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ARRL Experimenters' Exchange

MAY 1990

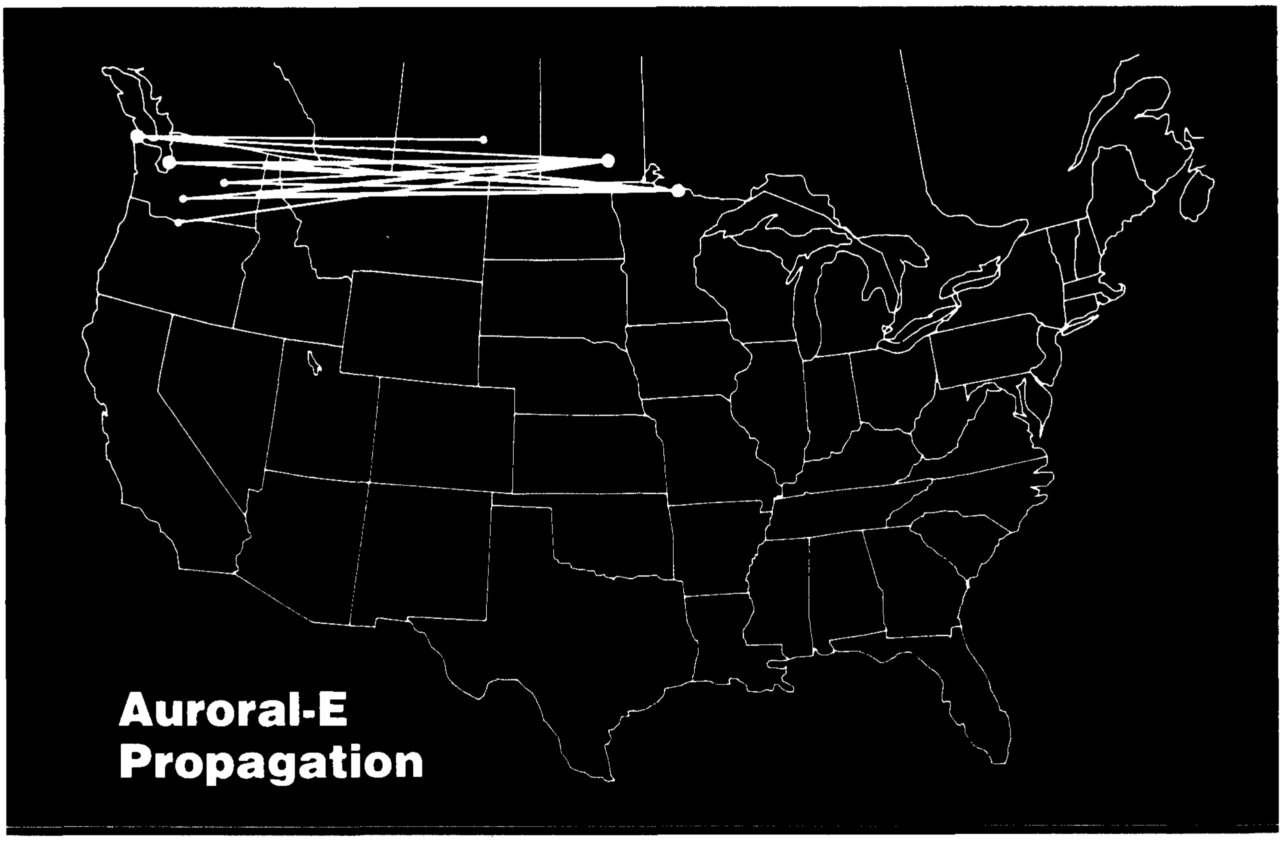

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TABLE OF CONTENTS

MORE 144-MHz AURORAL E —— **3**
By Emil Pocock, W3EP

144-MHz auroral-E propagation reported in August 1989 144-MHz, and some common characteristics it shares with the March 1989 event.

PSEUDO-SYNC: A TERMINAL PROGRAM FOR MODE B AMTOR, PART II —— **5**
By Jerry W. Egleston, Sr, WAØSVG

Included is a brief description of a conventional synchronzing method along with more detailed methods used by the author in Pseudo-Sync.

PACKET RADIO OPENS COMMUNICATION IN SUDAN —— **8**
By Patricia Mantey

How packet radio was used to connect the United Nations Development Program office in Khartoum with five field offices in rural Sudan. Reprinted with permission of *VITA News.*

COLUMNS

CORRESPONDENCE —— **10**

Update on antenna impedance measurement; moving ahead with Phase 4; filling a gap.

COMPONENTS —— **11**
By Mark Forbes, KC9C

Some basic information about voltage regulator ICs.

GATEWAY —— **13**

Highlights: HF packet radio with PSK successful; 9600 baud data communications via satellite; packet radio on RUDAK-2.

MAY 1990 QEX ADVERTISING INDEX

American Radio Relay League: 4
Communications Specialists Inc: 7
Digital Radio Systems Inc: Cov III
Down East Microwave: 12
Henry Radio Stores: 20
L. L. Grace: Cov II
P. C. Electronics: 19
Quorum Communications Inc: 18
SWIFT Enterprises: 12
Yaesu USA Inc: Cov IV

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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.

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

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

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

Empirically Speaking . . .

Future Systems

It is time to give some attention to what Amateur Radio systems should look like early in the 21st Century. Many of our present systems (for example, HF SSB and VHF FM) are analog. The ARRL 1990-1991 *Repeater Directory* shows more than 17,000 repeater listings, and the number has been growing steadily every year. Yet, the trend in electronic communications systems is now digital, and for good reason. Chief among them is that, once an analog source is encoded in digital form, it can be reproduced and relayed virtually an unlimited number of times without cumulative noise or distortion. The compact disc is now the medium of choice for music, and once-favored LPs are fading away. Similarly, digital tape and digital broadcasting promise to be significant in the future. Once people hear the clear, noiseless reproduction of digital sound, few will want to turn back the calendar to the good ol' analog days.

While there have been digital communications systems even before the beginning of radio (CW and RTTY, for example), voice and image communications have remained mostly analog in many radio services. That is rapidly changing, however. The newer fixed microwave relay systems are digital. The second round of cellular telephone systems will be digital. The federal government has used digital secure voice communications for many years.

Much of this migration to digital technology has come about as a result of the integrated circuit (IC). The microprocessor has become the heart of the digital circuitry but has been accompanied by an abundance of support chips. More recently, digital signal processing (DSP) ICs have made it possible to design multipurpose boxes capable of changing their characteristics by changing the software. Within limitations, the DSP process can be adaptive, ie, capable of changing itself to deal with different behavior of the incoming signal itself or inputs from other sources. All it takes to do wonders with DSP is a little software. The bad news is that the programming presently is esoteric and beyond the skills of the average individual. The good news is that some hams—notably Bob McGwier, N4HY, and Tom Clark, W3IWI—are already productive in this new technical environment.

The benefits of using digital communications for new Amateur Radio systems are manifold. One is simply that the quality of a voice transmission can be improved. Possibly that is not thought to be a high priority in the Amateur Radio Service, as we pride ourselves in our ability to read through QRM and QRN. Nevertheless, many hams appreciate the better quality of VHF FM over HF SSB or SSB via a satellite, and the ease of communicating ideas on VHF FM seems to support this.

Newer CODECs (coder-decoders) these days can deliver good speech quality with bit rates as low as 4 kbit/s. These rates are low enough to be accommodated by packet radio links operating at speeds of 4.8 kbit/s or higher. Multiplexing of several digital voice streams should be easily handled by 56-kbit/s packet systems with room left over for data communications. When the transmission speed is raised to 1 Mbit/s or higher, the number of possible voice or data streams becomes significant, and moving images could be transmitted.

Several experimenters are working on something called "DREAMNET." The idea is to link the country together with a backbone network (or web) of UHF-microwave stations transmitting T-1 (1.5 Mbit/s) or higher-rate packets. The radio segment of the station could be in the $250 range, with the digital segment comparably priced. Of course, the terrestrial backbone would be supplemented by satellite links. Such a network could be implemented in a way that would make it likely to survive, or be easily recoverable, in a catastrophe that disrupted normal communications.

If a DREAMNET-type backbone network were in place, we would still need local or metropolitan area networks to connect the local stations with each other and to the backbone network. An all-digital system would be transparent to the type of communications (whether data or voice), and a number of new user services would be possible.

There is much work to do to fully develop such concepts. Volunteers are needed to work on various aspects of future systems. The time seems ripe for a greater dialog between those volunteers leading to general consensus and an agreed system plan. The pages of *QEX* are available for that dialog.
—*W4RI*

More 144-MHz Auroral E

By Emil Pocock, W3EP
RR 3 Box 70 (Rte 207)
Lebanon, CT 06249

Since the announcement in December 1989 *QST* of the first-ever reported incidence of widespread auroral-E propagation on 144 MHz, which occurred earlier in the year on March 13-14, a second notable 144-MHz auroral-E event has been reported. This session took place during the early hours of August 15, 1989, along the Canadian-US border west of the Great Lakes. At least 25 contacts were known to have been made between 0615 and 0725 UTC, although one station reported a 144-MHz auroral-E contact as late as 0810. The number and extent of amateur contacts may have been limited by the time (0800 UTC was 2:00 AM local in the Central time zone) and the relative lack of 144-MHz stations in the western parts of the US and Canada.

The paths of all known contacts are plotted in Fig 1. The average distance spanned was about 1900 km, nearly the same as the longest contacts reported during the March event. The longest reported contact was made between WB7UZO (CN78) and VE3KNI (EN38) at about 2300 km; the shortest reported contact was about 1450 km, made by WB7UZO and VE5LY (DO70). Signals were exceedingly strong (up to 60 dB over S9), clear, and free of Doppler effects, consistent with E-layer reflections near the maximum usable frequency (MUF). The approximate midpoints of all 25 known contacts (shown in Fig 2) lay within a discrete area, further suggesting that a very small region of enhanced E-layer ionization was responsible for the unusual propagation.

Associated ionospheric conditions were similar to those reported during the March event. A geomagnetic storm was in progress. The geomagnetic A index was 61 on August 15 (up from 54 the day before), while the K index reached 6 at 0000 UTC August 15 and held at that level until at least 0900. Aurora propagation was widely reported across the northern third of the country on the 50- and 144-MHz bands during the August 15-16 period. Auroral-E propagation on 50 MHz was widespread for more than an hour prior to 0615 and continued for at least an hour after evidence of auroral-E on 144 MHz disappeared. Apparent double-hop 50-MHz auroral-E contacts were reported from the Pacific Northwest to the Canadian maritime provinces, New England, and the South. The aurora was visible across the northern tier of the United States.

Conclusions

Although this geomagnetic storm and associated aurora did not reach the magnitude of the March 1989 event, the two periods of auroral-E share common characteristics. Both took place during major to severe geomagnetic storms. Path midpoints, and thus the apparent location of unusual E-layer ionization, lay along the US-Canadian border. Strong aurora propagation on 144 MHz and widespread 50-MHz auroral-E conditions preceded the appearance of 144-MHz auroral-E. Auroral-E was observed on 144 MHz for relatively short periods of time: 72 minutes during March and 70 minutes in August.

This latest event seems to substantiate earlier

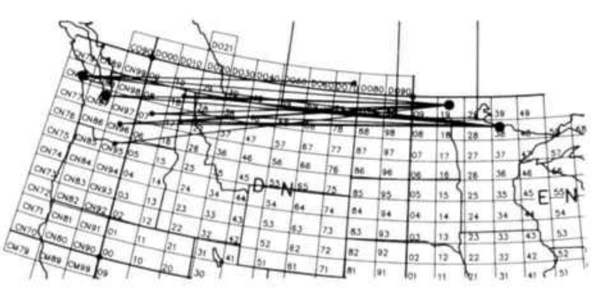

Fig 1—Paths of 25 known 144-MHz auroral-E contacts, Aug 15, 1989, 0615-0725 UTC. The lines may represent more than one contact along the same path. Large dots show the locations of reporting stations.

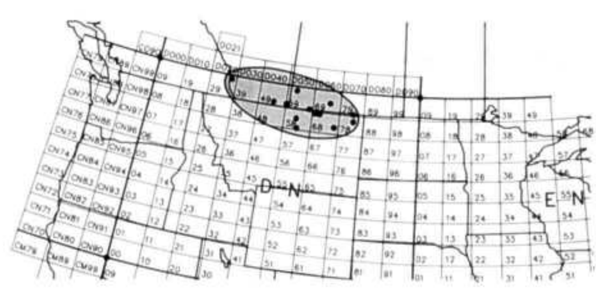

Fig 2—Midpoints of 144-MHz auroral-E contacts are shown by dots. The shaded area encompasses the midpoints of all 25 contacts and thus indicates the known extent of an E-layer region with an MUF greater than 144 MHz.

observations about auroral-E propagation. It behaves much like sporadic-E and appears to have a distinct MUF that rises and falls over time. Path distances fell within the E-layer single-hop range, although the 2300-km contact of WB7UZO and VE3KNI stretches that theoretical limit by about 100 km for E-layer reflections at 105 km. This suggests that ionization may have been a bit higher than average. It occurs during great auroras, but a K index of 6 may be sufficient to trigger auroral-E propagation as high as 144 MHz. Path midpoints during the August event (K = 6) were at a more northerly geographic latitude than path midpoints during the March event (K = 9) and at a considerably greater geomagnetic latitude, plotted as magnetic inclination. This is entirely consistent with long-term aurora observations, but suggests that 144-MHz auroral-E may be more common across Canada than previously suspected.

Prospects

Further episodes of 144-MHz auroral-E can be expected during the next two years as we go through the peak of solar cycle 22. Alert stations should monitor both 50 and 144 MHz for conditions that seem to precede 144-MHz auroral-E. Stations north of the Canadian-US border may wish to pay particular attention to this possibility whenever the K index exceeds 5. I would be most grateful for any further reports of these or future auroral-E episodes. Send reports to Emil Pocock, RR3 Box 70 (Rte 207), Lebanon CT 06249.

Acknowledgements

This report was based on the logs and observation of NF7X, VE3KNI, VE4ABE, VE4AQ, W7FI, and WB7UZO. I appreciate their contribution to this study.

References

Pocock, Emil, "Auroral-E Propagation at 144 MHz," *QST*, Dec 1989, pp 28-32.

Preliminary Report and Forecast of Solar Geophysical Data, 22 August 1989, NOAA-USAF Space Environment Services Center, Boulder, CO.

Bits

Johnson Space Flight Center to Host 1990 AMSAT Symposium

The 1990 AMSAT Space Symposium will be held at NASA's Johnson Space Center near Houston, Texas, on October 19-21. The Johnson Space Center Amateur Radio Club, W5RRR, will be this year's host.

Registration will open on Friday afternoon at the nearby King's Inn. Tours of the Center will be possible on Friday and Monday. The tour will include such areas as Mission Control, the Shuttle Mock-up facility, as well as the "Zero-G" Tank, a massive swimming pool used to train mission specialists for Shuttle Extra Vehicular Activities (rubber rafts are not allowed and space suits are not necessary).

The Symposium will take place on Saturday in the Visitor Center's Main Auditorium. It is sure to be a day packed with talks and presentations on various amateur satellites and related projects. The day will conclude with a Texas-style Bar-B-Que and the AMSAT Banquet.

Mark your calendar and make plans to attend this year's AMSAT Symposium. This is the "Year of the Amateur Satellite" and if you haven't gotten involved in the Amateur Space program, this would be an excellent way to find out what it's really all about. This is sure to be one of the most exciting Symposiums ever.

For more information, contact AMSAT at PO Box 27, Washington, DC 20044.—*AMSAT News Service*

Pseudo-Sync: A Terminal Program for Mode B AMTOR, Part II

By Jerry W. Egleston, Sr, WAØSVG
2813 Baker Rd
Independence, MO 64507

Introduction

When I began developing Pseudo-Sync, my (FEC) terminal emulation program for the C-64 computer, I wanted to try some unconventional methods of signal processing. Multiple sampling of the received data appealed to me, as did a method for maintaining synchronization that I call pseudosynchronizing. Pseudo-Sync shifts the receiver's data, while conventional methods shift the receiver's clock phase to maintain synchronization. This article will give a brief description of a conventional synchronizing method and then describe in more detail the methods I used in Pseudo-Sync. I think you will agree that these methods are unusual, if not unique.[1]

Phase-Lock Method

The most popular method of maintaining synchronization between a data receiver and transmitter is to recover the transmitted clock and phase-lock the receiver's clock to it.[2] Multiple sampling of data is sometimes used to determine when a data transition occurs during the bit time slot period. The phase of the receiver's clock is then varied to keep the data sample time near the center of the bit time slot. When using a computer, this can be done by loading smaller or larger starting numbers as needed into an interrupt counter/timer. In this way, the interrupts occur sooner or later than a standard cycle.[3] Frequent checking and small corrections keep the receiver's clock in phase with the transmitter's. The frequent corrections can also cause the receiver's clock to jitter or wander about a fixed reference point in time. The process is susceptible to noise influence.

Pseudo-Sync Method

Pseudo-Sync uses a much different approach. The computer's timer counts are not varied. Instead, the received data are shifted to maintain synchronization. Multiple sampling, a voter, and a signature analysis procedure (SAP) are used.[4] Data samples are taken seven times each ten millisecond and written into a mailbox. After each seven samples, the mailbox is dumped into an indexed signature analysis byte (SAB). After seven SABs are filled, signature analysis begins.

[1]References appear on page 7.

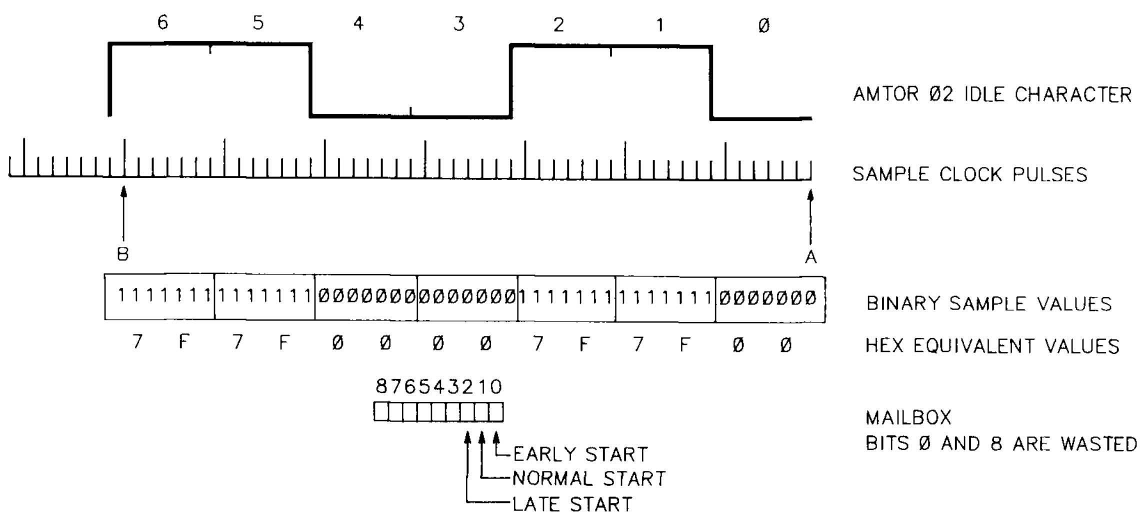

Fig 1

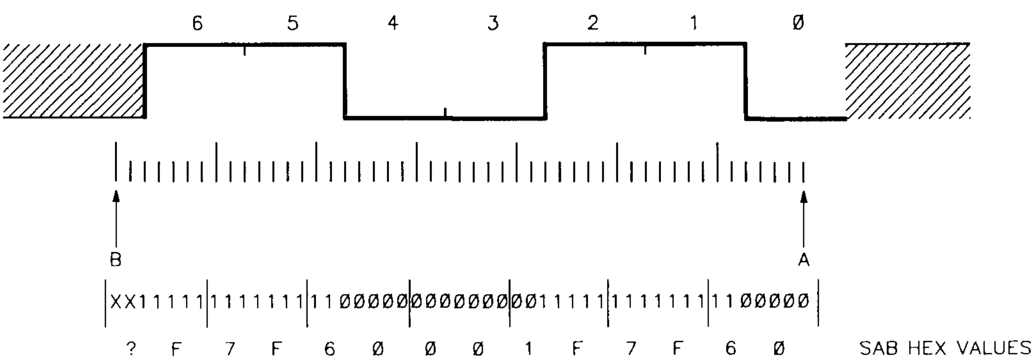

Fig 2

Table 1

Signature Analysis Byte Values for 02 Idle Reference Character

	6	*5*	*4*	*3*	*2*	*1*	*0*		
	7F	78	00	07	7F	78	0X		Three Periods Early
	7F	7C	00	03	7F	7C	0X		Two Periods Early
	7F	7E	00	01	7F	7E	0X		One Period Early
-----	7F	7F	00	00	7F	7F	00	-----	Normal Sync
	XF	7F	40	00	3F	7F	40		One Period Late
	XF	7F	60	00	1F	7F	70		Two Periods Late
	XF	7F	70	00	0F	7F	70		Three Periods Late

X means unknown, could be either 1 or 0

Signature Analysis

For each properly framed noise free bit of original data, Pseudo-Sync builds one SAB that contains either the Hexadecimal number 7F, or 00. 7F represents seven samples, all equal to binary one. 00 represents seven samples, all equal to binary 0. A phase shift between the transmitted clock and the receiver's clock will cause different hex numbers to form in the SABs. By performing some calculation, the SAP can determine if a phase shift is present and the relative direction. As we shall see, signature analysis also provides some security against noise influence.

Refer to Fig 1. At the top is a square wave representing an AMTOR FEC 02 idle character. Bit zero is at the far right. Shown directly below are the clock pulses that sample the square wave. The first clock pulse is at the far right. Point A is the anticipated beginning of the 02 character. Point B is the anticipated end. The taller clock pulses mark the anticipated data bit boundaries. Next down on the diagram are the binary values of each sample. The samples are divided into seven-bit bytes, SABs, with their hex equivalents shown just beneath them. With the conditions shown, the SAP will determine normal sync, although it is obvious that some phase shift is present. The resolution of the SAP is plus and minus one sample period.

Shown next is the mailbox. The program controls the relative phase between the received data and the transmitted clock while shifting data in and out of the mailbox. Note that the mailbox has nine bits. The mailbox is normally filled beginning at bit one and ending at bit seven. However, certain conditions will alter the starting point. Regardless of where the data enters the mailbox, after seven samples the data is transferred into a SAB from bits one through seven. Bits zero and eight are always wasted. More on the mailbox later.

Fig 2 is another representation of the AMTOR 02 idle character. The shaded areas before and after illustrate that during reception the preceding and succeeding bit values will be unknown. The actual values will change with the data being sent. Note the greater time displacement between the data and the sample clocks as compared to that of Fig 1. Also note the different values contained by the SABs. By studying the SAB patterns for various amounts of displacement, I could establish a simple method for the computer to calculate how much phase shift is present and the direction. Table 1 shows all of the valid SAB values for the various amounts of shift that can be detected by the signature analysis procedure.

Artificial Intelligence

SAB one and seven are not used in signature analysis because of the uncertainty of the previous and successive bit values. Here are the rules for SAP computation (hexadecimal number):

1. The voter must declare that a 02 idle character has been received.
2. The sum of SAB 3 and SAB 5 must be 7F.
3. The sum of SAB 2 and SAB 4 must be 7F.
4. SAB 3 must be 01, 03, or 07 for advanced phase. SAB 4 must be 00.

5. SAB 4 must be 40, 60, or 70 for retarded phase. SAB 3 must be 00.

Normal sync produces SAB 3 = SAB 4 = 00.

It is assumed that noise will produce values in the SABs that will fail one or more of the rules during SAP calculations. The program checks for this, and skips any action until all rules are satisfied.

Mailbox

As mentioned previously, the mailbox is used to shift the data and correct for a time displacement between the received data and the transmitted data. With conditions as shown in Fig 2, the SAP determines that the data is being read two sample periods late. To correct this condition, the SAP instructs the sampler to start filling the mailbox at bit two for the next (and only the next) SAB. After seven samples are taken, bits one through seven are transferred from the mailbox into the SAB. Thus a brutal, yet precise correction of one sample period is made. The SAP limits the correction to one sample position regardless of the amount of shift detected. If further shifting is needed, the process must wait until a new SAP instruction is received from a new set of SABs. Because the SAP resolution is plus and minus one sample period, only shifts determined to be two or three sample positions are acted upon.

Considerable time can elapse between corrections without losing data integrity. This is possible because of the voter and isochronous sampling, guaranteed by nonmaskable interrupts.[5] Pseudo-Sync can maintain sync during deep fades and sharp impulse noise. The program normally switches the terminal to standby when ten successive error characters are received. For grins, I disabled this feature. While receiving a very weak signal with QSB, the terminal never lost sync. Of course garbage was printed during the fade outs, but when the signal improved, printing resumed immediately.[6] My PK-232 had to attempt resync after each loss of signal, and printed far less data.

Conclusion

The techniques applied in the program are useful at relatively slow synchronous speeds and lend themselves to other applications. For example, modifying the SAB table data would allow the SAP to use characters other than idle for sync maintenance. The SAP's artificial intelligence could be beefed up to help identify unknown synchronous signals and perhaps to decode them without requiring any idle or synchronizing characters whatsoever![7] And, of course, the program does a respectable job for AMTOR FEC mode as it stands.

References

A generic copy of the program for the C-64 computer is available for free by sending a self-addressed, stamped mailer and disk to the author.

1. Information about specific procedures is hard to find. Much of it is proprietary.

2. For a brief treatment, see Jim Grubbs, K9EI, *Digital Communications with Amateur Radio*, (Richardson, TX: Master Publishing, 1988), page 2-10.

3. This is the method described by Robert M. Richardson, W4UCH, in "Packet Radio—The 3rd Generation Software Approach AX.25 Protocol," *ARRL Computer Networking Conferences 1-4*, 1985, page 3.91.

4. A description of the voter is given by the author in "Pseudo-Sync: A Terminal Program for Mode B AMTOR," *QEX*, November 1989.

5. True isochronous sampling is not possible. The sample period will vary slightly depending upon which instruction is executing and how far it has progressed when the interrupt occurs. However, nonmaskable interrupts insure much less variation than is common with maskable interrupts. The variation is further reduced by using mostly instructions requiring 3 or 4 clock periods to execute. Thus, the jitter should be limited to no more than three microseconds out of each 1.43 millisecond sample period, or about 0.2%. For more information about interrupts, see Dan Heeb, *Compute!'s VIC-20 and Commodore 64 Tool Kit: KERNAL*, (Greensboro, NC: Compute! Books, 1985), Chapter 1.

6. For version 1.4, you can do this by adding the following BASIC program line to the support program:

145 FOR I=50515 to 50522 :POKE I,234 :NEXT I

7. I have experiments planned to use the space character and artificial intelligence to sync on FEC. This should allow much faster printing when tuning upon a transmission in progress. (You know, the ones that send gobs of data without any idles.)

Packet Radio Opens Communication in Sudan

By Patricia Mantey
Photos by Mark Oppenheim

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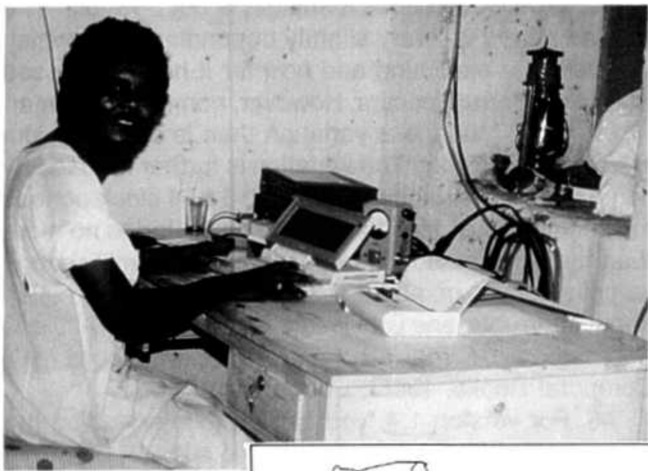
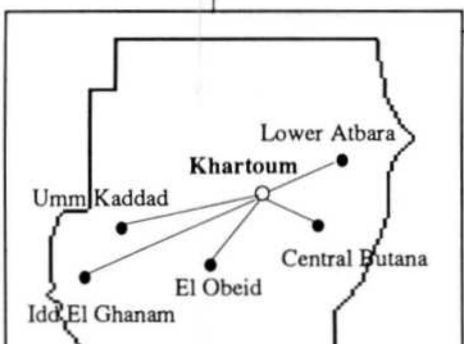




Locations of Area Development Scheme offices

"I was at home, minding my own business, turned on the computer, logged onto the local packet radio BBS, and saw an interesting message about Sudan, a strange and wondrous sounding place that I wasn't 100 percent sure where it was located." This is how VITA volunteer Mark Oppenheim, KD6KQ, described becoming involved with VITA's packet-radio project in Sudan.

Mark Oppenheim, along with VITA volunteer David Henderson, N3EOY, spent six weeks during the past summer in Sudan as consultants for a VITA/UNDP packet-radio project. They installed a packet-radio network to connect the United Nations Development Program office in Khartoum with five field offices in rural Sudan, and trained local operators to run and maintain the radios.

VITA became involved in this project through a request from the UNDP program director in Sudan, Dr M Taghi Farver, to use packet radio to improve their project communication capabilities. The project staff were already using lap-top computers for many aspects of their work, but needed to advance communication beyond voice capabilities. "We were attracted by packet radio's potential for powerful, rapid communications and its ability to make our project more manageable," said Dr Farver. "It is the only viable means of communication in such a vast country where no alternatives exist."

The UNDP program promotes rural development through an Area Development Schemes Project (ADS). The ADS field offices operate at the village level in such areas as agricultural credit and cooperative support, agricultural extension, training workshops, a technology resource center, replication of solar pump technology to increase water supplies, and reforestation programs.

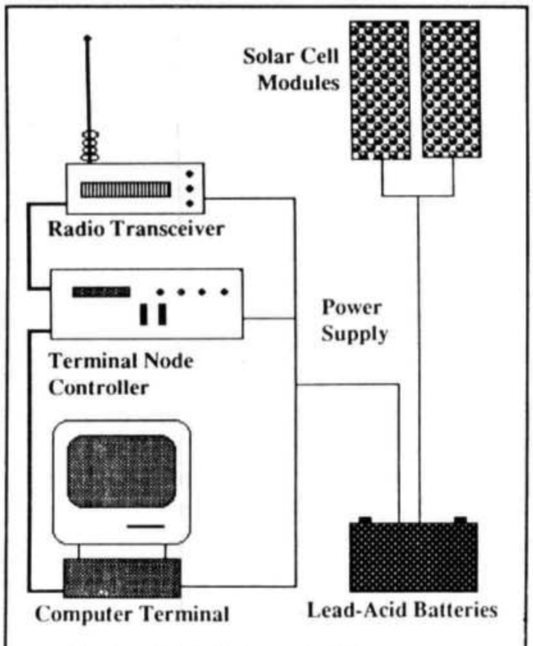
In the past, messages between offices were often hand carried long distances, sometimes through harsh desert conditions, and could take several days to reach their destination. Telex or radio messages could also be sent if such connections existed, but were often delayed because of unreliable power, or were communicated incorrectly because of audio problems or operator error.

"Each telex message that comes in needs to be retyped by the radio operator—a time-consuming process," said Mr Oppenheim. "Packet radio does away with this time-consuming and error-producing step, and permits large volumes of data to be transmitted immediately to and from any remote site with 100 percent accuracy, in a form that computers at either end can use.

"Because messages are printed out from the computer, packet radio breaks through all of the boundaries of static, cheap radio speakers, etc," continued Mr Oppenheim. "It eliminates the problems of tonal inflections and accents over a noisy sideband radio channel. In packet, no transmission is left to the imagination."

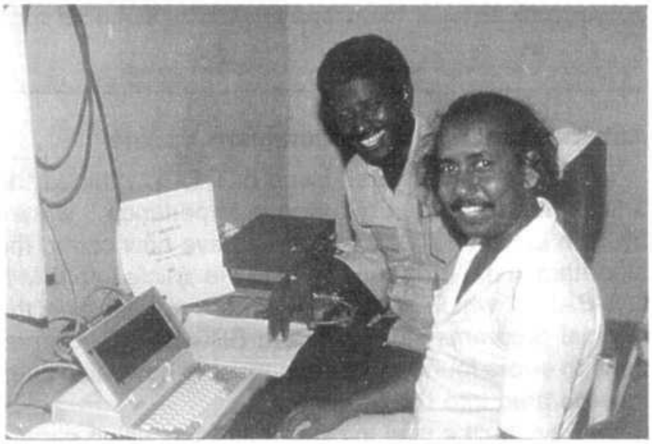
"Not only can they rapidly exchange administrative traffic, but they now have the ability to transmit computer binary files from spreadsheet and database programs instead of having to hand carry diskettes hundreds of miles," observed Mr Henderson.

Packet radio is used by the ADS offices to transmit field data, reports, administrative communication—functioning as an electronic mail system—and also for file transfers and technical and agricultural information exchanges. "The instant communication, and the rapid information and decision turnaround of the packet-radio system are a great contribution to staff morale," said Dr Farver. "Packet radio fulfills a need which we couldn't even dream of initially."



Packet Radio Schematic Diagram

Both VITA volunteers Oppenheim and Henderson have been Amateur Radio operators and packet enthusiasts for many years. They began working together to plan their trip long in advance, even though one lives in California and the other in Pennsylvania. "Mark and I spent many hours planning this project. We exchanged planning lists using the VitaNet BBS communications system," said Mr Henderson. "A lot of consideration was given to the types of equipment and personal gear to take with us. It paid off, as we found that we were well prepared." The volunteers also communicated extensively with Gary Garriott, WA9FMQ, VITA's director of information technology during pretrip planning, and consulted often with Norm Sternberg, W2JUP.


Mokbuhl Hussein (front) and Mutassim Hasan Farah send the first packet radio message from Lower Atbara

Once in Sudan, they encountered a number of technical and logistical problems, but none was insurmountable. A manufacturing defect was discovered in the station antennas, but after consulting with the manufacturer, new parts were shipped, and their stay in Sudan had to be extended to complete the installation.

Towards the end of the project, an intensive two-day training session was conducted in Khartoum. Two technicians from each ADS field site team received hands-on instruction in the more advanced features of the packet system from the VITA volunteers to supplement the on-site training each had already received. The operators received more than 20 hours of training, and each spent many additional hours experimenting on their own.

Both volunteers acknowledged that the cooperation they received from the Sudan project staff was essential to their mission. "The UNDP/ADS personnel, headed by Dr Farver, were great," noted Mr Henderson. "Their desire to make this project a success made our job much easier, and we couldn't have succeeded without them."

According to Dr Farver, the UNDP project is also interested in a possible linkage to VITA's low-orbiting satellite, PACSAT, to enable them to tap technical databases outside of Sudan. When operational, PACSAT will permit communications among more than 500 packet--radio ground stations through the world. The PACSAT prototype is scheduled for launch in early 1990.

VITA has been involved in packet-radio projects in the Philippines, Jamaica, Ethiopia, Mozambique, Tanzania, and Lesotho, and is currently designing and installing packet-radio networks in several other developing countries as a step toward building a global packet radio network.

The potential applications for packet radio are numerous and include health, agriculture, education, scientific exchanges, business development, and disaster relief assistance. For more information about packet radio for humanitarian purposes in developing countries or for information on becoming a VITA volunteer, contact: Dr Gary Garriott, WA9FMQ, Director of Information Technology, VITA.

Correspondence

Antenna-Impedance Measurement Update

The November 1987 issue of *QEX* contained the article "Measurement of Antenna Impedance," written by Tom Lloyd, G3TML, and me. I have now coded the algorithm of the programs used in the article into IBM® GW-BASIC, which should have more appeal than the original programs which were in BBC BASIC. Corrections to errors found by correspondents have also been incorporated into the programs.

I have built a new measurement box using a more symmetrical layout. The component leads are kept as short as possible. The performance at VHF (145 MHz) seems very encouraging. The bridge capacitor in the measuring box should be around 20 pF. Additionally, a small capacitor of 2 or 3 pF across the unknown Z socket will cancel out lead inductance; the exact value should be determined experimentally while making measurements on a suitable standard.

I am now preparing documentation to go along with these new programs. These .EXE and .COM files should run on any IBM or IBM compatible computer. I will make copies available to anyone who wants them. For your copy, send $10 (which covers my costs and airmail postage) to Peter Dodd, G3LDO, 37 The Ridings, East Preston, West Sussex, BN16 2TW England.—*Peter Dodd, G3LDO*

Filling in the Gap

As a recent subscriber to *QEX*, I'd like to express my satisfaction with the two excellent articles on VHF/UHF home-brew technology published in the January 1990 issue.

The articles "1.3-GHz Measurements using Home-Brew Gadgets," by John C. Reed, W6IOJ, and "Hy-Brid Hi-Power," by Tim Pettis, KL7WE, are the type which I am hoping you continue to publish.

In my opinion, *QEX* is filling a gap left by many other Amateur Radio publications.—*William Orr, VE3PUO, 11 Lakeview Avenue, St. Catharines, Ontario, Canada L2N 2P8*

[We want to print what you like to see. So, if you have any special topics of interest, we'd be interested in hearing what they are.—Ed.]

Phase 4—Time to Move Ahead

I could not agree more with the commentary by Dick Jansson on the status of the AMSAT Phase 4 program described by him in the February 1990 *QEX* editorial (yes, we *do* read these columns!). My impression is that the Phase 4 program has really been given the short end of the stick (perhaps for good technical or administrative reasons) in the past, but now is the time to move ahead in this area. Unless we can get a satellite up in orbit that the Amateur Radio generalist can use, we cannot expect the degree of operation that is needed to reduce congestion of the HF bands and increase the reliability of our communications capability during emergencies. When a good portion of your operating time is spent doing tracking duties, it is certainly my feeling that this detracts from our primary interest of communicating. I know that I have personally held off my active involvement in satellite communications until the point where I felt that there would be a reasonable possibility of a platform capable of being used in a convenient manner.

All of the points (and many, many more, including political ones) that he has raised are valid and require examination before we move further along.

Those of us who are technically inclined Amateur Radio operators appreciate the effort put into the publication of *QEX*. It does a good job in sharing information among us that we cannot get elsewhere.—*John H. Klingelhoeffer, WB4LNM, 1500 Kingsway Drive, Gambrills, MD 21054*

Bits

PMRK-2 Heater Kit

Designed to overcome the frequency-drift problems of free-running microwave oscillators, such as Gunn Sources, the PMRK-2 proportional Heater Kit from SHF Microwave Parts Company attaches to existing screws in such devices, and gently warms them to a constant (adjustable) temperature. The PMRK-2 will maintain temperature within 0.2 of a degree, consumes only 5 watts (average) at + 12 V dc, and uses no hard-to-find parts. Measuring 1.75 × 2.75 × 0.5 inches, it weighs just 1 ounce, comes with PC board, instructions and all parts, including an aluminum mounting bracket which mates with all standard UG-39 horn-mount bolts found on most Gunn Sources. Using the PMRK-2 Kit, 10-GHz Gunn oscillators can be stabilized within 5 kHz for long periods of time. Cost of the PMRK-2 is $20, postpaid, from SHF Microwave Parts Company, 7102 West 500 South, La Porte, IN 46350. Shipment from stock.

Components

By Mark Forbes, KC9C
P O Box 445
Rocklin, CA 95677

I received quite a bit of mail regarding last month's feature of the LM1211 single-chip IF detection system . . . even some "DX" from Europe. Reiterating the offer, if anyone is interested in obtaining some of these great parts, drop me a line and let me know how many you'd like; don't send any money though. When we get enough to make a quantity buy, I'll pool the requests and we'll get a bulk quantity at a good price. I expect the price to be in the $5 range.

Voltage Regulators

Based on the number of questions I've answered for ham friends in the last few months about voltage regulators, I've reached the conclusion that I must have taken them for granted. Integrated voltage regulators make power supply regulation simple. So, to answer those questions that you may have, or to refresh your memory about their operation, here's some basic information about voltage regulator ICs. The particular parts I'll illustrate the concepts with are all available from Radio Shack, and cost less than $2.

All of these devices are dc regulators, so you will need to build a voltage transformer, rectifier, and filter circuit to produce unregulated dc for their use. There are two types of regulator ICs available: fixed voltage and adjustable. For single voltage supplies, the fixed voltage parts are a bit easier to use where they are available. Radio Shack carries three fixed-voltage regulators, all packaged in TO-220 cases, and capable of delivering 1 A of current with a heat sink (Radio Shack #276-1363). The three voltages available are +5, +12, and +15.

Radio Shack also carries two types of adjustable regulators; the LM723 and the LM317T. The LM723 is packaged in a 14-pin DIP and can be used for circuits requiring 150 mA or less, or for driving pass transistors in high current applications. Output voltage is adjustable from 2 to 37 V dc. The LM317T is basically an adjustable version of the fixed regulators, packaged in the TO-220 case and capable of providing 1.5 A with a heat sink. The LM317T can be adjusted for output voltages from 1.2 to 27 V dc.

All the regulators require an input/output voltage differential to properly operate. In other words, you have to supply at least about 5 volts more on the input than you want on the output. The differential is necessary to supply voltage drops for the internal Zener diodes, plus allow for any sag on the input supply. Most will accommodate input/output voltage differentials of 25 to 40 volts; however, the power dissipation of the device is equal to V × I, where the voltage term is the differential voltage. Using the LM317T as an example, its maximum power dissipation is 15 W, maximum current is 1.5 A, and maximum voltage differential is 40 V dc. To get maximum current, 15 W/1.5 A, or 10 V dc is the maximum voltage differential that would not exceed the power dissipation rating. Be careful not to exceed any of the specs!

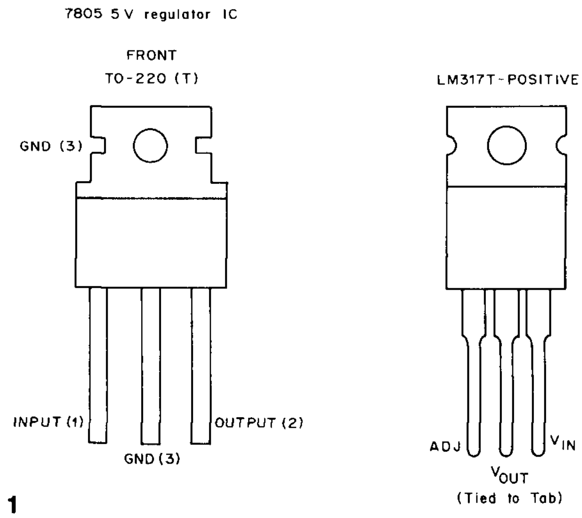


Fig 1

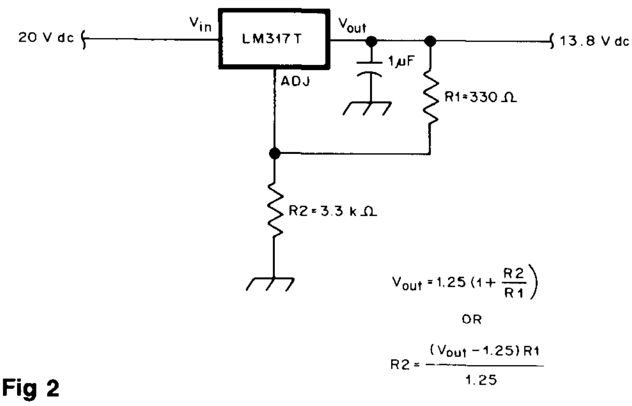


Fig 2

The fixed-voltage regulators are extremely simple to use. Basically, the unregulated voltage is applied to pin 1, pin 3 is grounded, and the output is taken from pin 2 (see Fig 1). You may find it prudent to bypass the output with about a 1-μF capacitor. If 1 A is insufficient, you can drive a pass transistor for increased current. Although some sources don't recommend paralleling regulators for increased current, I've found that this scheme often works okay. You may want to experiment with this to see what results you find.

The variable regulators are the ones I use most frequently. One reason is that equipment made to operate from "12 volt" automotive electrical systems don't actually use 12 V dc, but 13.8 V dc, which is what a car battery supplies. To get the 13.8 V dc, the variable regulator is very handy. These regulators are also useful in variable-voltage supplies, such as a bench supply.

Fig 2 shows a typical circuit using the LM317T. The output voltage is determined by R1 and R2, and is calculated with the following formula:

$$V_{out} = 1.25\,(1 + R2/R1)$$

You must choose your resistors so as not to drop below the necessary input/output voltage differential. Typically, R1 is a few hundred ohms, and R2 is a few kΩ. For an adjustable supply, try R1 = 270 Ω, and use a 5-kΩ pot for R2. Since you more often know the output voltage rather than the values for the resistors, a more handy version of the formula is:

$$R2 = \{(V_{out} - 1.25)R1\} \,/\, 1.25$$

With this formula, insert the value for the desired output voltage, choose a value for R1, and then calculate what the necessary value for R2 is for your output voltage.

To build a 13.8-volt regulator, use a 330-Ω resistor for R1, and 3.3 kΩ for R2. Input voltage should be about 20 V dc. Since either 5% or 10% resistors will be used, you may have to fine tune the values to get near enough to 13.8 V dc to operate your equipment. Using a small resistor in series with either R1 or R2 (depending on whether you need to increase or decrease the voltage) is the best way to fine tune the output voltage.

That's how simple voltage regulator ICs are to use. Pick up some and try experimenting with them yourself.

Bits

TAPR FAX

Tucson Amateur Packet Radio now has a fax on-line. If you wish to send an inquiry, order, sketch, a schematic for a problem, or whatever, TAPR can now accept Group 2 and Group 3 faxes. Just dial the TAPR number 602-749-9479 and tell your fax machine to start cranking. This line is multiplexed with the voice line and the answering machine, but if your fax sends fax tones to get things synchronized, our unit will automatically switch to fax mode and accept your transmission. The answering machine and fax are on-line 24 hours a day.

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

HF PACKET RADIO WITH PSK SUCCESSFUL

Earlier this year, Walt Kaelin, KB6BT, and Julius Breit, W9UWE, got several multimode TNCs that have phase-shift keying (PSK) modulation. Out of curiosity, they decided to try PSK rather than FSK on HF packet radio. Since early February, they have been operating 1200-baud PSK on 10 meters and the results have been astonishing.

Both stations are using TASCO TNC-24 MK II TNCs and Kenwood TS-440S transceivers with power outputs of 50 watts into vertical antennas. They are 4000 km apart. Much of the time, their HF PSK circuits compare very favorably with 1200-baud VHF/UHF PSK operation. If a "half-way decent" transmission path exists between them, they have no problem transferring lengthy files in approximately the same amount of time it takes on the landline at 1200 baud.

S-meter reading above S-1.5 at KB6BT and W9UWE will usually provide an immediate connect. Signals between S-1.5 and S-2 will pass traffic with mediocre results, usually with repeats. Signals above S-2 give excellent results with very few repeats. They also can handle traffic under severe fading conditions. The 1200-baud speed is fast enough to send one or more packets and receive an acknowledgment during signal peaks. They have set their PACLEN to 40 and have turned on CONPERM to prevent disconnection during fading.

PSK shows a surprising immunity to noise. At times when the signal seems barely audible in the noise, the stations will connect and acknowledge.

KB6BT and W9UWE believe that they are the first hams in the US to use PSK on HF. If any readers have PSK HF capability, KB6BT and W9UWE invite you to connect to them and leave a message. Presently, they are operating on 28.119-MHz USB. W9UWE is on the air most of the daylight hours with the mailbox call sign of W9UWE/1, while KB6BT is on the air 24 hours-per-day with the mailbox call sign of KB6BT/7.

The FCC restricts 1200-baud operation to 10 meters and above, but if you search, you can find much 1200-baud PSK activity on 15 meters when the band is open to the Pacific area. Many hams in Japan, Philippines, and Australia have switched to PSK operation and you can find them on 21.105- and 21.109-MHz LSB.

KB6BT and W9UWE like their results and are enthusiastic about the possibilities and advantages of PSK versus FSK HF packet radio. Give PSK a try to see if it can be the solution for some of our HF packet-radio problems.

from Julius W. Breit, W9UWE, and
Walt Kaelin, KB6BT

9600 BAUD DATA COMMUNICATIONS VIA SATELLITE

cmd:C GØK8KA v UOSAT3Q1

cmd:*** CONNECTED to GØK8KA VIA UOSAT3Q1
[04-Apr-90 22:12:03]

Hi Jeff - a world first??? >>>>

What say

Yes - a bit pedestrian, but what do you expect for a first cut. . .

Yes, but my tnc doesn't seem too happy with it!

Hmmm - shall I send you the file??? >>>

I gotta check some asynchronous tlm, so will have to suspend the pce for a bit. Sorry. . .
Yes, try to send it. now>> (* Phew! *)

OK will send. (* So I did *)

This is the first transaction to be digipeated through OSCAR-14 at 9600 baud between James Miller, G3RUH, and Jeff Ward, GØ/K8KA. The date and time are April 4 at 2215 UTC, orbit number 1041, and this is the fastest data transmission through an amateur satellite to date.

UoSAT-D is on 9600 baud for about 1.5 minutes every 5 minutes, sometimes longer. This signal sounds like an unsquelched background hiss. Yet, the squelch will be triggered as normal. To figure out if UO-14 is in 9600 baud mode, look for d:1 in the LSTAT telemetry frame. This means the high speed digipeater is on (d:0 means it is off). This is the same convention used in the Microsats because the same software is in use for these tests. The downlink frequency was 435.070 MHz, ± 10-kHz Doppler shift. As it uses FM, the receiver needed only occasional manual adjustments The uplink frequency used was 145.975 MHz.

Equipment at both ends was FT-736R with transmit audio directly connected to the varactor and receive audio directly connected from the discriminator. James reports that the two nondestructive additions to the FTQ736R took about 30 minutes to set up. Using similar techniques, many of today's commercial transceivers can be modified to allow for similar high-speed data communication. A 9600-baud full-duplex modem must drive the transceiver and some designs are commercially available now. (A comprehensive article describing the G3RUH design appeared in the *7th ARRL Computer Networking Conference* papers, pages 135-140).

from AMSAT News Service

RUDAK-2 TO CARRY PACKET RADIO

RUDAK-2, the second generation packet-radio experiment to RUDAK, now is completed, tested, and fully integrated into a Soviet geological research satellite, known as GEOS. It will fly in July and carry not only a Mode B linear transponder for SSB and CW contacts, but also a variety of packet-radio experiments.

The digital communications capability of RUDAK-2 is astounding: five different data rates from 400 bit/s to 9600 bit/s using various modulation schemes. Radio amateurs will have the choice of using four different uplink frequencies for the various data rates. There is also a provision for digital signal processing (DSP) experimentation. Powering this "super-TNC" will be two on-board computers, providing processing at 15 million instructions per second (MIPS). RUDAK-2 will be compatible with the AX.25 protocol and those amateurs who have equipment for FO-20, PACSAT, LUSAT, AO-13 PSK telemetry, and UO-14 will be ready to use RUDAK-2.

The following are the transponder specifications provided by AMSAT-DL:

Amateur Radio Payload: Linear and Regenerative Transponders

Linear Transponder Uplink: 435.030-435.120 MHz (90 kHz)

Linear Transponder Downlink: 145.880-145.970 MHz (inverted)

Output Power: 12 watts HF maximum.

Beacon: 145.880 MHz, CW telemetry.

RUDAK-II: Two on-board computers with IPS operating systems for packet radio (AX.25) (mailbox, telecommunications experiment with DSP up to nearly 20 kHz, etc), 1-Mbyte RAM disk, four separate uplink channels.

Gain of satellite RX and TX antennas: 2.3 dBi each (dipoles)

Input sensitivity: < -125 dBm (435 MHz) for a C/N_0 of 45 dBHz

SAT-RX-1: 435.016 MHz ± 10 kHz 1200 bit/s FSK NRZIC/Biphase-M (JAS, PACSAT)

SAT-RX-2: 435.155 MHz ± 10 kHz (AFC) 2400 bit/s BIT/SK Biphase-S

SAT-RX-3a: 435.193 MHz ± 10 kHz (AFC) 4800 bit/s RSM NRZIC/Biphase-M

SAT-RX-3b: 435.193 MHz ± 10 kHz (AFC) 9600 bit/s, RSM NRZI (NRZ-S) + scrambler

SAT-RX-4: 435.041 MHz ± 10 kHz (digital AFC) RX for RTX-DSP experiments

The downlink can be switched to the following operating modes:

Transmit frequency: 145.983 MHz

Mode 1: 1200 bit/s BIT/SK NRZI (NRZ-S) (like FO-20)

Mode 2: 400 bit/s BIT/SK Biphase-S (AMSAT mode for OSCAR-13 beacon)

Mode 3: 2400 bit/s BIT/SK Biphase-S (planned for OSCAR-13)

Mode 4: 4800 bit/s RSM NRZIC (Biphase-M) (like 4800 bit/s uplink)

Mode 5: 9600 bit/s RSM NRZI (NRZ-S) + scrambler (like 9600 bit/s uplink)

Mode 6: CW keying (only for special events)

Mode 7: FSK (F1 or F2B), eg, RTTY, SSTV, fax, etc (only for special events)

Mode 8: FM modulated by D/A signals from DSP-RISC processor (eg speech)

Power consumption: 14 V @ 350 mA (max) = 4.9 W; Standby: 80 mA (RUDAK without power amplifier)

RUDAK-2 is a joint project of AMSAT-U-ORBITA, the Adventure Clubs in Moscow, and the AMSAT-DL/RUDAK Group in Marburg, Munich and Hannover.

from AMSAT News Service

PIGGY PACKET SYSTEM AVAILABLE FOR AEA PK-232

Nova Comm Systems has announced the availability of the Piggy Packet System for the AEA PK-232 multimode controller that provides additional features not found on the stock PK-232. The Piggy Packet System rides piggyback on the PK-232 and, among its other features, provides power and voltage regulation and protection. The product includes the following features.

- 12 volt 1.2 A internal power supply,
- Fuse and overload protection for both units,
- Master power switch,
- Audio amplifier for monitoring packet-radio audio,
- Transmit lights for both radio channels,
- Custom input and output configurations for nearly every kind of radio,
- Special keying circuits for radios to prevent lock-up problems,
- DB-9 connectors for the PK-232 connection,
- Special circuitry for hand-held radios,
- Convenient size for stacking with the PK-232,
- Individual connections for speaker, MIC, and keying for each radio system, and
- Adjustable radio input levels for monitoring circuits.

The Piggy Packet System is available as a kit for $189.95 or assembled and tested for $249.95 from Nova Comm Systems, 4304 92nd Cir, Circle Pines, MN 55014, telephone 612-784-9059. Blank PC boards with schematics are available for $55 and the case and transformer are available for $75.

MULTIPLE TNCS PER RADIO

Bill Slack, NX2P, has designed a circuit that connects one to four TNCs to one radio to allow a network node or switch to share the same radio and antenna used by an existing PBBS or user. Bill has built several prototypes that let him greatly increase local network connectivity by multiplying the available RF hardware.

Two of his circuits at a dual-port PBBS permits it to access a backbone, while at his QTH, Bill uses one circuit for his personal station, a special service PBBS, and a network node. The activity on each is not very high and it permits him to run it all without getting another radio.

There is a fair amount of interest locally in making a lot purchase of blank PC boards and parts for the circuit. Currently, Bill has over half the number of commitments he needs to make it worthwhile and is looking for others who want to participate in the lot purchase.

from Bill Slack, NX2P, via CompuServe's HamNet

PACKET-RADIO NTS INFORMATION SOURCE

The Northern California Net (NCN) NTS handbook has gone to press. This volume contains all one needs to know about handling NTS traffic. The book is primarily for members of the NCN, but it contains material of interest to all hams involved in handling NTS traffic. A disk is also available with all the reference material necessary to become a crackerjack NTS operator. For information on obtaining these items, write to Steve Harding, KA6ETB, 1112 Arlington Ln, San Jose, CA 95129.

from *Indiana Packet NTS Newsletter*

ARES/DATA VERSION 1.2 AVAILABLE

Version 1.2 of ARES/Data, the public service, emergency communications data base application for IBM PCs and compatible computers is now available. New features include the following:

- DIR command that provides a brief listing of the public directory,
- Versions of the program with 3, 2, and 1 index files to provide faster import performance with large data bases,
- New parameter in the configuration file for DRSI PC*PA users with fast CPUs, and
- Inhibit journal file update during imports function to speed-up performance.

from W. E. Moerner, WN6I WN6I@K3MC

DSP USED TO RECEIVE DOVE MODE S PACKETS

AMSAT Ground Command Station N4HY got a Mode S receive-only down converter to help his efforts in uploading software to DOVE-OSCAR-17. But, due to a low index of modulation on the DOVE S-band transmitter, N4HY had to resort to using digital signal processing (DSP) techniques to copy the packets transmitted on 2401.220 MHz. Another factor that has caused him to turn to DSP is the very high Doppler shift present during Mode S passes for low-earth-orbiting satellites. On a recent DO-17, there was approximately a 100-kHz shift in frequency from the beginning to the end of the pass at 2401 MHz! With a down converter and a 45-element loop Yagi antenna, Bob will have sufficient signal-to-noise ratio to complete the DOVE software upload process successfully.

from AMSAT News Service

AMTOR-PACKET LINK STATION LIST

The following is a list of AMTOR-Packet Link (APLINK) stations, their selcal, location, hours of operation (if not 24), and scan frequencies (mark carrier). The source of the list was the WA8DRZ APLINK.

9K2DZ NKDZ Safit, Kuwait
14072

AH6D AAHE Honolulu, HI
14068.5 14069.5 14070.5 14071.5 14072.5
14073.5 14074.5 14075.0 14075.5 14077.0

DU9BC DUBC Davao City, Philippines
14072.0 (24 hrs) 7023 (mornings)

FE1JPY FJPY Angers, France
14070.8 (even wks 1300-2200Z, odd wks 1900-0100Z, weekends 1300-0100Z)

G4SCA GSCA Plymouth, England
3587.5 3589 7035 7036 14070 14070.5
14071.5 14072 14077 14081 (1300-2200Z)

HL9TG HLTG Camp Humphrey, Korea
14073.5

K1UOL KUOL Bethel, CT
14071.5 (days) 7077 (nights)

K2PEQ/4 KPEQ Fort Lauderdale, FL
14079 (1100-2300Z)

K7BUC KBUC Phoenix, AZ
7047.5 7071 10140 14071.5 14073.5 14074 14075

KB1PJ KBPJ Boston, MA
14070.5

KE5HE KEHE Hearne, TX
3607.5 3625 7037.5 7071 10140.5 10142.5 14070.5
14071.5 14072.5 14073.5 18102.5 21092.5

KK4CQ KKCQ Pensacola, FL
14070.5

LU1LDS LLDS Paso de Los Libres, Argentina
14072.3 (2200-0200Z)

NØIA/7 NNIA Las Vegas, NV
1400-0200Z (days) 3625 7071.0 10140.5 14070.5 14072.5
21072.5 21074.0 28125
0200-1400Z (nights) 3625 3627 7047.5 7071 7072.5
10140.5 14072.5 28.1255

N5DST NDST US MOW
14071.5 (1300-2000Z) 7075.5 (2000-1300Z)

ND6D NNDD /MM2
14069 (when vessel at sea)

NI9Y NNIY Mishawaka, IN
14072.5

OZ2FAR OFAR Farum, Netherlands
14076

PJ2MI PJMI Curacao
14077.8 (1000-1200 and 2200-0100Z)

SU1ER SUER Cairo, Egypt
14072 (testing only)

TG9VT TGVT Guatemala City, Guatemala
14074

V73AT VVAT Kwajalein, Marshall Islands
14069.5 14070.5 14071.5 14073.5
14074.5 14075.5 14077 14079 14081 (0800-0130Z)

VE8DX VIDX Pond Inlet, NWT, Canada
7073.5 7077 14071.5 14072.5 14073.5 14077
21071.5 21075 21079.8 28071.5 28075 28080

VK2AGE VAGE Goonellabah, NSW, Australia
7045 14075 14077 21076
(0200-0700Z beamed NA, 0700-1030Z Asia, 1030-1200Z NA
1200-1800Z EU, 1800-1900Z NA, 1900-0000Z EU)

VK2EHQ VEHQ Kulnara, NSW, Australia
14070.5

VK6YM VKYM Beckenham, Australia
14081 (1400-2300Z beamed EU, 2300-1000Z Pacific)

VU2DPG VDPG New Dehli, India
14079 (1400-0100Z) 28079 (0100-1400Z)

W1FYR WFYR Gilsum, NH
14070.5 14072.5 21074 (days)
7071 (nights)

WA1URA/9 WURA Grabill, IN
3732 7075.5 7076.9 10140.5 10141.5
14070.5 14071.5 14073.5 14074.9 21075.9 28123.9

WA8DRZ/6 WDRZ Redwood City, CA
10140.5 10141.5 14068.5 14069.5 14070.5
14071.5 14072.5 14073.5 14074.5 14075.5

WB7QWG/9 WQWG Indianapolis, IN
7072.5 7075.5 14071.5 14073.5 21071.5 28075.5

WB8APD WAPD Willoughby, OH
14071.5

ZF1GC ZFGC Bodden Town, Grand Cayman Island
14069.5 14070.5 14071.5 14072.5
14073.5 14074.5 14075.5

ZL1ACO ZACO Pukekohe, New Zealand
14072.5

ZS3NH ZSNH Windhoek, Namibia
14070

JOHNSON SPACE FLIGHT CENTER TO HOST AMSAT SYMPOSIUM

AMSAT has announced that the 1990 AMSAT Space Symposium will be held at NASA's Johnson Space Center near Houston on October 19-21. The Johnson Space Center Amateur Radio Club (W5RRR) is the host.

Registration will open Friday afternoon at the nearby King's Inn and tours of the center will be possible Friday and Monday. The symposium will take place Saturday in the Visitor Center's Main Auditorium. It will be a day packed with talks and presentations on various amateur satellite and related projects. The day will conclude with a Texas-style bar-b-que and the AMSAT banquet.

Many details have yet to be worked out, but if their schedules allow, Ron Parise, WA4SIR, mission specialist on the upcoming STS-35 shuttle mission, and Ken Cameron, KB5AWP, the shuttle pilot on STS-37, will be present. Ken's mission is scheduled approximately two weeks after the symposium, so he may have some late inside information on how he plans to operate during the mission.

from AMSAT News Service

TAPR packetRADIO STATUS

TAPR showed its packetRADIO at the Dayton HamVention® in 1989 as a "proof-of-concept" device. To make the radio reproducible, TAPR has undertaken an extensive design effort for the past several months.

The radio is now at the alpha test level. Six units were produced. Each radio has six PC boards: LO, exciter, PA, receiver, modem and optional TNC boards. In addition, the alpha circuitry will be designed to fit in a metal Ten Tec cabinet (TAPR is investigating a custom cabinet for the beta units).

After building and testing the initial alpha test unit, the other five units will be constructed. This will help TAPR in generating and checking documentation and reproducibility.

Once completing the six units, TAPR will make the needed alterations for beta test. TAPR probably will build one or two beta test units to be sure that the new layout of the PC board corrects whatever was wrong and did not add new problems. At that point, TAPR will get the parts for the beta test units. They expect this to happen by the latter part of the year.

Originally, the beta test was to have resulted in the distribution of 100 or so wired-and-tested units. That has changed. TAPR still hopes to place 100 units in the field for an extensive testing phase, but the units will be kits that will cost approximately $250 to $350 each.

The packetRADIO boards

The LO or local oscillator board provides two 50-ohm outputs near 99 MHz and has provisions for ovens on the four crystal oscillators. This board has been built, tested and is functional.

The exciter board generates a 45-MHz FM output and includes a balanced mixer to combine the LO energy and produce an output on 2 meters. Two stages of amplification follow the balanced mixer to produce approximately 200 mW of output on 2 meters. The board contains oscillators for simplex, +600 kHz, and −600 kHz.

The exciter board is currently being built and tested stage-by-stage. The initial results are encouraging.

The PA board contains the power amplifier and T/R switch. The board layout is complete and the bare boards were delivered in early April. The board will be populated in May and tested after that.

The receiver board also has been laid out and one prototype has been built. It has yet to be tested and adjusted. It was laid out from the functional hacked-up proof-of-concept board. It will likely be May or June before the alpha unit is tuned up and ready to be replicated for the remainder of the alpha units.

The modem board is laid out, built and ready for testing. This board generates the 9600-bit/s modulating waveform and the 1200-bit/s tones. The 9600-bit/s randomizer and 1200-bit/s demodulator are also on this board.

The optional TNC 2 compatible TNC board is built and tested. It is a four-layer board designed to be electrically quiet since it functions inside the radio. It is a TNC 2 with an added parallel output port to permit the TNC to control the radio's frequency, speed, and offset.

from Lyle Johnson, WA7GXD

GATEWAY CONTRIBUTIONS

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

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

Bits

Microprocessors: A Programmer's View

By Robert B. K. Dewar and Matthew Smosna, *Microprocessors: A Programmer's View* examines and compares the powerful microprocessor architectures developed by recent technology.

Covering all aspects of this technology, the authors analyze processors from a software point of view, including many assembly language programming examples to show the significance of the architectural variables among the different processors. The guide explains the characteristics of today's advanced PC and workstation microprocessors and presents detained material on the latest RISC (reduced instruction set computers) processors, contrasting the benefits and drawbacks of these chips compared to the older CISC (complex instruction set computers) design.

Microprocessors: A Programmer's View contains 462 pages with illustrations, is 6.5 × 9.25 inches, and sells for $39.95. It's available from McGraw-Hill Publishing Company, 11 West 19th Street, New York, NY 10011, tel 800-2-MCGRAW.

PACSAT Launch Boosts Third World Communication

From *VITA News,* January 1990 issue.

VITA's (Volunteers in Technical Assistance) PACSAT communications program took a giant leap forward on January 21, when an Ariane 4 rocket carrying seven satellites was launched into orbit from French Guyana. One of the satellites on board, the UoSat-D(3), contained the PACSAT Communications Experiment (PCE) as a payload. The PCE is the prototype for the PACSAT communications system.

The launch of UoSAT-3 begins the second of a three-phase PACSAT program to establish a global information network. The predecessor to the PCE, the Digital Communications Experiment, was launched in UoSat-2 by NASA in 1984. It became the first functional nonmilitary digital store-and-forward system of its kind in the world. Still in operation, it has paved the way for this second generation PCE. Both satellites were built by Surrey Satellite Technology LTD, a subsidiary of the University of Surrey.

The PCE on UoSat-3 will operate in both amateur radio bands and experimental frequencies for which VITA has been licensed. VITA currently holds the only experimental license for the PCE in the US. Use of the later frequencies is where VITA hopes to demonstrate the utility of storing and forwarding messages and computer files from and to Third World countries for development and relief purposes.

Potential applications of the PACSAT program for development activities are numerous according to Henry Norman, VITA's president, "PACSAT will truly accelerate the development process. There is no development without communications, and PACSAT will make it possible for even the most remote areas of developing countries to communicate with technical centers on a daily basis."

VITA would like to hear from organizations interested in developing a demonstration ground station project, especially for use in the areas of health, education, and environment. For more information on VITA's PACSAT program, contact Gary Garriott, WA9FMQ, at the address below.

VITA, Volunteers in Technical Assistance, is a private, nonprofit international development organization. It makes available to individuals and groups in developing countries a variety of information and technical resources aimed at fostering self sufficiency—needs assessment and program development support; by-mail and on-site consulting services; information systems training; and management of long-term field projects. For more information on VITA, or to send a tax-free donation, write to VITA at 1815 North Lynn Street, Suite 200, Arlington, VA 22209.