QEX 12 January 1983

The ARRL Experimenters' Exchange

Second ARRL Packet Conference Call for Papers

The ARRL is sponsoring a second Amateur Radio Computer Networking Conference on March 19, 1983 in San Francisco, CA. The conference will be in cooperation with the 8th West Coast Computer Faire being held March 18-20.

The deadline for camera-ready papers is February 5, 1983. All papers should be mailed to Paul L. Rinaldo, W4RI, 1524 Springvale Avenue, McLean, VA 22101. If you plan to speak, please request an author's guide and advise Paul of the title of your paper immediately. Proceedings for this conference will be separate from those for the Faire which had a deadline of November 30, 1982.

Technical papers are invited on all aspects of amateur packet radio, advanced radioteletype (RTTY) including AMTOR, and related Amateur Radio digital communications via hf, vhf/uhf and satellite media. Topics may include network and system architecture, proposed standards, hardware, software, protocols, modulation and encoding schemes, and applications. This is an excellent opportunity to have your ideas influence the future of amateur digital communications.

This event will be hosted by the Amateur Radio Research and Development Corporation (AMRAD) and the Pacific Packet Radio Society (PPRS). Making up the conference committee are:

Hank Magnuski, KA6M	- Coordination (PPRS)
Stu Neblett, K6VCO	- RTTY & Packet Demos
Bob Reiling, W6JHJ	- Faire Liaison
Paul Rinaldo, W4RI	- Coordination (AMRAD) Technical Papers
Curtis Spangler, N6ECT	- West Coast Publicity

Teleconference Radio Net

You are invited to listen and talk to Vic Clark, W4KFC, president of the ARRL when he discusses "The Future of Amateur Radio" on Thursday, March 3, 1983, at 8:30 EST. On Thursday, June 2, 1983, Joe Reisert, W1JR will be the featured speaker.

The following repeaters are participating:

Avon	CT	W1NI/R	224.78
Beaverton	OR	W7LJN/R	147.32
Billerica	MA	WR1ABP	147.12
Cherry Hill	NJ	WB2NQV/R	147.375
Chicago	IL	W9SRO/R	147.15
Dallas	TX	K5JD/R	146.97
Long Island	NY	WB2NHO/R	147.375
Los Angeles	CA	W6VIO/R	224.04
Madison	WI	WR9AVT/	146.76
Minneapolis	MN	WØTN/R	146.64
Phoenix	AZ	WB7AAC/R	147.36
Rochester	NY	WB2AQQ/R	145.11
Roswell	GA	N4CLA/R	145.47
San Antonio	TX	WB5FZA/R	146.70
Washington	DC	WD4IWG/R	147.21
Wichita	KS	WRØABB	146.82

For more info, contact Rick Whiting, WØTN, 4749 Diane Dr, Minneapolis MN 55343, 612-870-2071 (w).

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Metal-Boom Quagi (Chladek): 3, Oct.
Monopole with Drooping Radials (Belrose): 10, Sep.

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Amateur Computer Experimenter's Net (Gervenack): 2, Jun.
AMICON Teleconference (AMSAT): 10, Jun.
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(continued on page 10)

Correspondence

Problem with Epson Users Newsletter

In the February 1982 issue of QEX, on page 5, is a description of a newsletter for Epson printer owners. On February 27, 1982 I ordered a subscription to this newsletter, enclosing a check for $12.00 for one year. The check was cashed but I have not received any newsletters. I was fairly inactive in the hobby during the spring and summer and did not write to the publisher until October 3, 1982. I explained the situation but have still not heard anything. - Christopher J. Gay, KU4A, 420 Sandalwood Drive, Lexington, KY 40505.

Ed. Note: Any product described in QEX is not advertising but is included for the information of the readers. The information about the product is believed to be correct, but readers are cautioned to check before sending money. It's a good idea to write/phone the vendor and ask for a description and price list prior to a commitment to buy. The philosophy used in mentioning products in QEX is that the experimenter would like to have information about new items without delay. This philosophy is in contrast to that used in QST which has been to be as thorough as possible in checking out such information, even at the expense of delaying it somewhat, because of QST's large readership (an error could be compounded thousands of times) and because QST is read by many beginners. If other readers have signed up for the Epson newsletter and received service, we'd like to know about it so we can pass along that word as well.

RTTY Spectrum Occupancy

It was refreshing to read the comment in the November issue (QEX 10) that math complexities should not be diluted in the magazine. Indeed, we may learn a lot from digging deeply enough. During my tenure as Engineering Manager of WUFT (TV) at the University of Florida one of the graduate engineering students we employed at the station asked me for a project. I asked him to analyze an ordinary frequency shifted RTTY signal from the standpoint of spectrum spread. He came up the next day with four sheets of integral calculus, Forier analysis. Though I couldn't read it sensibly I did find the bottom line(s) which said that plus or minus 1 KC (this was before hertz became the standard) from the center between the two signals we still had 10 watts power in the spectrum from a 1 kW signal. This two KC wide occupancy could easily accommodate ten ordinary cw signals with modern technology. Surely such a signal deserves its own band of frequencies as it's clearly not compatible with efficient use of the cw bands.

Please ask George to run a duplicate project and see if it verifies the results. - Rowland Medler, W4ANN, 1041 N.E. 20th Ave, Gainesville, FL 32601.

Wrong Year

I assume the deadline for the Radio Shack program described on page 10 (of QEX 10) is in 1983, not 1982. - Dave Sumner, K1ZZ, ARRL, 225 Main St, Newington, CT 06111.

Ed. Note: Sorry. The deadline is March 31, 1983.

Errata - Computer Simulation of a Half-Wave Filter

I found an error in my article in the second issue of QEX.

Enclosed is a corrected computer print-out. As shown in the program list (line No. 0062), "ALOG 10" should have been used, not "ALOG."

Every value of insertion loss in the original was incorrectly shown and it was 2.3 times greater than it should be. (This is because the natural logarithm is about 2.3 times the common log.)

However, the tendency of the variation of insertion loss according to the location of load on an SWR circle remains the same. - Bill K. Imamura, JA6GW, 2-2-37, Hikari-ga-oka, Fukuoka City, Japan 816.

```
--XL-------2XL-------XL--
      I          I
      XC         XC
      I          I
--------------------------
```

SWR = 2.0 Q = 1.0 XC = 1.00 XL = 1.00

N	LOAD		Z-IN (1ST STAGE)		Z-IN (2ND STAGE)		INSERTION LOSS
-180 DEG							
1	0.5	0	2	0	0.5	0	0
2	0.5	0	0.05	1.35	.2E-02	1.412	-26.4
3	0.5	0	.3E-02	2.626	0	2.646	-47.7
4	0.5	0	.2E-02	3.734	0	3.742	-61.4
5	0.5	0	.1E-02	4.792	0	4.796	-71.5
-150 DEG							
1	0.526	-0.197	1.665	0.624	0.526	-0.197	0
2	0.526	-0.197	0.067	1.335	.2E-02	1.412	-25.1
3	0.526	-0.197	.9E-02	2.624	0	2.646	-46.9
4	0.526	-0.197	.3E-02	3.733	0	3.742	-60.7
5	0.526	-0.197	.1E-02	4.791	0	4.796	-71
-120 DEG							
1	0.615	-0.4	1.143	0.742	0.615	-0.4	0
2	0.615	-0.4	0.097	1.327	.3E-02	1.412	-23.4
3	0.615	-0.4	0.012	2.621	0	2.646	-45.6
4	0.615	-0.4	.3E-02	3.732	0	3.742	-59.5
5	0.615	-0.4	.1E-02	4.791	0	4.796	-69.3
-90 DEG							
1	0.8	-0.6	0.8	0.6	0.8	-0.6	0
2	0.8	-0.6	0.138	1.345	.4E-02	1.412	-22
3	0.8	-0.6	0.018	2.62	0	2.646	-43.9
4	0.8	-0.6	.5E-02	3.731	0	3.742	-58
5	0.8	-0.6	.2E-02	4.791	0	4.796	-68.5
-60 DEG							
1	1.143	-0.742	0.615	0.4	1.143	-0.742	0
2	1.143	-0.742	0.152	1.399	.5E-02	1.414	-21.7
3	1.143	-0.742	0.025	2.624	0	2.646	-42.5
4	1.143	-0.742	.7E-02	3.732	0	3.742	-56.4
5	1.143	-0.742	.3E-02	4.791	0	4.796	-66.8
-30 DEG							
1	1.665	-0.624	0.526	0.197	1.665	-0.624	0
2	1.665	-0.624	0.118	1.438	.3E-02	1.415	-22.9
3	1.665	-0.624	0.027	2.634	0	2.646	-42.3
4	1.665	-0.624	.8E-02	3.734	0	3.742	-55.6
5	1.665	-0.624	.3E-02	4.792	0	4.796	-65.7
0 DEG							
1	2	0	0.5	0	2	0	0
2	2	0	0.08	1.44	.2E-02	1.415	-24.6
3	2	0	0.02	2.64	0	2.646	-43.5
4	2	0	.7E-02	3.737	0	3.742	-56.4
5	2	0	.3E-02	4.793	0	4.796	-66.2
30 DEG							
1	1.665	0.624	0.526	-0.197	1.665	0.624	0
2	1.665	0.624	0.057	1.427	.2E-02	1.415	-26
3	1.665	0.624	0.014	2.64	0	2.646	-45.2
4	1.665	0.624	.5E-02	3.738	0	3.742	-58
5	1.665	0.624	.2E-02	4.793	0	4.796	-67.7
60 DEG							
1	1.143	0.742	0.615	-0.4	1.143	0.742	0
2	1.143	0.742	0.045	1.411	.1E-02	1.414	-27
3	1.143	0.742	0.01	2.637	0	2.646	-46.6
4	1.143	0.742	.3E-02	3.737	0	3.742	-59.5
5	1.143	0.742	.1E-02	4.793	0	4.796	-69.3
90 DEG							
1	0.8	0.6	0.8	-0.6	0.8	0.6	0
2	0.8	0.6	0.04	1.396	.1E-02	1.414	-27.5
3	0.8	0.6	.8E-02	2.635	0	2.646	-47.6
4	0.8	0.6	.3E-02	3.736	0	3.742	-60.7
5	0.8	0.6	.1E-02	4.793	0	4.796	-70.6
120 DEG							
1	0.615	0.4	1.143	-0.742	0.615	0.4	0
2	0.615	0.4	0.039	1.381	.1E-02	1.413	-27.6
3	0.615	0.4	.7E-02	2.632	0	2.646	-48.1
4	0.615	0.4	.2E-02	3.735	0	3.742	-61.4
5	0.615	0.4	.1E-02	4.792	0	4.796	-71.4
150 DEG							
1	0.526	0.197	1.665	-0.624	0.526	0.197	0
2	0.526	0.197	0.042	1.366	.1E-02	1.413	-27.2
3	0.526	0.197	.7E-02	2.629	0	2.646	-48.1
4	0.526	0.197	.2E-02	3.734	0	3.742	-61.6
5	0.526	0.197	.1E-02	4.792	0	4.796	-71.7

```
OKITAC-4300     SDOS-43    FORTRAN  SOURCE  LIST      DATE  82/ 9/ 6      PAGE   0001

LINE-NO   ERROR CODE          STATEMENTS                                                    IDENT.

C  T NETWORK INPUT IMPEDANCE AND INSERTION LOSS
      INTEGER DEG, DEGREE
      COMPLEX XXC,XXL,ZZ1,ZZ2,ZZ3,UNIT,XXC2,ZZIN,ZZ4,ZZ5,ZZ6,ZZOUT
      DIMENSION QQ(4), R(12), X(12), DEG(12)
      DATA QQ/1.,2.,4.,10./
C
      READ(8,110) SWR
  110 FORMAT(F3.0)
      READ(8,120) (DEG(K),K=1,12)
  120 FORMAT(12(I4,1X))
      READ(8,130)  (R(K),K=1,12)
  130 FORMAT(6(F7.3,1X))
      READ(8,140) (X(K),K=1,12)
  140 FORMAT(6(F7.3,1X))
C
      WRITE(1,150) SWR, (R(MM),MM=1,12)
  150 FORMAT(1H ,10X,14HLOAD IMPEDANCE,10X,4HSWR=,F5.1//
     +11X,1HR,5X,12F9.3/11X,1HX,5X,12F9.3///)
C
      DO 10 I=1,4
      Q=QQ(I)
      XC=(1.+Q**2)/Q/2.
      XL=Q
      WRITE(1,700) SWR,Q
  700 FORMAT(1H ,15X,4HSWR=,F3.0,10X,2HQ=,F3.0/)
      WRITE(1,500) XC, XL, Q
  500 FORMAT(1H ,10X,3HXC=,F5.2,15X,3HXL=,F5.2,15X,2HQ=,F4.1/)
      WRITE(1,100)
  100 FORMAT(1H ,10X,1HN,15X,4HLOAD,26X,4HZ_IN,11H(1ST STAGE),12X,
     +4HZ_IN,11H(2ND STAGE),12X,14HINSERTION LOSS,/)
C
      DO 20 J=1,12
      DEGREE=DEG(J)
      WRITE(1,600) DEGREE
  600 FORMAT(1H0,15X,I4,4H DEG)
      RO=R(J)
      XO=X(J)
      ZZOUT=CMPLX(RO,XO)
      ZOUT=CABS(ZZOUT)
C
      DO 30 N=1,5
      XL=Q
      XL=XL*FLOAT(N)
      XXL=CMPLX(0.,XL)
      XC=(1.+Q**2)/Q/2.
      XC=XC/FLOAT(N)
      XXC=CMPLX(0.,-XC)
C
      ZZ1=ZZOUT+XXL
      ZZ2=(ZZ1*XXC)/(ZZ1+XXC)
      ZZ3=ZZ2+XXL
      ZZ4=ZZ3+XXL
      ZZ5=(ZZ4*XXC)/(ZZ4+XXC)
      ZZIN=ZZ5+XXL
```

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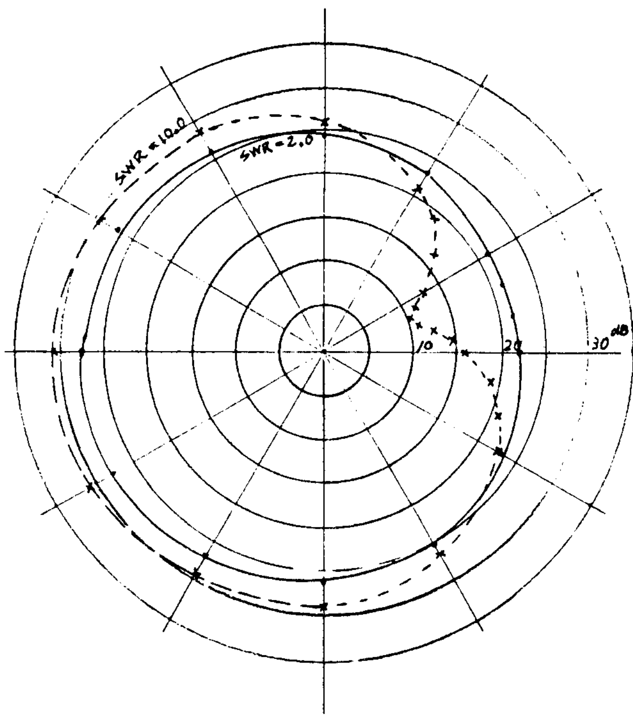
OKITAC-4300     SDOS-43    FORTRAN  SOURCE  LIST      DATE  82/ 9/ 6      PAGE   0002

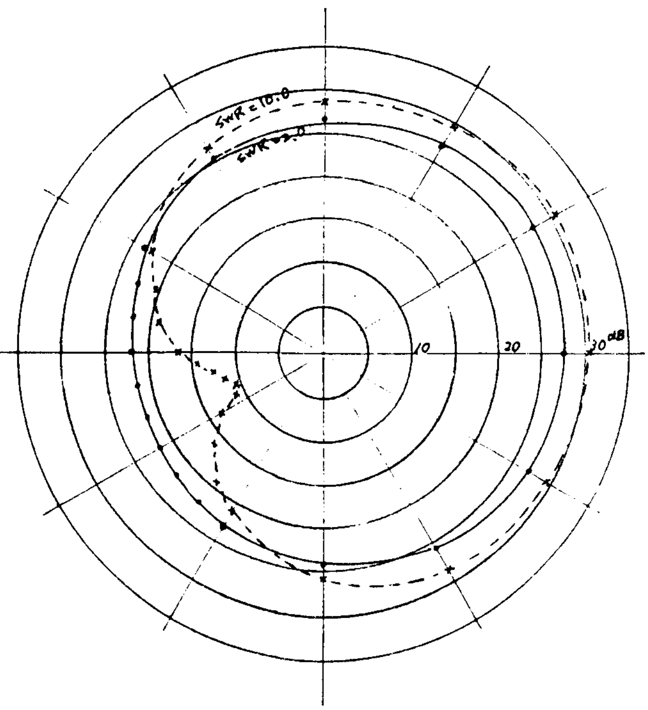
LINE-NO   ERROR CODE          STATEMENTS                                                    IDENT.

      ZIN=CABS(ZZIN)
      RIN=REAL(ZZIN)
      XIN=AIMAG(ZZIN)
C
      P1=RO/((1.+RO)**2+XO**2)
      P2=RIN/((1.+RIN)**2.+XIN**2)
C
      DB=10.*ALOG10(P2/P1)
C
      WRITE(1,200) N,ZZOUT, ZZ3,ZZIN, DB
  200 FORMAT(1H ,10X,I1,10X,3(2F10.3,10X),F10.3)
   30 CONTINUE
   20 CONTINUE
      WRITE(1,900)
  900 FORMAT(1H1)
   10 CONTINUE
      STOP
      END
```

PAI NETWORK SWR = 2.0 es 10.0



T NETWORK SWR = 2.0 es 10.0



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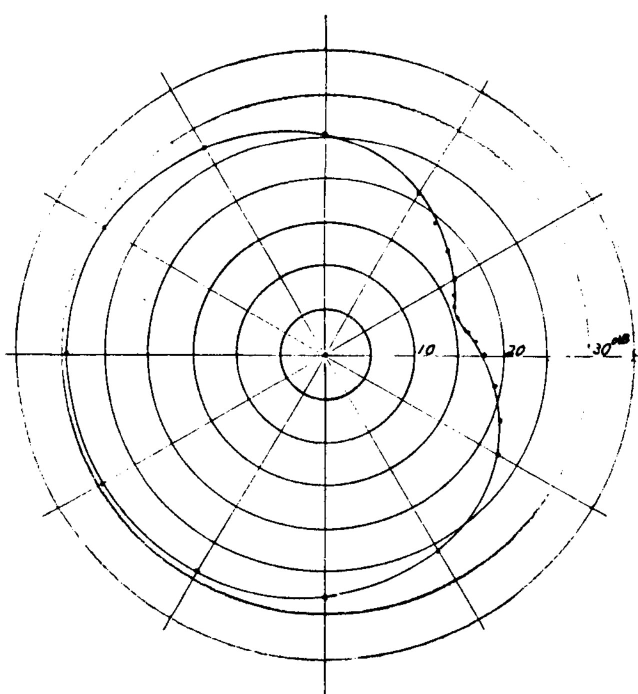
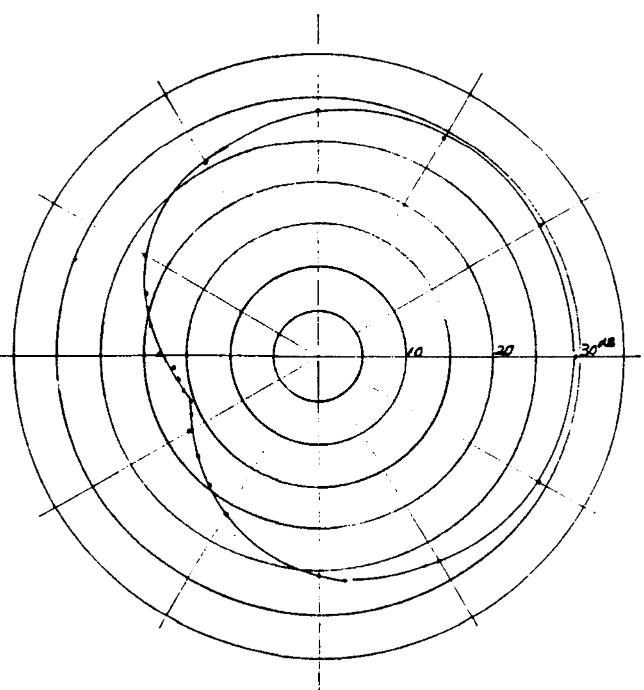


T NETWORK SWR = 5.0



Digital Voice Modulation

By G. W. Horn,* I4MK

Reading QEX I became acquainted with the fact that, at least in the States, there is a considerable interest, among hams, in digital communications. However, all the information reported in QEX refers to data (packet radio) only. It is worthy to note that speech too can be transmitted and received in digital form. In this way, intelligibility may be improved, even under adverse conditions, since pulses are far less susceptible to noise and interference during transmission. Besides, at the receiving end, speech is regained from pulses, even if weak and/or distorted, can be restored to their original form.

Speech can be encoded digitally by several techniques, such as A/D conversion, PCM (pulse-code modulation), LPC (linear-prediction code), FFT (fast Fourier transform), Vocoder process, delta modulation, and so on. Some of these processes have been exploited in voice encryption for secure communications. The choice between the various techniques is dictated by the available channel bandwidth as well as by the voice-reproduction quality which may be accepted. It is true that LPC and Vocoder techniques allow transmission of speech at low pulse repetition rates (2.7 kb/s for LPC and far less for Vocoder). Unfortunately, at the receiving end, speech has to be reconstructed by synthesis (as the "digitalk" ICs do). Therefore, there is no way of recognizing the speaker. As a matter of fact, all voices will sound identical and robot-like (which could be amusing to hear in a space movie, but certainly not in a rag-chewing QSO).

Therefore, discarding A/D conversion and PCM for obvious bandwidth and synchronization reasons, the only possible way a ham has to transmit speech in digital form, in my opinion, is delta modulation. Let us consider this process in detail.

Delta modulation takes advantage of the fact that speech signals do not vary abruptly. Also, generally, there is only a small change in level from one time instant to the next. It is therefore possible to get reasonably good reproduction of the voice waveform merely by transmitting the information on whether the output needs to "go up" or "go down" in a given time interval. The speech signal is therefore sampled at a convenient rate. Then the subsequent samples are compared with each other. If the sample level goes up, a positive pulse (1) is transmitted. If it goes down, a negative one (0) will be transmitted. See Fig. 1.

It is quite obvious that the reproduction quality strongly depends on the speech sampling rate. Sampling speed (i.e., pulse repetion rate) determines the bandwidth of the processed signal, that is the width of the occupied channel. By using a sampling rate of 32 kb/s, a very good voice quality may be obtained, but such a fast rate calls for an exceptionally wide channel occupancy. Lowering the sampling rate, quality deteriorates and, at the same time, quantization noise increases, making the S/N ratio worse.

If delta coding is carried out merely by comparing the subsequent sample level (linear delta modulation), the system will work satisfactorily on voice signals which are close to full-scale output to the modulator. Very low signals will be severely distorted, and S/N ratio greatly degraded.

ADM (adaptive delta modulation) and CVSD (continuously variable slope delta modulation) overcome this problem by compressing the signal at syllabic rate before coding and expanding it at the receiving end after decoding. Either compression or expansion are governed by a digital algorithm, which makes both processes very effective. See Fig. 2. Incidentally, a unit made of a delta modulator followed by a delta demodulator could be used profitably as a speech processor in conventional ssb equipment. Commercial telephone quality can be achieved, with CVSD, at sampling rates as low as 9 kb/s (Motorola with regard to their MC-3418 says 8 kb/s).

Since the delta-modulated signal consists of a stream of ones and zeros, delta modulation may be considered as an auto-synchronous 1-bit PCM. A further advantage of delta modulation series format is the ease with which, by additional circuitry, many information channels can be multiplexed (and even enciphered using a simple long shift register and a few gates, acting as a linear sequence generator). For time-sharing operation, the stream of ones and zeros first may be stored in RAM and then transmitted at the right time.

There are several commercially available ICs which perform delta modulation. Examples are: Motorola MC3417/3418, Harris HC55516 (sampling rate 16 kb/s) and HC55532 (sampling rate 32 kb/s, NRZ code), Consumer Microcircuits FX209 and its improved version FX309. The last IC is particularly interesting because of its extremely low current drain (0.2 mA at 10 Vcc), which makes it well suited to battery-powered applications. It also requires minimal external components for operation. Besides, it can modulate/demodulate down to zero frequency.

Fig. 3 shows a schematic diagram which we have successfully tried for delta modulation and demodulation (at 32 kb/s sampling rate). It is worthy to note that this diagram slightly differs from that reported in the manufacturer's data sheet.

As stated earlier, the big disadvantage of delta modulation is the wide bandwidth needed for transmitting its stream of bits. This drawback partially may be overcome by using particularly efficient systems of modulation such as quaternary phase and consequently unconventional emission modes. Motorola, for instance, in their MX-300 - H23/24 radios (intended for secure voice communications) uses 20F3Y emission (frequency bands 136-174 and 403-430 MHz, 30- and 25-kHz channel spacing respectively, audio 300-3000 Hz, 12-kb/s sampling rate and 4-kHz deviation).

A quite different approach for squeezing the delta-modulated signal into a conventional phone channel could be attempted by compressing in frequency the audio baseband signal before sampling and expanding it in frequency at the receiving end once decoded. There are several techniques for compressing a voice-frequency spectrum (300-3000 Hz) into a narrower one. A compression of this kind may be carried out in frequency domain, the time domain or both.

The approach reported by J. F. Clevald, WB6CZX in QST, November/December 1978 was only a rough example of a 2:1 compression carried out in the frequency domain. A similar but much more elaborate and effective process (4:1 compression ratio) has been devised by J. Das (Electronic Technician, August 1961)(see also E.W. Pappenfus et al, "Single Sideband Principles and Circuits," McGraw-Hill, 1964, pp.335-336).

Baseband frequency compression in the time domain was conceived as early as 1947 by D. Gabor

*S. Giovanni Persiceto 40017, 17, via Pio IX, Bologna, Italy

("New Possibilities in Speech Transmission," Jour. IEE, Vol. 94, No. 32) as reported also by S.J. Campanella in his well-known paper, "A Survey of Speech Bandwidth Compression" (IRE Trans. on Audio, September-October 1958).

By combining the two above techniques it could be possible to compress the delta-modulated rf signal into a conventional 3-kHz-wide phone channel to get digital transmission of true natural speech. In fact, baseband frequency compression is easier to perform in the time domain than in the frequency domain because the relevant process can be carried out entirely at digital level. Baseband compression in the frequency domain calls for orthogonal modulation and selective filtering operations which are much more difficult to implement.

I shall greatly appreciate any comments on the possibility of using delta modulation in ham radio as well as hear somebody else's experiences in polyphase modulation and in baseband frequency compression.

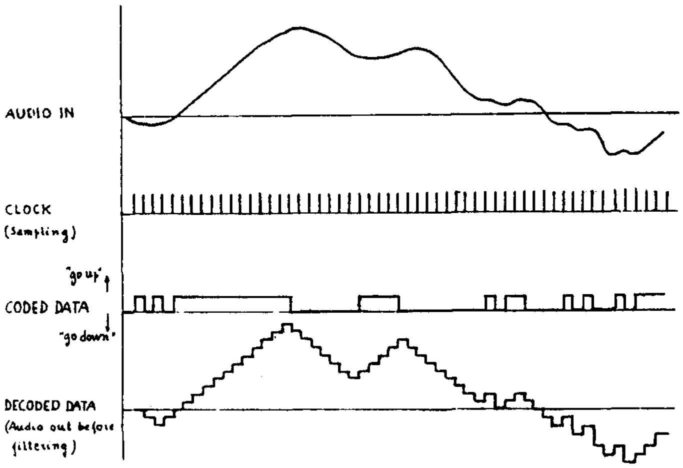


Fig. 1 - Timing of Delta-modulation and demodulation process

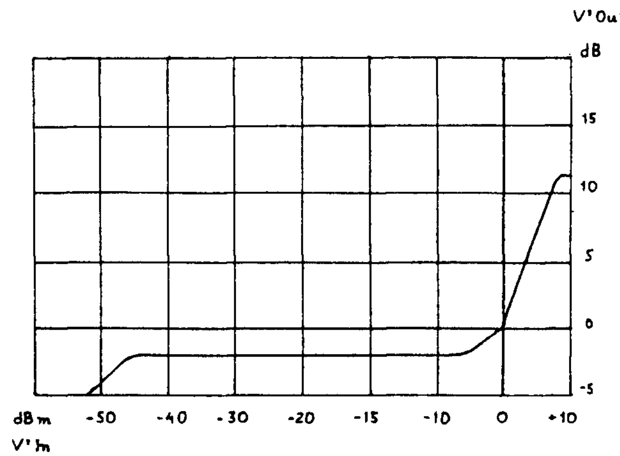


Fig. 2 - AGC characteristic of continuously variable slope Delta modulation (CVSD)

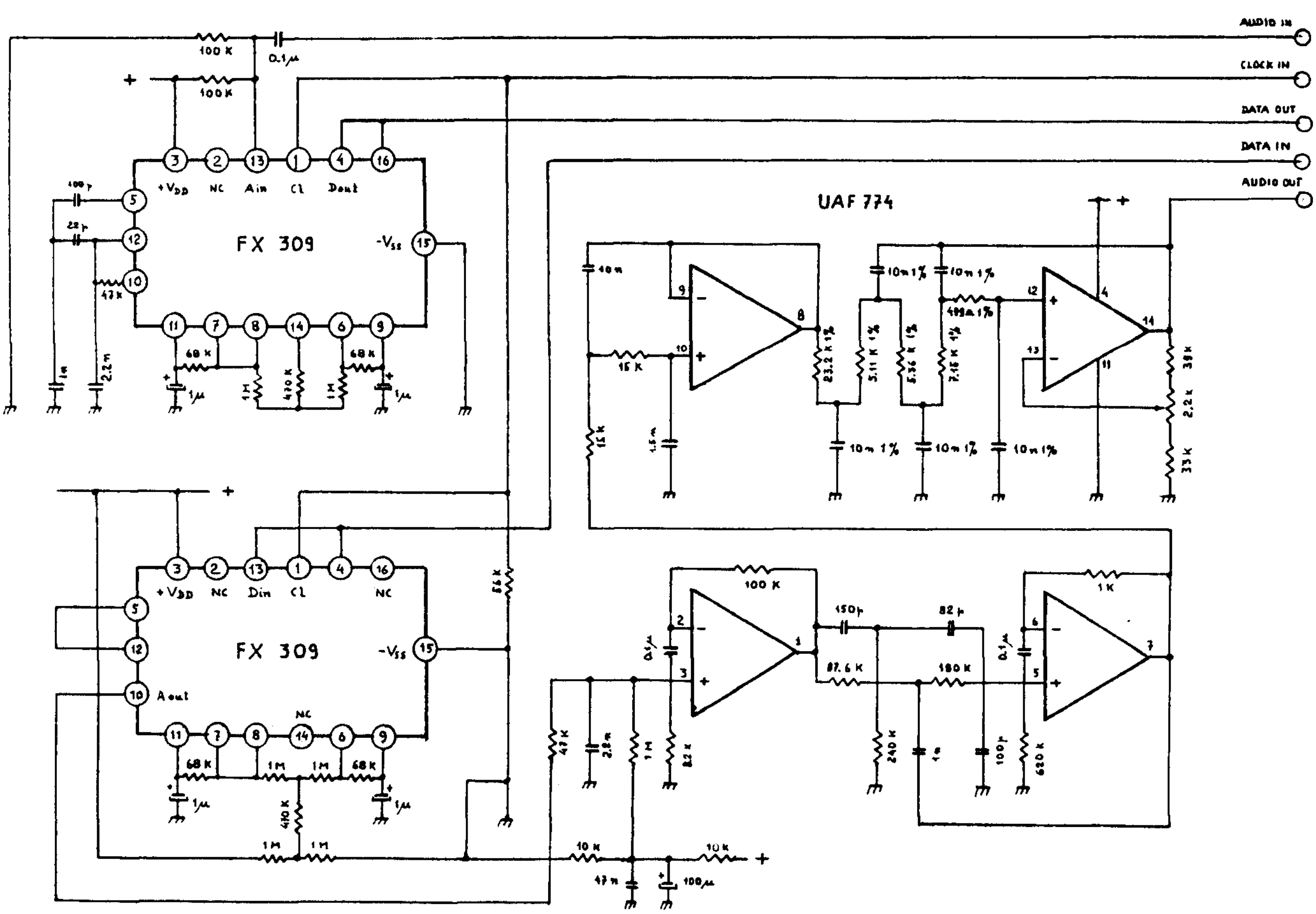


Fig. 3 - Schematic diagram of a Delta-modulator and demodulator (sampling rate 32 kb/s). (An HBF4047 may be used as a clock generator.)

Microwave Alignment Probe

By Ivo Chladek,* ZS6AXT

Many vhf/uhf radio hams are aware of the G4COM receiver alignment aid for optimizing rf amplifiers. This instrument provides automatic noise-figure measurement and costs next to nothing.

Unfortunately the original article [1] and improvements [2][3][4] do not describe suitable construction of the probe which is a very important part of this instrument. The probe must be constructed in such a way that it is suitable for the microwave bands with a minimum deviation from 50-ohm impedance. Furtermore, it must enable easy change of the noise diode as not every one produces enough noise.

The sketch represents construction of the probe for my G4COM receiver alignment aid. After finding a suitable noisy diode, the box which was constructed from two U-shaped pieces of 0.6-mm tinned tin was soldered together.

*P.O. Box 3093,Kenmare 1745, Republic of South Africa.

A good compromise of the value of the chip capacitors is around 500 pF. The 100-ohm resistors should be the smallest type available, soldered with the shortest possible leads.

Performance of this probe is really good. A MRF901 preamplifier for 1296 MHz gives 80% deflection of the meter with the 'G4COM' output potentiometer adjusted to 50%. My instrument is the original version [1] without any modification for higher output.

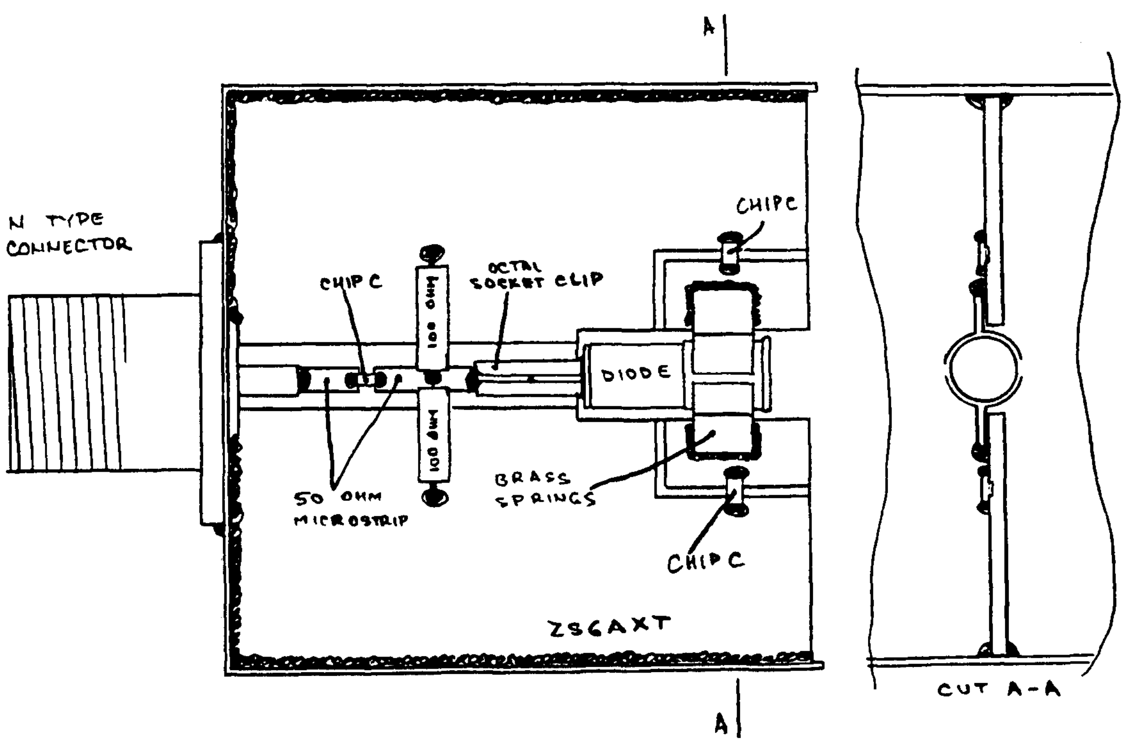
References

[1] J.R. Compton, G4COM, "An Alignment Aid for VHF Receivers," RSGB Radio Communication, January 1976.

[2] Technical Topics, Radio Communication, February 1978, pp.133-134.

[3] Technical Topics, Radio Communication, June 1978, p.511.

[4] Technical Topics, Radio Communication, May 1979, p.424.



G4COM ALIGNMENT AID:
PROBE CONSTRUCTION FOR MICROWAVE USE
(DOUBLE SIDED P.C. BOARD)

Modifying the VADCG TNC to Use 2716 EPROMs

By Robert R. Anderson,* K2BJG

The ROM chips uses in the Vancouver Amateur Digital Communications Group (VADCG) packet radio terminal node controller (TNC) are the older three-voltage 2708 1k x 8 EPROMs. Changing these to the newer, single-voltage 2716 2k x 8 EPROMs provides several advantages to the builder of this popular TNC board.

The 2708 EPROM requires -5 Vdc, +5 Vdc and +12 Vdc. Furthermore, the -5 Vdc must on prior to the application of positive voltages and must be turned off last. This requirement was not included with the VADCG assembly notes concerning power supply design. Not including provisions to meet this -5 Vdc on-first, off-last requirement is the probable cause when the TNC board no longer works and you find that the 2708 EPROMs are so not that you cannot hold your fingers on them. These problems all go away with the 2716 EPROMs which require only a single +5 Vdc power supply. Since -5 Vdc is not required elsewhere on the board, power supply design is simplified, and costs are reduced.

Those already up and operating with 2708 EPROMs who decide not to make this modification are cautioned to insure that the -5 Vdc on-first, off-last requirement is met.

Programming of the 2716 EPROM is a simplified procedure requiring much less sophisticated programming equipment than required to program the 2708. This is a big advantage to most amateurs who must depend on others to accomplish their EPROM programming for them. Chances are considerably improved on finding someone with equipment capable of progamming the 2716 rather than the 2708.

*69 Page Drive, Oakland, NJ 07436.

The 2716 EPROM has twice the memory capacity of the 2708. This means that two 2716 EPROMs can replace the four 2708 EPROMs currently used. This together with the fact that 2716 EPROMs are easier to find on the ham market can result in lower costs. The remaining two unused 24-pin sockets (with further memory modifications) can be used at a later date should additional memory be required, for either 2716 ROM or 6116 RAM.

The modification consists of revised connections to four EPROM pins and adding diode OR circuits for chip selection.

1. Pin 21 on U15 thru U18 formerly Vbb connected to the -5 Vdc bus is reconnected as Vpp to the +5 Vdc bus.

2. Pin 20 formerly the CHIP-SELECT pin connected by four individual lines from each EPROM U15 thru U18 to memory decoder U8 is now the OUTPUT-ENABLE pin. This pin on each EPROM u15 thru U18 is connected to the READ line from the 8085 CPU U1.

3. Pin 19 on U15 thru U18 formerly Vdd connected to the +12 Vdc bus is reconnected as addres 10 to the A10 line from the 8085 CPU U1.

4. Pin 18 on U15 thru U18 formerly the programming pin connected to ground is now the CHIP-SELECT pin. Connections from each EPROM to the next must be broken to allow chip selection.

Diode OR circuits consisting of 1N914 diodes and a 4.7-k pull-up resistor combine two memory decoder outputs selecting 1k of memory each into one signal to select 2k of memory for each 2716 EPROM at U15 and U16. See Fig. 1. U17 and U18 are no longer used and are not selected after this modification.

(Continued on next page)

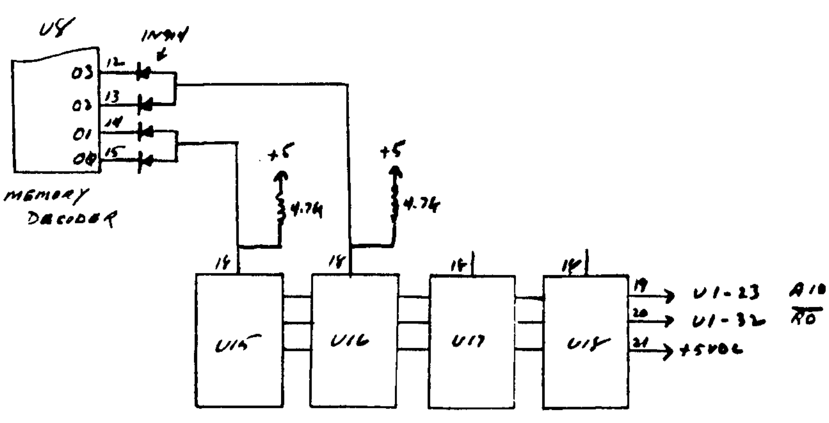


FIGURE 1

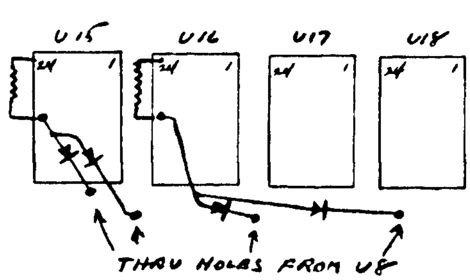


FIGURE 2

Data Communications

Conducted by
David W. Borden,* K8MMO

This month I have received several letters from readers (yes Virginia, I have real readers) discussing packet radio applications software. I thought sure this was a topic of interest only to Tom Clark, W3IWI and myself, but no, others seem to desire ideas and inspiration on the subject. Some readers even provide useful information!

Cal Sondgeroth, W9ZTK writes concerning a program he has written called TRANSFER, similar to Ward Christensen's MODEM program (which by the way has now grown to epic proportions having been enhanced by every assembly language programmer from Detroit to San Francisco). This program runs on his California Computer Systems (CCS) 300 hooked to a Bell Standard 103 home-brew phase-locked-loop modem in Mendota, Illinois. His fellow experimenter lives in Peoria (Ken, N9BBO). Working together on this data project, these two have perfected this radio computer program transfer mechanism.

TRANSFER, like MODEM7, transfers data in blocks of 128 bytes with checksums. Cal notes that with this system, the delays for repeater turn-around and the ACK/NAK can take almost as long as 128 bytes of data. Their program uses record numbers for each block and ACK/NAK is by record number. The scheme has worked well for them in good data transfers. Extra features include time-out on receive, cw identification, automatic transmit delay to let a repeater timer reset. If you would like to obtain a copy of Cal's program for non-commercial use, write Cal Sondgeroth, W9ZTK, 800 Fifth Avenue, Mendota, IL 61342. You should include return postage and a disk or some cash for copying since we are all doing this in our spare time, not for profit. I think someone should take the software and Vancouver packet board and combine them into a package.

Cal inquires about packet radio since his CCS computer has a Z80 SIO chip which will do HDLC. He specifically asked about the S-100 two-port packet board as the CCS is an S-100 bus computer.

The two-port packet board was designed locally by Terry Fox, WB4JFI, who will supply schematics for it if you are patient and send some money to cover postage. It makes use of the standard Vancouver technology in the 8273 HDLC controller chip. This chip differs from Cal's Z80 SIO in that it does NRZI encoding and Digital Phase-Lock Loop recovery of the clock. These are two features we have been using to get away from fancy (meaning expensive) modems. An expensive, high-speed modem will do clock recovery and supply the clock to the protocol chip. With DPLL we do not need to worry about that and can use inexpensive, surplus Bell Standard 202 modems at 1200 baud. The 8273 will be surpassed by the 8530 HDLC (two-channel) chip, but we are all down on the learning curve for that chip and must do more software work. The clever thing Terry has done on the two-port board is to use an AMD 9519 Interrupt Controller chip. This makes working with the 8273s easy, using our Z80 microprocessors. Note that the Vancouver TNC board made use of the 8085 microprocessor and a superior interrupt structure. Using a Z80 is not that easy. The 9519 simplifies the problem.

I have begun to work on some software for the board. Terry provided some routines to send a packet using interrupts. The Los Angeles gang have provided some PASCAL packet code to do AX.25. We have all awaited their Z80 code, but they have not sent it, so I am going to try to implement the AX.25 stuff on our dual-port board. I was going to try to do it in JRT PASCAL, because the package was so inexpensive, but alas, JRT PASCAL uses a run-time package called EXEC to do floating point, random disk support, etc. In short, it is not a true compiler like MT+. So, back to the MT+ keyboard I went. Since I got the software on paper, I am typing it in. I am anxious to see how big it is going to be. I have 56k to put program into, so I expect it will fit.

I also received a letter from the West Coast concerning the HOST mode packeteering. WB6YMH wrote a letter telling me how he had done the Host mode using only changes to his CP/M Basic Input/Output Software (BIOS). Skip discovered some of the same problems I did, but solved them in totally different ways. Next month I will print excerpts from this letter since many packeteers will be wanting to put a computer on their local nets.

*Rte 2, Box 233B, Sterline, VA 22170, 703-450-5284 (home)

Modifying the VADCG TNC

(continued from previous page)

The 2716 EPROM at the U15 position is now address 0000H thru 07FFH and should contain the entire line interface program (LIP). The 2716 EPROM at the U16 position is now address 0800H thru 0FFFH and should contain the entire terminal interface program (TIP).

Modification procedure:

On top of the board, make the following cuts:

U15-18	to	thru hole	(gnd bus)
U15-20	to	thru hole	(00 U8-15)
U16-20	to	thru hole	(01 U8-14)
U17-20	to	thru hole	(02 U8-13)
U18-20	to	thru hole	(03 U8-12)

On the bottom of the board make the following cuts:

U15-18	to	U16-18	
U16-18	to	U17-18	
U17-18	to	U18-18	
U18-18	to	thru hole	(gnd bus)
U18-19	to	thru hole	(+12 Vdc bus)
U18-21	to	thru hole	(-5 Vdc bus)

On the bottom of the board install the following jumpers:

U18-19	to	U1-23	(A10)
U15-20	to	U16-20	
U16-20	to	U17-20	
U17-20	to	U18-20	
U18-20	to	U1-32	(RO)
U18-21	to	+5 Vdc bus	(to right)

On the bottom of the board install 4.7-k resistors:

U15-18	to	U15-24	(+5 Vdc)
U16-18	to	U16-24	(+5 Vdc)

On the bottom of the board install 1N914 diodes, cathode ends to the thru hole (U8):

U15-18	to	thru hole	(00 U8-15)
U15-18	to	thru hole	(01 U8-14)
U16-18	to	thru hole	(02 U8-13)
U16-18	to	thru hole	(03 U8-12)

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Components

Conducted by Mark Forbes,* KC9C

I hope that everyone had a pleasant holiday and that maybe Santa brought some goodies to experiment with or maybe a new soldering iron. If not, perhaps this month's column can give you some ideas for new projects.

Seeq Ethernet Data-Link Controller

Seeq Technology, Inc. has introduced an Ethernet Data-Link Controller (EDLC), which is designed to support the data link layer of the Ethernet specification for local-area networks. Carrier-sense multiple-access with collision detection protocol is employed in ths chip. The part, designated the 8001, is packaged in a 40-pin DIP and operates at 10 Mbits/second. The EDLC features automatic 32-bit CRC generation and checking, error interrupt and status generation, standard MPU interface and control signals, loop-back capability and operates on a single 5-Vdc power supply. Pricing on the 8001 was not available yet, but additional information can be obtained from: Seeq Technology, Inc., 1849 Fortune Drive, San Jose, CA 95131, 408-942-1990.

Supertex DMOS FET, VN10K

Supertex has introduced their version of the popular VN10K N-channel, enchancement-mode DMOS power FET. This transistor can be substituted directly for a 2N2222 in many applications. When current is of concern, the VN10K is ideal since FETs are voltage-controlled switches. The VN10KN is ideal when interfacing microprocessor circuits to real-world inputs and outputs. Other suppliers of the VN10KN include Siliconix and Intersil. Supertex, Inc.'s address is 1225 Bordeaux Dr., Sunnyvale, CA 94086, telephone 408-744-0100.

Standard Microsystems CRT9700

The CRT 9007 by Standard Microsystems is a video processor and controller which supports either sequential or row-table-driven memory-addressing modes. The 9007 has a multiplicity of programmable features. Among the programmable features are: fully programmable display format with 8 to 240 characters per data row, 2 to 256 data rows per frams and 1 to 32 raster scans per data row; programmable monitor sync format with 4 to 2048 raster scans per frame and a sync width of 1 to 128 characters horizontal and 2 to 256 lines vertical; direct outputs to the CRT include horizontal, vertical and compositie sync, composite blanking and cursor coincidence. Other features are too numerous to include here! If you would like more information on this versatile part, contact Standard Microsystems Corporation, 35 Marcus Blvd, Hauppauge, NY 11788, 516-273-3100.

Avantek Low-Noise GaAs FETs

Avantek, of Santa Clara, California has developed two low-noise gallium-arsenide FETs which can perform at frequencies of up to 15 GHz. Operating in the 2- to 10-GHz frequency range is the AT-12570-5. This part also boasts a 0.9-dB noise figure and a 15-dB gain at 2 GHz, with +20 dBm power output at 4 GHz. The second FET is the AT10650-5 which operates in the 4- to 15-GHz range. This part has a 1.8-dB noise figure, 10-dB gain at 8 GHz and a +13 dBm power output at 12 GHz. Both of the transistors are in microstrip-line packages.

National Semiconductor LM1894 DNR

National's LM1894 Dynamic Noice Reduction System (DNR)(tm) is intended mainly for stereo fm-broadcast and magnetic-tape noise reduction but could have applications in ham radio as well. Psychoacoustic masking (see LM1894 data sheet and its refs for an explanation) and an adaptive bandwidth scheme allow the DNR to achieve 10 dB of noise reduction. The DNR is non-complementary in that it **does not** require encoded source material. The LM1894 operates from 4.5 to 18 Vdc. One interesting point is that the LM1894 does not require a license to use. National can be contacted at 2900 Semiconductor Drive, Santa Clara, CA 95051.

*1000 Shenandoah Dr, Lafayette, In 47905, 317-447-4272, 2300-0230 UTC weekdays, until 0230 weekends.

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2) document advanced technical work in the Amateur Radio field, and

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

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