

LOW COST ENTRY INTO PACKET RADIO USING BAYCOM BY CHRISTOPHER C. RENDENNA, **KB2BBW**

This paper picks up where last year's topic, "Low Cost Entry Into Packet Radio Using Digicom" (11th ARRL Computer Networking Conference) left off. Its purpose is to acquaint the beginner or experienced packet user with the versatile BayCom Modem as well as providing information on setting up a low cost packet radio system via the BayCom modem and software. It assumes the reader is minimally computer literate and has a basic knowledge and understanding of packet radio basics.

History

BayCom's history began in the Winter of 1989 when Florian Radlherr (**DL8MBT**), the father of DIGICOM, put his programming expertise and free time to use. The result was the development and completion of a packet terminal program whose operations were heavily dependent upon the software - not the hardware. The first released version was V 1.00. Totally in German, it contained the minimal of features as well but a well documented schematic for the BayCom Modem. The next release, version, V1.20, had a three part screen (TX, RX and Monitor) with cursor flexibility to move within each of the three, resizing of the windows, page scrolling, conventional multi-connect ability that included file transfer, EGA video support and screen save feature upon exiting of the program.

Initial response to this version was overwhelming and inspiring. This response, the BayCom Movement as I call it, led to the release of V1.40 in 1991. Bugs were cleared out, 300 baud HF operation with an AM7910 or 7911 chip modem was possible, logbook, disconnect timer, screen clearer, remote control, 50 and 60 line VGA display driver and personalized connect messages were just a few of the enhancements made without sacrifice to previous operational commands. Since this program was still in German, an English version (V1.40E) was released shortly after.

By the end of 1992, the BayCom group's tireless effort resulted in the completion of V1.50. Two versions were released: V1.50 was a European version and V1.50A was a United States version. To protect the hard work of the BayCom Group, licenses were issued to PacComm and Tigertronics to allow commercial distribution of the software in the United States. This action by the BayCom team was in response to those unscrupulous folks who thought they could make a profit by selling the software. The program is copyrighted by Florian Radlherr, **DL8MBT** and Johannes Kneip, **DG3RBU**. The English translation and manuals are copyrighted by Denis Godfrey, **GOKIU**. However, copying of the disk is allowed under certain circumstances. (See Appendix A)

Version 1.50A allows open squelch operation with the DCD command, incorporates a screen saver, definition of standard texts and macros, expansion to support COM3 and COM4, additional cursor movements, disable/enable transmitter, directory display, mouse support, and CW identification (V1.50 English version to conform to law). Those users who own the BayCom USCC-Card (a modem designed on a card for insertion inside of a PC) can enjoy the luxury of, in addition to the TCM3 105 chip, the AM7911 modem allowing baud rates between 300 and 2400. A G3RUH compatible FSK-modem developed by DF9IC can allow baud rates of up to 9600. Perhaps the most valuable feature is the improvement of the on-line help windows that allow an explanation of every command in the program

Hardware

The original German modem design is based around the TCM3 105 chip which allows both VHF and 300 baud **HF** operation. BayCom **V1.50A** will work with the modem design using the 791017911 chip, as utilized by A&A Engineering (See Appendix B and C). **PacComm's BayMod-9** (one of many of their models) keeps loyal to the original German design using the TCM3 105 in their modems. Tigertronics, Inc. has a modem that uses a supposedly unique patented chip that draws very little current from the computer making it ideal for laptop use. Additionally, there are kits being offered by smaller companies and amateur radio clubs utilizing different schematic configurations. The prospective buyer should always inquire first.

With the exception of the 7910 modem from A&A Engineering which uses an external power source, most BayCom modems are powered off the serial port. The following technical information is courtesy of John - **WA6IKO**.

"The first thing you need to realize is that there is no "real" source of power on an RS-232 port, so you need to steal the power from the signal lines. Many people glance at the RS-232 specs and conclude you can draw **10ma** from the drivers. Wrong! Look closer - **10ma** is the "short circuit" current limit from the port. That means if you short the port to ground (zero volts available!) you will be drawing **10ma**. The only common CMOS modem chip is the TMS-3 105. Circuits using this chip like to gobble up about 8ma @ 5 volts. To make matters worse, you need to regulate this voltage for the chip to work reliably. There seem to be two approaches to this problem, both with limitations. Many of the circuits floating around use a common **78L05** voltage regulator. The problem here is that the regulator can drop as much as 3 volts across itself in the process of regulating. Add to this a .7 volt loss for the diode that isolates the regulator from the port. Now you need 5 volts (for the chip) + 3 volts (for the regulator) + .7 volts (for the diode) = 8.7 volts @ **8ma**. **All from this from** a port that gives you **10ma** if you short it out.

In a "real" BayCom modem, the designers saw the regulator drop problem and decided to use a zener "shunt" regulator circuit. But this has it's problems also. We still have 5 volts that we need + .7 volts (for the diode) + .95 volts drop through the series resistors that drives the zener (120 ohms @ **8ma**) = 6.65 volts. This sounds okay until you realize that the zener is drawing zero current at this supply voltage (which means it's not regulating!) By the time you find a little more power to get the zener going, your not much better off than you were with the **78L05**.

Fortunately, since they knew they were pushing the limits of even the best of RS-232 driver chips, the BayCom folks provided a second source of power in their design. That is why many of the laptop computers (low RS-232 drivers) simply won't work with the 3 105 circuits.

The BayPac modem by Tigertronics start with special diodes that have only 150 mv drop + a special regulator (not a zener) that only drops 100 mv + a custom chip that only needs 4.5 volts @ 2 ma = 4.75 volts. Compared to the **78L05** design, the BayPac needs only 55% of the voltage and 25% of the current."

Users should note that earlier designs of the BayPac modem did not use a second source of power.

There seems to be more than several instances of computers re-booting by themselves when using a BayCom modem. This is prevalent to 16Mhz era computers including some the 386-SX computers by AST and PackardBell. Rest assure that this is a computer hardware **problem** and not a modem or V1.5 software problem. Unfortunately, the only cure is to use J-Comm's "Soft TNC" software. The details of the problem will not be published here, as they point to a company who denies the facts anyway. However, the user should be away of the symptoms and cure.

Ninety-nine percent of all PC compatibles will work with the BayCom Modem. An old PC can be picked up at any hamfest for \$100 - \$300. Most modem versions utilize a COM port and cost anywhere from \$40.00 to \$70.00. (See Appendix D) Since the software is available when you buy the modem or **from** a private source, the cost of a packet set-up becomes quite **attractive**.

Initial Set-up

The cable configuration will depend on the modem hardware and transceiver. Refer to the company's manual for proper set-up. As for the software, **V1.50A** can be run **from** a disk or hard drive (recommended). Create a subdirectory and copy all the files to it. Some disks will have an install program which will make this easier. There are basically twelve files in **V1.50A**:

1. **L2.EXE** This is a memory resident program which allows BayCom to send and receive packets after one exits the program.
2. **SCC.EXE** User interface program.
3. **OFF.COM** Removes L2 **from** RAM.
4. **SCCINI** ASCII file containing user default parameters
5. **PARA.EXE** Converts SCCINI ASCII file into machine language.
6. **SCC.PAR** File created by **PARA.EXE** from SCCINI.
7. **TERMHELP.SCC** BayCom help file.
8. **SCC.VID** If the feature is activated, BayCom will save the contents of the three split screens upon exiting.
9. **SCC.PWD** Password file that must be created if the :J command is to be used.
10. **BAYCOM.BAT** Run this batch file to start BAYCOM.
11. **INSTALL.BAT** Batch file that will create a BayCom subdirectory and then copy the files to it.
12. **SCC.LOG** If the :LOG command is on, the program will create this file and write to it a list of all the stations that were connected.

Before one runs the program, a few changes should be made to the SCCINI file. Use you favorite word processor, open the file and edit the COM port setting to the appropriate number. Enter your call sign and SSID under the MY parameter, which should be different from the SSID under the digipeater (DCALL) parameter. Personal preferences will determine the **content** you place in the connect text (CTEXT) and quit text (QTEXT) fields. Note that the semi-colon (;) at the beginning of each line acts like a REM statement. The line will be ignored.

Getting on the Air

After executing the batch file "BAYCOM", the program will run and three screens will appear. The top is the transmit, middle is the receive and the bottom is the monitor screen. The user should be sensitive to the fact that all commands are entered after the colon (:), while anything typed without the colon and then followed by a carriage return will automatically be transmitted over the air. Die-hard Digicom users will recognize this difference immediately. :HBAUD should be set at 1200, FRACK around 5-10, TXDELAY around 40-50, then fine tuned down to around 30 or 40 depending on the transceiver type. Electronic switching relays do not need as long of a TXDELAY value as do the older mechanical relays. The DWAIT parameter is relative to the amount of traffic on the frequency and should be set at a level that is courteous to all. The on-line help or manufacturer's manual should be reviewed before hand for more in-depth information and additional features.

Tricks of the Trade

BayCom is a versatile terminal program. It was never meant to be a mailbox, yet I receive numerous requests for information on how this can be done. Well, when there is a will, there is a way! Just as in V1.4, the user can specify which commands would be allowed to be used for remote. They are entered in the RCMD line of the SCC.INI file. Set the REMOTE parameter to on. By leaving the computer and transceiver on continuously, one can simulate a mailbox. Simply edit the CTEXT announcing to connected stations that they may leave a message using the //W <filename> command. (All remote commands sent by another station follow two slashes). File names should be limited to eight characters. After text is sent by the connecting station, the command //W OFF, is sent and closes the file. Mail can then be viewed with the :V <filename> command by the host.

For the more daring, one can insert the OSHELL command in the RCMD line. Users will be able to access your computer (and hard drive) by using the command //OSHELL just as if it was their own computer. This setting is dangerous as an evil minded user could actually delete your whole hard drive! If you are determined to set up your system like this, have the common sense to change the attributes of important files to read only or hidden. There is mini-bbs program called Multi-User BayCom which is recommended for the mailbox-minded user. Sources and software descriptions are contained in Appendix D and E respectively.

The simplicity of the BayCom modem makes it compatible with other software packages as well. (See Appendix E) To cover each and all of these would go beyond the scope of this paper. One should keep abreast of the latest developments by acquiring a copy of the Original BayCom Exchange. (See Appendix D). BayCom can be an inexpensive way to open up into the world of packet radio. Try it!

[Chris Rendenna, KB2BB W/AAR2MG, caught the packet bug from his elmer Jack, K2ZBR back in 1983. Chris then got involved with TCP/IP through his father, Vince, N2CLR, who is a Digital Networking Specialist at AT&T Discovering Digicom in 1985 led Chris into the world of BayCom. Finding no literature on Digicom or BayCom, Chris created the Original Digicom Exchange in 1990 and the Original BayCom Exchange in 1993. These publications, voluntarily put together, were the first and still are the only regular means of bringing together Digicom and BayCom users alike. Currently, the Exchanges have unexpectedly reached six continents. Chris hopes the Exchanges might make WAC some day - hi!]

APPENDIX A

R. Dussmann
J. Kneip
C. Lachner
F. Radlherr GdBR

BayCom

Mr. Chris Rendenna
709 Ten Eyck Avenue
Floor 2
Lyndhurst, New Jersey
07071 USA

16.11.92

Your request BayCom 1.50

Dear OM Chris,

BayCom is neither commercial nor shareware. It is software, which is copyrighted by Florian Radlherr, DL8MBT. As a private user, you are allowed to receive, to give and to use a copy of BayCom 1.50 on a private basis. You may NOT use it for any commercial purpose (to sell the program or to give it away as a donation together with a commercial product). You may also not spread it in large numbers (e.g. a club for his members) without our permission.

If you want to sell modems or the program, you must licence with us.

PacComm is licenced for version 1.50, the same is Tigertronics.

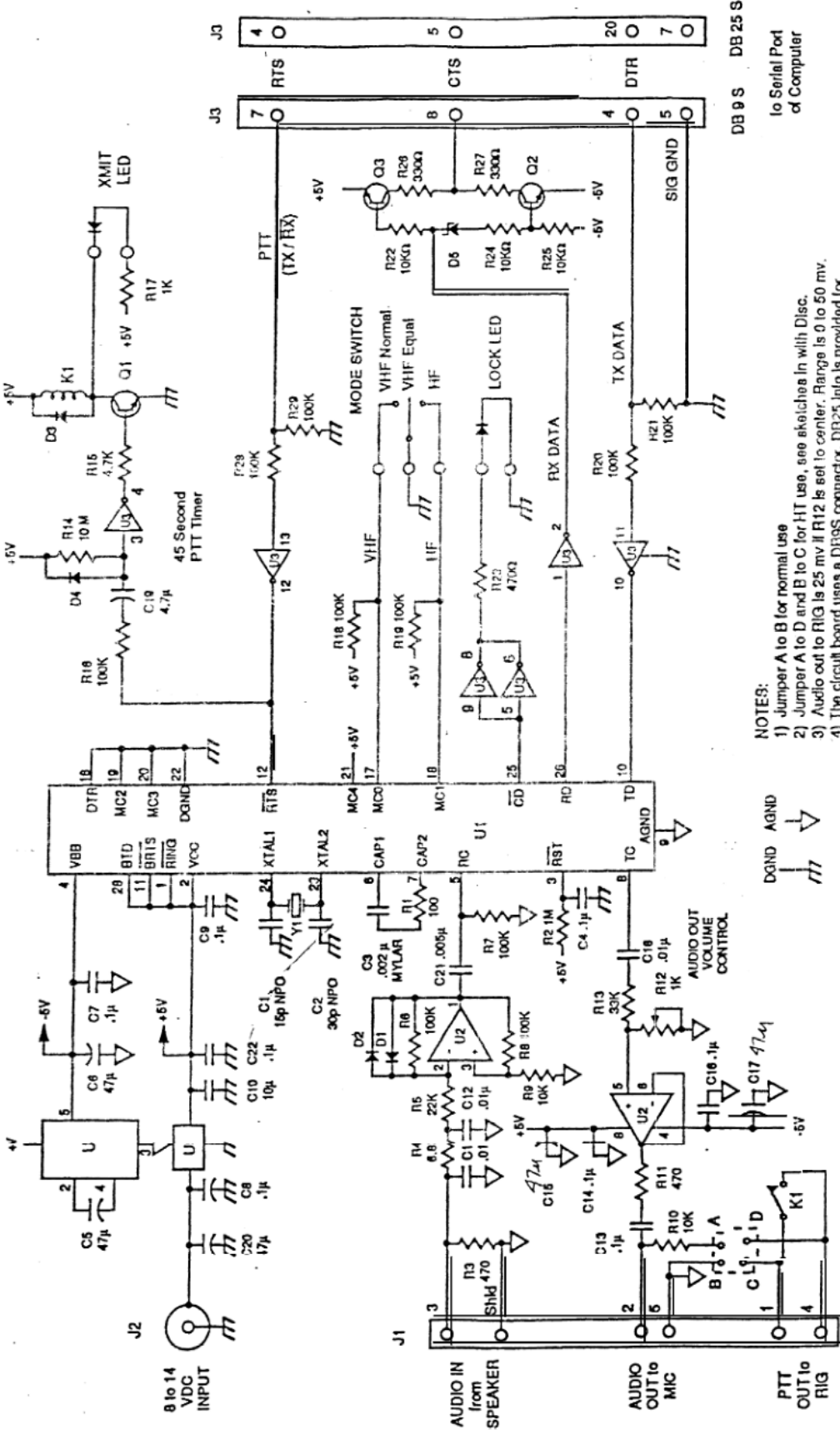
I hope you will agree with these regulations. We do not want to force everybody to licence with us, but we want to prevent any commercial use without our benefit.

Kind regards



Johannes Kneip, DG3RBU

APPENDIX B



- NOTES:
- 1) Jumper A to B for normal use
 - 2) Jumper A to D and B to C for HT use, see sketches in with Disc.
 - 3) Audio out to RIG is 25 mv if R12 is set to center. Range is 0 to 50 mv.
 - 4) The circuit board uses a DB25 connector. DB25 into is provided for those who wish to make an adapter

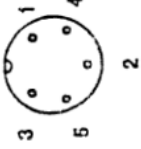
DB 9 S DB 25 S
to Serial Port
of Computer

A & A Engineering		2521 W. La Palma, Unit K Anaheim, CA 92801 USA	
SCALE: DIA	DATE: 26 APL 91	d9 W6UCM	DRN BY: STASA
REV: 13 MAY 92		REV: 13 MAY 92	
Baycom Modem			DRAWING NUMBER: REV
Schematic			492-190 0

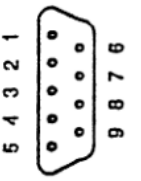
Mating 2.1 mm Power Plug
as viewed from the wiring side

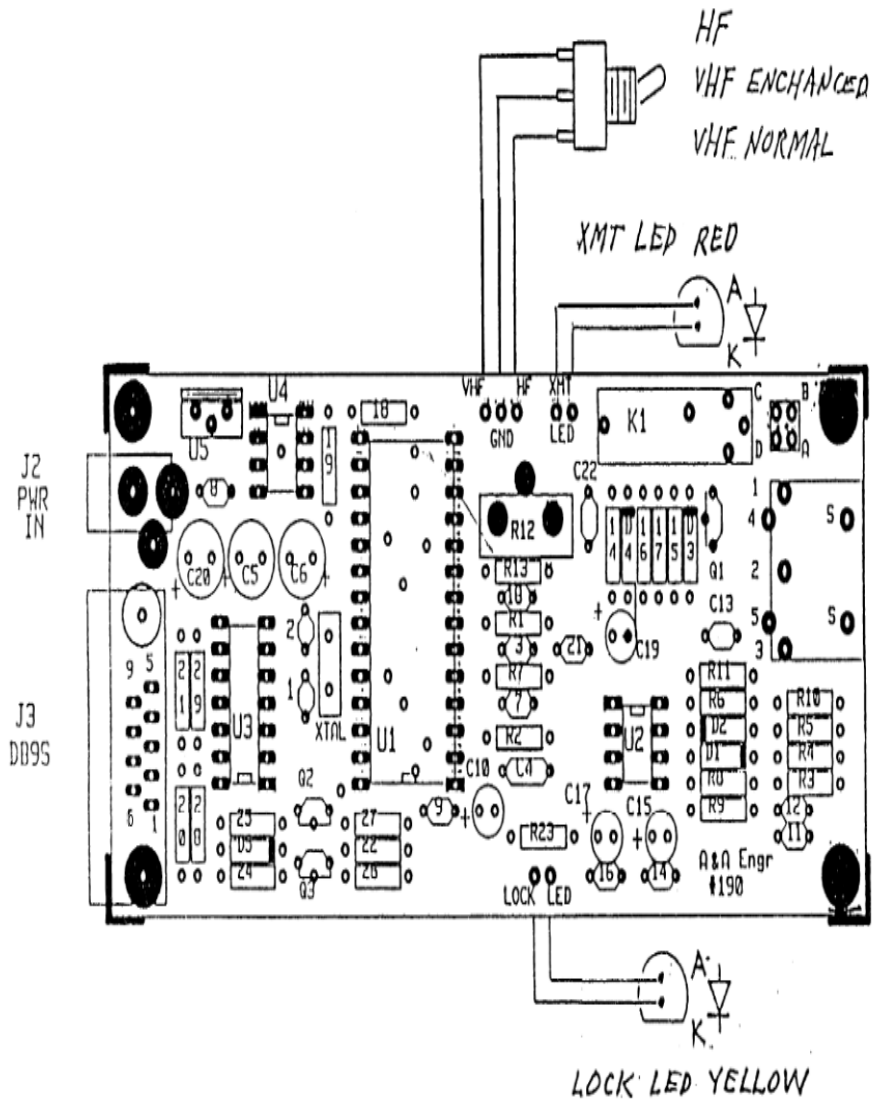


Mating 5 pin DIN
as viewed from the wiring side



Mating 9 pin D
as viewed from the wiring side

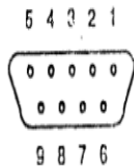




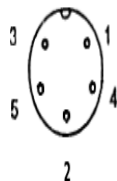
REF DES	QTY	DESCRIPTION
R1	1	100 Ω 1/4 W 5% BN-BK-BN
R2	1	1 MΩ 1/4 W 5% BN-BK-GN
R3,11,23	3	470 Ω 1/4 W 5% YL-VI-EN
R4	1	6.8 kΩ 1/4 W 5% BL-GY-RD
R5	1	22 kΩ 1/4 W 5% PD-RD-OR
R6,7,8,16,18,19,20,21,28,29	10	100 kΩ 1/4 W 5% BN-BK-YL
R9,10,22,24,25	5	10 kΩ 1/4 W 5% BN-BK-OR
R12	1	1 kΩ 1 Turn Vatt Pot
R13	1	33 Ω 1/4 W 5% OR-OR-OR
R14	1	10 MΩ 1/4 W 5% BN-BK-OL
R15	1	4.7 kΩ 1/4 W 5% YL-VI-RD
R17	1	1 kΩ 1/4 W 5% BN-OK-RD
R26,27	2	330 Ω 1/4 W 5% OR-OR-DH
C1	1	15 pF NPO Disc
C2	1	30 pF NPO Disc
C3	1	.002 μF Mylar (202 OR 222)
C4	1	.1 μF Mylar (104)
C5,6,20	3	47 μF Radial
C7,8,9,13,14,16,22	7	.1 μF Disc/Mono (104)
C10	1	10 μF Radial
C15,17	2	.01 μF Radial
C11,12,18	3	.01 μF Disc/Mono (103)
C19	1	4.7 μF Radial
C21	1	.005 μF Mylar (502)
D1,2	2	1N60/270 Ge Diode (or equivalent)
D3,4	2	1N4148 Si Diode
D5	1	1N5231D 5.1 V Zener Diode
Q1,2	2	PN2222A Transistor
Q3	1	PN2907A Transistor
U1	1	AM7910 XC
U2	1	LM1458 IC
U3	1	CD4584 IC or CD40106
U4	1	MAX660 X OC LT1054 CN8
U5	1	7805 PC
SOC	2	8 pin IC socket
8OC	1	14 pin IC socket
8OC	1	IC socket
8OC	1	28 pin IC socket
K1	1	5V Read Relay
Y1	1	2.4576 Mhz Crystal
J1 (card)	1	3 pin DIN PCB Connector Radio x/o
J1 (cable)	1	5 pin DIN Cable Connector Radio I/O
J2	1	2.1mm PCB Power Connector
J3	1	9 pin D PCB Signal Conn Serial I/O
BM1	1	.8P3T toggle switch
LCD	1	RED LED w/ mntg ellip (XMT)
LED	1	YEL LED w/ mntg ellip (LOCK)
HRDM	1	4 Pin .100 Header
HRDM	2	Shorting Bars
PCB	1	#492-190 Circuit Board

APPENDIX C

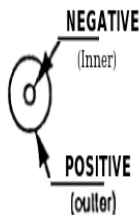
Mating 9 pin D as viewed from the wiring side



Mating 5 pin DIN as viewed from the wiring side



Mating 2.1 mm Power Plug as viewed from the wiring side



A & A Engineering		2521 W. La Palma, Unit K Anahelm, CA 92801 USA	
SCALE n/a	de W6UCM	DRN BY STASA	
DATE 28 APR 91		REV 13 MAY 92	
Baycom Modem			
Component Layout			DRAWING NUMBER REV 492490 1 0

APPENDIX D

SOURCES FOR HARDWARE

A&A Engineering, 2521 LaPalma, Unit K, Anaheim, CA 92801 (714) 952-2114
(714) 952-3280 FAX
Crawford Amateur Radio Society, PO Box 653, Meadville, PA 16335
PacComm Packet Radio Systems, Inc., 4413 N. Hesperides Street, Tampa, FL 33614-7618
(813) 874-2980 (813) 872-8696 FAX
Ramsey Electronics, Inc., 793 Canning Parkway, Victor, NY 14564 (716) 924-4560
Tigertronics, Inc., 400 Daily Lane, PO Box 5210, Grants Pass, OR 97527 (503) 474-6700
(503) 474-6703 FAX

SOURCES FOR SOFTWARE

(PacComm and Tigertronics are currently the only two companies licensed to sell BayCom **V1.50A** with their modems, however, amateurs may obtain a copy of the software from the address below as long as they comply with the conditions as stated by the BayCom Team in Appendix **A**).

BayCom V1.5, Multi-User BayCom, and others may be obtained by sending a **SASMailer** + floppy (360,720, or 1.44) to:

Chris Rendenna, **KB2BBW**
709 Ten Eyck Avenue
Lyndhurst, NJ 07071 USA

SOURCE FOR BAYCOM PUBLICATIONS

Currently, there is only one source of current **information** regarding **BayCom**. Send a SASE for the latest issue.

The Original BAYCOM EXCHANGE, Chris Rendenna, **KB2BBW**, Editor
709 Ten Eyck Avenue, Lyndhurst, NJ 07071
KB2BBW @ WA2SNA.NJ.USA.NA

ACKNOWLEDGMENTS

Many thanks to Stas **W6UCM** of A&A Engineering for permission to print his BayCom 7910 chip modem design.

I would also like to take this opportunity to thank all the BayCom users throughout the world who have assisted me in various ways with this paper. Most of all, I want to thank the BayCom Team in Germany for producing a fine and enjoyable product.

APPENDIX E

***** SOFTWARE GUIDE FOR THE BAYCOM MODEM *****

The following guide was first published in the February 1993 issue of the Original BAYCOM EXCHANGE (Vol. 1, No. 2). Many thanks to Jeff (N9NGF @ W9QYQ.IN), Denis (GOKIU) and G6IIM who helped with the list and sources.

BAYCOM V1.2 Terminal Program for PC's without a TNC by Florian Radlher (DL8MBT) and Johannes Kneip (DG3RBU). Developed in 1989/90. Screen editor, 3-part split screen (TX, RX and Monitor), scroll capability, 8 ports, supports EGA video, screen save. The only bug is an inoperational DIG1 feature. (See Vol. 2 No. 12 December 1991 of DIGICOM EXCHANGE)

BAYCOM V1.3 This is a little know version that is completely in German. Similar to V1.2 with a few enhancements.

BAYCOM V1.4 New updates to V1.3 includes: Operation with AM79 10/79 11 modems, system messages are switchable between German and English, log file, DISC timer, switchable between Insert and **Overwrite**, DOS Shell, remote control within limits, 50 and 60 line VGA display, Personalized connect text, and more. Although DIG1 bug has been fixed, **BTEXT** and **QTEXT** now have bugs. (See Vol. 2 No. 12 December 1991 of DIGICOM EXCHANGE)

BAYCOM V1.5 Supports COM 1 and COM 2. Bugs seen in V1.2 and V1.4 are fixed, but now there seems to be a keyboard buffer bug in the original V1.5 experimental version. Later **official** prove to be bug-free. This version for European distribution.

BAYCOM V1.50A This is the copyrighted US version of BayCom. **All** bugs have been corrected, additional ports are supported. More parameters in **SCC.INI**.

ESKAY PACKET Also known as SP or Super Packet by **DLIMEN** and **DLIBHO**. The last public domain version was V6.11. V7.00 is no longer public domain. The latest version is V7.50, which contains an English manual. The program has a similar screen layout as BayCom, but has many more features, such as 35+ remote commands, autorouting, binary transfers, and up to 10 simultaneous connections, to name a few. In order to use it with the BayCom modem. Must use the driver called TFPCX.EXE. This driver is what actually does the work of the **TNC**.

GRAPHIC PACKET Written by Ulf Saran (**DHIDAE**) Latest public domain version is V1.52, released just this summer. Very impressive program that works with the TFPCX.EXE driver available in Eskay Packet. It does not have as many features as Eskay Packet, but is easy on the eyes. It has auto binary transfers, on-screen clock, up to 10 multi-connects, and mouse support.

TFPCX (The Firmware (PC) Extended) Resident AX.25 Controller for PC without TNC by Rene Stange (DGOFT). This is a driver program that allows **BayCom** modems and USCC Cards to use SP and GP. TFPCX is compatible with The Firmware from **NORD**<**LINK** and runs resident in the background as an AX.25L2-Controller on IBM Compatible PC's (Not on ATARI ST). TFPCX **V2.3B** now has a Soft-DCD (Programmable Squelch Barrier) and makes possible an internal self connection for internal Test work. It will not work well with computer speeds under 8 Mhz.

Baud	PC MHz	XT 5	XT 8	286 12	386 20
300		*	*	*	*
1200		?	*	*	*
2400		/	?	*	*
4800		/	/	?	*

- * - Operation possible
- ? - Operation possibly with some restrictions
- / - Operation not **possible**

WG7J NOS Note that there are many different versions of NOS. You can find NOS on just about any good ham bbs. You will also need a driver to use the **BayCom** modem. The most current one at this time is listed below:

AX921123 Some of the earlier versions of this driver had bugs, so beware. File name denotes release (November 23, 1992) and most likely there is a more recent version floating around on the **land-line** ham BBS'.