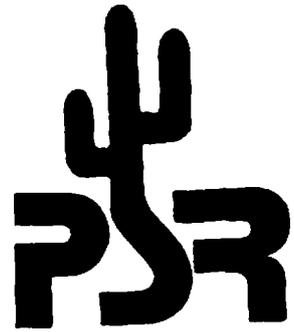


# Packet Status Register

May 1983

Number 5



## Tucson Amateur Packet Radio Corporation

With the appearance of more and more local packet radio groups, we hear more often the questions, "How can our group be affiliated with TAPR? Do our members all have to join TAPR?" We are trying now to work out an affiliation arrangement which would be mutually beneficial. We are duplicating each other's efforts in some areas, such as newsletter publication, and simultaneously competing for a limited supply of packet radio dues. However we need local organizations badly. We would like to be able to coordinate development activities by groups around the country instead of doing it all ourselves. A local group is also the only way to efficiently get new people started in packet radio. (Try to imagine getting someone in Newington to help you set up your first Novice station!)

Possibilities we are considering include regular local club news in the PSR in return for club support for PSR publication (we need more editors!), and reduced-dues arrangements for club members or rebates for affiliated clubs similar to the ARRL's arrangement. We need dues to finance our R&D efforts, you need money to put up your packet repeater, and you may have R&D efforts of your own. We all need more people to work on our projects. Let us hear your suggestions on this subject.

Margaret Morrison, KV7D  
Editor

TAPR will be going to the Southwest ARRL Convention again this year. It will be in Anaheim over Labor Day weekend. There will probably be at least a couple of sessions devoted to packet radio, and we are looking into the possibility of a booth. Based on our experience last year and the turnout at Dayton, there should be enormous interest in packet radio. If everything goes as planned, we should be turning out kits by September, so we will have lots to talk about. We would like to see as many of our West Coast affiliates there as possible. We'd also like to hear from members within commuting distance of Anaheim willing to let a few packeteers crash on the floor!

Don't forget the HF net on 21.280 MHz at 1900 Z Sundays. This net is turning into a good source of the latest packet poop. If the skip gets much longer on 15 meters we will have to move to 20. If you don't hear us on 21.280 try listening around 14.235. This is a preliminary frequency suggestion, and subject to change.

Harold Price, NK6K, reports from Los Angeles that Donald Jacob, WB5ERU, is in the process of putting a bulletin board up. They hope to have a dedicated message system/file server up soon. The L.A. group is also giving some thought toward the initial planning of a Phase III-B gateway system. As with most high-tech projects, much software, hardware, and \$\$\$ will be needed.

Paul Rinaldo, W4RI, has moved to Newington to take up his position as Senior Technical Editor of QST. We've seen packet radio and other digital techniques mentioned with increasing frequency in QST lately, and we hope that this trend will continue under Paul's editorship. We're sure Paul will do a good job for us as well as for thousands of other hams.

Paul reports that he is editing Chapter 14, Specialized Communications Systems, of the 1984 Radio Amateur's Handbook. This chapter will include satellites, EME, 10-GHz Gunnplexer communications, amateur television, spread spectrum, RTTY, and packet radio. He is planning to add a section on AMTOR and expand the packet portion. Any ideas or suggested material should reach Paul no later than June 1.

Den Connors, KD2S, past president of TAPR, has moved to Massachusetts to become the new data communications guru for Wang. Those of us in Tucson will miss Den, but we couldn't help noticing that he seemed glad to be going back to the East. Good luck in the new job, Den.

A meeting will be held in the early summer between members of the West Coast Beta Test groups to get started on linking from San Diego north to San Francisco and points between. Initial discussions between Hank Magnuski, KA6H, and NK6K indicate that a meaningful link can be established with existing TNC hardware and either small changes to the TNC software or a small microcomputer controlling two TNCs. Anyone wishing to get in on the fun should contact his local Beta Coordinator or Harold.

We have a report that ZL1WN and ZL1AOX are on the air exchanging CP/M .COM files and text with good results. Isn't ZL1AOX, is anxious to start transmitting data to AMSAT people in the U.S. via packet radio on HF.

Tom Clark, W3IWI, has tapes of packets being bounced off the moon from the 140-foot telescope at Greenbank. Unfortunately, he was not able to achieve a successful connect with himself.

Dick Gulbrandsen, WD9DBJ, says that the Chicago Area Packet Radio enthusiasts have gotten together and formed a local club. We welcome CAPR to the packet radio scene, and look forward to hearing about their progress.

PLEASE look on your TNC. If one of the EPROMS says "FUJITSU" or "27C64", contact TAPR at once! This EPROM belongs to one of us here in Tucson, and we will replace it with a standard device. Thank you!

# The President's Corner

by Lyle Johnson, WA7GXD

JOIN THE PACKET RADIO REVOLUTION! proclaimed the handout sheet in bold print. At the Dayton Hamvention, packet radio was well represented. The St. Louis bulletin board system was on the air. Pete Eaton's TNC was attached to a terminal that the public could operate. A color videotape was running recorded off-the-air packet displays. AMSAT had a TAPR TNC hooked up monitoring the booth's activity and occasionally connecting to the bulletin board. We rotated manning the booth, and I can't remember a time when there were fewer than 5 people asking questions, grabbing flyers and generally expressing interest.

We had a two-hour time slot for the Packet Forum in the largest meeting room at the Hara Arena. Was there interest? I can only say that we were the only group to fill the room (400 to 600 seats) and have people standing around the walls. At the end of two hours, over half were still there!

Paul Rinaldo, W4RI, led off with a history of packet activity, followed by Pete Eaton, WB9FLW, with a talk on packet radio fundamentals and the St. Louis gang. I gave a description of TNC functions and some TAPR hype, followed by Bob Neben, K9BL, who talked on packet applications with emphasis on emergency communications. Bob then provided a demonstration of packet radio.

We had help from many organizations to make the Dayton trip a success. SLAPR provided the booth, and Bill Reed, WD0ETZ, and Pete Eaton worked hard to organize the presentation. The Miami Valley FM Association printed a few thousand handouts. Hats off to Bob Neben for organizing the forum, and getting the time and space with the Dayton committee. AMRAD helped man the booth, provided a VADCG board and copies of the AMRAD Newsletter. ARRL provided copies of QEX and a sample of the Proceedings of the San Francisco Conference. TAPR provided TNCs, a Beta Test Manual and sample copies of the Packet Status Register. It all went very, very well.

The ARRL Southwest Division Convention is scheduled for Labor Day weekend in Anaheim, CA. TAPR is requesting three time slots as well as booth space. The SW Division Convention was held in San Diego last year, and was a turning point for TAPR, as we changed from a local group to a

regional group. We hope to return this year with more to offer than memberships in a fledgling organization.

We are hoping to be able to have tutorial sessions on packet radio during the first two days of the convention with a hard-core technical session on the third. In addition, we hope to be able to offer TNC bare boards and parts kits!

TNC boards and kits?! Yes! Once the redesigned TNC has been laid out, we expect to do a trial run of about 20 TNC kits. These should be ready around the end of June. The trial run will enable us to check out the new design, and simultaneously to evaluate the kit and its directions. The kits will be purchased and assembled by selected individuals in Tucson and at Beta Sites. The sites which have exhibited the most technical expertise will get a chance to have one or more of the folks who have been clamoring for a board to actually get one!

The rules are simple enough. The site agrees to support the person(s) getting the kits. The kits will be carefully built and tested within two weeks of receipt. The Beta Coordinator will look over the kit builder's shoulder. Please note that this is not a trivial job, and that we will be counting on you to come through.

Since this is still a testing phase, only TAPR members will be allowed to participate. We must prove that the hardware changes and revised board layout have helped (or at least not hindered) the performance of the TNC, and that the assembly portion of the manual is clear and understandable.

After this final test of the kits, and assuming that Beta Test has provided the rest of the field input needed, the kits will be made available. As in Beta Test, advance deposits will be required and disclaimers will have to be in our hands prior to shipment. Once a general release is made, it will be on a first-come, first-served basis, with the exception that TAPR members may get preferential placement. If all goes well, the first kits should appear around the beginning of August.

So talk it up! Packet is here! TNCs are just around the corner!

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The Tucson Amateur Packet Radio Corporation is a nonprofit scientific research and development corporation. The corporation is licensed in the State of Arizona for the purpose of designing and developing new systems for packet radio communication in the Amateur Radio Service, and for freely disseminating information acquired during and obtained from such research.

Anyone may join TAPR by filling out a membership application and paying yearly dues of \$12. Members may vote for members of the Board of Directors, hold office, and serve on the Board. The annual meeting is held in Tucson on the first Saturday in February.

The officers of the Tucson Amateur Packet Radio Corporation are:

Lyle Johnson, WA7GXD	President
Den Connors, KD2S	Executive Vice President
Heather Johnson, N7D2U	Secretary
Chuck Green, N8ADI	Treasurer

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# Software Update

by Margaret Morrison, KV7D  
and Harold Price, NK6K

Work is beginning on Version 3 of the TNC software. This will be a major revision and will include a number of new features. In particular, it will support the prom-programmer attachment which is now in the testing stage.

A severe problem which is now confronting the software developers is that the software has just about expanded to fill the space available. Version 2.1 software used all but about 2 K of ROM. (People who programmed the Vancouver TNC, with its 4 K of ROM will please be quiet.)

We are investigating a couple possibilities for alleviating this crunch. We may be able to get access to a more efficient P-code system to replace the native-code 6809 Pascal compiler we are now using. There are a couple candidates under investigation, and the deciding factor will be whether we can conveniently burn proms with the source produced by these systems. If we can not compress the code into 24 K after adding all the features we would like, we will probably resort to using the memory expansion planned for the kit version of the TNCs. In order to maintain compatibility with Beta owners who don't want to invest the rather stiff price of a 27128 EPROM, we will choose the least essential features to locate in the lower 8 K of ROM. This will be done in such a way that the extra features may be added by replacing the Version 3 "A" 2764 EPROM with a Version 3 27128. Some hardware changes will also be necessary in order to use a 27128.

Following is a summary of the principle modifications proposed for Version 3. The "optional" designation means that the feature is high on the list of candidates for that bottom 8 K which is not on Beta boards. We would like to hear your comments on this designation, but please realize that space will be limited!

## EPROM Programmer

Software will be provided to allow copying from any ROM socket to the 2764 or 27128 EPROM in the programming socket. The software will use the Intel fast-programming algorithm which is also compatible with other brands of EPROMS and older 2732s and 2716s, although the algorithm may not program them more rapidly than the conventional procedure. An optional feature will accept input from the RS-232 port in Intel hex or Motorola S-record form for storage in RAM in blocks of up to 4 K. This would allow you to use the TNC as a general-purpose programming attachment to your home computer.

## Morse ID

Version 3 will assume the hardware modification to allow FSK IDs and will read the state of the transmitted tone in order to get the CW right side up. The only difficulty with an unmodified Beta board would arise if the input line (which is now floating) is in the wrong state, which would cause the ID to be sent with tones and spaces interchanged, for a truly unintelligible result. To prevent this, the input should be tied to the appropriate power supply rail.

Primarily in response to comments from Beta Sites outside the U.S., we will include a feature to allow disabling of the ID, and specification of an ID string different from the packet address string.

## Terminal I/O

Version 3 will allow the parallel port to be used for terminal I/O instead of the RS-232 port. If the RS-232 port is used for terminal I/O, status information will be output on parallel port pins. This will include a connected signal and link status, and possibly link condition information in the form of number of retries required. An optional feature will allow the user to define a command data stream and a packet data stream which can be separately assigned to the RS-232 port or the parallel port. This, if enabled, would replace Command Mode, and messages from the TNC operating system would appear on the command-stream port.

## New Hardware Support

The NOVRAM extension will not be used in Version 3 but will probably be required in an early update. The peripheral line currently used to read switch 2 will be used as a NOVRAM address line in the new TNC design. Version 3 will not support use of switch 2 to override the default parameters to specify 110 baud. If space allows, an autobaud routine will be included to compensate for this loss.

Optional software will determine the system clock speed (1.8432 MHz or 921.6 kHz) by calibrating the system clock against the UART clock. This will allow compensation of the timing functions and HDLC baud rate programming for the fast-clock option of the new TNC design.

## Protocol

A super-transparent mode will be an optional feature which will allow the TNC to be used as a Level 1 packet transmitter and receiver. Any packet received will be transmitted, header and all, as full eight-bit characters, to the async port. Information received from the async port will be transmitted to the HDLC exactly as received. This will allow the user to write his own Level 2 protocol on his own computer. The user may even choose to receive frames with bad FCS, to allow a forward-error correcting protocol to be used.

Version 3 will implement a call-back feature. If a TNC receives a connect frame when it is already connected to another TNC, it will send this information in a special type of frame. The calling station will thus get a "busy signal" instead of no answer.

## Bugs in Version 2.1

The major problem Beta participants have had interfacing TNCs to computers involves flow control. Most cases of missed characters are traceable to failure to implement flow control by the computer. However, there is a TNC bug which appears if FLOW is ON. If a control-S is sent to the board, followed by other other output, the control-S is undone by the typein flow control at the end of the output line. Recommended fix is to turn FLOW OFF.

The PID byte added in Version 2 appears a few places it shouldn't. A funny character at the beginning of an incoming packet, usually "p", is the PID byte. Don't worry about it.

# Hardware Happenings

by Lyle Johnson, WA7GXD

Members of the TAPR hardware team met in Tucson in mid-May to review the field input on the TNC design. While all of the results are not yet in, especially on the demodulator portion of the modem, fairly firm plans have been made for the TNC board revision. The changes are outlined below.

Please note that all important changes can be easily made to the existing Beta boards. We have also tried to keep the changes such that software compatibility will be possible between Beta TNCs and the new design. If there is sufficient interest, we may be able to provide "upgrade kits" consisting of the ICs necessary to perform these modifications to the Beta boards.

## FSK Morse ID

A 74LS86 exclusive-OR gate will be added, with inputs from HDLC TxD and VIA CB2. TxD and !MISCIN pins of HDLC will be tied together to enable software to read the TxD state to ensure the CWID is "right side up." Beta TNC owners who do not make this modification should tie !MISCIN to either +5 or ground (to be determined) to allow the present CWID to function properly with the new software.

The tone on-off command will be tied to the PTT command line !MISCOT of the HDLC controller. This will suppress tones so that the operator can use a microphone while the TNC is hooked up to the radio.

A 10 K resistor will be placed in series with the +12 volt line to R33 to protect both R33 and U25 from damage due to attempting to switch the tone on and off with the wiper of R33 at the +12 volt end of its travel.

## Transmitter Keying

A VFET will be used with a Zener diode to suppress spikes, in place of the existing Darlington driver. This should result in a more universal keying circuit.

The watchdog timing capacitor will be increased by a factor of at least three to allow use in a slow speed environment such as HF.

## Modem

Nonpolarized coupling capacitors will be used for all external audio connections. The speaker load resistor will be AC coupled. Testing is being conducted to improve the performance of the demodulator.

Jumpers will be provided to disconnect the on-board modem. The jumpers may be replaced by a connector to an off-board modem. The connector will provide the user with access to virtually all of the HDLC external I/O pins for maximum flexibility. Pull-up and pull-down resistors will be used for default settings of these pins.

## Memory

Jumpers will be provided for pin 23 of U7 and U8, like that currently provided for U9. This

will allow use of 8 K RAMs or EPROMs in these sockets. U10, U11 and U12 will have pin 26 tied to A13 for compatibility with 27128 EPROMs. The address decoder will be programmed to address a 27128 at U18. The 6809 !MALT line will be tied to +5 via a pull-up resistor to allow use of RAMs such as the Intel 2186 "intelligent" RAM.

## NOVRAM

U27 will be changed to an XD2212 256-by-4 device, four times as large as the current one. U6 line PA1 will be tied to one of the new address inputs, and switch 4, in conjunction with a pull-up resistor will be tied to the other. This will provide twice as much software-accessible NOVRAM storage in each of two switch-selectable banks. This feature will allow the operator to select either of two sets of parameters, which would be useful for transparent and conversational modes, or husband-and-wife stations.

## RS-232 Port

Pull-up resistors will be added to all inputs, eliminating the need for JPI and jumpers in the RS-232 connector to allow use of "three-wire" RS-232 terminals. U15 will get 0.1 ufd bypass caps from pin 1 and pin 14 to ground. The DB-25 connector will be changed to female in accordance with RS-232 standard.

## Power Supply

A new transformer will be wound to provide adequate voltage to the 7812/7912 regulators. Bypass capacitors will be more evenly spread. The negative-voltage regulators will have 10-ufd bypass caps. The 5-volt rectifier will be changed to a 3-amp bridge. Pins will be provided to allow use of an off-board 5-volt regulator. Filter capacitors will be at least 3/4 inch from the on-board heat sink.

## General

All connectors will be polarized, and shrouded where practical. Mounting holes will be plated through and grounded. Open spaces on the board will be gridded with ground foils. All LEDs and switches will be tied to a 16-pin DIP socket for ease of extension to a front panel. LEDs will be added to monitor the Data Carrier Detect and RxD inputs to the HDLC chip. Two more LED indicators will be provided with inputs left to the discretion of the user. (Possibilities include RS-232 TxD and RxD.) This will leave one section of the Darlington driver for a user-defined function.

The clock oscillator will be doubled in frequency, to 7.3728 MHz. This will allow the TNC to support higher data rates, such as might be required for PACSAT use or future packet-radio radios, designed for digital communications. The divided-down clock signal to the microprocessor will be jumper-selectable, since use of the 1.8432 MHz input may require higher speed parts.

There you have it. If you have any comments or suggestions, call us today! Express mail probably won't be fast enough!

# Beta Test Status

by Dan Morrison, KV7B

I never thought I'd be able to write these words, but WE'VE SHIPPED ALL THE BOARDS! (Even the one for Tom Hutcheson!) Naturally, instead of relaxing, the Tucson group is now in the throes of digesting all your suggestions/complaints/wish-lists.... We're also digesting the information you have been sending us about radio and terminal interfacing. I'll discuss some of this information with you in the hopes we can act as a sort of information exchange.

## Computers and Terminals

So far, we've been told about people hooking up the Apple II, 2100, H89, TRS-80 Color Computer, Model I, and Model III. There are also several S-100 systems running, a Big Board (with a hum-dinger of a BBS program on it, we understand), and several other home-grown systems hanging off the TNC async port. Unfortunately, very few of you have come forth with software descriptions or interfacing information. (The interfacing we understand--after all, how many ways can you run RS-232?) It seems that most software being used, either for terminal emulation or for BBS service is of the "I bought it for \$29.95 down at Fast Freddy's Bit Palace" variety, and not of the "After only 3 weeks of 8-hour-a-day labor I've written a complete comm package including all ISO layers up through level 6" variety. However, we do have some information. This breaks down as follows.

### Hardware

It seems about fifty percent of people polled wish we'd picked the opposite sex terminal connector. In view of the fact that devices acting as modems really should have the opposite sex at the terminal end of the cable, this change will be made for the kit version. In addition to this, several people have pointed out the (now) obvious solution of including pullup resistors to allow no-jumper 3-wire connections. This shall also come to pass.

We've received one list relating pin numbers on the Model I expansion interface J1 connector and the TNC's DB-25 connector. And that, folks, completes the list of digital hardware interfacing information we've received. (We've also received many many suggestions about adding flexibility to the interface, but I won't go into these comments here. They've all been studied and many have been incorporated.)

## Software

As of this writing, we've received three listings and one machine-readable program for terminal-like communication. We have yet to receive any public domain software for BBS and the like (consider this a hint in the strongest possible language!).

From Gary Kaatz, W9TD, we've received a machine-language CP/M program listing which runs at either 300 or 1200 baud and supports a printer as well. The system should include an 8250 UART for the terminal, and a 6850 for the Console at port 00H and the printer at port 9FFH.

We also have in hand a disk-based program written by Steve Parkman, WB7OHM for the Color Computer which includes lots of buffer space, provision for moving data back and forth between buffer and disk, setup files, up and down scrolling, etc. Steve informs us that the cassette based version is imminent.

Courtesy of Dan Harmon, WA9YKK, we have a listing of a machine-language program for the Apple II with the California Computer Systems 7710A serial async interface card. He calls it a "dumb" terminal program, and says it runs at least as fast as 1200 baud.

Finally, we have a 20 line BASIC program which runs 110 baud bare-bones, no-handshaking on the Model III. (Unfortunately I can't credit the author, as the listing was separated from his letter.)

That's the lot. Of course, we've heard of a number of commercial products, but then, so have you, probably. We're still hoping for distributable (i.e. non-proprietary) BBS packages of any description. Please, if you know of any send it along. We would like to be able to include a selection from a (hopefully) large library of software as an appendix to the manual going out with the kits, and if you would like to be included as an unpaid author, here's your chance!

## Radio Interface

By comparison to the async port information, we have received a glut of information on radio interfacing. By far the commonest report has been

(continued on page 6)

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## Membership Application

Tucson Amateur Packet Radio Corporation  
P.O. Box 22888, Tucson, Arizona 85734

Name: \_\_\_\_\_  
Call \_\_\_\_\_ License \_\_\_\_\_  
Sign: \_\_\_\_\_ Class: \_\_\_\_\_

Address: \_\_\_\_\_  
City & \_\_\_\_\_  
State: \_\_\_\_\_

Zip (Postal) Code: \_\_\_\_\_

Home Phone: \_\_\_\_\_ Work Phone: \_\_\_\_\_

I hereby apply for membership in T.A.P.R. I enclose \$12 dues for one year.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

New membership: \_\_\_\_\_ Renewal: \_\_\_\_\_

What related organizations do you belong to? \_\_\_\_\_

If you are interested in actively participating in packet radio development, let us know your skills and interests.

(continued from page 5)

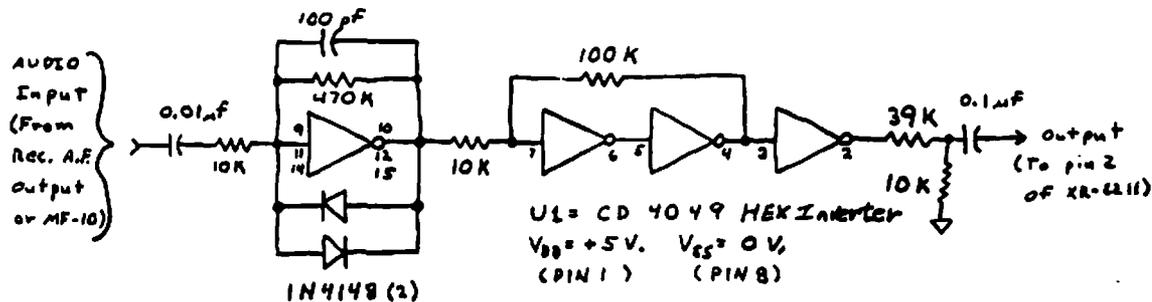
that no problems were encountered either in hooking up the radio or in using it. The exceptions seem to be either rigs needing very small PTT voltage in order to key the transmitter (e.g., the IC-2AT) or rigs with PTT and audio circuitry intermixed (e.g., the IC-2AT). We have also been made aware of the ease with which the TNC can over-drive some rigs (e.g., the HW-2#36). We are going to tame down the audio output circuit a bit on the kits. A number of reports included more-or-less detailed hookup diagrams. The rigs so-mentioned include: 227R, IC-2AT, IC-22A, IC-22C, IC-22S, MOCOM-70, TR-2400, TR-7400A, and the TR-9000. We've received reports for several other rigs too, but with no details on the hookup. Thanks to everybody sending in reports, and especially to those of you who included comments and circuits.

#### Modem

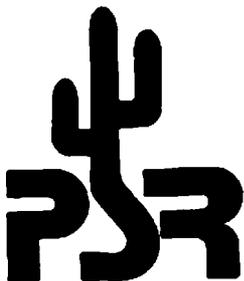
Most recently we've been working on improving the demodulator performance. As many people have found out, the demodulator is not especially tolerant of noise. This behavior has been quantitatively measured by Steve Goode, K9NG, who has been

doing a tremendous amount of research on the TAPR modem. In fact Steve, along with Gary Kaatz, W9TD, and more recently a local designer, Eric Gustafson, N7CL, have been working on our demodulator, and have learned quite a bit. It has turned out to be surprisingly difficult to improve upon the bit error rate of the presently configured demodulator. On the other hand, Steve believes it might be possible to obtain another 1 dB or so of sensitivity by choosing the proper demodulation method. As of this writing several schemes have been tried to no avail, but the search continues. If there are any experts lurking in the woodwork out there who have not yet volunteered, please give me a call as soon as possible, as time is running out on the new hardware design.

In the mean time, experimentally minded packeteers might play with the following circuit which is intended to feed audio into the 2211. It's a zero-crossing detector/limiter designed by N7CL which seems to give greater tolerance to audio volume setting, although it has not improved the noise performance, according to recent measurements. It should be used after the MF-10, perhaps cutting back on the gain of the 3240 input amplifier so as to reduce levels into the circuit.



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Check the address label for your membership expiration date.