QEX December 46 1985 $1

The ARRL Experimenters' Exchange

1986 Handbook

If you thought the **1985 ARRL Handbook for the Radio Amateur** was tops, heft a 1986 edition! There's lots of new reference material, particularly in the digital area, and new construction projects. If you don't have a dealer nearby, you can order copies from ARRL Hq. (See ARRL ads in November **QST** for details.)

ARRL Amateur Radio Computer Networking Conferences 1-4

That's the title of a new publication that combines the pioneer packet-radio papers from the first four ARRL-sponsored Computer Networking Conferences which spanned 1981-1985. It also contains reprints of **Gateway**, the ARRL Packet-Radio Newsletter, from its premiere issue through September 17, 1985. This collection is available from ARRL Hq for $18.00 (USA).

Experience with Computer-Aided Drafting?

If you have used a personal computer to do schematic drawings, how about sharing your experience with other **QEX** readers?

Planning to Move?

We get letters from individuals who say they have moved, are getting **QST** okay, but not **QEX** since the move. A look at the membership/subscription record in the computer shows the person's old address. What happens is that the old post office will forward magazines (**QST** is mailed Second Class) but not Third Class material (**QEX** goes Third Class in the U.S. unless the extra cost of First Class postage is paid). We are happy to provide the missed copies once we are informed what happened.

Of course, the better approach is to let ARRL Hq know of your move well in advance. A single change of address notification to Hq will take care of **QST**, **QEX**, and anything else we mail to you.

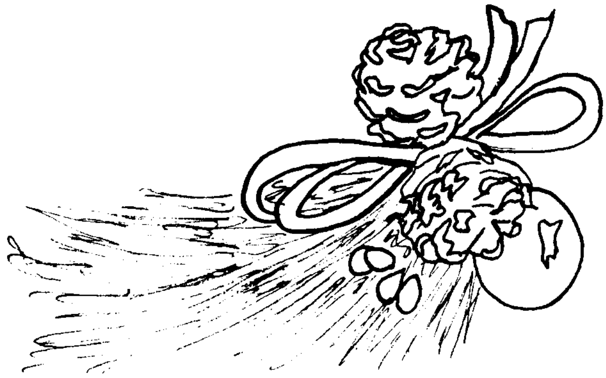
North American Teleconference Radio Net

Below are the features of the NTRN session on Friday, December 13 at 8:00 P.M. Central Standard Time:

What Every Amateur Should Know about ACSSB -- Just what is amplitude compandored single sideband (ACSSB)? What is its place in Amateur Radio? What could be its impact on amateur 2-meter FM or satellite operation? ACSSB is just beginning to be used in the commercial Land Mobile radio services. It provides the benefits usually associated with FM such as receiver squelch, automatic frequency control (AFC) and capture effect. Leading the discussion will be Paul Rinaldo, W4RI.

An Interview with Engineer-in-Charge James Berry, FCC Monitoring Station, Grand Island, Nebraska -- This discussion will cover the Grand Island facility and how its responsibilities have changed with technology. Amateurs can also pick up some pointers on what to do when experiencing radio frequency interference or observing a violation of FCC rules.

For additional information on participating in this network or obtaining a list of those repeaters involved, please send an s.a.s.e. to NTRN Net Manager Timothy Loewenstein, WAØIVW, Midway Amateur Radio Club, P.O. Box 1231, Kearney, NE 68847-1231 or telephone 308-234-2034 (home). -- W4RI



Correspondence

Wanted: A Source for Low-Cost Reliable Pager System

I joined the ARES/RACES group of Santa Clara City in July. One thing people talk about at times, but don't seem to accomplish, is arranging a tone paging or alerting system for our 2-meter repeater. We would like to respond at once to an alert, but not have to hear the chatter. For example, I could not listen to my HT at work, but could wear a pager to beep me in times of emergency.

Such a device would have to be inexpensive enough to encourage many participants to buy it, or it would not affect our readiness. One possibility is an audio decoder with an alarm that listens to a scanner or hand-held radio.

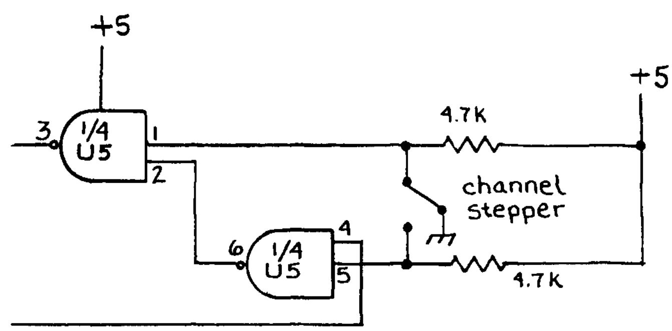
How about pagers? Is there anything such as old commercial VHF "high-band" pagers that are being replaced in large numbers, but could simply be recrystalled for our repeater? Maybe there is a new, highly integrated inexpensive pager that could be set up for our frequency.

In part, I am looking for a more or less ready-to-wear solution. I also wonder if people know what works or is out of the question. The situation is partly technical. The other part is people problems — getting enough hams to do the same thing.

Has someone constructed an audio decoder and alarm box which could easily be duplicated (and reliable — a low false rate)? I have considered the ComSpec $60 4-digit DTMF sequence decoder, but I doubt that I would have a lot of company. Any suggestions? -- Richard Rawson, N6CMJ, 141 Kit Carson Court, Santa Clara, CA 95050.

Feedback on Logic Reference

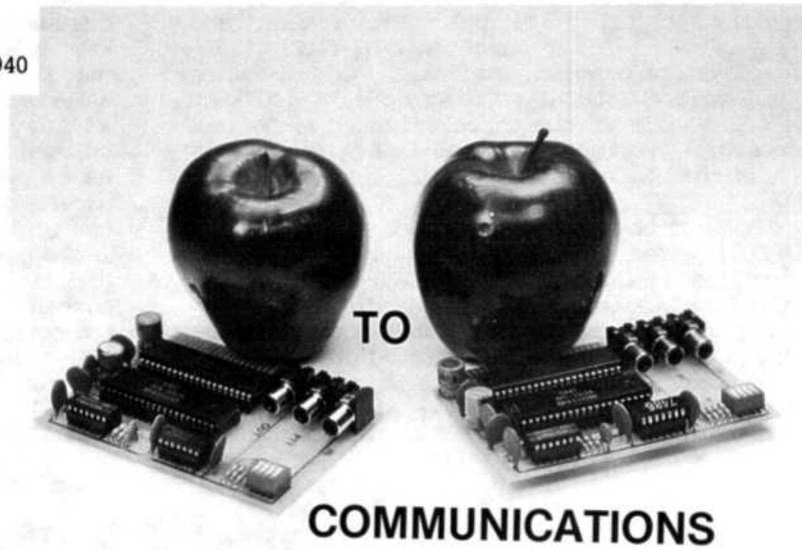
Re the September 1985 **QEX** issue, page 4, Fig. 1. The channel-stepper switch as wired will short the +5-V dc! The schematic should be wired as follows:



— Vernon Fabishak, P. O. Box 20972, Greenfield, WI 53220.

Notes on TELEFAX

By W. Conley Smith, K6DYX
67 Cuesta Vista Drive, Monterey, CA 93940



We are impressed, but hardly amazed by the power and versatility of the microprocessor-based computer. There seems to be software available to do most anything. In the amateur tradition, however, there is great satisfaction to be had by going the "do-it-yourself" route.

I decided to write my own program for sending and receiving radioteletype (RTTY) in both Baudot and ASCII with all the bells and whistles. With this software working admirably, my attention was turned toward sending graphics over the air with an extension of the program called TELEFAX. One successful example is shown in Fig. 5.

The program is written in machine language for the 6502 microprocessor (Apple), and requires a peripheral board that includes a 6522 Versatile Interface Adapter (VIA), and an AY-5-1013A Universal Asynchronous Receiver Transmitter (UART). A close up of the board is shown in Fig. 2. Originally homemade, the board can now be purchased from A & A Engineering.[1] More on how to purchase the kit and my program at the end of this article.[2] Any frequency-shift keying (FSK) converter, audio frequency-shift keying (AFSK) converter, or interface will serve well, but it must be able to handle 200-baud ASCII speed.

A HIRES (high resolution) screen is used with the TELEFAX program. Information on this system follows in next month's **QEX.** Commercial software is also available for many displays on the HIRES screen, or you can write your own.

Development and debugging of this program was done on two meters, working across town with Paul Herrschaft, KQ6G. The program will work equally well on the low bands. We invite questions about its implementation from qualified amateurs.

Introduction

These notes apply to the machine language program catalogued as TFX. The program requires that a 6522 VIA and an AY-5-1013A UART peripheral board be placed in slot no. 5. Fig. 3 displays the schematic and pin connections of the two ICs used. The VIA generates interrupts and controls the UART functions. Details on this subject appear in another section of this article. The machine language program occupies locations $8000 through $91A2.

The program is called by the BASIC program TELEFAX. It may be commanded to load a picture or diagram into the HIRES screen 1 memory from a diskette in computer drive no. 2. Entry to the machine language is made by a CALL 32768 ($8000 Hex). The VIA is initialized and the various commands are displayed. These commands may be referred to at any time by typing CTRL-Z.

Input, output, and a PTT signal come directly from the peripheral board in slot no. 5 (the VIA). Fig. 4 shows the component layout of the board. Dip switches permit inversion of any or all of these signals. An external converter or interface must be used to generate the AFSK tones to be sent and to detect the AFSK tones received.

Three memories are provided. Memory no. 1 starts at $1700, no. 2 at $4000, and no. 3 at $6800. A BRAG TAPE, which must be written by another program, can be sent by the CTRL B command. It must begin at location #1000.

On receive, the text is displayed on the upper screen. Memory no. 2 may be opened or closed to store the received text without disturbing the display. You can change modes, but both screens will clear. The CTRL-G command switches the system to the TELEFAX receiving mode.

The keyboard data you enter while in the receive program is stored in memory no. 3. CTRL-A automatically stores the ID (DE K6DYX). When the ESC key is pressed, the program sends the text, if any, that has been stored in memory no. 3. While this is being sent, you may type additional text which will be transmitted after the stored data. Pressing ESC while sending from any memory sets a flag. A second press of the ESC key causes a jump to the SEND routine, but without disturbing the memory. This is helpful in case you want to recall it later.

The typed text appears on the lower screen when using the send mode. Automatic ID is available, and a series of RY lines may be sent. The standard test tape, "The Quick Brown Fox..." and CQ may be sent. CTRL-B sends the BRAG TAPE. CTRL-Z displays the commands available. CTRL-G causes a jump to the TELEFAX sending mode, and CTRL-R sends from one of the three selected memories. (The store in memory command is available only when in the receive mode.)

When in the store mode, text will appear on the full screen as it is being typed. Keying (output) is inhibited. ESC or CTRL-C returns you to the RECEIVE routine. The text stored may then be sent at any time by the CTRL-R command. The text in memory no. 1 will remain undisturbed until overwritten. Text in memory nos. 2 and 3 might be overwritten when you are in the RECEIVE routine (see above). The BRAG TAPE must be written by another program.

The picture on page no. 1 ($2000-$3FFF) of the HIRES screen is displayed and a series of asterisks appears along the bottom of the screen when you are in the TELEFAX sending mode. The data in this mode is sent at 200-baud ASCII. Pressing SPC halts the series and sends a flag. The flag is a signal to the receiving station to begin displaying data. No further action will be observed on the sender's screen until the end of the picture. This takes about 6 minutes and 15 seconds to complete, or until the program is aborted by pressing ESC.

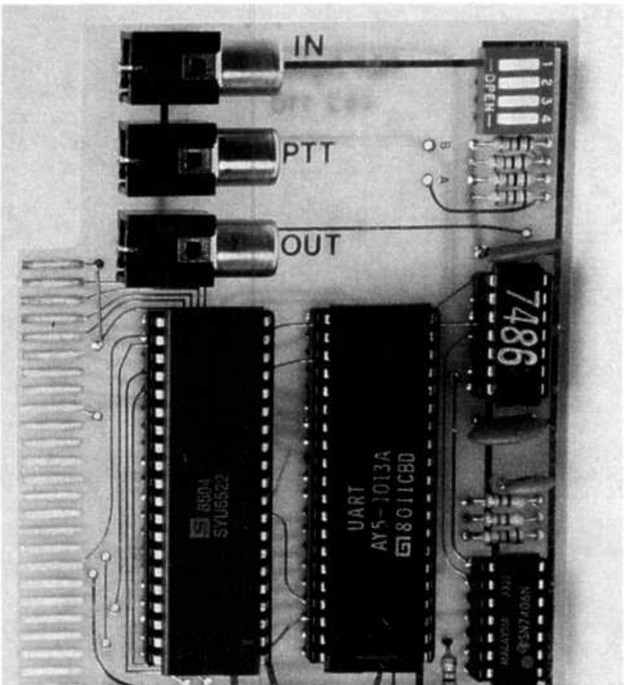


Fig. 2 -- A close up of the A & A Engineering peripheral board.

Instructions are listed at the bottom of the blank screen when you enter the TELEFAX receiving mode. You will be given the option of pressing the space bar to begin receiving data, or the ESC key to abort. No data will be stored or displayed until SPC is pressed, whereupon the series of asterisks being transmitted by the sending station will appear, running along the bottom of the screen. When the sending station sends the flag as a result of his pressing SPC, the series of asterisks ends and the picture begins to appear on the blank screen, drawn line by line and interlaced. Receiving may be aborted at any time by pressing ESC. If the picture is complete, the screen changes to display the full picture with the bottom (instruction) line removed. A press of SPC causes a jump to the normal RTTY RECEIVE program. The diagram or picture data remains in HIRES page 1 memory and may be saved or dumped to a printer at a later time.

Technical Details

The peripheral board holds two 40-pin integrated circuits: the 6522 VIA and the AY-5-1013A UART. The UART accepts input data in serial form from an external teletype converter and presents it in parallel form to certain pins of peripheral slot no. 5. It also accepts data in parallel form from certain slot pins and streams it out in serial form to an external tone generator for transmission as AFSK. The VIA provides the signals to control the UART functions and for operating the PTT of a radio transmitter. In addition, it supplies an interrupt signal for the computer program.

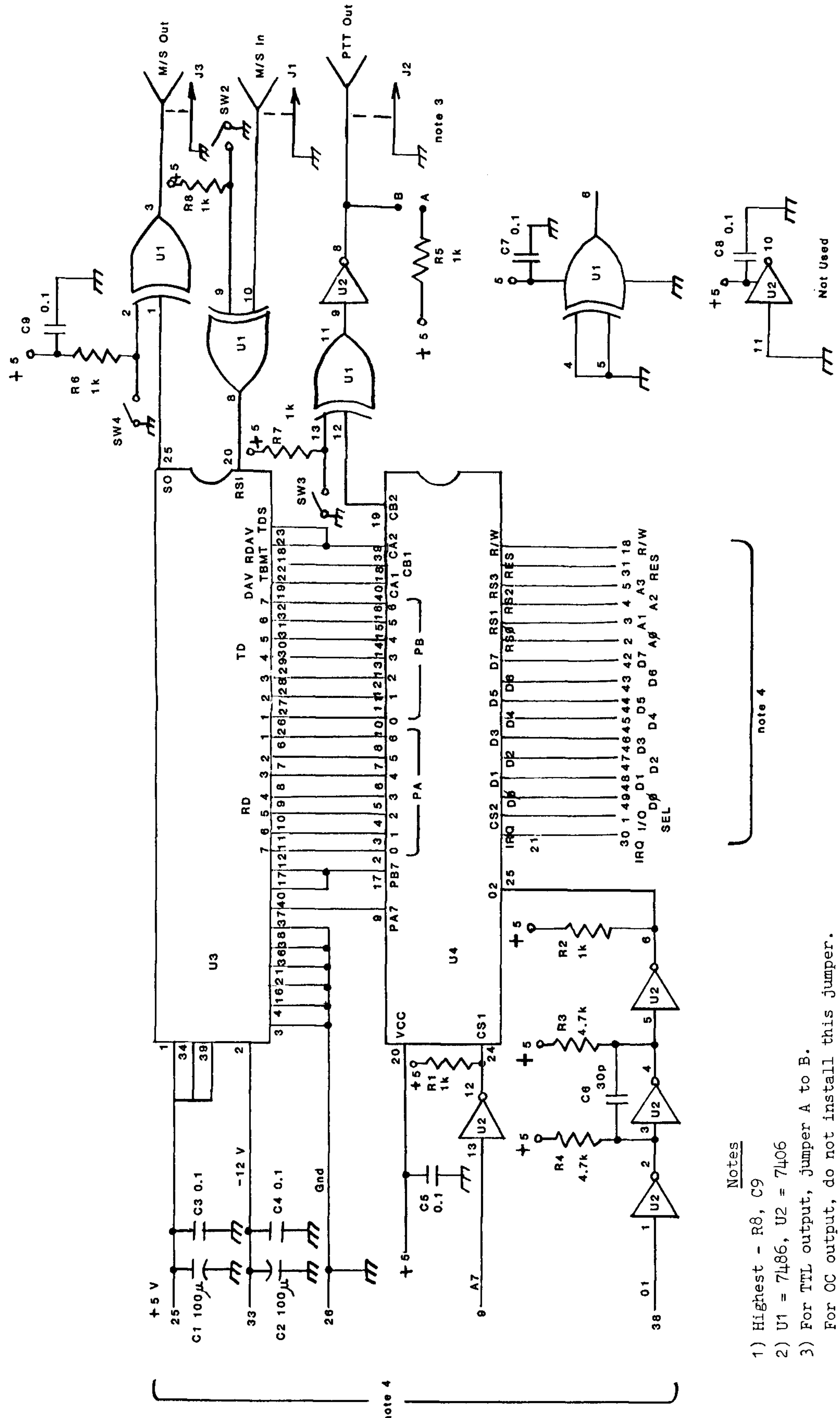
The Mark/Space input on the A & A Engineering peripheral board is a standard TTL load. Its output can handle up to ten standard TTL loads. Mark can be made logic (Ø) or logic (1), and Space can be logic (1) or logic (Ø) for either the input or output by means of dip switches on the board. With the dip switches in the **closed** position the PTT signal is a positive voltage on Send, and Mark is a positive voltage for both input and output.

The Program

The machine language program called TDDX begins at $7CCC and runs through $91BB for a length of $14EC. It is entered from the BASIC program TELEFAX at location $8000, but may also be initialized directly from the diskette.

Two parameters must be preset for proper operation of the UART. The first parameter concerns the number of data bits (by status of UART pin no. 37 (NDB)). If it is (Ø), then it should be five bits for Baudot. If (1), then seven bits for ASCII. The second is the bit rate. The clock input at the UART chip is pin nos. 17 and 40.

The clock frequency must be 16 times the baud rate. The chart below will give you standard settings.



Notes

1) Highest - R8, C9
2) U1 = 7486, U2 = 7406
3) For TTL output, jumper A to B.
   For OC output, do not install this jumper.
4) Pin numbers refer to Apple Peripheral Connector
5) SW2 through 4 for NORMAL or INVERT,
   SW1 is not used.

Fig. 3 — The schematic diagram of the peripheral board. Pin connections for the UART and VIA ICs are also shown.

For	Baud Rate	Clock Frequency
60 WPM Baudot	45.45 Hz	727 Hz
75 WPM Baudot	56.90 Hz	910 Hz
100 WPM Baudot	74.20 Hz	1187 Hz
110 Baud ASCII	110.00 Hz	1760 Hz

A square wave of the desired clock frequency is generated by the VIA using its Timer 1 in the free running mode to divide the Apple frequency (1.023 MHz). The square wave generator in the VIA provides a further division by two. An example:

For a clock frequency of 727 Hz, we must have a division by 2 x 727 = 1454. The divisor is then 1023000/1454 = 703 or #$02BF Hexadecimal. #$BF goes in T1L ($C504) and #$02 goes in T1H ($C505).

Initialization of the VIA puts in these values and also clears the UART buffers by a pulse from VIA pin no. 39 (CA2). This same clear strobe action occurs at other locations in the program. The VIA is also set to detect a data available signal from the UART at VIA pin no. 40. A bit test in the program allows a read of the data from $C501. In the KEY subroutine, a similar bit test detects a buffer empty signal from the UART at VIA pin no. 18 (CB1), and allows the data to be transmitted to be written in at $C500.

While waiting for the finish of these bit tests, the program allows continuous insertion of keyboard data or commands by a system of interrupts. The clock signal which times the UART is used to generate the interrupt flag. In the SEND, RECEIVE, or SEND FROM MEMORY routines, the interrupt is simply pointed to different locations. Action during the interrupt is so fast that transmission or reception of data is not noticeably affected.

When you enable the PTT, the program supplies a signal at CB2 of the VIA. This makes it convenient to switch from transmit to receive via the PTT input of a radio transceiver. CB2 (pin no. 19 of the 6522), goes high (logic (1)) on receive and low (logic (Ø)) on send. This is buffered on the A & A board. If a jumper connection is made between points A and B, the drive capacity of the PTT output is approximately ten TTL loads. With points A and B disconnected, the output is open collector with a 30-V maximum at 40-mA maximum, suitable for driving most relays.

Tables for referencing screen display commands, instructions, and certain status conditions occur at various locations. They can always be referenced by the command "LDA...,X".

I wrote this program with some cosmetic considerations. To avoid splitting words at the end of a screen line, a "wrap" subroutine is employed. The program detects a space after the 32nd character in each line and the computer places a return character in this space on the screen. This action is used for both the sending (lower) and receiving (upper) screen. In case the receiving station is using a mechanical radioteletype machine with a maximum line length of 72 characters, a character counter is employed by this program to count up to 60 characters. A space transmitted after the 60th character causes the injection of two carriage returns and a line feed. If no space is transmitted, the action occurs on the 72nd character regardless.

The screen indices are saved and recalled at appropriate locations in order that the screen display will not be erased when moving from send to receive, and so on. Both screens may be cleared, however, by the CTRL-E command or by CTRL-Z, which calls for a display of commands available.

Conversion tables are available. Computer keyboard and screen data are in ASCII. To transmit or receive five-level Baudot, a conversion is necessary. Tables for this begin at location $8092.

Sending a Graphic

The procedure I use for sending a graphic is as follows. A diagram or picture is loaded into the HIRES screen of the computer and contact is established with the receiving station by RTTY. When assured that practically error-free copy is possible by ASCII, the receiving station presses the TELEFAX-RECEIVE command and, as the sending station, I enable the TELEFAX-SEND command. The diagram and a string of asterisks appear immediately on my screen until I command a "GO" signal. The signal initializes a data flow that is placed in the receiving station's HIRES page 1 memory and on the receiving station's screen.

Since it takes over 8000 characters (bytes) to fill the screen, it takes nearly 16 minutes to send and receive a picture at 110-baud ASCII. Amateurs are required to identify every ten minutes. Before you become disappointed, let me say that by using 200 baud, a picture transmission takes a little over six minutes. At the end of the transmission, a flag switches the sending program back to normal RTTY. The picture remains on the receiving station's screen until the operator presses the SPACE key, whereupon the program returns to the normal RTTY mode. The picture may be saved or dumped to a printer at a later time.

Special Considerations for GRAPHICS

The Apple HIRES page no. 1 data occupies memory locations $2000 through $3FFF. Forty bytes for each screen are selected in a pattern or sequence that results in interlacing of the lines. The SEND GRAPHICS routine transmits the data bytes sequentially, beginning at $2000 and ending at $3FFF. The RECEIVE GRAPHICS program selects the screen line to be displayed by a computation subroutine, masks off bit 8 (the "color" bit), and stores each byte in the receiving computer's HIRES memory. It also displays the picture line by line, interlaced, on the receiving screen. A total of 8191 bytes is required for the full HIRES screen. Because 110-baud ASCII is too slow for completion of the screen transmission in less than 10 minutes, a 200-baud rate is employed. This speed requires a good quality converter or interface for receiving AFSK.

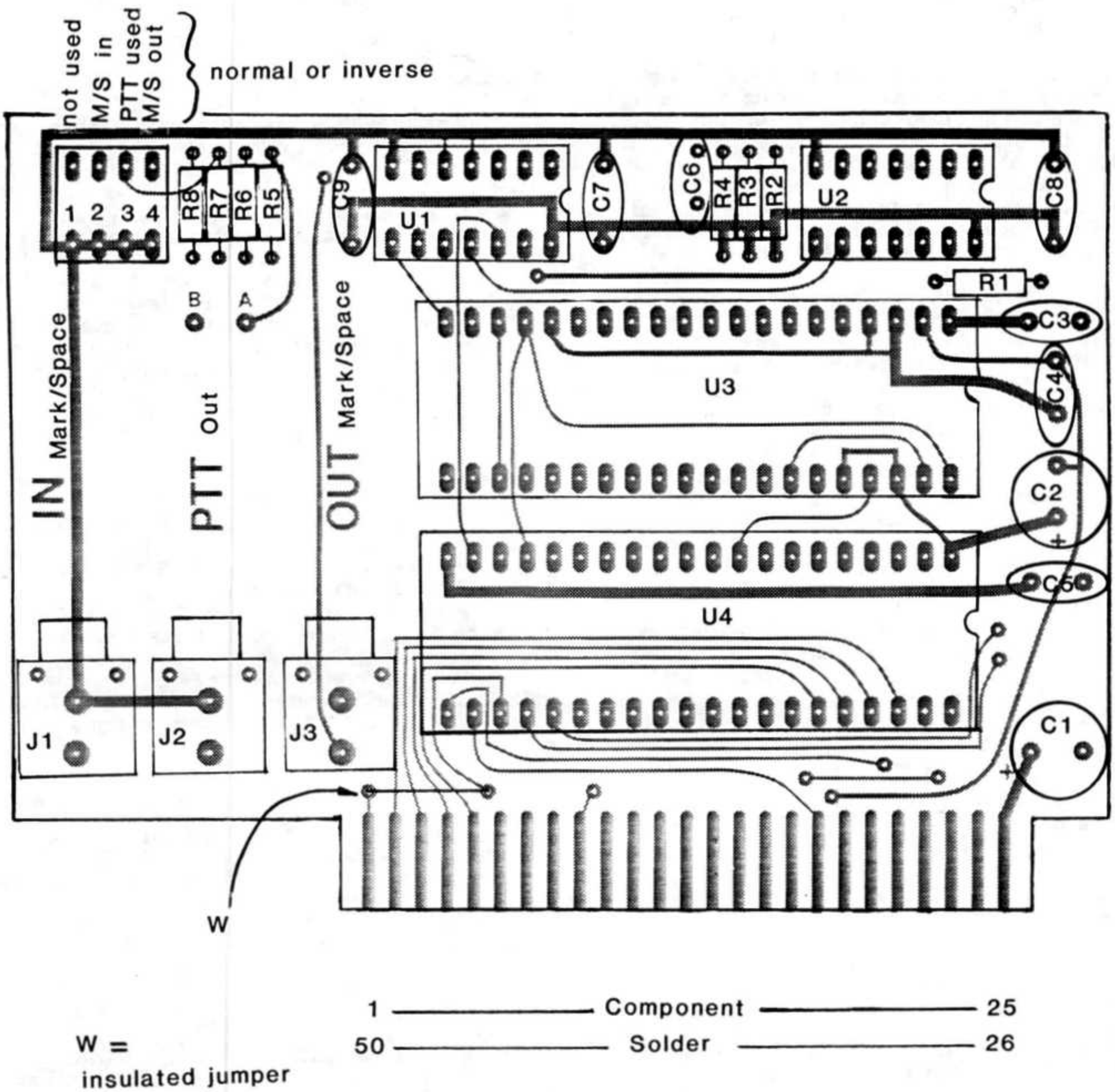


Fig. 4 -- Top view of the component side of the TELEFAX board. Jumper A-B is for the TTL output. For OC output, do not install this jumper. Components for this board and complete kits for the Apple //e and Apple][+ can be purchased through A & A Engineering. Components are as follows:

R1, R2, R5, R6, R7, R8 — 1 kilohm, 1/4 W
R3, R4 — 4.7 kilohm, 1/4 W
C1, C2 — 100 µF Radial
C3, C4, C5, C7, C8, C9 — 0.1 µF Disc
C6 — 30 pF Disc
U1 — 7486
U2 — 7406
U3 — AY-5-1013A
U4 — 6522
J1, J2, J3 — Phono Jacks
SW — 4-Pos Dip Sw

The receiving station **must** receive lines of asterisks from the transmitting station before the HIRES data can be received. If reception is not perfect, the display will be seriously skewed, if received at all. It is good practice for the transmitting station to run six or eight lines of asterisks before pressing the space key. This allows the receiving station to abort and try again if perfect copy is not received.

Special Considerations for Data

With a few line changes, the same program that handles the sending and receiving of graphics can be used for sending and receiving a machine language program. (I call this "DATA.") The essential differences between the two are that the data to be sent must be stored at location $4000 (memory no. 2), and you must have inserted the location of the end of the data when you loaded it by TELEFAX. When reception of data is complete, the receiving station sees it disassembled and, by repeatedly pressing the space key, the entire program can be examined. When ESC is pressed, you are returned to the RECEIVE program, just after receiving GRAPHICS. The COUNT LENGTH program can be used to save the data to the diskette. See below.

Count Length

The COUNT LENGTH program is useful for saving any text you have in any location. The only requirements is that the text must end with the character "^" (Hex $DE). This character is not displayed when the text is run. $DE is a flag that indicates the "end of text." It is automatically placed at the end of any text stored in any memory by the TDDX program. The COUNT LENGTH program asks you where to start counting ($1000 for BRAG TAPE), and it counts until it comes to a $DE. If you use the COUNT LENGTH program to count and save a text in say, memory no. 2, you will have to instruct it to start counting at $4000. Likewise, $1700 for memory no. 1 or $6800 for memory no. 3. I routinely copy W1AW bulletins and store them in memory no. 2. The bulletins are saved on the diskette using the COUNT LENGTH program.

COUNT LENGTH can be used for saving a machine language program received by the DATA routine. This data begins at $4000 and an end flag ($DE) is automatically placed at its end. However, COUNT LENGTH cannot be used to save a GRAPHIC. Keep in mind that the HIRES screen 1 starts at $2000 and has a length of $1FFF.

Customization

The display banks are presently written for the amateur call sign K6DYX in the SEND ID subroutine, and K6DYX SMITTY IN MONTEREY in the SEND CQ subroutine. See program lines $81AØ et. seq. This may be changed by writing other Apple ASCII bytes in these locations. Space is available for a total of 32 bytes or letters without affecting other displays. Certain program lines set the length of the ID and the CQ transmissions. Values in these program lines may have to be changed for a particular customization. An auxiliary program is included on the diskette for customizing to your own requirements. It takes care of all the changes required. Customizing TDDX will also save TDDX as you have modified it.

Provision is made for sending a set description of your amateur station equipment (BRAG TAPE). Command CTRL-B calls this, but the BRAG TAPE cannot be edited or written to by this program. An auxiliary program, WRITE BRAG TAPE, is included on the diskette for this purpose. The BRAG TAPE must begin at line $1000 and it may extend to $16FF (memory no. 1 starts at $1700).

When you have written your BRAG TAPE, save it using this name so TELEFAX can load it. To do this, use the COUNT LENGTH program which will be called automatically.

Printer

Calling the CTRL-P command while in either send or receive dumps the text in memory no. 2 to an Epson printer and returns you to receive as soon as an end flag is encountered. The subroutine for this begins at $8840. For other makes of printers, certain lines may have to be changed. Consult your printer manual.

References

[1] Kits for this TELEFAX project are available from A & A Engineering for both the Apple®//e and Apple®][+. Complete price information appears on page 9.

[2] The author will furnish a copy of this machine language program to anyone who sends a 5 1/4-inch floppy diskette to his residence. He will customize it for your amateur call and include a complete listing of the TELEFAX control functions (hardcopy). The cost is $10.00 plus return postage.

TELEFAX Peripheral Board Price Information

Now that you are interested in converting your Apple computer to a TELEFAX sending and receiving machine, how do you go about obtaining the peripheral board? Simple. A & A ENGINEERING, an electronic engineering and manufacturing company, will supply the complete kit, as well as individual components, to help you design your own board. Their address is 7970 Orchid Drive, Buena Park, CA 90620, tel. (714) 521-4160. Prices for their merchandise are as follows:

6 RES	1 k 1/4 W	5%	$ .60
2 RES	4.7k 1/5 W	5%	$ .20
6 CAP	0.1 µF	Disc	$ 1.20
2 CAP	30 pF	Disc	$ .30
2 CAP	100 µF	Radl	$ .80
1 IC	7486	U1	$ .40
1 IC	7406	U2	$ .60
1 IC	AY-5-1013A	U3	$ 3.80
1 IC	6522	U4	$ 4.85
2 SOC	14 pin dip socket		$ .70
2 SOC	40 pin dip socket		$ 1.30
1 PCB	492-114-0 Circuit Board		$18.55
3 CON	PC Mount Phono Jack		$ 1.80
1 SW	4 Pos Dip Switch		$ 1.25

PRICE SUMMARY

Circuit Board Only	$18.55 plus $1.50 s/h
Complete Kit Price	$36.35 plus $1.50 s/h
Assembled Price	$49.95 plus $2.00 s/h

California Residents Please Add 6% Sales Tax

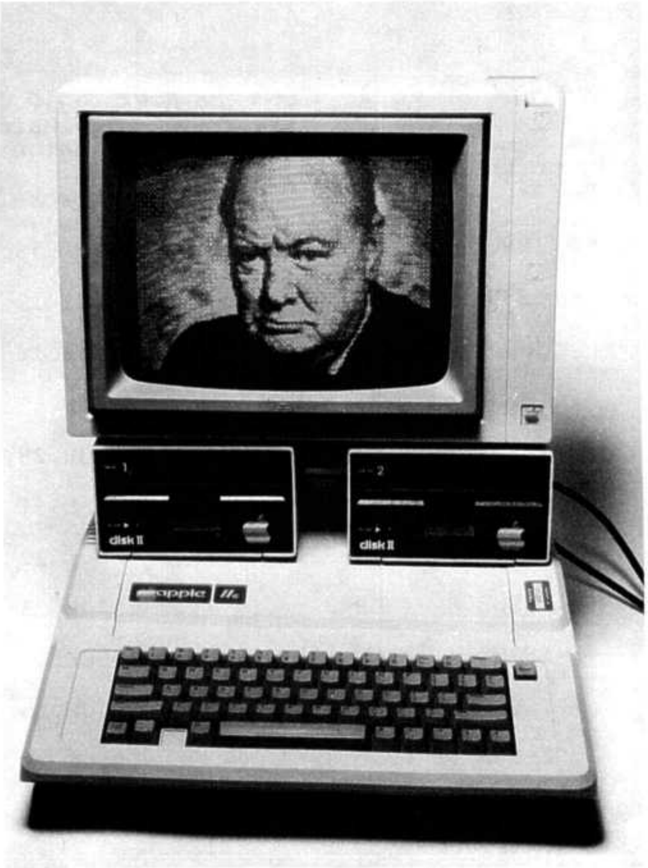


Fig. 5 -- The face of Winston Churchill is displayed on an Apple®//e using the TELEFAX program and a peripheral board.

Update On ACSSB Packages

The January 1985 issue of **QEX** advertised the sale of ACSSB packages bought as bulk surplus from Sideband Technology, Inc., of Rochester, NY. These were sold through **QEX** and Project OSCAR during the first half of the year. As explained in that article, the boards were to be sold as is, with no warranty. Items such as crystals, ICs, and power supplies would have to be installed by the buyer.

Since that time, several purchasers have expressed a need to locate others involved with ACSSB technology, whether they too are constructing a board, or work in industry. Parts are hard to locate, and techniques on how to convert the board to an operable condition are the shared hardships.

I would like to request that purchasers of the ACSSB packages who would like to assist others in getting their unit to work send their name and address to me in care of **QEX.** In turn, a list will be compiled and distributed to those experiencing problems. Correspondence concerning construction and operating information could then be conducted on a personal basis.

Also, if you have decided that ACSSB technology is not for you and you would like to sell the package, let me know. A notice will be published in a future issue. In the meantime, questions about the kit could be directed to ACSSB 1, 15 Valdez Lane, Watsonville, CA 95076. -- Maureen Thompson, KA1DYZ

The American Radio Relay League
225 Main Street
Newington, CT 06111

QEX Back Issues List

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Name____Call________________

Address____

City________________________ State or Province__________ ZIP or Postal Code________

A Square-Wave Generator with a Useful Range from 47 kHz to 52 MHz

By Clint Bowman, W9GLW
P. O. Box 282, Prospect Heights, IL 60070

Why square waves? I have found that by using calibrated square waves in conjunction with a high-frequency oscilloscope, I could determine resonant frequencies, transfer characteristics, and the relative "quality" of all sorts of tuned circuits. High-pass, low-pass, band pass, as well as crystal filters and broadband ferrite loaded circuits, are included.

Further, the saturated nature of a square wave results in almost uniform amplitude output over a broadband range of frequencies. Consequently, this eliminates the necessity for adjustment of the output attenuator with frequency change.

A square-wave generator is easier for the amateur to construct than a sine-wave unit, especially if a band switch must be used. My generator uses a "two-terminal" oscillator with one terminal common with all inductances and the tuning capacitors. This simplifies band switching greatly!

This generator is built around a Motorola MC1648P integrated circuit. In most locations it should be a readily available component at a cost of three to four dollars in single lot quantities. The MC1648P is a voltage-controlled oscillator, with buffered output and a possible frequency range from near dc to over 200 MHz. In practice, the low-frequency range is limited to the amount of capacitance in the parallel-tuned frequency determining circuit as well as the dc resistance in the inductor in that circuit. Typically, up to 50-ohms dc is permissible in the inductor.

The upper frequency is limited by variable and stray capacitance. Accordingly, in a broad-coverage instrument such as this one, a compromise had to be made. The result was limited operation from about 50 kHz to 50 MHz in seven bands.

Mechanically, the usual precautions should be taken when constructing the generator. Short direct leads and firm mounting of components is a necessity. Series regulation with high-grade regulators in the power supply will reduce high-frequency jitter noticeably.

Output pin no. 3 on the MC1648P must be isolated. This can be accomplished with a common source MOS buffer. Broadband gain is provided by an LM733 video amplifier (see "Wide-band Instrument Amplifier," April 1984 **QEX**.) Emitter coupled output to a BNC connector is provided by a 2N2369A high-speed switch.

The main tuning capacitor was salvaged from an old AM broadcast band radio set. It consists of an oscillator section of about 135 pF and a mixer section of 368 pF with a common shaft. This capacitor must be isolated for dc voltage from the chassis and the panel. The BC oscillator section alone is used for tuning the three upper bands, while both sections are used for the remaining four lower bands. This arrangement provides a more nearly uniform progression from one end of the spectrum to the other.

The 5-kilohm trimmer feeding terminal 2 of the LM733 should be adjusted for best square-wave output. This adjustment need be made only once.

The MC1648P could also be used in narrow-band VFO service successfully, especially if the variable capacitor is replaced with a high-grade fixed capacitor of good thermal stability, and the coil tuned by lead-screw and ferrite core. Reference my article, "A Variable-Frequency Oscillator for Communication Equipment," p. 6, August 1985 **QEX**.

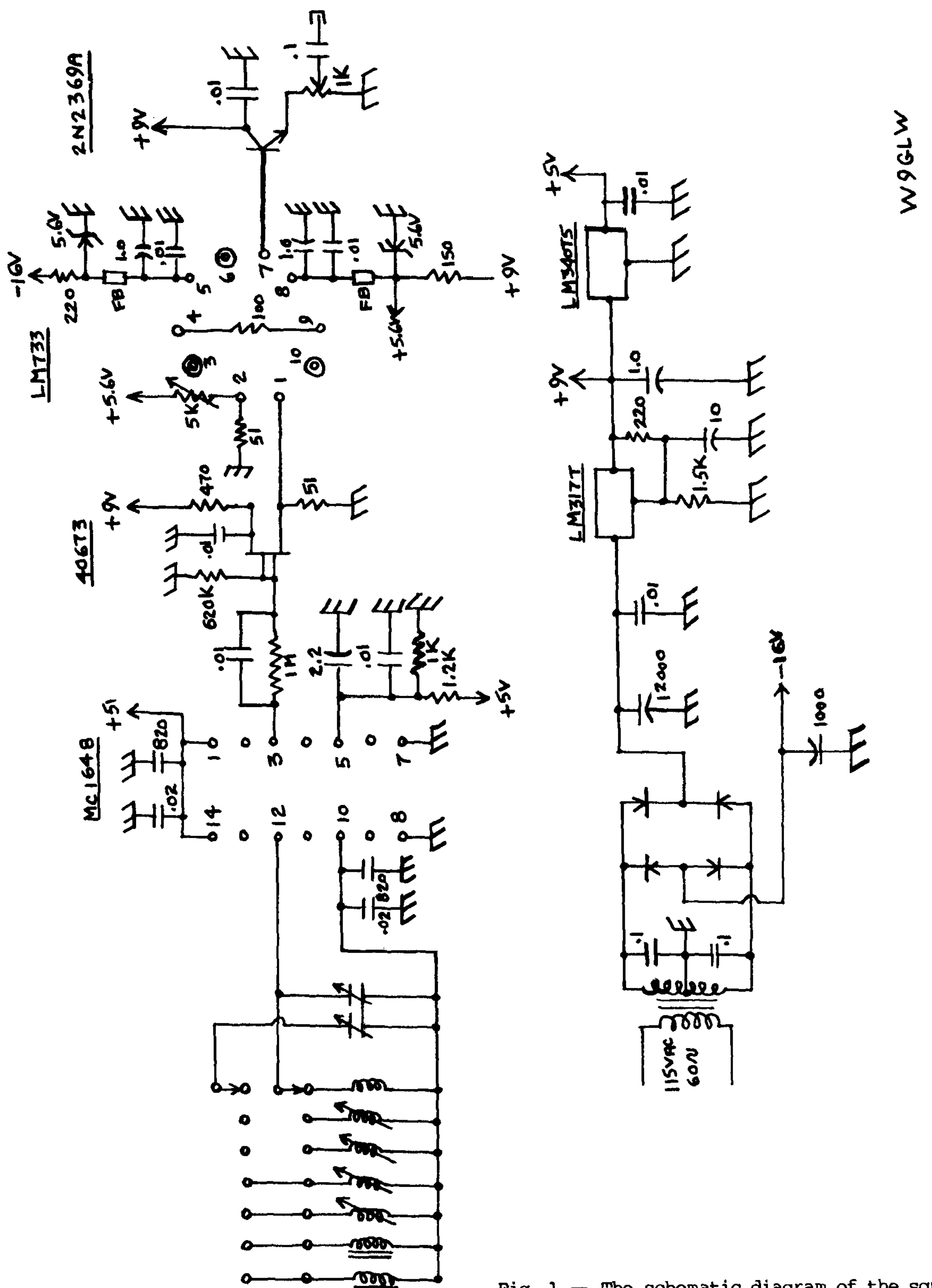

Fig. 1 — The schematic diagram of the square-wave generator. The frequency range is 47 kHz to 52 MHz.

Bits

RF Technology Expo 1986

The second annual RF Technology Expo will be held January 30 to February 1, 1986, at the Anaheim Hilton and Towers, Anaheim, California. The technical program features more than 75 original papers to be presented by RF engineering leaders from all over the globe. Subject material ranges from basic to advanced. The theme this year will be on "Developing the RF Engineer."

The Expo will present two special day-long courses on the "Fundamentals of RF Design." The morning session covers an introduction to high frequencies, while the afternoon discussion is on small-signal amplifier design. Registration is limited to 350 attendees on each of the two days it is offered (January 29 and 30). Registration for this seminar must be made in advance.

Approximately 144 booths will be on display to advertise new product developments and breakthroughs. Special group rates are also offered: three-day pass, one-day pass, or an exhibits only pass. If you would like more information on this Expo, contact RF Technology Expo, 6530 S. Yosemite St., Englewood, CO 80111. The session schedule for this event is listed below.

RF Technology Expo 86 Session Schedule

	Pacific Ballroom D	Huntington Room A-C	Capistrano Room A-B	El Capitan Room A-B	Avila Room A-B	San Simeon Room A-B
Thursday Morning January 30		**OSCILLATORS I** **Session A-1** Application Notes for Doubly Rotated Quartz Crystal Resonators — Lynn C. Heishman Practical Considerations for Modifying or *Pulling the Frequency of a Quartz Crystal* Oscillator — John B. Fisher Choosing the Right Crystal and Oscillator for the Application — Brian Rose	**POWER AMPLIFIERS I** **Session B-1** Average Efficiency of Power Amplifiers — Frederick H. Raab High Voltage HF/VHF Power Static Induction Transistor Amplifiers — *Robert J. Regan* Harmonic Wave Shaping for High Efficiency Power Amplifiers — Bill McCalpin	**RECEIVERS AND TRANSCEIVERS** **Session C-1** Intermodulation, Phase Noise and Dynamic Range in Receivers — Peter Chadwick Microwave Integrated Receiver for the Morelos Mexican Satellite System — Arturo S. Serrano Improve Synthesized Transceiver Performance and Reliability by Simple Screening of the VCO Active Device — Jaime A. Borras	**CIRCUITS AND COMPONENTS I** **Session D-1** A 140 MHz Lumped Element Hybrid — Rajeswari Chattopadhyay The Schottky Diode Mixer — *Jack H. Lepoff* Pin Diode Attenuators and Vector Modulators at Intermediate Frequencies — N.R.W. Long	**FILTERS I** **Session E-1** Design of Coaxial High-Pass Filters Having Various Transfer Properties — Dick Wainwright S-Band High Performance Combline — V.K. *Lakshmeesha*
Thursday Afternoon January 30		**SAW CIRCUITS** **Session F-1** SAW Accelerometers: Integration of Thick and Thin Film Technologies — Tim B. Bonbrake — Carl A. Erickson, Jr. Evolution Into SAW Resonators — *Ronald* J. Coash Harmonic Filtering of a 500 MHz SAW Resonator Oscillator — Philip Snow	**AMPLIFIERS** **Session G-1** The Q Factor of a Microwave Matching Network in RF Class C Amplifier Design. — P. Gonord, S. Kan and J.R. Ruaud Limiting Amplifier Design on High "K" Soft Board — *Steve Chambers* Design of a 900-1400 MHz Three Stage LNA Using Bipolar Transistors — Gary Franklin	**SYSTEMS** **Session H-1** Long-Range Radio Alarm System — A New Approach — David J. Goodman A Tracking Impedance Measurement System — *Virgil L. Newhouse* S-Band Butler Matrix Feed Network — V.K. Lakshmeesha	**ANTENNAS I** **Session I-1** Using Vertically Polarized Antennas to Reduce Interference with TV Reception — Don Jones Reliable Obstructed Path Coverage Determination — *Bruce Ziemienski* Extending the Bandwidth for a Helical Antenna — Al Henderson	**EMC/EMI** **Session J-1** How to Make Simple and Not So Simple Test Equipment in Your Own Lab — Jim Weir Simple Approaches to Limiting Radiation from Foil-Shielded Computer Cables — *Howard C. Rivenburg*
Friday Morning January 31	**COMPUTER AIDED DESIGN I** **Session K-2** The Poor Man's Engineering Work Station, or Cheap CAD. — Richard B. Kolbly Computer Aided Noise Temperature Measurement System. — George Peter Computer Aided Design of a Monolithic Microwave Amplifier — Bernard D. Geller — Gary G. Hawisher	**ADVANCED TECHNIQUES I** **Session L-2** An Automatic Network for Characterization of RF Circuits in Time Domain — M. Dragoman Mathematics of the Linvill Stability Criteria — Robert B. Gunderson Spectral Shaping of Radio Frequency Waves — Jerry J. Norton	**PACKAGING** **Session M-2** An RF Plastic Package Comparison Study — Lance Ulik — Kamil Gresko Packaging Considerations for RF Transistors — Norman E. Dye Crosstalk in VHSIC Packaging — A. Pergande — R. Canright	**FILTERS II** **Session N-2** Dielectric Resonator Filters for UHF and Microwave Applications — Marian L. Majewski Design of Combline and Interdigitated Bandpass Filters — Dick Wainwright PC Mountable Miniature Helical Filter — V.K. Lakshmeesha	**CIRCUITS AND COMPONENTS II** **Session O-2** The Pin Diode — Uses and Limitations — Jack H. Lepoff A Microstrip Miniature Transfer Switch — Rajeswari Chattopadhyay RF and Microwave Transistor Bias Con*siderations* — Gary Franklin	**RF POWER DESIGNS** **Session P-2** High Power Wideband Modules Using Silicon FETs — Lee B. Max — Robert A. Samsel Unequal Power Splitter Hybrid Couplers — S. Pal Practical Wideband RF Power Transformers, Combiners and Splitters — Roderick K. Blocksome
Friday Afternoon January 31	**BASIC TECHNIQUES** **Session Q-2** The Basics of RF Power Amplifier Design — Daniel Peters Understanding RF Transistor Data Sheet Parameters — Norman E. Dye New Insights into "Old" Network Analysis Applications — Lorenzo Freschet	**OSCILLATORS II** **Session R-2** Oscillator Design Using the Device Line and Load Pull Method — Gary Franklin Low Phase Noise VHF Quartz Crystal Oscillators — Measurement Specifications and Applications — Kim Peck Maximizing Crystal Oscillator Frequency Stability — Brian Rose	**POWER AMPLIFIERS II** **Session S-2** Power Amplifiers Using Pulse Duration Modulation — Su-Wen Zhang Automatic High Power RF Characterization — David Wandrei Design Considerations for a 1 kW Solid State L-Band Power Amplifier — Orville B. Pearce	**TEST AND MEASURMENT** **Session T-2** A 405 MHz Phased Array Antenna for Atmospheric Wind Measurement — Daniel C. Law Testing of Narrowband Communication Receivers — ACSB and SSB — Malcom Levy Broadband HF Antenna Testing — David L. Faust — Moray B. King	**DESIGNS** **Session U-2** Temperature Compensation Circuits for Data Transmitters — S. Pal A Phase Noise Analyzer Using A Low Noise PLL Crystal Oscillator Demodulator — William Ress Design of Dielectrically Stabilized Oscillators Using Feedback Techniques — M.L. Sharma — R. Partha	
Saturday Morning February 1	**COMPUTER AIDED DESIGN II** **Session V-3** An Evolution of Optimization and Synthesis Programs for Personal Computers — Stephen E. Sussman-Fort Aiding Computer Aided Design — Curve Fitting with any Number of Variables — Al Pergande Interactive Computer Aided Graphics Applied to RF Circuit Design — Alan Victor	**ADVANCED TECHNIQUES II** **Session W-3** Modulation Techniques for Biotelemetry — Robert W. Vreeland Use of a Computer Model to Determine the Complex Parametric Relationships of Crystal Oscillator Circuits — Gregory L. Weaver Time Delay vs. Frequency Variations Due to Impedance Mismatched Effects — Donald J. Lanzinger	**POWER AMPLIFIERS III** **Session X-3** High Power UHF Pulsed Push-Pull Amplifier Design — Joseph J. D'Agostino, Jr. New Hybrid Power Amplifier Modules Speed RF Systems Design — Eric Ulrich Two Power MOSFETs Deliver 1 kW RF — Helge O. Granberg		**CIRCUITS AND COMPONENTS II** **Session Y-3** Designing for Reliability with Bipolar Transistors — Gary Franklin Thermal Resistance — Class A/Class C Behavior in RF Bipolar Power Transistors — Antonio Morawski Practical Active Frequency Multiplier Design — Geoffrey Giese	**ANTENNAS II** **Session Z-3** Some Notes on Active Antenna Preamplifiers — R.W. Burhans Spherical Dielectric Antenna — S. Pal

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American Radio Relay League
225 Main Street
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telephone 203-666-1541

Larry E. Price, W4RA
President

David Sumner, K1ZZ
Executive Vice President

Paul L. Rinaldo, W4RI
Editor

Maureen Thompson, KA1DYZ
Assistant Editor

Geoffrey H. Krauss, WA2GFP (VHF+ Technology)
Associate Editor

Lisa Fuini
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