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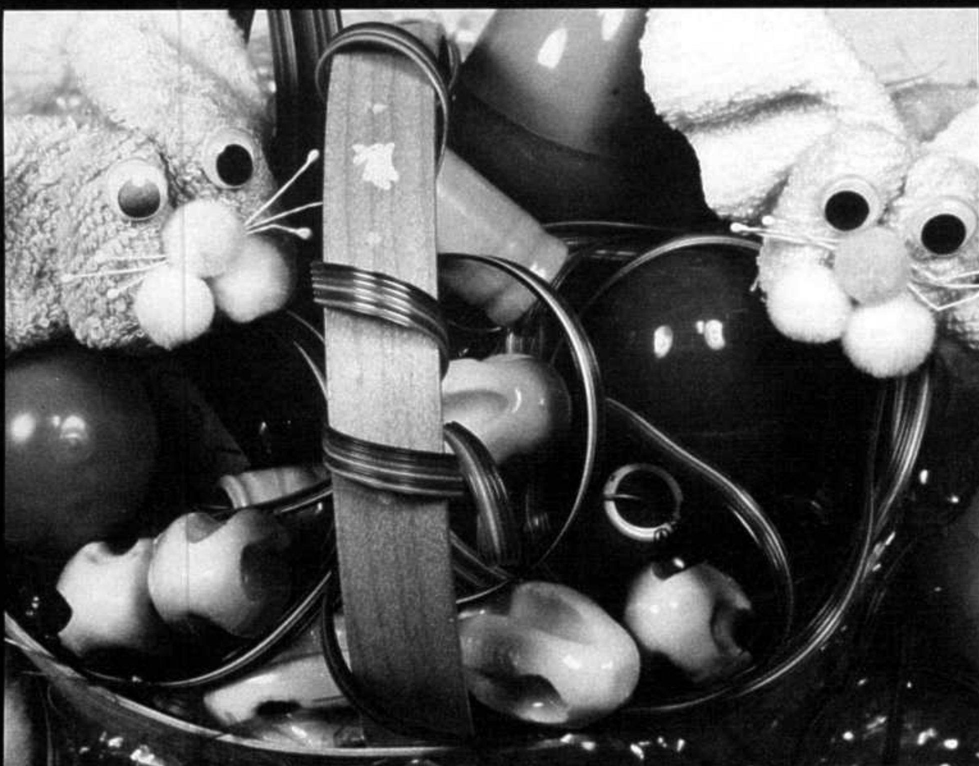
ARRL Experimenters' Exchange

APRIL 1990



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David Sumner, K1ZZ
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Paul L. Rinaldo, W4RI
Editor

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Assistant Editor

Mark Forbes, KC9C
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QEX Circulation

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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

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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.

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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.*

Empirically Speaking. . .

The Blooding of the Spectrum

Spectrum management used to be a nice, relaxed game in which everyone made up the rules as they went along. And why not? There was room for everyone. Even some of the more doubtful uses of the radio spectrum had their brighter sides—jobs, convenience, etc. For years, there has been a discrepancy between what's on paper and what's on the air. Master frequency lists show users dozens deep, while real-time monitoring reveals little or no activity. Some of this is simply the nature of things: You're not going to find an emergency-only frequency in use unless there's an emergency, for example. Another problem is frequency hoarding—keeping a frequency on paper, just to have it, without any plans to use it. These and many other aspects of spectrum management were dealt with in a Notice of Inquiry (NOI) issued by the National Telecommunications and Information Administration (NTIA), an agency of the Department of Commerce. While the FCC governs non-Federal Government telecommunications, NTIA is responsible for Federal Government of telecommunications, NTIA is responsible for Federal Government uses, and is the principal advisor to the President on telecommunications matters. The NOI was entitled: "Comprehensive Policy Review of Use and Management of the Radio Frequency Spectrum."

Mind you, NTIA didn't open this Pandora's box on a whim. Granted, the occupation of the spectrum has been increasing year after year, and pressures have risen to the point where people are talking about auctioning, renting, leasing or otherwise getting users to part with a bit of the green in exchange for use of some part of the spectrum. But what apparently got NTIA's attention was a move afoot in the Congress to get the Federal Government to return 200 MHz of their spectrum back to the public. Ouch.

Wait, there's more. In testimony before the Subcommittee on Telecommunications and Finance, House Committee on Energy and Commerce in February, Motorola outlined the need for additional spectrum to handle future demands for land mobile communications. They estimated that 200 MHz would be needed now, 300 MHz more in 5-7 years, and yet 300 MHz more in 12 years—all in the 1-3 GHz range. Besides user demand, there was the matter of the Europeans and Japanese having plans along the same lines. Obviously, the 200 MHz of Federal spectrum wouldn't come close to satisfying this projection.

Some spectrum users claim that the UHF TV bands are not fully occupied and maybe those unused channels could be used for land mobile. "Halt," say the TV broadcasters; "we need it for HDTV—high definition television." Some commenters have asked: "Why not put that stuff on cable TV or fiber?"

Now the HF broadcasters want their piece of the spectrum pie. In previous spectrum allocation conferences, they talked about their requirements and thought that a 50% expansion would be just fine. The additional spectrum would come from fixed and mobile services, and could have some impact on amateur HF allocations. Of course, the amateur service would like to have some more space in the HF bands, and, in a separate filing, we let the FCC know of our HF requirements.

As if that weren't enough, the Office of Technology Assessment—an agency of the United States Congress—did a lengthy study on the US telecommunications infrastructure. The word "infrastructure" these days usually means things like highways and bridges. But in telecommunications it also means the national telephone system and can include almost every other means of electrical communications, depending on the context. So, not to be outdone, NTIA issued a second NOI asking the public for comments.

Needless to say, spectrum management has become blood sport. The golden age of using the spectrum for everything imaginable is behind us. We feel confident that Amateur Radio is solidly based on citizens' rights to use their spectrum. Nevertheless, there will be challenges as well as people who generally support the amateur service feeling that they can make better use of some of our frequencies. As spectrum continues to be scarce, all users and would-be users must ask themselves tough questions such as:

- Could a nonradio means (wire or fiber) do the job?
- Have you adjusted your time on the air, bandwidth, antenna pattern, and other technical parameters to just what you need so others may share your frequency(ies)?
- Do your claims on paper accurately reflect your usage?
- Do you believe your use of the spectrum is more beneficial to society than some other use?

Most major users of the spectrum, including the League, have filed comments with the FCC on WARC preparation, and with NTIA on spectrum management and telecommunications infrastructure. Just exactly what will come out of this is not accurately known. But the scarce resource we call the radio spectrum will doubtless be the subject of increasing interest and more intensive management.—*W4RI*

Practical Digital Signal Processing: A Simple, High-Performance A/D Board

By André Kesteloot N4ICK
ARRL Technical Advisor
6915 Chelsea Road
McLean, VA 22101

For most radio-amateurs, who for decades have been using discrete components to design circuits, Digital Signal Processing (DSP) is far from being as "intuitive" as assembling resistors, capacitors, inductances and transistors. Yet, DSP is a very powerful emerging technology and as the magazine *Electronics* put it in a recent article: "The future of DSP depends upon making the technology available to users who are not signal-processing experts."[1]

Since these three words, Digital Signal Processing, seem to appear by magic in every other technical column we read these days, this introductory article will describe a few of the purposes of DSP, some of the techniques used, and above all, a simple plug-in board for the IBM® clone which will allow the reader, with but a modest investment, to conduct some experiments with DSP.

The world at large is definitely analog: Whether we want to measure or record a slowly changing phenomenon, such as the ambient temperature, or a rapidly fluctuating one, such as the complex sound of an orchestra, we are confronted with analog variations. The computer world, on the other hand, is digital. To process (ie, to compare, multiply, amplify, store, filter, encode, divide, decipher, integrate, differentiate, etc) these external-world signals in a computer, one thus first needs to transform the analog signals into digital quantities. The benefits of DSP are evident: Digital processing is inherently more precise and less prone to noise than its analog counterpart. (The Compact Disc revolution is a good example of a practical application of digital audio.) In the present state of the art, low-frequency signals can be processed easier and faster in a digital fashion than in an analog one. High-frequency signals, however, are still difficult to process. This is only a hardware problem, not a conceptual one, and every month brings around a faster and better integrated circuit.

All DSP tasks can be performed (albeit slowly) by a regular personal computer, but specialized/dedicated ICs are now manufactured to accomplish these chores much more efficiently.

These "DSP engines," such as the Texas Instruments TMS320, the AT&T DSP32C and the Motorola 56001, were designed to perform processing tasks (specifically number-crunching), and are intrinsically faster for those jobs than your plain-vanilla 8088 or Z80. Yet it is perfectly possible to get a "feel" for DSP by harnessing the capabilities of your IBM PC-XT clone. The software needed makes extensive use of Fast Fourier Transforms (FFTs): mathematical formulas allowing for the transformation of frequency-domain quantities into time-domain ones, and vice-versa.

This article will assume that you may be interested in DSP but that you do not want to invest too large a start-up capital to investigate its possibilities. Your XT clone will be expected to perform the computations, admittedly not as fast as if you had a dedicated DSP engine.

The one piece you will have to add to the ubiquitous XT clone is an analog-to-digital converter. (For a good description of the A/D process, which is beyond the scope of this article, the reader is referred to the *ARRL Handbook*, 1990 Edition, page 8-21 as well as to note 2.)

In the March 1989 *AMRAD Newsletter* I had described a simple, one-chip 10-bit A-to-D converter based on the LTC-1092 and housed in a small box connected to the XT clone via the printer port.[3] Its main disadvantage was that the information was transmitted to the computer in serial form through the printer port, which is inherently slow. (In fact, Paul Rinaldo, W4RI, recently remarked to me that the simple circuit I had then described probably represented a major contribution to the little-known field of Slow Fourier Transforms.)

Design: To go faster, one solution is to write directly to the XT address-and-data bus, a solution adopted for the design presented in this article. The circuit is designed to fit on a plug-in board for the XT and its clones. It features the MAX164, a recently introduced Maxim CMOS A-to-D chip with 12-bit resolution. (The higher the resolution, the better the fidelity with which the signal will be acquired.)

The MAX164 sports 12-bit resolution, and can thus differentiate between 2-to-the-12th-power, or 4096 levels. Since the MAX164 accepts signals between −5 and +5 volts, in practical terms it means that if a 10-volt peak-to-peak signal is applied to the input of this chip, the smallest detectable variation will be 10 V/4096 or 2.5 mV. (Hence the better than 70-dB dynamic range stated by the manufacturer.)

Essentially, one could extract the data from an A/D chip in two ways, either (a) serial which would entail a 12-bit string of data plus the overhead for each reading, or (b) parallel, where the whole data are placed on the bus at one time. The MAX164 is a parallel chip, and of the four ways to operate it, I chose as most appropriate for the XT what Maxim calls the "ROM mode, 2 byte read." The XT is designed with an 8-bit data bus, and to output 12 bits on this bus, it is necessary to slice the 12 data bits into two consecutive bytes, one of 8 data bits, the other with the remaining 4 data bits.

There are two ways to get 8-bit data from the MAX164 (which are not clearly explained in the Maxim manual). In the "Slow Memory Mode," the XT is put in a wait-state while the chip samples the input signal, whereas in the "ROM Mode" the sampling is accomplished between reads,

[1]Notes appear on page 6.

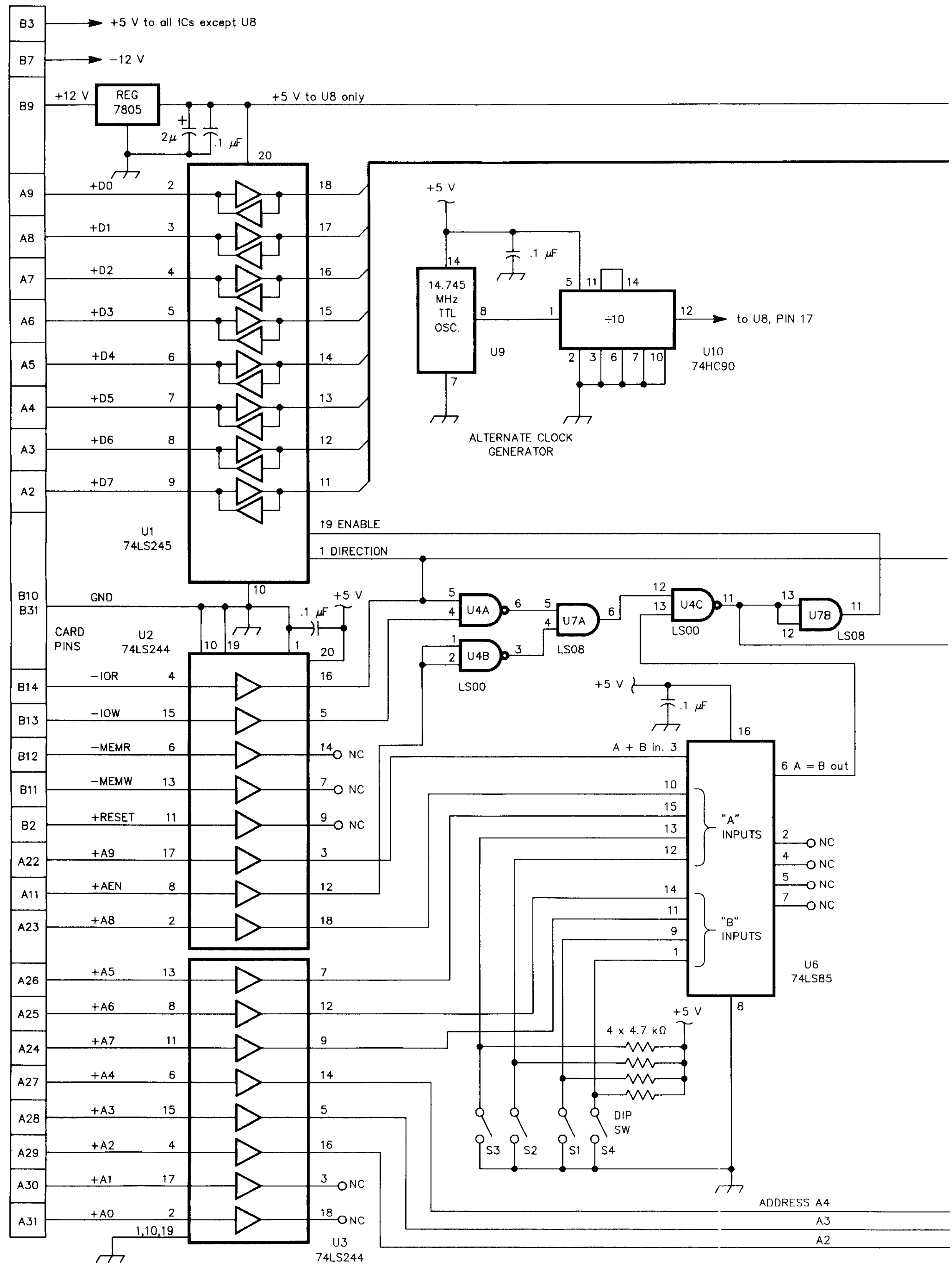
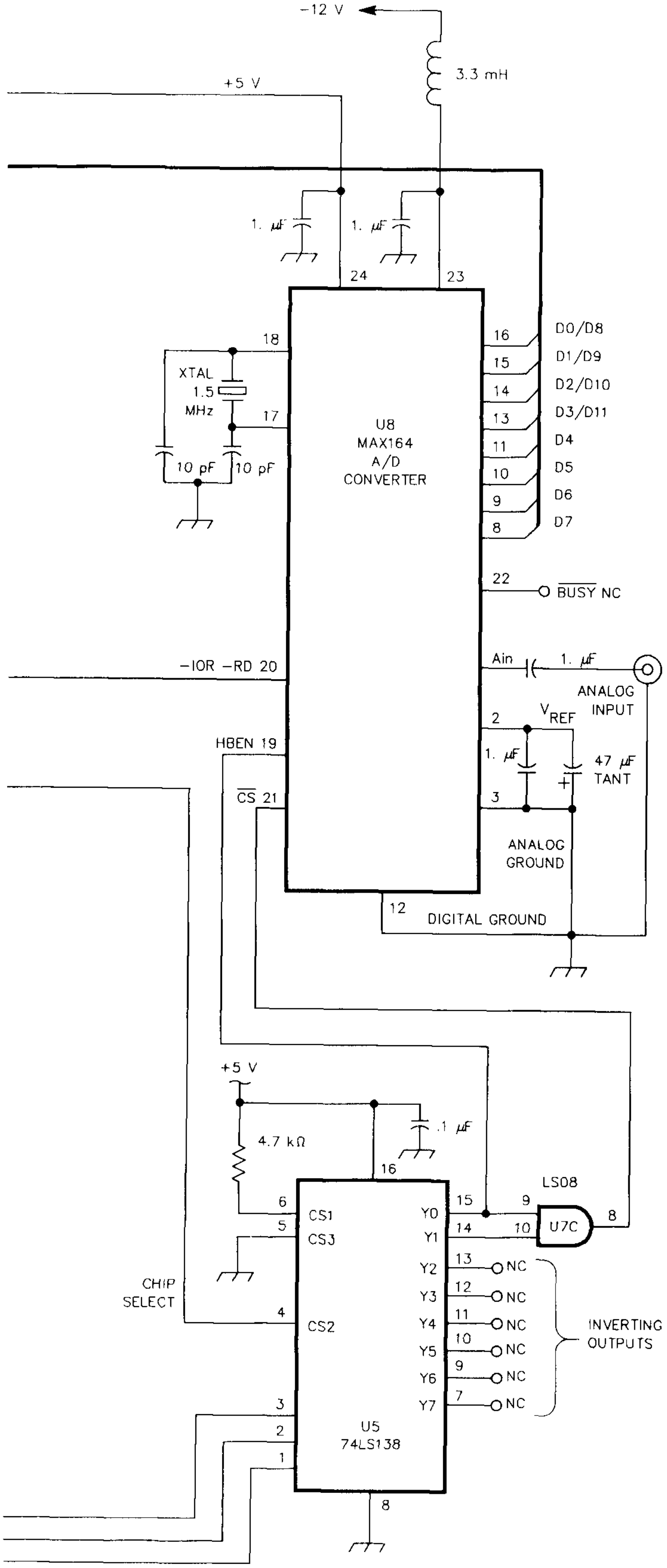

B3
+5 V to all ICs except U8
B7
−12 V
B9
+12 V
REG
7805
+5 V to U8 only
2μ
.1 μF
20
A9
+D0
A8
+D1
A7
+D2
A6
+D3
A5
+D4
A4
+D5
A3
+D6
A2
+D7
U1
74LS245
19 ENABLE
1 DIRECTION
+5 V
14.745
MHz
TTL
OSC.
U9
÷10
to U8, PIN 17
U10
74HC90
ALTERNATE CLOCK
GENERATOR
B10
B31
GND
CARD
PINS
U2
74LS244
U4A
U4B
LS00
U7A
LS08
U4C
LS00
U7B
LS08
B14
−IOR
B13
−IOW
B12
−MEMR
B11
−MEMW
B2
+RESET
A22
+A9
A11
+AEN
A23
+A8
NC
A + B in. 3
6 A = B out
"A"
INPUTS
"B"
INPUTS
U6
74LS85
A26
+A5
A25
+A6
A24
+A7
A27
+A4
A28
+A3
A29
+A2
A30
+A1
A31
+A0
1,10,19
4 x 4.7 kΩ
DIP
SW
S3
S2
S1
S4
ADDRESS A4
A3
A2
U3
74LS244

Fig 1



memory mode, the BUSY line of the MAX164 is connected to the I/O CH READY line of the XT bus (to create a wait-state), while in the ROM mode the BUSY line is left unconnected. The IBM Technical Manual warns us not to keep the 4.77-MHz 8088 in a wait-state for longer than 2 µs. Since the MAX164 would keep it down for 8 µs, the ROM mode is preferred.

Circuitry: Most of what is needed (track-and-hold, reference zener, 12-bit latch, clock oscillator, etc) is included inside the MAX164, and the balance of the circuitry is mainly decoding and interfacing "glue." Fig 1 shows the general arrangement: U1, a 74LS245 tri-state 8-bit bus transceiver allows data to flow from the MAX164 to the 62-pin IBM bus, and vice versa. The direction of data flow is determined by the voltage on pin 1. (When -IOR is high at pin 4 of U2, data flows from the XT bus to the A/D board, while when -IOR is brought low, data flows from the A/D board to the XT bus.)

U2 and U3, two 74LS244s are byte-wide (octal) line-drivers connected as straight-through buffers. (They are permanently enabled as their pins 1 and 19 are grounded.) U5, a 74LS138 is used to decode addresses A2 to A4. Each 3-bit address drives one output low while all other ones remain high. Since pin 6 is always high and pin 5 is always low, U5 is enabled solely when its pin 4, CS2, is brought low.

Addresses A5-A8 are decoded by U6. The latter, a 74LS85 four-bit comparator compares the signals from U2 and U3, and pin 6 of U6 goes high when the two words present at pins 10, 12, 13, 15 and 1, 9, 11, 14 respectively, are equal. (See *Software*, below.) Finally, a 74LS00 quad NAND gate and a 74LS08 quad AND gate are added to provide the necessary "glue." (For more information on decoding, see note 4.) If you wonder whether this whole circuit is not a little more than what you had originally in mind, remember that this decoding scheme can be used for all sorts of other applications on the same card: my A/D converter and the decoders only take one-half of a full-size card, and there is thus ample space for other circuitry.

When I/O location 300h is read by the software, pin 15 of U5 goes low bringing low pin 21 (-CS or Chip Select) and pin 19 (HBEN = High Byte ENable) of the MAX164. Simultaneously, the XT 8088 microprocessor brings low the -I/O Read line, pin 20 of the MAX164. Note that -I/O Read is available on pin B14 of the card connector. This signal, buffered, appears at pin 16 of U2. When these three pins (pins 19, 20 and 21) of the MAX164 are low, a conversion cycle is initiated and the first byte is sent to the bus via U1. Then, the software (see later) reads I/O location 304h. Pin 14 of U5 now goes low and -CS goes low. -RD (pin 20 of the MAX164) is low, as we are still in a reading cycle, but because HBEN (pin 19) is now high, a new conversion does not take place. Instead, the other byte is now sent to the data bus. The complete data (comprised of these two bytes) is now available in the XT's memory for computation / processing purposes.

The MAX164 contains an amplifier stage which can be used either as a crystal oscillator, or as a buffer for an external oscillator. Maxim recommends using a 1.5-MHz crystal, something not always easy to locate. Instead, I used a 14.745-MHz TTL oscillator (they are available for all sorts of frequencies at Hamfests) and a 74HC90 wired as a divide-by-10 stage. Of course, any alternative oscillator/ divider arrangement producing a clock pulse around 1.5 MHz will do nicely.

The MAX164 requires +5 volts and −12 volts. Any noise present on these two bus bars will tend to influence the output signal, and although it is tempting to use the +5 and −12 V lines of the XT clone, in fact, much cleaner results will be achieved by creating your own voltage sources. A clean +5 V line can readily be produced by connecting a 78L05 regulator to the XT +12 volt line, whereas a −12 V line could be generated from the +12 volt line with a voltage doubler and a regulator.

Construction: JDR manufactures for the XT the PR-2 plug-in board, which had most of the decoding circuitry described above already printed on it.[5] I suggest you use that board as, for $29, it will considerably simplify your life. The MAX164 is available in small quantities from DANCON.[6] That chip comes in a 24-pin narrow-dip package; if you cannot locate a 24-pin dip socket, simply position an 8-pin and a 16-pin socket end-to-end on the board. You will want to keep separate the analog and the digital grounds, and connect them together at one point only. On one of my boards, the input connector is in fact a piece of shielded cable terminated by an RCA jack (a Radio Shack cable assembly RS 42-2358 cut in two), and dangling from the back of the board. This scheme avoids unwanted ground returns.

Software: Every port on the IBM bus has a specific function (eg, 3BCh is printer data out). Ports 300h to 31Fh are reserved for experimenters. To read the correct ports, the four dip switches associated with U6 should be in the following positions: S1 OFF, S2, S3 and S4 ON, which will decode ports HEX 300 to 31F. (If all four switches are ON, then you will decode ports HEX 200 to 21F; if the first three are OFF and the last one is ON, addresses between 3C0 and 3CF will be selected, and so on.) My hardware is setup so that reading port 300h will return the least significant byte (and will start a sample), and reading location 304h will return the most significant 4 bits. In the Slow Memory Mode, the LSB needs to be read first, then the MSB:

```
MOV DX,300h
IN AL,DX
MOV AH,AL
MOV DX,304h
IN AL,DX
XCHG AL,AH
```

In ROM Mode, they need to be read backwards:

```
MOV DX,304h
IN AL,DX
MOV AH,AL
MOV DX,300h
IN AL,DX
```

Note that, in the ROM mode, the first sample contains old information, and needs to be discarded. The bytes are read backwards because reading 300h will start a sample, but the data won't be ready right away (which is why the first sample is to be ignored). The next read will retrieve the data whose sample was initiated by the previous read. Make certain that you wait at least 8 μs before doing the next read (no software delay was required on a 4.77-MHz PC-XT).

In the Slow Memory Mode, reading port 300h will create a wait-state (ie, will place the 8088 on hold) until sampling is completed, which means that the data is available right away. The Maxim data sheet suggests that this mode will give cleaner results. On a 4.77-MHz XT using a driver written in assembly language, we managed to get a maximum sampling rate of 45 kilosamples per second. (All other things being equal, the sampling rate is directly proportional to the XT clock speed, hence the sampling rate is about 90 kilosamples on a 10-MHz XT.)

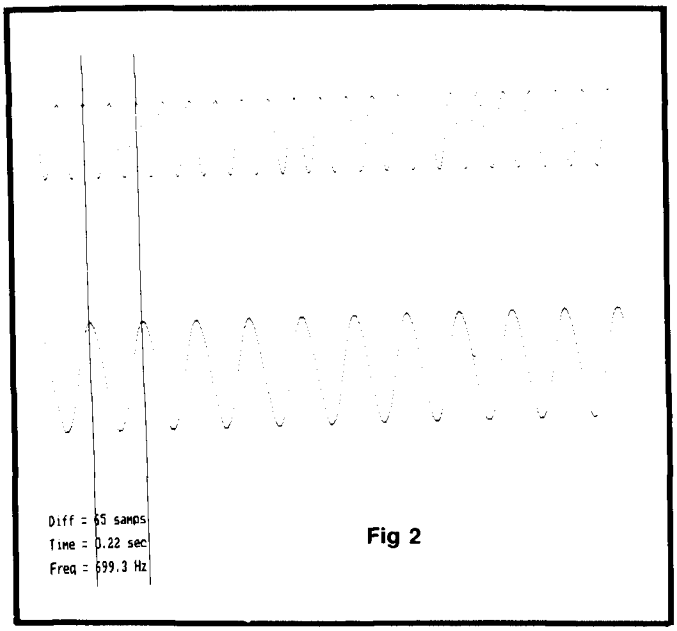


Fig 2

Several software programs, written by the AMRAD Software gang (and particularly John Teller, N4NUN, and Lawrence Kesteloot, N4NTL), are available on the AMRAD BBS under the MAXBOARD heading.[7] One such program samples an incoming sine wave, shown on Fig 2 lower trace, then multiplies that incoming signal by 2 and displays it as the upper trace. Note that by using multiplication by DSP, it would be just as easy to multiply the incoming signal by 3.5 or 4.2, something not attainable in hardware.

Ham Applications: while the software just described turns the XT clone in an oscilloscope, some other possible ham radio applications of DSP were described in a series of very informative articles by Matjaz Vidmar, YT3MV[8]. Other DSP programs have been written which allow for spectrum-analyzer functions and for HF modem applications[9].

Notes:

[1]J. McLeod, "Digital Signal Processing," *Electronics*, March 31, 1988; p 57.

[2]T.W. Henry, "High-Speed Digital-to-Analog and Analog-to-Digital Techniques," *Motorola Application Notes* AN-702.

[3]A. Kesteloot, N4ICK, "A Simple 10-Bit A/D Converter for the IBM Compatible," *AMRAD Newsletter*, Vol XVI, No. 2, March 1989. Write to AMRAD, PO Box 6148, McLean, VA 22106.

[4]L. Eggebrecht, *Interfacing To The IBM Personal Computer,* Howard Sams & Co, Indianapolis 1983. (Note that the numbering of the card pins A2 to A9 on p 77 of this book is erroneous. Otherwise, this book is recommended reading.)

[5]JDR Microdevices, 110 Knowles Drive, Los Gatos CA 95030, 800-538-5000.

[6]DANCON Electronic Wholesalers, 304 Mill Street, Vienna VA 22180, 703-255-9755.

[7]The AMRAD BBS is available at 300/1200/2400 bauds, at 703-734-1387.

[8]M. Ditmar, YT3MV, "Digital Signal Processing for the Radio Amateur," *VHF Communications*; Part I, Vol 2/88, pp 77-97; Part II, Vol 1/89, pp 2-24; Part III, Vol 2/89, pp 74-94.

[9]D. Borden, K8MMO, "HF DSP Packet Modem Considerations," *AMRAD Newsletter*, Vol XVI, No. 3, May 1989.

Graphics by Packet—Introducing NAPLPS Software from Japan

By David Cowhig, WA1LBP
6317 May Blvd
Alexandria, VA 22310

Japanese hams are using the NAPLPS [Telidon] videotex system implemented in MS-DOS® programs to exchange drawings, schematics, repeater maps and even cartoons by packet radio. Akihira Kurashima (Roy), JM1VSP, Mr Komai and several other members of ASCII-NET, a Japanese computer network analogous to CompuServe™, wrote most of these NAPLPS programs. I translated the IBM® PC related Japanese language documentation which accompanies these MS-DOS NAPLPS programs. These MS-DOS programs output graphics images to a CGA or IBM black and white monitor. You can also view NAPLPS graphics output by the NAPLPS decoder on a Hercules monochrome graphics monitor by using a CGA emulation program.

The North American Presentation Layer Protocol Syntax (NAPLPS), pronounced nap-lips, is a method for transferring graphics information among computers which have different display formats. NAPLPS is based on a videotex system named Telidon by the department of the Canadian government which developed it. Ted Thompson, VE3FTT, did pioneering work on ham NAPLPS (see September 1983 *QST*). A series of articles beginning in the February 1983 issue of *BYTE* explains the NAPLPS in detail. An article in the March 1983 issue of *BYTE* explains how to write NAPLPS text files which can then be changed into a NAPLPS data file by a conversion program such as NAPCONV by Akihisa Kurashima, JM1VSP. Japanese hams use packet radio, and members of the ASCII-NET computer network use these programs to create, encode, exchange and decode pictures, maps, cartoons and other graphics information by packet radio or by landline BBS.

The NAPLPS standard was developed by the American National Standards Institute (ANSI) in the USA and the Canadian Standards Association (CSA) in Canada. NAPLPS can switch new character sets in and out of the 256 character set that can be specified using one byte. Thus, NAPLPS can use more than 256 characters in drawing pictures and is easily expandable. Additional character sets such as the Supplementary character set, two control sets, the Mosaic character set and the Picture-Description Instruction set are part of the NAPLPS standard. Other character sets can be added.

You can use the operation codes (op codes) of the Picture-Description set to perform operations such as drawing lines, arcs, rectangles, selecting which color to use, etc. The op codes and the character sets make it possible to send a high resolution graphics image using far less information then would be required to send the same image by a video system (slow-scan or fast-scan TV). Perhaps these programs could find a similar application for titling and graphics in fast-scan amateur television. Yoshi Iwasaki, JA3CF, JA3AA, JA3BR and several other Japanese hams have formed the Packet Image Communications Study Group to collect and encourage the creation of new packet graphics software and original packet graphics. Another goal of the Study Group is to exchange packet graphics software and images with foreign hams. [Write: Packet Image Communications Study Group, c/o Yoshi Iwasaki, JA3CF, 1229, Hiro Hirogawa, Ariba-Gun, Wakayama, 643 JAPAN].

You could use these programs to exchange graphics with Japanese hams. JA3CF wrote me recently that he sent copies of the NAPLPS program to 25 hams throughout the world. Some NAPLPS pictures and cartoons are true works of art. See the NALPPIC*.ZIP files and you will agree.

Many of the NAPLPS codes are non-ASCII codes, so US regulations do not currently permit them under 50 MHz without special authorization or an agreement between the USA and a foreign country that permits their use in amateur communications between the USA and that foreign country. Most NAPLPS QSOs in Japan, like most packet work, occur on 440 MHz at 1200 bit/s or higher.

These programs include NAPCONV, which translates a NAPLPS graphics command text file into NAPLPS data which produces a color image on an IBM CGA monitor (use software or hardware emulation to view on Hercules monitors), NEWNAP, which decodes NAPLPS data, and RNCV a program which decodes the NAPLPS graphics data to produce a text file of NAPLPS graphics commands. NEDIT, a mouse driven NAPLPS graphics editor, enables you to draw NAPLPS images using a mouse.

NEDIT, unfortunately, runs only on Japanese personal computers since it has no IBM driver. The developers in Japan are considering release of the source code. It should not be difficult for a computer techie to modify NEDIT to run on PC compatibles and then to make NAPLPS produce graphics output for Hercules, VGA, EGA, etc, since NAPLPS was designed to support many different graphics standards. Mouse-driven NAPLPS editors are available in the USA on fancy engineering workstations made by Hewlett-Packard, but few of us have one of those next to the rig!! Perhaps someone familiar with computer graphics will write an IBM PC graphics driver for this graphics editor program. You can use graph paper to make up a NAPLPS graphics command text file for NAPCONV to work on until we get NEDIT to run. See NALPPIC1.ZIP and NALPPIC2.ZIP and the documentation (start with NAPLPS.DOC in NALPVIEW.ZIP) for examples.

Mr Komai wrote a program which encodes NAPLPS data in a binary file as well as a memory resident program which automatically switches your computer into the graphics mode to decode a NAPLPS image should someone send

Continued on page 10.

A Standard for Morse Timing Using the Farnsworth Technique

By Jon Bloom, KE3Z
ARRL Laboratory

In recent years there has been a renewed interest in Farnsworth timing of Morse transmissions. Farnsworth timing is defined as sending the characters at a faster speed than the words. For example, sending the characters at 20 WPM but adding enough time between them to slow down the rate to 10 WPM.

The problem in learning Morse is that at speeds above a few WPM, Morse is most easily read by ear when the characters are recognized rhythmically rather than by counting the dots and dashes. But the person just learning Morse starts at very slow speeds, where counting is easier than recognizing the slow rhythm of the characters. So in order to increase their ability to read Morse above a few words per minute, students are forced to shift from the counting mode to the rhythm recognition mode. This is probably the cause of the oft-mentioned "13-WPM barrier."

The idea behind the Farnsworth method is to eliminate the counting phase by sending the characters at a speed at which rhythm recognition is easy and counting is not. This forces the student to learn the rhythms. Initially, the

The ARRL Morse Transmission Timing Standard

1. General

This standard is motivated by recent changes in the systems used to generate Morse text for ARRL.

1.1 Scope

This standard defines the timing parameters used for all ARRL Morse training materials, including code-practice tapes, code tests and W1AW Morse transmissions.

2. Timing

At speeds of 18 WPM and above, standard timing specified in 2.1 will be used. At speeds below 18 WPM, Farnsworth timing specified in 2.2 will be used.

2.1 Standard timing

Standard timing is as follows:

The period of a single *dot* is one *unit*, measured in seconds.

A *dash* is a period of three units.

A period of one unit separates each *element* (dot or dash) within a character.

A period of three units separates each character within a word. A period of seven units separates each word.

For purposes of specifying code speed, the "PARIS" 50-unit standard is used.[1] From that standard, the following relationship is derived:

$$u = \frac{1.2}{c}$$

where:

u = period of one unit, in seconds

c = speed of transmission, in words per minute (WPM)

2.2 Farnsworth timing

At speeds below 18 WPM, characters are sent using 18-WPM timing, but with extra delay added between characters and words to produce an overall lower speed.

Speeds are specified as s/c, where *s* is the overall transmission speed and *c* is character speed. For example, a 5-WPM transmission sent with 18-WPM characters is specified as 5/18 speed.

The character timing used is as specified in 2.1 (above), using the *unit*, *dot* and *dash* periods, as well as the one-unit interelement spacing. The adjustment to a lower speed is made by adding delay between characters and words. The added delays are constant for a given Farnsworth speed and will maintain the 3/7 ratio of character space to word space.

The added delays are calculated as follows:

$$t_a = \frac{60c - 37.2s}{sc}$$

$$t_c = \frac{3t_a}{19}$$

$$t_w = \frac{7t_a}{19}$$

where:

t_a = Total delay to add to the characters (31 units) of a standard 50-unit word, in seconds

[1]Notes appear on page 9.

rate of transmission is slowed (by the addition of time between characters) to allow the student to gradually build the skill of recognizing and writing the received text. The process by which the student recognizes the characters is never changed; he just gets better (faster) at doing so.

Recently, ARRL finished converting all of its Morse materials to Farnsworth timing. ARRL is using a standard of sending transmissions at an 18-WPM character rate. (Of course, at 18 WPM and faster speeds, ARRL transmissions revert to standard timing, since no extra time has to be inserted.) This standard applies to all code practice and test tapes, and to W1AW transmissions.

In implementing Morse generation here at ARRL, we ran across a problem: There is no standard for Farnsworth timing. In fact, we couldn't find any definitive specification for how Farnsworth timing is calculated. It's fine to say that you're going to transmit, for example, a 10-WPM text using 18-WPM characters, but exactly how much time needs to be added to the transmission, and where? The ARRL code tapes and W1AW transmissions are generated by computers, and you need a specific answer to that question to write the computer program. Thus, the ARRL Morse transmission timing standard. Note that while ARRL has settled on a standard character speed of 18 WPM, this is not inherent in the idea of Farnsworth timing—any speed can be used.

Bits

Eastern VHF/UHF/SHF Conference

The 16th Annual Eastern VHF/UHF/SHF Conference will be held May 18-20, 1990, at Rivier College, Nashua, New Hampshire. The Conference is sponsored by the Northeast VHF Association.

Activities will include: Friday evening, informal gathering; Saturday, technical talks and "rap sessions" for each of the VHF/UHF bands, with a buffet-style banquet set for the evening followed by informal social activities; Sunday, antenna gain measurements and, weather permitting, a parking-lot swapfest.

Preregistration by May 14 is $23, at the door is $30. Saturday banquet cost is $20. For those wishing to attend *only* the Sunday activities, there will be a $5 registration fee.

For more information on the 16th Annual VHF/UHF/SHF Conference (and where to stay) please contact David Knight, KA1DT, 15 Oakdale Avenue, Nashua, NH 03062.

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t_c = period between characters, in seconds
t_w = period between words, in seconds

Reference

[1] Hale, Bruce S., et al, *The 1989 ARRL Handbook for the Radio Amateur*, Newington, CT, ARRL, 1988, p 19-4.

APPENDIX A — DERIVATION OF TIMING EQUATIONS

A.1 Unit period

The unit period, *u*, is derived from the "PARIS" 50-unit standard as follows:

s words of 50-units each transmitted in the space of one minute are, by definition, being transmitted at *s* words per minute. Thus, units are occurring at 50*s* units per minute. The equation is:

$r = 50s$ where *r* is the rate in units/minute

To convert to units/second:

$$r\,\frac{\text{units}}{\text{min}} \times \frac{1\ \text{min}}{60\ \text{sec}} = \frac{r}{60} = \frac{50s}{60} = \frac{5s}{6}$$

the reciprocal gives *u*, the period of a unit in seconds:

$$u = \frac{6}{5s} = \frac{1.2}{s}$$

A.2 Farnsworth Timing Delays

The total delay added to each 50-unit word transmitted is the difference between the time it takes to send the word using standard timing at speed *s* (the overall speed) and the time it takes to send just the characters at speed *c* (the character speed). The time it takes to send a 50-unit word at speed *s* is, by definition:

$$t_{50} = 50 \times \frac{1.2}{s}\ \text{seconds}$$

A standard 5-letter, 50-unit word contains 31 units of element and interelement spacing (that is, everything exclusive of intercharacter and interword spacing). The time it takes to send 31 units at speed *c* is:

$$t_{31} = 31 \times \frac{1.2}{c} = \frac{37.2}{c}\ \text{seconds}$$

The difference between these two times at a given Farnsworth (s/c) speed is therefore:

$$t_a = \frac{60}{s} - \frac{37.2}{c}$$ where *s* and *c* are as defined in paragraph 2.2

or, by algebra:

$$t_a = \frac{60c - 37.2s}{sc}$$

In the transmitted word, this delay is divided among four intercharacter spaces, each t_c long, and one interword space t_w long, representing 19 total units (4 × 3 + 7 = 19). This gives the relationships for the division of t_a into these delays:

$$t_c = \frac{3t_a}{19} \text{ and } t_w = \frac{7t_a}{19}$$

Graphics by Packet—Introducing NAPLPS Software from Japan

Continued from page 7.

you one. Roy, Mr Komai and several members of ASCII-NET, have written several NAPLPS coding, decoding, binary data formating and graphics editing programs which they distribute free of charge on the condition of no commercial use. Roy, JM1VSP, told me that NAPLPS programs which run on Apple® computers and under CP/M® are available in Japan.

You can make NAPLPS images by using graph paper to determine which points you should enter in the NAPLPS command text file. See PIYO.DAT as an example. Use NAPCONV to change the NAPLPS command text file into NAPLPS code. Take a look at the graphics files made by Japanese hams in NALPPIC1.ZIP and NALPPIC2.ZIP and at the 1983 *BYTE* articles to get a better idea on how NAPLPS pictures are made. Use NEWNAP to display the NAPLPS code file (which has the suffix .npb or .pdi) on your screen.

You can write to Roy, JM1VSP, with your suggestions for improving future releases of this NAPLPS software. E-mail: UUNCTINACSTS.AC.JP1KURA. Write: Akihisa Kurashima, JM1VSP, 3-5-23 Shakujii-dai Nerima-ku Tokyo 177 JAPAN.

These NAPLPS programs should be used and distributed free of charge and are limited to noncommerical use. You can download these NAPLPS files from the following land-line BBS: Virginia Connection (703) 648-1841, AMRAD (703) 734-1387. The Virginia Connection has a 19,200-bit/s modem so it might not be too much trouble for your local SYSOP to post these files on her board. The names of the files are: NALPVIEW.ZIP; NALPFORM.ZIP; NALPEDIT.ZIP; NALPMAKE.ZIP; NALPPIC1.ZIP; and NALPPIC2.ZIP. If you don't have a modem, send a postage prepaid diskette mailer with 5.25-inch DS/DD MS-DOS formatted diskette enclosed or a check for $3 to David Cowhig, WA1LBP, 6317 May Blvd, Alexandria, VA 22310.

Let's work together with our Japanese friends, some of the most enthusiastic hams on the planet, to make packet graphics better. These programs are complicated to start with and making pictures is tedious but they are very interesting and have great potential. As Benjamin Franklin said, "What good is a baby?"

Previous versions of this article appeared in the July 1989 *Autocall* and the April 1989 *Ye Olde RF Output*.

A Review of Phil Geffe's Filterware, BAND

By Ed Wetherhold, W3NQN
ARRL Technical Advisor, Passive LC Filters
1426 Catlyn Place
Annapolis, MD 21401

Back in 1963, a comet crossed the electronics literature sky in the form of a "little blue book" (*lbk*), otherwise known as *Simplified Modern Filter Design*, by Phil Geffe. The publication of this 182-page book by John F. Rider had a tremendous and long-lasting effect on many electronics engineers and radio amateurs interested in filter design. With the publication of this book, it became possible for electronics engineers and radio amateurs unfamiliar with modern network synthesis to apply those new procedures in the design and construction of modern filters (Butterworth, Chebyshev, elliptic, Bessel, etc). Before that, the only means of designing filters by the nonspecialist was to use the less precise procedures of Zobel and his Constant-k and m-derived networks.

You can see one of the effects of Geffe's *lbk* on the radio amateur literature by referring to the *ARRL Handbooks* from 1984 to the current 1990 volume. On or near page 2-41, you will find tables of 50-ohm Chebyshev and elliptic filter designs using standard-value capacitors (SVC). The publication of the SVC filter tables in the *ARRL Handbooks*, in the 23rd edition of the *SAM's Radio Handbook* and in many other books and magazine articles was a direct consequence of the *lbk* publication. I know this to be true because I was responsible for generating the SVC tables and having them published in Amateur Radio handbooks and magazines both in the US and England. I am certain that the publication of these SVC tables would never have occurred, or occurred much later, if it hadn't been for my having the good fortune of discovering Geffe's *lbk* at my place of work many years ago! I found Geffe's book so useful that I paid the supreme compliment to the author by buying the book for my own personal use at home!

Now, at the beginning of 1990, and more than a quarter of a century after the publication of the little blue book, the same comet again crosses the sky of the electronics literature, this time in the form of Phil Geffe's *Filterware*. We now have the opportunity of gaining access to some of Geffe's vast knowledge of filter design through the computer and the floppy disk. Ten or twenty years ago, having access to a computer was possible for only the professionals at work. Today, that is no longer true. Like me, you either have your own computer, or have convenient access to one at work. So, it is very timely that Geffe now offers his expertise in a form that can be easily accessed by today's radio amateurs and electronics engineers.

The purpose of this review is to shorten the time for radio amateurs and electronics engineers to become aware of this new filter design aid. Instead of waiting years for the effect of Geffe's new offering to gradually trickle down, those reading this review and interested in filter design can take immediate action to obtain this new software and explore its capabilities.

Geffe's first software disk, BAND, designs narrowband LC band-pass filters having bandwidths of less than one octave and which are based on the Butterworth, Chebyshev, Bessel and Constant-k low-pass prototypes. The relative advantages of these types are, respectively, flat passband, equi-ripple passband for better attenuation rolloff, constant narrow-band delay, and recurrent element values. The BAND software is ideal for designing band-pass filters frequently needed by the radio amateur, such as a CW filter having a 100-Hz bandwidth at a center frequency of 750 Hz. In this case, the 13% bandwidth is within the capabilities of the BAND program, where the maximum acceptable relative percentage bandwidth is 70.7%. (NOTE: Relative percentage bandwidth = 100 X Fb/Fc where Fb and Fc are, respectively, the 3-dB bandwidth and the geometric center frequency in Hz.) Those interested in microwave filtering will find the bottom-C-coupled design of interest because only series coils with shunt and series capacitors are used, thus making it possible to construct the filter in a tubular configuration that closely simulates a rigid, concentric transmission line.

The narrow band-pass types available in BAND include the resonant-branch (where every branch is an LC pair), the capacitively top-coupled shunt resonator, and the capacitively bottom-coupled series resonator. The top and bottom-C-coupled configurations are preferred for narrowband designs having relative bandwidths less than 15 percent while the resonant-branch configuration is preferred for designs with relative bandwidths between 15 and 70 percent. When requested, the program will do successive Norton transformations to make all coils equal. Also, for the C-coupled configurations, the middle series capacitors are automatically split into two capacitors to form a tee configuration which is then transformed into a pi configuration for smaller capacitor values. For example, for a 5-resonator, bottom-C-coupled band-pass filter having a 100-Hz 3-dB bandwidth and a center frequency of 500 Hz, the tee-to-pi transformation reduces the total capacity required to less than half of its original value. For narrow-band applications requiring relative bandwidths of about 15 percent or less, the user has the option of having capacitors inserted at the network ends, where a Norton transformation adjusts the overall impedance level so all the coils can be set equal to a user-specified optimum value. Of course, because of the many program options available and the many variables involved, the user must try several different combinations of parameter values until a design is obtained that is satisfactory in all respects. Formerly, this was a very tedious and time consuming task. Using Geffe's BAND, an optimum design is obtained in a fraction of the time previously required.

An unusual feature of BAND is that when the capacitor and inductor Qs are specified, it calculates the component values that will exactly produce the desired response. This is accomplished with a special algorithm developed by Geffe that iteratively tries different combinations of values until the exact desired response is obtained. The user is thus assured that when the capacitors and inductors having the specified Qs are assembled, the desired response will result.

The desired filter parameters are first entered in the various fields displayed on the CRT monitor. After this, the program evaluates the design, and then outputs the filter schematic diagram in a vertical format consisting of Cs and Ls interconnected by dots. The program output may be directed either to the CRT alone, or to the CRT and printer. The component values are printed alongside the schematic diagram on the same line with their corresponding C and L.

After the component values of a trial design are viewed on the CRT, the user may loop back to the first screen and enter new values if the initial computer-calculated component values are unreasonable. For example, when an inappropriate bandwidth is selected for a certain filter type, negative capacitor values will occur. In this case, the parameters are changed until reasonable component values are obtained. When an apparently suitable design is obtained, a resident network analysis program can be accessed within the loop to tabulate the filter parameters of insertion loss, phase, group delay, VSWR and return loss over the frequency range and step specified by the user. If the response is less than satisfactory, the user can stay within the program and loop back to the input fields to modify the parameter values.

Although the technical capabilities of BAND are quite impressive, its ease of use leaves much to be desired. This program is not what you would call user friendly! For example, if you specify the lower and upper band edges such that the bandwidth is greater than one octave, you are thrown out of the program and back to DOS. If you specify a combination of parameters that cause an excessively long iterative compute time, and the design is obviously inappropriate, the only way to terminate the program is CRTL-BREAK, which again puts you back to DOS. You then have to again manually enter all the parameters. BAND does not have the option of storing parameters to a dedicated file, so if you want to compare different designs, you will have to enter each one manually. After entering all the parameters, you are given the option of having the output sent only to your CRT monitor or your monitor and printer. Naturally, you pick a CRT output to first see if the design is satisfactory. After several tries using different parameters, you finally have a design in which you want a hard copy. But to get the hard copy, you have to again cycle through the input fields until you again get to the choice of sending output to CRT or printer, and then you have to wait while the computer again calculates the same design which you accepted. After the computer finishes its iterative calculations (up to 90 seconds for a five-resonator design) the output finally goes to the printer. Obviously, the CRT or printer choice should occur after, not before, the iterative calculations are performed. The current version of BAND will not make the tee-to-pi capacitor transformation without endcaps. To get the capacitor transformation, the user must independently perform the calculations. A later version of BAND is expected to include the transformation.

Another shortcoming this writer found was the printed output did not contain a listing of all the input data specified. If at a later date the design is to be repeated with slightly different parameters, you had better make penciled notes on the hard copy, otherwise you won't remember if you specified "endcaps" or not, or how you specified that the design was to be finished—automatically or not. The printed summary lists the band-edge frequencies, the type (for example, Butterworth), BP type (Bottom-C), the component Qs, the attenuation specified at the band edges and the minimum passband insertion loss and frequency. However, the bandwidth, the filter degree and F-center are not listed. If you want to record the bandwidth and F-center, you must calculate them by hand and write them on your hard copy.

It would take this writer much more time and space than available to explore and comment on the many user selectable options in Geffe's versatile and powerful BAND program. To fully appreciate the BAND program, you should read the PRINT.ME file included on the disk which explains the many features of the program. To facilitate the distribution of the PRINT.ME file to those interested in learning more about this software, Phil Geffe has given me permission to transfer the entire PRINT.ME file to paper and to make it available at no charge to anyone sending a stamped, self-addressed, business-sized envelope to me at 1426 Catlyn Place, Annapolis, MD 21401. By reading Geffe's PRINT.ME file, you can quickly decide if the BAND program will satisfy your filtering requirements.

The price of the BAND software is $99 postpaid (US only). Make your check payable to Philip Geffe, and mail it to him at 503 Williamsburg Road, Cincinnati, OH 45215.

The program is available on 3.5-inch or 5.25-inch disks, and you must specify which disk you want. You will need an IBM-compatible computer with DOS 2.11 or more, double-sided disk drives and at least 640 kbytes of RAM. To use BAND with my 1984 Sanyo MBC-550, I had to modify the motherboard, increase the RAM, and add a short program to my AUTOEXEC.BAT file to take care of timing differences between my MBC-550 and the IBM® computer. Others having similar non-IBM computers perhaps can also modify them to work.

A graphics card is not needed as everything is done in the text mode. The program output is not affected by the presence, or absence, of a numeric coprocessor, although the operation will be relatively faster with a coprocessor. The prompt screens for the monitor are presented in attractive colors, but monochrome also works fine. The software is not copy protected so it may be copied for home use by the purchaser; however, the copyright specifies that the software is authorized for use by only one person at a time. Resident on the disk is a PRINT.ME multipage introduction and explanation of the program features and procedures. The text can be outputted to your printer directly from DOS by typing TYPE PRINT.ME in the printer echo mode. In the concluding sentence of his PRINT.ME notes, Geffe invites you to write to him concerning comments and suggestions on the program. If you have any suggestions as to how the BAND software may be made more convenient for the user, please take advantage of this offer.

If you are a radio amateur or an electronics engineer, I recommend this software to you, and I am sure you will find it to be as good an investment as was the little blue book more than 25 years ago!

Correspondence

Down with HF Packet Retries

In the November *QEX*, Allan Kaplan, W1AEL, had some very interesting ideas for reducing retries on HF packet. I expect that the problems with implementing his techniques will be more political than technical. It's the classic "chicken or the egg" syndrome—people will not see a benefit until enough other people have already adopted the new technology. No one likes to spend hours sending out CQs that no one else can decode.

What we need is a method that will work with the thousands of TNCs that already exist. For example, if you left out some of the fancy stuff, you could implement Allan's "packet combining" technique without the other station even knowing it. You don't need any fancy error-correcting codes simply to compare retransmitted packets for hit bits.

You might not even have to modify your TNC. 300 baud is slow enough that I bet you could run the TNC in "KISS" (transparent) mode, and have your PC look for errors. I'm not a software hacker—I hope someone will turn this idea into code soon.

There is another technique that is 100% compatible with old hardware—better modems. PLL decoders work well on VHF where static and interference are not severe, but the old discriminator-type demodulators are much better on HF. I haven't tried it, but I bet a slightly modified version of Irv Hoff's (W6FFC) old ST-6 RTTY demodulator would work great on HF packet.—*Al Bloom, N1AL, ARRL Technical Advisor, 1578 Los Alamos Road, Santa Rosa, CA 95409.*

HF Diversity Tests

Dear Editor (*Gateway*):

This is a criticism of the HF diversity tests (see *Gateway*, Vol 6, Nos 3 and 4). The ARRL Digital Committee reportedly discussed improving the performance of HF Packet Radio in the areas of:

- Modem Design
- Protocols
- Diversity Techniques
- Network Management

This is laudably progressive, innovative and commendably forward looking. So far, so good!

Of various diversity techniques, it is quite understandable why one would wish to avoid tests of frequency diversity, but it is beyond comprehension why the ancient dual space diversity technique has been preferred to time diversity, which, seemingly, has been totally ignored—unless the intention is to incorporate time diversity into the proposed improved modem design.

Is there really anything *new* to be learned or demonstrated from dual space diversity tests? As you, Mr Editor, rightly intimate, this technique has been in use since—when? 1925? Or thereabouts!

- HF Packet Radio & Time Diversity are progressive, innovative, and forward looking.
- Dual Space Diversity is unprogressive, uninnovative, and backward looking—a very humble opinion, that is.

A simple time diversity scheme is depicted in Fig 1.

A 3-channel modem would emit data in virtual real-time on channel 1, with the same data being emitted on channel 2 & channel 3, but delayed, respectively, by 3 and 6 seconds. Conversely, at demodulation, channel 1 & channel 2 would be delayed, respectively, by 6 and 3 seconds, while channel 3 would be in virtual real time. After demodulation, the three data outputs would be bit-by-bit compared, and a simple majority vote would then determine the output to the data sink.

However, if dual space diversity is still a *must*, then a 5-way time diversity scheme could be incorporated into the system such as Fig 2. In this case, the system becomes a 5-way majority vote.

Alternatively, instead of FSK, frequency exchange (FEX) could be employed with (say) channel 1 being 2340 & 540 Hz; channel 2, 1620 & 900 Hz; and, channel 3, 2700 & 1980 Hz. In this case, the data (erect and inverted) would be carried on 6 channels, or 10 channels when using dual space diversity (DSD). Slide-back detection would then meld erect and inverted channels to produce 3 channels (or 5 channels when using DSD) prior to majority voting.

As you will know, time diversity (TD) was "invented" by operators, and is variously known as "words twice," and "tapes twice," etc! Electronic TD was first incorporated into the "Barry Modem" by George Barry and Robert Fenwick (both PhDs). Their original company has since been taken over and no longer trades independently on the stock exchange. TD is also manufactured by a European company. In comparison with the "Barry Modem" which does majority voting on a bit-by-bit basis, this European version of TD combines any two "channels in agreement" and ignores the third.

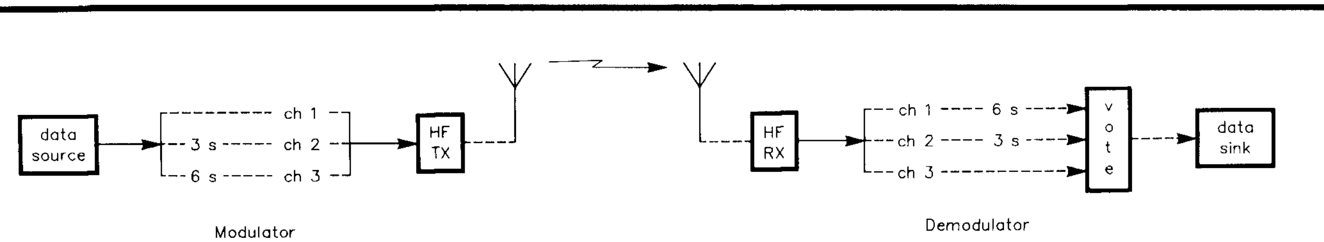

Fig 1

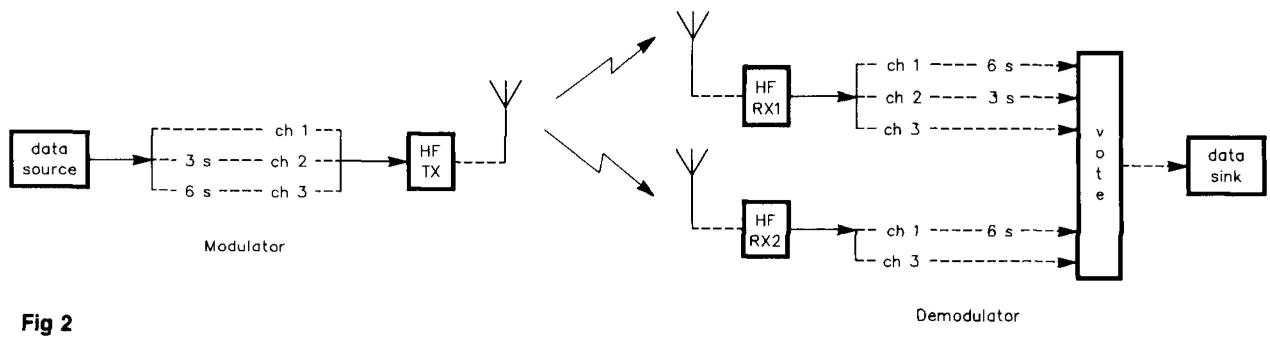

Fig 2

A Piccolo style multitone modem (MTM) could be considered as an alternative. Piccolo (manufactured in the UK), uses six tones in sequential pairs to cover Baudot, and 12 tones in sequential pairs to cover ASCII. There is a way for the Baudot version to carry ASCII.

The TD modem is more versatile than Piccolo, it being transparent to code and speed. The TD modem could even be used to provide error control (via its 3-way majority vote) for hand produced Morse as well as electronically produced Morse.

Mr Editor, your eventual system could become global. *—George W. Cook, VE3FJV, 183 Temelec Circle, Sonoma, CA 95476-8026.*

US versus Foreign Component Equivalents

Thank you for reprinting the series on the "G3TSO Modular HF Transceiver" in the August and September issues of *QEX*.

It made for interesting reading and gave me some suggestions on which way to turn in the design of a similar rig I have been contemplating for several months.

There is a problem with reprinting pieces from foreign publications which is not addressed, however, and I think you should consider dealing with it before you run any more pieces from the foreign Amateur Radio press. That problem is finding the specified components or their equivalents in this country.

I submit not many amateurs will have a cross reference, or even have access to one, to translate some of the called for devices in those articles into their US equivalent. For instance, the schematic on page 6 of August *QEX* calls for eleven BA244 diodes in addition to the readily available 1N914 diode. What's the US equivalent to the BA244? Or what about the BF241 transistor on the same schematic? Three transformers require Fairite 28-430002420 toroids, yet no hint is given to the corresponding US toroid. The list could continue, but you get my point.

ARRL has for years encouraged home brewing and construction of rigs such as the one described in this two-part article, and the presentation in *QEX* should further that end. To run into a components list calling for items not readily identifiable or obtainable throws cold water on whatever enthusiasm you might have generated at the outset and runs counter to your efforts.

In the future, if you are going to reprint quality pieces like these—and I urge you to do so—run a little box that lists the US equivalents for the components. You might go so far as to suggest some parts houses where they can be found, thus boosting sales for some of your advertisers. *—Fred Bonavita, W5QJM, PO Box 2764, San Antonio, TX 78299-2764*

[Editor's note: Is there a volunteer who would like to take on the job of coming up with US substitutes for foreign parts in future construction articles? If so, we'd like to hear from you.]

Bits

Radar Handbook

Radar Handbook, second edition, by Merrill I. Skolnick, 1,200 pages, 700 illustrations, $87.50. Includes the newest developments in radar capability and applications. Twenty-five chapters covering transmitters, electronic counter-countermeasures, radar guidance of missiles, pulse compression, data processing, MTI and airborne MTI radar, meteorological radar, HMF over-the-horizon radar, bistatic radar, and more. The *Radio Handbook*, order number 057913-X, is available from McGraw-Hill Publishing Company, tel 800-2-MCGRAW.

VHF + Technology

By Geoff Krauss, WA2GFP
16 Riviera Drive
Latham, NY 12110

A note of thanks to Larry Carracciolo, N3CCW, for recently providing a copy of a manual for the Alfred 5030 TWT amplifier. This unit is apparently the successor to the earlier 501-504 series of Alfred TWTAs; the manual may, or may not, provide some guidance to those who have the earlier 500 series units and have been seeking manuals, in vain, for a long time. I've made some copies and would be glad to send one out if you need one; send a self-addressed, 9- × 11-inch, stamped (with at least $1 in US postage) envelope to me at the above address. For those of you who do not need a complete copy but want to know some of the basic specs just in case a unit ever pops up at a flea market: power output, 10 watts; gain, 30 dB; frequency ranges, 5010—1 to 2 GHz, 5020—2 to 4 GHz, 5030—4 to 8 GHz, and 5040—8 to 12.4 GHz. I have a note from Deane Kidd, W7TYR, who has an old Alfred catalog page that lists the 501-505 series as 10-*milliwatt*, 20-dB gain units with frequency ranges of: 505—1 to 2 GHz, 501—2 to 4 GHz, 503—4 to 8 GHz, and 504—8 to 12.4 GHz. (Deane is seeking data for an RCA A1369 TWT and, amongst other items, manuals for Alfred 5-6868 and 5-6996B TWTAs, 6151 Osc and plug-ins Q01-Q03, M1 and Q21-Q23. Deane also has lots of other manuals, especially Tektronix, but requests that manual seekers first send an SASE to find out if he has the manual you need; his address is 27270 SW Ladd Hill Road, Sherwood, OR 97140.)

On another topic, I've completed my reading of the ARRL-published *Proceedings of the 1989 Central States VHF Society* and the *1989 Microwave Update Conference*. As usual, there is simply more good information here than can be individually commented upon. I wish that there were even more VHF/UHF conferences that published Proceedings, especially if they could all be of this depth and quality. If you have not yet obtained your copy, you really ought to. (No, I don't get a fee for plugging the books published by the League; I just happen to think that the committees that put together the talks at Central States and Microwave Update have consistently gotten fantastic information out to the VHF+ community.)

STATE-OF-THE-ART: 3300-3500 MHz (9 cm) band

While this band (the first of our true SHF, ie, above 3 GHz, bands) occupies a much-larger frequency range, the only present North American activity I am aware of is the weak-signal work centering around the calling frequency at 3456.1 MHz. Even historically, the only other publicized usage was some wideband FM with Polaplexer-mounted Klystrons, à la designs of the Santa Barbara Microwave Society, although this technology has been superseded long ago. As a matter of fact, my backfiles do not show any other form of activity in published European articles, either.

One frequently used method for generating a 9-cm CW signal is to multiply the so-called "magic frequency" of 1152 MHz in a frequency tripler. Passive triplers use snap-recovery diodes (SRDs), a special form of variable-capacitance (varactor) diode, to generate a narrow pulse of energy which contains many different harmonics, and

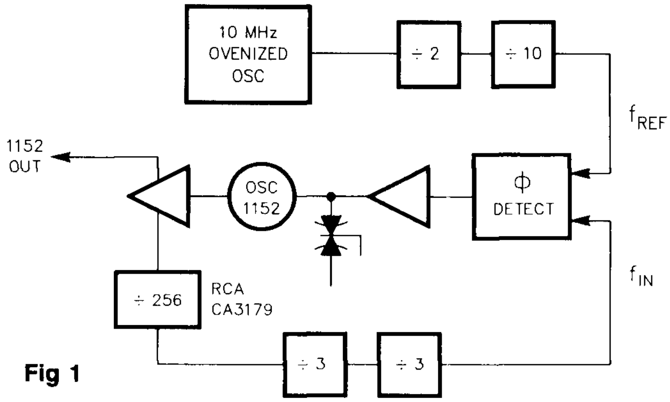

Fig 1

uses a subsequent bandpass filter to allow only the desired (third) harmonic to pass. Passive triplers are most often found as part of frequency source "bricks"—block-like subassemblies which use a phase-locked loop (PPL) to lock a power oscillator to a high multiple of a lower frequency, but more-highly-stable reference source (see Fig 1 for possible look). Active triplers use a microwave transistor; typically, the device acts as an amplifier at the input frequency (say, 1152 MHz) and the amplified signal is applied across the base-collector diode of the transistor, which acts as a nice varactor diode. In either case, good efficiency in passive varactor triplers or active multipliers generally requires that idler circuits be present at the unused second harmonic to recycle energy at the second harmonic and mix it with the input frequency to create the desired third harmonic. Idlers are generally not needed in SRD triplers, which may seem to make them a bit easier to build. Actually, the art of designing a good multiplier for use above 1 GHz is very specialized and is not easily acquired by most of us mere mortals; thus, as you come across a design that you want to use, follow the directions as closely as possible (and even then be prepared for difficulties). This may be one reason why the multipliers in the most-used example of the other class of transmitter (the heterodyne, or frequency up-converter) use ordinary HP-2800 series Schottky diodes and lots of following amplification. In any event, a typical multiplication "tree" for generating 3456 signals is shown in Fig 2. Each multiplication stage (eg, the tripler from 96 to 288 MHz) would have its multiplier device to generate harmonics, and a subsequent band-pass filter to remove the unwanted harmonics. This can get pretty complicated, even if miniaturization techniques are used to keep the size to something manageable, and many amateurs are forsaking use of transmitter multiplier chains (especially since a separate chain, at a different frequency, is normally required in the local oscillator of the receiver. However, the chain form is shown here as the "bricks" can often be easily obtained, are complete and need only have a new crystal

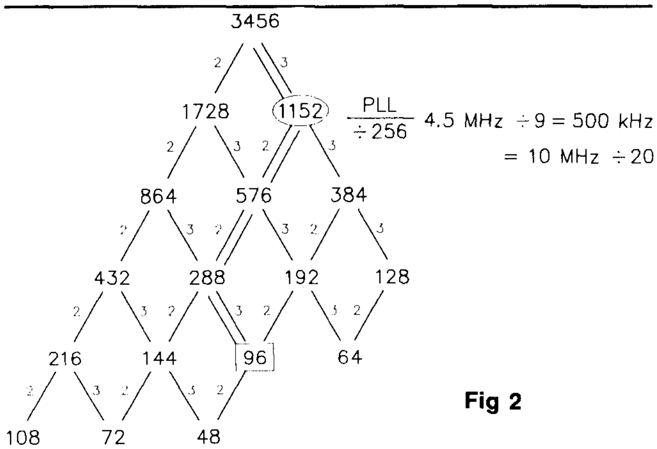

Fig 2

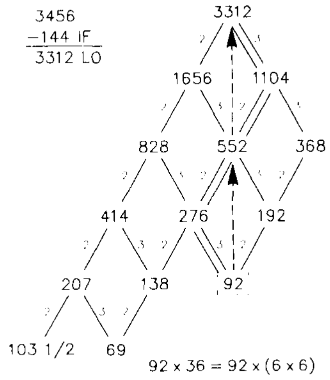

Fig 3

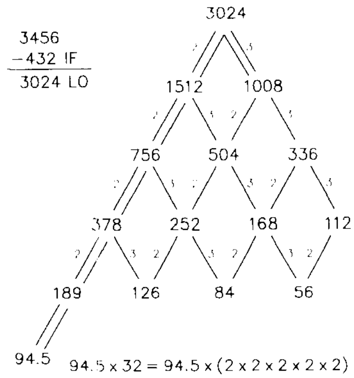

Fig 4

and a power supply added before some relatively simple tune-up gets a carrier signal on the air. No amateur specific multiplier chains are commercially manufactured/available.

The typical 9-cm receiver is a frequency down-converter, using a heterodyne mixer and a local oscillator chain. The IF frequency is often selected to be the 144-148-MHz amateur band. ideally, for good rejection of unwanted signals at the image frequency, the IF should be one-tenth of the RF frequency, so that a 345.6-MHz IF would be indicated. However, use of one of our existing VHF bands as the IF allows a second conversion to be accomplished using reception equipment which may be otherwise already available. Of course, if you have a suitable two-meter receiver, the 3456 mixer output need not be further converted. The "tree" for an LO for a 144-MHz IF receiver is shown in Fig 3. Often, other IFs are considered: a less-common choice is the 432-MHz band as an IF; an LO tree for the required 3024-MHz signal is shown in Fig 4. The common starting frequency (as high as possible, commensurate with the usual range of fifth- or seventh-harmonic crystals, ie, 80-120 MHz) are boxed in, and the typical multiplication paths are doubled lines.

A good receiver needs a low noise figure, and very low NFs can be obtained on the 9-cm band, using GaAsFETs. One of the easiest ways is to use a surplus satellite TV (3.7-4.2 GHz) preamplifier; most have noise temperatures in the 80-60 dB range, even at the ham band frequencies below the CATV band edge. With gains that high, following noise figures of up to 20 dB can be tolerated (indeed, I know several users who follow a $15 surplus CATV LNA with other low-cost, surplus CATV reception mixers, which often uses fairly sophisticated image-rejecting mixers and the like). If that much gain is not needed, an even lower noise figure LNA may be found in the set described by Al Ward, WB5LUA, in May 1989 *QST*.

If one is going to use a heterodyne down-converting mixer for reception, it is possible to use an up-converting mixer for signal transmission. This form of transmitter accepts any common form of modulation of the input IF signal and is truly amateur state-of-the-art. In fact, the one commercially available 3456-MHz unit is a true transceiver, with a transmitter up-converter, reception down-converter and common local oscillator chain. It is available from Down East Microwave (who just happen to advertise elsewhere in this issue). The unit offered, in several forms (kit, built, bare board for your own components, etc) is the well known design by Jim Davey, WA3NLC. The small size (and, in fact, its entire existence) is due to the availability of microwave monolithic integrated circuits (MMICs) or the Avantek/MCL series. It is only in the last several years that such MMIC units, and the necessary companion no-tune bandpass filters from Rick Campbell, KK7B, have been available. An article on the 3456-MHz unit was published in June 1989 *QST*, and is *must* reading for all would-be builders of this unit; unfortunately, it is needed to augment the documentation provided with the kit (yes, a local VHF+er provided one for my construction and I am now in the midst of building it!) While the output is in the 10-mW (+10 dBm) range, this is sufficient to work out to 70+ miles, with reasonably simple antennas. The output level of this transceiver, or any other transmitter in the milliwatt range, can be boosted into the 0.1-2 watt range by use of at least one stage of solid-state amplification; at this frequency, power GaAsFETs are the only feasible devices. I know that a device like a Mitsubishi MGF-1800 gives 100-mW output with 10-dB gain with a device cost of about $45; devices from Avantek, M/A-COM and others have been seen but not tried. For output power above a few watts, tubes are needed; while there are a few usable types, TWTs are still the most desirable, especially since a TWTA will cover an octave band (typically, 2-4 GHz) and thus serve both 2304 and 3456 in one unit.

Lastly, only two types of antennas have been typically used on 9 cm: the parabolic dish, and the loop Yagi. The first can be as physically large as one can handle, and provides increasing gain with increasing size, however, feed efficiency and wind-load size limits tend to set actual gain to something under about 40 dB. The loop Yagi does not have anywhere near as much gain, being in the 20-dB range, but typically is much smaller, lighter, less expensive and can be easily transported (a definite plus for grid-square expedition and other uses away from a fixed QTH). Better yet, there is a commercial source (Down East Microwave) of 3456 loop Yagis, and of ancillary equipment needed to set up Yagi arrays.

Again we see that it is possible to obtain state-of-the-art ham equipment for a new VHF+ band, if one really wants to get on the air up at SHF. Next column: the one ham band which growing numbers of VHF+ers can use, but for which *NO* ham equipment is commercially available!

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

NEW TNC 2 FIRMWARE AVAILABLE

Tucson Amateur Packet Radio (TAPR) released TNC 2 firmware version 1.1.7. This new firmware release offers significant changes and enhancements including:

- Prioritized acknowledgment (PriACK) protocol
- Improved channel access methods (similar to "persistence")
- Improved compatibility when running AX.25 V1 (T3 may be disabled)
- Filtering to inhibit monitoring of NET/ROM, ROSE, TCP/IP and other networking packets
- Improved transmit timers (time- and/or character-based) and quick-release of PTT at the end of a frame
- Pre-frame synchronization of zeroes instead of flags for reduced TXDELAY (to permit other stations to lock onto your transmissions faster)
- No dead-time between frames during multi-frame transmissions
- Improved KISS operation in the full-duplex mode (for Microsat and other applications)
- Improved RR/RNR buffer to provide "full-handling" for less channel congestion
- Improved modem demodulator calibration facilities
- Additional error (Health) counters
- Documentation of the format and location of the default parameters in EPROM for those who prefer a custom EPROM instead of trusting battery-backed RAM for remote site locations

The new release of firmware is available as a programmed EPROM with documentation for $12 from TAPR at PO Box 12925, Tucson, AZ 85732, telephone 602-749-9479. The firmware is also available as a binary file that may be downloaded from CompuServe's HamNet.

from Lyle Johnson, WA7GXD
via CompuServe's HamNet

PACKET-RADIO SATELLITES STATUS REPORT

DO-17 Popular On 2-Meters;
AO-16 and LO-19 Cross-Band Digipeating

Week seven at the AMSAT satellite factory finds each satellite closer to full commission for general use. DO-17 continues to excite newcomers to the world of amateur satellites with its ease of telemetry reception. Anyone with a 2-meter FM receiver tuned to 146.825 MHz, a ¼-wave ground-plane antenna, and a standard TNC can receive telemetry packets from DO-17. By listening from 0800 through 1300 and 1900 through 2400 local time, several DO-17 passes may be monitored.

DO-17 transmits packets for approximately 2.5 minutes followed by an "off period" of approximately 30 seconds. As is true with each of the Microsats, the telemetry offers 59 telemetry points and the AMSAT Software Exchange has programs available that translate the data points into more easily recognizable information, ie, battery voltage, solar cell current, etc.

AO-16 and LO-19 have been available for digipeating packets. Numerous stations have successfully connected to "DX," as far as VHF-packet-radio operations are concerned, via these two birds. The store-and-forward capabilities of AO-16 and LO-19 have yet to be enabled, pending further testing.

The modulation protocol on these two birds requires using an external 1200-baud PSK modem instead of the FSK modem that is standard in commercial TNCs. To access AO-16 or LO-19 requires approximately 100-watts EIRP FM. Your downlink receiver must be set to USB or LSB. To digipeat through AO-16, you must use the address "PACSAT-1"; to digipeat through LO-19, use the address "LUSAT-1." The downlink and uplink frequencies of AO-16 and LO-19 are as follows:

AO-16:	
downlink	437.025, 437.050 MHz
uplink	145.900, 145.920, 145.940,145.960 MHz
LO-19:	
downlink	437.150, 437.125 MHz
uplink	145.840, 145.860, 145.880, 145.900 MHz

First TCP/IP Microsat QSO?

Bob McGwier, N4HY, and Jon Pearce, WB2MNF, lay tentative claim to the first Microsat TCP/IP QSO. They were on the 0307 pass of LUSAT on March 3. Since they were both calling each other, they had two Telnet and one FTP sessions. To use the satellite as a digipeater, the NET ARP entry is ARP ADD (your call sign) AX25 (your call sign) LUSAT-1 (for LUSAT, of course). You also need a ROUTE for (your call sign) to your KISS port.

WO-18 Shoots The World

Chris Williams, WA3PSD, reports that the Ground Command Station at Weber State University (WSU) is receiving pictures from space daily. This past week, the best picture taken was of the coastline of British Columbia near Vancouver Island. Since Weberware 1.0 can recover the color in pictures from the imaging data stored in memory, the oceans show up with the proper hues as seen by the camera. Initially, it was difficult for the WSU students to pin-point the area snapped by the camera, but checking the satellite tracking software and the time the lens shutter was opened, they figured out that it was the BC coastline. The camera on WO-18 can only take a 170-square mile picture when looking straight down, so, at times, one has to be very good at geography to figure out what the pictures represent.

The integration of horizon sensor readings into the picture taking software on-board WO-18 will indicate when the satellite is pointing at the earth. The software is being changed so that pictures will only be taken at those times. This will mean an end to pictures of deep space or the sun.

WO-18 may be heard on 437.100 MHz (± 10 kHz for Doppler shift). The alternate frequency is 437.075 MHz.

WA3PSD also announced that the beta test version of the picture processing software, Weberware 1.0, will be sent to a group of carefully chosen software testers, who will perform intensive checks of the software. If no major bugs are discovered, radio amateurs can expect Weberware 1.0 to be available from the AMSAT Software Exchange approximately the first week of April. WA3PSD wants to emphasize that the priority at WSU is taking care of WO-18. Second priority is getting the image processing software finished. The students at WSU are working as quickly as possible to get this very complicated program into a user friendly state. Weberware 1.0 will run on IBM® AT clones equipped with EGA or VGA monitors.

Because of the instant popularity of WSU's efforts in building the Webersat, many grade school and high school students from the greater Ogden and Salt Lake City areas are showing up at the Ground Command Station to experience the care and feeding of an OSCAR satellite. The WSU students have enthusiastically embraced the job of explaining to all the finer details of WO-18 and its many on-board scientific experiments. Hopefully, many of these young people will not only become interested in Amateur Radio, but also start thinking about space.

The Webersat team encourages all radio amateurs to continue to save picture data and telemetry from WO-18. To receive a beautiful QSL card from WSU, send your QSL card, a copy of WO-18 telemetry and an SASE to Chris Williams, WA3PSD, Eng Tech Bldg, #236, Weber State University, Ogden, UT 84408-1805.

FO-20 In Full Mode

FO-20 is now operating in "full mode," ie, both transponders (JA and JD) are functioning. If necessary, the transponders will be shut down on Wednesdays. If the JD transponder is shut down, all posted messages will be discarded without warning.

UO-15 Problem Undergoing Diagnosis

Volunteers at the Stanford Research Institute (SRI) have been working with the University of Surrey (UoS) to find what is preventing UO-15 from downlinking telemetry. Martin Sweeting of the UoS reported that SRI is making a 150-foot dish antenna and its sophisticated signal processing equipment available to figure out if any of the subsystems on UO-15 are still operational. SRI has aided UoS in the past by using the same dish to uplink a signal of "sufficient strength" to overcome the desensing of UO-9's command receiver by its 2-meter transmitter.

SRI is trying to receive the local oscillators' signals on board UO-15. The calculated received signal strength of UO-15's LOs is approximately −160 dBm. A trial run receiving LO signals from the healthy UO-14 was successful, although it required signal analyzers using FFT techniques to provide a 1-Hz resolution bandwidth over a 5-kHz bandwidth to discern the signals. SRI now will try to locate UO-15's LO signals and, from the results of those efforts, the UoS's engineering team will determine if it is possible to "pull the cork" on UO-15's transmitter.

from AMSAT News Service, CompuServe's HamNet, and Jon Pearce, WB2MNF

TAPR ANNUAL MEETING REPORT

The annual meeting of Tucson Amateur Packet Radio (TAPR) occurred on February 24-25 in Tucson. The board of directors met on February 23 and announced the results of the election for the board with the following members being elected to three-year terms: Tom Clark, W3IWI; Pete Eaton, WB9FLW; Don Lemley, N4PCR; Harold Price, NK6K; and Dave Toth, VE3GYQ. The board also selected the following as TAPR's officers for one year terms: Lyle Johnson, WA7GXD, president; Harold Price, NK6K, executive vice president; Bob Nielsen, W6SWE, vice president/member services; and Greg Jones, WD5IVD, secretary/treasurer.

Saturday morning, there were talks on Microsat by Doug Loughmiller, KO5I; TAPR version 1.1.7 TNC 2 software by Lyle Johnson, WA7GXD; TCP/IP by Phil Karn, KA9Q; HF packet-radio diversity by Steve Hall, WM6P; high-speed networking by Bdale Garbee, N3EUA; and the OMNITRACS communications vehicle by Franklin Antonio, N6NKF. The afternoon session had talks on TexNet by Harry Ridenour, NØCCW, who mentioned that TexNet is now available as firmware for the TNC 2. Other topics included Great Lakes (GL) Net by Jay Nugent, WB8TKL; a 56k-bit/s repeater by Doug Yuill, VE3ØCU; ARRL happenings by ARRL Southwest Division Director Fried Heyn, WA6WZO, and ARRL Headquarters' Jon Bloom, KE3Z.

Amateur Radio manufacturers in attendance also made presentations. DRSI presented their K3MC "Awesome I/O Card," a 56001-based DSP PC packet-radio card, which will operate at 24 MHz. It includes a 16-bit A/D converter on-board and will cost approximately $400. PacComm talked about their PSK-1 modem, which is a fully-assembled modem for satellite work, and the G3RUH modem. Kantronics presented their Data Engine (DE), the DVR 2-2 VHF transceiver, and the 2/70 power amplifier for the DVR 2-2. WA7GXD reported on the progress of the TAPR packetRADIO.

Outgoing TAPR president Andy Freeborn, NØCCZ, closed the meeting with the financial report for 1989. Afterward, Pete Eaton, WB9FLW, presented Andy with a plaque from TAPR expressing the organization's appreciation for all Andy's work over the years and especially for his service as president.

from Andy Freeborn, NØCCZ, via CompuServe's HamNet, and Steve Goode, K9NG, via *The CAPRA Beacon*

PRODUCT PREVIEW: KANTRONICS 56K-BAUD DATA ENGINE

The "de 56" data engine from Kantronics is a dual port data-over-radio platform, providing high-speed full- or half-duplex operation. Its open architecture allows developers to provide custom firmware designed for specific applications. The firmware is provided in a 64-kbyte EPROM, but provisions exist to allow up to 512 kbytes of EPROM space and up to 512 kbytes of static RAM.

The platform, as shipped, will include packet-radio firmware and a VHF modem installed inside the unit. At the heart of the system is the PC-compatible 10-MHz V-40 processor and an 85C30, which provides the HDLC function. This hardware will support up to 56 kbaud operation through both radio ports and up to 19.2 kbauds through the computer/terminal serial port.

Headers inside the unit permit modem developers to install special modems internally. If required, a jumper board may be installed to provide an external modem disconnect through rear panel connectors. RAM contents are battery-backed to provide a clean restart if a power interruption occurs.

The front panel of the de 56 has two windows allowing modem developers to provide LED displays for tuning or other purposes. Eight firmware-controlled front panel LEDs give developers complete flexibility in function.

Other features include 20-bit address space; a processor watchdog timer; and Host, KISS, PBBS, and gateway modes. Options include a battery-backed clock, an additional 1200-baud modem, a modem development board, a developer's manual, and additional modems that are under development.

The size of the de 56 is 1¾ × 6 × 9 inches and 2½ lbs. It requires 12 V dc at less than 150 mA. Kantronics expects to be shipping the de 56 in mid to late Spring of this year.

from Phil Anderson, WØXI

SAREX-2 TESTED

In late February, the Shuttle Amateur Radio Experiment #2 (SAREX-2) packet-radio station underwent extensive testing at the Marshall Space Flight Center in Huntsville, Alabama, according to AMSAT Area Coordinator Ed Stluka, W4QAU. This testing was in conjunction with the training of STS-35 Payload Specialist Ron Parise, WA4SIR, in the use of the ASTRO-1 experiment, which will be primary payload on that shuttle mission. The primary payload, ASTRO-1, will be used to conduct astronomical experiments. During several days of testing, radio amateurs in the Huntsville area were able to connect to WA4SIR and to receive a QSO number.

This special packet-radio station will fly on STS-35 on May 9, 1990, and will give each radio amateur who connects to WA4SIR a QSO number confirming the contact. When the connecting station sends in a QSL card and the contact number, the station will receive a beautiful QSL card commemorating this "Ham In Space" shuttle flight.

The SAREX-2 packet-radio station has a Motorola 2-meter FM handheld transceiver with 5 watts output, a Heathkit HK-21 TNC 2, and a Grid laptop computer with a 40-Mbyte hard disk drive to store the calls of the stations connecting to WA4SIR during the nine-day mission. The specially written software, which will be running the SAREX-2 packet-radio station, allows completely unattended operation and logging of the calls of the connecting stations. It will also prevent duplicate QSO numbers from being sent.

Although no digipeating will be allowed through SAREX-2, connecting to this packet-radio station will be like any terrestrial packet-radio contact. Just use your TNC with your 2-meter transceiver, and everything else is the same. After you have connected and received your QSO number from WA4SIR, on subsequent orbits you can monitor the SAREX-2 message beacons that will be sent periodically. The message beacons will contain information about the flight of STS-35 and other interesting items.

from AMSAT News Service

PACKET-RADIO DISTRIBUTED BBS OPERATIONAL

The February issue of the Association of Computing Machinery's *Communications* features a long article from a group at MIT who have implemented a "distributed" BBS as a "Community Information System" (the Boston Community Information System or BCIS) using packet radio and personal computers.

The way the system works is simple. Data from The Associated Press, the *New York Times* and even feeds from USENET are "broadcast" via an SCA subchannel on a local FM broadcast station at 4800 bauds using FSK. Local packet-radio adapters (TNCs) receive the data using a protocol that is much simpler than AX.25 or TCP/IP. They pass the data on to the user's personal computer, which sees if it is of interest to the user by checking it against a "filter" list generated by the user. If it qualifies, it stores the data on the personal computer's disk and the user can retrieve it using database-style query techniques. This process is called the "simplex" portion of the system, which overall is called a "polychannel" system.

Should a user query for something not in the local disk database, an autodial modem accesses a "local" database server to ask for the requested information (this is the "duplex" portion). Because the local users have no authorization to initiate transmissions on a commercial broadcast channel, dial-up modems are used.

The idea sounds a lot like the distributed ham PBBS in use in Japan. Which leads us to the $64 question: Why can't our local ham PBBSs work in a similar fashion with our current PBBSs becoming "servers" (and even gateways to USENET or the Internet)? These would be accessible directly by packet radio instead of dial-up modems and our local TNC/computer combinations would become the recipients of data of interest to us.

from Bill Meahan, WA8TZG

AMIGA, ATARI AND UNIX VERSIONS OF KA9Q'S TCP/IP SOFTWARE AVAILABLE

Version 900214 of the KA9Q TCP/IP software package for the Commodore Amiga computer may be obtained by downloading it from Data Library 9 (DL9) of CompuServe's HamNet. Its file name is AMIGAN.ZOO.

The latest PE1CHL release of the KA9Q TCP/IP software package for the Atari ST computer may be obtained from Mike Curtis, WD6EHR, 7921 Wilkinson Ave, North Hollywood, CA 91605-2210 by sending two blank double-sided or three blank single-sided disks, a postage-paid, self-addressed disk mailer and a note stating your needs.

The UNIX version of the KA9Q TCP/IP software package is available via anonymous FTP from host vax.cs.pitt.edu in the file pub/ka9q/net-unix.cpio.Z.

from Julian Macassey, N6ARE, and Bob Hoffman, N3CVL

W1HUE AND POLI CHANGE ADDRESSES

Larry East, W1HUE, the US distributor of "APR," the public domain packet-radio terminal program for the Apple® II family of computers, has the following new address: PO Box 51445, Idaho Falls, ID 83405-1445. (APR may be obtained by sending Larry a blank 5¼ or 3½ inch disk and a postage-paid, self-addressed disk mailer.)

Packeteers Of Long Island (POLI) have the following new address: PO Box 11, Jericho, NY 11753.

from Larry East, W1HUE, and Alex Mendelsohn, AI2Q

PBBS RESTRUCTURING

(The following is in response to Barry McLarnon's article entitled "Restructuring of the Packet Bulletin Board System Proposed" that appeared in the January 19 issue of Gateway.)

Barry McLarnon's article was right on the money. It points to something I have been after for several years, ie, adoption of the RFCQ822/1022/X.400 standard internal headers for packet-radio messages.

In the past, the From: and the PRMBS's reply To: fields have shown their usefulness. If we try to assemble our bulletin distribution system into a USENET-like system, we need to add the field Newsgroups: to the internal headers. Also, if we can add a Keywords: field, if desired. The point is that we will not need massive software recoding each time we want to add a feature. We only have to add a field.

The PRMBS code already has "mail" and "message sweeper" functions that performs some of the "readnews" function of USENET. I only have to add code to allow it to select and reject articles by newsgroups.

For now, I suggest that we extend the To field. We can put in an internal header with a well defined (20 or more bytes long) field name for the newsgroup, eg, "space.amsat.microsat" or "space.amsat.dove," and use the convention of a major group name with a maximum of six characters, eg, AMSAT. A message that is forwarded to a system as follows:

SB SPACE @ ALLUSA < N4HY $AMSQ700

would be rejected if a system does not want "SPACE" stuff (it would be nice to have the ability to reject subparts of that thread, but that cannot be done without the code getting cumbersome). The sending system does not have to know what newsgroups each system will accept or reject. Instead, the receiving SYSOP configures the system to accept/reject any group. It can be done better, but this is what is possible in the immediate future. (I could add and activate this feature into PRMBS in less than a week and it would have no impact on the network in terms of incompatibility.)

One problem is that in many areas there is insufficient decentralization and linear progressions for mail passing. If some SYSOPs decide not to accept a certain newsgroup, it would stop the distribution of the group. To avoid this, I would add code to PRMBS to allow generation of the redistributed messages, but hide the original from view on the rejecting system until those messages were fully distributed.

This turns us to the problem of network topology. We have to do more "hubbing," ie, getting more, lower powered stations clustered around one or two more powerful stations that talk to similar stations and distribute the mail on backbone channels and onto secondary backbone channels to clusters, who allow users to log on via a third channel.

from Brian Riley, KA2BQE

GATEWAY CONTRIBUTIONS

Submissions for publication in *Gateway* are welcome. You may submit material via the US mail or 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*.