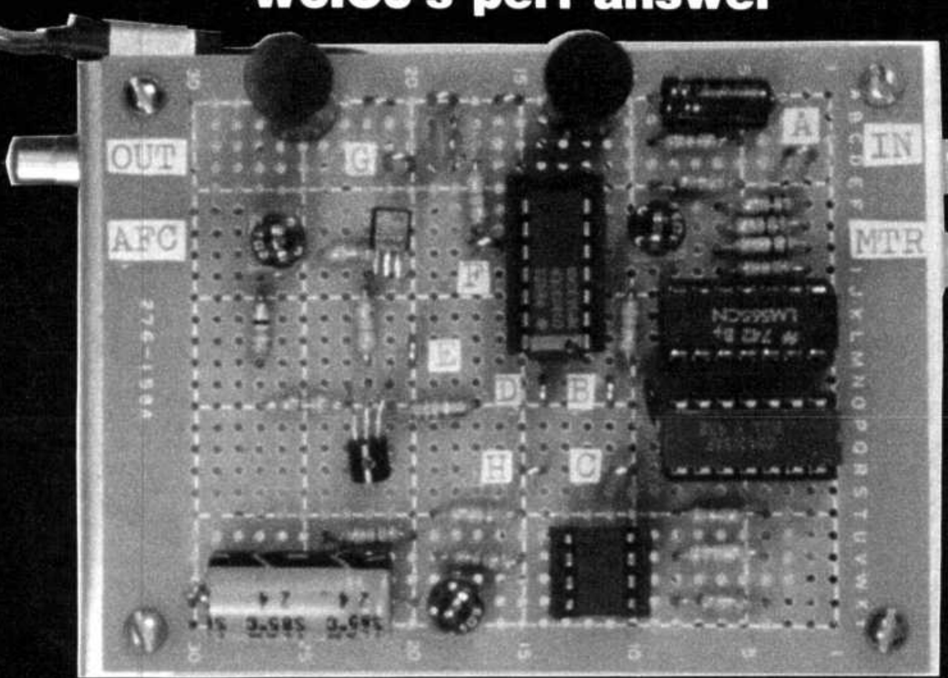
$1.75

QEX 103 WITH Gateway

ARRL Experimenters' Exchange

SEPTEMBER 1990

W6IOJ's perf answer



to a Microsat demod problem

EX: The ARRL
xperimenters' Exchange
merican Radio Relay League
25 Main Street
ewington, CT USA 06111

Non-Profit Org.
US Postage
PAID
Hartford, CT
Permit No. 2929

TABLE OF CONTENTS

QEX (ISSN: 0886-8093) is published monthly by the American Radio Relay League, Newington, CT USA.

David Sumner, K1ZZ
Publisher

Paul L. Rinaldo, W4RI
Editor

Lori Weinberg
Assistant Editor

Mark Forbes, KC9C
Geoffrey H. Krauss, WA2GFP
Bill Olson, W3HQT
Stan Horzepa, WA1LOU
Contributing Editors

Michelle Chrisjohn, WB1ENT
Production Supervisor

Sue Fagan
Graphic Design Supervisor

Dianna Roy
Technical Illustrator

Technical Department
Charles L. Hutchinson, K8CH
Manager
Gerald L. Hall, K1TD
Deputy Manager

Production Department
Mark J. Wilson, AA2Z
Publications Manager

Circulation Department
Debra Jahnke, *Manager*
Kathy Fay, N1GZO, *Deputy Manager*
Chetty Tardette
QEX Circulation

Offices
225 Main St, Newington, CT 06111 USA
Telephone: 203-666-1541
Telex: 650215-5052 MCI
FAX: 203-665-7531 (24 hour direct line)
Electronic Mail: MCI MAIL ID:215-5052
(user name ARRL)
Telemail address: ARRL

Subscription rate for 12 issues:
In the US by Third Class Mail:
ARRL Member $10, nonmember $20;

US, Canada and Mexico by First Class Mail:
ARRL Member $18, nonmember $28;

Elsewhere by Airmail:
ARRL Member $38, nonmember $48.

QEX subscription orders, changes of address, and reports of missing or damaged copies may be marked: *QEX* Circulation.

Members are asked to include their membership control number or a label from their *QST* wrapper when applying.

Copyright © 1990 by the American Radio Relay League Inc. Material may be excerpted from *QEX* without prior permission provided that the original contributor is credited, and *QEX* is identified as the source.

COLUMNS

SEPTEMBER 1990 QEX ADVERTISING INDEX

THE AMERICAN RADIO RELAY LEAGUE, INC

The American Radio Relay League, Inc, is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A bona fide interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US.

Membership inquiries and general correspondence should be addressed to the administrative headquarters at 225 Main Street, Newington, CT 06111 USA.

Telephone: 203-666-1541 Telex: 650215-5052 MCI.
MCI MAIL (electronic mail system) ID: 215-5052
FAX: 203-665-7531 (24-hour direct line)

Canadian membership inquiries and correspondence should be directed to CRRL Headquarters, Box 7009, Station E, London, ON N5Y 4J9, tel 519-660-1200.

Officers

President: LARRY E. PRICE, W4RA
PO Box 2067, Statesboro, GA 30458

Executive Vice President: DAVID SUMNER, K1ZZ

Purposes of *QEX*:

1) provide a medium for the exchange of ideas and information between Amateur Radio experimenters

2) document advanced technical work in the Amateur Radio field

3) support efforts to advance the state of the Amateur Radio art.

All correspondence concerning *QEX* should be addressed to the American Radio Relay League, 225 Main Street, Newington, CT 06111 USA. Envelopes containing manuscripts and correspondence for publication in *QEX* should be marked: Editor, *QEX*.

Both theoretical and practical technical articles are welcomed. Manuscripts should be typed and double spaced. Please use the standard ARRL abbreviations found in recent editions of *The ARRL Handbook*. Photos should be glossy, black-and-white positive prints of good definition and contrast, and should be the same size or larger than the size that is to appear in *QEX*.

Any opinions expressed in *QEX* are those of the authors, not necessarily those of the editor or the League. While we attempt to ensure that all articles are technically valid, authors are expected to defend their own material. Products mentioned in the text are included for your information; no endorsement is implied. The information is believed to be correct, but readers are cautioned to verify availability of the product before sending money to the vendor.

Empirically Speaking...

PCS—The Next Generation

The Federal Communications Commission (FCC) recently released a Notice of Inquiry (NOI) on the possibility of new Personal Communications Services (PCS) under General Docket 90-314. This has no direct bearing on the amateur services, but is of interest from several points of view:

- PCS is something that we might use in business or privately,
- it is of technical interest, and
- it would cause further pressure on the UHF spectrum.

You are certainly aware of the (analog) cellular telephone and may use one on the road. Then there is Future Public Land Mobile Telecommunications System (FPLMTS), which I've written about in this column. If these two systems are the bread, then PCS will be the salami, provided that the FCC carries the docket to a Report and Order permitting PCS, whatever that may be.

The Europeans have already decided to have a second-generation cellular system based on digital modulation and microcell technology. The United Kingdom has jumped the gun and licensed three personal communications network (PCN) systems to commence operations by the end of 1992. The European Telecommunications Standards Institute (ETSI) should have an agreed standard by that time. This NOI is the FCC's way of asking whether the United States ought to play this game. Two petitioners think so:

- Cellular 21 wants nine 100-kHz channels in the 940-941 MHz band with two 50-kHz guard bands for 10-mW second-generation cordless telephones (CT-2) and asked the Commission to earmark 941-944 MHz for expansion.
- PCN America asked the FCC to allocate the 1700-2300 MHz band for PCNs involving cordless radio networks using microcells and digital spread-spectrum modulation for voice, data and image transmission.

The FCC is concerned that existing services (radio paging, cellular and cordless phones) will not be adequate in the years 1995-2000. They point out that the rest of the world is marching toward establishment of PCNs in the 1700-2300 MHz band. It's no news that the federal government is concerned about United States' competitiveness. That means making sure that US industry sells its telecommunications gear to the US market and has a good shot at sales in developing countries. Europe and Japan feel pretty much the same way about their products. There is a tremendous economic incentive for each of the major telecommunications competitors to have their systems become standard.

Worldwide interoperability of at least the portable (not vehicular mobile) units is considered a good thing these days, as people travel the world and would like to lug their portable radio telephone along with their laptop computer and combination fax/photocopier. That would mean not only having international technical standards but common frequency allocations. That would be hopeless dreaming for second-generation cellular but is a definite goal for the third-generation FPLMTS.

At WARC-92, administrations will be trying to find 60 MHz for worldwide roaming of portable units and 170 MHz (not necessarily the same in each region) for mobiles expressly for FPLMTS. However, the second-generation systems will also be looking for some frequencies. Each administration or region may find frequencies domestically for their second-generation systems or may be striving for some harmonization of frequency bands for both second- and third-generation systems. If you're totally confused by now, wait until WARC-92.

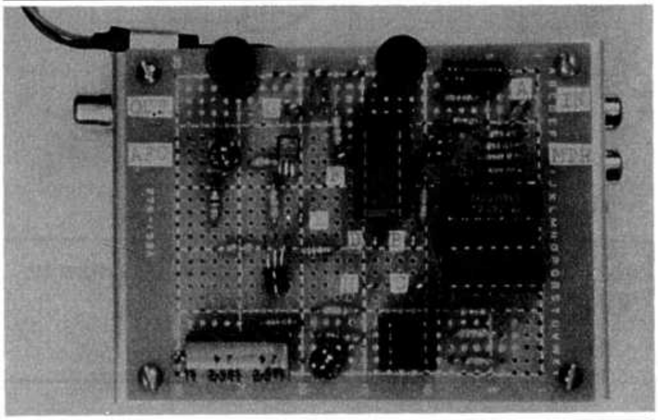
What does all this mean to amateurs? For one thing, the WARC-92 agenda item for all this stuff names the frequency range 1-3 GHz. We have two ham bands within that range. For another, the proponents of new systems are revealing some neat technology these days as part of their quest for spectrum at WARC-92. Because the WARC-92 preparation period is brutally short, companies did not have the luxury of playing coy or even "I'll show you mine if you show me yours first." Within weeks of each other, many companies had to go public with their proposed system descriptions or be left out of the spectrum. While these documents are generally at the system architecture level rather than circuit level, they represent the state-of-the-art. While proprietary information is lacking, these documents are in the public domain and, with a little imagination, contain lots of valuable information for developing future amateur systems.

Shouldn't we be taking advantage of this glut of new technology and planning our next-generation systems now?—*W4RI*

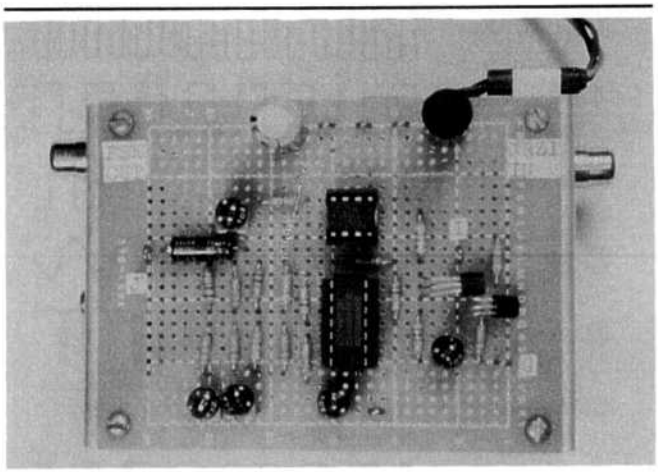
Microsat Demodulator

By John C. Reed, W6IOJ
770 La Buena Tierra
Santa Barbara, CA 93111

Launch of the Microsats is a big step forward in the on-going digital revolution. As far as I'm concerned, it's time to get on board and understand these systems. The alternative is to end up like the vacuum-tube diehards did in the fifties. I decided that the one sure way of doing this is to build related hardware and make it work. In this example, the hardware is a demodulator that uses the Microsat signals as received by my SSB receiver and processes this data to properly interface with my old PK64 packet TNC. It's a relatively simple assembly that will interface with any VHF TNC, and all parts, including the ICs, can be purchased from a single mail-order supplier (All Electronics Corp, PO Box 567, Van Nuys, CA 91408, tel 800-826-5432). The description includes a test device that simulates the digital synchronizing format. An oscilloscope and an audio oscillator are additional recommended test equipment.



Demodulator mounted on 2-3/4 × 3-3/4-inch perf board.



Audio frequency shift keyer mounted on 2-3/4 × 3-3/4-inch perf board.

Phase Shift Keying (PSK)

Microsats LUSAT, PACSAT, WEBERSAT, and the latest Japanese satellite, FO-20, all downlink with the same PSK modulation system. This method has a continuous carrier, phase shifted 180 degrees to carry digital information. The modulated input is in the standard packet 1200 bit/s NRZI digital format, the phase shift occurring whenever there is a level transition (0 bit in the bit stream). Why PSK? The primary reason is that it requires less bandwidth as compared to the more conventional FSK (frequency shift keying) methods. An example is comparing the PSK system that processes 1200 bit/s through the typical 2-kHz bandwidth SSB receiver with performance of conventional HF and VHF packet FSK methods. Test results of this project have made me a believer in the PSK method. As an example, both the noise threshold and the noise rejection performance have been impressive.

Block Diagram Description

Referring to the demodulator block diagram, Fig 1, and the demodulator waveforms, Fig 2, the following describes each waveform diagram. Note that in the timing sequence there is one 0-bit level change to illustrate the PSK operation.

A Carrier—The detected carrier is like a CW signal; it can be any frequency in the receiver pass band. The choice is not particularly critical as long as the sampling rate and pass band are able to carry the 1200-bit/s phase-shift information. I have used frequencies ranging from 1600 Hz to 10 kHz. The indicated waveform diagram is close to this 1600-Hz carrier condition. A second example would be a 5-kHz carrier and, in this case, the phase shift will take about four carrier cycles. The advantage of the higher-frequency carrier is that the out-of-phase transients are easier to filter, resulting in a cleaner demodulated waveform that is less frequency sensitive. The carrier frequency choice is usually a case of fitting it into the band-pass response of a particular receiver.

B PPL/VCO output—The VCO is adjusted to lock-in at twice the carrier frequency. This 2f condition is necessary to implement a 90-degree phase shift.

C Divide by two—Dividing B produces a square wave that is coherent with the input waveform.

D Phase shift—The two input Exclusive-OR gates having B and C inputs result in a square wave shifted 90 degrees. This is a method of obtaining the proper phasing for the PPL lock-on square wave while retaining a coherent square wave for data processing.

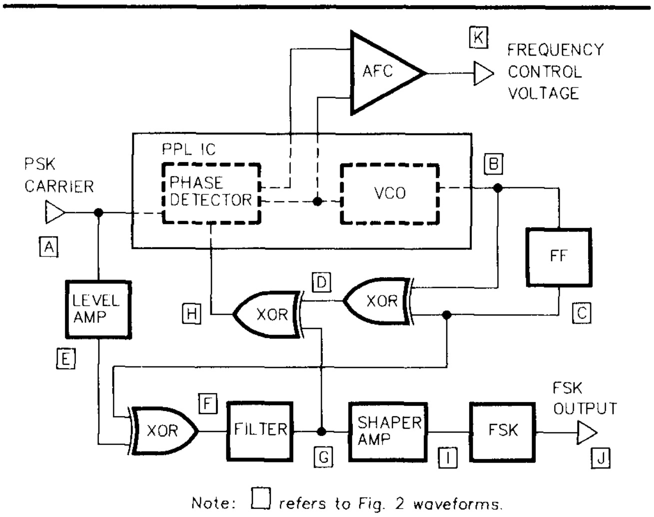


Fig 1—Demodulator block diagram (note: ☐ refers to Fig 2 waveforms)

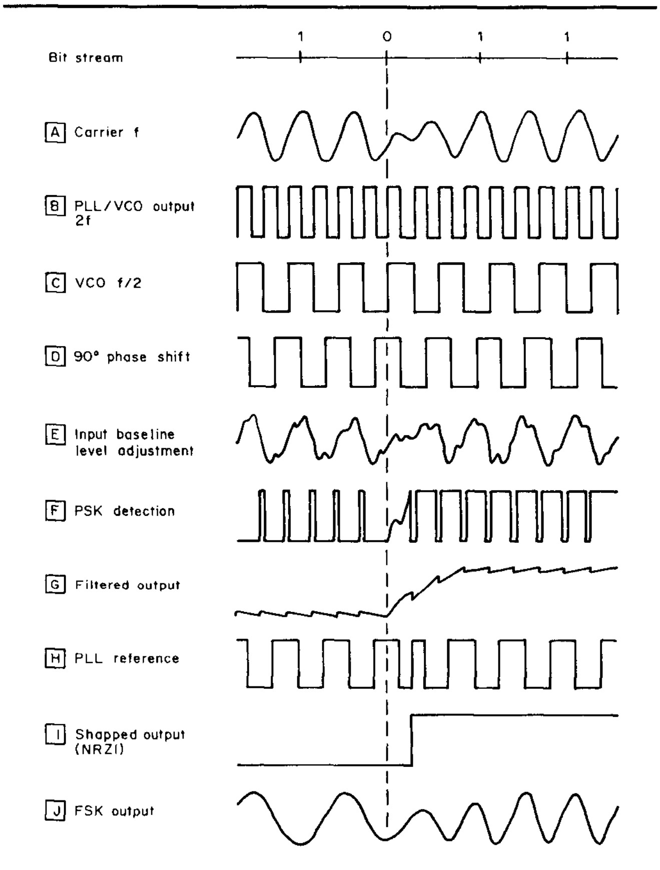


Fig 2—Demodulator waveforms

E Input base-line—The input signal is amplified to produce a 0- to 5-V square wave. The no-signal base line is set at a level corresponding to the threshold of the following digital circuit. This places the receiver noise at the base-line level for optimum S/N performance.

F Phase shift demodulator—The XOR having a square wave on one input that is coherent with the input signal, and the processed input signal on the second input, will indicate a carrier output only when there are noncoherent phase-shifted pulses.

G Filter—Filtering F with a time constant consistent with the 0.8-ms bit period results in the NRZI output.

H PSK lock-on—G is combined with D in an XOR to phase shift the PLL lock-on square wave 180 degrees. This synchronizes the PLL lock-on pulses with the phase-shifted input signal.

I Shaping—G is amplified and clipped such that two successive zero bits make a 0.8-ms pulse.

J FSK—A frequency shifted oscillator is keyed to produce 1200 Hz at one level and 2220 Hz at the other level. It makes no difference which frequency is assigned to a particular level. The TNC selects the reference timing from the multiple bits in the start flag regardless of whether they are 1200 or 2200 bit/s.

K AFC (automatic frequency control)—The PLL is frequency sensitive. With a 1600-Hz carrier, the frequency control must be maintained to within about 200 Hz. This low-frequency carrier is a worse case due to the difficulty in filtering the low-frequency phase-shift error transients. A 5-kHz carrier, as an example, has a tolerance of about 1 kHz. This frequency sensitivity can be a problem due to the large Doppler frequency shift associated with polar orbiting satellites. In a typical Microsat pass of about 12 minutes, the frequency will shift approximately 17 kHz. You can track the bird with the tuning dial, but it's practically a full-time job (particularly when using a 1600-Hz carrier). AFC solves the problem. The PLL error voltage is amplified and filtered to provide a convenient means of controlling the receiver frequency. I had no problem in implementing AFC in my home-built receiver by applying this PLL error voltage to a varactor across one of the IF local oscillators.

Circuit

Referring to the demodulator schematic, Fig 3, the free-running PLL/VCO frequency is: f = 1.2 / 4RC Hz, where RC is the time constant concerned with the R and C on pins 9 and 8 of U1. Although the optimum value for R is 4k, the loop performs well over a reasonable range. The values indicated in the schematic are satisfactory for a carrier frequency ranging from 1600 Hz to about 3 kHz. Remember, the above formula is for the VCO which is operating at twice the carrier frequency. Changing the capacitor value from 0.02 mF to 0.01 mF will cover a higher range, to about 6 kHz.

You may note the time-constant circuit between pin 3 of U2 and pin 2 of U3A. This is to compensate for the slight phase shift in the divider, the time constant allowing a cleaner output at pin 3 of U3A. Note waveforms B, C, and D.

Tester

In the PSK output there is a series of synchronizing packet start flags (01111110) transmitted between data streams. The demodulator will indicate this as a 150-Hz series of 0.8-ms pulses. The tester simulates this sequence. The waveform diagram, Fig 5, and the schematic, Fig 6, describe this assembly.

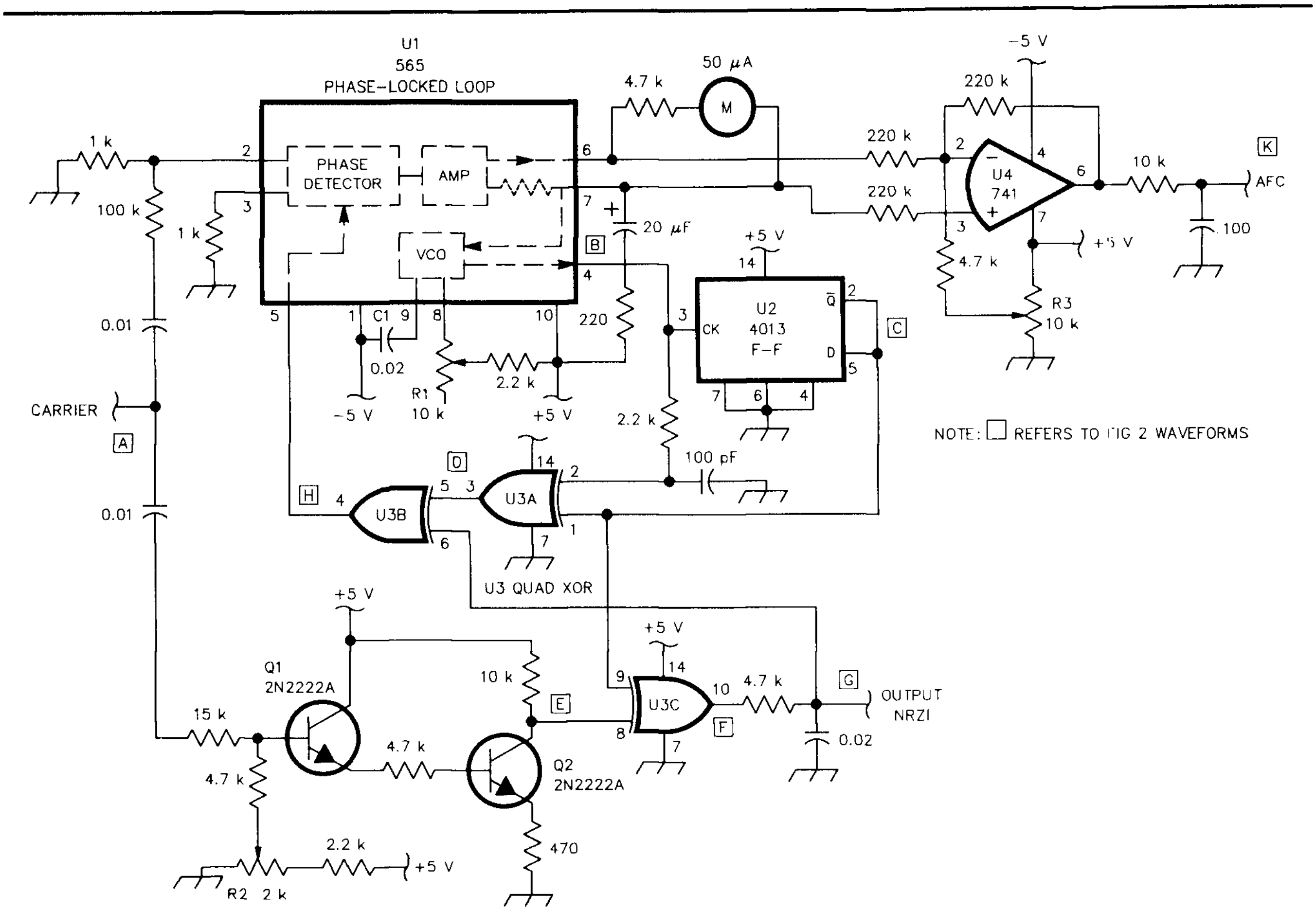
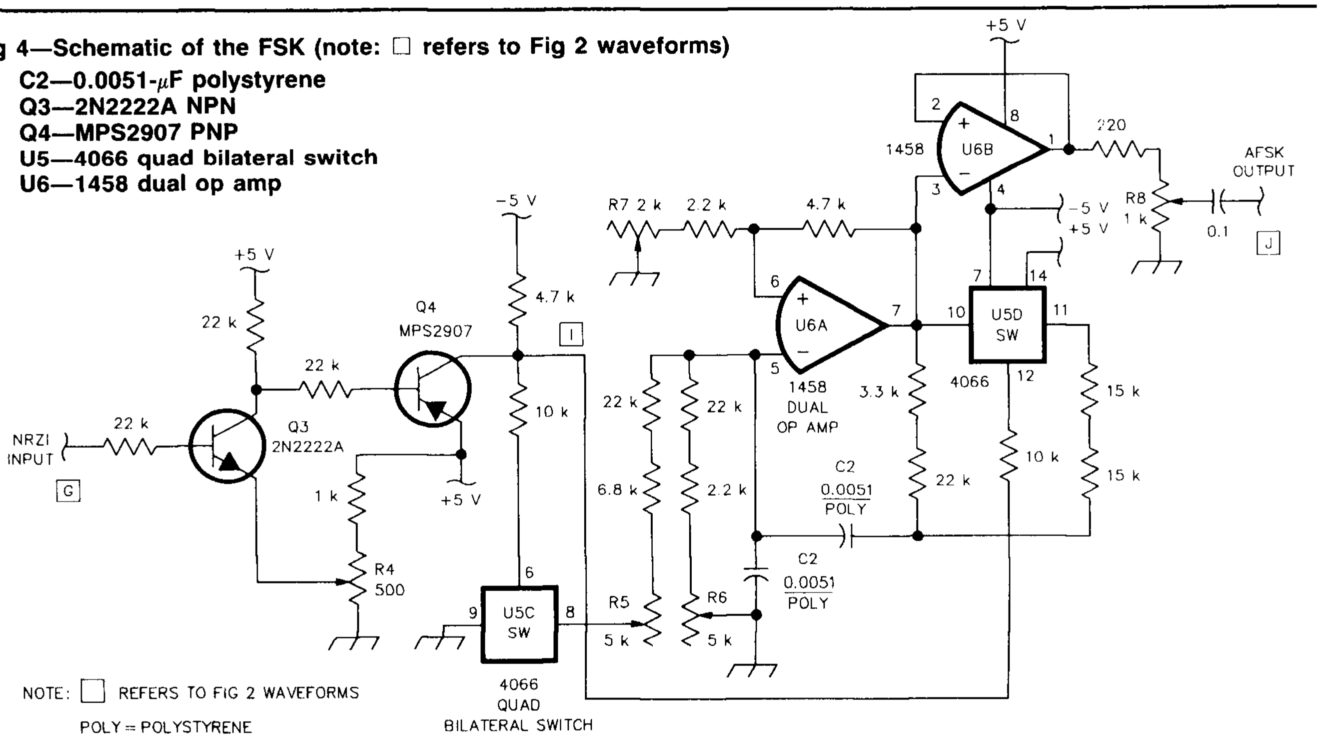


Fig 3—Schematic of the demodulator (note: ☐ refers to Fig 2 waveforms)

C1—0.02-μF polystyrene
Q1, Q2—2N2222A
U1—565 phase-locked loop
U2—4013 flip-flop
U3—4030 quad exclusive OR gate
U4—741 operational amp

Fig 4—Schematic of the FSK (note: ☐ refers to Fig 2 waveforms)

C2—0.0051-μF polystyrene
Q3—2N2222A NPN
Q4—MPS2907 PNP
U5—4066 quad bilateral switch
U6—1458 dual op amp



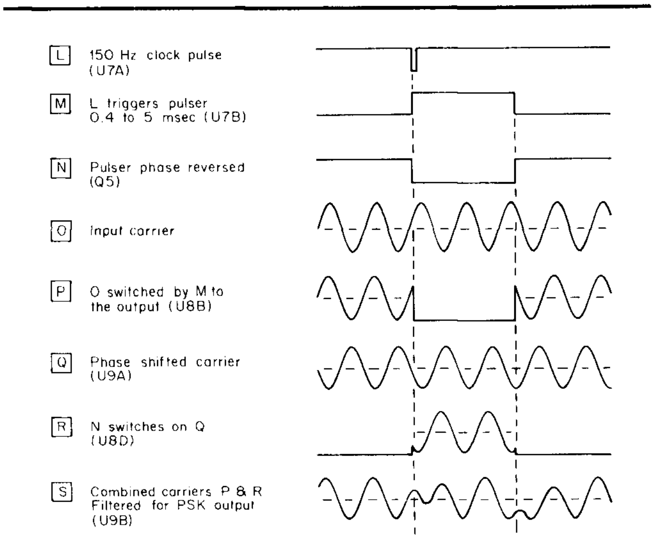


Fig 5—Tester waveforms

Alignment

Following are the alignment procedures. All are referenced to the related circuit diagrams and waveforms.

Tester—Figs 5 and 6. (1) Clock: Adjust R9 for a clock frequency of 150 Hz. (2) Pulse width: Adjust R10 for a pulse width of 0.8 ms. (3) Carrier: Connect the input to a 1600-Hz sine wave 4 V P-P (4) Output: Adjust R11 for an output level of 1 V P-P.

Demodulator—Figs 2 and 3. (5) Signal base line: Adjust R2 for a level of 2 V on pin 8 of U3C (adjustment is made with no carrier input). (6) VCO frequency: Adjust R1 for 3200 Hz while observing pin 4 of U1 (adjustment is made with no carrier input). (7) Demodulator output: Connect the tester carrier to the demodulator input and trim R1 for minimum phasing transients while monitoring the NRZI output. The phase-error meter connected across pins 6 and 7 of U1 will indicate near minimum error when this adjustment is completed. The normal NRZI output will be a clean 0.8-ms pulse, either positive or negative depending upon which phase the PLL locks on.

FSK—Figs 2 and 4. (8) Shaper output: Adjust R4 for a pulse width of 0.8 ms while monitoring the shaper output on the collector of Q4. (9) Demodulator level trim: Adjust R2 (Fig 3) for an error-free output while observing the collector of Q4 and at the same time reducing the tester input to the demodulator. The results should be an error free output with an input of about ¼ V. (10) Oscillator feedback: Temporarily connect the NRZI input to +5 V. Adjust R7 for stable oscillator output while maintaining minimum distortion. (11) FSK frequency: Adjust R6 for an output of 2200 Hz. Temporarily connect the NRZI input to ground. Adjust R5 for an output of 1200 Hz. (12) FSK output: Remove the temporary grounding of the NRZI output and confirm normal FSK output of 4 V P-P.

Receiver connection—(13) Optimum receiver noise

(continued on page 13)

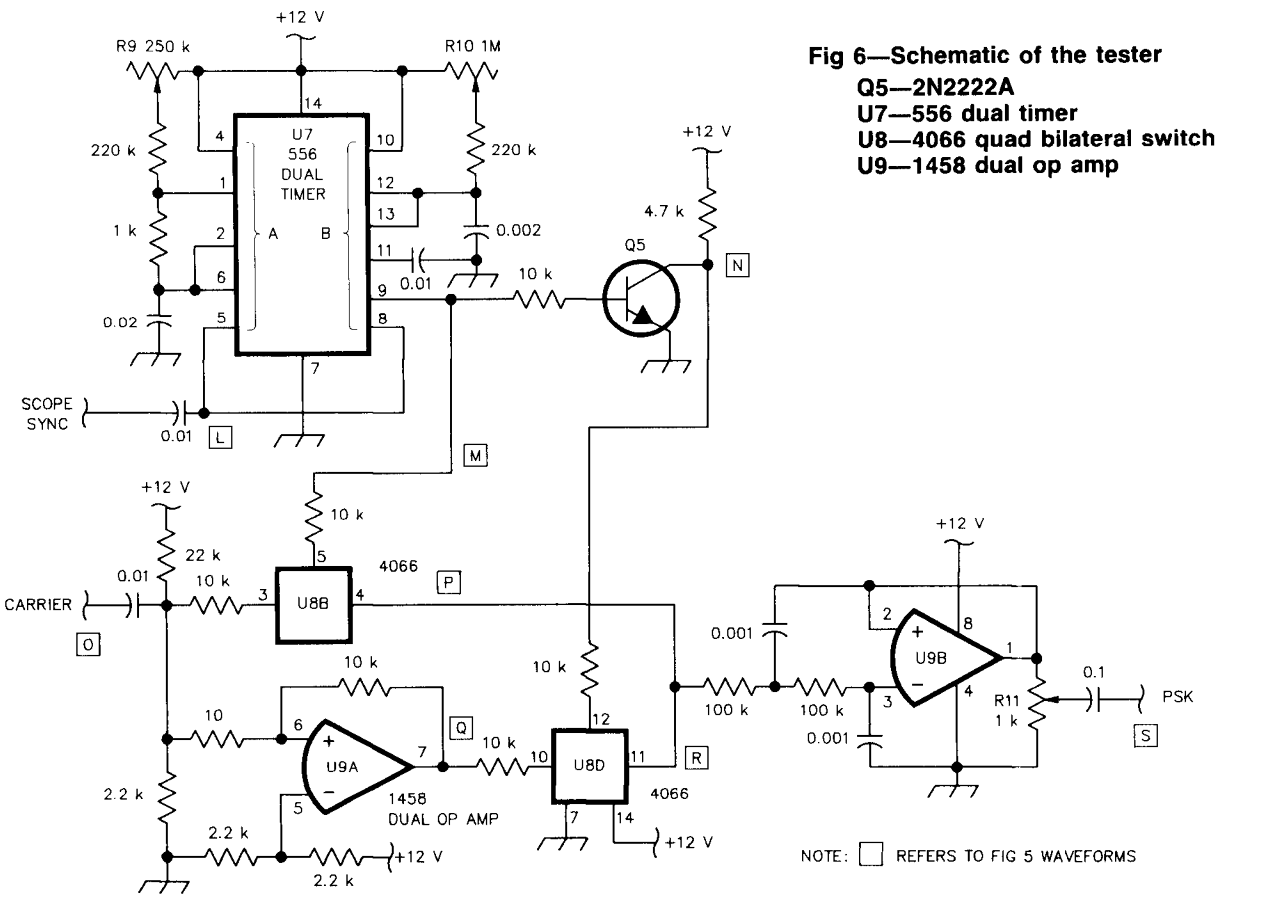


Fig 6—Schematic of the tester
Q5—2N2222A
U7—556 dual timer
U8—4066 quad bilateral switch
U9—1458 dual op amp

The Fourth Method: Generating and Detecting SSB Signals

By D. H. van Graas, PAØDEN
Gemeenlandslaan 9
1276 AT Huizen
The Netherlands

While looking for a simple system when building a new SSB transmitter, I found a nice audio phase shifter designed by HA5WH, in the *ARRL Handbook* (1986 edition, pp 18-9—Fig 1).

Omitting the op-amps, the outputs of the shifter (selected components within 1%) were four equal signals each 90 degrees out of phase.

I don't like RF phase shifters, expensive doubly balanced mixers and all other kinds of balancing. So I thought (based on the old frequency converter system with ac motor generators) using a dual-analog 1 to 4 multiplexer, the HEF4052B, must give good results. Because of switching effects, the usable operating frequency is not high, in this case, 90 kHz suppressed SSB carrier.

The SSB Exciter Diagram, Fig 2

The 11.59055-MHz crystal oscillator signal is first divided by 16 (HEF4029B) and then divided by eight in a second HEF4029B, driving the multiplexer. By counting up or down (changing the rotation direction of the multiplexer) LSB or USB is obtained.

The resistors around the HEF4029B limit the switching currents. A balanced-output LC filter on 90.55 kHz is connected to a balance mixer to eliminate switching spikes. The output of this mixer on 11.5 MHz is filtered by a simple crystal filter, removing unwanted mixing products at least 90 kHz away.

Results

With an output of 300 mV peak-to-peak on 11.5 MHz, 2-kHz test tone: The carrier suppression is better than 50 dB, other sideband suppression is better than 50 dB (<1 mV P-P).

Because of the high 300-2700 Hz audio level, 4 V P-P to inputs shifter, dc balancing of the buffer-op amps is not required.

The True SSB Detector Diagram, Fig 3

First, I had to find out if the audio phase shifter would work as an audio phase combiner.

An identical filter as combiner connected to the shifter in the exciter gives the following results:

By an input 4 × 900 mV P-P, 0°, 90°, 180° and

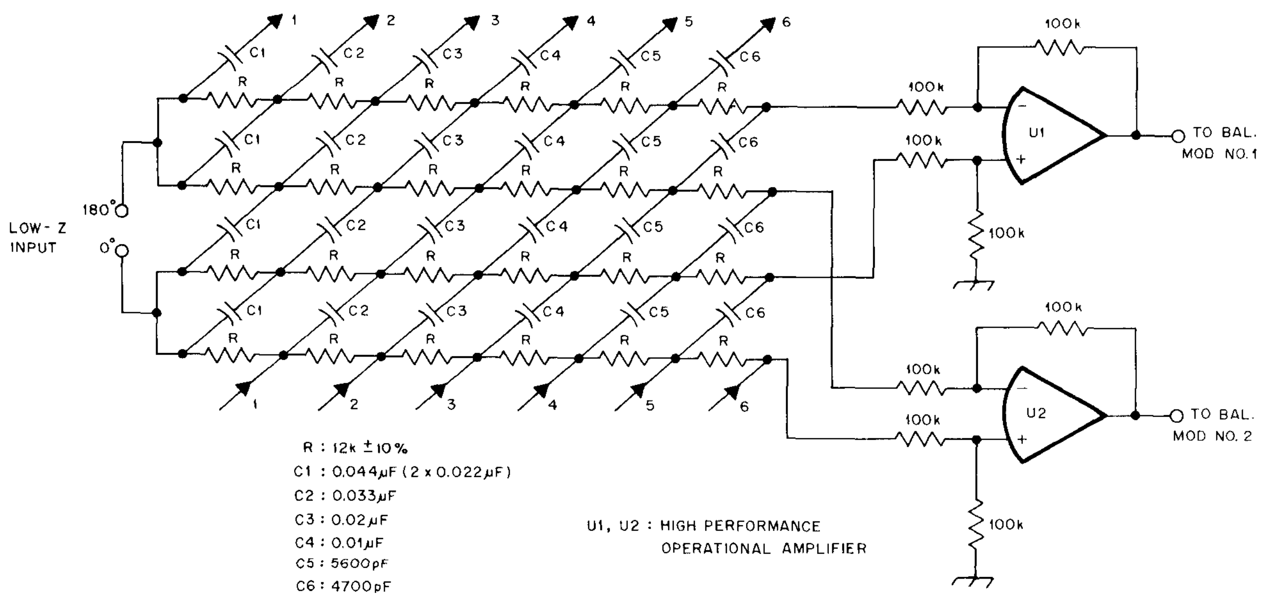


Fig 1—A high-performance audio phase shifter made from ordinary loose-tolerance components (designed by HA5WH), from the *ARRL Handbook*, 1986, p 18-9.

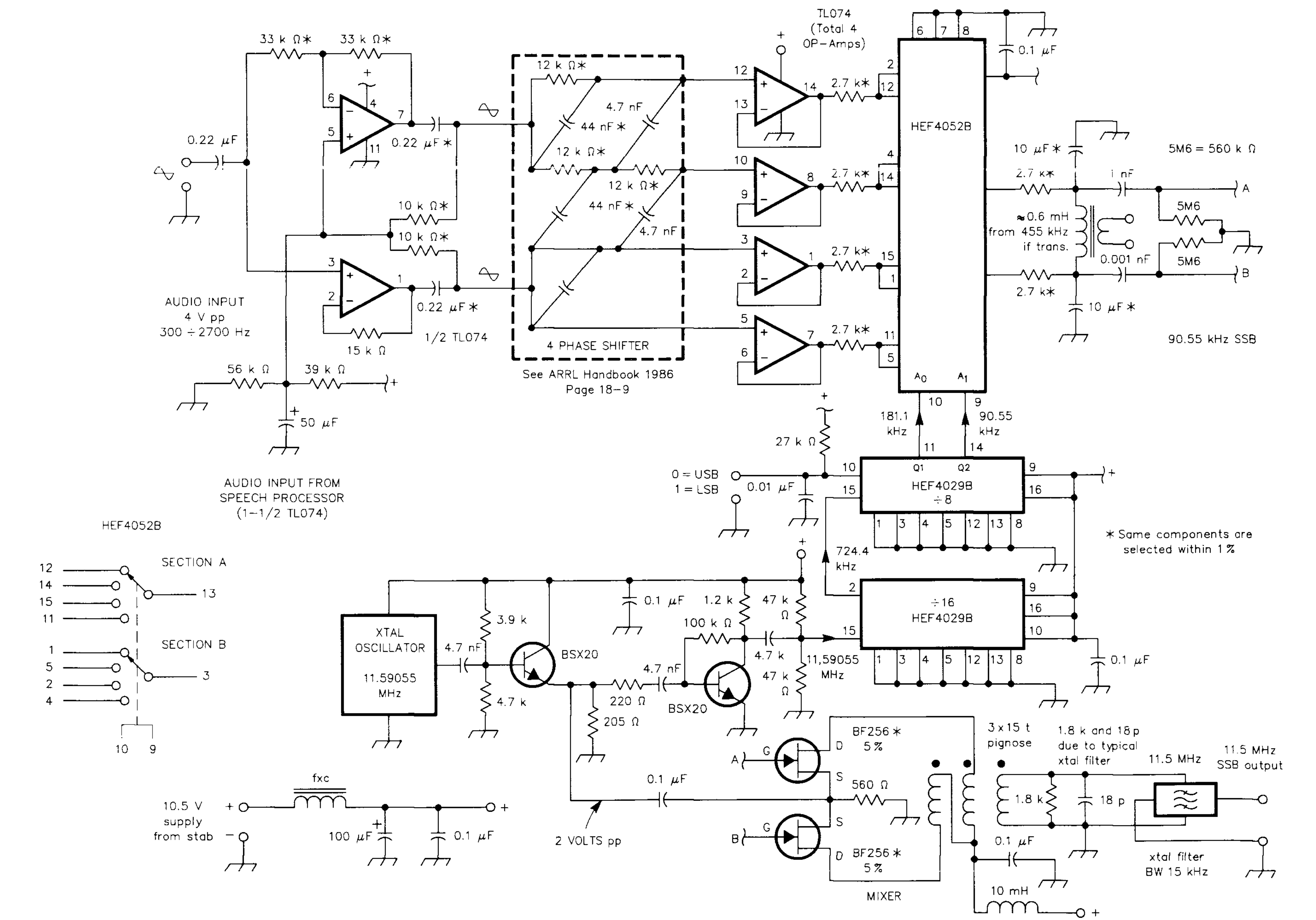


Fig 2—SSB Exciter (also see Fig 1)

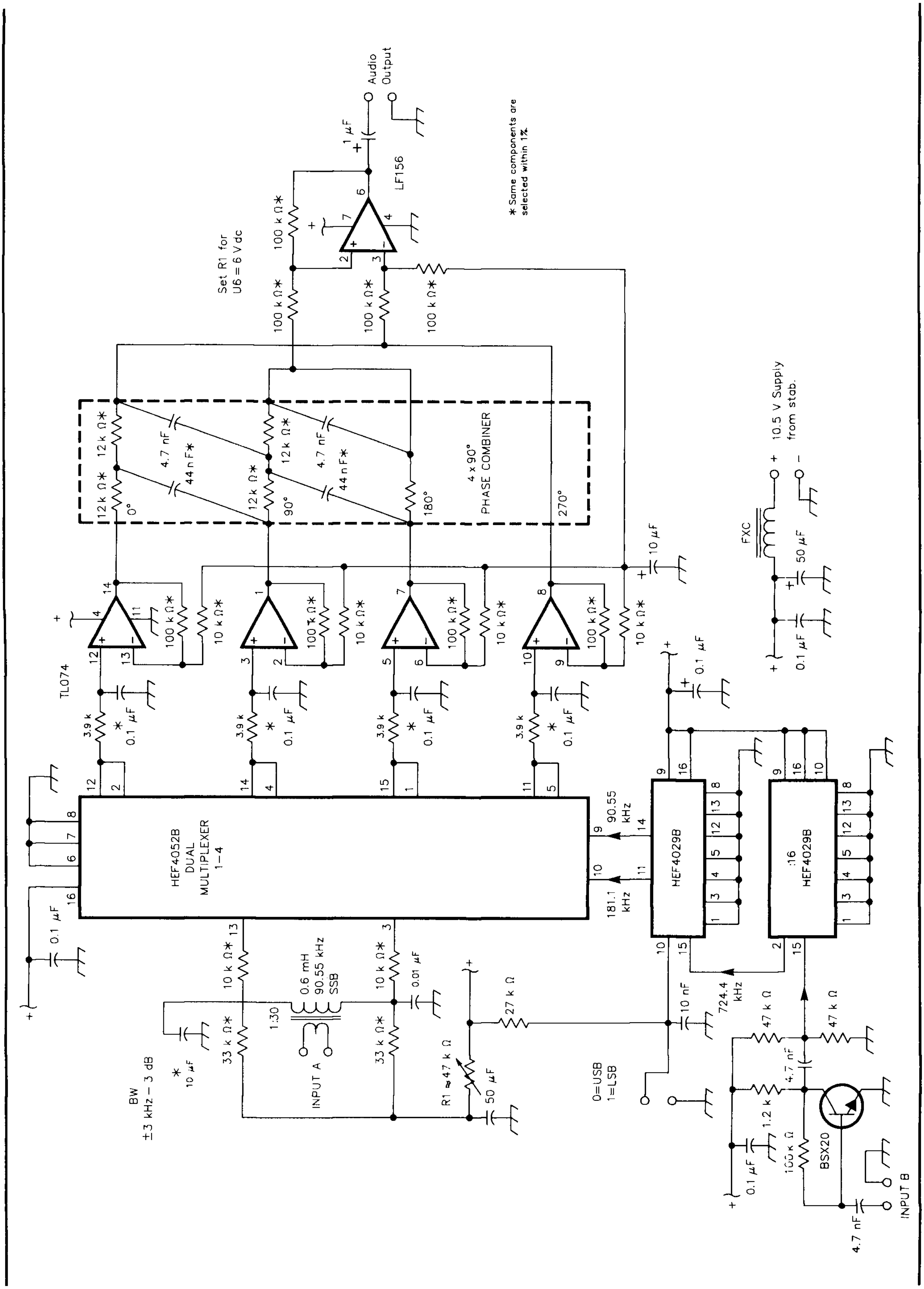


Fig 3—SSB Detector

270°, the output of the LF 156 is 600 mV P-P. By changing the 0° and 180° of the inputs, the output is noise only, less than mV P-P.

So the filter also works as a phase combiner.

The input to the detector, 90 kHz, is obtained by mixing (in a good double-balanced mixer) the 11.5-MHz IF and the crystal oscillator on 11.59055 MHz.

After the mixer, a gain-controlled 90-kHz amplifier is connected to input A. Input B received the signal from the crystal oscillator. Its unloaded output 2 V P-P; $R_{int} = 50\ \Omega$.

Results

Signal input on point 3 of the multiplexer is 120 mV P-P; 92.55 or 88.55 kHz.

Output LF 156: 700 mV P-P 2 kHz.

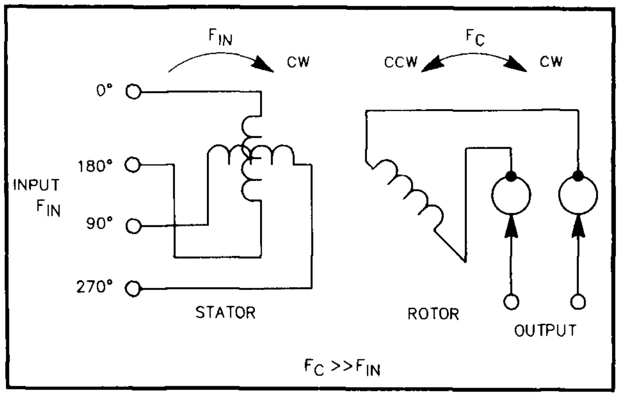
Sideband and carrier suppression: better than 50 dB. Switching spikes −15 dB (360 kHz) but an audio low-pass filter <2700 Hz will remove the spikes.

Playing with both systems together was a lot of fun. Much success to the next builders of this system.

SSB Exciter

The heart of the circuit is a combination of the dual-analog switch HEF4052B and the audio phase shifter designed by HA5WH.

Take a "selsyn" (one part of an electric axle, formerly used by radar systems). Its stator consists of two coils, 90° mechanically shifted. Its rotor consists of one coil and slip rings.



Feeding the stator by two electric signals 90° out of phase creates a clockwise-rotating field. If the rotor is at rest, the output has the same frequency as the input signals. By rotating the rotor CW, the output frequency is the sum: $f_c + f_{in}$. It is a linear system; no start of harmonics or mixing products. By rotating the rotor CW, the output frequency $= f_c - f_{in}$. Suppose: f_{in} = 300 − 2700 Hz audio, where f_c = carrier frequency (90.55 kHz). Depending on rotation direction of the rotor, we get USB or LSB only.

Replacing the selsyn by a rotating switch (HEF4052B), we get the same results, but because of the abrupt switching (or sampling), harmonics of f_c must be removed.

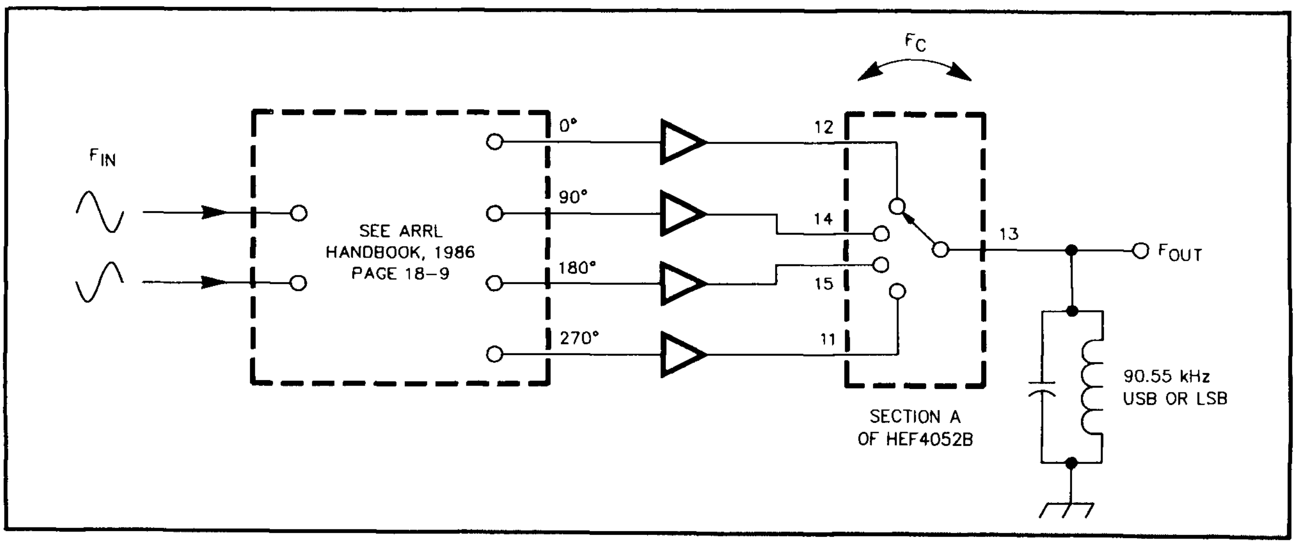
The four op-amps TL074 (only two are drawn) between the shifter and the switch act as buffers.

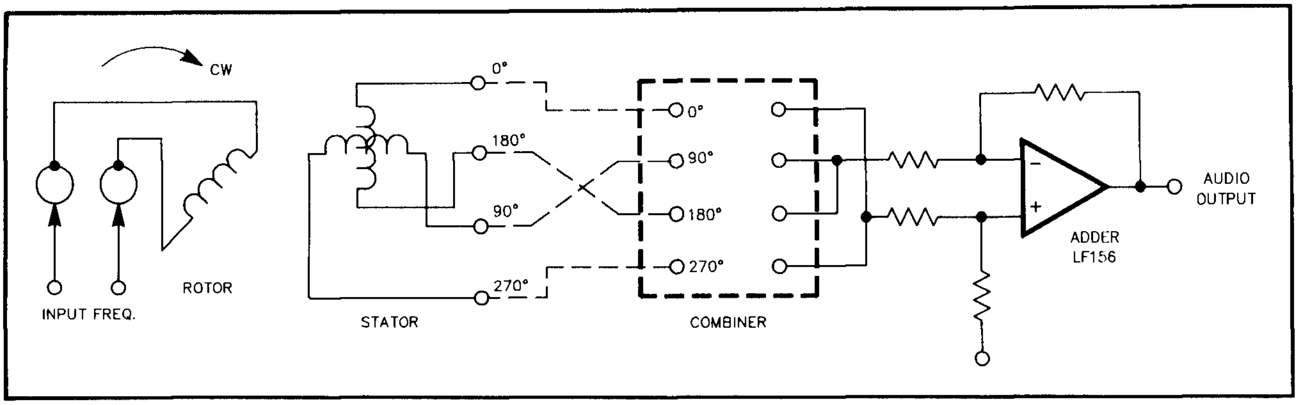
Both sections of HEF4052B are used in balance. As driver, the switch, a synchronous up/down counter HEF4029B, is used. By using the outputs Q1 = 11 and Q2 = 14, the counter divides by 8. USB or LSB is obtained by counting down or up (point 10).

The audio input to the phase splitter is obtained from a speech processor (AVC; clipping and filtering). There are many circuits in various handbooks, so I won't include details. Other circuitry depends on what we need. In my case, f_{out} must be 11.5-MHz SSB and the speed of the switch about 100 kHz. So:

$$f_{xtal} - \frac{f_{xtal}}{128} = 11.5 \text{ MHz or}$$

$$f_{xtal} = 11.5 \times \frac{128}{127} = 11.59055 \text{ MHz}$$





f_{switch} = 11.59055 − 11.5 = 90.55 kHz

128 = divided by 16 and divided by 8

SSB Detector

Back to the selsyn:

Situation:

A) rotor speed 100,000 c/s CW input frequency 101,000 c/s	output stator 101,000 - 100,000 = 1 kHz CW
B) rotor speed 100,000 c/s CW input frequency 99,000 c/s	output stator 100,000 - 99,000 - 1 kHz CW

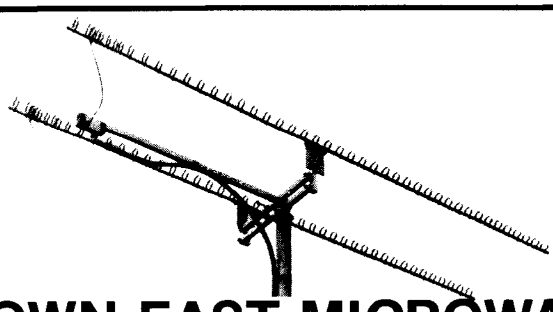
Replacing the selsyn by the rotating switch, the results are the same, *but* the filter designed by HA5WH (Fig 1) shows a new combiner phenomenon.

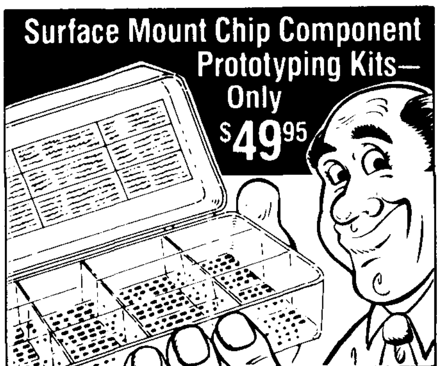
In situation A, the two outputs of the combiner are maximum 1 kHz. In situation B, the two outputs of the combiner are minimum 1 kHz.

The op amp, as adder, brings the audio output from minimum to zero and from maximum to twice maximum. So, within the specs of the 300-2700 Hz combiner, only one sideband is received. By changing the switch rotation direction, the other sideband is received. A 300-2700 Hz audio filter removes all other frequencies below 100 and above 2700 Hz, along with the switching spikes and harmonics from the rotating switch. (See Fig 3.)

Input A, 90.55-kHz SSB is obtained from a mixer; 11.5-MHz SSB and 11.59055 MHz of a crystal oscillator. Input B comes from the same crystal oscillator; first divided by 16, then by 8.

The audio output is connected to a 300-2700 Hz audio filter (details appear in various handbooks).


DOWN EAST MICROWAVE
Amateur Microwave Antennas and Equipment
902, 1269, 1296, 2304, 2320, 2400, 3456 MHz
TROPO, EME, WEAK SIGNAL, OSCAR MODE L, MODES, ATV, REPEATERS
LOOP YAGIS, POWER DIVIDERS, COMPLETE ARRAYS
KIT FORM OR ASSEMBLED AND TESTED
SOLID STATE LINEAR AMPLIFIERS FOR 902 & 1296 MHz
Write for Free Catalog to:
DOWN EAST MICROWAVE
Bill Olson W3HQT, Box 2310 RR1
Troy, ME 04987 (207) 948-3741



CC-1 Capacitor Kit contains 365 pieces, 5 ea. of every 10% value from 1pf to .33μf. CR-1 Resistor Kit contains 1540 pieces; 10 ea. of every 5% value from 10Ω to 10 megΩ. Sizes are 0805 and 1206. Each kit is ONLY $49.95 and available for Immediate One Day Delivery!
Order by toll-free phone, FAX, or mail. We accept VISA, MC, AMEX, COD, or Pre-paid orders. Company P.O.'s accepted with approved credit. Call for free detailed brochure.
COMMUNICATIONS SPECIALISTS, INC.
426 West Taft Ave. • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire USA 1-800-854-0547

Components

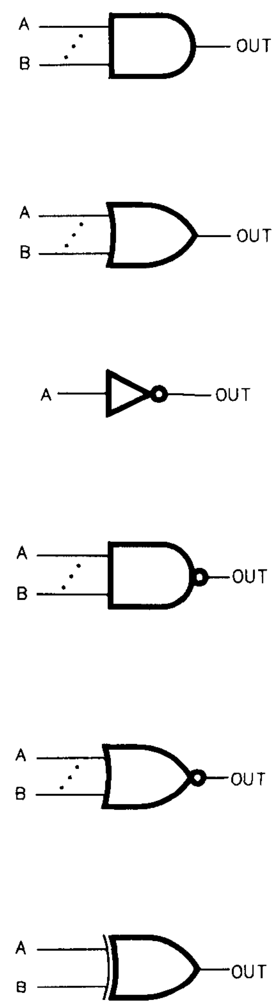
By Mark Forbes, KC9C
PO Box 445
Rocklin, CA 95677

Gate Basics

The past couple of months I've briefly talked about a basic component and how it is used. I've received many comments that these "basic how-tos" are helpful, so I'll continue this month. This month's brief is about digital gate circuits. A lot of hams find digital circuits almost frightening, yet they couldn't be much simpler! Only two things can occur in a digital circuit: It's either on or off. Combining these on and off signals are *gates.* A gate is simply a circuit that combines two or more "on and off" signals in a predetermined way. The way that the signals are combined is defined by a *truth table.*

Symbols for the five basic gates (plus the "inverter") are shown in Fig 1, along with their truth tables. For shorthand, "on" is represented by the number "1" and "off" is represented by the number "0." The AND gate, in words, *turns on its output only when ALL inputs are on.* The OR gate turns on its output when any or all of its inputs are on. An INVERTER simply reverses the input; if the input is on, the output if off and vice-versa. Placing an inverter on the output of the AND and OR gates creates two new gates called NAND (NOT-AND) and NOR (NOT-OR). The final gate of interest is the EXCLUSIVE OR. It differs from the OR in that its output is on if one, but not both, inputs are on.

There you have it! They are quite simple. The symbols and truth tables may be a bit confusing at first glance, but just remember that they are shorthand just as any schematic symbols are, and the truth tables are the "specifications" for the gate. Next time, I'll continue discussing digital fundamental components. If you have any particular component you'd like to see discussed in a basic way, please drop me a line.



AND

A	B	OUT
0	0	0
0	1	0
1	0	0
1	1	1

OR

A	B	OUT
0	0	0
0	1	1
1	0	1
1	1	1

INVERTER

A	OUT
0	1
1	0

NAND

A	B	OUT
0	0	1
0	1	1
1	0	1
1	1	0

NOR

A	B	OUT
0	0	1
0	1	0
1	0	0
1	1	0

EXCLUSIVE OR

A	B	OUT
0	0	0
0	1	1
1	0	1
1	1	0

Note: AND, OR, NAND, NOR can have two or more inputs.
EXCLUSIVE OR can have only two inputs.
INVERTERS have only one input.

Fig 1—Truth Tables

Digital Video "DVI" Technology

An interesting development has been announced by IBM and Intel that might be of interest to hams who experiment with video modes. The "components" are actually two boards that plug into either the PC-AT bus or the Micro Channel bus. They take full-motion audio and video and compress the information so that it can be stored reasonably compact on CD-ROM, or presumably magnetic disk or tape, within a 386-based PC.

The Intel ActionMedia 750 Delivery Board allows playback of the stored data with full-motion video, digital audio, or high-resolution stills, or special effects. It can be purchased with 1-Mbyte or 2-Mbyte or video RAM. The Intel ActionMedia 750 Capture Board takes analog audio and video inputs and digitizes them for storage and playback via the Delivery Board.

Although these aren't cheap yet (prices have a way of falling fast), they are within the realm of some amateurs. The two-board set could allow full-action ATV programs to be produced and recorded for later playback on ATV. Another possible use might be to incorporate the system into an ATV repeater for use in a way like packet bulletin-board systems. Someone could record programs into the ATV repeater's BBS and they could be available for playback, at random, at a later time.

Currently, the boards sell for about $2,000 each. For more information, contact Intel, 3065 Bowers Avenue, Santa Clara, CA 95052-8131, and ask for information on the ActionMedia 750 products.

Gore-Tex For Hams!

Anyone familiar with camping, hiking, hunting, or fishing has no doubt heard of Gore-Tex™ fabric. Simply put, it's a water-repellant fabric that "breathes" by allowing tiny perspiration and water evaporate to travel outward through its network of tiny pores, but the pores are small enough that rain-drop-sized water cannot flow inward. Thus, the user stays dry, even if perspiring.

Well, the folks at W.L. Gore & Associates, Inc, makers of Gore-Tex, have found some interesting new uses for the material in the microwave transmission cable field. The material is billed as a flexible, lightweight alternative to semi-rigid cable for operation up to 18 GHz. The cables use the Gore-Tex PTFE (polytetrafluorethylene) dielectric, which provides insertion loss of only 1 dB/ft at 18 GHz, and have a velocity factor that is 17% higher than semi-rigid cable. Also, higher frequency cable assemblies are available, according to the manufacturer.

For more information on this very different product, contact W.L. Gore & Associates, Inc at 800-228-3024.

Integrated Mixer Covers 500 kHz to 500 MHz

Mini-Circuits has introduced the UNCL-1H integrated mixer circuit. It covers 500 kHz to 500 MHz RF, and has an intermediate frequency from dc to 500 MHz. Conversion loss is 6.5 dB, isolation between the local oscillator and fundamental is 36 dB, and isolation between the local oscillator and the intermediate frequency is 25 dB. The 8-pin, hermetically sealed ICs are priced at $27.95 for single pieces. If you'd like to order or to get more information, contact Mini-Circuits, PO Box 350166 (yes, there are six digits!), Brooklyn, NY 11235-0003, or phone 718-934-4500.

1230- to 1250-MHz Coupler

Sage Laboratories is making the model FC4545-2 two-channel frequency coupler for operation in the lower end of the 1.2-GHz amateur band. Insertion loss is 0.25 dB maximum, and channel isolation is 40 dB minimum. SWR over the band is 1.15:1 and the parts can handle continuous average power of 100 W...not a problem for most amateur stations! Also, just in case you need it, the parts are rated for use to 70,000 feet. To find out more about the coupler, contact Sage Laboratories at 508-653-0844.

Microsat Demodulator

(continued from page 6)

level at the demodulator input is 0.5 V P-P. Monitoring at E will indicate 2 V of noise and monitoring at G will be a mixture of noise and free-running VCO, about 4 V P-P. In receiving the Microsat PSK signals, digital readout will occur when the PLL locks and when the synchronizing input pulse exceeds a tangential s/n condition at G, the NRZI output.

Summary

Tests have been made using two receivers. One is an HF receiver/472-MHz converter with a band pass of 1.8 kHz. The second is a home-built 70-cm receiver with a band pass of 15 kHz. Initial test using the narrow band-pass receiver were disappointing; packet readout was far from solid. The problem became apparent when looking at the received PACSAT-1 signals. The phase change during a one-bit period was marginal, and overshoots extended well into the octet. My fix was to accentuate the high-frequency response by turning the IF shift tuning completely in one direction, a 600-Hz shift, and then increasing the carrier frequency from 1600 to 2500 Hz. This resulted in a much cleaner output and also a solid packet readout. However, the system is still very sensitive to both level and frequency, requiring good AGC and AFC. It is apparent that a particular receiver requires tailored conditions to compensate for different transient response characteristics.

Performance using the wideband receiver has been great, particularly when adjusted for a carrier of 5 kHz or higher. You may be wondering about the added noise of the wideband system. It is true that, in the examples indicated, the input noise will increase almost three times that of the narrow-band receiver. However, the final s/n of the NRZI output depends upon filtering of phase-error transients through the PSK detector and this presents some opposite s/n tradeoffs. In summary, if you have the alternative of using a wide band-pass receiver, use it—avoid the critical consideration concerned with a narrow-band system.

PACSAT performance has been outstanding. It is comparable to the local VHF-packet repeaters. As I write this, the BBS feature has not been activated. What I see on the screen are stations using it as a digipeater and the satellite-identifying information. This identifying information is repeated every ten seconds when the satellite is not being used for other purposes. The information includes up-time, real-time, and telemetry. It often fills my PK64-20-kbyte buffer in a 12-minute satellite pass. My only complaint is that the telemetry is in binary format and all that garbage jams my printer.

YAGI OPTIMIZER $65

YOjr has everything you need to design and optimize HF or VHF Yagis with up to 10 elements. YOjr automatically maximizes forward gain and F/B, and minimizes SWR. You may choose the tradeoff among these 3 factors. YOjr models tapered elements, optimizes simultaneously at 3 frequencies across a band for broadband designs, and can scale any design to a new band. Polar patterns are displayed and printed. YOjr is extremely fast, and can compute several trial designs per second. YOjr is intuitive, graphical, and interactive. 8087 and extra-fast no-8087 versions both included. YOjr 1.0, $65. Full credit toward YO 3.0, with much more, $130. Add 6.25% CA, $5 overseas. U.S. check, cash, or money order. For IBM PC, 5.25" or 3.5" disk.

Brian Beezley, K6STI, 507-1/2 Taylor, Vista, CA 92084

Conducted by: Stan Horzepa, WA1LOU
75 Kreger Drive
Wolcott, CT 06716-2702

PACKET PROVIDES SPONTANEOUS FIRE PLOTTING

Recently I had the opportunity to be part of a demonstration by the California Department of Forestry and Fire Protection (CDF) for the State Fire Marshall's conference at the Asilomar State Conference Grounds in Pacific Grove, CA. The demonstration showed the operation of a new fire-mapping system called "LoranPlot" and the operation of the VIPCOM1 communications bus manned by CDF-trained amateur-radio operators.

LoranPlot was started to assist the real-time mapping of the perimeter and area of a fire from the air. The LORAN navigation system installed in CDF helicopters have provisions to collect the real-time longitude and latitude information via an RS-232 serial link. (LORAN is a system of LOng RAnge Navigation in which pulsed signals sent out by two pairs of radio stations are used to determine the geographical position of a ship or aircraft with reference to the time of arrival of the signals.) Utilizing a standard laptop computer, it is possible for the pilot or observer to start and stop the data collection when or where desired as well as add comments to the data file. These comments are usually simple descriptions, for example: "BARN," "HOUSE," "CAR," etc to emphasize the plotted data. Normally, after a plotting run, it is necessary to land the aircraft and take the computer to another location. There the computer is connected to a plotter and the information is plotted onto a standard topographical map using additional plotting software on the laptop computer.

Although this system is far superior to the old manual method of drawing on a map by hand while flying over the fire area, there is still a time lag in processing the data because the aircraft must return to its base where the computer is connected to a plotter to view the information. With a fast moving fire the information is outdated before it is plotted.

Seeing a chance to do some experimental radio work, a group of hams from the CDF "Volunteers In Prevention" program proposed transmitting ASCII data from the airborne computer to the ground using amateur packet radio. Not only could the information be collected from the aircraft while it was flying overhead, but, if it were necessary, the data could be relayed hundreds of miles using the packet-radio backbone network. Here is how we made it work.

The pilot, Fred Nunes, N6CYA, used a Heathkit Pocket Packet TNC and 440-MHz ICOM HT connected to an antenna on the bottom of the helicopter. The laptop would do double duty running the "LoranPlot" collection software and controlling the TNC using PROCOMM™, a communications program. Prior to the demonstration, a long distance data transfer test was successfully conducted between the helicopter base and the communications bus 70 miles away. By linking through the Northern California backbone network, we successfully transferred sample navigation plot data.

For the live demonstration, Fred flew over the area of a previous fire collecting the data from LORAN using the laptop computer. After the data was collected, Fred connected to the packet-radio station on board VIPCOM1 and uploaded the plot data using PROCOMM. Two minutes later, the transfer was completed and Fred could plot another area or continue his primary mission of "fire suppression." The collected data was edited to remove the "CONNECT" and "DISCONNECT" messages and processed by the plotting software, which plotted the fire perimeter (with comments) onto a topographical map. Time from start to finish...five minutes from the initial connection to plotted results.

Judging from the applause and comments from the audience of fire officials, the demonstration was a resounding success! Amateur Radio again proved the feasibility of new technology. In the future, this system will work on state radio frequencies using commercial TNCs, but the technology was proven using amateur know-how and equipment. After the demonstration, there were tours of the communications bus where the capabilities of voice, digital (packet radio) and amateur television were explained to the participants. Many of the officials were familiar with RACES, but were not aware of all of the capabilities hams could provide.

(Special thanks to Fred, N6CYA, Dick, KB6MRM, Jim, KA6YRK, Chris, W6/G8HJD, and Mike, KB6PDA, for making it all work.)

by Tony Bamberger, N6TYG

UoSAT/MICROSAT PBBS PASSES ALPHA TESTS

Harold Price, NK6K, and Jeff Ward, GØ/K8KA, made significant progress in testing store-and-forward communications software on UO-14 at the University of Surrey (UoS). (This software will also be run on AO-16 and LO-19 after it has been completely tested and debugged.)

When Harold arrived at UoS, he and Jeff loaded the 210-kbytes of code to UO-14 for testing. The tasks loaded were hit.exe (the Housekeeping Integration task), cpe.exe (the Cosmic Particle Experiment data collector), mfile.exe (the ramdisk file system server), tlm.exe (the telemetry server), qax25.exe (the AX.25 "virtual TNC") and ftl0.exe (the BBS itself, "File Transfer Level 0").

During the course of the test, they reloaded the software five times to overcome operational glitches and install bug fixes. When the satellite was out of range, memory dumps were examined and new code versions were compiled and ground-tested using two IBM Real-Time Interface Coprocessor cards (in their respective PCs) and the UO-14 engineering model.

To stress the software and reveal bugs, they started a bulletin broadcast, which fills any free downlink time with UI frames. With this running, they connected to the BBS and downloaded a 30-kbyte file. Throughout the test, European stations continued digipeating. After downloading the file twice without incident, the alpha tests were declared complete.

The success of the hard work performed by Harold and Jeff clears the way for the following activities:

First, release of the UoSAT/Microsat PACSAT protocol specifications. Complete definitions of PACSAT File Headers, PACSAT Broadcast format and the File Transfer protocol Level 0 (FTL0) will be freely available. They have been in draft form for some time and Harold is getting final versions ready for publication in the *ARRL/CRRL Networking Conference Proceedings*. If all goes well, they should also be available in electronic format in early fall.

Second, development of user ground station software for BBS access. The FTL0 protocol is designed for automated access (not hunt-and-peck keyboard control). Once fully tested, this software will be available through AMSAT-UK and AMSAT-NA, thus making UO-14 truly open for access.

Third, porting the file system and the FTL0 BBS to AO-16. Although most of the code will run without modification, there are some differences in satellite hardware and "operating philosophy" which must be addressed. This involves drivers for the ramdisks and support for ALOHA access on the A0-16. (UO-14 will use an experimental reservation multiple access scheme with limited ALOHA contention.)

This is taking longer than a similar BBS-only effort would on the ground. Remember that UO-14 is simultaneously running six programs: sampling telemetry, collecting data from the Cosmic Particle Experiment, providing a multiple-connection virtual TNC, broadcasting via a new point-to-multipoint protocol and waiting for full-duplex binary file transfers at 9600 bit/s. Including DOVE and WEBERSAT, six programmers in two continents and four time zones have collaborated to bring this together.

from Jeff Ward, GØ/K8KA
via AMSAT News Service

NEW PACKET-RADIO SATELLITE IN THE WORKS

The launch of the next Soviet Amateur Radio satellite, RS-14, has been delayed until October because of a hardware failure in the primary payload. RS-14 will include a digital transponder for packet-radio BBSing (RUDAK-2), which was built by AMSAT-DL.

The French plan to launch ARSENE (Ariane Radioamateur Satellite pour l'ENseignement de l' Espace) in September 1992. This geostationary satellite will include FSK packet radio on Mode B with three uplink channels and one downlink channel.

AN IMPORTANT MESSAGE FOR PACKET MAILBOX USERS

The following is a letter to the Radio Society of Great Britain (RSGB) from the head of the British government's Radiocommunications Agency (RA) section that deals with Amateur Radio.

"Over the last few months the Department has been made aware of a number of instances where the packet-radio mode has been used for the transmission of messages which are far removed from the license condition concerning self-training and messages relating to technical investigations or remarks of a personal character.

"I am sure that you are equally aware as to the type of messages I mean. Included amongst them are messages inciting others to join in a particular dispute. The second type of message that I have in mind is where amateurs offer items for sale via packet radio.

"I need not remind you that the terms and conditions of the Wireless Telegraphy Act license are that amateurs must use the facility for self-training and that where messages are addressed to other licensed amateurs, they must relate solely to technical investigations or remarks of a personal character. The terms in this license do, of course, reflect into the dispensation for Amateur Radio under the Telecommunications Act license. The Department's Radio Investigation Service cannot give very much time to Amateur Radio because of its other priorities, but it has followed up individual instances where messages do not conform to license conditions. However, I think it would be helpful if the RSGB would issue a general reminder to amateurs generally and mailbox operators in particular about the terms and conditions of the license and some guidance in good practice in mailbox operation. For example, we would regard it as reasonable for a mailbox operator to review the content of messages and refuse to forward and delete those he considers unacceptable.

"Frankly, if the sort of traffic described above continues or increases then the Department would have to give serious consideration to the continuation of the packet-radio network in its present form. I hope, therefore, that we can look to the Society to give a positive lead in this area."

Ever since packet radio was included in the UK license, the RSGB has advised mailbox users through its Packet Working Group (PWG). In particular, draft guidelines were produced by the PWG some time ago and were distributed on the packet-radio network as well as in *Connect International*. Since then, the guidelines have been examined by the RSGB's Council and Licensing Advisory Committee and improvements have been adopted.

On receipt of the above letter, the RSGB's guidelines were sent to Waterloo Bridge House for the RA's comments. As soon as a form of words is agreed, we will give the mailbox message guidelines the widest publicity, including in *RadCom*. In the meantime, anyone requiring clarification of the legality of a packet-radio message should consult PWG Chairman, Ian Suart, GM4AUP, who is QTHR. Mailbox SYSOPs should note the RA's view (which is already RSGB policy) on dubious messages: they "should refuse to forward and delete those (they) consider unacceptable."

from *RadCom*

AN OPEN LETTER TO *QST*

I wish to thank you and other Amateur Radio media for the recent publicity concerning the award I was given at the 1990 Dayton HamVention®. It is an honor to have one's efforts rewarded by such a prestigious organization and for the multitude of media in ham radio today to recognize this work. However, I believe the reporting has been incomplete.

The reporting, in general, made it appear (to me anyway) that Microsat was an N4HY enterprise. Nothing could be further from the truth. I played an important, possibly crucial role, in the Microsat project. I did help manage the project during an awkward time and did, in fact, make major contributions to the satellite hardware and software. I managed the final construction of the CPU (based on a good design by Lyle Johnson, WA7GXD, that was exceedingly difficult to manufacture in the space allotted) by inducing (former?) friends of mine, who believed in the project to sacrifice many, many hours of time, expertise, valuable resources, and to demand innumerable favors to complete the satellites.

It must be said, however, that the satellites are a testament to ALL of the people who participated in the project. I am proud to have worked with a group comprised of people from AMSAT, TAPR, the ARRL lab, BRAMSAT, AMSAT-LU, Weber State University and others. Had the Dayton HamVention nomination or award been based solely on Microsat, I would have refused it as unfair and unjustified. In fact, the award was based on my participation and contributions to some of the best projects in Amateur Radio today. The joint work with W3IWI and WA7GXD on digital signal processing (DSP) software and hardware for TAPR and AMSAT, with KB2CST, KA2MOV, and AEA on a new DSP-based multimode controller unveiled at Dayton this year, the satellite tracking program known as Quiktrak™, DOVE hardware, command/control software for all the Microsats, etc were the basis for the nomination for this award. I feel uniquely blessed to have played a part in these outstanding projects. I wish to share the honor bestowed on me by the Dayton HamVention with others who have worked with me on the myriad projects I am or have been a part of and which were the premise for the award nomination.

Let me tread on hazardous ground and render a personal opinion on the Microsat project and probably get myself into trouble at the same time... HI! My opinion is that there were four unique pieces of this project that made it glue together and work. First, Jan King, W3GEY, and Dick Jansson, WD4FAB, came up with the modular mechanical structure and solar panel design which provided the impetus for the entire project. The mechanical structure has been copied by other satellites of recent vintage because of the beauty, simplicity and agility of the structure for spacecraft design.

Second, Tom Clark, W3IWI, gave us the concept and initial design for a local area network and electrical bus for the spacecraft electronics that enabled the developmental work for the individual modules comprising the spacecraft to be done by people geographically separated by great distances. I give but one example. AMSAT-LU designed a CW beacon experiment for LUSAT, LO-19. This module was built in Argentina, placed in a module and interfaced to the rest of the spacecraft by the local area net and bus design done by W3IWI and implemented by Bob Stricklin, N5BRG. This module had never "seen" the other modules in the spacecraft before and worked perfectly when placed in the spacecraft on the first try. This experience was repeated several times in all four spacecraft.

Third, given all this hardware, you have to have software to run a spacecraft designed around a computer. Harold Price, NK6K, induced Quadron, Inc, a company he helped found, into giving us a modified version of the their multitasking kernel (operating system, written by Harold) for use on the Microsats for Amateur Radio satellite projects. It is not unlike having a (good) DOS and has allowed us to use standard PC-clone software development tools to write the applications needed to run the spacecraft. This modularity, in terms of structure, electronics and software are what made Microsat possible.

The fourth and final piece that I consider vital, cannot and should not be underestimated. It is the many people who made major efforts to bring these ideas together into satellites. It never ceases to amaze me that Amateur Radio, in general, and AMSAT, in particular, always succeeds in getting people to make personal sacrifices that are completely unthinkable when these projects are started, in order that they may succeed. These sacrifices are of a nature that would almost never be seen by people in their regular work and indeed are often made at a cost of loss of "domestic tranquility." The people of the Microsat team will never be adequately thanked, but I would like to express my personal thanks here. I am extremely proud of the work we accomplished. The work in making the complete facilities afforded by these satellites available to Amateur Radio continues and we are beginning to plan our satellite building future here in AMSAT-NA and with our traditional international satellite building partners. Why don't you come join us? See you on the birds!

73,

Bob McGwier, N4HY

IP ADDRESS COORDINATOR LIST UPDATED

Here's the list of regional IP address coordinators as of July 25, 1990, courtesy of Brian Kantor, WB6CYT, the global AMPRNet address coordinator. (An IP address is required to use the KA9Q Internet Protocol Package for Amateur Radio TCP/IP operation. Contact your region's coordinator for an address assignment.)

IP ADDRESS	*IP ADDRESS COORDINATOR*	*LOCATION*
United States (alphabetically by location)		
44.022	KL7JL	AK
44.100	K4FUM	AL
44.110	WD5B	AR
44.124	WB7TPY	AZ
44.016	WB5EKU	CA: L.A., San Fernando Valley
44.010	KA6CCF	CA: Orange County
44.002	K6RTV	CA: Sacramento
44.018	KE6QH	CA: San Bernardino, Riverside
44.008	WB6CYT	CA: San Diego
44.006	WB5EKU	CA: Santa Barbara/ Ventura
44.004	N6OYU	CA: Silicon Valley—San Francisco
44.032	N3EUA	CO: Colorado Springs

44.020	AIØC	CO: northeastern
44.084	K9MWM	CO: western
44.088	KE3Z	CT
44.096	WA1IVD	DC
44.098	no call	FL: Garry Paxinos (awaits call)
44.036	KD4NC	GA
44.014	KJ9U	HI
44.050	KCØX	IA
44.012	K7JD	ID
44.072	WD9DBJ	IL: northern (Chicago)
44.048	KA9FJS	IN
44.122	WIØR	KS
44.106	N4CLH	KY
44.108	N5KNX	LA
44.056	AE1C	MA: Boston
44.044	W3VH	MA: western
44.060	WB3FFV	MD
44.118	WA2YVL	ME
44.102	KV8G	MI: lower peninsula
44.092	KD9UU	MI: upper peninsula
44.094	WDØHEB	MN
44.046	WBØROT	MO
44.042	WA4DDE	MS
44.082	N7GXP	MT
44.074	KA4OJN	NC
44.114	N7GXP	ND
44.090	NFØN	NE
44.052	K8LT	NH
44.064	KA9Q	NJ: northern
44.065	WB2MNF	NJ: southern
44.030	WS5N	NM
44.125	KF7TI	NV
44.068	W2JUP	NY: Long Island
44.069	WA2WPI	NY: upstate
44.070	N8EMR	OH
44.078	K5JB	OK
44.026	WA7TAS	OR
44.116	WS7S	OR: northwestern, Portland
44.080	WA3WBU	PA: eastern
44.112	N3CVL	PA: western
44.014	KJ9U	Pacific Islands
44.126	KP4QG	PR
44.104	W1CG	RI
44.038	N4QXV	SC
44.114	N7GXP	SD
44.034	WD4NMQ	TN
44.076	WB5BBW	TX: central
44.028	KD5QN	TX: Dallas
44.077	KA5EJX	TX: western
44.040	WA7MBL	UT
44.062	WA4ONG	VA: not DC
44.054	KD1R	VT
44.012	K7JD	WA: eastern
44.116	WS7S	WA: Vancouver
44.024	N1DMM	WA: western (Puget Sound)
44.092	KD9UU	WI
44.058	KB8AOB	WV
44.086	WB7CJO	WY

44.066	unassigned
44.120	unassigned
44.128	reserved for testing

International (alphabetically by location)

44.144	ON7LE	Belgium
44.153	LU7ABF	Argentina
44.136	VK2ZXQ	Australia
44.143	OE1YSS	Austria
44.135	VE3GYQ	Canada
44.157	CE6EZB	Chile
44.145	OZ1EUI	Denmark
44.148	HC5K	Ecuador
44.139	OH1MQK	Finland
44.151	FC1BQP	France
44.130	DL4TA	Germany
44.154	SV1IW	Greece
44.137	PAØGRI	Holland
44.149	VS6EL	Hong Kong
44.156	HA5DI	Hungary
44.132	YB1BG	Indonesia
44.155	EI9GL	Ireland
44.138	4X6OJ	Israel
44.134	I2KFX	Italy
44.129	JG1SLY	Japan
44.129	JH3XCU	Japan
44.161	LX1YZ	Luxembourg
44.141	LA4JL	Norway
44.146	DU1UJ	Philippines
44.158	CT1DIA	Portugal
44.160	ZS6BHD	South Africa
44.133	EA4DQX	Spain
44.140	SMØRGV	Sweden
44.142	HB9CAT	Switzerland
44.159	HS1JC	Thailand
44.131	G6KVK	United Kingdom
44.152	OA4KO/YV5	Venezuela
44.150	YU3FK	Yugoslavia

Universal (alphabetically by location)

44.193	W3IWI	AMSAT
44.193	W3IWI	Outer Space

GATEWAY CONTRIBUTIONS

Submissions for publication in *Gateway* are welcome. You may submit material via the US mail or electronically, via CompuServe to user ID *70645,247* or via Internet to *70645.247*@compuserve.com. Via telephone, your editor can be reached on evenings and weekends at 203-879-1348 and he can switch a modem on line to receive text at 300, 1200 or 2400 bit/s. (Personal messages may be sent to your *Gateway* editor via packet radio to WA1LOU @ N1DCS or IP address 44.88.0.14.)

The deadline for each installment of *Gateway* is the tenth day of the month preceding the issue date of *QEX*.