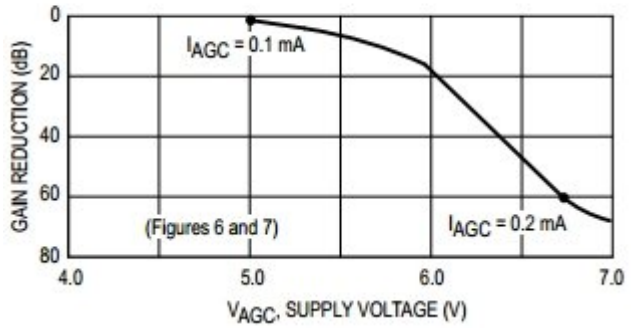
AGC FOR THE X1M

WE ARE FORTUNATE IN THAT THE DESIGNERS OF THE X1M USED AN MC1350 AS ONE OF THE IF AMPLIFIERS. THIS IC HAS A WIDE RANGE AGC CAPABILITY ON PIN 5. THE ORIGINAL DESIGN TIED PIN 5 TO AN SMD POTENTIOMETER AND FIXED THAT VOLTAGE AROUND 4.2VDC. HERE ' S A GRAPH OF THE GAIN OF THE 1350 VS. PIN 5 VOLTAGE:

Figure 2. Typical Gain Reduction

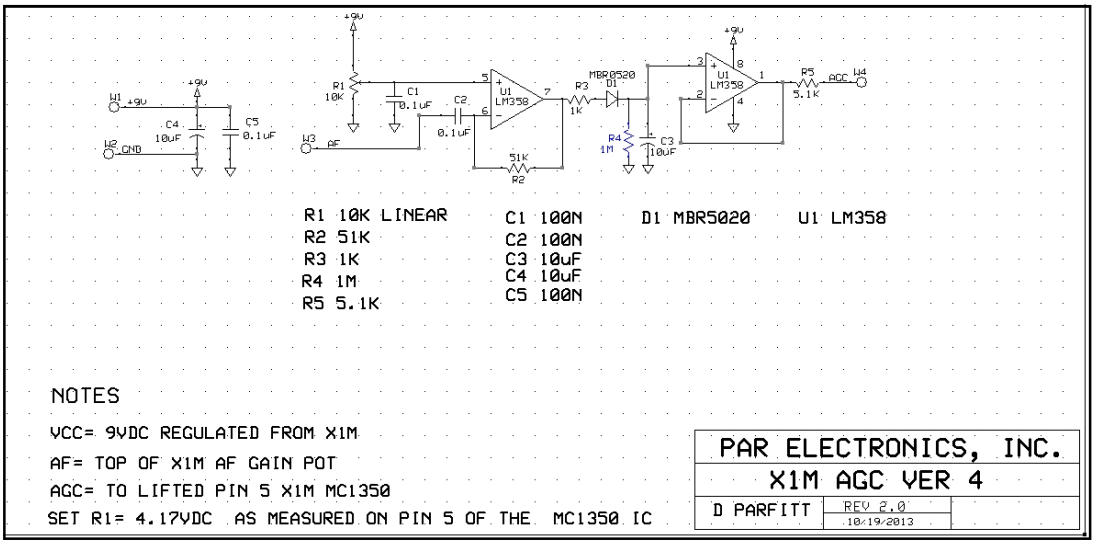


I HAVE LOOKED AT A NUMBER OF MC1350 ' S AND THE FULL GAIN AGC VOLTAGE APPEARS TO BE AROUND 4.17VDC – DESPITE WHAT THE GRAPH SHOWS.

SO ALL WE NEED TO DO IS SUPPLY PIN 5 WITH A VOLTAGE THAT INCREASES AS THE SIGNAL LEVEL INTO THE RADIO INCREASES. THE TOP OF THE X1M ' S AF GAIN CONTROL SUPPLIES US WITH THE NECESSARY SIGNAL THAT IS PROPORTIONAL TO THE SIGNAL LEVEL INPUT.

WE NEED TO LIFT PIN 5 OF THE MC1350 SO THAT IT IS NO LONGER TIED TO THE FIXED VOLTAGE ON THE WIPER OF RW1C. THE ONLY OTHER TIE POINTS REQUIRED ARE +9VDC AND GROUND.

HERE ' S THE SCHEMATIC OF OUR AGC CIRCUIT:



THE FIRST OP AMP OPERATES AS AN INVERTING AMPLIFIER. ITS GAIN VARIES A BIT WITH AUDIO FREQUENCY BUT RUNS AROUND +30DB. SO WHAT WE HAVE AT PIN 7 IS AN AC SIGNAL THAT IS CONSIDERABLY LARGER THAN WHAT WE HAD AT THE INPUT. R1 PLACES THIS AC SIGNAL ON A DC PEDESTAL . D1 AND R4 RECTIFY THE AC SIGNAL AND IT IS APPLIED TO THE INPUT OF THE SECOND OP AMP WHICH IS A VOLTAGE FOLLOWER – THAT IS, IT HAS A GAIN OF ONE AND IS NOT INVERTING. R3 DETERMINES HOW FAST C3 CHARGES (AGC ATTACK) AND R4 DETERMINES HOW FAST THE PEAK AGC VOLTAGE DECAYS (DECAY TIME). R4 IS LABELED AS 10M ON THE SCHEMATIC – BUT IT WAS CHANGED TO 1M DURING THE TESTING PHASE. THE OUTPUT OF THE SECOND STAGE GOES THROUGH A 5.1K RESISTOR WHICH TENDS TO ISOLATE THE AGC DURING X1M TX CYCLES. I HAVE NOT YET DETERMINED WHY THIS IS NECESSARY – BUT LOW VALUES LIMIT THE POWER OUTPUT ON SSB. AT THIS TIME IT IS SUFFICIENT TO SAY THAT R5 ALLOWS FOR FULL TX POWER AND DOES NOT CHANGE THE AGC CHARACTERISTICS.

BUILDING THE PCB

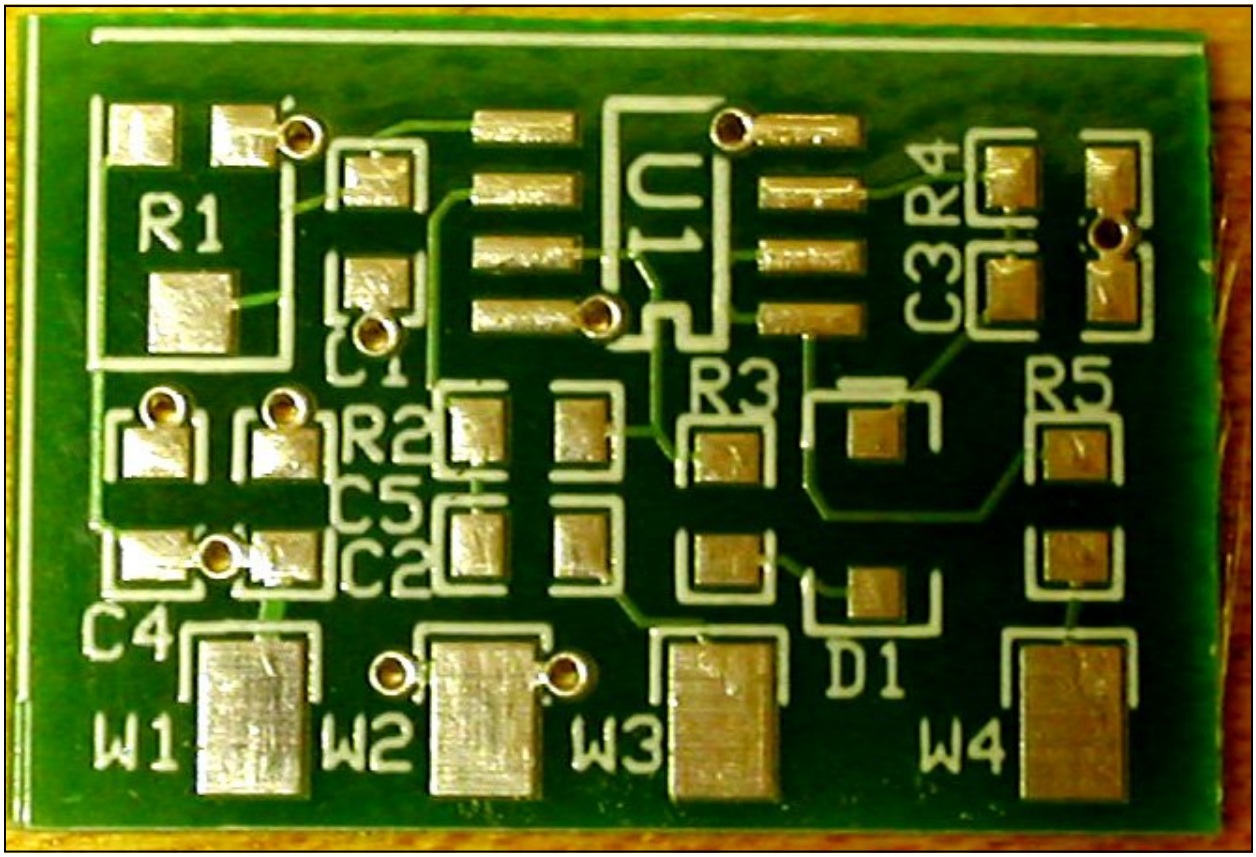
BEFORE BUILDING AND INSTALLING THIS AGC BOARD, YOU MUST DO MY AF GAIN MOD, WHICH CONSISTS OF SHORTING OUT RESISTOR R80C ON THE BOTTOM SIDE OF THE TOP BOARD – DIRECTLY UNDERNEATH U8C, THE LM386 IC. THE NEXT PHOTO SHOWS THE BARE PCB. COMPONENT LOCATIONS ARE CLEARLY MARKED ON THE SILKSCREEN LAYER. I WOULD SUGGEST THAT YOU FIRST MOUNT ALL OF THE RESISTORS, INCLUDING THE POT R1. THESE ARE THE LOWEST PROFILE

PARTS LIST

QTY	DESCRIPTION	MARKING
1	PRINTED CIRCUIT BOARD	
1	5 ”RIBBON WIRE	
1	R1 10K LINEAR POT	
1	R2 51K	5102
1	R3 1K	1001
1	R4 1M OR 10M OPTION	1004 OR 1005 SEE TEXT
1	R5 5.1K	5101
3	C1, C2 C5 100nF	NONE – BROWN BODY
2	C2, C4 10uF	NONE – THICK BROWN BODY
1	D1 SCHOTTKY DIODE	L6 E7 BLACK BODY
1	U1 LM358 DUAL OP AMP	DASH AT PIN 1 END

I HAVE GONE BACK AND FORTH A LOT ON THEVALUE OF R4. WHILE THE 1M VALUE RESULTS IN A FASTER AGC (MAYBE MORE DESIIREABLE FOR CW) IT CAN ALSO INTRODUCE A “POP ” ON THE FIRST SYLLABLES OF VERY STRONG STATIONS WHEN THERE ARE LONG PAUSES IN BETWEEN WORDS. THE 10M VALUE RESULTS IN A SMOOTHER AGC AND I FOUND I PREFER THAT. I AM SHIPPING BOTH VALUES, SO YOU CAN EXPERIMENT.

A SIDE NOTE – THIS AGC IS AUDIO DERIVED AND AS SUCH THERE IS AN UN-AVOIDABLE DELAY BETWEEN WHAT THE MC1350 SEES AND THE TIME WE CAN DETECT IT AND GET THAT MC1350 TO REDUCE ITS GAIN. THUS A SHORT POP IS SOMETIMES UNAVOIDABLE. THE ADVANTAGE OF AUDIO DE-RIVED AGC IS ITS SIMPLICITY. RF OR IF DERIVED AGC WOULD REQUIRE MA-JOR REWORK TO THE X1M PC BOARD AND WAS NOT DEEMED FEASIBLE

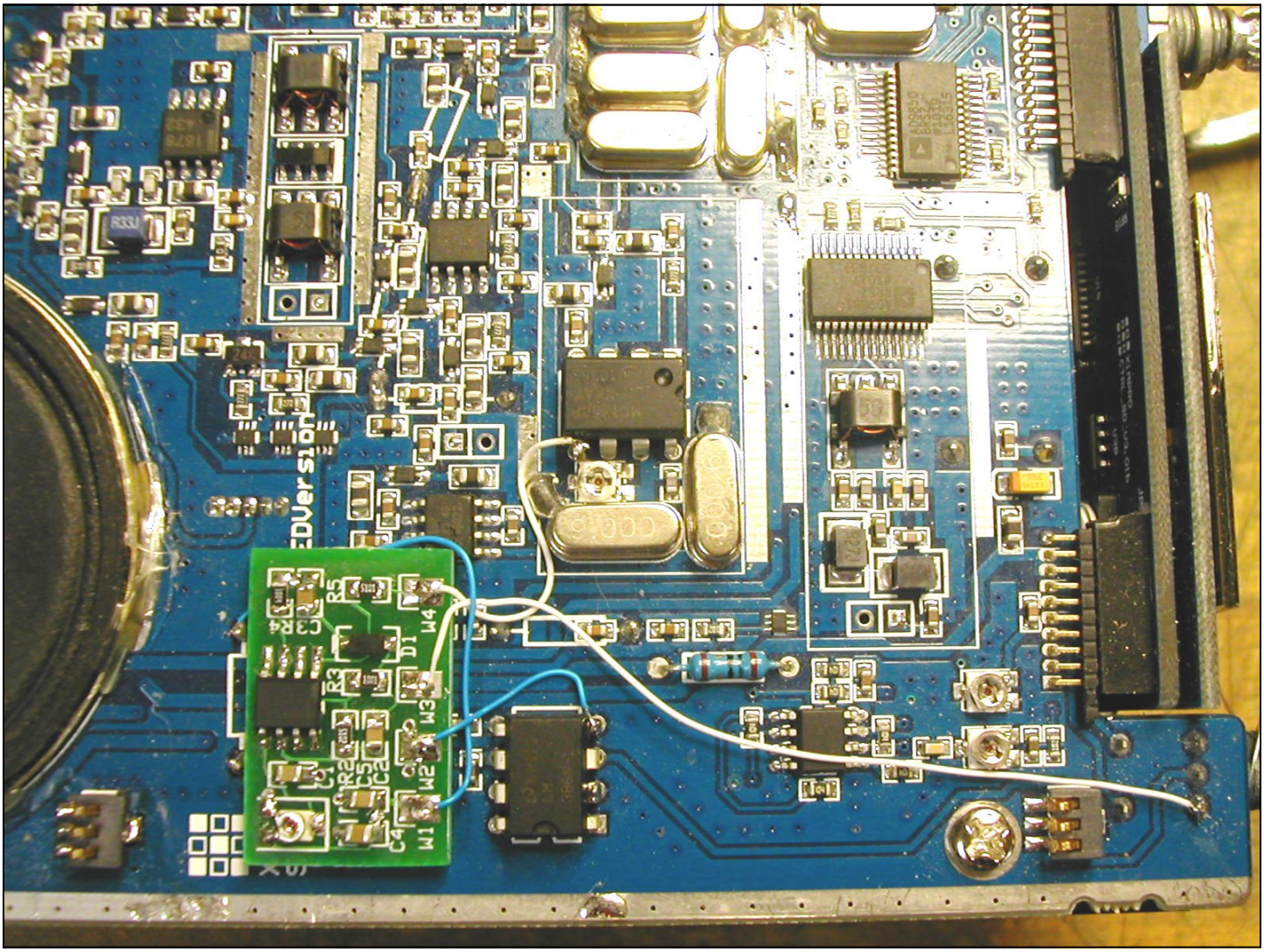


ONLY 2 COMPONENTS ARE POLARITY SENSITIVE – U1 AND D1. THE SMD PART U1 HAS A GRAY DASH ON THE END THAT DENOTES PIN 1. THAT GRAY DASH END OF U1 HAS TO CO-INCIDE WITH THE " NOTCH " ON THE SILKSCREEN OUTLINE OF THE PCB.
D1 SIMILARLY HAS A DASH ON ONE END AND IT HAS TO BE ORIENTED SO THAT THE DASH IS ALIGNED WITH THE DASH ON THE SILKSCREEN – THAT IS, THE DASH ON D1 WILL POINT TOWARDS THE TOP OF THE BOARD. D1 ALSO HAS THE MARKING L6 E7 ON THE PART. MOUNT U1 AND D1 AT THIS TIME.

NEXT, INSTALL THE CAPACITORS. NOTE SMD CAPS ARE NOT MARKED. THEY HAVE BROWN BODIES. THE THREE 0.1Uf CAPS ARE THE SMALLER CAPS. THE 10uF (NON POLARITY SENSITIVE) ARE THE LARGER, THICKER CAPS.

I FOUND OUT THE HARD WAY THAT THE AGC BOARD CANNOT BE INSTALLED AT THE EDGE OF THE X1M ' S TOP BOARD – IT MUST BE SET IN A 1/4 INCH OR SO.

THE BOARD IS ATTACHED TO THE X1M TOP BOARD VIA TWO SIDED TAPE – THE THINNER THE BETTER. IT WILL NOT TAKE MUCH TAPE TO AFFIX THE BOARD. YOU WANT TO AVOID HAVING THE TAPE END UP ON TOP OF THE 8 PIN DIP, JUST BELOW AND TO THE LEFT OF



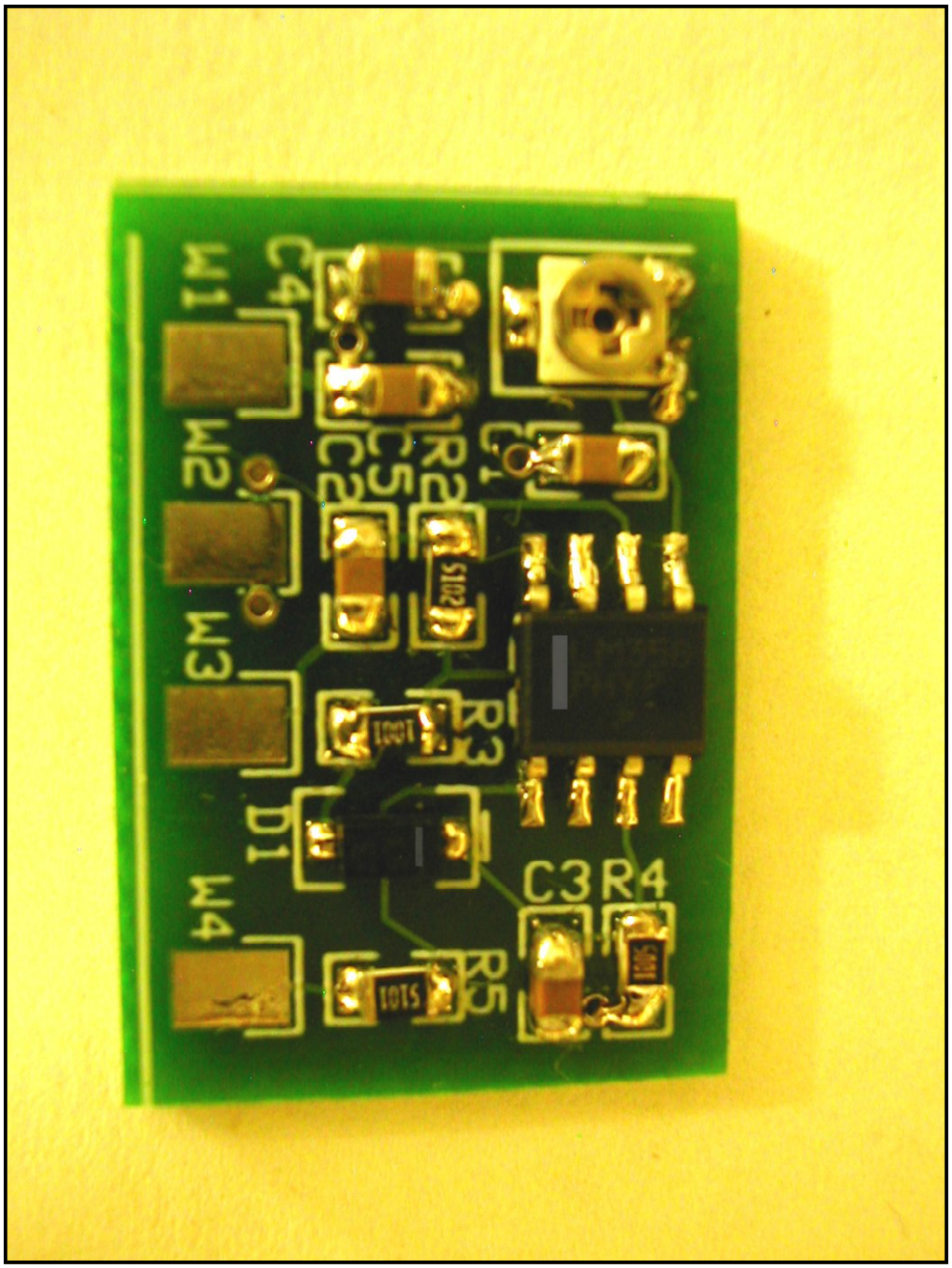
NOTE THAT THE UPPER RIGHT OF THE AGC BOARD LAYS OVER THE 8 PIN DIP IC. MAKE SURE YOUR DOUBLE SIDED TAPE DOES NOT COVER THIS IC. THERE IS VERY LITTLE HEADROOM AND IF THE BOARD + TAPE ARE ON TOP OF THE IC, YOU WILL HAVE DIFFICULTY GETTING THE TOP COVER INSTALLED. IN SHORT THEN, TRIM YOUR DOUBLE SIDED TAPE SO THAT THE AGC BOARD SITS AS LOW AS POSSIBLE.

ONCE YOU HAVE THE AGC BOARD AFFIXED TO THE X1M TOP BOARD, IT IS TIME TO FINISH UP BY RUNNING WIRES FROM AGC PADS W1/W2/W3/W4 TO THE X1M.

I USED #30 WIRE WRAP WIRE BUT IT IS A BEAR TO WORK WITH. I AM INCLUDING RIBBON WIRE WITH THE KITS. AN EXACTO BLADE WILL CONVENIENTLY CUT THE WIRE 'S INSULATION FOR STRIPPING.
W1 IS THE +9VDC CONNECTION. DIRECTLY TO THE REAR OF THE AGC BOARD IS A COMPONENT THAT IS INSTALLED ON THE BOTTOM OF THE X1M TOP BOARD (L58C). YOU MAY CONNECT W1 TO EITHER SIDE OF THIS COMPONENT, WHOSE LEADS ARE CLEARLY VISIBLE ON THE TOP OF THE X1M BOARD. ALTERNATIVELY YOU MAY CHOOSE TO CONNECT W1 TO PIN 6 OF THE AUDIO AMP LM386.

W2 IS GROUND. I USED PIN 4 OF THE LM386 IC.
W3 IS THE AF INPUT AND MUST BE CONNECTED TO THE LEFT MOST PIN OF THE AF GAIN POT (RW4C) AT THE FRONT OF THE X1M TOP BOARD.
FINALLY, W4 IS THE CONNECTION TO PIN 5 OF THE MC1350 IF GAIN IC. BEFORE CONNECTING TO PIN 5, YOU MUST LIFT PIN 5 FROM THE X1M PC BOARD. CAUTION MUST BE EXERCISED HERE. I RECOMMEND THE BEST FLUSH CUT WIRE CUTTERS YOU CAN LOCATE FOR THIS TASK. ONCE YOU HAVE CUT PIN 5, BEND IT UP A BIT SO THE PIN CAN NO LONGER TOUCH THE PCB OR POT RW1C.

CHECK ALL OF YOUR CONNECTIONS AND SOLDER JOINTS FOR ACCURACY AND NO SOLDER BRIDGES. ONCE YOU ARE SATISFIED THAT ALL IS CORRECT. TURN ON THE X1M . WITH NO ANTENNA CONNECTED ADJUST R1 FOR 4.17VDC AT PIN 5 OF U1. I AM STILL NOT CERTAIN WHAT THE BEST TOOL IS FOR THIS TINY POT – BUT A SMALL FLAT BLADE JEWELER 'S SCREWDRIVE APPEARS TO WORK.
THAT 'S ALL THERE IS TO IT..


M1
C4
M2
C5
R2
C2
C1
M3
R3
D1
C3
R4
M4
R5