K8LG MINI PIC KISS TNC

VERSION 2.0 WITH GPS

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JUNE 2006

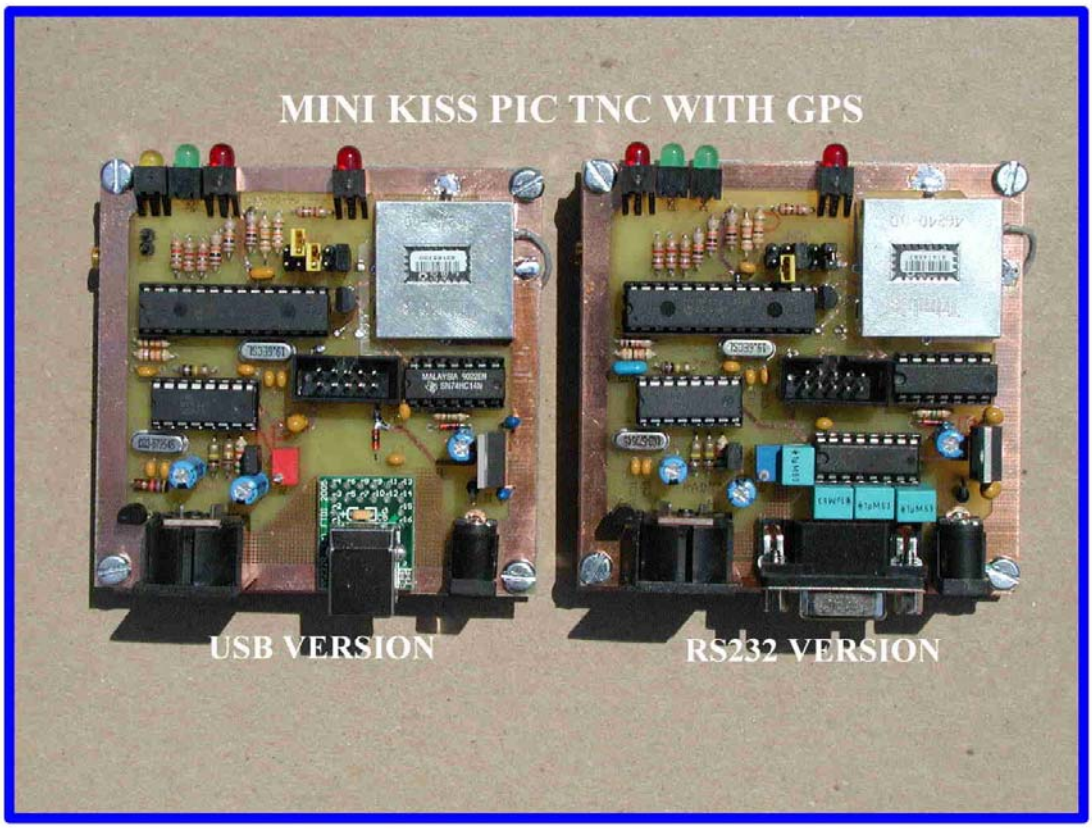

Figure 1: K8LG MINI KISS PIC TNC with GPS Version 2.0

INTRODUCTION

The MINI KISS TNC uses the standard KISS protocol originally developed by Mike Chepponis, K3MC and Phi Karn, KA9Q in 1987 and is designed for use in APRS applications where the on-board memory (RAM) considerations are modest. A receive buffer of 512 bytes and a transmit buffer of 768 bytes (512 Rx and 3072 Tx for PIC18F2525) are more than sufficient for APRS and most home applications. For BBS, DX CLUSTER, and other applications I make a version that has 32KB (4K Rx and 28K Tx) total buffer space. An MX-COMM MX614 modem chip is used to receive and transmit1200 baud data. The processing of packet information is done in the PIC firmware.

I have been involved in the lunching and recovery of weather balloons using APRS tracking for the past several years. Typically the tracking vehicle will have an APRS station consisting of: a notebook computer running APRS software, a GPS receiver, a TNC, and a radio. With older a notebook computers the data streams from the TNC and GPS receiver could be accommodated via the COM and USB ports. Newer notebooks have no COM port so it would simplify connections to multiplex the two functions (TNC and GPS) on a single port. A hardware solution has been available through the use of Hardware Single Port (**HSP**) developed by Bob Bruninga, WB4APR. Several APRS software packages (WINAPRS, UI-VIEW, etc.) support the hardware switch to multiplex APRS and GPS data on a single port in KISS mode. The KISS protocol does not use hardware flow control making the two flow control pairs (RTS/CTS and DSR/DTR) available for HSP use. HSP uses the RTS or DSR to signal the hardware switch to send either TNC data or to send GPS data.

We have been using the UI-VIEW package by the late Roger Barker, G4IDE. The UI-VIEW software uses the RTS line to signal the TNC when it expects to receive a $GPRMC GPS sentence. In place of the hardware switch we have implemented a software switch as part of the KISS MODE TNC firmware with two serial ports, one for connection to the PC with RS-232 levels and one for GPS with TTL levels. This method has the advantage of allowing the computer port and GPS port to operate at different speeds and permits buffering of KISS input data while GPS data is being sent.

The PIC firmware in my TNC receives GPS data at 4800 baud with a once per second reparation rate. This data is buffered to memory and kept until the next frame is received. When the RTS line goes TRUE the program checks for a valid and complete GPS frame in the PIC GPS buffer. If one is present it is sent to the computer serial port, if not the software will wait for the next complete frame to be received and then sent it. Once the frame is received by the APRS software (UI-VIEW here) the RTS line is set to NOT TRUE and normal KISS functions continue. More than 83% of the time this will take about 42ms to accomplish and the other 17% it will take less than 1.2 seconds. To avoid loss of KISS data the PIC firmware is designed to buffer and re-transmit any interrupted KISS data in these periods.

OEM GPS receivers are used with this TNC may be programmed to send one $GPRMC sentence every second. This appears to be the sentence that UI-VIEW expects to see. I tried to use the $GPGGA sentence and UI-VIEW kept the RTS line TRUE for about three seconds although it decoded and used the GGA data. The Motorola ONCORE GT+ and the TRIMBLE LASSEN SQ receivers have been used. The TNC board is designed to accept the TRIMBLE LASSEN

receiver as a plug-in. The ONCORE GT+ is connected to the 10-pin header (J3) and mounted under the TNC. The advantage of the TRIMBLE is its small size, lower power consumption, and low cost ($45 in single units).

Both the Motorola and the Trimble are powered from regulators on the TNC board. The Trimble uses VR2 a 3.3 Volt regulator and the Motorola uses the VR1 a 5.0 Volt regulator.

GPS SETUP

The Trimble must be setup to out put the standard NEMA $GPRMC sentence at 4800 baud every second using the TRIMBLE supplied programs SQ_MONITOR and TSIPCHAT which may be found on the TRIMBLE WEB site www.trimble.com. Once set to send RMC once a second the settings are stored in the SQ nonvolatile memory and no other adjustments are needed need. After the GPS receiver is soldered on to the board it may be accessed via the 10- pin connector (J3) when the PIC CPU (U4) is removed from its socket. You will need a TTL to RS-232 level converter between the GPS receiver and the computer to do this.

Motorola provides a program, WINONCORE12, to configure the ONCORE 8 and 12 channel receivers. Set the ONCORE to the NEMA RMC sentence at one-second intervals using WINONCORE12. This program may be down loaded from the Motorola WEB site www.oncore.motorola.com at no charge. If the ONCORE GT+ receiver has no on-board back up battery it will not hold these values when power is removed. A back-up battery may be connected between pins 1 (POS) and 3 (GND) of the interface connector on the ONCORE board. We use a PANSONIC ML1220/V1AE (DIGIKEY P294-ND) coin cell rechargeable Lithium battery between these pins. The battery is charged when the board is powered and will hold settings for months after charging.

OPERATION

The TNC is powered via the 2.1 mm power connector and will draw less than 20ma without a GPS receiver connected. The input voltage is polarity protected by diode D1 and supply voltage should be in the range of 8 to 15 volts. The TRIMBLE GPS and it's antenna draw an additional 30 to 60 ma for a total of 50 to 70 ma, while the Motorola ONCORE GT + and it's antenna draws about 180 ma for a total current of about 200ma. Additional heat sink may be required on voltage regulator VR1 (7805) when using the Motorola GPS with input voltages in the high end of the 8 to 15 Volt range.

The PC is connects to J1 (9-pin DB connector) for serial version of the TNC and to J1 the (USB connector) for the USB version. The computer serial port speed is set JU2-4 and JU2-5 jumpers. It is recommended the speed be set to 19, 200 baud (JU2-4 open and JU2-5 closed) for normal operation with a GPS receiver attached.

Jumper JU2-1 is used to select DCD mode (hardware/software) for the packet MODEM. When JU2-1 is open DCD is software driven and works best if there is un-squelched audio applied to the MODEM input. If JU2-1 is closed the MODEM expects to see squelched audio from the radio and the DCD is driven by squelch open/closed. If in doubt leave this jumper position open.

JU2-2 is used to select CALIBRATE mode when closed. When JU2-2 is open the TNC will be in normal KISS mode. JU2-3 is used to select GPS mode when closed. When JU2-3 is open JU2_3 is open the TNC will operation in normal KISS mode.

A TRIMBLE LASSEN QC GPS receiver may be installed on the TNC board connecting via J4. An external GPS receiver may be connected to the GPS serial port at J3. JU4 must be open (cut trace on bottom side of board) when using an external GPS connected to J3.

Connect the radio cable to J2 (5 pin DIN connector), the computer serial/USB cable to J2 (DB-9 for RS-232 or USB-B connector). On power up the firmware will flash the LED's three times and set parameters: TX Delay = 500 ms, Slot Time = 100 ms, Persistence value = 63, TX Tail Time = 20 ms, and Half Duplex mode as default values. These parameters will be updated by the UI-VIEW. The transmit audio level should be adjusted (calibrate function) so the transmit deviation is 3 KHz. UI-VIEW must bee set for KISS mode with shared GPS data. There is no need to send a KISS mode setup but if it is sent it will be ignored.

When using the USB version you will need to install a driver for the FTDI MM232R. This driver will be on the CD supplied with the TNC or may be downloaded at no cost from the FTDI WEB site www.ftdi.com at no cost. The USB port will appear as a COM port (e.g. COM5). To see the assignment your system gives this port look at the COM and LPT tab of the DEVICE MANAGER under SYSTEM section of the CONTROL PANNEL. This will be the setting you will use in UI-VIEW.

CALIBRATION FUNCTIONS

The calibration function will allow the TNC to be keyed and either a MARK or SPACE tone be sent. Enter calibration mode place by placing a jumper on JU3-2 and applying power. Using a terminal program (Hyperterm, TELIX, etc.) you will receive a prompt asking for an input of K, M, S, G, or E. These commands are for:

K – Toggle PTT line (transmit)

M –Set the MODEM tone to MARK

S – Set the MODEM tone to SPACE

G – Display GPS string

E – Exit calibrate mode

The transmit audio level is adjusted with R1 (10K pot.) located near the J2 (5 pin DIN connector). Jumper JU1 is used to select transmit audio range. With JU1 shorted the audio level will be in high range (up to about 1.5V RMS) and with the jumper off the audio level will be in low range (up to about 180 mV RMS). The "Twist" or difference between MARK and SPACE transmitted audio levels may be measured by going between MARK and SPACE tones and

observing the transmitter deviation. Normal transmit deviation should be set for 3 KHz. Calibrate mode may also be used to confirm the serial port speed setting.

The G command is used to observe the incoming GPS data. In order to use the G command a a GPS receiver must be on the board or connected to the GPS port (J3) and have the GPS function selected by a jumper on JU2-3. This command will allow you to see the GPS data being received by the receiver.

The K8LG PIC KISS TNC has a TNC-2 type watch dog timer to limit the transmitter key-up time in the event of a PTT line failure. The time-out value is set by the RC time constant of C21 and R18 and may be changed by changing either component. In addition to the hardware time-out timer there is a software time-out timer.

When all calibration functions are complete remove the jumper from JU2-2 and restart the TNC by turning the power off and on.

JUMPER SETTINGS FOR K8LG PIC MINI KISS TNC Version. 2.0

JU1: This jumper sets the transmitter audio level range.

JU1 – ON High range (0 to 1.5 V RMS)
JU1 – OFF Low range (0 to 180 mV RMS)

JU2: This has 5 jumper positions for options.

JU2-1 – ON Use the MX-614 hardware CD line. This requires squelched audio.
JU2-1 – OFF Use software Carrier Detect allowing open squelch operation.

JU2-2 – ON Calibrate mode. This allows the setting transmit audio level for proper deviations.
JU2-2 – OFF Normal mode, TNC operates as KISS TNC.

JU2-3 – ON GPS mode. The GPS will send RMC sentence when the RTS on the Serial port is active,
JU2-3 – OFF Normal mode, no GPS data sent.

JU2-4 and JU2-5: This jumper is used to select the TNC to computer serial speed.

JU2-4	JU2-5	Terminal speed
OFF	OFF	4,800 BAUD
ON	OFF	9,600 BAUD
OFF	ON	19,200 BAUD
ON	ON	38,400 BAUD

JU3: RESET or future option. Normally open (off).

JU4: On board GPS select. When on data from the Trimble GPS is passed to the GPS port. This jumper should be off when using a GPS receiver connected to J3.

LED FUNCTION

D4: Yellow LED ------ DCD active when receiving valid AX.25 frame.

D3: Green LED ------ Active when transmitting an AX.25 frame from host to TNC.

D2: Red LED --------- On when PTT line is active.

D5: Red LED --------- Power on indicator, on all times.

On power-up the firmware will flash the LEDs D2, D3, and D4 in sequence. This is an indication the firmware is operating correctly and the TNC has initialized.

CONNECTOR PIN-OUTS FOR K8LG PIC TNC

JP: POWER CONNECTOR: 2.1mm male connector.

Center pin --- Positive (+8 to 15 VDC)
Sleeve -------- Negative (Ground)
Current requirement: 10 to 25 ma with reverse polarity protection for TNC only.

J1: SERIAL PORT CONNECTOR: Female DB-9 RS-232 connector

1 – No connection
2 – Transmit data (From the host)
3 – Receive data (To the host)
4 – No connection
5 – Signal ground
6 – No connection
7 – Request To Send (RTS) (From the host)
8 – Clear To Send (CTS) (To the host)
9 – No connection

J1: USB CONNECTOR: USB connector (USB-B)

J2: RADIO CONNECTOR: 5 pin female DIN connector in TAPR pin-out format.

1 – Transmit audio. (To radio Mic. or audio input.)
2 – Signal ground
3 – Push to talk (PTT). (Transmitter keying line.)
4 – Receive audio. (From radio to TNC.)
5 – No connection.

J3: GPS SERIAL PORT CONNECTOR: 10 pin male header connector.

1 –-– No connection
2 –-- No connection
3 –-- Receive data (From GPS)
4 –-- Clear To Send (CTS) (To the GPS)
5 –-- Transmit data (To the GPS)
6 –-- Request To Send (RTS) (From the GPS)
7 --- No connection
8 --- No connection
9 –- Ground
10 – +5 Volt output (used for TNC power)

J4: TRIMBLE GPS COPNNECTOR: 8-pin 50 mil pitch SMT header

1 –-– Transmit data TXD (TTL/CMOS)
2 –-- Ground
3 –-- Receive data RXD (TTL/CMOS)
4 –-- Pulse Per Second (TTL/CMOS) PPS
5 –-- No connection
6 –-- No connection
7 --- Power (+3.3VDC)
8 --- Battery Backup Power (2.5 VDC to 3.6 VDC)

PARTS LIST

C1-C6 ---------- 1.0 uf / 25V
C7, C14, C15, C17, C18 ---------- 0.1 uf / 50V
C8, C9, C16 ---------- 22 uf / 25V
C10, -C13 ---------- 22 pf / 50V 5%
C20 ---------- 1.0uf / 16V SMT

D1 ---------- 1N4001
D3 – D6 ---------- LED
D5, D7 ----------1N914

PARTS LIST

JP ---------- 2.1mm power connector
J1 ---------- DB-9 female connector
J1 ---------- USB Connector
J2 ---------- 5 pin female DIN connector
J3 ---------- 10 pin header
J4 ---------- 8-pin 50 mil pitch SMT header
Samtec CLP-104-02-G-D
JU1 ---------- 2 pin header (TX audio select)
JU2 ---------- 10 pin header (Option selection)
JU3 ---------- 2 pin header (Reset/Option)

Q1 ---------- 2N7000 (PTT keying)

R1 ---------- 10K Pot.
R2 ---------- 51K 0.25W
R3, R4, R5 ---------- 100K 0.25W
R6, R7, R13 – R17---------- 10K 0.25W
R8 ---------- 1.5M 0.25W
R9 – R12---------- 1.0K 0.25W
R18 ---------- 47K 0.25W

U1 ---------- MAX232N
U2 ---------- MX-614 (MODEM)
U3 ---------- 74HC14N
U4 ---------- PIC18F252-I/P
PIC18F2525-I/P
VR1 ---------- 7805 (5V pos. regulator)
VR2 ---------- 2950A CZ-3.3 (pos. regulator)

X1 ---------- 3.579545 MHz crystal
X2 ---------- 19.6608 MHz crystal

Socket (2) ---------- 16 pin for U1, U2
Socket ---------- 28 pin for U3
Socket ---------- 14 pin for U4
Socket ---------- 8 pin SMT (GPS receiver)

Hardware ---------- 1 Lot

GPS RECEIVER ---------- Trimble LASSEN SQ

USB INTERFACE ---------- FTDI MM232R

PRINTED CIRCUIT BOARD

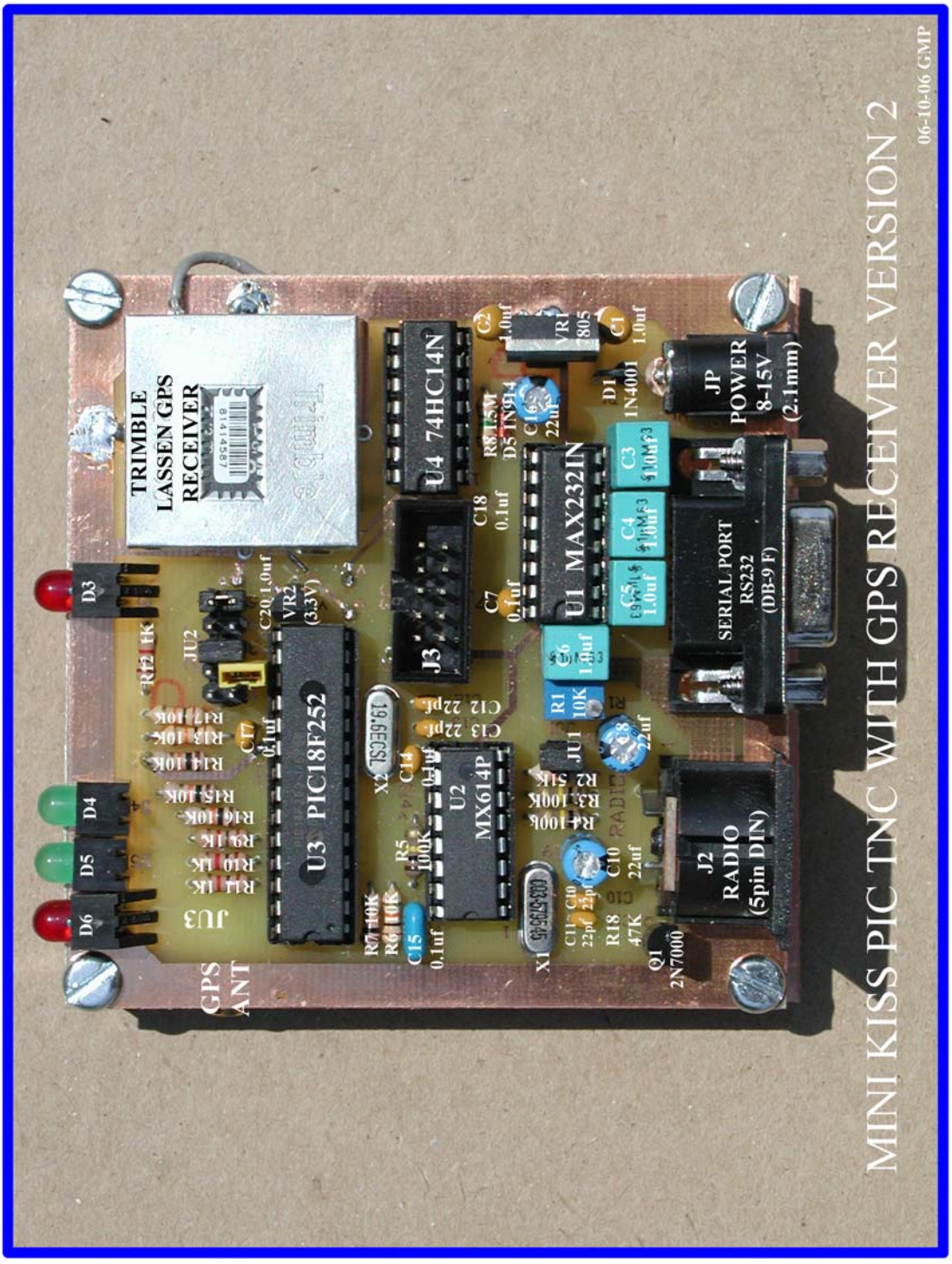

Figure 2: RS-232 VERSION OF MINI KISS PIC TNC.

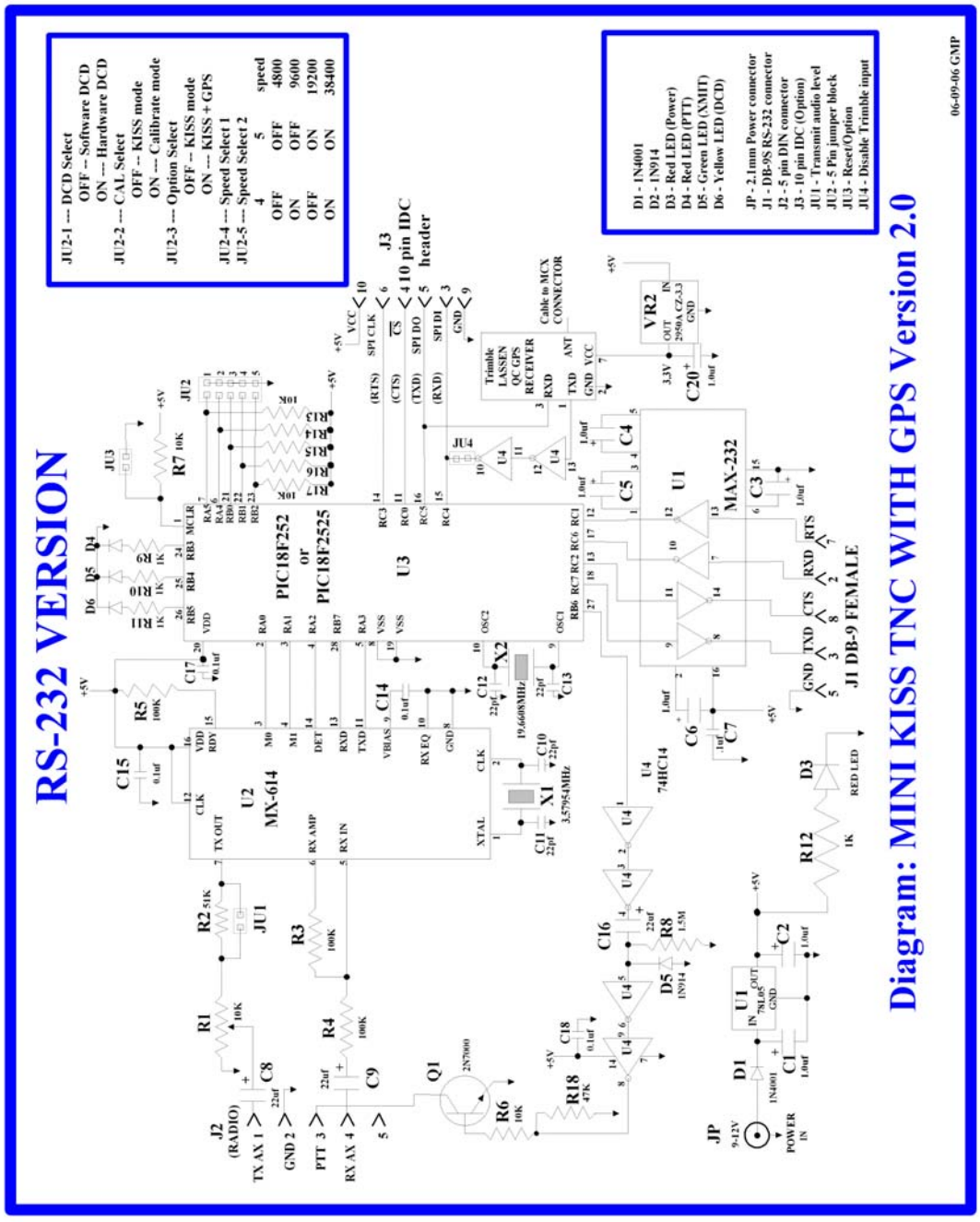

Figure 3: DIAGRAM OF RS-232 VERSION OF MINI KISS PIC TNC.

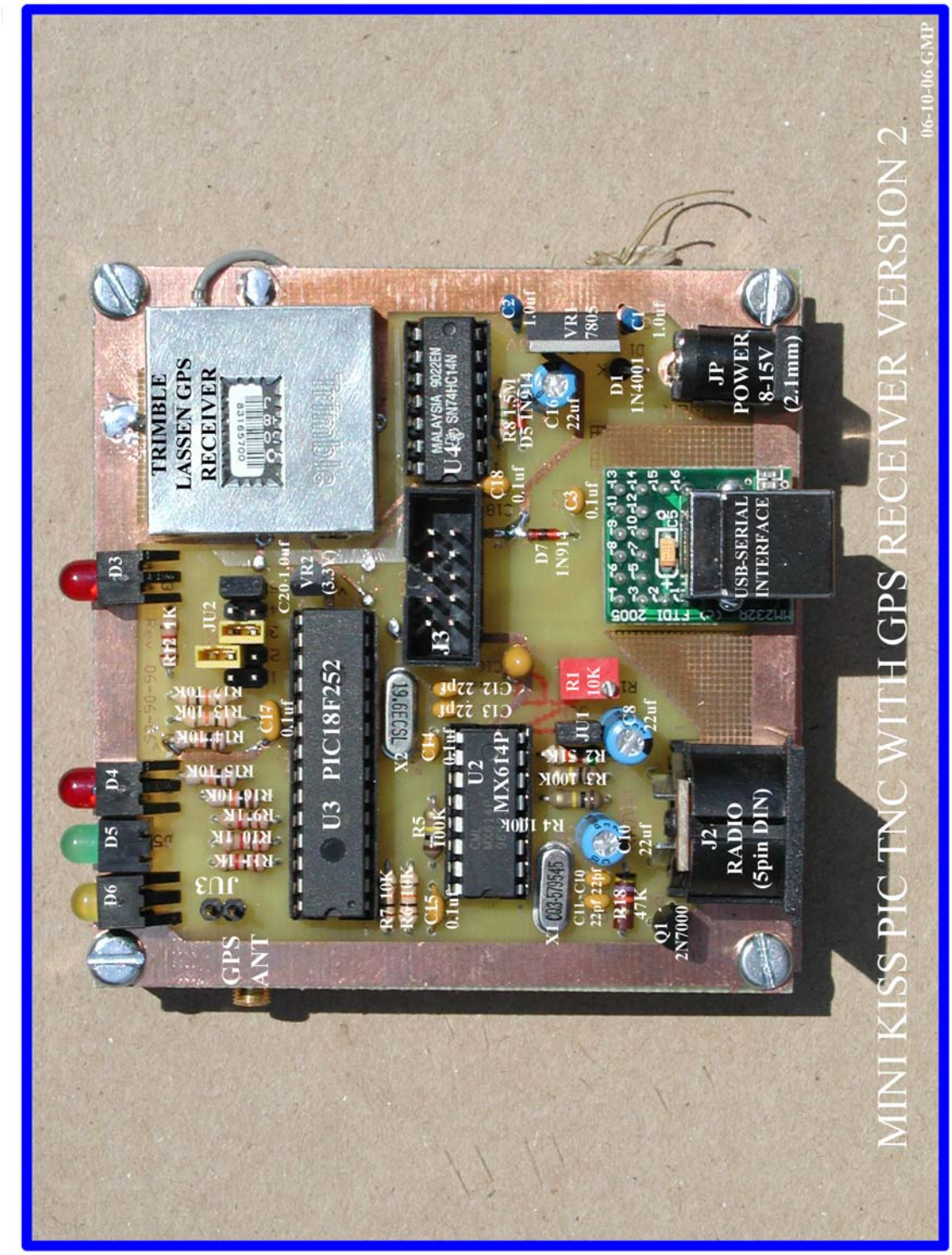

Figure 4: USB VERSION OF MINI KISS PIC TNC.

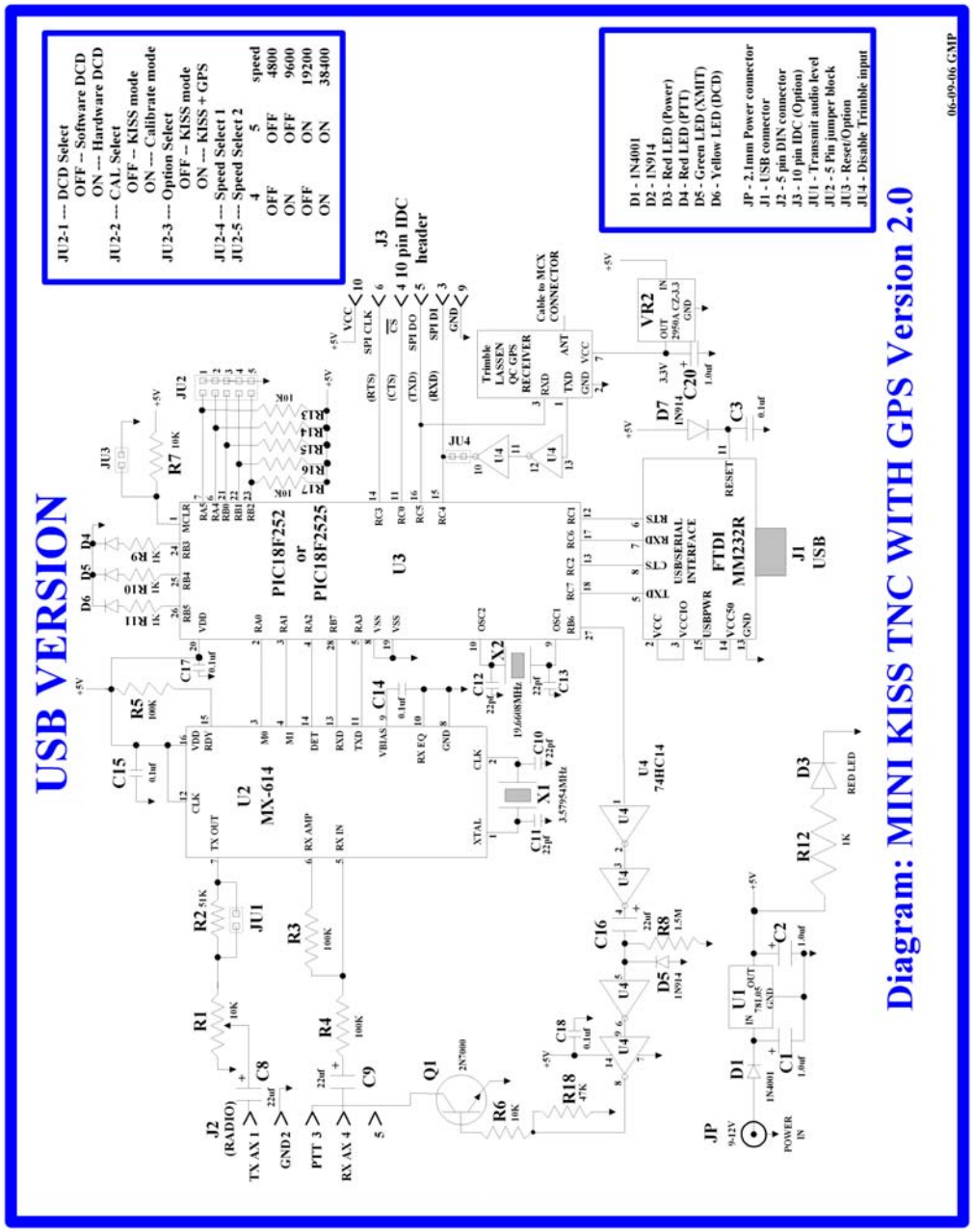

Figure 5: DIAGRAM OF USB VERSION OF MINI KISS PIC TNC.

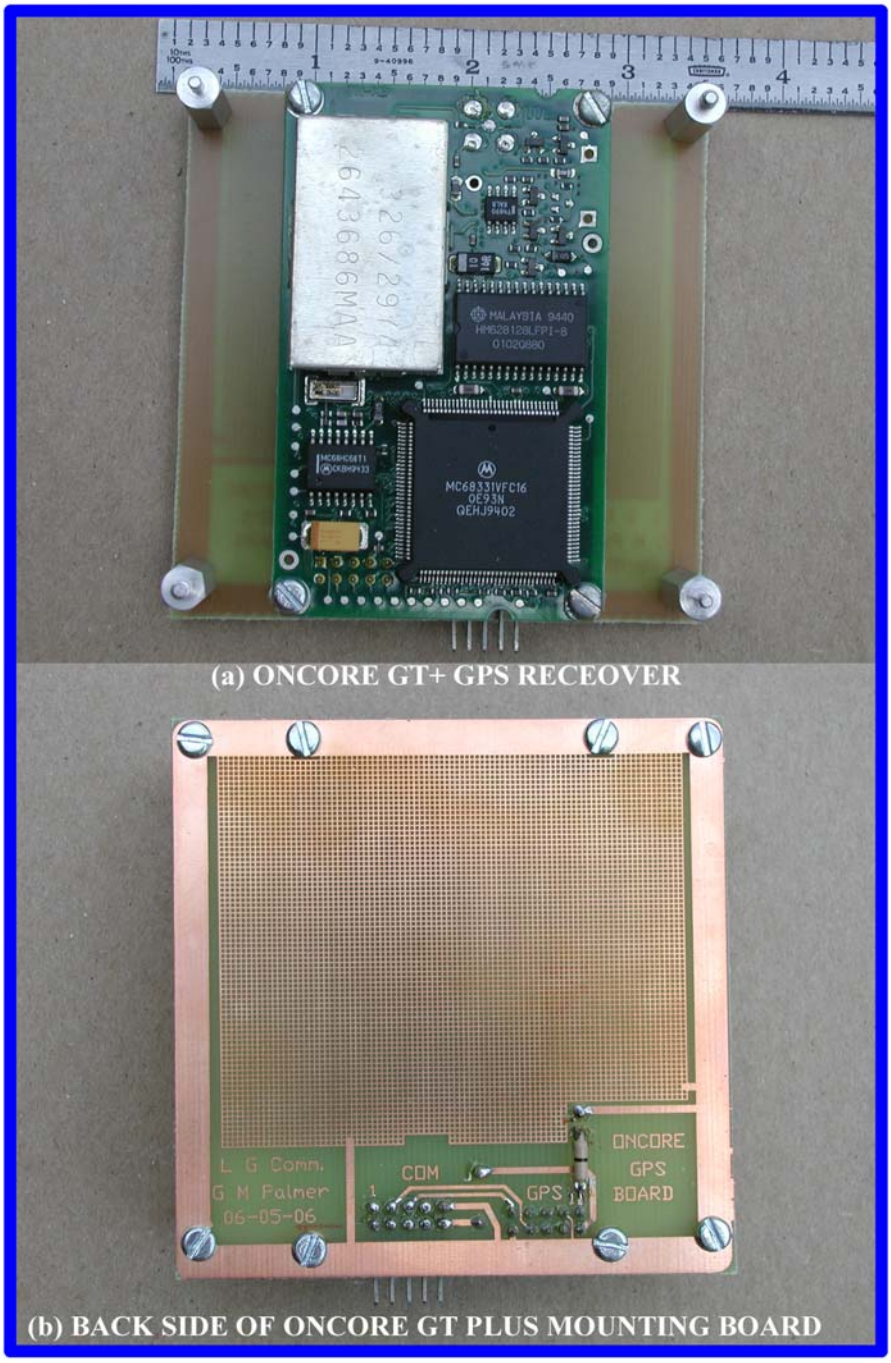

Figure 6: (a) MOTOROLA ONCORE GT+ GPS and (b) MOUNTING BOARD