frequencies will count in this QSO party.

EXCHANGE:

QSO number, operator's first name, QCWA chapter identification (official number or name), and state or country. Members not affiliated with a chapter should use "AL."

FREQUENCIES:

Any authorized amateur frequency in the bands that are listed below is permissible. The following suggested frequencies have been selected to minimize interference to others; however, please feel free to wander up or down from these if you so desire: 3900-3930, 7230-7260, 14280-14310, 21350-21380, 28600-28630. These frequencies are selected as a starting place. When pileups occur, don't be afraid to go either side of these frequencies.

SCORING:

Each contact made with another QCWA member will count as a single point. This year's contest has three multipliers: chapters, states, and countries. For each band, every new chapter is a multiplier of one, every new state (USA) is a multiplier of one, and every new country (ARRL DXCC list) is a multiplier of two. At the end of the party, add up your total contacts for all bands and multiply it by the sum of all your multipliers for all bands. This will give you your total and final score.

ENTRIES:

Please keep separate logs for each band. Logs should include the following information: time (GMT), call, QSO numbers, name, chapter number or name, and state or country. It is the responsibility of each contestant to provide a legible log, no carbon copies, and to list all claimed contacts. The total contacts and multipliers for each page should be recorded at the bottom of each page. The total contacts for the party will not be returned. Make sure you have correct postage when you mail your logs. Send logs no later than March 31st to: Spaceport Center #66, Donald McClenon N4IN, 3075 Florida Avenue, Melbourne FL 32901. Separate logs and scores must be submitted for both the CW and phone parties.

YL ISSB QSO PARTY—CW

Starts: 0001 GMT March 12
Ends: 2359 GMT March 13

Two six-hour rest periods are required. Operating categories include: single operator, DX/WK partners, and YL/OM teams. All bands will be used and the same station may be contacted on different bands for contact points but not as country multipliers. VHF and UHF may be used but all contacts must be direct and not through repeaters. Nets are not allowed!

EXCHANGE:

Name, RST, SSB number, country, W/K state or VE province, and DX/WK partner's call. If no partner, leave blank. If nonmember, send "no number."

FREQUENCIES:

On HF, use the USA General-class band portions. Check 80 and 40 meters on the hour.

SCORING:

Score 3 points for each member contacted on own continent, 6 points if different continent. Nonmember contacts count *one* point. Only member station contacts count for multipliers. Multipliers are each state, country, and VE province; also, each team contacted but only once for each team. When DX/WK partners contact each other, it counts as a double multiplier. If your total dc input power is 250 Watts or less during the entire QSO party, then count an additional power multiplier of two. Final score is sum of QSO points times the total multiplier.

AWARDS:

Special certificates will be awarded to the winners of each category. Regular certificates for country, US state, and Canadian province winners.

ENTRIES:

Logs must show date/time (GMT); station contacted; RST; mode; band; SSB number; US state, VE province, or country; and period of rest time. Summary sheets show states, Canadian provinces, countries, YL/OM teams, and DX/WK teams and partner contacts. Send logs and summary sheets to: Rick & Minnie Connolly (K0RDJ & KA0ALX), Star Rt. 1, Crocker MO 65452 prior to June 1st. Be sure to indicate who your DX/WK partner is!

WORKED ALL MORTON CONTEST

0001 GMT March 12 to 2400 GMT March 13

Morton stations will be working all bands, phone and CW, about 5 kHz apart up from the bottom edge of the General portion of each band. Contest exchange consists of RS(T) and state, province, or country. Certificates will be issued to those hams who have QSOs with five or more members of the Morton Amateur Radio Club or residents of Morton, Illinois during the contest period. To receive the award, applicants should send log information listing at least five Morton contacts along with a large SASE to: WD9AEU, 701 Columbus Ave., Morton IL 61550.

IDAHO QSO PARTY

Starts: 0000 GMT March 12
Ends: 2359 GMT March 14

Sponsored by the Kootenai Amateur Radio Society of northern Idaho.

EXCHANGE:

RS(T) and Idaho county, state, province, or country.

FREQUENCIES:

SSB—3920, 7260, 14250, 14325, 21325, 21380, 28550.

CW—50 kHz up from the lower band edge.

Novices—25 kHz up from their lower band. No net frequencies, please!

SCORING:

Idaho stations score 1 point for each QSO and multiply by the number of Idaho counties, states, VE provinces, and countries worked. Others score 1 point per Idaho QSO and multiply by the total number of Idaho counties worked.

AWARDS:

Awards will be issued to the top scorer in each Idaho county, state, VE province, and country.

ENTRIES:

Mailing deadline for all entries in the USA is April 16th, May 1st for all DX coun-

CALENDAR

Mar 5-6	ARRL International DX Contest—Phone
Mar 12-13	YL ISSB QSO Party—CW
Mar 12-13	QCWA QSO Party—SSB
Mar 12-13	Morton Contest
Mar 12-14	Idaho QSO Party
Mar 12-14	Virginia QSO Party
Mar 13	Wisconsin QSO Party
Mar 19-20	Bermuda Amateur Radio Contest
Mar 19-20	Tennessee QSO Party
Mar 19-21	BARTG Spring RTTY Contest
Apr 9-10	CARF Commonwealth Phone Contest
Apr 9-10	ARRL QSO Party—CW
Apr 16	Holiday in Dixie QSO Party
Apr 16-17	ARRL QSO Party—Phone
Jun 11-12	ARRL VHF QSO Party
Jun 25-26	ARRL Field Day
Jul 9-10	IARU Radiosport Championship
Jul 15-17	*A5 Magazine* SSTV DX Contest
Aug 6-7	ARRL UHF Contest
Aug 19-21	*A5 Magazine* UHF FSTV DX Contest
Sep 10-11	ARRL VHF QSO Party
Oct 8-9	ARRL QSO Party—CW
Oct 9-10	ARRL QSO Party—Phone
Oct 15-16	ARRL Simulated Emergency Test
Nov 5-6	ARRL Sweepstakes—CW
Nov 19-20	ARRL Sweepstakes—Phone
Dec 3-4	ARRL 160-Meter Contest
Dec 10-11	ARRL 10-Meter Contest

NEWSLETTER OF THE MONTH

Galena crystals, horn speakers, and 4-pillar tubes are all subjects you would not expect to find in a modern amateur publication—unless it happened to be the *Old Timer's Bulletin*, this month's winner in *73*'s newsletter contest.

The *Bulletin* is published by the Antique Wireless Association, which is devoted to the research and documentation of the early history of wireless communications.

What differentiates this bulletin from many others is the relatively little space devoted to organizational news; instead, the *Bulletin* contains a variety of construction articles, historical shorts, and sage antique-radio restoration advice.

The December, 1982, issue included construction plans for a 1928-vintage transmitter using two UX-210 tubes and the design parameters for Atwater Kent horn speakers. Another article, "Arthur Wehnelt and His Wonderful Cathode," looked at the contributions of this little known physicist, while contributor Alan Douglas pulled Raytheon's 4-pillar tubes out of the cobwebs.

Special sections include columns for antique-radio collectors, a section on home-brewing parts, and tips on restoring old radios.

The *Bulletin* is spiced with reprints of news articles and cartoons from early in the century, and the artwork throughout meshes with the publication's focus on that era. Reading it, you could almost imagine that you were back in the days of the spark gap.

The *Bulletin* is typeset and printed, with good-quality black and white photographs throughout. Even those who do not remember the days when the tube was king can enjoy reading about the early progress of electronics and probably learn a thing or two in the process.

Congratulations to the Antique Wireless Association for making the good old days alive and interesting.

If your club would like to enter *73*'s newsletter contest, send a copy to: Editorial Offices, *73*, Peterborough NH 03458.

tries and Canada. Send entries to: Vladimir J. Kalina KN7K, South 1555 Signal Point Road, Post Falls ID 83854.

VIRGINIA QSO PARTY

Starts: 1800 GMT March 12
Ends: 0200 GMT March 14

The 1983 QSO party is again sponsored by the Sterling Park Amateur Radio Club of Sterling Park, Virginia. The same station may be worked on each band and each mode. Virginia stations may contact in-state stations for QSO and multiplier credit. Virginia mobile stations may be worked in each new county they operate from for new QSO and multiplier credit regardless of whether or not previously worked on the same band and mode in another county. QRP stations must run 5 Watts or less for their entire operating time.

EXCHANGE:

QSO number starting with 001 and QTH consisting of state, province, DX country, or Virginia county. Virginia stations note that the reference for valid counties is *CQ*'s *Counties Award Record Book* which lists a total of 95 countries.

FREQUENCIES:

Phone—3930, 7230, 14285, 21375, 28575, and anywhere on 160-meter band except in DX windows for US stations.

CW—60 kHz up from the low end of each HF band except anywhere in 10- and 160-meter bands or Novice subbands.

SCORING:

Count one point per QSO. Virginia stations multiply total QSOs by the sum of states, Canadian provinces, DX countries, and Virginia counties worked. Others multiply QSOs by the number of Virginia counties worked.

AWARDS:

Engraved plaques to the top scoring stations in the following categories: high Virginia single operator (fixed location), sponsored by K3RZR and KA3DTE; high Virginia mobile station donated by Electronic Equipment Bank of Vienna, Virginia; high out-of-state (including DX) station; high QRP station (if 5 or more QRP entries are received) donated by K7HMP.

ENTRIES:

Follow ARRL standard contest guidelines for logs. Indicate each new multiplier as worked. Send a summary sheet, with your log and an SASE for a copy of the results, to: Virginia QSO Party, c/o Barry Pybas KW4I, 313 W. Derby Avenue, Sterling Park VA 22170. Mailing deadline is April 15th.

WISCONSIN QSO PARTY

1700 TO 2400 GMT March 13

Use both CW and phone, stations may be worked once per mode on each band. Mobiles may be worked again when changing counties. No repeater QSOs!

EXCHANGE:

RS(T) and state, province, or Wisconsin county.

FREQUENCIES:

Phone—3990, 7290, 14290.
CW—3560, 7050, 14060.

SCORING:

Phone contacts count 1 QSO point while CW contacts count 2 QSO points. Wisconsin stations multiply QSO points by total number of states, provinces, and Wisconsin counties. DX countries count for QSO points but not multipliers. Non-Wisconsin stations multiply QSO points by number of Wisconsin counties (72 max). As a bonus, Wisconsin mobiles add 500 bonus points for each county that you operate from outside your home county with a minimum of 15 QSOs per county to qualify.

AWARDS:

Awards will be presented to the highest scores in each state and province, as well as to the highest aggregate club score.

ENTRIES:

All entries must contain a log consisting of: time in GMT, call, RS(T), state, Wisconsin county, mode, and a score summary. Logs containing more than 100 QSOs must be accompanied by a dupe sheet. Entries must be postmarked by April 15th and sent to: Wisconsin QSO Party, c/o West Allis Radio Amateur Club, PO Box 1072, Milwaukee WI 53201.

BERMUDA AMATEUR RADIO CONTEST

Starts: 0001 GMT March 19
Ends: 2400 GMT March 20

The Bermuda Amateur Radio Contest, in its 25th year, is again sponsored by the Radio Society of Bermuda. The contest is open to all licensed amateurs in Canada, the USA, the United Kingdom, and the Federal Republic of Germany. Of the 48-hour contest period, your total operating time cannot exceed 36 hours with off periods clearly logged. Each off period must not be less than three consecutive hours. All stations must be single operator only and must be operating from their own private residence or property. Use all bands, 80 through 10 meters. No crossband or crossmode contacts are permitted. Additionally, no phone contacts are allowed between W and G or West Germany on 40 meters.

EXCHANGE:

All stations will send RS(T) reports and give the following: Canadians add province, UK stations add county, US stations add state, West German stations add DOK number, and Bermuda stations add parish. US and Canadian stations may exchange reports with West German, UK, and Bermuda stations only. UK and West German stations may exchange reports with US, Canadian, and Bermuda stations only.

SCORING:

Each completed contact, on each band, counts 5 points. Only one contact per station on each band regardless of mode. For all stations outside Bermuda, the multiplier is the total number of VP9s worked on each band. For Bermuda stations, the multiplier is the total number of states, provinces, counties, and DOK numbers for West Germany worked on each band.

AWARDS:

Printed awards to the top scorer in each state, province, county, and DOK area in West Germany. The top scorer in Canada, US, UK, and West Germany shall receive a trophy to be awarded at the Society's annual dinner held in October of each year. Round trip air transportation plus accommodation will be provided to overseas winners to enable them to receive their awards. Top winners for the 1979 through 1982 contests shall be eligible for the area awards only.

RESULTS

1982 WASHINGTON STATE QSO PARTY CERTIFICATE WINNERS

Callsign	QSOs	Multipliers	Total
Alaska			
NL7D	28	16	896
Arizona			
W7ZMD	104	32	9,216
W7RIR	63	29	4,785
Arkansas			
WB5RYB	44	20	2,180
California			
N6QA	64	29	5,568
W6OUL	45	19	2,242
Colorado			
WA4EFE	55	24	3,936
Connecticut			
KA1ICX	28	14	1,176
Florida			
WA4FNA	49	16	2,352
Georgia			
N4NX	66	27	4,401
KE4XW	61	21	2,772
Idaho			
KU7Z	3	3	18
Illinois			
N9AUZ	59	25	4,050
K9HRC	37	20	2,220
W9QWM	28	16	1,200
Indiana			
KI9U	94	36	9,000
KK9G	46	21	2,415
WD8QBB	42	23	2,277
Kansas			
WDØCCW	96	34	6,528
KØFPC	37	23	2,438
Kentucky			
WA4EBN	50	26	3,900
Louisiana			
W5WG	101	33	9,174
Maine			
KA1HB	18	15	810
Maryland			
W3FG	40	18	2,106
Massachusetts			
W1AQE	26	17	1,326
KA1CLV	28	12	1,008
N. Michigan			
W8WVU	70	30	6,300
WB8WKQ	75	30	5,640
KS8Q	66	26	4,472
Minnesota			
WBØLNO	13	10	260
Missouri			
WA4PGM	19	13	494
Nebraska			
WØJJL	12	7	238
New Jersey			
W2CC	2	2	8
New Mexico			
K5QQ	11	8	184
New York			
W2WSS	25	15	1,125
N2DBD	25	12	900
North Carolina			
W4OMW	39	23	2,668
Oklahoma			
K5KW	40	20	2,380
Oregon			
WA7RQS	120	36	9,432
Pennsylvania			
WA3JXW	30	16	1,296
South Carolina			
KE4VP	3	3	18
South Dakota			
WAØBZD	4	4	36
Tennessee			
WD4SIG	17	13	663
Texas			
W5PWG	73	27	5,724
N5QQ	37	25	2,775
WA5DTK	44	20	2,300
Utah			
W7LN	13	9	351
K7SQD	13	8	312
Vermont			
WB2NDE + K2QE	61	27	4,428
Virginia			
W4KMS	27	16	1,168
Wisconsin			
WB9PYE	47	19	2,489
Canada			
British Columbia			
VE7FBS	27	13	702
Manitoba			
VE4RF	29	18	1,566
Ontario			
VE3KK	42	18	2,268
Prince Edward Island			
VE1ABU	6	4	72
Brazil			
ZY1NEZ	11	7	154
Japan			
JA2YKA (JE2SRB, JA9SSY, JR2GMC)	51	25	3,250
JA1WVK	19	8	440
New Zealand			
ZL2RY	29	13	1,131
Washington			
Adams county			
N7AYF/M	92	37	6,808
Asotin county			
KN7L	181	46	24,426
Benton county			
K7FR	250	46	23,000
Chelan county			
K7GAH	63	28	5,292
Clallam county			
WA7YMC	175	44	18,832
Clark county			
W7GHT/M	25	15	1,125
Columbia county			
N7AYF/M	93	34	6,324
Cowlitz county			
KA7JVW	185	43	15,910
Douglas county			
N7AYF/M	52	27	2,808

ENTRIES:

Logs must show all dates and times in GMT. A separate sheet must be used for each band. All contestants to compute their own scores and check for duplicate contacts. Dupe sheets must be submitted with logs to cover each band where more than 200 contacts are logged. For every duplicate contact for which points are claimed, a penalty of three contacts will be deducted by the contest committee. An excess of claimed duplicates may mean disqualification. No penalty will be exacted against duplicates for which no points are claimed. Each page must be clearly numbered and marked with contestant's call, year, and band to which it refers. All contestants must sign a statement that they have complied with the rules and terms of their license. All logs must be received by the Contest Committee, Radio Society of Bermuda, Box 275, Hamilton 5, Bermuda, not later than May 31st. Overseas contestants are recommended to forward their logs via airmail. All decisions of the contest committee are final.

Bermuda parish abbreviations are as follows: SAN—Sandys, PEM—Pembroke, SOU—Southampton, HAM—Hamilton, STG—St. George, DEV—Devonshire, WAR—Warwick, SMI—Smiths, PAG—Paget.

TENNESSEE QSO PARTY

2100 GMT March 19 to 0500 GMT March 20, 1400 to 2200 GMT March 20

This is the 13th annual QSO party sponsored by the Tennessee Council of Amateur Radio Clubs. You may work the same station on different bands, modes, or counties. Repeater contacts are not allowed. Mobiles compete against mobiles, portables against portables. Single-transmitter entries only. No county line operations allowed for multiple contacts. Portable stations must set up per field-day rules. No "list" operations are allowed. No CW contacts in phone bands.

EXCHANGE:

Signal report and state, province, country, or Tennessee county.

SCORING:

Score one point per phone QSO; 1.5 points per CW QSO. Combine phone and CW scores as one contest. Recognition will be given for phone or CW only scores. Tennessee stations multiply QSO points by sum of number of different states, Tennessee counties, and VE/VO provinces. All others multiply QSO points by the number of different Tennessee counties worked (95 max). For each portable or mobile station working outside their home Tennessee county, score 500 bonus points for each county outside of home county with a minimum of 10 QSOs.

FREQUENCIES:

Phone—1860, 3980, 7280, 14280, 21380, 28580.

Novice—3725, 7125, 21125, 28125.

CW—1815 and approximately 50 kHz up from bottom of each band. Note, you must log a minimum operating time of 10 minutes for each change of band or mode.

AWARDS:

Plaque to highest scoring Tennessee fixed, Tennessee mobile and portable, plus out-of-state fixed. First place certificates to highest scoring station in each state, Canada, DX country, Tennessee Novice/Technician, out-of-state Novice/Technician, Tennessee phone only, and Tennessee CW only. Participation certificates to every station sending in logs with at least 15 contacts.

ENTRIES:

Logs must show date/time in GMT, station worked, band, mode, exchange, and score. Submit a cross-check sheet similar to ARRL CD77 for each band and mode with 100 or more contacts. Logs must be legible to avoid disqualification. Logs must be postmarked by May 1st and sent to: Oak Ridge ARC, Attn: Contest Coordinator, PO Box 291, Oak Ridge TN 37830. Please include a business-size addressed envelope with your logs.

BARTG SPRING RTTY CONTEST

Starts: 0200 GMT March 19 Ends: 0200 GMT March 21

The total contest period is 48 hours, but not more than 30 hours of operation is permitted. Time spent listening counts as operating time. The 18 hours of nonoperating time can be taken at any time during the contest, but off periods may not be less than 3 hours at a time. Times on the air must be summarized on the summary sheet.

There are separate categories for single-operator, multi-operator, and shortwave-listener stations. Use all amateur bands from 80 through 10 meters. Stations may not be contacted more than once on any one band.

EXCHANGE:

The message exchange consists of: 1) Time in GMT; this must consist of a full four-figure group, and the use of the expression "same" or "same as yours" will not be acceptable. 2) RST and message number; the message must consist of a three-figure group starting with 001 for the first contact made.

SCORING:

All 2-way RTTY contacts with other stations within one's own country are two points; outside your country are ten points. All stations can claim a bonus of 200 points for each country worked, including their own. Note that any one country may be counted again if worked on a different band, but continents are counted only once. The ARRL country list is used and, in addition, each W/K, VE/VO, and VK call area will be counted as a separate country. Final score is (sum of QSO points times the total number of countries worked) added to (the number of countries times 200 bonus points each times the number of continents).

Note, proof of contact will be required in cases where the station worked does not appear in any other contest log received, or the station worked does not submit a check log.

AWARDS:

Certificates will be awarded to the leading stations in each of the three classes, the top station in each continent, and the top station in each W/K, VE/VO, and VK area.

If a contestant manages to contact 25 or more different countries on 2-way RTTY during the contest, a claim may be made for the Quarter Century Award (QCA) issued by BARTG and for which a charge of $3.00 (USA) or 15 IRCs is made. Make your claim at the same time you send in your log. Holders of existing QCA awards should indicate and list any new countries to be added to their existing records. Make your claims at the same time that you send in your log. However, due to the high volume of work, it will not be possible to prepare and dispatch any new awards or update any existing awards until the final results of the contest have been evaluated and published.

Additionally, if any contestant manages to contact stations on 2-way RTTY on each of the six continents and the BARTG contest manager has received either a contest or check log from each of the six stations concerned, a claim may be made for the WAC Award issued by the *American RTTY Journal*. The necessary information will be sent to the *Journal* who will issue the WAC Award free of charge.

ENTRIES:

Use a separate sheet for each band and indicate all times on the air. Logs should contain: date/time in GMT; callsign of station worked; RST and message number sent; time, RST, and number received; and points claimed. Logs received from shortwave listeners *must* contain the callsign of the station heard and the report sent by that station to the station he is working. Incomplete loggings are not eligible for scoring. The summary sheet should show the full scoring, the times *on* the air and in the case of multi-operator stations, the names and callsigns of all operators involved with the operation of the station. All logs must be received by May 31st in order to qualify. Summary and log sheets are available from the contest manager at the address shown below. The judges decision will be final and no correspondence can be entered into, in respect of incorrect or late entries, and all logs submitted will remain the property of the British Amateur Radio Teleprinter Group. Send entries to: Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX.

SPRING VHF/UHF QSO PARTY

Starts: 2100 GMT March 26 Ends: 0400 GMT March 27

Sponsored by the Ramapo Mountain Amateur Radio Club, this year's rules for this VHF/UHF contest are similar to last year's rules and current ARRL contest rules. Operating classes are defined as follows: single operator—one person performs all transmitting, receiving, spotting, and logging functions; multi-operator—those obtaining any form of assistance, such as the use of relief operators, loggers, or spotting nets.

EXCHANGE:

Each 2-way QSO must include an exchange of station callsign and section designator.

SCORING:

The grid-square and range scoring system has been retained, based on proven results obtained from the 1982 ARRL UHF contest. Each section is a geographical area one degree in longitude by one degree in latitude, identified by a 4- or 5-digit number indicating the next lowest degree of longitude and latitude. For example, RMARC club station WA2SNA, located in Oakland NJ at 74° 15′ west and 41° 03′ north, would use a section designator of 7441.

Each QSO has a point value based on the distance between stations as determined by the larger of the differences between the section designators' latitude or longitude plus 1, with a maximum of 10 QSO points. For example, WA2SNA in 7441 works W3XX in 7638. The difference between 74 and 76 is 2. The difference between 41 and 38 is 3. The larger difference is three; adding one to it results in 4 QSO points.

The section multiplier is the total number of different sections worked per band. The following band multipliers are used to determine the final score for each band: 50 MHz = ×2, 144 MHz = ×1, 220 MHz = ×8, 432 MHz = ×4, and 1296 MHz = ×16. The score per band is equal to the total of QSO point values per band times the section multiplier times the band multiplier. The total score is the sum of individual band scores.

ENTRIES:

Prepare a separate log sheet for each band. Heading information must include your station callsign, section designator, and class of entry. Each QSO entry must include the date and time in UTC, callsign, section designator, and QSO point value. Each band summary must include the total of QSO point values and the total of different sections worked.

One entry sheet should be prepared for each band. They should include the band, QSO point total, number of sections, band multiplier, and band score. Also include the total of all band scores, your station callsign, your section designator, ARRL section and division, and mailing address. It must also be signed by the licensee or trustee of the call used.

Until May 1, you may send an SASE to the Ramapo Mountain ARC, PO Box 364, Oakland NJ 07436, to receive logs and entry forms.

HAM HELP

I am looking for original copies of the TME 11-227 and TME 11-227A directories of WWII German and Japanese radio equipment. I also need intelligence equipment from pre- and post-WWII such as the SSTR-1 and the SSTR-5.

Tony Grogan WA4MRR/F0NZ
5 Rollingwood Dr.
Taylors NC 29687

I want to get in touch with people who are experienced in dealing with power companies and who know what can be considered normal or abnormal power line noise.

Gary Mitchell KH8AC
PO Box 184
Comwall Bridge CT 06754

Could someone please help me find a manual for the Telequipment model D-66 oscilloscope? It was made in England. I will gladly pay for the manual or for a good copy of it.

W. G. Driscoll KC4KE
6060 James Rd.
Austell GA 30001

I would like to locate the manual and schematics for the Hammarlund HFM-40. I will pay for postage and copying costs. I am also interested in hearing from anyone who has put the HFM-40 on 6-meter FM as a repeater.

David Kelly N4HHE
4223-D Myrtlewood Dr.
Huntsville AL 35805

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

which is sought in schools, but merely that the right system be used in getting an answer.

We know that some people have no problem at all in learning the code. These people normally see no reason why everyone else shouldn't have to learn the code, too. I'm fortunate in that I am able to get my code speed anywhere I want it in a jiffy. A few hours and I'm zipping along. It took me maybe a half hour to learn the code in the first place and just a few hours to get to 13 per. The nervousness of the exam put me off the first few times I went down, but finally . . . after not having practiced more than an hour total since failing the test, I went down . . . more to help another chap than to take the test myself. I decided that well, hell, as long as I was there, why not? Passed—no strain.

Others are able to rack up hundreds of hours trying for the big 13 and develop quite an inferiority complex over the situation. They try code tapes, copying over the air, classes, and so on. Nothing works. I'm talking about reasonably intelligent people. The army found that a certain percentage of their recruits were just flat unable to learn the code, so they would try them out for a few days and get rid of the people who were difficult learners.

Now, if a person makes a serious effort to learn the code, but is prevented by a lack of the right brain circuits, I assume that this is the kind of stupid person we want to keep out of our hobby, right? And I assume that no matter what this person has achieved outside of this code failure, he should be prevented from getting a ham ticket and bothering us. I have in mind some absolutely brilliant electronics engineers I've known who tried and tried to get the code and just couldn't . . . who needs that kind of trash on the bands?

No, the majority is probably right in pushing hard for us to keep our present system of encouraging everyone to cheat as much as possible on the technical exam, using the Bash materials so they don't have to know one damned thing about electricity . . . and sorting it out with the fabled code test . . . unless, of course, they buy those California tapes . . . in which case, they will have in their hands the actual FCC code test. Oh, well, we can't win 'em all, right? Will these tapes be available in Dayton again this year? Bet they will.

More than changes in the exams or in the code tests, perhaps it is time for us to consider putting more of the responsibility for the growth of amateur radio onto our clubs. Right now, most of our clubs attract newcomers, who attend a few meetings and then get bored, dropping out. For the most part, I've been finding our ham clubs in the hands of a few old-timers who like to get together and meet each other. Not much more than that happens. I see youngsters very rarely at club meetings and when I do, I often hear grumbling by the grizzled old men who sit toward the back of the room in a separate group.

Perhaps we are happy with a dying hobby and perhaps these old-timers are absolutely right . . . we shouldn't make any changes. Why should we go out and try to get 12-year-old kids into hamming? They're a bore on the air and create trouble at club meetings. Besides, all this stuff about needing kids so they can become career engineers and technicians is a waste of time . . . we can buy all we want from Japan and other Asian countries. Heck, even if we did develop technicians, our companies couldn't afford to compete with Japan and Taiwan . . . wages are too low over there. And besides, their governments are backing their electronics industries while ours is doing its best to screw ours.

Yes, perhaps the old-timers are right and the situation is completely hopeless and there is no use in even trying to do anything about it.

But, Pollyanna me . . . always the hopeless idealist . . . I keep thinking that if we could only get our ham clubs to get into the excitement of recruiting youngsters in the 12-15-year age bracket . . . infect them with the virulent virus of hamming . . . run classes as part of our club activities . . . and then have it so our clubs could give the license exams instead of wasting FCC money on this, we just might get some growth started.

We have such an incredible way to go to even catch up with Japan, much less get ahead of them again in electronics, that even if we were to get ham radio growing at 33% per year, it would take over ten years just to catch up . . . and a few more years to get ahead again. It may take that long before the government (congress) recognizes that business needs help, instead of regulation and taxing, if it is going to compete on a world basis. I really hate to see the US losing one electronics market after another to Asia . . . because we have so few technicians, so much difficulty getting growth capital, minimum wages driving up costs, so little emphasis on automation and robotics . . . and so on.

When I looked into building a new plant for our Instant Software division, I found where the bottom line was. Let's say I wanted to set up a plant with $100,000 worth of equipment to produce a product which I would sell largely worldwide. Now, in the US, before I could invest the $100,000, I would have to earn $200,000 and send half of that to the government in taxes. In Ireland, I found that I would have to invest only $50,000 and the government there would match that, giving me the needed $100,000. Further, the government would train workers for me at their expense . . . and wages would be far below ours to boot. Is it any wonder that Apple, Memorex, and many other firms expanded into Ireland instead of adding facilities here? You get four times the bang for the buck there, so businessmen put down their waving flags and were practical.

Getting back to hamming . . . one of the reasons I have been pushing so hard for all these years to get the legislation through to allow clubs to give the tests is my faith in the clubs as the best approach we have to getting growth of the hobby. Now that the law has been changed to permit this, I'm anxious for us to get started. I believe that if clubs do the teaching of our newcomers *and* the testing, we won't need any FCC tests or code. The clubs will know who is serious and who isn't. I'm hoping that this sort of entry into the hobby, where newcomers are taught not only theory, rules, and such, but operating procedures and ham lore as well, will result in much better hams.

In the meantime, I'll be pushing where I can . . . publishing articles on construction projects . . . and so on, all trying to keep things moving in the direction that seems most productive for hamming . . . and our country . . . In the long run. I'd sure like to have your help and support, but I'm used to being fought and jammed, so I'll do my best with or without help.

BASHED YET?

Yep, my good friend Dick Bash is at it again. You really have to give him a lot of credit. A lesser person would have become discouraged when the FCC changed the test on his blitz-taught students and flunked almost all of them. Well, Dick had their money, so it was no skin off his . . . er . . . nose, right?

So Bash is going out again, giving his one-day intensive memorization of the FCC answer courses, all for the low, low price of $150 for the Tech/General or Advanced, or $225 (wow, a bargain!) for both. Dick has a nice guarantee for you, too . . . if you pass, he keeps the money. If you flunk, he keeps the money. What could be fairer than *that*? Oh, if he runs the class again, you can take it again for free if you can find it. If you don't register ahead of time, it's $25 more at the door for each course.

Will the FCC be waiting for their nemesis again with a new exam and flunk his trusting flock? Heh, heh, only the Shadow knows.

If the FCC doesn't change the questions, Bash will definitely get you ready to pass the exam. And you don't have to worry one little bit about having to learn a thing about electricity or radio. No knowledge or understanding whatever is necessary to pass this test once you have been grilled in the answers for a full day. But better not wait a day or you may start forgetting some of the test answers.

Bash will be going around to Seattle, Los Angeles, San Jose, Chicago, Boston, and Dallas. Let me see . . . with about thirty students per class, twelve classes in about a one-month period, ole Dick is going to really rake it in. Who says you can't make big money out of amateur radio? Not counting all of his sales of books and code courses ($10), it looks as if Dick could pull in $45,000 in that one big swing. Hey, good work there, Dick!

I don't know if Dick picked up the FCC's actual code exam from the booth near his at Dayton, but if he did, you are really in luck. Why, you would then be able to pass the whole FCC exam without knowing either the code or the theory, rules . . . or anything! By golly, if we can't get some growth in the hobby this way, what *will* do it?

ANOTHER OGRE

Not all of the falling behind of electronics manufacture in our country can be laid at the feet of the ARRL and their incentive licensing disaster of 1963. The resulting loss of engineers and technicians to the country has been devastating, but there have been other factors involved which have worked to cut American production and put Americans out of work.

One of the more insidious robberies of jobs has been caused by the borrowing of cash by the government to pay the increasingly large government debt. They've done this via short-term, high-interest notes which investors have been buying. According to the most recent figures, the government is now responsible for 29.7% of *all* borrowing. This has doubled in the last decade and has a lot to do with the unemployment situation.

Remember that the more profits companies can make, the more they will expand their operations, creating jobs. And as people make higher salaries they will spend more, again creating jobs. But when the government comes in with super high interest on their borrowing, this takes billions away from the private sector . . . billions which would otherwise be invested in making more jobs.

The deficit of 1982 is mind-boggling, of course, but one sadder result of this is that the 200 billion will have to be borrowed from investors, further robbing our industries of investment capital and thus preventing them from investing in growth and the badly needed creation of jobs.

This bleeding of investment capital by the government reflects back on us in another insidious way, too. By keeping our industries from getting reasonably-priced money for modernizing plants, they are forced to be ever less competitive with foreign manufacturers. Today, the US has the highest percentage of obsolete plants, the lowest percentage of capital investment, and the lowest growth of productivity of any major country.

This is a difficult situation for those who want to expand welfare and unemployment benefits. In order to get the money to pay people who are not working, we have to borrow it from those who are. And when we use money in that way, the government has to compete against our industries to borrow the money, taking it from them with higher interest rates. Yes, these people spend the money, but make nothing for us to buy in return for it, so the capital thus used up does not end up making more. This unwinds the economy and makes us less productive.

There is no simple answer to everything, but we do at least see a lot of the problems which are sinking our country. The lack of capital for building new and modernizing old businesses is damaging. The lack of trained technicians and engineers puts us at a further disadvantage. If we did have the cash to expand electronics production, we would probably send it to Asia, where we would get more return for the investment because they have more and better technicians there.

If we are able to start getting our kids interested in amateur radio, we could, in a decade, begin to turn the engineer and technician problem around. The cash situation is not going to improve until we make it clear to politicians that we are serious about eliminating deficits. I note that there are a lot of senators and representatives who do not yet have this message . . . which means that we are not making that clear.

TOO MUCH SCIENCE?

On my birth certificate, it lists the occupation of my father as "aviator" and my mother as "artist." If you think about that, you'll get some insight into my trains and lapses of thought. There is the mixture of the mechanical and the artistic which resulted in a technical publisher.

This same background has led me to be interested in both the scientific explanations for the world and the occult ques-

tions which science has been unable to answer. Science has done a good job of answering many questions about how the universe works. But it has also failed to successfully tackle a great many observable phenomena. We have come to terms with many of these via religions, which call for belief without scientific proof. Other questions which are not answered either by science or religion tend to be pushed aside with annoyance.

But it is dishonest of a scientist to deny the existence of data just because he is unable to explain it or set up an experiment which repeats it. Science, if it is going to be true to itself, is going to have to admit that there are a lot of things which do not fit into the framework of the universe that they have built up. Scientists are going to have to start seriously trying to understand pesky things such as UFOs, ESP, reincarnation, PK, the spirit body, how memory works and where it is, medium communication with the dead, ghosts, and so on.

The easy path pursued by most scientists has been to unmask a few charlatans and then ignore everything else. Proving that a few of the UFO photos are fake doesn't solve the UFO situation at all.

The more we interest our kids in technical hobbies, the more scientists we'll end up with. You don't develop first-rate scientists by starting people in their 20s any more than you get good ballet dancers from late starters. No, it takes the twist of mind provided by amateur radio or computers (and I think we can all agree that these hobbies definitely do twist the mind) to get a good scientist going.

Dr. Hynek, the outstanding scientist investigating UFO phenomena, got his start as a ham. His credo seems to be much like mine . . . pointing to a wealth of data and a paucity of provable explanations . . . and asking if anyone can come up with a theory to explain all of this.

For all of our wonderful progress in science and the high technology gadgets we have derived from it, we still have an enormous number of rather key things which we don't understand and thus have to accept on belief. Once we start getting a handle on some of these mysteries, we will have powerful tools for further progress. Will an understanding of the essence of man lead to time and space travel in some mode barely dreamed of today?

Or will we find out that there really is some benefit to praying to the coffee table to have a nice day?

The questions are there in large numbers. We have to find out more about talking with plants, Kirlian photography, mind photographs, bent spoons, and so on. Can an understanding of human memory lead us to design computer memories in a different way, perhaps ridding ourselves of all size limitations?

Until we understand all of the mysteries of our world, we have plenty of room for science to work . . . and we need a good supply of new scientists. Hopefully, there will be a few more with the combination of the artistic and the mechanical . . . the scientific and the metaphysical . . . so that we will have some scientists able to tackle these things. Just ignoring them and refusing even to think about them is not a scientific answer.

In the past, I have written about such odd phenomena as UFOs, both about my own experiences in this field and those of other readers. I got quite a bit of mail from hams who had had personal UFO experiences. The easiest way to handle things like this is to ignore them. There was a "Nova" program recently which went to rather great lengths to debunk UFOs. And since then, I've read quite a bit about the films they took for the show which were not shown . . . or even mentioned . . . films which give strong evidence that something odd really is going on. For some reason, they wanted to do another whitewash on the subject.

The same situation surrounds many of the anomalies which perplex the more thoughtful and open-minded scientists today. One can still find scientists with good reputations in some field who refuse to accept that there is any such thing as mental communication. Yet most of us have experienced this at one time or another, so we know it exists . . . and wonder at the objectivity of someone who won't even check the evidence. I will never forget some emotional distress I was under one day many years ago. I was distraught . . . and at that very moment the phone rang. It was my mother asking what was wrong, calling from 135 miles away. She'd never done that before . . . and never has since. There was no way on Earth that was a coincidence. She knew nothing of any of the situation or its development.

Ask me sometime about the UFO which a bunch of us here at the magazine saw just down the road one evening . . . and which suddenly sped away over the horizon in seconds when it started moving. We could see it for at least fifteen miles, a distance it covered in about four seconds—after hovering for several minutes.

There are a lot of things to investigate . . . if we can develop enough scientists . . . and they are able to break away from orthodox thinking enough to handle these elusive problems. But until we start getting more kids started in high-tech hobbies, our chances of making progress will be slight. Has *your* ham club done anything to spread the ham radio bug in your local schools?

DOWN WITH DXCC

My recent editorial pointing out the harm which DXCC and the Honor Roll has done to our hobby brought in an interesting letter from a well-known DXer. His response was to attack me, not the ideas which I had discussed.

The problem with DXCC is that it puts a premium on making contacts with operators in rare countries. This, in turn, if you stop even for a moment to think about it (which may be too much to ask DXers), means that operators in rare countries are not permitted to get on the air and rag-chew. Now, let's think about that for a minute. What is the most popular aspect of amateur radio? No, rag-chewing is by a wide margin the most popular amateur radio activity. We see the bulk of our low bands used for this, as well as virtually all of our VHF operation.

What chance does Paul 9M8PW in Sarawak have to rag-chew? He is no sooner on the air than the pileups start, with ops getting ever more insistent that he stop talking and give them a report and a QSL. They don't want to know about the Sarawak River and the twenty-foot-long croc which has been grabbing children up river. They don't want to know about Paul and what he teaches or that the monsoon rains have flooded half of Kuching that morning. They don't really care that his name is Paul or how long he has lived there or what he is doing . . . they want a QSL card so they can get a certificate. Many callers have no idea of where 9M8 actually is.

It turns out that Kuching is a fascinating place to live. Just a generation away from head-hunting, the people there are friendly and hard working. Once you get away from the capital city, you find that many of the small towns are built on stilts. Not just the houses, but entire villages are on stilts. They call them long houses—often they contain hundreds of families living together. Each family has a separate set of rooms, but they are together, sort of like a bamboo-made hotel or motel. The ladders down to the ground are made out of single trees, notched to provide the steps. The people zip up and down these narrow stairs just as we do our three-foot-wide staircases.

Having towns on stilts keeps them above the water that runs off on the ground after the monsoon rains, which hit just about every day during half of the year. The temperature is comfortable, even though this is only about a hundred miles from the equator, running about 70° at night and maybe 88° during the hot afternoons. The humidity? Ugh! The rains last a few minutes to maybe an hour at a time, so you can usually outwait them.

Living is easy in a place like this, with hunger unknown. Wild bananas and pineapples are all around, coconuts, and so on. All sorts of fruit and vegetables grow in profusion. You just plant 'em and jump back. And living up off the ground not only keeps you away from the floods after each rainfall, but also keeps you away from most of the small animals and bugs. It's cooler, too. Even in town, many of the houses are built up in the air, with an open parking space for cars on the ground level.

But each remote country of the world has a different story to tell, if you'll listen. However, until we take off the pressure of the awards for getting QSL cards from rare countries, how are we going to share in these things? And how are we going to make hamming fun for ops in these spots?

I enjoy getting on for a few days from some weird place and making thousands of contacts. But remember that I do this for fun. I know that if I were to live in one of these places, I would get pretty tired of the unending pressure for the shortest contact possible, writing down calls month after month so chaps can get QSL cards. The paperwork involved is a drudge.

It's no wonder that every now and then we develop a DXpeditioner who uses this pressure to make money. People on the Honor Roll will eagerly pay $50 each for a contact with a new spot. Indeed, that was the going price ten years or so ago. I'll bet that a mercenary today could ask for and get $250 each for a new country. The charge for those not on the Honor Roll would be down to around $25. If I ever retire from publishing, I just might grab a couple of portable rigs and set out to prove that I can make $100,000 a year via DXing.

Now, for those readers who have not followed my personal enthusiasms, I'd like to assure you that you will have to look hard to find a more energetic contester. And I think I can keep up with anyone in the world when it comes to making fast contacts from rare spots. I've got that down to a science now, if you'll break quickly with the last letter of your call, please. Hold off for a few seconds and give it to me just once phonetically and I'll get you. If you give it twice, you'll go to the end of the list. I don't just work the loud stations that way—I work right down to the weak mobile stations and other rare DX callers.

Can anything be done about DXCC and the Honor Roll? Of course not, but that isn't going to stop me from beefing about what it has done to amateur radio. Who knows, I may come up with something even more pernicious.

ASIAN TOUR

Speaking of Asia, I'm sponsoring a tour of Asia for this coming May, if you're interested in a first-class trip. This will be a short one, running about two weeks, and will visit Tokyo, Taipei, and Hong Kong. This is aimed more at the computer aficionados, so it will coincide with the microcomputer show in Tokyo, plus smaller get-togethers in the other countries (which are not as deeply into micros as Japan).

The tour will use the best of hotels . . . strictly first-class . . . and includes breakfasts and even some of those spectacular dinners. Having just returned from one, I can tell you that they are truly first-rate.

In Tokyo, we'll try for a meeting with the TIARA, the Tokyo International Amateur Radio Association. You'll not want to miss Akihabara, the electronics section of Tokyo, with hundreds of stores selling electronic equipment, ham gear, parts, and so on. You'll find most of the ham rigs running about 50% to 75% of the American price . . . unless you wait for Hong Kong, where they are generally even lower.

You'll get a kick out of Tokyo. The subways are easy to use. There are McDonald's all over the place in case you get a Big Mac attack . . . plus all the old home features such as Shakey's, Kentucky Fried, and even Wendy's. For the more adventurous, there are all kinds of Japanese meals, from raw fish right on through. This last trip, we had a complete raw-fish meal, with two courses of raw whale included . . . courtesy of the chaps at TDK.

If we get some hams on the trip . . . and you're interested . . . I'm sure we'll get a good reception from Kenwood as well as TDK . . . and perhaps Yaesu. We'll be too far away for Icom, unfortunately . . . wonderful people.

In Taipei, you'll enjoy the city . . . the people . . . and some of the incredible things you can see there. We can certainly get together to meet Tim Chen and see the radio club . . . and BV1A. I don't know if we can swing it to let you sit down at the mike of the station or not . . . but it's worth a try.

The next stop is Hong Kong, where you won't believe the prices on electronic equipment. There are dozens upon dozens of small shops, all trying to outdo each other. The city is big, with hundreds upon hundreds of high-rise apartments and business buildings. Transportation? Anything and everything . . . from modern subway to trishaws. I like Phil VS6CT's approach to crossing the ever-jammed streets. He just steps into the traffic without looking at the cars and they always stop for him. It takes some guts to get used to his system, but I can assure you that it works. He's lived there for years and is still alive as testimony.

If you bring along an HT, we *can* get ham tickets in Hong Kong. No problem . . . get 'em in minutes. They have a repeater, of course.

The ferry across the bay between Hong Kong and Kowloon costs 8¢ for first class, as I recall. Wonderful sight—and you'll get great pictures.

The tour starts from Los Angeles on May 20th and will be returning two weeks later, June 3rd. This is immediately after NCC in Anaheim, which runs May 16th-19th. I'll be there for NCC and then go on the tour, so if you go, you might not only have someone interesting to talk to, but you will also have someone who really knows the ropes.

If you have the wanderlust as I have, you may want to delay your trip back for a few days and add some other countries to your trip. This can be done remarkably inexpensively. Travel in that part of the world can be surprisingly low-cost. This last trip, I added a bunch of extra stops to

the tour, going to Singapore, Bangkok, Kuching (Sarawak), Brunei, Sabah, and Manila. I traveled a day and then visited two days, taking three days more for each country visited. The hams in each country were first-rate. The hotels were fine (except for Brunei...and now I know of a good one there) and the food superb. I gained five pounds on the trip...despite my jogging just about every morning. You'd laugh to see me running three and four miles in the early morning through the streets of Taipei, stopping now and then to snap a picture.

Other than imitation diamond-encrusted $15,000 Tifffany watches for $30, what bargains are there in Taipei? Plenty. You'll be shopping up a storm in the department stores there. You'll also get pretty sharp with chopsticks.

I don't have the exact price of the tour yet, but I'm sure it will run no more than around $2,500 for the air fare, hotels, many meals, all ground transportation, tips, airport taxes, and so on. Also, when you are in a group like this the usual baggage limits are waived, so you can pick up all the souvenirs you want. Drop me a line if you're interested and I'll send your letters on to Commerce Tours in San Francisco, the firm we work with on trips like this.

TAIWAN IN TROUBLE

Taiwan has been growing almost incredibly in exports over the last few years, but they are getting into deep trouble these days...mostly as a result of their success. Most of the products of Taiwan have been labor-intensive, depending for their success on low wages. But now, as their wages have escalated...inevitable with only a little over 1% unemployment...they are becoming uncompetitive with similar goods from other low-wage countries such as the Philippines, where the minimum wage is around $2 a day and many people still have to live in the streets.

The obvious route is to change from labor-intensive goods to higher-priced things such as electronics...but here they are up against an educational problem of enormous proportions. Japan made this change from inexpensive exported goods to high-priced, high-tech manufacturing years ago and has built up the infrastructure of education needed to support such an industry.

As any DXer is well aware, there is exactly one ham in Taiwan. I had the pleasure of having breakfast with Tim Chen BV1A during my recent visit to Taipei and discussing this with him. Tim had some hope because there is a move underway to bring more people into amateur radio in Taiwan which could eventually result in dozens of stations on the air. In the past, the government has discouraged new amateurs or even shortwave listening, with the result that there has been no real incentive for kids to get interested in radio. This, in turn, has made it so that there have been very few electronics engineers or technicians in Taiwan.

I've been getting to the Taiwan Consumer Electronic Shows for several years now, seeing their products and talking with the manufacturers. I've also endeared myself to businessmen of Taiwan by pointing out what they already know... that their electronic equipment is all imitative, with no creativity in evidence. Thus their equipment has had to sell almost entirely on price, with new ideas and quality taking a back seat.

Lacking the scientists to develop new products, or the engineers to put in automation and robots, Taiwan has had to depend mostly on copying the equipment from other countries and on their low wages. Now, with their wages rising faster than those of the rest of the world, they are in trouble, and they haven't the supply of engineers and technicians to turn to for help.

Business has been brisk in recent months in rip-offs of the Apple computer. Again, lacking anything significant in technicians, Taiwan manufacturers have had to turn to copying the most successful of the microcomputers, the Apple. There are over a hundred small firms... and some fair-sized ones, too...making Apple imitations. I saw them everywhere at the electronics show in Taiwan and even had a chance to talk with some of the manufacturers personally.

If Taiwan is able to get kids interested in high-tech hobbies such as amateur radio and computers, the country could, in a few years, be able to get away from trying to make a living from the ideas of others and come up with creative ideas of their own, as has Japan. Within the memory of those of us who were around in WWII is the image of Japanese products as being junk. For many years, most Japanese products were cheap imitations of better products, with shoddy workmanship.

Today, as you know, not only has Japan set the world standard for productivity, but also for quality. They've left most other countries far behind in these regards. And in the last few years, we've also seen the emergence of Japanese creativity.

Though I put a good deal of emphasis on the importance of getting kids into high-tech hobbies as a way for a country to develop technicians and engineers, I am among the first to agree that this is by no means the only problem we have in trying to compete with the Japanese. But without being able to match them...or even come close...in engineering talent, no amount of government help of industries, more favorable tax climates for electronics firms, etc., is going to help us to regain world superiority in technology.

There have been a number of good programs on television lately showing the difference in education between the US and Japan (and even Russia). Our schooling system has disintegrated a good deal since I went to school, with math, sciences, and so forth being almost done away with in many areas. No wonder kids are having a problem even with the Novice ticket, which anyone with a high-school science education should be able to pass. The fact is that few kids *are* getting a high-school science education. Phooey.

Oh, there are a lot of things we need to overhaul...and I will make few friends by bringing these things up. One only has to read the reports in *Reader's Digest* on the activities of unions to terrorize uncooperative manufacturers to realize that America has no monopoly on human rights. While we are indignant over the Israelis making life extremely miserable for the Palestinians, the torture in Argentina, the executions in Guatemala, and so on... things which are going on all over the world...we have not too different things going on right here which we want to cover up.

The worker who works harder than his fellow workers is harassed until he slows down and stops making everyone else look bad. I saw that one myself back when I worked for a company which made transmitters for the Army. The union there was furious that the test people didn't just pass along anything put together by the production people...and never mind that the transmitter would be needed by the Army in working shape. When I got busy and turned out about double what my fellow workers could manage a day, they started sabotaging the units I'd aligned to prove that I was turning out poor work. No, I've been there, so when I read about this happening all over the country, I tend to believe it.

We geared up and won WWII, getting the cooperation of millions of people. I think we can surmount the current depression if we make a decision to do it and stop our own people from fighting each other. Unions can do worlds of good to help people and production...they can also drive you crazy with featherbedding, slowdowns, restrictive work rules, intra-union fighting, and so on. Unions which insist on using every weapon at their command to maintain their members at higher than the normal wage for their work are robbing the rest of us. This comes to roost when they come up against foreign competition, such as with cars. American cars would drive the Japanese cars right out of the country if the car unions would settle for average wages for their workers and put on the pressures for productivity and quality.

When I have to rent an American-made car on a trip, I am invariably amazed at the poor performance and quality of the product I am driving as compared with my Japanese cars. That door doesn't fit right because someone on the production line just didn't care...and the inspector was under union pressure not to make the worker look bad...or was out on coffee break when my car went by.

Well, the world is changing. More and more "workers" are going to be replaced by robots who do not forget a few screws and bolts when assembling a car. Robots will make the windows fit exactly right. Robots will not call in sick when a DXpedition is brewing on 20m or when hung over from too much brew the previous night. Workers are going to have to think in terms of education...perhaps with some science in the mix so they will be able to cope with the type of work we have today...and will have in the next twenty years.

The world of 1999 looks to me as if it is going to be a high-tech world, with telecommunications on the order of 10,000 times more than we have today...with people able to communicate with others anywhere in the world in seconds from small hand-held computer-like communicators. We'll have teleconferencing and so on. But these developments are going to call for an incredible number of technicians, engineers, and scientists. Our present school system is totally inadequate to cope with this need.

Taiwan has the same problem, only it is hitting them hard right now. They need thousands of technicians and engineers and they need them today. In all of Taiwan, I found one firm with an innovative computer product. That was the Micro Professor, which looks like a comer. It will run Apple programs, but does not appear to be an Apple rip-off, even in its electronics.

One is struck by the impact of the lack of copyright enforcement in Taiwan. Not only are there many bookstores full of cheap copies of almost all of our best-selling computer books, but one can also go into stores all over Taipei and buy a $15,000 watch for about $30. Sure, it's a copy, but a good one. I picked up some local copies of Apple manuals...and saw any number of copies of well-known programs, usually selling for about $10. Not bad for VisiCalc. Within days of a new program coming out in the US, it is available all over Taipei for a few dollars.

Taiwan will be able to shift to higher-tech products and thus make more income per sale...and be able to pay higher wages...if they have the technical people to cope with the changes in world technology. To me, this means getting their kids into high tech and providing the schools they need to take this interest and develop it.

HAM HELP

I have a Midland model 13-866 CB radio which I converted to 10 meters, following the modifications outlined in the April, 1981, issue of *73*. However, it does not receive on 10 meters, the transmit signal is garbled, and it will not change frequencies. I need information on how to make it work.

Joe Oden WD9HYM
4129 South Wichita
Wichita KS 67217

I need the following items: horn speakers, spark gear, high impedance headphones with cords, 201A (or equivalent) tubes, old terminals, bus-bar wire, vernier dials made prior to 1930, 2- to 4-inch bakelite 0-100 dials, and telegraph keys.

Alan Shawsmith VK4SS
35 Whynot St.
West End, Brisbane
Q 4101, Australia

I am looking for construction plans or a schematic for a one-tube QRP rig.

MacArthur Moore
5230 Heston
Philadelphia PA 19131

Could someone help me find the schematic for an Eico model 150 signal tracer?

A. B. Wells WA5COM
PO Box 50
Tunica LA 70782

I am looking for CB magazines printed prior to 1967.

John W. Heacock K3YCP
8100 Bass Lake Rd.
Apartment 110
New Hope MN 55428

I am trying to find the manual and replacement capacitors for a Hallicrafters Sky Ranger S-39 receiver. I also need an operational or as-is DX-40 transmitter and a manual. I am willing to cover copying and postage costs.

Dave Drinnan VE3MPX
21 Beaverbrook Lane
Kanata, Ontario
Canada K2K 1L4

I am searching for service manuals or schematics for the Jefferson-Travis model 350A-1, vintage unknown. I will pay for postage and copying costs.

Steve Stout KA5CRI/9
1537 Winslowe Dr.
Palatine IL 60067

REVIEW

THE AEA CODE TRAINER

Everybody has his own way of learning the code, and most people think that the way that they learned it was the best. It was with this possible bias in mind that I approached the AEA BT-1 code trainer, a Morse-code training device that uses no tapes but an IC to produce the tones.

AEA, which specializes in keyers and code readers, should know the code better than many manufacturers, and this knowledge has led to a novel approach for learning the code. The BT-1 is designed for use by people who are completely unfamiliar with Morse code. With the trainer, you move step by step through each character, singly and then in groups.

So far, this is pretty standard fare. However, the machine does not teach the code from simplest to more complex, for example from E to Y. The first character learned is F, and from there the student moves on to K, B, Q, and the last letter learned is I.

In addition, the code trainer does not begin sending each character at a slow speed. Every character is at its 20-wpm length, regardless of the spacing between characters. As they explained in the manual, this is to overcome the proverbial plateau many people encounter at about 10 wpm. By learning the sound at a higher speed at the start, your ear will have to adapt less as you increase the code speed.

AEA also suggests a strict adherence to the sequence of characters which they suggest. After learning to recognize each character, both by itself and in groups of increasing length, the student moves to the next character. As he or she moves down the list of new characters, the characters previously learned are thrown into the groups at random. However, the character being learned is weighted at 50 percent—that is, one-half of the characters will be the new character.

Once all of them have been learned (the list includes numbers and common CW ciphers), the student can increase the speed by decreasing the spacing between characters and changing the character length as well. Each training selection may also be called up without weighting the new character, making the characters of each group completely random.

The BT-1 has several accessories which enhance its use, such as a full-sized headphone jack instead of a ¼-inch earphone jack, and a second jack in which a key may be inserted for use as a code practice oscillator. The pitch of the tone is also selectable in discrete steps, adapting the trainer to a variety of ears. Its small size and the included nicad battery pack and charger make it extremely portable, so you can get your daily half-hour of practice in many situations.

A 12-button keypad controls the operations of the BT-1. However, one of the difficulties in using the trainer is learning the commands which control it. All of the commands, except for the stop command (#), are at least 2 keystrokes, and in most cases 4. I found that to use it I had to have the manual close by at all times for quite a while until I learned the proper commands.

Because of the relatively complex controls, the speed at which you are copying is also difficult to determine. One command sets the character speed from 18 to 99 words per minute, and another command sets the delay between groups of characters. The delay range is from 0.1 to 9.9 seconds, with a default value of three seconds. The character speed default, as mentioned above, is 20 words per minute.

For this reason, as well as the somewhat limiting factor of listening to code in purely random groups, I found that the code trainer worked most effectively in conjunction with tapes. For characters with which I have difficulty, such as X and some of the CW ciphers, I drilled myself on the BT-1 to increase my proficiency. But to increase my overall speed, I found that I used tapes. With the known speed for the tapes, it was easier to keep track of my progress, and it alleviated the boredom of listening to and writing random groups.

However, I would recommend the code trainer to Novice classes and individual students. AEA's method, while not the standard procedure, seems to work. The portability of the unit would hopefully lead to more frequent use. And, as we all know, there is no substitute for diligent practice when trying to learn the code.

For additional information, contact *Advanced Electronic Applications, PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number 486.

Avery L. Jenkins WB8JLG
73 Staff

AEA's BT-1 code trainer.

THE AZDEN PCS-4000

The progress of large-scale integration (LSI) has left hams somewhat in its wake, because this technology is highly dependent upon the economy of scale—the more you make, the cheaper they get. The amateur market is often too small to bring the advantages of LSI to bear in new products. However, Azden has brought amateurs back to the state of the art with the introduction of its new PCS-4000 2-meter transceiver.

Azden's use of LSI has enabled it to produce a microcomputer-controlled radio that is little larger than the average in-dash AM radio. The PCS-4000 measures 2 inches high by 5½ inches wide by 6¾ inches deep, and much of this miniaturization has been accomplished by replacing mechanical control mechanisms with logical functions performed by the microcomputer.

All of the transceiver's tuning is conducted through the 16-button keyboard, which doubles as a touchtone™ pad. The Azden has an extended range of 142 to 149.995 MHz and frequencies may be selected in 5- or 10-kHz steps or from the two banks of 8 memory locations. The relationship between the memory banks is controlled by a 4-position memory mode switch. This switch allows the operator to choose a frequency from either bank, both banks, or select a receive frequency in one bank and a transmit frequency in the other. By using this switch, non-standard repeater offsets may be programmed into the machine.

Standard offsets and simplex operation are also selected via the keyboard, and the offset may be stored in memory with the chosen frequency. Nine LEDs indicate the memory address and bank currently in use.

Other indicators on the front panel include the green LED frequency display, which indicates the transmit frequency as well as the receive frequency, a digital S-meter, and a channel-busy indicator. Other LEDs show whether the PLL circuit is locked, which offset has been chosen, and whether the frequency is from the memory bank or has been directly keyed in.

Besides the volume, squelch, and memory mode controls, the PCS-4000 sports only 4 mechanical controls. Three switches choose the frequency step, select whether the scanning feature will settle on busy or vacant frequencies, and turn on the optional 1750-Hz tone.

The scanning features may be used in conjunction with the memories, or an entire portion of the band may be scanned to locate either busy or empty channels. These options are also keyboard-selectable. The scanner will also automatically resume after monitoring a busy channel for about 10 seconds, which gives you enough time to decide whether you want to stay on that frequency or not.

The Azden puts out a husky 25 Watts in the high power mode and 5 Watts in low power. Current consumption runs from 0.6 A in receive to 6.0 A while transmitting, and spurious frequency rejection is better than −60 dB.

The receiver has a sensitivity of 0.2 uV and a selectivity of 6 dB down @ ± 6 kHz and 60 dB down @ ± 15 kHz. The audio output is 2 W into a 2-inch speaker. The receiver is a double heterodyne operating with a first i-f of 16.9 MHz and a second at 455 kHz.

The transceiver is controlled with an MB 8855222M single-chip microcomputer. Circuitry has been sectioned into four boards—the control board, the PLL and transmit circuitry, the receive unit, and a PA board. All of the functions of the PCS-4000 have been packed into 15 ICs, 9 FETs, and 34 transistors.

The flexibility of the microprocessor control system has given the PCS-4000 a variety of special functions which I have found valuable. Besides being able to select a frequency or memory address from the keyboard, a single button will reverse transmit and receive frequencies. I have found this feature useful for quickly finding out whether a station is strong enough to work simplex.

Another very valuable feature not found on many other radios with programmable memories is the nicad backup which Azden built into the transceiver. Although the manual recommends supplying power to the radio directly from the battery, the nicad will preserve the radio's memory when it is removed from the permanent power source. I regularly take my radio inside for safekeeping, so without this feature I would have to reprogram 16 channels every morning. The nicad is automatically recharged whenever the radio is on, and it only supplies enough power to retain the memory; you cannot operate the transceiver from the battery.

The battery comes with the initial charge already completed, unless the unit sat on a dealer's shelf for several months. Azden has included as an accessory the necessary jumper cable and instructions for charging the battery should it be necessary.

There is also one priority channel in each memory bank, in the first memory address. The priority channel in either bank can be instantly accessed, regardless of what bank you are presently operating from. Two buttons on the keyboard are reserved for this function, and the priority channel in the first memory bank may also be called up with the remote control located on the microphone.

The microphone incorporates two other controls as well, The up/down buttons will change the frequency by 5- or 10-kHz steps or will proceed sequentially through the memory if you are operating in the memory mode.

The scanning circuitry has proved to be especially versatile, and with it I have found and immediately been able to access repeaters that I previously did not even know existed. In addition to searching for your choice of busy or vacant channels and scanning the memory or a selected band slice, the scan may be conducted with a repeater offset. For example, if you are scanning the range above 147 MHz, you can instruct the transceiver to automatically add 600 kHz to your transmit frequency.

The 25-W output gives the PCS-4000 a good signal range, and all comments on the transceiver's audio give it a good report card. It picks up little road noise, and the audio lacks the heavy bass component found on some other transceivers.

Although I have had some problems with the transceiver, they have been relatively

minor and can be expected as an operator adapts to a new radio. The microphone button which calls the priority channel is located on the upper tip of the transmit button, and therefore is easily activated when you are pawing for the microphone while keeping one eye on the road. Until I became used to handling the microphone differently, I sometimes would begin a QSO on 146.150 and suddenly find I was talking to the breeze on .52 simplex.

There is also an interesting feature on this radio which could be made more useful. The PCS-4000 will emit a beep whenever a keyboard command is received, enabling the operator to do some extensive radio fiddling while keeping his or her eyes on the road. Unfortunately, the beep is not always loud enough to hear over the road noise.

However, these are minor problems and not integral to the otherwise excellent capabilities exhibited by the PCS-4000. By using the options available on this radio, I have found a versatility in mobile operation previously just imagined and proved to my satisfaction that bells and whistles are not always superfluous, but can become a useful adjunct to my operating. And by bringing state of the art back to hams, Azden has provided an incentive for other manufacturers to try to catch up.

For further information, contact *Amateur-Wholesale Electronics, Inc., 8817 SW 129 Terrace, Miami FL 33176; (303)-233-3631.* Reader Service number 487.

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73 Staff

TEN-TEC MODEL 560 CORSAIR TRANSCEIVER

It was with a great deal of anticipation that I sliced the packing tape on a huge shipping carton whose return address said Sevierville, Tennessee—Ten-Tec's home in the foothills of the Great Smoky Mountains.

For some time, those of us involved with the amateur radio industry had been hearing rumors of a new Ten-Tec transceiver reputed to be even better than, and a replacement for, their respected Omni-C. Very few, if any, of amateur radio's press had yet seen the new rig, and it wasn't until the dealer notices were out and some of the ads in hand that any of us really knew what the rig looked like or what its features were supposed to be. The introduction had been carefully planned to take maximum advantage of the traditional year-end buying season . . . a strategy sharing popularity with Dayton's famous Hamvention as an ideal time for the debut of new amateur radio equipment.

Like its privateering namesake, the Corsair was clearly intended to capture a share of the amateur radio marketplace from other well-known transceiver manufacturers. The ultimate test of that effort will be the reception by John and Joe Ham, but, for now, it was my privilege to have one of these brand-new, solid-state transceivers for evaluation. The *73* staff had requested that a full complement of crystal filters be provided to take care of RTTY and CW needs as well as SSB operation, so it was with considerable excitement that I finished opening the box. Time to see what was inside.

Two other cartons inside the large one appeared: a small and rather heavy one, and a somewhat larger but lighter one. Opening the small one first, I noticed the foam-in-place packing material completely surrounding the contents, conforming to every contour of the equipment to protect it from transit damage. Pulling this aside, I found the deluxe power supply neatly bagged in a heavy transparent plastic envelope. "What a good-looking unit," I thought as I set it on the operating desk. "Ooh, what a pretty radio," said my wife who had been watching the unveiling. "Is that your new rig?"

Next, I opened the larger carton and again found the same secure foam surrounding another plastic-bagged unit. Here was a piece of gear that looked good even before it was unwrapped, and I thought back to all of the earlier Ten-Tec equipment I had seen come from the box: my first PM-1, then the PM-2, the Argonaut, the Century 21, the Models 540 and 544, and the Omni series. All were innovative and unusual, presenting new ideas and approaches in performance and styling for solving age-old problems. It is no wonder then that I keenly anticipated the setup and operation of the new Model 560, Corsair.

The Corsair is slightly wider than it is deep, and one's first impression is of crisp, contemporary styling and no-nonsense, rugged construction. A band of darkened glass along the top of the front panel is set off from the rest of the panel by a trim stripe cleverly painted to look like brushed chrome or aluminum, which nicely sets off the bronze-black finish . . . guaranteed to look attractive on my walnut operating desk.

The six-digit LED frequency display and the meter, next to it on the left, lie behind the glass band, called a "blackout" display because when the rig is off, neither the display nor the meter is visible. When lighted, the display is large and easy to see: five digits in red and the sixth in green, showing 100-Hz steps. The meter is also easy to read and presents four selectable functions.

The speaker/power supply matches the decor of the transceiver, and together they make a handsome pair sitting side-by-side on the desk. Black knobs with bright-metal centers peaceably coexist with aluminum toggle switches for the most frequently used controls, while smaller knobs in a flat black finish serve the set-and-forget functions. A tilt bail under the rig allows the front of the rig to be raised to a comfortable viewing angle. The standard four-in microphone connector and the usual earphone jack immediately above it occupy the lower left corner of the panel.

Dominating the center of the front panel is the tuning dial with its fluted knob and vernier skirt. It is divided into 100 increments, each representing one kHz, to facilitate frequency reset and supplement the LED readout. The accompanying photograph reveals more than a detailed description for the moment, so we will leave that until later. First, let's take a look at the more technical aspects of the rig.

General Description

The Model 560, Corsair is a medium-powered transceiver employing the latest solid-state technology. As received from the factory, it contains all necessary crystals for operation in the 160-, 80-, 40-, 30-, 20-, 17-, 15-, 12-, and 10-meter bands (full coverage of the latter). Although intended primarily as a fixed station, it may be used mobile or portable because it operates from a 12-14-volt-dc source or from a 115-volt-ac source through an optional external power supply. Broadband circuitry eliminates the need for tune-up, and the normal sideband for the band in use is automatically selected when bandswitching. LED indicators are provided so the operator can tell at a glance which particular functions are in use. Nominal input power is 200 Watts, and full output power at a 100% duty cycle (RTTY and SSTV buffs take note) is available on all modes and bands. Further, the Corsair is capable of operating into an infinite swr without damage to its finals.

The Corsair transceiver from Ten-Tec.

Frequency coverage on the various bands includes a generous 40-kHz overrun at the top and bottom edges of each band, whose limits are: 1.8-2.3, 3.5-4.0, 7.0-7.5, 10.0-10.5, 14.0-14.5, 18.0-18.5, 21.0-21.5, 24.0-24.5, and 28-30 MHz. The heart of the frequency-determining circuit is a permeability-tuned oscillator operating in the 5.0-5.5-MHz range. Note that phase-locked-loop circuits were purposely not used in order to provide better receiver performance.

Stability of the vfo (PTO) is less than 15-Hz change per degree F over a 40-degree change from 70-110° F after 30 minutes warm-up, and less than 10-Hz change between 105 and 125 volts ac using the Ten-Tec 18-Amp supply. The tuning is vernier and gives approximately 100 kHz per full revolution of the dial skirt and about 18 kHz for one full revolution of the knob. Readout is direct with +/− 100-Hz accuracy in 0.3"-tall numerals. The last numeral is green while the first five are red.

The transceiver contains one LSI, 20 ICs, 94 transistors, 107 diodes, and six LED readouts on 22 PC assemblies with plug-in cables. Its construction is a rigid steel chassis with dark-painted, textured aluminum panels and a snap-up steel tilt bail. Dimensions are: 5¼" H × 15" W × 14" D (including the massive heat sink). Weight is 14 pounds. The rig requires 12-14 volts dc for operation, at 850 mA in the receive mode and 18.5 A maximum in the transmit mode.

Receiver

The receiver is a triple-conversion superhet having a sensitivity of 0.25 microvolts for a 10-dB signal-plus-noise-to-noise ratio on all bands and 0.8 microvolts typical with the rf preamplifier switched off. It is interesteing to note that the preamplifier circuit attenuates incoming signals by being switched out of the circuit (giving 10 dB of attenuation) and by inserting 10 dB of resistive attenuation in series with the antenna lead and input, for a total of 20 dB of signal attenuation. The dynamic range is better than 90 dB with a third-order intercept point of +15 dBm. Selectivity is obtained through 12-pole crystal filtering in the i-f circuits (consisting of 8-pole and 4-pole filters in series) instead of the more usual 8-pole filters, resulting in a nominal SSB bandwidth of 2.4 kHz and a 1.7:1 shape factor between the 6-dB and 60-dB down points on the selectivity curve. Optional 250-Hz, 500-Hz, and 1.8-kHz filters were installed in the unit sent for test by *73*'s staff. If desired, an optional 8-pole filter may be substituted for the standard 4-pole filter (giving 16 poles, cascaded) to provide nearly ideal steep-sided skirts on the selectivity curve and an even better shape factor. A notch filter is also provided for attenuating interfering signals by a *minimum* of 50 dB and is tunable between 200 Hz and 3.5 kHz, which means that you can notch out annoying heterodynes within the audible range and obtain vastly improved reception. This is particularly useful on SSB, but is very successful on CW as well. A CW "spotting" tone of 750 Hz is also provided for zero-beating a received signal. This is done by tone-matching instead of zero-beating; that is, when the "spot" tone matches the received tone, you are exactly zero-beat with the desired signal. Incidentally, this system is much more accurate than the null, or zero-beat, method, because the latter method could introduce an error of at least 200 Hz since the audio response of the circuits cuts off at about 200 Hz.

I-f frequencies are 9 MHz and 6.3 MHz, and the PTO covers 5.0-5.5 MHz. Audio output up to 1 Watt with less than 2% distortion (reference to 8 Ohms) can be selected. Spurious responses are all below the equivalent 10-dB S+N/N ratio except at 1.838 MHz (where the equivalent 15-dB S+N/N ratio applies), at 21.300 MHz (where the equivalent 20-dB S+N/N ratio applies), and at 28.980 MHz, where the "birdie" can be eliminated by tuning to the next higher band segment (29.0-29.5 MHz) and tuning 20 kHz below the lower band edge. Although the birdies are detectable, they were not objectionable in our evaluation and could be heard only under quiet band conditions. There is an adjustable noise blanker whose threshold may be varied by rotating a small knob on the front panel. I-f rejection is greater than 60 dB.

The S-meter is factory set to provide an S-9 indication at a signal input level to the antenna terminal of 50 microvolts. Each transceiver is supplied with its own performance specifications as measured in the laboratory before shipment. In the case of the one tested by *73*, S-9 was obtained with an input signal of 47 microvolts at the antenna terminals.

The antenna input is low impedance (nominal 50 Ohms), unbalanced to ground. The dynamic range is given as 90 dB nominal, and the *73* test transceiver was measured in the laboratory before shipment (see box). Offset tuning is provided in two ranges: a low range of +/−500 Hz and a high range of +/−4

Corsair #560-00056
as tested by 73

Sensitivity/RX Performance

	Sens.	Image	I-f Rej.	Bird or RX Spur
160m	– 119 dBm	>90 dB	>90 dB	-
80m	– 120 dBm	– 67 dB	– 77 dB	-
40m	– 120 dBm	– 64 dB	– 75 dB	6.999
30m	– 120 dBm	– 66 dB	– 64 dB	-
20m	– 121 dBm	– 84 dB	– 84 dB	14.0
18m	– 121 dBm	>80 dB	>90 dB	18.00, 18.165
15m	– 121 dBm	– 64 dB	>90 dB	21.000, 21.300, 21.320, 21.365
12m	– 109 dBm	– 53 dB	>80 dB	-
10A	– 121 dBm	– 51 dB	>80 dB	-
10D	– 122 dBm	– 52 dB	>80 dB	28.98

Note: Sensitivity reference point is 10 dB Signal-Plus-Noise/Noise

S-Meter:

Threshold – 121 dBm

S – 9 = 45 μV

IP_3 = + 5 dBm (rf amplifier on) and + 15 dBm (rf amplifier off)

	TX: Output	Harmonics	
160m	98 W	– 50 dBc	3rd order two-tone: – 28 dB
80m	97 W	– 45 dBc	- Carrier – 55 dB
40m	95 W	– 48 dBc	-
30m	97 W	– 50 dBc	-
20m	95 W	– 52 dBc	Opp. Sideband≥ – 45 dB
18m	95 W	– 45 dBc	ALC range: to 30 W
15m	93 W	– 55 dBc	-
12m	93 W	– 52 dBc	-
10m	93 W	– 65 dBc	-

Measured performance of the Ten-Tec Corsair transceiver tested by 73.

kHz. This feature is particularly useful for netting (low range) or for DXing where the foreign station listens up or down by several kHz.

Transmitter

The transmitter dc power input is 200 Watts maximum at 14 volts dc (CW and SSB) and a 100% duty cycle of up to 20 minutes is permitted without exceeding the temperature limitation as measured on the final amplifier heat sink. Operation in excess of this limitation should only be undertaken by force-cooling the heat sink with a small fan (not supplied). Rf power output is 85-100 Watts typical into a resistive load, and each transmitter is measured on all bands prior to shipment (see box). Output impedance is nominally 50 Ohms, unbalanced to ground, through a UHF-type connector. The microphone input, although nominally high impedance, will accept either Hi-Z or Lo-Z microphones with 5-millivolt output. An optional electret microphone may be obtained from Ten-Tec. Polarizing voltage is available on pin 4 of the connector for microphones such as the electret sent with the unit for 73's evaluation.

T/R switching is by VOX or PTT on SSB and instant or semi-break-in on CW. The CW sidetone is internally generated, and its pitch and volume (which is independent of the receiver's audio control) may be adjusted to suit the operator by means of two thumbwheel controls inside the rig and reachable through a hole in the bottom of the metal cover near the tilt bail. The CW sidetone operates only in the CW mode.

SSB generation is by means of a four-pole crystal-lattice filter at 9 MHz, using the balanced modulator system of carrier suppression which is typically 60 dB (see box). Unwanted sideband suppression exceeds 45 dB with a 1.5-kHz tone input (see box). Spurious output is better than – 45 dB relative to full output of the transmitter.

The panel meter is switchable to read several functions: forward (output) power, collector current (Ic), vswr, and speech processor level. These functions are selected by a front-panel switch near the meter.

CW offset is 750 Hz, automatically provided, and ALC is front-panel adjustable between 30 and 100 Watts output. An LED indicator flashes at the ALC threshold as drive is increased or as modulation peaks reach a preset level.

Observations on Use of the Operating Controls and Accessory Features

OFFSET tuning is similar in function to the receiver incremental tuning offered on most modern transceivers, except that this one has a dual range selectable by a toggle switch on the front panel plus the fact that the receiver, the transmitter, or both at once may be varied by this control through switch selection. . . particularly useful for net operation and for working DX.

Passband tuning adjusts the position of the second i-f crystal filter in relation to the fixed first i-f filter. When the filter selected by the XTAL switch is wide (2.4 or 1.8 kHz), the PBT control becomes essentially a variable bandwidth control whereby counterclockwise rotation reduces the bandwidth on the low side of the selectivity curve, and clockwise rotation reduces the bandwidth of the high side of the selectivity curve. When the XTAL switch selects a narrow filter (500 or 250 Hz), the PBT control is used in the normal passband tuning sense. The Ten-Tec PBT circuit produces the effect of varying the bfo, changing the pitch of signals passing through the narrow filter to separate signals that are very close together. For example, on RTTY, the passband tuning can be adjusted to pass only the 2295- and 2125-Hz tones for superior rejection of adjacent signals.

VOX/QSK depends upon the mode of operation selected (SSB or CW) and the position of a front-panel switch. For example, in the SSB mode, if you select the VOX position, normal VOX operation is achieved and VOX gain, VOX delay, and anti-VOX controls are effective to tailor it to your own preferred style. If you select the FAST position, you have PTT operation with fast recovery. If you select the SLOW position, you also have PTT operation but with slow recovery from the microphone switch. In the CW mode, however, the VOX is inoperative and T/R switching is accomplished by the break-in keying circuits. In this mode, FAST gives you full break-in keying, while SLOW permits semi-break-in keying.

AGC switching is provided so that the hang time, i.e., receiver recovery time, may be selected to suit the operator. In the OFF position, there is no auto gain control, and i-f gain is controlled by the rf gain control.

Noise blanker level is adjustable and sets the blanking threshold. In the fully counterclockwise position, the blanker is off. Clockwise rotation of the control increases blanker sensitivity, permits fine adjustment, and prevents overloading, ensuring the best possible fidelity of the received signal.

The DRIVE control adjusts both the microphone gain and CW level.

The ALC control sets the threshold level at which automatic level control starts. When rotated fully clockwise, the input power is factory-adjusted for 200 Watts on the least efficient band when the ALC LED indicator just starts to blink. Power can be reduced below this level to approximately 30 Watts by rotating the control fully counterclockwise. A change in the ALC control adjustment requires a change in the DRIVE setting.

You can use either high- or low-impedance earphones with the Ten-Tec Corsair, and the equalizing audio circuit is such that the audio amplifier operates at its best signal-to-noise ratio at all times.

WWV is received at 10 MHz. Set the LED frequency readout at 10.000 with the bandswitch and tuning knob. Set the switch for selectivity at position 3 (2.4 kHz) and zero-beat WWV's carrier. If the LED frequency display does not read exactly 10.000/0, you may adjust the timebase oscillator internally to read the exact frequency at zero beat.

The rear panel of the Corsair contains some interesting features that will make operation of the rig and accessories more convenient and will permit great versatility. Before looking at the back-panel features, we should have a look at some interesting front-panel provisions that may at first seem a bit confusing.

The RF-POWER dual-function control contains a push-pull switch which turns the rig on and off (in = on; out = off). Rotation of the control varies the gain by changing the bias to the i-f amplifiers. This is the rf-gain control and on-off switch.

As you might expect, the input level to the audio amplifier of the receiver is controlled by the AF-RF AMP knob, but it also has a push-pull switch connected to the control which activates the rf amplifier of the Corsair. The LED lights when the control is pushed in, telling you that the rf amplifier is operative. When the switch is pulled out, a 10-dB attenuator is switched into the circuit and the 10-dB-gain rf amplifier is disconnected entirely. The effect is a 20-dB reduction in signal applied to the rf mixer stage, which results in improved dynamic range and better sensitivity than would be possible if only an attenuator were used. Superior operation in the QSK or VOX modes can be obtained by temporarily setting the rf control fully clockwise, and then adjusting the setting (while receiving a strong station at about S7 or better) to a level slightly higher than desired. Then reduce the level of that signal by means of the rf control to a comfortable level. In this way, only one setting of the AF-RF power control need be made, and agc pumping and intercharacter signal blasting when QRM is present may be avoided when operating CW.

Rear-Panel Features

The EXT T/R jack is intended to actuate a high-power linear amplifier and is derived from a set of normally-open contacts on the auxillary relay located on the control board. When operating CW, a thumb potentiometer located on the control board controls the drop-out delay of the relay, but in SSB, the drop-out delay function is switched out of the circuit. Adjustment should be made to suit the individual station requirements only *after* external equipment is installed and must be controlled by this relay.

Obviously, the key or keyer plug is inserted in the KEY jack. Keyers designed for negative-line keying, i.e., grid-block keying, will not work. The key line is positive and is a high-impedance circuit requiring very little current for actuation.

Two AUX 12 VDC jacks are provided, either of which may be used to power external equipment such as an external vfo or keyer. The jacks are connected to the + 12-V-dc line *after* the protective fuse, which is rated at 20 Amperes.

A nine-pin female connector (ACCESSORIES) is available for interfacing an external vfo. When the vfo is not used, an external jumper must be used and the rig is shipped with the jumper in place.

The LINEAR socket consists of a 12-pin female connector which enables front-panel bandswitching of a linear amplifier or antenna relays. Nine band positions correspond to nine switch terminals, while three additional terminals are intended for a common, a ground, and a T terminal.

AUDIO IN-OUT jacks provide connections to the microphone and speaker for attachment of a phone patch or a RTTY unit. AUDIO OUT may also be used for connecting an external speaker *without* disabling the internal speaker.

A RECEIVE ANTENNA jack is provided for connection of a receiving antenna to the receiver input at all times by placing the small switch nearby in the *receive* position. In the *transceive* position, the receiver input is connected to the antenna socket for normal transceiver operation.

VFO IN-OUT jacks make it possible to switch off the transceiver's internal PTO such as when using an external vfo. The Corsair is shipped with an external U-shaped jumper in these jacks, enabling the internal PTO.

The PTT jack is in parallel with the microphone switch for activating the push-to-talk line and is operable in the SSB mode *only*. This permits an external switch such as a foot switch to be used for transmit/receive control.

The EXT SPKR jack is for an external station speaker and disables the speaker of the Corsair when an external station speaker is plugged in.

Operating the Corsair Transceiver

The bottom line, of course, is how the Corsair operates. Is it smooth and easy? Is it convenient? What are the disadvantages and drawbacks, if any? What is the "feel" of the rig, an indeterminate quality that is very subjective and depends upon the operator. . . but nevertheless important.

When I first spoke with Dan Tomcik at Ten-Tec about this rig, I stressed the importance of CW in my own operating and allowed as how I expected this Ten-Tec rig to excel in that department. Dan quickly corrected my impression. . . but he didn't

tell me I was wrong. What he said was, "yes, indeed, Ten-Tec has the reputation of building CW rigs that delight the operator with their QSK features and their rock-solid signals . . . but Ten-Tec rigs also have fine SSB performance which has often been overlooked." He wanted to make sure that I knew the Corsair was a no-holds-barred, fine SSB *and* CW rig. Consequently, I was on the lookout for something above average in audio quality on both transmitting and receiving.

Now we can return to the setup in my own shack, and I have to tell a little story at this point. In their effort to send the rig to us as quickly as possible, Ten-Tec omitted the instruction manual (which, by the way, is very complete and clear with good diagrams and descriptions). I used this opportunity as an advantage to see if it would be possible to set up the rig and operate it *without* the manual. Now I realize that this is the time-honored, traditional American way to do things . . . after all else fails, read the instructions. So here I was in exactly that position, but I reasoned that the rig was designed to operate into an infinite swr without damage to the transistors and the heat sink looked big enough to cool the Hercules kilowatt, so I wasn't too worried. Therefore, I proceeded with care and carefully connected the proper plugs to their mating receptacles. Each was labeled clearly. Ground strap first, antenna connector, speaker, keyer power supply interconnection (yep, switch was off), and finally, I plugged it into the ac outlet in my shack wall. The moment of truth was about to arrive; switch on and what do you know—signals, loud and clear, coming fom the neat compression-loaded speaker!

I first checked the band edges on receive and checked the calibration against WWV . . . perfect. Then I adjusted the controls for CW reception and checked the filters—very nice! Next, I tried the various other controls, including notch filter, offset tuning, passband tuning, and the various gain controls. Do you detect a bit of delay here, sort of a putting off of the ultimate test? Well, you're right. The manual was missing, and I didn't want to blow the rig by inadvertently doing a no-no. I needn't have worried.

From previous Ten-Tec rigs I knew that the LOCK position of the control is the tune-up position, so I selected LOCK and slowly advanced the DRIVE control with the meter reading FWD, or forward power. The needle obediently came up and my antenna seemed to be taking the load nicely. As received from the factory, the ALC control had been set fully clockwise. Not realizing that this was the normal full-output position, I backed it off to minimum, or maximum counterclockwise position, wondering why I could not obtain full-rated output (and input). By bringing the ALC up slowly, I found the reason that it had been set fully clockwise in the first place. It provides a limited variable adjustment of output power.

From that point on, contacts were quick and simple. Everyone commented on the keying quality and the solid signals, and I particularly enjoyed full QSK, in spite of some QRM close to the frequency. By appropriate adjustment of the rf gain, I was able to minimize its effect, and a tweak of the NOTCH and PBT knobs solved the problem. Many contacts later I decided that the Corsair was some nice rig. I had used it on 160, 80, 40, 30, 20, 15, and 10 meters . . . all with good signal strength and quality reports.

"But what about SSB," you ask? Wait a minute; I am coming to that! I hadn't requested a microphone with the rig so one wasn't sent. A stupid oversight on my part, so I scrounged around the shack and workshop for a mike that would work. Aha! Found one. Oh, oh . . . no four-pin connector anywhere. SSB would have to wait until another day.

For the next three days (and nights), I burned up the bands with this Corsair, getting to know it better and better. I found the more I used it, the better I liked it.

Finally, the manual and microphone arrived, and I was relieved to see that I had done everything right according to the book. In fact, I guess I had been a bit conservative. Now to check it out on SSB.

Evening operation with a vertical antenna on 40-meter SSB is not conducive to your average quiet QSO. The band was alive with foreign broadcasts, but I managed one or two QSOs using the processor to keep average voice power up. Incidentally, if you use the processor according to the manual, you will get *very* complimentary reports! I got some unsolicited praise for "excellent and natural voice quality," "lots of punch," "nice, narrow signal," "didn't know you were using a processor," and the like.

Next, I ran some DX on 15 meters with essentially the same reports. Much praise and no objections of any kind. Well, why not try it on 20? Isn't that the ultimate test for low power and modest antennas? So, I did . . . and results were the same. "Your audio is smooth," "Broadcast quality," "unusual for a sideband rig," etc. I got the same kind of reports on 160: "Mellow . . . nice, easy listening."

What more can be said? I like the Corsair and, for once, I felt completely comfortable (well . . . almost) on SSB; for me, that's quite an admission. Naturally, I expected to be happy with CW, and I was. The reports have been uniformly complimentary, and just this evening I worked a Colorado station on 15 meters who told me (in an *unsolicited* report, mind you) that he had looked at the keying waveform on his scope and it was *perfect*!

Here's another thing, too, that may be of importance to you: The Corsair is roomy inside. Things are well laid out and spaced for service. You don't feel crowded, and you have the confidence in your own ability to remove and replace a PC board, for example, if it is ever needed. Here is another Ten-Tec plus: SERVICE. That is intentionally capitalized, too. I had a problem with a Century 21 a few years ago and called Ten-Tec's service department. They helped me troubleshoot the cause over the phone, asked me to mail the board with its defective component back to them, and put a new board in the mail on the day of my call! You can't beat that—anywhere. With Ten-Tec you have a feeling that you would *like* to do your own servicing, and that's a new feeling for most of us with other rigs. Sure, they could have made it smaller, but why should they? This way, it's very neat and open and still of a reasonable size for desk or den. The rig is fully warrantied for one year, and the transistor finals are warrantied for five years on a *pro rata* basis!

Okay, you've heard the favorable impressions. What about the *bad* things, you ask? Well, there are a couple of things that aren't bad, but could be improved upon . . . and probably will be. They aren't serious, and might not even bother someone else—you, for example. But for the record, here they are.

There is no frequency memory. That is, there is no extra on-board selectable frequency that can be stored until needed. Frankly, I admit being lazy and have become used to some of the newer rigs with their keypad memory entry and recovery. I also missed the dual on-board vfo's provided by some of the rigs. This is convenient, and although not a requirement, sure is handy. Ten-Tec provides an optional external vfo for connection to the Corsair, and up until a few years ago, that would have been the epitome of luxury. Today, it's okay, but not state-of-the-art. Nevertheless, the DX operator will want his external vfo for split-band operation.

Next, I do a fair amount of shortwave listening and really appreciate general coverage in a receiver. It's true that this is a communications transceiver and is not intended to have all the bells and whistles, but when you have a basic rig this good, you'd like to have it cover some of the SWL bands, too. I also missed having an AM reception position on the mode switch. Frankly, I don't give a hoot for transmitting AM anymore, but I do like to listen to BBC or Deutsche Welle occasionally without having to zero-beat their carriers to recover audio. Nit-picking, sure; I know.

Finally and most bothersome to me was an essential feature that did not meet my expectations: the tuning vernier. It felt rubbery and I think it has a teeny bit of backlash. It left me with the impression that it might creep after being set on a frequency. It turns a tad easier clockwise than it does counterclockwise, so I checked with the boys at Ten-Tec and they tell me this is easily corrected by a dial adjustment . . . it's purely mechanical and the function of alignment during assembly. Great! I'm happy to hear that this isn't the way all Corsairs behave. Yours will probably be perfect in this respect. The only reason I noticed it is that some of the comtemporary rigs have such silky-smooth tuning that one quickly comes to expect it in *all* rigs. In possible defense of dial friction is the undeniable fact that it isn't as easily knocked off frequency or inadvertently shifted. However, a dial lock is the solution to that problem.

In summary, while the Corsair lacks a few bells and whistles, it sure has *performance* aplenty.

The suggested retail price at $1169 is ballpark for a rig that has all these good points; the external power supply is available at $199 for the deluxe model with a front-radiating speaker and $169 for the utility supply without speaker. If you want more than the nominal 2.4-kHz selectivity, you will have to specify extra crystal filters when ordering your Corsair. These are available for 1.8 kHz (SSB) and 500 and 250 Hz (CW and RTTY). They all fit into the rig and can be selected when needed. This is an improvement over some of the newer rigs where you have to choose only one of the three for use in addition to the standard one supplied. Many hams don't need and wouldn't want the narrow filters anyway, so it's logical to offer them as options.

All in all, I like the Corsair and would probably be happy with it in my shack as an only transceiver. When it comes to sheer operating ability, the Corsair will probably hold its own against anything available today. It's rugged, honest, easy to use, and nice to look at . . . besides which it sounds great on the air. Its sensitivity, selectivity, dynamic range, and resistance to front-end overload are superior . . . and it stays put on the frequency of your choice.

Whether or not the Corsair is your cup of tea depends on what you rate as desirable features and what you like in a rig . . . but after all, that's what makes horse races and amateur radio fascinating.

For more information, contact *Ten-Tec, Inc., Sevierville TN 37862.*

Jim Gray W1XU
***73* Staff**

DOVETRON'S WIDGET

In this era of expensive, state-of-the-art rigs and microprocessor-controlled transceivers, there is still room for useful gadgets. Dovetron has recognized this largely unsatisfied need with the introduction of a new, simple gadget, appropriately named the Widget.

The Widget is designed to alleviate one problem which has accompanied the increasing miniaturization of 2-meter transceivers—that of low-quality audio reproduction. When so much is compressed into a small space, there is little room left for the speaker, and it is usually placed in a position better suited for the heater fan to hear than the driver. However, with the Widget, you can listen to your 2-meter radio through the in-dash AM radio and benefit from the higher fidelity as well as the larger speaker size and better placement.

The Widget takes the receive audio output of your transceiver and retransmits it at the low end of the broadcast band. You then tune your radio to the appropriate frequency and capture the low-power signal.

Connection of the Widget is simple—you just plug it into the external speaker jack of your mobile rig and unwind the enclosed wire antenna to ensure good pickup. The cable included with the Widget has a subminiature plug on one end, which is standard for most mobile radios. The antenna is not always necessary, and it can be unplugged from the back of the device. I found that with my mobile installation, the transceiver and the radio were close enough that I did not need the antenna. No power connection is necessary; the Widget rectifies part of the incoming audio to power the circuit.

The circuit is housed in a small (about 2 by 1 by ½ inches) sturdy black box with an LED on one end. The LED signifies that the Widget is receiving a signal and indicates the relative signal level. The box is made of high-temperature plastic designed for year-round exposure in an automobile, and the PC board is made of epoxy-glass FR4. It includes an audio high-pass filter to limit the bass characteristics; the tone may also be controlled by the AM radio.

But why let the uses of the Widget stop with that? The circuitry can be powered by miniscule audio output, so use with a handie-talkie is feasible. If your handie-talkie also doubles as a mobile rig, the Widget will make marginal contacts much easier.

With the antenna fully extended, I found that the Widget has a range of 40 or 50 feet, which gives it some usefulness around the home. You could hook it up to the HF rig and use a cheap portable radio to monitor the frequency, or connect it to the television set for remote listening. By hooking up the Widget to a high-fidelity AM receiver, it could also be used to improve the audio quality of small tape recorders or other portable radios.

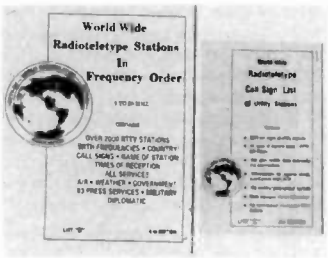
Unfortunately, the Widget is crystal-controlled, which gives it good stability but prevents the transmitter frequency from being moved to avoid interference from the commercial broadcast stations. I encountered this problem in the Boston area, where there is a station located near 530 kHz. This is the Widget's transmit frequency. Although the station was not directly on 530 kHz, my radio, like many other car radios, lacked the selectivity to reject the nearby station. Thus, the relatively low signal of the Widget was overrun by the station, making it unusable on that frequency.

However, the second and third harmonics, at 1060 and 1590 kHz, respectively, are also available at a slightly lower power level. In my case, the signal was strong enough to use one of the harmonics.

According to the specifications, the unit has a life expectancy of about 10 years. In addition, the nature of the Widget prevents it from becoming outdated—unlike a transceiver, small gadgets do not have to be state of the art. It comes with a 30-day warranty and may be repaired for a nominal fee within 90 days.

For further information, contact *Dovetron, Box 267, South Pasadena CA 91030; (213)-682-3705.* Reader Service number 488.

Avery L. Jenkins WB8JLG
***73* Staff**



RTTY CALLBOOKS

For anyone interested in RTTY, here are two books which are indispensable—*The World Wide Radioteletype Call Sign List* and *World Wide Radioteletype Stations in Frequency Order.* These books provide a vast amount of RTTY information in a minimum of space, and they have been designed for easy access and cross-referencing.

The RTTY station frequency list has 2,198 listings, a number which is continuously growing, according to the book's publisher Thomas Harrington W8OMV. Harrington collects his information from a variety of sources, including the ITU, the RTTY services themselves, and two dozen listeners he has stationed worldwide.

The book lists stations from 3 to 30 MHz in ascending frequency order. In addition to the frequency and callsign of the station, Harrington has included the station's location, the service it represents (if known), and any other information he has been able to collect. If the baud rate differs from the standard 50 baud, the different rate is noted.

The type of traffic each station handles is also noted. This will range from test slips such as "ry" or "the quick brown fox jumps over the lazy dog" to military traffic and weather bulletins.

Harmonic emissions of identified stations are listed as such, and their fundamental frequencies are also given. Harrington has included unofficial stations, those with callsigns not approved by the ITU, and other apparently underground transmissions. With each of these listings, the date a transmission from the station was last heard is given, as well as any other information obtained.

The language each station is transmitting is also identified, including Serbo-Croation. Similarly, stations transmitting in the Cyrillic alphabet or third-shift Cyrillic alphabet are also identified.

The back of the book contains a list of press service frequencies by country, service, and frequency. Another appendix lists stations transmitting meteorological data, and a third gives utility stations abbreviations and mnemonics.

The callsign list, although smaller than the frequency list, contains about 4,000 entries. In addition to the callsign, each entry includes the location and service of the station. Appendices offer further information, from a partial reproduction of ITU rules relating to station identification to a list of service and country abbreviations.

Not only does this book cover RTTY stations, but also it includes CW, weather, and satellite stations as well.

The callsign book provides a useful conjunct to the frequency list, in addition to carrying information not contained in the other book. It is especially useful because stations do not always remain on their posted frequencies, and the call letter book provides a rapid means of identifying them.

To facilitate merging these lists with additional information garnered by the user, neither book has been bound. Both lists are held together with staples, so the pages may be easily separated and placed into a loose-leaf binder or other notebook.

The amount of information contained in these books, as well as the amount of information transfer which they represent, is nothing short of fantastic. I did not realize until I began to peruse the lists how much information is accessible to the ham or SWL equipped with RTTY and a general-coverage receiver.

Imagine listening to weather bulletins from Kuwait, or military messages from El Salvadoran forces. Although the transmissions may be encoded or otherwise untranslatable, the material is available for your study.

The press frequencies listed would also appear to be an extremely valuable tool. A vast amount of filtering occurs in the world's newsgathering forces as the day's events are distilled into a half-hour newscast or a few columns of print. By tuning in the press frequencies, you can catch much of the news before it has become victim to the filtering process.

You need not worry about the information becoming very far out of date, either. Harrington updates his material three times a year in supplements to the main list. All of the entries have been positively verified before they can be listed in the books. Harrington's stringent requirements include verification of the station's existence by the station itself, by the ITU, or by three reports of the station from different sources or at different times.

My surprise upon seeing these lists may be likened to the feeling I had when I turned on a ham-band radio for the first time. There's a whole new world out there waiting to be explored, and these books are the key to it.

For further information, contact *Universal Electronics, Inc., 1280 Aida Drive, Reynoldsburg OH 43068; (614)-866-4605.* Reader Service number 484.

Avery L. Jenkins WB8JLG
***73* Staff**

AWARDS

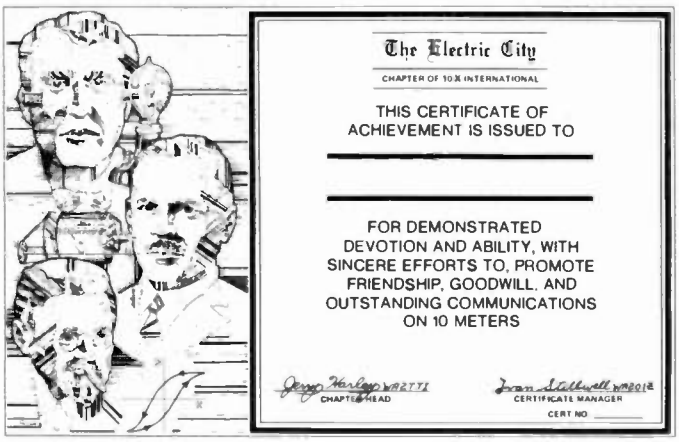
Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

THE ELECTRIC CITY CHAPTER OF 10-X INTERNATIONAL

Electric City is the nickname given to Schenectady, New York, because of the numerous electrical developments generated by the Edison General Electric Company, now the General Electric Company (GE). GE was founded in 1982 by the merger of the Edison General Electric Company and the Thomas Houston Company.

The design of this award certificate is based on three of the most famous people associated with the Electric City. As you have probably already recognized, Thomas A. Edison is the top picture and Charles P. Steinmetz is the bottom picture. The center picture is of Ernst F. W. Alexanderson, who is responsible for the design of the Fessenden alternator used at Brant Rock, Massachusetts.

To go back a little, Reginald Fessenden (physicist, inventor, and radio pioneer) of the National Electric Signaling Company believed in the possibility of developing smooth and continuous flow of high-frequency vibrations, which, at the time, was impossible with the intermittent spark-gap system then in use. He envisioned the idea of superimposing the human voice on the continuous flow of high-frequency vibrations in much the same manner as Alexander G. Bell had done on the direct current with the telephone. How to produce the high-frequency-vibration flow was the great problem. Believing that a generator might be built with this capability and being familiar with the high-frequency dynamo built by Elihu Thomson of GE, he contacted GE. In 1903 Steinmetz built a 10,000-Hertz alternator for Fessenden. The output of this alternator was a whopping 1000 Watts.



In 1904 Fessenden ordered an alternator capable of 100,000 Hertz. The order was assigned to a brilliant young engineer at GE—Ernst Alexanderson. The machine was completed and tested at 50,000 Hertz in the summer of 1906 and was delivered to Fessenden at Brant Rock. Its first demonstration deserves to go down in history as one of the great events in scientific annals. The demonstration, performed on Christmas Eve, 1906, is described as follows: Early in the evening, wireless operators on ships within a radius of several hundred miles sprang to attention as they caught the call "CQ CQ" in Morse code. Was it a ship in distress? They listened eagerly and, to their amazement, heard a human voice coming from their equipment—someone was speaking! Then, they heard a woman's voice in song. It was uncanny! Many of the operators called their officers to come and listen. Soon, the wireless rooms were crowded. Next, someone was heard reading a poem, then there was a violin solo. Then, a man made a speech, and they could understand most of the words. Finally, everyone who had heard the broadcast was asked to write to R. A. Fessenden at Brant Rock. This was how the first voice radio broadcast in history was transmitted.

Now you can understand why the Electric City chapter of 10-X International chose for their center picture a man whose picture is probably not recognized, but whose achievements in voice communications made possible the hobby and the way of life we now all enjoy.

To obtain the distinguished Electric City award, stations must accumulate a total of 50 points as well as work a minimum of three 10-X International chapters. Five points are scored for CH plus CM. C equals four points, HC plus L is three points, FS plus DX is two points, and all others are one point.

Forward a list of your contacts and be sure to include the 10-10 number for each station worked. Enclose $1.00 plus two US first-class stamps; DX stations enclose $2.00 in US funds.

For further information about this awards program or to submit an award application, address your correspondence to: Ivan Stillwell WA2OIZ, 18 Englehart Drive, Scotia NY 12302

TWO-LETTER CALL WAS

Representing the Heart of America Radio Club, Inc., out of Kansas City, Missouri, comes this Worked All States award announcement from our good friend, A. Hoogenraad WBØRAF.

To qualify for the Two-Letter Call Worked All States award, the applicant must work one two-letter callsign in each of the fifty US states. Two-letter calls would be, for example, WØRR, AKØA, KBØVL, etc. In short, any call with two or less characters in the suffix qualifies as a good contact.

To apply for this award, prepare a list of contacts in alphabetical order by state, giving the callsign, date worked, band, mode, and state. Have your list of contacts verified by two amateurs or any club secretary. Send a $2.00 (US funds only) award fee to: Adrianus Hoogenraad, 7204 E 28th Street, Kansas MO 64129.

WORKED LAEN P AWARD

The Boras Amateur Radio Society of Sweden is proud to announce the Worked All Laen P award. This award is available to licensed amateurs and SWL stations worldwide.

To be valid, all contacts must be made

on or after January 1, 1980. Applicants may utilize any band or mode; however, repeater contacts such as those made on 10-meter FM are invalid.

Scandinavian countries must work and confirm 25 different stations in Laen P Sweden. Other Europeans must work 15 different stations, while stations outside the European continent must work a minimum of five different stations in Laen P Sweden.

GCR applies. Forward your verified list of contacts to: Lars Lind SM6NT, Ekesund S-520 11, Vegby, Sweden. Enclose $2.00 (US) or ten IRCs.

THE DX LONG CHAT HAM

This award is sponsored by the Long Chat Ham Club in celebration of its sensational start. All the club members prefer a long QSO with DX stations rather than a short contact. The DX-LCHA is issued for confirming contacts with five foreign ham stations for more than fifteen minutes each.

For the award, send your application, GCR, or log, certified by a local radio club or two other amateurs, with four IRCs to: Award Manager Aki Kogure JG1UNE, Charme #303, 5-37-5 Denenchofu, Ohta-ku, Tokyo 145, Japan. Be sure your application clearly indicates the beginning and ending time of each contact made.

ISLE OF EIGHT FLAGS AWARD

Representing the only location in the United States governed under eight flags, Vance LePierre W5IJU writes to share with us the Isle of Eight Flags award. As they appear on the certificate, they include France (1562-1597), Spain (1597-1735, 1748-1763, and 1783-1821), Great Britain (1736-1748 and 1763-1783), the Patriot's Flag of 1812, the Green Cross of Florida (1817), Mexico (1817), the Confederate Flag (1861-1862), and the US Flag (1821).

To qualify, the applicant must work any two stations on Amelea Island Florida on or after January 1, 1975. You may use any band or mode. Submit log data and $2.00 or eight IRCs to: Vance LePierre, 2618 McGregor Blvd., Fernandina Beach FL 32034.

JUMBUNNA AWARD

Chris Levingston VK3AOR, from Kilsyth, Australia, writes to tell us about an award dedicated to the Australian Novice.

The award requires the applicant to work and confirm a minimum of 15 VK3 Novice stations. Prepare a list of qualifying contacts in order by their callsign, giving the date, time, band, and mode of communications. Have this list verified by at least two amateurs or a radio club official. The cost of this award is $3.00 or 12 IRCs. Send your application to: Chris Levingston VK3AOR, 2 Acacia Avenue, Kilsyth, Victoria, Australia 3137.

By the way, VK Novice stations are identified by the suffix N, V, P, or K. The K suffix denotes a combined Novice and limited license holder. These stations are permitted CW on 3.525-3.625 MHz, 21.125-21.200 MHz, and 28.100-28.600 MHz. They are limited to ten Watts dc of power. On SSB, Australian Novices may operate thirty Watts PEP on 3.500-3.625 MHz, 21.150-21.100 MHz, and 28.300-28.600 MHz.

THE BEST LITTLE DXPEDITION IN TEXAS

Chartered under the laws of amateur radio camaraderie and brotherhood, the Texas Independent Telegraphers Society is proud to announce the Best Little DXpedition in Texas on the weekend of March 12-13, 1983. Members and friends of the society will be operating from LaGrange, Texas, the location of the famous Chicken Ranch.

For those hams who need a peck of Texas history, the Chicken Ranch represents the oldest institution in Texas. It became a part of Texas folklore when it was exploited by a Houston newscaster who projected it into the living rooms and political backrooms of Texas. It became nationally famous when used as the setting for a Broadway musical and a Hollywood movie.

Now, radio amateurs of the world will have an opportunity to work the home of the Chicken Ranch. Using the callsign, W5VD (very distinctive), the station will operate from 1200Z March 12th until 1800Z March 13th. Depending on the band conditions and the time of day, prime frequencies will be 7.280, 14.280, and 21.380 MHz. CW frequencies will be 7.100, 14.050, and 21.100 MHz with period excursions into the Novice band. Special certificates and QSL cards will be available to those who work the Chicken Ranch special-event station. QSL to W5VD, PO Box 3225, Bryan TX 77801. Hope to pluck you from the pileup.

SOUTHWIRE COMPANY

The Southwire Employees Amateur Radio Society (SWEARS), based in Carrollton, Georgia, announces that the second annual SWEARS anniversary special-event station will be activated on March 26, 1983, to honor the 33rd anniversary of the parent company's (Southwire Co.) first production of wire. Specially-designed QSL cards will be awarded.

Plans call for operation on 14.270 (± 10 kHz), 21.345 MHz (± 10 kHz), and 28.600 (± 10 kHz). Novices should check the first 10 kHz of the 15- and 10-meter bands. Operation will likely not be continuous on all bands, so check all frequencies. For further information, contact: Terry Martin WD4AON at (404)-832-5375.

ELMER OF THE YEAR

Francis C. Leonard W2NPT was chosen as QCWA's Northern New Jersey Chapter's "Elmer of the Year" by a committee which included such prominent local amateurs as George Diehl W2IHA, newly elected director of the Hudson Division of the ARRL, Curtis Williams W5DTR/2, section communications manager of the Northern New Jersey Section, and Joseph Painter W2BHM, head of the W2 QSL Bureau.

W2NPT, a founder and past president of the Fairlawn, New Jersey, Radio Club, has devoted most of his time for the past 20 years to helping new and would-be hams—old and young, boys and girls—obtain their tickets and get on the air. His basement ham shack continues to be a haven for hatching new ham ops.

HAM HELP

I need the service manual and schematic for a Hammarlund HQ-145 and a Galaxy V transceiver. I would prefer the original, but a copy is OK.

Henry Galbraith W9RDJ
1214 S. Alvord Blvd.
Evansville IN 47714

I am looking for RTTY software to use in conjunction with my TRS-80 model I and the Micro Modem, which I built from plans which appeared in the September, 1982, issue of *73*. Any assistance would be greatly appreciated.

William Eyler, Jr.
454 Kent Ave.
Catonsville MD 21228

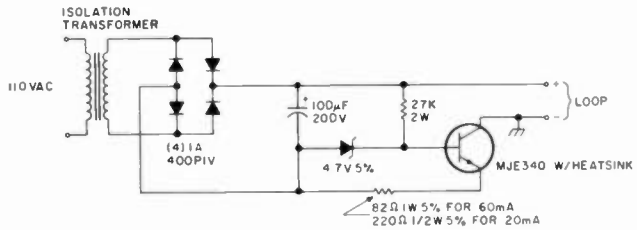
I would like to purchase a copy of the *CQ Surplus Conversion Manual* and the manual for a Hammarlund HQ-110A receiver.

Richard McCubbin WD8RQH
Box 65
Mulliken MI 48861-0065

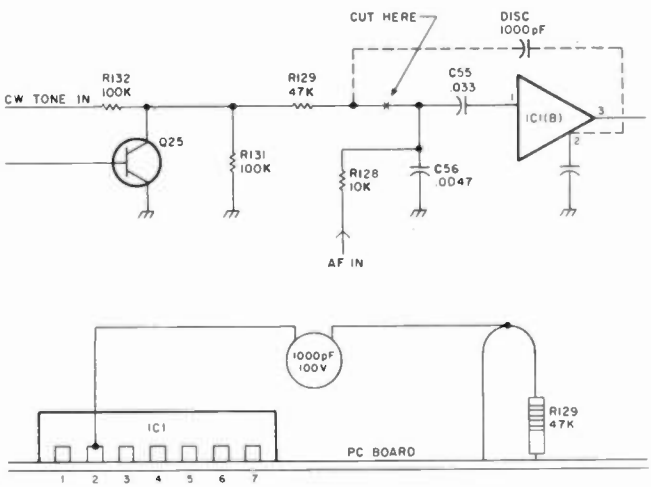
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices,* 73 Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*

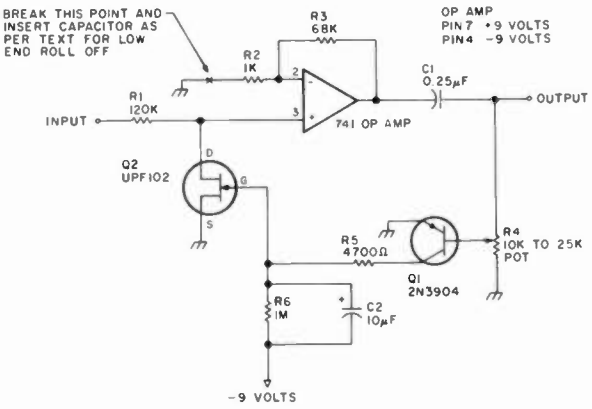


RTTY CONSTANT-CURRENT LOOP SUPPLY: This supply provides a constant 60 mA or 20 mA, regardless of the resistance in the loop. The supply's current is determined by the value of the resistor coming out of the MJE340 transistor.—Al McKenna WB6BSP, Healdsburg CA.

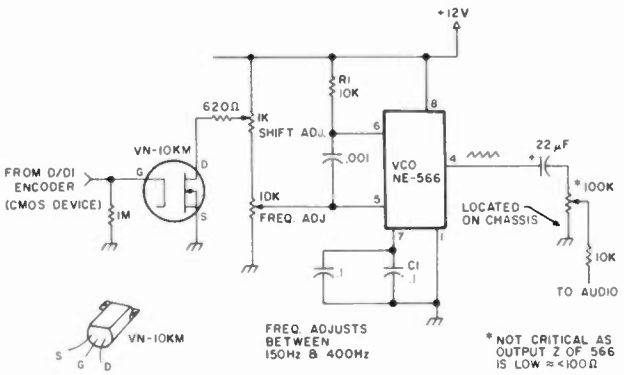


ICOM 720A CONVERSION: This simple change makes the CW sidetone volume independent of the af gain control. All you have to do is cut the top loop on R129 and solder a 1000-pF disc capacitor from R129 to pin 2 of IC1. You can reach the parts through the access cover.—Peter Wiggin ZS6ARW, Alberton, South Africa.

LOW-POWER AND RETRIGGERABLE TIMERS FROM NAND GATES: Fig. 1 shows a simple one-shot timer which is not retriggerable and, unlike some timers, is not affected by a steady signal on the trigger. This timer costs less than those using a 555, and it also has complementary inputs and outputs. The quiescent current drain is less than 100 nanoamperes, and the circuit can sink or source about 0.5 mA while operating from 3 to 15 volts. Although this circuit cannot directly drive a relay, it is useful for driving more logic. The upper limit on the time period is limited by the quality of capacitor used, with about 10 minutes being the limit for most junk-box electrolytics. Fig. 2 shows a simple retriggerable timer. The output of this one is normally a low, going high upon a low trigger. The output time will be extended each time the input is triggered low. Don't forget to tie the inputs of all unused gates to + Vcc. The values of R1 and C1 will determine the timing on both circuits. The formula 0.8RC will give an approximation of the time in seconds.—Craig Crichton K7UKW, The Dalles OR.



GENERAL-PURPOSE LIMITER: The FET is used as a variable resistor forming part of a voltage divider across the input of the 741 op amp. Q1, which is fed through the pot hanging on the output of the 741, does not begin to conduct until the negative cycles of the output reach about .6 V. The rectified voltage is applied to the FET, causing its resistance to vary with the voltage. When the circuit reaches its limit, the gain is greatly reduced. To set the circuit up, apply 20 mV of tone to the input while measuring the output. Adjust R4 until the gain just starts to drop. And to roll off the low end, put a .25-mF capacitor between R2 and ground.—Allan Joffe W3KBM, Dresher PA.



VCO-DECODER INTERFACE: This circuit matches a garage-door-opener encoder/decoder chip to an NE566 vco. It provides proper matching between the CMOS device and the vco as well as a shift adjustment. The 10k pot adjusts the frequency between 15 and 400 Hz.—William Desnoes W2HBC, Oneida NY.

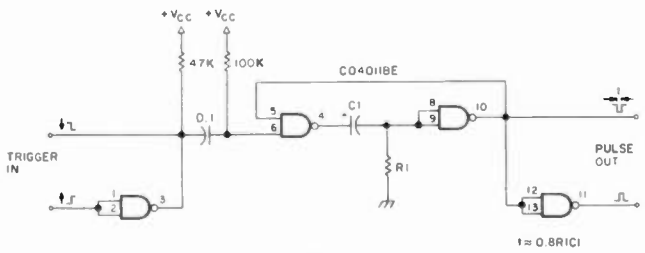


Fig. 1.

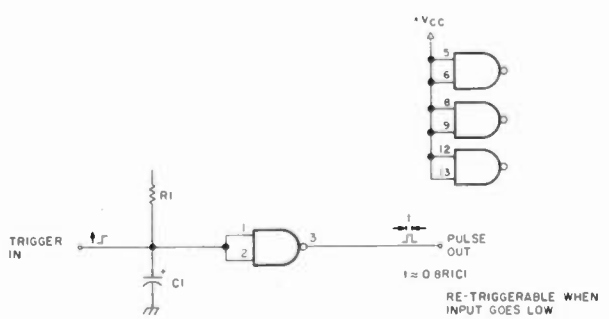


Fig. 2.

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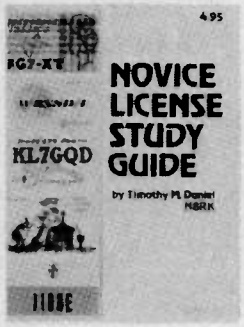

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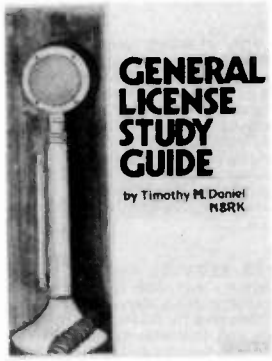

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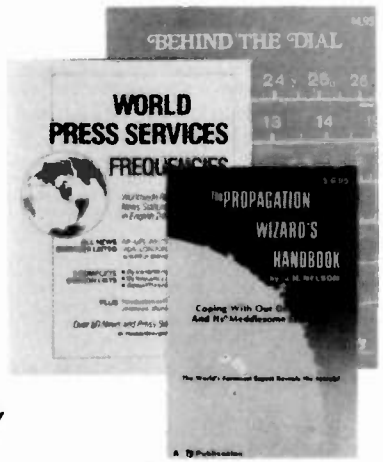

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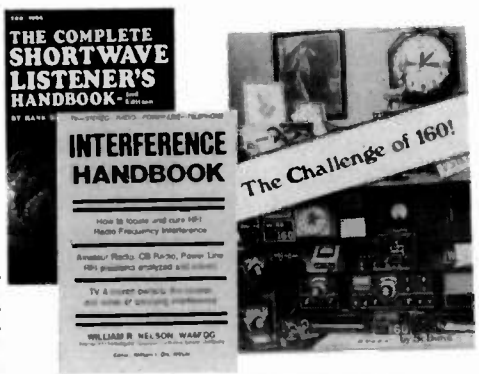

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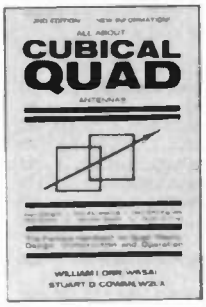

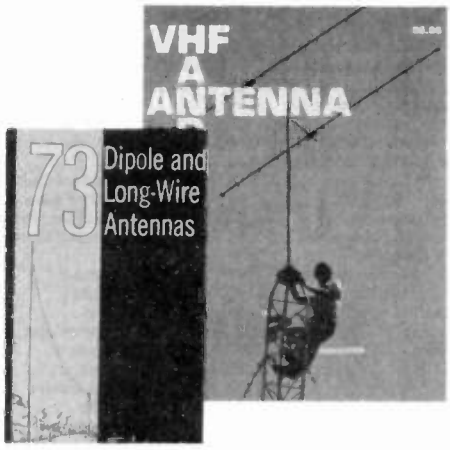

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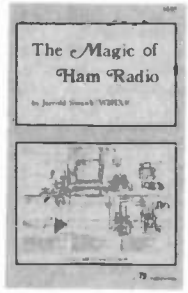

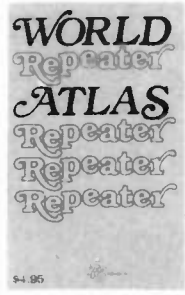

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R.S. No.		Page
2	AEA/Advanced Electronic Applications	48, 85
486	AEA/Advanced Electronic Applications	104
115	*A5 ATV Magazine*	129
164	A&W Productions	22
448	Advanced Communications International	81
124	Advanced Computer Controls	55
*	Alaska Microwave Labs	49
20	All Electronics	130
216	Alden Electronics	21
*	Amateur Electronic Supply	23, 95
5	Amateur-Wholesale Electronics	45, 73
487	Amateur-Wholesale Electronics	104
169	A. P. Systems	91
213	API Electronics	40
329	AR Technical Products	38
*	Associated Radio	57
*	Autek Research	89
*	Auto Connect	5
469	BG Carl Electronics	91
11	Barker & Williamson, Inc.	31
305	Barry Electronics Corp.	41
157	Boman Industries	29
223	Britt's Two-Way	40
226	Buckmaster Publishing	65, 95
*	Butternut Electronics Corp.	89
187	Call Letter Hats	116
102	Centurion International	4
89	Clutterfree Modular Consoles	61
163	Com-Rad Industries	129
382	Communications Concepts, Inc.	72
*	Communications Design	91
462	Communications Electronics Specialties, Inc.	14
482	Communications Electronics Specialties, Inc.	122
15	Communications Specialists	67, 82
222	Computer Applications	85
*	Connect Systems	5
190	Control Products Unlimited	123
21	Current Development Corp.	45
106	Cushcraft Corp.	13
346	Data Service	93
*	Dayton Hamvention	56
312	Daytapro Electronics	14
*	DGM Electronics, Inc.	56
225	Digi Com Engineering, Inc.	48
57	Discount Ham Radio	65
425	Doppler Systems	51
479	Dotronix, Inc.	121
488	Dovetron	107
219	E-Tek	129
453	EGE, Inc.	49, 123
*	Electronic Equipment Bank	69
447	Electronic Hobby Innovations	93
146	Electronic Rainbow Industries, Inc.	62
481	Electronic Specialists, Inc.	121
400	Engineering Consulting Service	130
22	Fair Radio	129
85	Faxscan, Inc.	50
218	Ferritronics	44
23	Fiesher Corp.	30
323	Fox-Tango Corp.	49, 61
178	Galaxy Electronics	129
*	Gilfer Shortwave	91
*	GFS Electronic Imports	129
143	GLB Electronics	45
195	Goldsmith Scientific Corp.	85
132	Grand Systems	63
31	Hal-Tronix	56
485	Hal Communications	121
*	Ham Radio Center	9
*	Ham Radio Outlet	3
33	Hamtronics, NY	142, 143
476	Hamtronics, NY	120
460	Handi Tek	130
303	Heath Co.	75
320	Hoosier Electronics	72
*	Hustler, Inc.	69
*	ICOM	Cov. II, 35
78	Independent Crystal Supply	129
445	Instant Software Amateur Radio Program	125, 127
36	International Crystal	48
*	IRL	71
39	Jan Crystals	50
209	Jarr Corp.	22
*	JK Audio	93
*	Jun's Electronics	51
*	Kantronics	40
*	Kenwood	Cov. IV, 7, 121
*	KLM Electronics	81, 120
204	Lacombe	63
322	Larsen Antenna	37
214	A. Lascurain	115
*	Liberty Electronics	130
220	Lunar Electronics	130
77	M-Squared Engineering, Inc.	61
44	Macrotronics, Inc.	62
45	Madison Electronics	69
134	Martin Engineering	93
47	MFJ Enterprises	39, 61, 63, 65
480	MFJ Enterprises	120
48	MHz Electronics	132-141
51	Microlog	24, 25
*	Mirage Communications	77
318	National Comm. Group Co.	57, 72
412	Nemal Electronics	123
483	Non-Linear Systems	120
137	Nuts & Volts	130
*	*Orbit* Magazine	57
*	P. C. Electronics	93
*	Palomar Engineers	4, 72
159	Parsec Communications	129
201	Pegasus Electronics Ind.	91
182	Peterson Electronics	130
61	Radio Amateur Callbook, Inc.	30
397	Radio World	89
62	Ramsey Electronics	131, 145
156	RF Electronics	45
171	Ridge Systems Co., Inc.	50
133	Rivendell Associates	115
418	Rolin Distributors	72
150	Royal	123
477	Royal	121
65	S-F Amateur Radio Services	85
500	*73* Books	84, 111-114, 123, 126, 128
	73 Dealer Ad	128
	73 Moving	128
	73 Subscriptions	83, 95
	73 University Microfilms	95
*	Simple Simon Electronics Kits	68
*	Spectronics	144
68	Spectrum Communications	16, 17
436	Spectrum International, Inc.	116
173	Spider Antenna	95
*	Telex Communications	15
224	Teltone	130
478	Teltone	121
*	Ten-Tec, Inc.	79, 105
*	The Antenna Bank	50
118	The Blacksburg Group	31
449	The Ham Shack	51
205	The Metheny Corp.	129
57	The Tuned Antenna	31
104	Trionyx	55
484	Universal Electronics	108
*	V-J Products, Inc.	63
*	Van Gorden Engineering	49
311	Vanguard Labs	130
200	Votuc Communications	93
*	W9INN Antennas	115
302	W-S Engineering	89
80	Western Radio Electronics	91, 95
83	Yaesu Electronics	Cov. III

73

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		OSCAR 8		RS-5		RS-6		RS-7		RS-8		
	Date	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Mar	1	0024	87	0124	140	0049	134	0135	143	0154	145	1
	2	0028	88	0119	140	0034	132	0125	142	0151	145	2
	3	0033	89	0114	140	0019	130	0115	141	0148	146	3
	4	0037	90	0108	140	0003	127	0106	140	0145	147	4
	5	0041	91	0103	140	0147	155	0056	139	0142	148	5
	6	0046	92	0058	140	0131	153	0046	138	0139	149	6
	7	0050	93	0052	141	0116	150	0037	138	0137	149	7
	8	0054	95	0047	141	0100	148	0027	137	0134	150	8
	9	0059	96	0042	141	0045	146	0017	136	0131	151	9
	10	0103	97	0036	141	0030	143	0008	135	0128	152	10
	11	0108	98	0031	141	0014	141	0157	164	0125	153	11
	12	0112	99	0026	142	0158	168	0148	163	0122	154	12
	13	0116	100	0020	142	0142	166	0138	162	0120	154	13
	14	0121	101	0015	142	0127	164	0128	161	0117	155	14
	15	0125	103	0009	142	0111	161	0119	160	0114	156	15
	16	0130	104	0004	142	0056	159	0109	160	0111	157	16
	17	0134	105	0158	173	0041	157	0059	159	0108	158	17
	18	0138	106	0153	173	0025	154	0050	158	0105	158	18
	19	0000	81	0148	173	0010	152	0040	157	0103	159	19
	20	0004	82	0142	173	0153	180	0030	156	0100	160	20
	21	0008	83	0137	173	0138	177	0021	155	0057	161	21
	22	0013	85	0132	173	0122	175	0011	154	0054	162	22
	23	0017	86	0126	174	0107	173	0001	153	0051	163	23
	24	0022	87	0121	174	0052	170	0151	182	0048	163	24
	25	0026	88	0115	174	0036	168	0141	181	0046	164	25
	26	0030	89	0110	174	0021	166	0132	181	0043	165	26
	27	0035	90	0105	174	0005	163	0122	180	0040	166	27
	28	0039	91	0059	175	0149	191	0112	179	0037	167	28
	29	0043	93	0054	175	0133	188	0103	178	0034	167	29
	30	0048	94	0049	175	0118	186	0053	177	0031	168	30
	31	0052	95	0043	175	0103	184	0043	176	0029	169	31
Apr	1	0057	96	0038	175	0047	181	0034	175	0026	170	1
	2	0101	97	0033	175	0032	179	0024	174	0023	171	2
	3	0105	98	0027	176	0016	177	0014	173	0020	172	3
	4	0110	99	0022	176	0001	175	0005	173	0017	172	4
	5	0114	100	0017	176	0144	202	0154	202	0014	173	5
	6	0119	102	0011	176	0129	200	0145	201	0012	174	6
	7	0123	103	0006	176	0113	197	0135	200	0009	175	7
	8	0127	104	0001	177	0058	195	0125	199	0006	176	8
	9	0132	105	0155	207	0043	193	0116	198	0003	176	9
	10	0136	106	0149	207	0027	190	0106	197	0000	177	10
	11	0141	107	0144	207	0012	188	0056	196	0157	208	11
	12	0002	83	0139	207	0155	216	0047	195	0154	209	12
	13	0006	84	0133	208	0140	213	0037	194	0152	210	13
	14	0011	85	0128	208	0124	211	0028	194	0149	211	14

AMATEUR SATELLITE NEWS

Soviet Telemetry Update

Russia's RS (Radio Sputnik) amateur satellites continue to transmit a steady stream of telemetry data. Since I last discussed RS telemetry in this column (*73*, Sept., 1982, p. 140), new interpretations of some data items have come to light. Table 1 is a revised list of the 35 RS telemetry items and the equations for decoding the raw numbers into interesting information about the spacecraft.

All RS telemetry is transmitted in Morse code at speeds from 15 to 25 words per minute. When the satellites are in range, virtually any 10-meter receiving installation should be capable of hearing the transmissions. Table 2 gives the telemetry beacon frequencies for all six of the RS satellites. It's easy—give it a try!

Thanks to *Amateur Satellite Report* for the updates.

The Home Stretch

The second half of April—probably the 21st—is now the scheduled date for the launch of the AMSAT Phase IIIB amateur satellite. If the launch takes place as planned, it will occur a little less than three years after the ill-fated attempt that sent the Phase IIIA satellite to the bottom of the Atlantic.—Jeff DeTray WB8BTH, Assistant Publisher, *73*.

Prefix	Interpretation
K	0.2 × N = output power of transponder in mW
D	N × 0.2 = voltage of main power source
O	20 × (100 – N) = charge current in mA
G	Service parameter; usually = zero (00)
U	Gas pressure of sealed system; equation unknown
S	N = temp. of voltage regulator (Celsius)
W	N = temp. of transmitter cooling fins (Celsius)
IK or SK	Same as K
ID or SD	Telemetry baseline; usually = zero (00)
IO or SO	0.2 × N = output power of beacon in mW
IG or SG	When N = 10 ± 1, a 10-dB attenuator is in line with main receiver front end
IU or SU	0.1 × (N – 10) = relative S-units, main receiver
IS or SS	0.1 × (N – 10) = relative S-units, robot receiver
IW or SW	0.1 × (N – 10) = relative S-units, command receiver
NK or RK	Same as K
ND or RD	50 × N = solar panel current in mA
NO or RO	2.7 × (N – 26) = temp. of 1st solar panel (Celsius)
NG or RG	2.7 × (N – 26) = temp. of 2nd solar panel (Celsius)
NU or RU	2.7 × (N – 26) = temp. of 3rd solar panel (Celsius)
NS or RS	0.8 × (N – 5) = temp. of structure (Celsius)
NW or RW	0.8 × (N – 5) = temp. of hermetically-sealed casing
AK or UK	Same as K
AD or UD	0.1 × N = voltage of transponder 9-volt line
AO or UO	0.1 × N = voltage of transponder 7.5-volt line
AG or UG	0.1 × N = voltage at first 9-volt stabilizer
AU or UU	0.1 × N = voltage at first 7.5-volt stabilizer
AS or US	0.1 × N = voltage at second 9-volt stabilizer
AW or UW	0.1 × N = voltage at second 7.5-volt stabilizer
MK or WK	Same as K
MD or WD	N = # of QSOs made by robot (occasionally reset to zero by ground controllers)
MO or WO	N × 0.1 = power consumption of heating system in Watts
MG or WG	N × 20 = input power of robot transmitter in mW
MU or WU	N × 20 = input power of service channel in mW
MS or WS	When N = 10 ± 1, a 10-dB attenuator is in line with the robot receiver front end
MW or WW	When N = 10 ± 1, a 10-dB attenuator is in line with the service receiver front end

Table 1. RS telemetry channel prefixes and their meanings. N is the two-digit number sent after the prefix. Where two prefixes are given, the first is used when the service (or command) channel aboard the satellite is not active. The second is used when the service channel is active, indicating the satellite is under command by ground controllers.

Satellite	Frequencies (MHz)	Satellite	Frequencies (MHz)
RS3	29.321, 29.401	RS6	29.411, 29.435
RS4	29.360, 29.403	RS7	29.341, 29.501
RS5	29.331, 29.452	RS8	29.461, 29.502

Table 2. RS beacon frequencies.

✓See List of Advertisers on page 114

FUN!

John Edwards KI2U
78-56 86th Street
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POTPOURRI

Potpourri! As our readers in F-, VY-, HH-, FS-, FR-, FM-, and FG-lands undoubtedly know, the word signifies a medley of various items. And that's what this month's Fun! is, a grab bag of questions on topics spanning the entire spectrum of amateur-radio activity. Think you're an amateur-radio renaissance man? Give this month's puzzlers a try.

ELEMENT 1—MULTIPLE CHOICE

1) From 1978 to 1979, a person claiming to be a lawyer threatened to take away all of our bands and give them to CB. Can you remember this generous chap's name and the organization he purported to represent?
   1) Richard Cooper and the Communications Attorney Service
   2) Harry Dannals and the American Radio Relay League
   3) Jon Ingram and the Citizen's Radio Coalition
   4) David Simpson and the Committee for Fair Communication

2) Remember that Jack Anderson column a few years back? You know, the one that claimed hams were controlling just about everything in Washington from the FCC to the Pentagon. Well, can you name the US Representative who gave Scoop Anderson his story?
   1) Claude Pepper of Florida
   2) Tip O'Neill of Massachusetts
   3) Elliott Levitas of Georgia
   4) Fred Richmond of New York

3) Roy Neal K6DUE hosted the films "The World of Amateur Radio" and "Moving Up to Amateur Radio." Can you name the narrator of "Ham's Wide World"?
   1) Walter Cronkite K2IBE
   2) Arthur Godfrey K4LIB
   3) Dick Van Dyke WJ6L
   4) Phil Donahue KE9UF

4) Which of the following amateurs is not a Westlink anchorman?
   1) Jim Davis KU8R
   2) Alan Kaul W6RCL
   3) Burt Hicks WB6MQV
   4) Stan Martin WA2DCS

5) A number of years ago, there was an amateur-radio column written in broken English supposedly by an oriental writer. Name the "author" and the magazine.
   1) Scratchi, in *CQ*
   2) Itchy, in *QST*
   4) Ching Chow in *Ham Radio Horizons*
   5) Hong Wouff in *73*

ELEMENT 2—TRUE-FALSE

	True	False
1) A ham was involved in the production of the movie "E.T.—The Extra Terrestrial."™	___	___
2) The first ham to operate from orbit was Neil Armstrong aboard *Gemini 6*.	___	___
3) In 1982, the Soviet Union launched two amateur Iskra satellites from the Solyut 7 space station. The word Iskra means "peace."	___	___
4) Ken Sessions K6MVH wrote the very first book dealing with ham repeaters.	___	___
5) A famous DXer is known by the name of Dr. DX.	___	___
6) At the relatively tender age of 22, James Hendershot WA6VQP was the youngest person ever to serve as the head of a repeater coordination council.	___	___
7) Joseph Merdler N6AHU is the current president of the Personal Communications Foundation.	___	___
8) A few years back, a novel that inlcuded ham radio as an integral part of its plot not only hit the best sellers list, but also was turned into a TV movie.	___	___
9) King Juan Carlos of Spain is a ham.	___	___
10) Queen Elizabeth of England is a ham.	___	___

ELEMENT 3—SCRAMBLED WORDS

Unscramble these terms and slangs relating to ham radio.

BUST	ETADOMLU	RETME
NCTOLREEA	EKY	DNAB
KIME	CORK	GLSU
RETHE		

ELEMENT 4—ALPHABET GUESS

Complete the words below by placing letters of the alphabet on every dash. Use each letter only once. The letter "Z" isn't used.

A B C D E F G H I J K L
M N O P Q R S T U V W X Y

1) _ I _ D E
2) _ O T _ _ T _ O M E _ E _
3) _ O U L E
4) _ _ _ _ _ G U I D E
5) Y O _ E
6) D U P _ E _
7) _ T U _
8) _ A R R I E R
9) _ R E _ _ E N C _
10) _ A _

THE ANSWERS

Element 1:

1—1 He's now believed to be living south of the border.
2—3 Still in Congress, but probably has found other ways to fish for votes.
3—2 Seems like old times just thinking about that film.
4—4 Stan's probably the missing "link."
5—5 Think ol' Scratchi ever got paid?

Element 2:

1—True Indirectly, anyway. Henry Feinberg K2SSQ designed the little alien's space communicator.
2—False As of yet, no ham has ever operated "spaceship mobile." That may change later this year, though, when Dr. Owen Garriott W5LFL is scheduled to take an HT aboard the shuttle.
3—False Spark.
4—True Not an easy question.
5—True A name given to him by Westlink's Alan Kaul.
6—True You read it here first.
7—True A much-needed and under-appreciated organization.
8—True "The French Atlantic Affair," by Ernest Lehman K6DXK.
9—True I've yet to work him, though.
10—False Not yet.

Element 3:

Stub, tolerance, mike, ether, modulate, key, rock, meter, band, slug.

Element 4:

1—DIODE, 2—POTENTIOMETER, 3—JOULE, 4—WAVEGUIDE, 5—YOKE, 6—DUPLEX, 7—STUB, 8—CARRIER, 9—FREQUENCY, 10—HAM.

SCORING

Element 1:

Five points for each correct answer.

Element 2:

Two and one-half points for each correct answer.

Element 3:

Two and one-half points for each word unscrambled.

Element 4:

Two and one-half points for each word completed.

Potpourri literally translates to "rotten pot." How rotten are you?

1-20 points—Rancid
21-40 points—Green around the gills
41-60 points—Slightly sour
61-80 points—Fresh as a daisy
81-100 points—Prime condition

Special thanks for this month's column go to Bill Pasternak WA6ITF (of *73*'s "Looking West" fame), who provided many of the trickier questions.

CORRECTIONS

Builders of the "Keyer on a Shoestring" (*73*, November, 1982, page 104) should note that the Radio Shack 276-2008 transistor specified for Q1 is no longer available. An appropriate substitute is the Radio Shack 276-2061 or Motorola MPSA42. When using these transistors, the resistor connected to the base of Q1 should be changed from 2.2k to 1k.

Jeff DeTray WB8BTH
***73* Staff**

Radio Shack recently introduced a new style of 10-uH choke which affects all of the coils in *73*'s series of Fun-Gear articles. Those articles were "The Fun-Mitter—A Goof-Proof Rf Project," Feb., 1981; "The Fun-Ceiver," July, 1981; "The Fun-Oscillator," Feb., 1982; "The Fun-Amp," May, 1982; and "Fun-Equipment Revisited," Jan., 1983.

The new Radio Shack choke can be identified by a smaller body, fewer turns (a total of 22), and the part number 273-101A. These new chokes will operate fine, provided the correct number of turns are removed. Table 1 shows the number of turns that must be removed from the full choke.

Mark Oman WA0RBR
Ft. Collins CO

Fun-Mitter

	L1	L4
80m	5 (8.4 uH)	14 (2.4 uH)
40m	0 (10 uH)	17 (1.2 uH)
20m	13 (2.8 uH)	18 (.6 uH)
15m	17 (1.2 uH)	19 (.4 uH)

Fun-Amp

	L2	L3
80m	10 (4.7 uH)	7 (6.2 uH)
40m	13 (2.9 uH)	10 (4.3 uH)
20m	18 (1.0 uH)	17 (1.4 uH)
15m	20 (0.5 uH)	18 (1.0 uH)

Fun-Ceiver

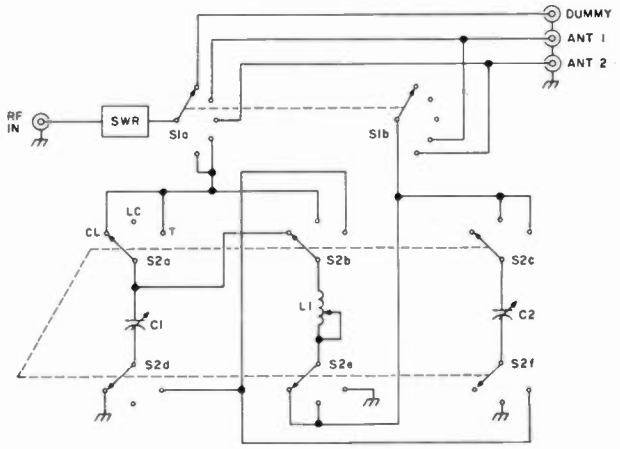
	L2, L3	L4
80m	5 (8.4 uH)	0 and 7 (16.2 uH)
40m	0 (10.0 uH)	7 (6.2 uH)

Fun-Oscillator

	L1
80m	0 and 7 (16.2 uH)
40m	7 (6.2 uH)

Table 1. Correct dimensions for Fun-Gear coils.

"A Tuner for Antenna Fanatics," which appeared in the November, 1982, issue, contained an incorrectly-drawn schematic. The switching system in Fig. 1 on page 42 should be wired as shown here. The only component change necessary is the substitution of a 6-pole switch for the 5-pole switch suggested in the article. Thanks to Jeff Steinkamp KA5MYF for pointing out the error.



Revised Fig. 1, "A Tuner for Antenna Fanatics."

Avery L. Jenkins
***73* Staff**

A diagram error appeared in Fig. 3 (page 33) and Fig. 5 (page 36) of "What? Another Audio Filter Project?" in the November, 1982, issue. Both diagrams show the cathode of diode D7 connected to a 100k resistor and pin 6 of U3. However, the cathode of D7 should be connected to the junction of D6 and the 1-uF capacitor. The 100k resistor should go directly to pin 6 of U3.

Avery L. Jenkins WB8JLG
***73* Staff**

The addresses of Ameco Equipment Company and Amidon Associates were accidentally reversed in "Beating the Untraceable Buzz" on page 58 of the January, 1983, issue. Amidon Associates is located at 12033 Otsego St., North Hollywood CA 91607; Ameco's offices are located at 275 Hillside Ave., Williston Park NY 11596.

Avery L. Jenkins WB8JLG
***73* Staff**

HAM HELP

I would like to hear from anyone who has successfully used a hidden antenna.

Michael H. Landwehr KE7T
PO Box 4502
Huachuca City AZ 85616

Wanted: the schematic for an Electrodata model AG-1 audio generator.

R. H. Klapheke
4113 Sunflower Dr.
Louisville KY 40216

I am looking for a way to modify a Motorola HT battery-pack recharger so that an Icom HT can be inserted in it.

Don Setliff WB8IMA
4729 Darnell Rd. #17
Huntington WV 25705

Can anyone supply me with the schematic needed to interface a modulator with a Pet 4032? I also need CW and RTTY programs.

Nazzaro Limongelli
Milano 1, 09100
Cagliari, Italy

I am searching for a CRT for a Tektronix 422 oscilloscope, or any information on repairing the old tube.

Robert L. Rowles KC5GT
701 NW 24th St.
Guymon OK 73942

I would like to locate someone in the Marion IL area who could help me learn the code. I am working toward my Novice license.

Ron Banfield
RR 4, Box 174, Lake Estates
Marion IL 62959

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Random ruminations at the end of winter. "What do I need to do to get an article published describing my new LSI circuit that not only multiplies Q, but divides, adds, and subtracts it as well?" Boy, how many times I get that one! First of all, look critically at what you want to write about. Is it interesting to others? Bounce the idea off a few close friends; if they are friends, they won't (shouldn't) pirate your idea. If it's not technical, ask your wife (husband/mother/father/significant other) for an opinion.

If all is still okay, write up an outline for the article. Now, I don't necessarily mean the formal (I-A-1-a, etc.) outline that you learned back in the fifth grade, but rather an informal sketch of the points you want to cover. Try to organize the article with, as radical as it sounds, a beginning, a middle, and an end.

For technical articles, the first segment normally introduces what the device is, perhaps why it is needed, and general specifications. The central part of the article deals with the nuts and bolts (design and construction) phase. At the end, alignment and testing, applications, and potential other uses or pathways may be explored.

Non-technical articles follow the same train of thought, but on a parallel track. Open your idea, develop it, and close, trying to keep some sense of order. Diagrams, drawings, or photographs might occur to you as being appropriate at certain places. Note these now for later development and inclusion.

Now it's time to, as they say, flesh it out; write the words that make the whole world read, or whatever. If you have not written before or are unsure of your ability to set down words that make sense, I have a tip for you. Get a tape recorder and say what you want to write. Describe the gizmo, investigate the concept, or expand the theme *vocally*, then listen to it and write down what you said. Alternatively, type it into a word processor (my favorite technique) or write it down in longhand on a yellow pad (my second favorite technique); just get those first ideas down onto paper. You will need it in this rough form so that it can be polished into a finished gem.

Once you get the first draft down, read it. Yes, look for misspelled words and the like, but also *read it* (out loud is a good idea). Does it make sense? Are there areas which could be explained better or places where the explanation is so long-winded that it chokes the meaning to death? Clean it up, revise it (this is where a word processor makes life easy!), and when you are happy, go back to the friend you approached before and see what he or she thinks. Does your opening try to "grab" the reader? Is your last sentence a conclusion or close, or does it just end in space?

Finished? Now type up a good copy. I know we aren't all typists, but there are some standards which should be followed. Your submission copy should be typed, not handwritten, on standard 8.5" by 11" white bond paper. It should be in upper- and lowercase, be double spaced, and have generous margins on all four sides. It should *not* be uppercase-only printer output (this is a human readable article, not a program) on newsprint-weight roll paper or pasted-up sheets from a narrow thermal printer. If you have a dot-matrix printer which produces good quality upper- and lowercase print, check with the publisher before you use it; most editors would still prefer typewriter-style characters for their weary eyes.

Diagrams should be neatly drawn, with black ink on 8.5" by 11" paper. They don't have to be super-artsy; most magazines will have them redrawn by a draftsman if your article is published. Just make sure they are clear and correct. Photographs should be sharp and clear, with 8" by 10" black and whites preferred. Little Instamatic™ or Polaroid™ snaps just won't reproduce well. Color should not be used unless it is essential to the picture; most magazines cannot or will not print color photos, anyway.

Now that you've worked on this labor of love to a state of perfection, where do you send it? Here are some items to help you make up your mind. For amateur radio articles, the ARRL's journal *QST*, pays you nothing for your contribution, allowing you to bask in the glory given to those few authors whose work is published each month. On the other hand, *73* pays its authors upon acceptance of the article, with the average being perhaps $100 or more. I need not go into the number of articles published here every month.

For computer-related articles, the choice is more difficult. With the great number of specialty and general-interest magazines being published, you may well choose to direct your work to a specific audience. Payment practices vary widely, though, from reasonable amounts of cash to extending your subscription for a couple of months to a letter of thanks. To the best of my knowledge, unlike *73*, those computer magazines that pay for articles pay on *publication*, not when they accept your article. Therefore, they can, and do, hold your article for many months or years on the promise of payment. Check it out before you submit your masterpiece.

When you have decided where to send your article, wrap it in a sturdy envelope, enclose a cover letter introducing both you and your work, and mail it off first class to the magazine. You should enclose sufficient first class postage for the article's return if it is (sob) rejected; otherwise it might find its way into the editor's circular file. Then sit back and wait a couple of weeks and, who knows, your article might lead the next issue of *73*!

Membrane keyboards—feh! I mentioned here a few months back that I purchased an Atari 400 computer for both the kids and some looks into the more "popular" (as opposed to my 6800) side of computers. After poking around a bit, I have reached my First Conclusion of Home Computers: Membranes may be good for a lot of things, but keyboards ain't one of them. I shall elaborate. Many of the "new breed" computers sport flat membrane keyboards rather than the more traditional typewriter-style keys. These flat panels are kidproof and less expensive to produce; they are also practically impossible to type on. Not much better are the little calculator-style button keys found on another raft of personal computers. Others' widespread frustration with this trend is evidenced by magazine articles and independent manufacturers' production of full-sized keyboards for the Atari 400, Sinclair ZX-81, Pet, and others. But if you add a $100 keyboard to an Atari 400, do you know what you get? An Atari 400 with an external keyboard. It reminds me of the time in high school when I tried to put expensive speakers on a cheap hi-fi compact. Couldn't understand why it sounded only marginally better. For the ham contemplating using a computer on RTTY or to write with, anything short of a standard (also called full-sized) keyboard is asking for trouble. No, membrane pads are fine for DTMF entry buttons, control switches on microwave ovens, or other occasional use terminals. But as keyboards designed for data entry? Feh!

Around the world with RTTY Loop brings a note here from Steve Pepler VE3KHU in Ottawa, Ontario. Steve is using a Mite teleprinter for computer output and is in need of a part. Steve, the sources I had for Mite parts dried up several years ago, and I have had no new leads since. If anyone knows of a source, drop me a line and I will let Steve and other Mite owners know about it.

Hans Granberg SM2DHG, a RTTY/computer buff from Sweden, relates his interest in the 6800 and its use on RTTY. I am sending Hans copies of old issues of RTTY Loop which may be of help in his endeavors.

This and many other letters raise another question for you all out there. Would you like to see a compilation of old RTTY Loops in book form? If so, are there any sections you would specifically like to see expanded or condensed? Please drop me a line (a postcard or QSL would be fine) with some sense of what you, the readers of this column, would like. I have been trying to work on such a tome, but I keep getting bogged down in the material. Let me know what you would like to see.

Next month, a tip of the hat to Al Jolson. Don't follow? You'll just have to wait for next month's RTTY Loop!

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

AMATEUR RADIO IN SOUTHERN AFRICA

What's the only country in the world which is completely surrounded by one other country and has no land below 1500 meters high? If you're up on your geographic trivia, you might be able to identify this mystery country as Lesotho, in southern Africa.

Not many people know where Lesotho is; fewer still know much about the tiny "mountain kingdom." Even the official Lesotho tourist brochures seem to be talking about a different place. These brochures are filled with photographs of the country's railroad and hotels; they mention the local TV station, the happy Basotho natives, and the rain-free climate.

What the tourist brochures do *not* mention is that Lesotho is one of the 20 least developed nations in the world. It is totally surrounded by South Africa, on which it depends for electricity, employment of the Basotho people, money from gambling at the Holiday Inn in Maseru, and food. That highly touted national railroad is less than a mile long, and half the hotels in the brochures don't really exist. It rains so seldom in Lesotho that the country must import almost all of its foodstuffs. In fact, the motto of the tiny kingdom is "Peace, Rain, Prosperity." And just because it has little rain doesn't mean the climate is perfect; Lesotho boasts the highest incidence of lightning in the world, and frequent high winds sweep dust storms across the treeless country. And that prized television broadcast with a power of only 400 mW! Can you imagine how easy it must be to cause television interference?

What the kingdom *does* have includes one of the longest reigning monarchs in the world, King Moshoeshoe II. It has majestic mountains, lots of them. The country is all mountains; even the "lowlands" are more than a mile high. And it has foreign aid. As a "non-aligned" nation, Lesotho enjoys frequent donations from other countries, including the US, France, Germany, and England. Lesotho recently received a grant of nearly 40 million dollars to fix up the nation's telephone system. There are only 4,000 phones in all of Lesotho; that's 10,000 dollars per phone!

With the highest incidence of lightning in the world, no trees to hang antennas from, a milliwatt TV station, and frequent high winds, you wouldn't think Lesotho would be an amateur-radio paradise, would you? But Rich Kingston 7P8BX (see photo) consistently receives signal reports 2 S-units louder than he gives out.

About half way along his round-the-world tour, Rich spent a few days in northern California with your DX editor. Rich offered to share his experiences as an amateur in southern Africa with *73* readers.

Rich finds amateur radio in Lesotho very successful. Using only a mobile whip, Rich and fellow Lesotho amateur Ed 7P8CG have worked stations around the world from a four-wheel-drive truck. And Rich finds no problems with his modest antenna farm of dipoles. "The other day I got on 40 SSB and worked VS6, VK, and a bunch of JAs. They couldn't believe I was barefoot into a dipole," Rich said. Rich claims the good signal reports he receives are due to strange propagation in Lesotho, but I think the 7P8 callsign is worth at least 2 S-units.

While Lesotho is not exactly rare on the amateur bands, there are many DXers still looking for their first 7P8 contact. Perhaps this information will help.

Among the more active Lesotho amateurs are 7P8s BX, CG, CL, CM, and CR. Ed 7P8CG is Vice Consul at the American Embassy in Maseru, the capital of Lesotho. Ed hopes to work DXCC on CW while in Lesotho and also can be caught working mobile. Martin 7P8CM uses a 40-meter dipole on 40 and 15 meters. A new Lesotho amateur, 7P8CR, hails from Italy and often can be heard on phone speaking Italian and Spanish. Rich himself puts his TR-44C and Swan radios on the air from his home station (7P8BX) and mobile (7P8CG). Rich hopes to supplement his existing dipole antennas with some new aerials soon, including a 15-meter beam.

Rich suggests the best time to look for 7P8 stations is early evening, Lesotho time. 1730 UTC is 7:30 pm, local time. Beginning

Rich Kingston 7P8BX, president of the Lesotho Amateur Radio Society (right), discusses schedules with Paul Hansen AE6H, president of the Redwood Empire DX Association.

about 1700 UTC. 10 meters is often open to the States. You can listen for ZS stations or the ZS 10-meter beacon to check propagation to Lesotho. 10 meters tends to fade away completely during the stateside summer. Rich explains, so try lower-frequency bands between June and August. 15 meters often opens to the States about an hour later, around 1800 UTC.

Rich says 2 IRCs or a green stamp will provide return airmail postage for your 7P8 QSL card. Rich's own QSL card (see photo) features a map of the continent, with Lesotho marked, and a colorful one-cent stamp. Lesotho, like many small countries, produces beautiful postage stamps; they add a nice touch to Rich's custom card. Rich has included on his QSL the logos from two International organizations to which he belongs: the Radio Society of Great Britain and Mensa, the high-IQ society.

Rich is also president of the newly formed Lesotho Amateur Radio Society (LARS). LARS recently held its first meeting at the home of the German ambassador to Lesotho, 7P8CI. Of the approximately 18 amateurs in Lesotho, 12 joined LARS. Only about 6 of these amateurs are active on HF, however.

At the first meeting, Rich presented the International Amateur Radio Union (IARU) films on amateur radio. Several Basotho (lifelong residents of the tiny mountain kingdom of Lesotho) attended the first meeting, but none has an amateur radio license to date.

Rich has helped bring some formal structure to amateur radio in Lesotho and has patterned the license examinations after the British model. The theory portion of the amateur examination is taken directly from the British test. The code requirement of 12 wpm is also similar to the British system. Unlike the US test, Lesotho amateurs must copy the 12-wpm code without error! No multiple choice to make it easier!

The Lesotho Amateur Radio Society has exciting plans for encouraging amateur radio activity within the country and with hams in other countries. A club station, 7P8RS, is under construction and looking for donated or loaned gear. LARS plans a Field-Day-type operation, perhaps in connection with the king's birthday. And an award for working 7P8 amateurs is in the works. About the latter, Rich says, "It won't be an easy award. Perhaps work 7P8RS and 7P8 stations on 4 bands. You'll have to try hard to earn this one."

One of the duties of a young national amateur radio society such as LARS is to set up an incoming QSL bureau for its members. The Lesotho Amateur Radio Society has started such a QSL bureau for local 7P8 amateurs. You can send your cards direct, to individual QSL managers, or to the bureau at Box 949, Maseru, Lesotho, Africa.

Any cards for 7P8 amateurs sent to the Lesotho Amateur Radio Society will arrive at LARS's PO box. The secretary or QSL manager of LARS will sort the incoming cards by callsign and hand them to appropriate LARS members at the next club meeting.

The incoming QSL bureau in the States works in much the same way, but on a much larger scale. Let's follow a card back from Rich 7P8BX to a stateside ham, KK6X.

At a club meeting, the members of LARS bundle up their stateside QSL cards without SASEs and mail them to the USA's official IARU incoming QSL bureau at ARRL headquarters. The cards are then sorted by call areas and mailed to the QSL bureaus in each amateur radio call district. The card we are following is sent to the sixth district QSL bureau in Sun Valley, California.

Here, local volunteer amateurs enter the picture, donating hundreds of hours of time to sort the many thousands of QSLs by the first letter of the suffix. KY6A, K6ANP, KB6AG, and WB6ANT would all go to the "A" letter sorter. At the next radio club meeting, the individual letter sorters pick up their shopping bags full of QSLs. Our card is sent to the "X" sorter in northern California.

Every month, the individual letter sorter gets 10-100 lbs. of QSLs to sort by individual callsign. The "X" sorter gets a break because there are no three letter suffixes beginning with X, as these callsigns are reserved for experimental licenses. With only one- and two-letter suffixes, the "X" sorter gets only a fifth of the cards the sorters of other letters receive.

At the same time as he gets our card, the "X" sorter gets any return envelopes for stations with X as the first letter of their suffix. He puts these into callsign order and adds them to the file of envelopes on hand. After he sorts the incoming QSLs, he puts each amateur's QSLs into the SASE provided by that ham. If there are enough cards in the envelope, our sorter will seal and mail the envelope, and a few days later a happy KK6X will pull his 7P8BX card out of the envelope from the bureau.

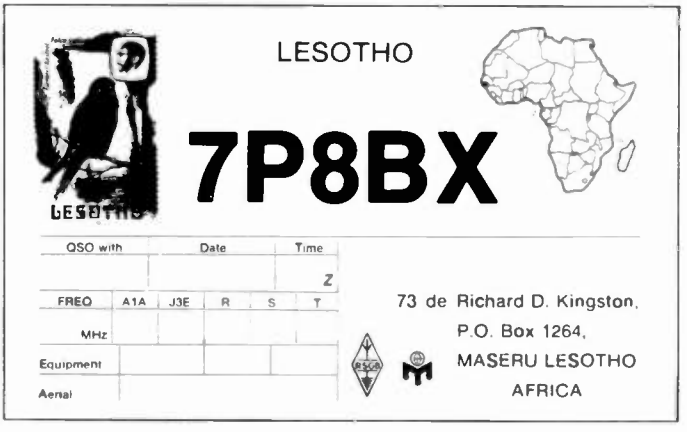
There are many potential pitfalls for the QSL card along this extended journey from Lesotho to a mailbox in California, any of which can delay delivery. The card might sit around for a while before being shipped to the sixth district bureau. It might just miss a sorting session there and not be sent off to the letter sorter for another month. That letter sorter might be forced to skip a month for various reasons. So the card could easily take six months to get across the country. If you think that's slow, think about how much you are paying for this service.

The cards move through the QSL bureaus entirely by volunteer hands. The sixth district QSL bureau handled more than 600,000 cards last year! That's almost 2,000 a day, 365 days a year! The QSL bureau volunteers contribute thousands of hours of rather tedious work to make a lot of DXers happy. And you'll never guess their biggest problem: unclaimed QSLs!

Thousands of cards pile up each year for amateurs who do not have an envelope on file at the correct QSL bureau. Sometimes there are thousands for a big contest station; sometimes only one or two for a ham who "doesn't work DX." One Technician who was helping sort cards came across three for himself! One was a callsign error, but two were from South American stations worked on 6 meters, years before.

What can *you* do to speed the process and get your QSLs back as fast as you can? I suggest three things: 1) get the proper

Jay W6GO (left) and Jan K6HHD O'Brien are in charge of the program at the International DX Convention at the Holiday Inn, Visalia, California, April 22-24, 1983.



Rich Kingston's QSL card features logos, a map of Africa, and a postage stamp for color.

envelopes or money to the bureau, 2) be patient, and 3) be patient.

You will seldom get your QSLs if you don't have an envelope or postage credits on file at your district QSL bureau. Your bureau is based on the number in your callsign, not where you live. WB2CHO/6 keeps postage credits on file at the 2nd district bureau.

Most district bureaus sell postage credits, a route often preferred by both bureau and DXer. You can find out the details of your own bureau's envelope credit system by sending an SASE to the bureau address, listed in the front pages of the *Callbook* or in *QST*. Generally, you send some money and your address, and they'll deduct postage as needed to mail your cards. When you run low, they'll note it on your return envelope.

Many bureaus prefer this method to receiving prepared envelopes, as they can buy standard envelopes in quantity, simplifying storage and reducing costs. Also, postage credits aren't outdated by a postage rate increase, and the QSL bureau finds it easier to keep the addresses and callsigns up to date with postage credits.

If you choose the envelope route, be sure to follow the bureau's suggestions for preparation of your return envelope. Get some 5" × 7½" envelopes and print your callsign *neatly* in the upper left corner. Put a single $0.20 stamp in the upper right corner and print your name and address neatly in the center of the envelope. Send a few envelopes prepared this way to your correct bureau, and wait.

Don't hold your breath. Cards can take many months or a year just to work their way through the bureau system to you. And this doesn't include the time it took *your* card to get to the DX amateur or the time it took the DX station to get around to answering your card.

In the case of the Russian stations, through Box 88, Moscow, a delay of several years is commonplace. It is not unusual to find Russian QSLs for contacts made 3-7 years ago in the bureau.

After you work a station who promises to QSL "via the bureau," you might wait six months or a year for the card. While a new DXer eagerly awaits his first bureau shipment, he can reflect on why most Honor Roll DXers are old: it takes *years* to finally get some cards. Longevity is one of the most important DX skills.

What if you have sent off envelopes or money to the bureau, worked a bunch of DX, waited a very long time, and still have nothing? Don't be afraid to drop a note to the bureau asking if you have any cards or asking them to mail any cards for you, no matter how few. Be sure to include an SASE for any reply, and be prepared to wait a few months while your envelope works its way through the system. And be nice; these are volunteers handling your cards, remember, and screaming that you have worked hundreds of DX stations and must have cards waiting won't help.

Ask politely if you have any cards waiting, and if so, would the sorter please mail them? On rare occasions, the sorter or bureau has a temporary problem, and your query might point it out. But more likely, the reason you haven't gotten anything back from the bureau is that the bureau has not received any cards for you!

Sorting the cards, putting them into the correct envelope, and mailing them takes even the "X" letter sorter a full day every month. Improper postage on envelopes costs the sorter about $4.00 of his own money every month. Why does someone contribute so much time and effort to this nearly thankless task? Well, one reason is that the letter sorter gets first peek at the incoming cards and gets to pull his own out. "That's why I volunteered to sort the 'X' cards," our sorter says. "I get mine first!"

But this is not the *only* motivation of these hard-working volunteers. Some amateurs in the Washington DC area sort cards from a different call district. They'll never see one of their own cards first. These amateurs are more motivated by the thrill they help provide. The thrill when the ham eagerly rips open the envelope from the bureau to see what treasures might lie inside.

Receiving an envelope from your QSL bureau is like receiving an invitation to a treasure hunt. For the active DXer, each envelope from the bureau will contain at least one prize, and sometimes a whole handful of new ones arrives at once. Inside that little envelope could be those long-awaited Asiatic Russians, or that South American who *swore* he would QSL via the bureau. Or it might be returns of one's own QSLs, marked "callsign unknown," or SWL cards from countries most DXers would love to work.

So some volunteers work in the QSL bureaus because they know just how eager you are for your cards and just how happy you are going to be when you open that envelope. So think of the hard-working volunteers at the QSL bureau the next time you wait for your 7P8 QSL "via buro."

NEW PRODUCTS

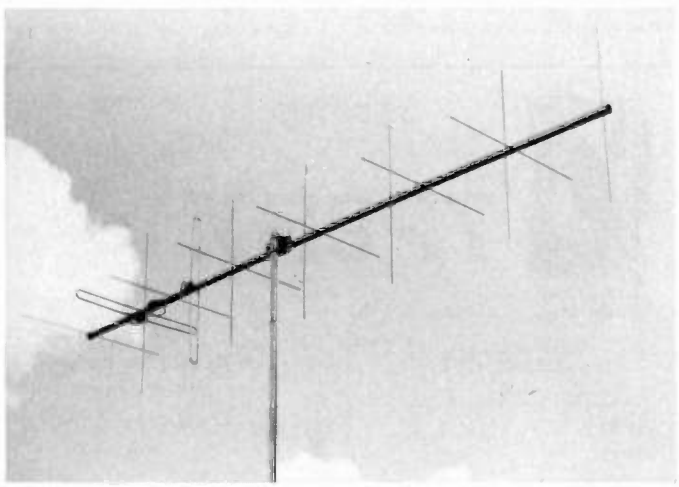
CIRCULAR SATELLITE TECHNOLOGY FROM KLM

The new KLM 143-150-14C circularly-polarized antenna not only provides optimum reception of OSCAR satellite signals, but also can dramatically improve 2-meter terrestrial communication. Linearly polarized signals (any mode, fixed or mobile) are frequently affected by buildings, mountains, and movement and, as a result, circular wavefronts develop. Reception with the 14C reduces flutter fading and multipath distortion and often improves S/N ratios. Benefits of circular polarity on transmit are similar, regardless of the polarization of the receiving antenna.

Since circularity may have a right-hand or left-hand "twist," the 14C antenna kit includes a feedpoint-mounted switcher keyed by +9 to +15 V dc right from the shack. For single feedline convenience, a special matching harness is included. If desired, the 14C can also function as two separately fed antennas, one vertical and one horizontal. Each set of feedpoints is equipped with a 2-kW balun ready for direct coax feed.

The 143-150-14C is built to provide years of reliable service. All aluminum is 6061-T6 and 6063-T832 alloys. All hardware is stainless steel except the U-bolts. The matching harness and balun coax features weather-impervious Teflon™ insulation and silver-plated conductors.

With seven elements in each plane, the 14C produces 11-dB-dc gain at better than 1.5:1 vswr. Circularity is maintained within 3 dB. Virtually unbreakable 3/16"-rod parasitic elements, anchored through the 1½" boom, help reduce weight to 7½ pounds, windload to 1.2 square feet. For more information, contact *KLM Electronics, Inc., PO Box 816, Morgan Hill CA 95037; (408)-779-7363.*



New KLM 143-150-14C circularly-polarized antenna.

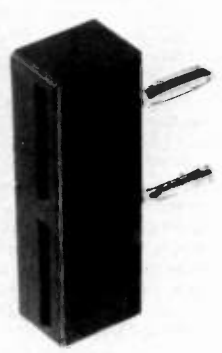
TEST ADAPTER

The new NLS Touch Test 20 test adapter for axial- and wire-lead electronic components has found a home with test engineers in test labs across the United States. Its popularity has caused Non-Linear Systems, Inc., to add this last test product to its accessory line of digital panel meter and digital test equipment line.

Measuring 1/2" by 2" by 5/8", the adapter has two slots on the side opposite the banana plus terminals, into which the leads of individual components may be inserted for component testing. The adapter eliminates the tedious task of applying prods and/or using test lead clips to make contact with the terminals of small components. Once the component leads are inserted, the testing becomes a hands-free operation, allowing for easier adjustment and control of the testing instrument. This method also eliminates the ambiguity introduced by lead or cable resistance. With banana-plug terminals 3/4" on center, the adapter can be used with any measuring instrument utilizing standard banana-plug receptacles with like separation.

This product is now available nationwide from local electronics distributors handling the NLS digital panel meter and digital equipments line of products.

For additional information, write *Non-Linear Systems, Inc., PO Box N, Del Mar CA 92014.* Reader Service number 483.



Non-Linear Systems test adapter.

NEW HAMTRONICS® CATALOG

Hamtronics, Inc., announces publication of their new 1983 catalog crammed full of goodies for the VHF/UHF/OSCAR enthusiast and two-way shops. The 36-page two-color catalog features many new products, including FM repeaters, new VHF and UHF FM receivers, helical resonator preamps and filters, low-noise receiver preamps, and a UHF receiver to listen to the space shuttle. Also included are the popular FM transmitters and power amplifiers, VHF and UHF receiving and transmitting converters, VHF transceivers, and other products Hamtronics has long been noted for.

For your free copy of this attractive new catalog (for overseas mailing, please send $2.00 or 4 IRCs), call (716)-392-9430 or write to *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468.* Reader Service number 476.

THE NEW MFJ-1440 VIDEO CONTROL CENTER

The new MFJ-1440 video control center combines enhancer, stabilizer, fader, switcher, distribution amplifier, and rf modulator to make professional-quality dubs and to give improved viewing quality of videotapes. You can make copies as good as the original, stop copyguard, improve sharpness, separate scenes, select from 4 inputs, and make 4 copies simultaneously. An rf modulator lets you monitor what you are taping or playing back on your TV set.

An Enhance control dramatically improves picture clarity, detail, sharpness, and increases contrast. You can actually see individual strands of hair and blades of grass.

An exclusive Logarithmic mode enhances light areas only for improving dark scenes.

A Noise Cancel control reduces picture noise exaggerated by enhancement.

Enhance before recording to cancel VCR and tape loss. Enhance during viewing to bring out detail and sharpness and to improve viewing of older tapes.

Enhancement can make viewing quality of 6-hour mode recordings comparable to 2-hour mode.

A bypass switch compares the enhanced with the unenhanced picture.

A Stabilizer control removes copyguard and stops picture roll and jitter. Play copy-

guarded tapes on any TV set. Duplicate any prerecorded tapes. Has stabilizer bypass switch.

The new Fader Design separates scenes, dubs out commercials, and cleans up edits and glitches for professional results. It has automatic and manual modes, simultaneous video and audio fade, continuously adjustable fade-out times, and audio dub jack for bypassing audio fade. The picture is in sync during fade.

The Video/Audio switcher adds convenience and eliminates messy cables. Select from 4 sources. (Connect VCRs, video disk, computers, games, video camera, etc.)

The Distribution Amplifier gives 4 video and 4 audio outputs for multiple recordings or monitoring.

The FCC-approved rf modulator converts video and audio signals to channel 3 or 4 for monitoring on your TV set.

The cabinet is eggshell white with walnut grain sides and measures 12 x 2 x 6 inches. The MFJ-1440 operates on 110 V ac or 12 V dc for portable use.

MFJ provides a 30-day money-back trial period. If you are not satisfied, you may return it for a full refund (less shipping). MFJ also provides a one-year unconditional guarantee.

For further information, contact *MFJ Enterprises, Inc., 921A Louisville Road, Starkville MS 39759.* Reader Service number 480.

DTMF RECEIVER KITS FROM TELTONE

Teltone announces the addition of two new DTMF receiver kits. These receivers will allow you to turn your telephone into a control device.

The TRK-927 contains the Teltone M-927 DTMF receiver and rotary dial pulse counter, a 3.58-MHz crystal, and a 40-pin DIP socket. The TRK-947 contains the M-947 DTMF receiver, a 3.58 crystal, and a 22-pin DIP socket. These units are packaged to simplify breadboarding by engineers, scientists, and hobbyists alike. Typical applications of these receivers include computer data entry, equipment monitoring and remote control, and central-office-quality DTMF-to-rotary conversion. Both kits are currently available.

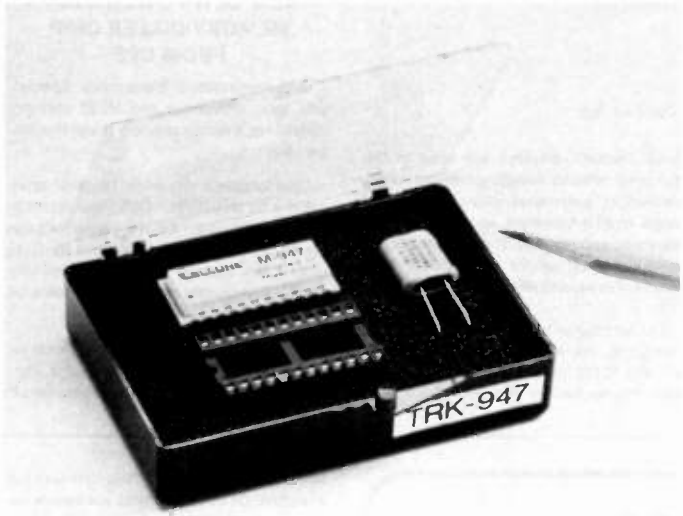
For additional information, contact *Teltone Corp., PO Box 657, 10801 120th Avenue Northeast, Kirkland WA 98033; (206)-827-9626.* Reader Service number 478.

R-2000 COMMUNICATIONS RECEIVER

Trio-Kenwood has just announced the new R-2000, a highly sophisticated, all-mode communication receiver that covers 150 kHz-30 MHz in 30 bands. Designed to answer the needs of the shortwave listener as well as the radio amateur, this new radio is capable of receiving signals on AM, USB, LSB, CW, and FM. Among the more interesting features to be found on this model are digital vfo's, 10 memories that store frequency, band, and mode data, memory scan, programmable band scan, and dual 24-hour quartz clocks, with a timer that can be programmed to turn the radio on and off on a pre-selected schedule. Additional features include a built-in lithium battery memory backup (estimated 5-year life), flourescent tube digital display, 3 built-in i-f filters with switch, manual "UP/DOWN" band scan, squelch, S-meter, noise blanker, and rf step attenuator. The R-2000 operates on 100/120/220/240 V ac or may be operated on 13.8 V dc using an optional DCK-1 cable kit.

For additional information, contact your local Kenwood amateur radio dealer or write *Trio-Kenwood Communications, 1111 West Walnut Street, Compton CA 90220.*

The MFJ-1440 video control center.



New receiver kit from Teltone.

R-2000 communications receiver from Kenwood.

CONTACT-80/MARK II SYSTEM FROM ROYAL

Royal has announced the release of the Contact-80/Mark II RTTY and Morse system for the TRS-80. The system consists of an interface unit which will link the computer to the station equipment and the necessary software on either disk or cassette.

The interface will mate with any stand-alone terminal unit for use as a RTTY terminal, and the interface contains its own decoder and keying circuits when used on CW. The program will send and receive RTTY at 60, 66, 75, and 100 wpm, ASCII at 110 baud, and Morse at any speed. The Morse receive mode will automatically synchronize its speed with that of the received code. The user may also change the decoding parameters to compensate for closely-spaced characters and machine-gun dots.

Contact-80 features a tri-split screen which shows received data, stored message numbers and text, and the transmitted message. The screen format may be easily changed for different uses.

The system also has MSO capability, a line printing spooler, automatic frequency monitoring, and a special mode to send and receive Basic programs.

For additional information, contact *Royal, 407 Conkle Rd., Hampton GA 30228; (404)-946-9314.* Reader Service number 477.

SOFTWARE POLLUTION CONTROL

Electrical pollution drives micro programs bananas! Power-line electrical noise, hash, and spikes often cause erratic computer operation. In addition, severe spikes from lightning or heavy machinery may damage expensive hardware.

Many systems create their own pollution! Disks and printers often create enough electrical interface to disrupt an entire program. Nearby electronic equipment is affected as well.

Electronic Specialists' recently announced Magnum Isolator is designed to control severe electrical pollution. Incorporating heavy-duty spike/surge suppression, the Magnum Isolator features four individually quad-pi filtered ac sockets. Equipment interactions are eliminated and disruptive/damaging power-line pollution is controlled. The Magnum Isolator will control pollution for an 1875-Watt load. Each socket can handle a 1000-Watt load.

The model ISO-17 Magnum Isolator eliminates severe ac power-line pollution for smooth program operation.

For additional information, contact *Electronic Specialists, Inc., 171 South Main Street, PO Box 389, Natick MA 01760; (617)-655-1532.* Reader Service number 481.

HAL'S MPT3100 SOFTWARE EXPANSION FOR THE DS3100 ASR VIDEO TERMINAL

Hal Communications Corporation has announced the MPT3100 software expansion of the popular DS3100 ASR video terminal. The MPT3100 expands the features of the mailbox option and adds a separate mode for collection, editing, and relay of multiple message texts.

The MPT3100 package will store any length of message up to 32,000 characters in any format. Each file receives a sequential serial number ID, and a directory of stored files may be accessed. The messages may be edited after they have been stored by using the MPT3100's edit mode, which includes custom identifier codes for user designs.

The relay mode allows repetitive transmission of text, and transmission order is user-set, rather than in the order the text was received. Different texts may also be grouped for retransmisson to specific geographic areas or stations.

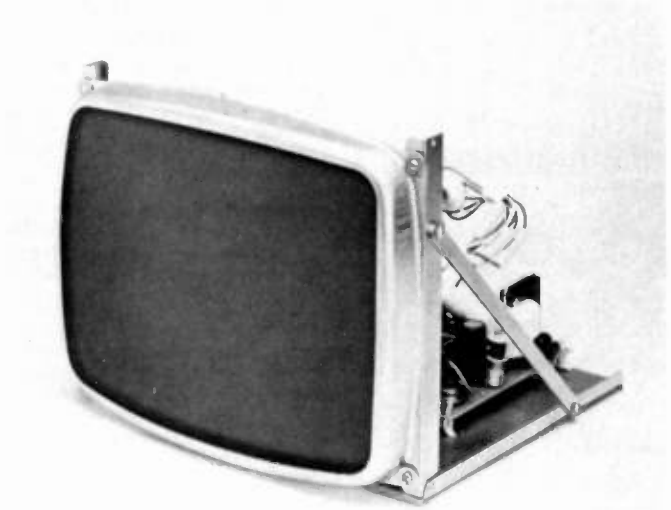
The mailbox enhancements allow the user to edit while receiving or transmitting or during a mailbox access by an outside station. Added comments have also made the directory search and SDIR listing more useful tools for the mailbox user.

For more information, contact *Hal Communications Corporation, Box 365, Urbana IL 61801; (217)-367-7373.* Reader Service number 485.

DTU-12 AMATEUR DATA DISPLAY FROM DOTRONIX

Dotronix, Inc., manufacturer of CRT displays, offers commercial-grade US-manufactured CRT displays for Morse-code translators, SSTV, ATV, or personal computer applications.

Get a clean, crisp computer-quality data display for your next ham project with a DTU-12 from Dotronix, available in kit, chassis, or chassis/ac power versions, and either P4 (white) or P31 (green) phosphor. The DTU-12 requires only 12 V at 1.5 Amps, standard TTL horizontal and vertical con-



DTU-12 display from Dotronix, Inc.

trol signals, and 2.5-V video drive. Scan rate is 15,750 Hz. Interface is through a 10-pin edge card connector.

These are brand new commercial-grade displays, factory adjusted for proper geometry and supplied with written specifications.

Dotronix, Inc., produces a complete line of compact and economical CRT displays, including 5-, 7-, 9-, 12-, 13-, 15-, and 17-inch sizes, in both chassis and kit configurations. Dotronix displays are used in the computer terminal industry, medical instrumentation, automated phototypesetting, airline flight information, and closed-circuit television applications. The company maintains sales and service operations in Minnesota, Texas, and Illinois.

For additional information, contact *Dotronix, Inc., 160 First Street SE, New Brighton MN 55112; (612)-633-1742 or (612)-633-8236.* Reader Service number 479.

CES MD22 chip.

NEW LOW-POWER DTMF MEMORY DIALER CHIP FROM CES

Communications Electronics Specialties, Inc., introduces the MD22 memory dialer chip, the only memory dialer in a single chip.

"We foresee a very broad range of applications for the MD22," CES President Ron Hankins remarks. "Its low power requirements and impressive capabilities lend it to quite a few types of communications systems." Component sales are available on the copyrighted chip, Hankins says.

No external RAM or tone generator is required with the MD22's unique design. This new proprietary chip actually operates off telephone line power due to its CMOS technology. The MD22 features a ten-year memory backup with a single lithium cell.

Other features of the MD22 include: 10- or 22-number capacity, programmable pause, manual or automatic dialing, automatic redial of the last manually dialed number, and program inhibit input to avoid memory loss.

The MD22 is programmed and operated from a standard twelve-button keypad.

CES is offering qualified users a complete dialer for installation in any standard telephone for product evaluation. For complete information, contact Ron Hankins, *CES, Inc., PO Box 507, Winter Park FL 32790; (305)-645-0474.* Reader Service number 482.

LETTERS

DISTORTED NEWS

We are Americans who have made our home in Latin America for seven years. Lately, we are seeing much distorted news about the Americas coming out of the US and would like to set the record straight for *73* readers.

When we first moved to Costa Rica—bag, baggage, grandmother, teenagers, and pets—we spoke no Spanish and knew little about the country. But, soon, our rural neighbors accepted us and graciously taught us their language, their culture, and how a city-bred family could enjoy ranch life in a foreign land. Truly, our delightful adventures there merit a book, at least!

My husband's love for the sea (Pearl Harbor survivor, retired Navy) prompted a further move, two years ago, to Colombia's Caribbean coast. We found a lovely old coconut plantation on the Pan American Highway near Santa Marta, the oldest (457 years), most fascinating city in all of the Americas.

Imagine, green palms waving in gentle ocean breezes, blue sea and sky, pounding surf and golden sand, and, towering 19,000 feet over all and snow-capped the year 'round, majestic Mount Columbus. We feel we have much...incomparable beauty, fine neighbors, perfect climate, a stable democratic government, and a satisfyingly-low cost of living.

Like Columbus, we have discovered a new frontier with a vast potential and, being human, are driven to tell others about our dream-come-true. If you are interested in the future of the Americas...and the Birds...write us by international airmail (35¢ a half-ounce) at PO Box 5222, Santa Marta, Colombia. It may take a while, but we promise to answer.

Now, from beautiful Santa Marta, we wish you salud (health), pesetas (wealth), amor (love), and the time to enjoy them all!

Juanita Bird
Santa Marta, Colombia

ICOM FOLLOW-UP

You may possibly recall that last June 19th I wrote to *73* to tell of my problem in trying to get some kind of response from Icom regarding a part I needed to repair a pair of Icom headphones that I have. You were kind enough to forward my letter to Icom's customer service manager, Tom Snellings. He, in turn, promised to get the part to me even if it was necessary to go to the factory for it.

As it turned out, this particular part was not available separately and Icom offered to exchange my set of phones for a new one. I naturally accepted their offer, which was more than I expected. If Icom had told me that the part was not available, I would have "jury rigged" something and would have settled for that.

What disturbed me was the complete lack of response. What I suspect happened was that some employee discarded my letters when they found that the item was not available. Of course, this is conjecture on my part, but I have that feeling.

The main purpose of this letter is to thank you and to let you know the way Icom followed up. Once again, thanks very much for your help.

Sam Zolick KB2UH
Howard Beach NY

FIST OR PHONE

Before all the stuffed shirts bury amateur radio and drive off all the young talent, how about developing a license that has either code or phone privileges or both? In other words, one can work CW on that portion of the band if one has the necessary license endorsement. You may work someone on the phone portion of the band if you have the phone endorsement. An amateur may work both modes if he or she has passed the tests for both endorsements. This is a simple solution which should satisfy everyone.

I foresee that if the "code establishment" continues to thwart some type of compromise like the one I have mentioned, then you can say "good-bye" to the recruitment of many bright young men and women into amateur radio.

Robert Baker KA1JDD
S. Yarmouth MA

THANKS TO BASH

I feel I must take exception to the editorial regarding Dick Bash and *The Final Exam* in your November, 1982, issue.

About four years ago I decided to get my General license after dutifully working my fingers to the bone for two years in the Novice bands. On advice from our local electronics store, I selected the Ameco Amateur Radio Theory Course and proceeded to study like hell for the next three months while working with the ARRL code tapes to bring my speed up to a solid 13 wpm.

In the Ameco book I took and passed every single test and when I went down to the dear old FCC, I got the surprise of my life. Although I passed the code with ease, the whole damn written test was on UHF; ergo, three months wasted. To hell with it—I quit ham radio!

I packed my TS-820 away and found another hobby (this *is* a hobby).

Per chance, about two months ago, I wandered into our local electronics store and there on the shelf was Bash—B.S., I figured, but what the hell—I bought it anyway. I dug up the ARRL code tape (why don't you pick on them?) and got my code back up and passed both with ease. I am now working on the Advanced, thanks to Dick Bash.

Since you chose to come down hard on Dick and *CQ*, I feel it is only fair for me to advise that this is the first and last *73* I will purchase. By the way, you may be interested in knowing that my former call from the 1950s was K6DDC (General class) so I am not exactly unfamiliar with amateur theory.

Scott Smith KH6JKX/HL
Kaneohe HI

P. S. Print this in your rag sheet if you want to.

Scott, lacking much in the way of letters protesting the Bash approach to licensing...which you endorse...perhaps that is the way to go. But I honestly think it is stupid to even ask anyone to bother with a written test at all under these conditions. There seems to be strong sentiment for letting in any dummy who can copy the code. So, how about it, shall we go this route and

Don't Be Left Out in the Cold with the Russian Woodpecker

GET A MOSCOW MUFFLER™

Another first from AEA. The Woodpecker Blanker, WB-1 really works. This unit effectively blanks the pulsing interference of the Russian Woodpecker. Two versions are available, the WB-1 for use with communication receivers and WB-1C for use with all popular transceivers.

This extremely useful accessory is designed for direct insertion between your receiver (or transceiver) and the antenna. It is both MORE EFFECTIVE than I.F. type blankers and requires NO MODIFICATIONS to your receiver! The unit operates from a 13 VDC ± 2 VDC power source at less than 575 mA. (AEA AC wall unit AC-1 will operate the blanker.)

The blanker works well on both CW and SSB modes that are being interfered with by a woodpecker. Controls on the front panel include; four push button switches, a synchronize control and a width control The WB-1 also features a low-noise untuned broadbanded 6 db gain pre-amp which can be selected with or without the blanker enabled. The WB-1C uses the same circuitry but includes a carrier operated relay (COR). This provides protection to the receiver section during transmissions from the attached transceiver.

Prices and Specifications subject to change without notice or obligation.

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TRS-80, MOD III INTERFACE (included with system) gives keyboard STATION CONTROL and connects with the TTY TU of your choice.
(No other equipment needed for CW operation)

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RG11U 96% shield, 75-ohm mil spec ..... 25¢/ft.
RG8U 96% shield, mil spec .... $27.95/100 ft. or 31¢/ft.
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UG 21D/U Amphenol Type N Male for RG8 ..... $3.00
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UG273 BNC to PL-259 ..... $3.00

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↙See List of Advertisers on page 114

just do away with anything but the ability to sign a name and copy code? Or is that signing the name too much to ask? Oh, about your ability to cope with the theory . . . the 50s? . . . have you opened a radio recently?—Wayne.

CW IS FUN

You keep insisting that SSB can get through every bit as well as CW. Well, this summer during a sked with AA0P, conditions deteriorated on 20m SSB, due to QRM and QSB, until I could not copy AA0P anymore. However, when we resorted to CW . . . QS copy! CW has a place.

Yes, RTTY is faster and more efficient. Yes, CW is slow. Yes, ASCII is the way to go. But I don't operate CW because I think CW is efficient or easy to receive or because of the "tradition." I like CW because it's fun. Isn't that why a lot of us got into this?

Bob Reynolds KB9MU
McHenry IL

P. S. I'm not an old-time CW op either. I'm 29 and I also enjoy SSTV and RTTY.

Yep, Bob, there are times when CW can get through . . . and there are times when SSB can't be beat. No emission is best all the time . . . as yet. I suspect that when we put our minds to it, we will be able to come up with some sort of machine-readable transmissions which will be virtually jam-proof and which will go right on through interference, static, fading, and so on. That's a good challenge. Meanwhile, I agree that CW can be fun and should be accepted because it is fun—not because there are people who want to force it on you.—Wayne.

RICH HERITAGE

Come on now, Wayne. Let's be realistic about this second language thing (*73*, November, 1982). You and I are savvy enough folks to know that the language of the ruling tribe is the language of the common little folks who live outside the castle gates. And the last thing the little guy wants is trouble with the rulers.

The language you and I speak would be a lot closer to Frisian or Dutch, were it not for the victory of some francophone Vikings at Hastings in 1066. And those same francophone Vikings might have ended up speaking a form of Gaelic, had not the Romans overrun Gaul some centuries earlier. (And had not the Gauls been chased into western Europe by the Slavs and Germanic tribes, our language would be closer to Basque—well, maybe.)

The fact remains that languages change, as do politics and economics. America is not so much a melting pot as it is a mulligan stew. By and large, we are the cultural descendants of herds of people, from Athabascan and Algonquin, through Spaniard and Anglosaxon, to Oriental and African. We are the cultural descendants of any group which has dragged or been dragged up on these shores.

These people—our cultural and linguistic forebears—deserve their rich heritage. Keeping this heritage alive in non-English-language press and media is not some heinous crime against "us." Rather, it would be far more heinous to ban these non-English media forces. The thought of banning such publications and media forces conjures up visions of some multimedia Kristallnacht. It won't hurt us at all to reach out to our fellow man, even if he doesn't speak our language as nicely as we think he should.

But this of course is a two-way street. We should indeed have a populace which speaks one language. To do that, we need to give the non-English speakers a reason to join the rest of us "anglos."

I can think of no better reason for the rest of us, who presumably speak English, to exorcise our prejudices, whether racial, sexual, religious, political, or linguistic.

Nils R. B. Young WB8IJN
New Carlisle OH

CB OR HAM?

A letter to you has been in limbo for some time now, but I just came across something which is really disgusting and an absolute insult to amateur radio.

While sitting here working on my antenna tuner and listening to the last few fading signals of 15 meters, I had an idea to drop my R4C down on 11 meters to hear what was going on. Brother, was that a mistake. Man, did I get hot!

On 27.395, at least the frequency was legal, I found a couple of CBers discussing their rigs. Let me see, Woody, in Trenton, has a Tempo transceiver, a ground-mounted vertical, and a set of "moon rakers." Harold has a ham rig that has great ears and a keyer that does great at 25 wpm! Wow, a CBer who can send and copy 25 wpm . . . a prime candidate for a ham ticket, right? Wrong. Come to find out, these turkeys were amateurs, I think, down on 11 with their ham rigs. Oh, yes, they did ID, naturally with their "callsigns" Mercury 5119 and Mercury 927, I believe. Come to think about it, these guys may have been doing this for a couple of years; I believe I have heard them before.

It is really sickening to hear these guys. Man, are they doing a great job of public relations for all of us amateurs in this area. To them, all we are is glorified CBers. That's the pits!

As you can probably tell, I am a new amateur. My ticket is just 6 months old and my pride has really gone to my head. It really gets my goat when I hear some of the stuff so-called amateurs are putting out on the air. They seemingly have no remorse for their behavior.

Turkeys or not, I am proud of amateur radio and of being an amateur radio operator. I will defend its principles and ideals until I am blue in the face. Just believe me though, this enthusiasm will be turned loose on these two if they keep it up!

On a lighter note, I have worked all states and 41 countries. Not bad for a mobile antenna on a balcony, is it? Thanks for listening.

Jerry Rogers KA8PTL
Monroe OH

Jerry, It is unlikely that those chaps were actually amateurs. Zillions of CBers bought ham rigs a few years ago and had them converted for 11 meters. As a matter of fact, a couple of our very large ham dealers made quite a business of making those conversions because CBers paid full list price for rigs with no questions asked while hams would do virtually anything to save $10 on the purchase . . . so they sold CBers first and we got what was left over. With the fading interest in HF operating, as the frequencies above the 40 CB channels were called, hams have been able to buy ham rigs again. There is still activity on the HF band, but it is a shadow of what we were hearing ten years ago. The FCC has never shown any serious interest in trying to shut down this illegal activity, so it has indeed been going for many years relatively unimpeded. There was a time when hams were screaming that these hordes of CBers were going to invade the ten-meter band, but it never really happened. I didn't think it would and said so at the time, but that was not a popular way to think then. Come to think about it, I always seem to be out of step like that.—Wayne.

EDUCATION

Here I go again, penning my second letter. Many of your ideas are echoes of my feelings, and further discussion would be redundant. Some of your ideas go contrary to my feelings, but thank goodness we are all different, and I am sure you get plenty of feedback. One topic which you hit on in your Never Say Die (Never Spend a Dollar?) column that I must respond to is education.

Your September NSD column stated, among other things, that the school system is set up so as to virtually guarantee failure as far as making any real money is concerned. How you reach this conclusion is questionable, but I have a more important querry: What can be done to change this?

My wife and I are both teachers (as well as hams). Karen works with learning-disabled children and I have a sixth-grade classroom. What are your thoughts on how to instill that desire of success with students who do not care? Any ideas would be welcomed.

The Whiteside Amateur Radio Club, which I sponsor, recently purchased your code series cassettes and the kids seem to be learning the code better than when I send it on an oscillator.

Thanks for any suggestions a teacher could use, and keep on plunking away at what you feel is right concerning amateur radio, politics, or whatever.

Carl J. Buehler WB9ZAJ
Belleville IL

Sure, Carl, whenever I discuss a problem I try to offer a solution to it. In the case of education, I noted that our colleges are geared towards training kids to work in the three proven areas for non-wealth . . . large corporations, government, and teaching. Once we recognize that the easiest way to make money is to be an entrepreneur, we can see the need for schools which teach kids how to be entrepreneurs. My aim is to set up a pilot-program college which will teach the fundamentals of electronics and computers, and then all of the business courses which are needed if one is going to successfully run one's own business or manage a business. In order to keep the cost down and also to provide the best possible teaching in the shortest time, the college will work hand-in-hand with a group of on-campus businesses with which the kids can get practical professional experience in advertising, sales, accounting, marketing, legal problems, production lines, technical developmental work, and so on. Between practical college courses and actually working at business, the students will be ready to go to work and be of value the day they graduate.—Wayne.

DX JUNKIES

I am calling for help as a battered, insulted, and reviled ham who has the misfortune to be "nearby DX" to hundreds of thousands of frantic thoughtless hams. At present, I seem to be the only active ham in the US Virgin Islands on CW.

It's almost impossible to keep a schedule with some old friends with dozens of hams cramming the frequency calling me. For what? The stupid endless waste of time known as 5-band DXCC. These misguided souls are frantic, like a bunch of starving junkies with their fix being my QSL card.

I have been an active ham since 1928 (W2AIS—'28-'51, KH6ARA—'51-'59, and KV4CI—'60 until the present). I am now retired and own my home, 6/10 of an acre, and a big active Labrador retreiver. I have barely enough time to keep up with domestic chores let alone reply to a flood of QSL cards.

When we were young, it took a QSL card to convince people that we really talked to the Far East or Iowa. Now, if you can't work DXCC in a few weeks, your antenna is no good.

For the past few weeks, I have endured insults, jamming, and vicious gossip. One morning, I heard a ham chide another working me by asking, "Why do you QSO that bastard? He doesn't QSL." My God! This is supposed to be a hobby, not a dogfight.

Though I had notices published in RSGB's *Radio Communication*, the JA magazine, and *CQ* telling of my intention to cease QSLing, the cards still pour in. When a ham asks me if I QSL and I tell him I don't, he will send me begging letters and homemade QSLs especially designed for my signature. Add to that dollar bills and countless IRCs. I could make a good side income on the dollar per QSL route, but that is not ham radio. Yesterday, I had to stand in line for a registered letter, and the Christmas lines are long. It was a registered, return letter from a JA ham. I added up the stamps plus the IRCs, and it exceeded $5! The worst aspect of this whole mess is what I call the "bang-bang thank you ma'am" type which is "ur 599 pse ur QSL info."

Wayne, you have clout and your editorials are read widely. Though I detest the whole QSL mess, I would cooperate by answering a "yes/no" printout for QSO claims. Why don't these crazed fanatics get together and have a master computer to handle it? God knows they spend multithousands of dollars on ham gear. Why not set up a "DX info center," hire help, buy software, and charge the applicants a yearly fee for the service? It could be done now.

If they did, the overloaded post office would be thankful and innocent victims would be relieved of the foul filth being spewed out by a deranged minority of DXaholics.

It is a timely topic for a "good Green tirade" to help these misguided souls regain some perspective as to what ham radio is meant to be—fun, not misery.

H. Miller KV4CI
St. Thomas, Virgin Islands

Sorry, OM, there is no escape from DXCC and its 5BDXCC extravaganza . . . plus the (dis)Honor Roll. This is an ARRL-made nightmare which makes life miserable for all hams in relatively rare DX countries. Of course, being within contact range of the entire US all of the time, you get the very worst of it. One of the reasons so many countries are rare is that the DXers drive any new ham off the bands as quickly as they can with demands that no contacts be over a few seconds long . . . and that the ham in the rare country devote his life to the unending pile of DXers. Even if a ham in one of these countries could work every single DXer just to get it over with, within two days he would be piled up again with chaps just piling on the heaps to prove they can get through. I'm sure we all really love the guy with the multi-kilowatt and big beam who gets a rare one and thanks him for the instant contact a few days ago . . . 73. OM, there is no answer to your problem that I know of. The ARRL certainly is not going to cancel DXCC just because it ruins the hobby for ops in 250 countries . . . and even if they did, there would be a replacement award within seconds to keep the pileups shrieking. Say, have you thought of moving to Florida?—Wayne.

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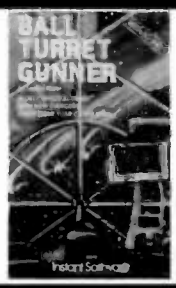

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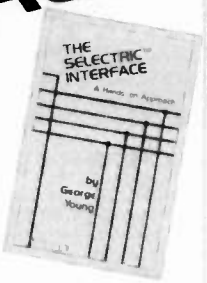

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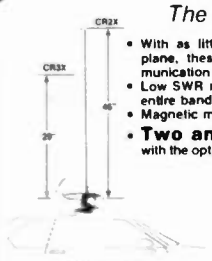

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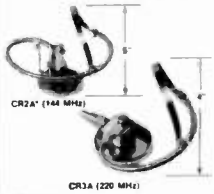

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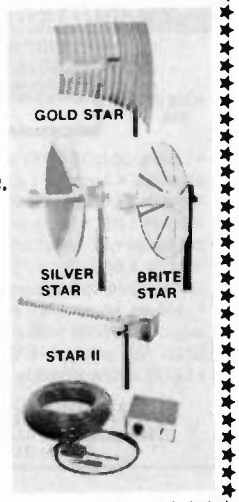

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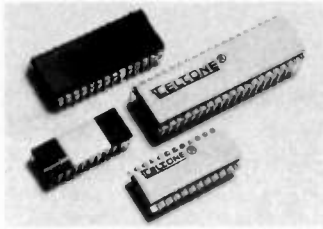
✓See List of Advertisers on page 114

Teltone DTMF Receiver kits turn phones into control devices



Teltone's DTMF Receivers let you turn the phone system into a control network. They outperform other receivers in noisy environments and operate over a wide dynamic range.

Two DTMF kits are available. The TRK-947 kit at $53.00, decodes DTMF. For both Rotary and DTMF, order the TRK-927 for only $75.00. Both include a 3.58 MHz crystal and a DIP socket.

To order call: (800) 227-3800 ext 1130
[In CA. (800) 792-0990 ext 1130]

TELTONE CIRCLE NO. 224

YAESU FT-207R OWNERS

AUTO SCAN MODULE AND BATTERY SAVER KIT

WRITE FOR CLUB DISCOUNTS

15 minutes to install; scan restarts when carrier drops off; busy switch controls automatic scan on-off; includes module and instructions.

Model AS-1. $25.00

new **FT-207R BATTERY SAVER KIT MODEL BS-1 $14.95**

- No more dead batteries due to memory backup
- 30% less power drain when squelched
- Simple to install; step-by-step instructions and parts included
- 4 mA memory backup reduced to 500 µA.
- 45 mA receiver drain reduced to 30 mA.
- Improved audio fidelity and loudness

ENGINEERING CONSULTING
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BREA, CALIFORNIA 92621
400

GO MOBILE WITH YOUR H.T.!

Model I—Icom IC-2A/T, Etc.
Model K-1 for TR-2500
—slides on bottom of radio

Guaranteed!

Model K—TR-2400;
—powered thru battery plug
Model N—FT-208R
Model T—Simple mod for Tempo

NOW FOR FT-208R & TR-2500

Model Y—FT-207R,
—fits into battery compartment

A unique battery eliminator HANDI-TEK Regulator allows constant hand-held operation from auto DC or base supply with no nicad drain and WITHOUT RADIO MODIFICATION! $24.95 PPD in USA. CA add $1.50 Sales Tax.
460

HANDI-TEK
P.O. BOX 2205, LA PUENTE, CA 91746

Lunar Line for Tired Receivers

Lunar's line of RF actuated in-line receiving preamplifiers can spark up that otherwise dead band. Missing those weak ones? Become an elephant with new ears. Models available from 28-220 MHz bands. Simply insert between your transceiver and antenna, apply 12 VDC and enjoy. Standard SO-239 connectors on RF ports - BNC available. Typical performance at 144 MHz: 1.4 dB NF 10 dB gain. Low noise performance from Lunar - simply, the best.
220

LUNAR electronics
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San Diego, Ca 92110
(619) 299-9740 • Telex 181747

SYNTHESIZED SIGNAL GENERATOR

MADE IN USA

MODEL SG100D
$349.95
plus shipping

- Covers 100 to 185 MHz in 1 kHz steps with thumbwheel dial • Accuracy 1 part per 10 million at all frequencies • Internal FM adjustable from 0 to 100 kHz at a 1 kHz rate • Spurs and noise at least 60 dB below carrier • RF output adjustable from 5-500 mV at 50 ohms • Operates on 12 Vdc @ 1/2 Amp • Available for immediate delivery • $349.95 plus shipping • Add-on Accessories available to extend freq. range, add infinite resolution, voice and sub-audible tones, AM, precision 120 dB calibrated attenuator • Call for details • Dealers wanted worldwide.

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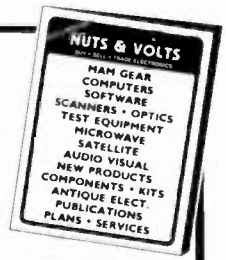

NUTS & VOLTS MAGAZINE

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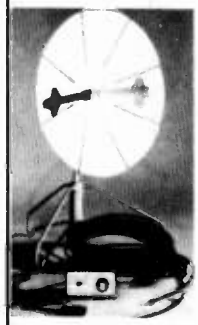
2.1 to 2.6 GHz Frequency Range
34db System Gain (or Greater)

Complete System (as pictured)	$149.95
Down Converter Probe Style (Assembled and Tested)	$ 64.95
Power Supply (12V to 16V DC+) (Assembled and Tested)	$ 59.95



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Call your Phone Order in Today. TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.50. Minimum order $6.00. Orders under $10.00 add $1.50. Add 6% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available

FM-3 Kit $14.95
FM-3 Wired and Tested 19.95

Color Organ

See music come alive! 3 different lights flicker with music. One light each for high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 $8.95

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit VD-1 $7.95

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 $2.95

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 $5.95

CPO-1

Runs on 3-12 Vdc 1 watt out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit $2.95

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage

FM-1 kit $3.95 FM-2 kit $4.95

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 $6.95

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation. 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 $5.95

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs

UT-5 Kit $5.95

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit $4.95

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker. Complete kit, SM-3 $2.95

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma). 1 min/month accuracy. TB-7 Kit $5.50
TB-7 Assy $9.95

CLOCK KITS

Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 $24.95
Clock with 10 min. ID timer, 12/24 hour, DC-10 $29.95
Alarm clock, 12 hour only, DC-8 $29.95
12V DC car clock, DC-7 $29.95

For wired and tested clocks add $10.00 to kit price. SPECIFY 12 OR 24 HOUR FORMAT

SATELLITE TV KIT

THE POPULAR SAT-TEC RECEIVER IN KIT-FORM!

image rejection, fully tunable audio to recover 'hidden' subcarriers, divide by two PLL demodulator for excellent threshold performance, tight tracking AFC to assure drift free reception, and of course, full 24 channel tunable coverage.

Build your satellite TV system around the R2B, close to ten thousand others already have and now it's available in kit form at a new low price. Order yours today.

Featured in a Radio Electronics magazine cover story (May 82), the reliable R2B Sat-tec TV receiver is now operating in thousands of locations. The R2B is easy to build; pre-etched, plated boards with screened component layout assures accurate component placement and the critical IF section and local oscillator are pre-assembled and aligned! All parts are included for the R2B; attractive case, power supply, descriptive operating manual as well as complete assembly instructions. Features of the receiver include: dual conversion design for best

A complete Satellite TV System requires a dish antenna, LNA (low noise amplifier), Receiver and Modulator.

R2B Receiver Kit $359.00
R2B Receiver, Wired and Tested $595.00
120° K Avantek LNA $495.00
RM3 RF Modulator $49.95
Prices include domestic UPS shipping and insurance.

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7651 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C-F	15/$1.00
2N3906 PNP C-F	15/$1.00
2N4403 PNP C-F	15/$1.00
2N4410 NPN C-F	15/$1.00
2N4916 FET C-F	4/$1.00
2N5401 PNP C-F	5/$1.00
2N6028 C-F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	5/$1.00
NPN 3904 Type T-R	50/$2.50
PNP 3906 Type T-R	50/$2.50
2N3055	5/$1.00
2N2646 UJT	3/$2.00

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs 15/$1.00
6 Hole Balun Beads 5/$1.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ¾" leads, bag of 300 or more $1.50

Switches

Mini toggle SPDT $1.00
Red Pushbuttons N.O. 3/$1.00

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx 2" diam. Round type for radios, mike etc. 3 for $2.00

Solid State Buzzers

small buzzer, 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible $1.50

Slug Tuned Coils

Small 3/16" Hex Slugs, turned coil, 3 turns 10 for $1.00

AC Outlet

Panel Mount with Leads 4/$1.00

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	.01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial $.50	.001 16V 15/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial 5/$1.00	100 pF 20/$1.00
	10 uF 15V Radial 10/$1.00	.047 16V 20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma $1.25

Ceramic IF Filters

Mini- kHz B.W. SOLD OUT $1.50 ea.

Trimmer Caps

25K 20 Turn Trim Pot $1.00
1K 20 Turn Trim Pot $.50

Sprague - 3-40 pf Stable Polypropylene .50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge $.75

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type $1.00

9 Volt Battery Clips

Nice quality clips 5 for $1.00
⅜" Rubber Grommets 10 for $1.00

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc.
sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.50

Connectors

6 pin type gold contacts for mA-1003 car clock module price .75 ea.

Leds

- your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red 8/$1
Mini Yellow, Jumbo Yellow, Jumbo Green 6/$1

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS

PS-2 kit $29.95
PS-2 wired $39.95

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity, specify -10 or -100

Wired, tested, PS-1B $59.95
Kit, PS-1B $44.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit $22.95
TR-1, RF sensed T-R relay kit 6.95

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz $11.95

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit $6.95

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V ct 1 A and 24 VCT.
Complete kit, PS-3LT $6.95

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa, low power drain.
50 for only $9.00 SOLD OUT 10 for $2.00

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size 1" x ¾" shrink to ¼". Great for splices 50/$1.00

Mini TO-92 Heat Sinks

Thermalloy Brand 5 for $1.00
To-220 Heat Sinks 3 for $1.00

Opto Isolators - 4N28 type $.50 ea.
Opto Reflectors - Photo diode + LED $1.00 ea.

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. 20 strips for $1.00

COS Photocells

Resistance varies with light. 250 ohms to over 3 meg 3 for $1.00

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FACIT 4555 SERIAL PAGE PRINTER

The Facit 4555 alphanumerical serial printer is complete. Equipped with RS232C Interface, printing mechanism, control electronics, drive electronics, power supply and character generator. The adaptation electronics can be modified in four versions:Bit-parallel data transfer, CCITT (EIA, RS232C) for bit-serial data transfer and the current loop (TTY) interface also for bit serial data transfer. The Facit 4555 prints on ordinary paper and is adjustable for different paper widths and formats, 9.5" paper width with 66 lines per page or DIN A4 with 70 lines per page.

SPECIFICATIONS

Print speed	up to 60ch.s.	Char. spacing	2.54mm/1/10" 80ch/line 1.55mm/0.06" 132ch/line
Printing mode	Incremental.		
Max. # of ch/line	80 alt. 132.	Char. Code	ECMA-6 7-bit coded char. set
Matrix	7 X 5 dot matrix.	Char. Set	63 Char. various national versions.
Char. Size Height	2.7mm/1/8"		
Char. Size Width	1.3mm/0.05" 132ch/line 2.1mm/0.083" 80ch/line	Feed mechanism	Sprocket feed.

THESE UNITS WERE PULLED OUT OF SERVICE IN GOOD WORKING CONDITION. WE CHECK EACH UNIT ON A RADIO SHACK TRS-80 COLOR COMPUTER.

PRINTER ONLY $129.99

Printer with linecord, box of paper, inter-connect cable for TRS-80 COLOR COMPUTER. $149.99

GENEVA CALCULATOR WATCH

This attractive watch has the following modes:
Normal Time Setting,
Calendar Setting,
Daily Alarm Time Setting,
Weekly Alarm Time Setting,
Chronograph,
Calculator.

Featured in Black Plastic $24.99 or Featured in Stainless Steel $29.99

SILICON DIODES

MR751	100vdc	6Amps	10/$5.00	100/$38.00
MR510	1000vdc	3Amps	10/$3.75	100/$24.00
HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
27Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

FAIRCHILD 4116 16K DYNAMIC RAMS 200ns. Part # 16K75

25 For $25.00 or 100 For $90.00 or 1000 For $750.00

FEED THRU SOLDER RF CAPACTORS

470pf +-20%

5/$1.00 or 100/$15.00 or 1000/$100.00

1000pf/.001uf +-10%

4/$1.00 or 100/$20.00 or 1000/$150.00

E PROMS

2708 1024x1	$2.00 each
2716 2048x8	$4.00 each
27L32/25L32	$10.00 each

HEWLETT PACKARD MICROWAVE DIODES

1N5711	(5082-2800)	Schottky Barrier Diodes	$1.00 or 10 for $ 8.50
1N5712	(5082-2810)	" " "	$1.50 or 10 for $10.00
1N6263	(HSCH-1001)	" " "	$ .75 or 10 for $ 5.00
5082-2835		" " "	$1.50 or 10 for $10.00
5082-2805	Quad Matched	" " "	per set $5.00 or 10 for $40.00

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800-528-0180
(For orders only)

MHz electronics

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacturers, and described in the RF Data Book.

5pf	10pf	18pf	30pf	43pf	100pf	200pf	1 to 10pcs. $1.00 ea
5.1pf	12pf	22pf	32pf	51pf	110pf	220pf	11 to 50pcs. $ .90 ea
6.8pf	13pf	25pf	33pf	60pf	120pf	470pf	51 up pcs. $ .80 ea
7pf	14pf	27pf	34pf	80pf	130pf	500pf	
8.2pf	15pf	27.5pf	40pf	82pf	140pf	1000pf	

NIPPON ELECTRIC COMPANY TUNNEL DIODES

$7.50

		MODEL 1S2199	1S2200
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ratio (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

Listsall Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

MHz electronics

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RF TRANSISTORS, MICROWAVE DIODES

PART	PRICE
1S2199	$ 7.50
1S2200	7.50
2N1561	25.00
2N1562	25.00
2N2857	1.55
2N2857JAN	2.55
2N2876	11.00
2N2947	18.35
2N2948	15.50
2N2949	3.90
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3632	13.80
2N3818	5.00
2N3866	1.30
2N3924	3.35
2N3927	17.75
2N3950	25.00
2N4072	1.80
2N4127	21.00
2N4427	1.30
2N4428	1.85
2N4957	3.45
2N4958	2.90
2N4959	2.30
2N5090	13.90
2N5108	4.00
2N5109	1.70
2N5160	3.45
2N5177	21.62
2N5179	1.00
2N5583	4.00
2N5589	8.65
2N5590	10.35
2N5591	13.80
2N5635	10.95
2N5637	15.50
2N5641	9.20
2N5642	10.95
2N5643	15.50
2N5645	13.80
2N5646	20.70
2N5691	18.00
2N5764	27.00
2N5836	5.45
2N5842	8.00
2N5849	20.00
2N5913	3.25
2N5922	10.00
2N5923	25.00
2N5941	23.00
2N5942	40.00
2N5944	9.20
2N5945	11.50
2N5946	19.00
2N6080	9.20
2N6081	10.35
2N6082	11.50

PART	PRICE
2N6083	$ 13.25
2N6084	15.00
2N6094 /M9622	11.00
2N6095 /M9623	12.00
2N6096 /M9624	15.50
2N6097	17.25
2N6136	21.85
2N6166	40.25
2N6201	50.00
2N6459	18.00
2N6603	12.00
2N6680	80.00
2SC756A	7.50
2SC781	2.80
2SC1018	1.00
2SC1042	12.00
2SC1070	2.50
2SC1239	2.50
2SC1251	12.00
2SC1306	2.90
2SC1307	5.50
2SC1760	1.50
2SC1970	2.50
2SC2166	5.50
8B1087 (M.A.)	25.00
A50-12	20.00
A283B	5.00
ALD4200N (AVANTEK)	395.00
AM123	97.35
AM688	100.00
BB105B	.52
BD4/4JFBD4 (G.E.)	10.00
BFQ85	1.50
BFR90	1.30
BFR91	1.65
BFW92	1.50
BFX89	1.00
BFY90	1.00
BGY54	25.00
BGY55	25.00
BGY74	25.00
BGY75	25.00
BL161	10.00
BLX67	11.00
BLY568CF	25.00
BLY87	13.00
BLY88	14.00
BLY89	15.00
BLY90	20.00
BLY351	10.00
C4005	20.00
CA402 (TRW)	25.00
CA405 (TRW)	25.00
CA612B (TRW)	25.00
CA2100 (TRW)	25.00
CA2113 (TRW)	25.00
CA2200 (TRW)	25.00
CA2213 (TRW)	25.00
CA2418 (TRW)	25.00

PART	PRICE
CA2612 (TRW)	$ 25.00
CA2674 (TRW)	25.00
CA2881-1(TRW)	25.00
CA4101 (TRW)	25.00
CA4201 (TRW)	25.00
CA4600 (TRW)	25.00
CD1889	20.00
CD2545	20.00
CMD514AB	20.00
D4959	10.00
D4987M	20.00
D5147D	10.00
D5506	10.00
D5827AM	20.00
DMD6022	30.00
DMS-2A-250	40.00
HEP76	4.95
HEPS3002	11.30
HEPS3003	30.00
HEPS3005	10.00
HEPS3006	19.90
HEPS3007	25.00
HEPS3010	11.34
HTEF2204 H.P.	112.00
5082-0112 H.P.	14.20
5082-0253 H.P.	105.00
5082-0320 H.P.	58.00
5082-0386 H.P.	POR
5082-0401 H.P.	POR
5082-0438 H.P.	POR
5082-1028 H.P.	POR
5082-2711 H.P.	23.15
5082-3080 H.P.	2.00
5082-3188 H.P.	1.00
5082-6459 H.P.	POR
5082-8323 H.P.	POR
35826E H.P.	POR
35831E H.P.	29.99
35853E H.P.	71.50
35854E H.P.	75.00
HPA0241 H.P.	75.60
HXTR3101 H.P.	7.00
HXTR3102 H.P.	8.75
HXTR6101/2N6617 H.P.	55.00
HXTR6104 H.P.	68.00
HXTR6105 H.P.	31.00
HXTR6106 H.P.	33.00
QSCH1995 H.P.	POR
JO2000 TRW	10.00
JO2001 TRW	25.00
JO4045 TRW	25.00
K3A	10.00
MA450A	10.00
MA41487	POR
MA41765	POR
MA43589	POR
MA43636	POR
MA47044	POR
MA47651	25.50

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GaAs, TUNNEL DIODES, ETC.

PART	PRICE
MA47100	$ 3.05
MA47202	30.80
MA47771	POR
MA47852	POR
MA49558	POR
MB4021	POR
MBD101	1.00
MDO513	POR
MHW1171	42.50
MHW1182	48.60
MHW4171	49.35
MHW4172	51.90
MHW4342	68.75
MLP102	25.00
MM1500	32.32
MM1550	POR
MM1552	50.00
MM1553	50.00
MM1614	10.00
MM2608	5.00
MM3375A	11.50
MM4429	10.00
MM8000	1.15
MM8006	2.30
MO277L	POR
MO283L	POR
MO3757	POR
MP102	POR
MPN3202	10.00
MPN3401	.52
MPN3412	1.00
MPSU31	1.01
MRA2023-1.5 TRW	42.50
MRF212/208	16.10
MRF223	13.25
MRF224	15.50
MRF237	3.15
MRF238	12.65
MRF243	25.00
MRF245	34.50
MRF247	34.50
MRF304	43.45
MRF315	23.00
MRF420	20.00
MRF421	36.80
MRF422	41.40
MRF427	16.10
MRF428	46.00
MRF450/A	13.80
MRF453/A	17.25
MRF454/A	19.90
MRF455/A	16.00
MRF458	19.90
MRF463	25.00
MRF472	1.00
MRF475	2.90
MRF477	11.50
MRF502	1.04

PART	PRICE
MRF503	$ 6.00
MRF504	7.00
MRF509	5.00
MRF511	8.65
MRF605	20.00
MRF629	3.47
MRF644	23.00
MRF816	15.00
MRF823	20.00
MRF901	3.00
MRF8004	2.10
MS261F	POR
MT4150 Fair.	POR
MT5126 Fair.	POR
MT5481 Fair.	POR
MT5482 Fair.	POR
MT5483 Fair.	POR
MT5596 Fair.	POR
MT5764 Fair.	POR
MT8762 Fair.	POR
MV109	.77
MV1401	8.75
MV1624	1.42
MV1805	15.00
MV1808	10.00
MV1817B	10.00
MV1863B	10.00
MV1864A	10.00
MV1864B	10.00
MV1864D	10.00
MV1868D	10.00
MV2101	.90
MV2111	.90
MV2115	1.55
MV2201	.53
MV2203	.53
MV2209	2.00
MV2215	2.00
MWA110	7.45
MWA120	7.80
MWA130	8.25
MWA210	7.80
MWA220	8.25
MWA230	8.65
MWA310	8.25
MWA320	8.65
MWA330	9.50
NEC57835	5.30
ON382	5.00
PPT515-20-3	POR
PRT8637	POR
PSCQ2-160	POR
PT3190	POR
PT3194	POR
PT3195	POR
PT3537	POR
PT4166E	POR
PT4176D	POR

PART	PRICE
PT4186B	$ POR
PT4209	POR
PT4209C	POR
PT4566	POR
PT4570	POR
PT4571	POR
PT4571A	POR
PT4577	POR
PT4590	POR
PT4612	POR
PT4628	POR
PT4640	POR
PT4642	POR
PT5632	POR
PT5749	POR
PT6612	POR
PT6626	POR
PT6709	POR
PT6720	POR
PT8510	POR
PT8524	POR
PT8609	POR
PT8633	POR
PT8639	POR
PT8659	POR
PT8679	POR
PT8708	POR
PT8709	POR
PT8727	POR
PT8731	POR
PT8742	POR
PT8787	POR
PT9790	41.70
PT31962	POR
PT31963	POR
PT31983	POR
PTX6680	POR
RAY-3	24.99
40081	POR
40281	POR
40282	POR
40290	POR
RF110	25.00
SCA3522	POR
SCA3523	POR
SD1065	POR
SS43	POR
TP1014	POR
TP1028	POR
TRW-3	POR
UTO504 Avantek	70.00
UTO511 Avantek	75.00
V15	4.00
V33B	4.00
V100B	4.00
VAB801EC	25.00
VAB804EC	25.00
VAS21AN20	25.00

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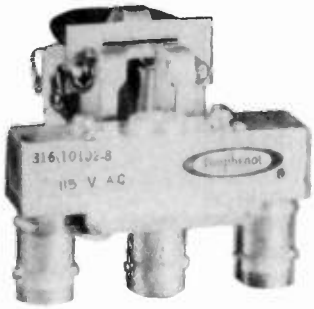
COAXIAL RELAY SWITCHES SPDT

Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.

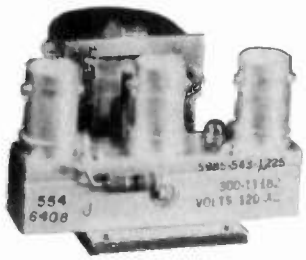
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



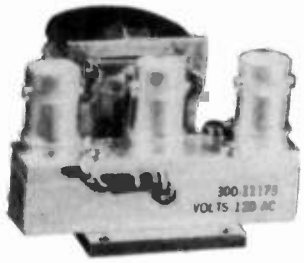
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00 $8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

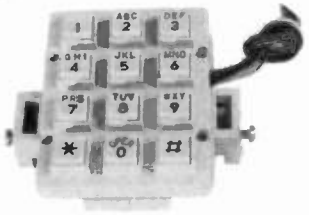
The Recall Phone Telephone employs the latest state of art communications technology. It is a combination telephone and automatic dialer that uses premium-quality, solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive. Alpha Cyanoacrylate. Set-Time 20 to 40 sec., 0.7fl.oz. (20gm.)
$2.00

TOUCH TONE PAD

This pad contains all the electronics to produce standard touch-tone tones. New with data.



$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.

$19.99 or 10/$149.99

INTEGRATED CIRCUIT.		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.

Features:

1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

We will be closed April 27th through May 2nd...

See you at the Dayton Hamvention!

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2E26	$ 5.69	KT88	$ 20.00	6562/6974A	$ 50.00
2K28	100.00	DX362	50.00	6832	22.00
2X1000A	300.00	DX415	50.00	6883/8032A/8552	7.00
3B22	19.75	572B/T160L	49.00	6897	110.00
3B28/866A	7.50	592/3-200A3	144.00	6907A	75.00
3-500Z	102.00	807	7.50	6939	15.00
3-1000Z	400.00	811	10.00	7094	125.00
3CX1000A/8283	428.00	811A	15.00	7117	17.00
3CX1500A7/887	533.00	812A	35.00	7211	60.00
3X2500A3	200.00	813	50.00	7289/3CX100A5	34.00
3CX3000A7	490.00	829B	38.00	7360	11.00
4-65A/8165	45.00	832A	28.00	7377	67.00
4-125A/4D21	58.00	4624	310.00	7408	4.00
4-250A/5D22	75.00	4662	80.00	7650	250.00
4-400A/8432	90.00	4665	585.00	7695	8.00
4-400C/6775	95.00	5675/A	25.00	7843	58.00
4-1000A/8166	300.00	5721	200.00	7854	83.00
4B32	22.00	5768	85.00	7868	5.00
4E27A/5-125B	155.00	5836	100.00	7894	12.00
4CS250R	146.00	5837	100.00	8072	65.00
4X150A/7034	30.00	5861/EC55	110.00	8117A	130.00
4X150D/7035	40.00	5876A	25.00	8121	60.00
4X150G/8172	100.00	5881/6L6W	6.00	8122	100.00
4X250B	30.00	5893	45.00	8236	30.00
4CX250B/7203	45.00	5894/A	50.00	8295/PL172	506.00
4CX250F/G/8621	55.00	5894/B	60.00	8462	100.00
4CX250K/8245	100.00	5946	258.00	8505A	73.50
4CX250R/7580W	69.00	6080	10.00	8533W	92.00
4CX300A/8167	140.00	6083/AX9909	89.00	8560/A	65.00
4CX350A/8321	83.00	6098/6AK6	14.00	8560AS	90.00
4CX350F/J/8904	95.00	6115/A	110.00	8608	34.00
4X500A	282.00	6146	7.00	8637	38.00
4CX600J/8809	607.00	6146A	7.50	8643	100.00
4CW800F	625.00	6146B/8298A	8.50	8647	123.00
4CX1000A/8168	340.00	6146W	14.00	8737/5894B	60.00
4CX1500B/8660	397.00	6156	66.00	8873	260.00
4CX5000A/8170	932.00	6159	15.00	8874	260.00
4CX10000D/8171	990.00	6161	233.00	8875	260.00
4CX15000A/8281	1260.00	6291	125.00	8877	533.00
4PR60A	100.00	6293	12.00	8908	12.00
4PR60B/8252	175.00	6360	5.00	8930/651Z	71.00
4PR400A/8188	192.00	6524	53.00	8950	12.00
5CX1500A	569.00	6550	10.00		

6BK4C	6.00	6JM6	6.00	6LQ6 (Sylvania)	7.50
6DQ5	5.00	6JN6	6.00	6LU8	6.00
6FW5	6.00	6JS6B	6.00	6LX6	6.00
6GE5	6.00	6KG6/EL505	6.00	6ME6	6.00
6GJ5	6.00	6KM6	6.00	12BY7A	4.00
6HS5	6.00	6KN6	6.00	12JB6A	6.00
6JB5/6HE5	6.00	6LF6	6.00	6KD6	6.00
6JB6A	6.00	6LQ6 (GE)	6.00	6JT6A	6.00
				6KD6	6.00

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"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO. Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

SPECTRA PHYSICS INC. Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS
105CFM at 60CPS THESE ARE NEW $ 7.99

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FAIRCHILD VHF AND UHF PRESCALER CHIPS		PRICE
95H90DC	350MC Prescaler divide by 10/11	$ 8.50
95H91DC	350MC Prescaler divide by 5/6	8.50
11C90DC	650MC Prescaler divide by 10/11	15.50
11C91DC	650MC Prescaler divide by 5/6	15.50
11C06DC	UHF Prescaler 750MC D Type Flip Flop	12.30
11C05DC	1GHz Counter Divide by 4 (Regular price $75.00)	50.00
11C01FC	High Speed Dual 5/4 Input NO/NOR Gate	15.40
82S90	Presettable High Speed Decade/Binary Counter used with the 11C90/91 or the 95H90/91 Prescaler can divide by 100. (Signetics)	5.00
11C24DC	This chip is the same as a Motorola MC4024/4324 Dual TTL Voltage Control Multivibrator.	3.37
11C44DC	This chip is the same as a Motorola MC4044/4344 Phase Frequency Detector.	3.37

GENERAL ELECTRIC CO. GUNN DIODE MODEL Y-2187
Freq. Gap (GHZ) 12 to 18, Output (Min.) 100mW, Duty (%) CW, Typ. Bias (Vdc) 8.0, Type. Oper. (MAdc) 550, Max. Thres. (mAdc) 1000, Max. Bias (Vdc) 10.0. **$39.99**

VARIAN GALLIUM ARSENIDE GUNN DIODES MODEL VSX-9201S5
Freq. Coverage 8 to 12.4GHz, Output (Min.) 100mW, Bias Voltage (Max.) 14vdc, Bias current (mAdc) Operating 550 Typ. 750 Max., Threshold 850 Tup. 1000 Max. **$39.99**

VARI-L Co. Inc. MODEL SS-43 AM MODULATOR
Freq. Range 60 10 150MC, Insertion Loss 13dB Nominal, Signal Port Imp. 50ohms Nominal, Signal Port RF Power + 10dBm Max., Modulation Port BW DC to 1KHZ, Modulation Port Bias 1ma. Nominal. **$24.99**

AVANTEK CASCADABLE MODULAR AMPLIFIERS	Model UTO-504	UTO-511
Frequency Range	5 to 500 MHz	5 to 500 MHz
Gain	6dB	15dB
Noise Figure	11dB	2.3dB to 3dB
Power Output	+ 17dB	– 2dB to – 3dB
Gain Flatness	1dB	1dB
Input Power Vdc	+ 24	+ 15
mA	100	10
PRICE	$70.00	$75.00

HEWLETT PACKARD MIXERS MODELS	10514A	10514B
Frequency Range	2MHz to 500MC	2MHz to 500MC
Input/Output Frequency L & R	200KHz to 500MC	200KHz to 500MC
X	DC to 500MC	DC to 500MC
Mixer Conversion Loss (A)	7dB	7dB
(B)	9dB	9dB
Noise Performance (SSB) (A)	7dB	7dB
(B)	9dB	9dB
PRICE	$49.99	PRICE $39.99

FREQUENCY SOURCES, INC MODEL MS-74X MICROWAVE SIGNAL SOURCE
MS-74X: Mechanically Tunable Frequency Range (MHz) 10630 to 11230 (10.63 to 11.23GHz) Minimum Output Power (mW) 10, Overall Multiplier Ratio 108, Internal Crystal Oscillator Frequency Range (MHz) 98.4 to 104.0, Maximum Input Current (mA) 400.

The signal source are designed for applications where high stability and low noise are of prime concern. these sources utilize fundamental transistor oscillators with high Q coaxial cavities, followed by broadband stable step recovery diode multipliers. This design allows single screw mechanical adjustment of frequency over standard communications bands. Broadband sampling circuits are used to phase lock the oscillator to a high stability reference which may be either an internal self-contained crystal oscillator, external primary standard or VHF synthesizer. This unique technique allows for optimization of both FM noise and long term stability. List Price is $1158.00 (THESE ARE NEW) **Our Price—$289.**

HEWLETT PACKARD 1N5712 MICROWAVE DIODE
This diode will replace the MBD101, 1N5711, 5082-2800, 5082-2835 ect. This will work like a champ in all those Down Converter projects. **$1.50 or 10/$10.00**

MOTOROLA MHW1172R LOW DISTORTION WIDEBAND AMPLIFIER MODULE.
Frequency Range: 40 to 300 MHz., Power Gain at 50MHz 16.6min. to 17.4max., Gain Flatness ± 0.1 Typ. ± 0.2 Max. dB., DC Supply Voltage – 28vdc, RF Voltage Input + 70dBmV **PRICE $29.99**

GENERAL ELECTRIC AA NICADS
Model #41B905HD11-G1
Pack of 6 for $5.00 or 60 Cells, 10 Packs for $45.00
These may be broken down to individual cells.

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DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

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PRICES: Prices are subject to change without notice.

RESTOCK CHARGE: If parts are returned to MHZ Electronics due to customer error, customer will be held responsible for all extra fees, will be charged a 15% restocking fee, with the remainder in credit only. All returns must have approval.

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See List of Advertisers on page 114

NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.

Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39.95
LNA 50	40-70	0.9 dB	20 dB	$39.95
LNA 144	120-180	1.0 dB	18 dB	$39.95
LNA 220	180-250	1.0 dB	17 dB	$39.95
LNA 432	380-470	1.0 dB	18 dB	$44.95

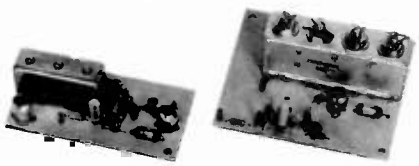
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $14.95
- P30C, VHF Kit with case $20.95
- P30W, VHF Wired/Tested $29.95
- P432K, UHF Kit less case $18.95
- P432C, UHF Kit with case $24.95
- P432W, UHF Wired/Tested $33.95

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49.95
HRA-220	213-233 MHz	$49.95
HRA-432	420-450 MHz	$59.95

RECEIVING CONVERTERS

Mocels to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
Kit $44.95	50-52	28-30
Less Case $39.95	50-54	144-148
Wired $59.95	144-146	28-30
	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
Kit $54.95	435-437	28-30
Less Case $49.95	432-436	144-148
Wired $74.95	432-436	50-54
	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

SPECIAL FREQUENCY CONVERTERS made to custom order $119.95. Call for details.

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 watts output.

	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79.95	28-30	50-52
Wired $119.95	27-27.4	144-144.4
(Specify band)	28-30	220-222
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99.95	50-54	432-436
Wired $149.95	61.25	439.25
	144-148	432-436*

*Add $35 for 2M input

FREE OFFER

For limited time, buy a transmit converter above with 40-45W PA ($129.95) and get $39.95 cabinet FREE.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

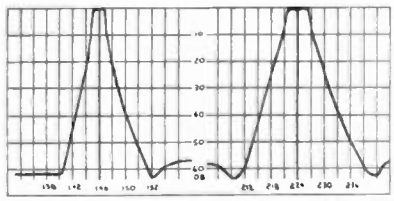
FM-5 PC Board Kit – **ONLY $159.95** complete with controls, heatsink, etc. 10 Watts, 5 Channels, for 6M, 2M, or 220

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $59.95

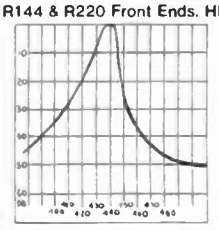
REPEAT OF A SELLOUT!

While supply lasts, get $59.95 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $159.95?

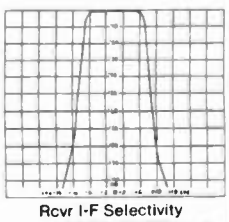
LOOK AT THESE ATTRACTIVE CURVES!



R144 & R220 Front Ends. HRA 144/220, & HRF-144/220

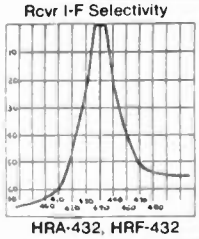


R451 Receiver Front End



Rcvr I-F Selectivity

Typical Selectivity Curves of Receivers and Helical Resonators



HRA-432, HRF-432

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JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
6M,2M,220	$595	$745
440	$645	$795

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

Also available for remote site linking/crossband & 10M.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.2 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY-TUNE TRANSMITTER; UP TO 20 WATTS OUT.

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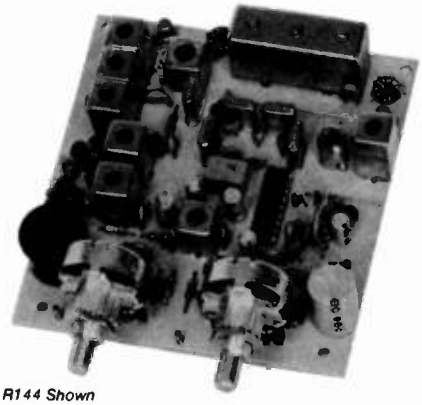
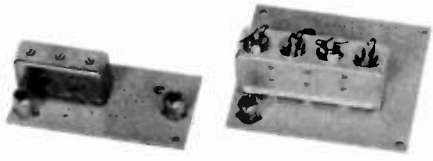
INTRODUCING — NEW 1983 RECEIVERS



R144 Shown

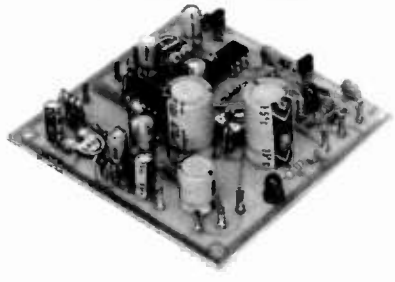
- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity (curves at left). AFC incl., xtal oven avail. Kit only $119.95
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.2 uV sens. Kit only $119.95.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $109.95. Also avail w/4 pole filter, only $94.95/ kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $84.95.
- **R110 UHF AM RECEIVER** for UHF uses, including special 296 MHz model to hear SPACE SHUTTLE. Kit $94.95.



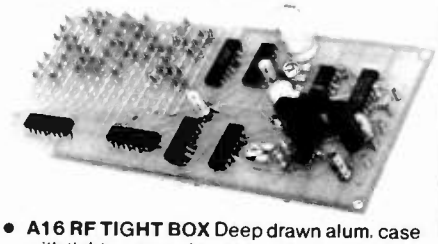
- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

  HRF-144 for 143-150 MHz $34.95
  HRF-220 for 213-233 MHz $34.95
  HRF-432 for 420-450 MHz $44.95

  (See selectivity curves at left.)

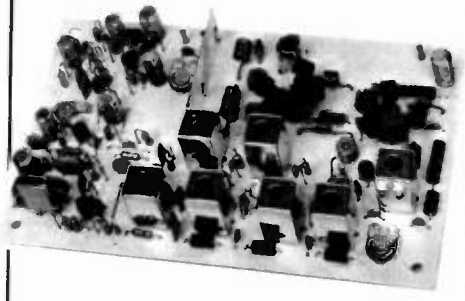


- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.



- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.

TRANSMITTERS AND ACCESSORIES



- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $59.95

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $69.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

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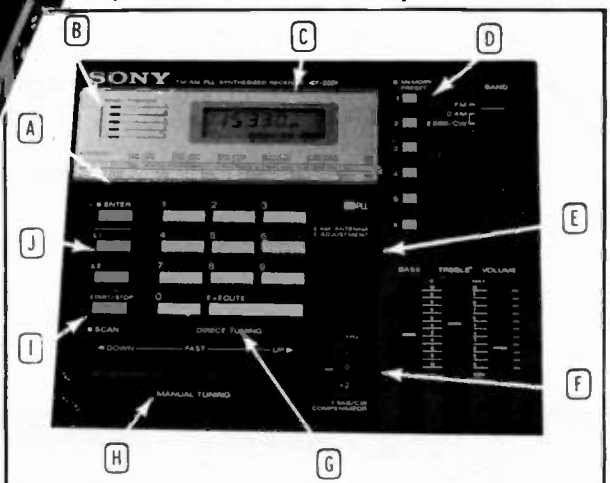

A Enter Button
B Signal Strength Indicator
C Liquid Crystal Display
D Memory Preset Buttons
E Antenna Adjustment Dial
F SSB/CW Compensator
G Execute Bar
H Manual Tuning Buttons
I Scan Button
J High/Low Limit Buttons

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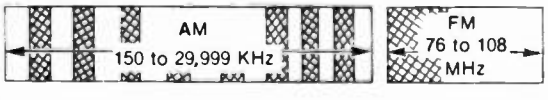
- **Dual PLL Frequency Synthesized—No Drift!**

A WHOLE NEW BREED OF RADIO IS HERE NOW! No other short wave receiver combines so many advanced features for both operating convenience and high performance as does the new Sony ICF-2001. Once you have operated this exciting new radio, you'll be spoiled forever! Direct access tuning eliminates conventional tuning knobs and dials with a convenient digital keyboard and Liquid Crystal Display (LCD) for accurate frequency readout to within 1 KHz. Instant fingertip tuning, up to 8 memory presets, and continuous scanning features make the ICF-2001 the ultimate in convenience.

Compare the following features against any receiver currently available and you will have to agree that the Sony ICF 2001 is the best value in shortwave receivers today:

DUAL PLL SYNTHESIZER CIRCUITRY covers entire 150 KHz to 29.999 MHz band. PLL_1 circuit has 100 KHz step while PLL_2 handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.

EXTENDED SPECTRUM CONTINUOUS TUNING



OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L_1" and "L_2" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "**FAST**" key increases the search rate for faster signal detection. **MEMORY PRESETS**. Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L_1" and "L_2" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES**: Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

SPECIFICATIONS

CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)

SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL. 60304
PHONE (312)848-6777

ramsey the first name in Counters !

9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1, AC adapter	3.95
BP-1, Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed. Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard 10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack + AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100 uV to 1 KV, 5 ranges
DC/AC current	0.1 uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

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2575 Baird Rd. Penfield, NY 14526 ↙ 62

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Terre Haute IN

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New England's Distributor and Authorized Service Center for all Major Amateur Lines. Tufts Radio Electronics, Inc., 61 Lowell Road, Hudson NH 03051, 883-5005.

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New Jersey's only factory-authorized ICOM and Yaesu distributor. Large inventory of new and used specials. Most major brands in stock. Complete service and facilities. Radios Unlimited, 1760 Easton Avenue, P.O. Box 347, Somerset NJ 08873, 469-4599.

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the May '83 issue must be in our hands by March 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	7A	7	7	7	7	7	7	14	14A	21	21A
ARGENTINA	21	14	14	14	7A	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	14A	14	14	7B	7B	7B	14B	14	14	21A	21A
CANAL ZONE	21	14	14	7	7	7	14	21A	21A	21A	21A	21
ENGLAND	7	7	7	7	7	7A	14A	21A	21A	21	14A	14
HAWAII	21A	21	14	7	7	7	7	14B	14	21A	21A	21A
INDIA	14B	14	7B	7B	7B	7B	14	21	21	14	14	14
JAPAN	21	14	7B	7B	7B	7B	7	7	7B	7B	14	21A
MEXICO	21	14	7	7	7	7	7	14A	21A	21A	21A	21A
PHILIPPINES	21	14	7B	7B	7B	7B	7B	14B	14	14	14	21
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	14	7	7	7B	14	21	21A	21A	21A	21A	21
U.S.S.R.	7B	7	7	7	7B	7B	14	21A	21A	14	14B	7B
WEST COAST	21A	14A	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

ALASKA	21	14	7A	7	7	7	7	7	14	14A	21A	21A
ARGENTINA	21A	14	14	14	7A	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	21	14	14	7B	7B	7B	14B	14	14	21A	21A
CANAL ZONE	21A	14	14	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7	7	7	7	7	7	14	21	21A	21	14A	14
HAWAII	21A	21A	14	7	7	7	7	7	14	21A	21A	21A
INDIA	14	14	7B	7B	7B	7B	7B	14	14A	14	14	14
JAPAN	21A	21	14	7B	7B	7B	7	7	7B	7B	14	21A
MEXICO	14A	14	7	7	7	7	7	14	21	21	21A	21A
PHILIPPINES	21A	14A	14	7B	7B	7B	7B	7B	14	14	14	21A
PUERTO RICO	21	14	14	7	7	7	14	21A	21A	21A	21A	21A
SOUTH AFRICA	21	14	7	7	7B	7B	14	21A	21A	21A	21A	21
U.S.S.R.	7B	7	7	7	7B	7B	7B	14A	21A	14	14B	7B

WESTERN UNITED STATES TO:

ALASKA	21	14	7A	7	7	7	7	7	7A	14	21A	21A
ARGENTINA	21A	21	14	14	7A	7	7B	21	21A	21A	21A	21A
AUSTRALIA	21A	21A	21	14	14	14B	7B	7B	14	14	21A	21A
CANAL ZONE	21A	14A	14	7	7	7	7A	21	21A	21A	21A	21A
ENGLAND	7B	7	7	7	7	7B	7B	14	21A	21	14	14
HAWAII	21A	21A	21	14	14	7A	7	7	14	21A	21A	21A
INDIA	14	14	14	14B	7B	7B	7B	7B	14	14	14	14
JAPAN	21A	21A	14A	14	7B	7B	7	7	7	7B	14	21A
MEXICO	21A	14A	7A	7	7	7	7	14	21A	21A	21A	21A
PHILIPPINES	21A	21A	14A	14	7B	7B	7B	7B	14	14	14	21A
PUERTO RICO	21A	14A	14	7	7	7	7A	21	21A	21A	21A	21A
SOUTH AFRICA	21	14	7	7	7B	7B	7B	14	21A	21A	21A	21
U.S.S.R.	7B	7B	7	7	7B	7B	7B	7B	14	14	14B	7B
EAST COAST	21A	14A	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency band may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

MARCH

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G/G	2 G/G	3 F/G	4 F/F	5 F/G
6 F/G	7 G/G	8 G/G*	9 F/F	10 F/G	11 G/G	12 G/G
13 F/F	14 G/G	15 G/G	16 F/F*	17 P/F*	18 P/F*	19 P/F
20 F/G	21 F/G	22 F/F	23 F/G	24 F/G	25 F/G	26 F/F*
27 F/F	28 G/G	29 G/G	30 G/G	31 F/G		

New

INTRODUCING . . .

THE FT-980 CAT SYSTEM ! ! !

Join the computer revolution in Amateur Radio with the Computer Aided Transceiver . . . the new FT-980 from Yaesu Electronics!

- 8-Bit microprocessor for greater operating flexibility.
- High-voltage, all solid state transmitter PA for excellent linearity.
- Keyboard entry of frequencies into any of twelve independent VFO/memory registers.
- Amateur band transmit plus general coverage receive capability.
- Full CW break-in with quiet solid state switching.
- CW Spot switch on front panel.
- Digital frequency display with resolution to 10 Hz. Digital readerboard-type coarse frequency sub-display.
- Keyboard entry of sub-bands for Novice, General, or Advanced Class operators. Separate sub-bands may be programmed on each memory.
- Up/Down scanning plus instant ±5 kHz/step QSY from front panel.
- SSB/CW/AM/FSK/FM operation built in. CW and AM Wide/Narrow selection using optional filters.
- Wide dynamic range and noise floor maintenance provided by husky front end design and IF filter gain balancing.
- 10 Hz synthesizer steps. Quick frequency change via keyboard or scanning controls.
- IF Notch filter at 455 kHz for interference rejection.
- Audio Peak Filter for narrow band CW signal enhancement.
- RX Audio Tone Control for signal laundering in AF line.
- Variable IF Bandwidth and IF Shift using cascaded filters.
- Memory storage of both frequency and operating mode.
- Pushbutton Memory Check feature for verification of memory frequencies without actually changing operating frequency in use.
- Pushbutton Offset Check feature for verification of memory-to-VFO frequency difference.
- Variable Pulse Width Noise Blanker.
- IF Monitor with front panel volume control.
- RF Speech Processor.
- Dual metering of Vcc, Ic, ALC, Compression, Discriminator Center, Relative PO, and SWR (Calibrated).
- Selectable AGC: Slow/Fast/Off.
- Separate RX-only antenna jack.
- Three FSK shifts built in.
- Optional Electronic Keyer Module
- Optimization of audio passband for mode in use, for preservation of noise figure with changing bandwidth.
- Computer interface optional module available mid-1983, for remote transceiver control from personal computer terminal.

For a detailed brochure covering the FT-980 CAT System, call or write your Authorized Yaesu Dealer.

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU

The radio.

0183

83

YAESU ELECTRONICS CORPORATION, 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
YAESU ELECTRONICS Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45146 ● (513) 874-3100

NEW

"DX-traordinary."

Superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

TS-930S

The TS-930S is a superlative, high performance, all-solid state, HF transceiver keyed to the exacting requirements of the DX and contest operator. It covers all Amateur bands from 160 through 10 meters, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.
Among its other important features are, SSB slope tuning, CW VBT, IF notch filter, CW pitch control, dual digital VFO's, CW full break-in, automatic antenna tuner, and a higher voltage operated solid state final amplifier. It is available with or without the AT-930 automatic antenna tuner built-in.

TS-930S FEATURES:

- **160-10 Meters, with 150 kHz-30 MHz general coverage receiver.**
  Covers all Amateur frequencies from 160-10 meters, including new WARC bands, on SSB, CW, FSK, and AM. Features 150 kHz-30 MHz general coverage receiver. Separate Amateur band access keys allow speedy band selection. UP/DOWN bandswitch in 1-MHz steps. A new, innovative, quadruple "UP" conversion, digital PLL synthesized circuit provides superior frequency accuracy and stability, plus greatly enhanced selectivity.
- **Excellent receiver dynamic range.**
  Receiver two-tone dynamic range, 100 dB typical (20 meters, 50-kHz spacing, 500 Hz CW bandwidth, at sensitivity of 0.25 μv, S/N 10 dB), provides the ultimate in rejection of IM distortion.
- **All solid state, 28 volt operated final amplifier.**
  The final amplifier operates on 28 VDC for lowest IM distortion. Power input rated at 250 W on SSB, CW, and FSK, and at 80 W on AM. Final amplifier protection circuits with cooling fan, SWR/Power meter built-in.
- **CW full break-in.**
  CW full break-in circuit uses CMOS logic IC plus reed relay for smooth, quiet operation. Switchable to semi-break-in.
- **Automatic antenna tuner, built-in.**
  Covers Amateur bands 80-10 meters, including the new WARC bands. Tuning range automatically pre-selected with band selection to minimize tuning time. "AUTO-THRU" switch on front panel.
- **Dual digital VFO's.**
  10-Hz step dual digital VFO's include band information. Each VFO tunes continuously from band to band. A large, heavy, flywheel type knob is used for improved tuning ease. T.F. Set switch allows fast transmit frequency setting for split-frequency operations. A=B switch for equalizing one VFO frequency to the other. VFO "Lock" switch provided. RIT control for ±9.9 kHz.
- **Eight memory channels.**
  Stores both frequency and band information. VFO-MEMO switch allows use of each memory as an independent VFO, (the original memory frequency can be recalled at will), or as a fixed frequency. Internal Battery memory back-up, estimated 1 year life. (Batteries not Kenwood supplied).
- **Dual mode noise blanker ("pulse" or "woodpecker").**
  NB-1, with threshold control, for pulse-type noise. NB-2 for longer duration "woodpecker" type noise.
- **SSB IF slope tuning.**
  Allows independent adjustment of the low and/or high frequency slope of the IF passband, for best interference rejection. HIGH/LOW cut control rotation not affected by selecting USB or LSB modes.
- **CW VBT and pitch controls.**
  CW Variable Bandwidth Tuning control tunes out interfering signals. CW pitch controls shifts IF passband and simultaneously changes the pitch of the beat frequency. A "Narrow/Wide" filter selector switch is provided.
- **IF notch filter.**
  100 kHz IF notch circuit gives deep, sharp, notch, better than -40 dB.
- **Audio filter built-in.**
  Tuneable, peak-type audio filter for CW.
- **AC power supply built-in.**
  120, 220, or 240 VAC, switch selected (operates on AC only).
- **Fluorescent tube digital display.**
  Six digit readout to 100 Hz (10 Hz modifiable), plus digitalized sub-scale with 20-kHz steps. Separate two digit indication of RIT frequency shift. In CW mode, display indicates the actual carrier frequency of received as well as transmitted signals.
- **RF speech processor.**
  RF clipper type processor provides higher average "talk-power," improved intelligibility.
- **One year limited warranty on parts and labor.**

Other features:

- SSB monitor circuit, 3 step RF attenuator, VOX, and 100-kHz marker.

Optional accessories:

- AT-930 automatic antenna tuner.
- SP-930 external speaker with selectable audio filters.
- YG-455C-1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in CW filters for 455-kHz IF.
- YK-88C-1 (500 Hz) CW plug-in filter for 8.83-MHz IF.
- YK-88A-1 (6 kHz) AM plug-in filter for 8.83-MHz IF.
- SO-1 commercial stability TCXO (temperature compensated crystal oscillator). Requires modifications.
- MC-60A deluxe desk microphone with UP/DOWN switch, pre-amplifier, 8-pin plug.
- TL-922A linear amplifier (not for CW QSK).
- SM-220 station monitor (not for pan-adapter)
- HS-6, HS-5, HS-4, headphones.

More information on the TS-930S is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

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Specifications and prices are subject to change without notice or obligation.